

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 June 2004 (03.06.2004)

PCT

(10) International Publication Number
WO 2004/046477 A2

(51) International Patent Classification⁷: **E04B**

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(21) International Application Number:
PCT/US2003/027746

(22) International Filing Date:
4 September 2003 (04.09.2003)

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(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/408,143 4 September 2002 (04.09.2002) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

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(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: INFRASTRUCTURE SYSTEM

(57) Abstract: A correlation system for configuring and modifying a control relationship between controlling apparatus and controlled apparatus, said correlation system comprising: programming means comprising a hand-held configuration and manually operable by a user to transmit correlation signals to said controlled apparatus and to said controlling apparatus; and said controlled apparatus and said controlling apparatus each having sensing means responsive to said correlation signals for effecting said control relationship between said controlled apparatus and said controlling apparatus.



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INFRASTRUCTURE SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

5 Not applicable.

REFERENCE TO A MICROFISHE APPENDIX

Not applicable.

BACKGROUND OF THE INVENTION

Field of the Invention

10 The invention relates to systems for providing vertically disposed space division and, more particularly, to a flexible system which employs lightweight and rapidly reconfigurable elements with internal stretch characteristics, and with means for providing power distribution, interconnection to and integration of functional components, data storage and control of components through digital programming.

15 Background Art

Building infrastructure, architectural interiors and space division continue to evolve in today's commercial, industrial, office and residential environments. For purposes of the description in this specification, the term "architectural interiors" shall be used to collectively designate the same. Historically, and particularly beginning with the industrial revolution,

20 architectural interiors in the form of space division often consisted of large rooms with fixed walls, ceilings and doors. "Partitions" were only in the form of load-bearing and stationary walls. Interiors would often include large and heavy desks, worktables, machinery, assembly lines or the like, depending upon the particular environment. Lighting, heating and cooling (if any) functions were often centrally controlled. With the exception of executive offices, privacy

for face-to-face or telephone conversations, meetings or other activities was difficult to achieve. To accomplish such privacy required additional fixed and costly room architecture. Of course, until the past several decades, and with the exception of telephones and typewriters, there was no need to configure architectural interiors or furniture to facilitate usage of other office equipment, such as computers, copying and facsimile machines. In general, occupants of such architectural interiors had no significant control over their individual environments. This was not only true with respect to locations of partitions or space dividers, but also with respect to lighting, heating and the like. Any reconfiguration of an architectural interior was a significant undertaking.

During the middle of the Twentieth century, architectural interiors began to see somewhat of a more “sophisticated” approach to flexibility. In part, this was caused by equipment automation, with the advent of electronic copy machines, teletypes, electric typewriters and the like. The architectural interiors needed to take into account greater needs for electrical power and configurations for supplying power to appropriate locations. Also, “shared” equipment, such as copy machines and teletypes, required consideration of centralized locations (and “common space”) and high voltage power supplies. Such automated equipment, and the physical locations of the same, required configurations for supplying power to interior sites. Accordingly, additional development work was performed regarding moving power from exterior supplies into locations other than merely along outer load-bearing walls. Although building owners and tenants began to concern themselves with the foregoing, architectural interiors still typically involved very heavy and relatively “stationary” furniture.

With respect to space division, additional work was performed regarding physical space dividers. For example, work was undertaken with respect to forming space dividers or partitions in the form of stud walls, steel frames and the like. However, such space dividers still

were typically relatively fixed with respect to physical locations, heavy, costly and difficult to move.

Also during this time, thought was being given to environmental concerns in architectural interiors, such as appropriate air ventilation and the like. New developments occurred in design of ductwork and the like, for bringing HVAC equipment and functions into interior sites. However, such HVAC equipment, as well as lighting and other environmental characteristics, continued to be controlled through central and often remote locations.

A further advance in architectural interiors began in the 1960's. Several furniture makers began work on office furniture systems having partitions or space dividers which provided at least a minimum level of individual privacy, and defined an individual's "workspace." Some of these space dividers were designed to provide electrical power (interconnected to the building's common power supplies) located at an occupant's workspace. Hanging and supporting bracket structures were developed to provide means for interconnecting furniture accessories (such as shelving, cabinets and work surfaces) to stationary walls or to the space dividers themselves. As these systems evolved, they included arrangements for use with specific utilitarian elements, such as computer stands, keyboard drawers and the like.

In general, these types of systems as developed over the past several decades can be somewhat characterized as permitting "partial" rearrangement of architectural interiors, and somewhat of an advancement in organizing interior space. Although the term "modular" is sometimes used to describe these types of systems, they did not fit within the true definition of a modular system. Instead, these systems are inherently "closed systems," and are limited to finite sets of interchangeable physical parts.

With respect to all of the known space division systems, each suffers from a number of various disadvantages. For example, many of the architectural interiors in existence today actually result in an "overperformance." That is, they have weight, bulk and other size parameters which are clearly unnecessary for their desired functionality. Their cost is significant. This cost occurs not only from initial acquisition prices, but also, as a result of their lack of true flexibility, from costs associated with moving or reconfiguring the interiors. Also, in part, additional costs result from the fact that reconfiguration of such systems often results in wastes of component parts. In this same regard, many component parts of known systems are not reusable when disassembled.

Still further, known space division systems for many reasons (including those previously stated herein), do not lend themselves to any type of "rapid" reconfiguration. In fact, they may require a significant amount of work to reconfigure. This work often requires use of trained specialists. Also, reconfiguration of known space division systems may involve additional physical wiring or substantial rewiring. Different trained specialists may be required when the reconfiguration in any manner involves such electrical or data/communications components. Still further, although these systems may involve lighting controllable by a workspace user, many environmental functions remain centrally controlled, often in locations substantially remote from the architectural interior being controlled.

Other disadvantages also exist with respect to these known systems. For example, space dividers in use today are often "ground-based," meaning that they are supported and extend upwardly from floor structures. Many of these configurations are limited in height, and do not particularly lend themselves to visual privacy. Also, as a result of the lack of flexibility and inherent problems with reconfiguration, known systems do not facilitate reconfiguration of

space divider groupings, for purposes of individual privacy, collaboration and other “interaction” characteristics.

As earlier mentioned, known space division systems still do not particularly assist in providing an occupant’s control of his or her own environmental conditions. Even further,

5 however, difficulties can arise in known space division systems when environmental characteristic control is provided within a general space of an occupant. For example, lighting associated with an occupant’s usage area may be controlled by a switch which is initially relatively close in proximity and readily accessible. However, if this interior space is reconfigured in any substantial manner, the switch controlling the lighting may no longer be
10 accessible or otherwise located in a functionally “correct” position. In this regard, known systems have no capability of providing any relatively rapid reconfiguration of controlling/controlled relationships among functional elements, such as switches, task lights, data terminals and the like. Also, to the extent these relationships are reconfigured, substantial rewiring by personnel having significant technical expertise will be required.

15 Another significant disadvantage with known space divider systems relates to their lack of development in light of advances in technology. However, many of these technological advances have modified today’s business, educational and personal work practices. Two examples of relatively recent technological advances consist of the semiconductor revolution and the corresponding miniaturization of numerous electrical and
20 data/communications components. Today, the work practices of many individuals involve the use of laptop computers and other portable, electronic devices. Many of these devices have the capability of operating on DC power. However, most of today’s space division systems do not provide for availability of such power. In addition, known systems do not provide any other

features which will facilitate efficiency in today's new work practices, such as ready access to data storage and the like.

The foregoing is only a brief description of some of the disadvantages associated with current development in architectural interiors and space division systems. In part, 5 disadvantages exist because of today's business practices. The following paragraphs briefly describe other aspects of today's activities in the areas of architecture and design, and why the foregoing disadvantages of known systems are becoming even more important.

In the past, problems associated with difficulty in reconfiguration of architectural interiors, and lack of in situ control of a location's environmental conditions, may not have been. 10 of primary concern. However, today's business climate often involves relatively "fast changing" architectural interior needs. Architectural interiors may be structurally designed by designers, architects and engineers, and initially laid out in a desired format with respect to lighting fixtures, switches, data lines, and other functional accessories. However, when these structures, which can be characterized as somewhat "permanent" in most buildings (as described in 15 previous paragraphs herein), are designed, the actual occupants may not move into the building for several years. Designers need to "anticipate" the needs of future occupants of the building being designed. Needless to say, in situations where the building will not be commissioned for several years after the design phase, the architectural interior of the building may not be appropriately laid out for the actual occupants. That is, the prospective tenants' needs may be 20 substantially different from the designers' anticipated ideas and concepts. However, as previously described herein, most architectural interiors permit little reconfiguration after completion of the initial design. Reconfiguring of structures in accordance with the needs of a particular tenant can be extremely expensive and time consuming. During structural

modifications, the architectural interior is essentially “down” and provides no positive cash flow to the buildings’ owners.

It would be advantageous to always have the occupants’ activities and needs “drive” the structure and function of the architectural interior layout. To date, however, many relatively “stationary” (in function and structure) interiors essentially operate in reverse. That is, it is not uncommon for prospective tenants to evaluate a building’s architectural interiors and determine how to “fit” their needs (workspaces, conference rooms, lighting, heating, ventilation and air conditioning ("HVAC") requirements and the like) into the existing architectural interiors.

Still further, and again in today’s business climate, a prospective occupant may have had an opportunity to be involved in the design of a building’s architectural interior, so that the interior is advantageously “set up” for the occupant. However, many business organizations today experience relatively rapid changes in growth, both positively and negatively. When these changes occur, again it may be difficult to appropriately modify the architectural interior so as to permit the occupant to expand beyond its original architectural interior or, alternatively, be reduced in size such that unused space can be occupied by another tenant.

The foregoing paragraphs describe reconfiguration as a result of delay time between original design and the time when users actually occupy space, as well as situations where reconfiguration is required as a result of a business organization’s growth or other “external” conditions requiring reconfiguration. In addition, it would also be advantageous to reconfigure architectural interiors substantially on a “real time” basis, where the needs of the occupants change almost instantaneously. That is, the time period required for reconfiguration

need not be of any substantial length of otherwise involve changes in a business climate for a particular occupant.

As an example, it may be advantageous for the occupant of a particular architectural interior to have a specific layout during morning and evening hours, while having a revised layout during mid-day hours. This could occur, for example, in an educational learning center, where usage of the architectural interior by students may change, for example, from primarily "individual" usage in the morning and evening hours, to joint projects and meeting activities requiring collaborative usage during mid-day hours. For such usage, it may be particularly advantageous to have the capability of rapidly modifying interconnections of individual space dividers, providing projection services, and facilitating relocation of laptops, task lighting and the like.

Other problems also exist with respect to the layout and organization of today's architectural interiors. For example, and as earlier described herein, accessories such as switches and lights may be relatively "set" with regard to locations and particular controlling relationships between such switches and lights. That is, one or more particular switches may control one or more particular lights. To modify these control relationships in most architectural interiors requires significant efforts. In this regard, a architectural interior can be characterized as being "delivered" to original occupants in a particular "initial state." This initial state is defined by not only the physical locations of functional accessories, but also the control relationships among switches, lights and the like. It would be advantageous to provide means for essentially "changing" the relationships in a relatively rapid manner, without requiring physical rewiring or similar activities. In addition, it would also be advantageous to have the capability of modifying physical locations of various functional accessories, without requiring additional electrical

wiring, substantial assembly or disassembly of component parts, or the like. Still further, it would be advantageous if users of a particular area could effect control relationships among functional accessories and other utilitarian elements at the location of the architectural interior itself.

5 Various types of space division systems are known in the prior art. For example, Roberts, U.S. Pat No. 5,274,970 issued January 4, 1994, discloses a freestanding space division system having upstanding posts for resting on the floor. At least one rail assembly is extended between adjacent posts and spaced from the floor. Saddles hang from the rail assembly, and trays are suspended from the saddles so as to form raceways. Vertical pole assemblies are
10 detachably mounted to each post and extend "axially" so that a pair of adjacent pole assemblies on a rail can define a panel receiving space.

 Goodman, et al, U.S. Pat No. 6,047,508 issued April 11, 2000, discloses a wall panel space division system having a movable panel with a rigid frame. A core panel is mounted in the frame, and at least one cover panel is detachably mounted on the frame and encloses an
15 associated portion. The frame has at least one vertical stile with first and second channels that extend longitudinally therealong. The stiles are shaped to receive utilities through outwardly opening sides. The outwardly opening sides of the panels are juxtaposed in opposing directions, so as to facilitate routing utilities along both faces of the panel. A variable height frame support may be positioned between the top of the panel and the building ceiling for floor-to-ceiling
20 applications.

SUMMARY OF THE INVENTION

In accordance with the invention, a correlation system is provided for configuring and modifying a control relationship between controlling and controlled apparatus. The

correlation system includes programming means comprising a hand-held configuration. The programming means is manually operable by a user so as to transmit correlation signals to the controlled apparatus and to the controlling apparatus. The controlled apparatus and the controlling apparatus each have sensing means responsive to the correlation signals for effecting the control relationship between the controlled apparatus and the controlling apparatus. The correlation system can comprise spatially transmitted signals.

The correlation system includes programming means. The programming means comprise a wand having a hand-held configuration, and a programmable controller. Switching means are provided which are manually operable by a user so as to generate state signals as input signals to the programmable controller. The programmable controller is responsive to the state signals so as to execute particular functions as desired by the user. The wand also includes mode selector means, adapted for receiving separate and independent inputs from the user. The mode selector means is further adapted to generate and apply second state signals as input signals to the programmable controller.

The wand also includes transmitting means for transmitting the correlation signals to the controlled apparatus and to the controlling apparatus. The programmable controller is responsive to the state signals and to the second state signals for applying activation signals to the transmission means. The transmission means can comprise an IR emitter. The correlation system can include a communication network for electronically coupling the controlling apparatus to the controlled apparatus. The controlled apparatus can include at least one controlled programmable controller, having a unique address identifiable through the communication network of the correlation system. The controlled apparatus can also include sensing means responsive to the correlation signals for applying control signals to the controlled

programmable controller. Correspondingly, the controlling apparatus can include at least one controlling programmable controller having a unique address identifiable through the communications network of the correlation system. Sensing means are responsive to the correlation signals, for applying control signals to the controlling programmable controller.

5 The controlling apparatus can include a plurality of switch units.

Correspondingly, the controlled apparatus can include a plurality of lighting units. The wand can include a trigger switch manually operable by the user, so as to generate state signals as input signals to the programmable controller. The wand can also include a visible light having first and second states. The programmable controller can be adapted to selectively generate and
10 apply activation signals as input signals to the visible light, so as to change the state of the visible light between the first and second states.

The wand can also include a lens spaced forward of the visible light, with the lens being transparent to both visible and infrared light. The lens can be a collimating lens for purposes of focusing the visible light into a series of parallel light paths. The correlation system
15 can include a plurality of separate and independent programming means.

The mode selector means can be adapted to generate and apply second state signals to the programmable controller as signals indicative of SET, ADD and REMOVE command signals. The controlled apparatus can include transmission means for transmitting address code signals to the programming means, where the address code signals are
20 representative of a unique address of the controlled apparatus. Each of the wands can include means for indicating successful reception and execution of command signals. The means for indicating successful reception and execution of command signals can include a visible light.

Still further, the configuring and modifying of the control relationship between the controlling apparatus and the controlled apparatus can be performed in the absence of any transmission of signals from the programming means which identify any element of the

programming means. In accordance with another aspect of the invention, the programming

5 means can comprise means for transmitting identification signals which expressly identify one or more elements of the programming means. The programming means can include a plurality of hand-held and manually operable wands. Each of the wands can comprise means for transmitting identification signals indicative of particular identification numbers of the wands.

The correlation system can also include means responsive to the identification signals for

10 establishing a wand prioritization hierarchy. Means can be provided for storing signals indicative of a last state in which the control relationship was configured.

The correlation system can also include means for tracking and identifying which of a plurality of elements of the programming means is within a physical space associated with the correlation system. The system also includes means for limiting capability of the

15 programming means to effect the control relationship, based upon identification of the

programming means and/or a particular physical space in which the control relationship is

attempting to be effected. Still further, the controlled apparatus can include one or more of a group consisting of light fixtures, microphones, cameras, monitors and wall sockets.

In accordance with another aspect of the invention, the controlled apparatus can

20 be provided with standard power and data connections. Each of the devices of the controlled

apparatus can be connected to a control bus. At least a subset of the controlled apparatus can be

provided with a unique global identifier. The identifier can reflect at least the manufacturer,

type, class of device and particular unit.

The correlation system can include a control unit transmitting command signals to all devices of the controlled apparatus connected to a bus, for purposes of identifying elements of the controlled apparatus. Each element of the controlled apparatus comprises means for responding, by transmitting its identifier as a signal. The correlation system also includes an identifier recording unit capable of receiving the identifier signals and converting the same to unique identifiers, and storing the identifiers in memory. The system also includes means for determining a set of identifiers, and providing the identifiers to a control unit. The placement of a device indicator adjacent a device can trigger the device to transmit its identifier by means of the control bus to a control unit. The control unit can include means for recording the device identifier as a tagged device, and mapping the device with a particular control. The correlation system can also include means for mapping a control in a particular parameter at a particular location within a workspace. In this manner, direct control of locations is provided, rather than control of devices. In accordance with another aspect of the invention, all of the electrical signals transmitted among the programming means, control apparatus and controlled apparatus are wireless.

Further in accordance with the invention, a method is provided for use in a correlation system for configuring and modifying a control relationship between controlling apparatus and controlled apparatus. The method includes the use of a programming means comprising a hand-held configuration manually operable by a user so as to transmit correlation signals to the controlled apparatus and the controlling apparatus. Receipt of correlation signals are sensed at the controlled apparatus. Further, receipt of correlation signals are also sensed at the controlling apparatus. A control relationship is effected between the controlled apparatus and the controlling apparatus, based on transmitted correlation signals.

A method in accordance with the invention also includes determining, through programmable processes, prior sets of correlation signals transmitted by the programming means. Determinations are made of next prior sets of correlation signals transmitted to the controlling apparatus. A particular control relationship is effected between the controlled
5 apparatus and the controlling apparatus based on a sequential relationship existing between transmission of the correlation signals to the controlled apparatus and correlation signals to the controlling apparatus.

The method in accordance with the invention also includes configuring a particular controlling apparatus so as to control states of a plurality of controlled apparatus. The
10 method further includes steps for effecting a master/slave relationship among two or more of the controlled apparatus.

A further method in accordance with the invention includes use of the wand for transmitting a first particular command signal C to switch S, where C is representative of the sequence number of the command signal from the wand, and S is representative of the particular
15 switch to which the command signal is transmitted. A second particular command signal C+1 is transmitting to light L, where L is representative of a particular one of the lights to which the command signal C+1 is transmitted. A third particular command signal C+2 is transmitted to light M, where M is representative of a particular one of the lights. A fourth particular command signal C+3 is transmitted to light N, where N is also representative of a particular one of the
20 lights. A fifth particular command signal C+4 is transmitted to switch T, where T is representative of a particular one of the switches. A determination is made that command signal C+3 was a command signal to the light N. Control is effected between light N and switch T. A determination is then made that command signal C+2 was a command signal to light M, and

control is effected of light M by switch T. Command signal C+1 is then determined as a command signal to light L, and control of light L is effected by the switch T. A determination is then further made that command signal C was a command signal to the switch S, and a further determination is made that a particular sequential configuration of control is completed.

5 The foregoing method also includes transmitting a sixth particular command signal C+5 to switch U, where U is representative of a particular other one of the switches. A determination is then made that command signal C+4 was transmitted to switch T. A control relationship is then effected so that switch U is a master switch for control of lights L, M and N, and switch T is slaved to switch U.

10 A further method in accordance with the invention includes the use of the wand for transmitting control signals to certain ones of lights. Further command signals are transmitted to particular ones of switches. A controlling relationship is then removed between the switches and the lights, based upon the command signals.

 Methods in accordance with the invention also include configuring and modifying
15 the control relationship in the absence of any transmission of signals from the programming means which identify an element of the programming means. Also, the method can include transmission of identification signals from the programming means, which expressly identify one or more elements of the programming means. The method can also include storage of signals indicative of a last state in which the control relationship was configured. The method can
20 include means for tracking and identifying which of a series of elements of the programming means is within a physical space associated with the correlation system.

 Further method steps in accordance with the invention include limiting capability of the programming means to effect the control relationship, based upon identification of the

programming means and/or particular physical space in which the control relationship is attempting to be effected. Means can also be included for generating a unique global identifier for each of at least a subset of the controlled apparatus. The unique global identifier can reflect at least a manufacturer, type, class of device and particular unit of each of at least a subset of a
5 controlled apparatus.

Other method steps in accordance with the invention include transmission of command signals from a control unit to all devices of a controlled apparatus connected to a bus. This is for the purpose of identifying elements of the controlled apparatus. Each element of the controlled apparatus can respond by transmitting an identifier as a signal. The method also
10 includes having an identifier recording unit receiving identifier signals and converting the same to unique identifiers, and storing the identifiers in memory.

The method can also include placement of a device indicator adjacent to a device of the controlled apparatus, and triggering the device to transmit its identifier by means of a control bus to a control unit. This method can further include recording the device identifier as a
15 tagged device, and mapping the tagged device for particular control. Still further, the method can include transmission of all signals between the control apparatus and the controlled apparatus as wireless signals.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 illustrates an example embodiment of a communications network in
20 accordance with the invention, showing details in block diagram format of a lighting unit and a switch unit;

FIG. 2 is a block diagram partially in schematic format, illustrating a wand structured in accordance with the invention;

FIG. 3 is a cross-sectional view of an exemplary embodiment of a rail system in accordance with the invention;

FIG. 4 is a two dimensional exploded view of certain of the elements of the rail system in accordance with the invention, with the principal elements also shown in FIG. 3;

5 FIG. 5 is a plan view of a series of commercial interiors, illustrating an exemplary use of the rail system with the commercial interiors, in accordance with the invention;

FIG. 6 is a perspective view of one embodiment of cable trays which may be utilized with the rail system in accordance with the invention;

10 FIG. 7 is a perspective and partially exploded view of a rail connector which may be utilized in accordance with the invention, for purposes of interconnecting adjacent primary tracks and providing intermediate support of the rail system in accordance with the invention;

FIG. 8 is a perspective illustration of a primary track which may be employed as a component of the rail system in accordance with the invention;

15 FIG. 9 is a perspective view of a power and communication bus strip which may be employed with the rail system in accordance with the invention;

FIG. 10 is an elevation view of a power connector which may be utilized through coupling with the power and communication bus strips, for purposes of providing electrical power and communication signals to components selectively interconnected to the rail system through the power connector in accordance with the invention;

20 FIG. 11 is an underside perspective view of a primary track interconnected at its end to a rail connector in accordance with the invention, and further showing the primary track partially exploded away from a primary track cover, in addition to illustrating certain power and communication elements of the rail system in an exposed state;

FIG. 12 is a partially perspective and exploded view of the primary track, illustrating the staggering of track elements in accordance with the invention, for purposes of providing relatively greater strength and rigidity;

FIG. 12A is a diagrammatic illustration of the staggered components of the primary track illustrated in FIG. 12, further clarifying the staggering of the components in accordance with the invention;

FIG. 13 illustrates an exemplary use of the primary track cap in accordance with the invention, and further illustrating the interconnection of the primary track cap with the primary track and electrical conduit (shown in phantom format);

FIG. 14 is an end view of the primary track cap in accordance with the invention;

FIG. 15 is a side elevation view of the primary track cap illustrated in FIGS. 13 and 14;

FIG. 16 is an illustration of the assembly of the rail system in accordance with the invention, showing a powered cross rail being coupled between two primary tracks, with the powered cross rail being configured so as to be substantially level with and in the same horizontal plane as the interconnected primary tracks;

FIG. 17 is an end view of one of the primary tracks illustrated in FIG. 16, and showing in greater detail the interconnection of the powered cross rail to the primary track;

FIG. 18 is a cross sectional view of the powered cross rail illustrated in FIGS. 16 and 17, and taken along section lines 18-18 of FIG. 17;

FIG. 19 is a perspective view of a rail system in accordance with the invention, and showing the system assembled and in use within a commercial interior, and further showing

a powered cross rail interconnected between two primary tracks, in a manner so as to be located below the plane formed by the two interconnected primary tracks;

FIG. 20 is somewhat similar to FIG. 17, and comprises a cross sectional view of one of the primary tracks of FIG. 19, and illustrating in greater detail the interconnection of the cross rail to the primary track in a manner such that the cross rail is supported below the primary track;

FIG. 21 is a cross sectional view longitudinally along the powered cross rail of FIGS. 19 and 20, and taken along section lines 21-21 of FIG. 20;

FIG. 22 is a cross sectional end view of a primary track, and illustrating the interconnection of a non-powered cross rail in a manner such that the non-powered cross rail is supported below the general plane of the primary track;

FIG. 23 is a cross sectional view taken longitudinally along the non-powered cross rail illustrated in FIG. 22, and taken along section lines 23-23 of FIG. 22;

FIG. 23A illustrates a rail system in accordance with the invention in use within a particular commercial interior, and illustrating the interconnection of a non-powered cross rail in an angled configuration below two supporting primary tracks, the view being similar in scope to FIGS. 16 and 19;

FIG. 24 is a cross sectional end view of a primary track and primary connector, with a hanging electrical power box coupled to the primary track, and further illustrating the use of electrical conduit projecting laterally from the longitudinal axis of the primary track;

FIG. 25 includes a number of the components illustrated in FIG. 24, but illustrates the use of electrical conduit projecting downwardly from the electrical power box, and further

illustrates, as an example, the interconnection of the electrical cord to components for energizing electrical receptacles;

FIG. 26 is a perspective view of a hanging clip which may be utilized in accordance with the invention with the rail system, for purposes of supporting various
5 accessories;

FIG. 27 is a cross sectional end view of the use of a primary track, power connector and the hanging clip illustrated in FIG. 26, for purposes of supporting and energizing a light fixture;

FIG. 28 is a perspective view of the use of the rail system in accordance with the
10 invention, in a particular commercial interior, and showing the use of the rail system with primary tracks, powered and non-powered cross rails, and accessories including light fixtures and vertically disposed partitions;

FIG. 29 illustrates a perspective view of a rail system similar in structure to the rail system in FIG. 28, and further showing the use of the rail system with a supported electronic
15 marker board or teleconferencing screen;

FIG. 30 illustrates the use of a rail system in accordance with the invention configured somewhat similar to the rail systems illustrated in FIGS. 28 and 29, and further illustrating the use of the rail system with manual manipulation of a wand for purposes of controlling lighting fixtures and the like;

20 FIG. 31 illustrates the further programming of a second light fixture associated with the rail system in FIG. 30;

FIG. 31A further illustrates manual manipulation of the wand so as to generate appropriate signals (which will be carried through the rail system) for purposes of programming relationships between the light fixtures and the switch unit illustrated in FIG. 31A;

FIG. 32 is a perspective view of a wand which may be utilized for the purposes
5 illustrated in FIGS. 30, 31 and 31A;

FIG. 33 is an elevation view of the wand illustrated in FIG. 32;

FIG. 34 is an end view of one end of the wand illustrated in FIGS. 30 and 31;

FIG. 35 is an example embodiment of one space divider within a space division
system with technology in accordance with the invention, with the space divider hung from a rail
10 system having communications, and with the space divider displaying certain SSL lighting
technology;

FIG. 36 is a plan view of an office environment showing the space division
system in accordance with the invention, in various configurations;

FIG. 37 is a side elevational view of the system, showing the space divider with
15 3D translucency, and with the use of stretch material;

FIG. 38 is an end view of the space divider of FIG. 37, showing material
characteristics and taken along section lines 38-38 of FIG. 37;

FIG. 39 illustrates a space divider in accordance with the invention, utilizing what
is characterized as "cattle mattress" material, with FIG. 39 being a side elevational view;

20 FIG. 40 is a sectional end view, taken along section lines 40-40 of FIG. 39, for
purposes of showing material characteristics;

FIG. 41 is a perspective view of two curved space dividers of the space division
system in accordance with the invention;

FIG. 42 is partial sectional view of the bottom and top detail of the space dividers in FIG. 41, taken along section lines 42-42 of FIG. 41;

FIG. 42A is an end view of an alternative embodiment for an articulated bottom which may be utilized with the space dividers of FIG. 41;

5 FIG. 42B is a perspective view of the alternative embodiment illustrated in FIG. 42A;

FIG. 43 is an end sectional view of a section of the space dividers shown in FIG. 41, taken along section lines 43-43 of FIG. 41;

10 FIG. 44 is a section of the junction between the adjoining space dividers shown in FIG. 41, and taken along section lines 44-44 of FIG. 41;

FIG. 45 is a "close up" sectional view of an end portion of a wall of the space division system in accordance with the invention, illustrating the use of 3D translucent material, and also showing power/communication cables extending through a pre-woven pocket;

15 FIG. 46 is a "close up" sectional view of the junction of the two space dividers in FIG. 41, illustrating the use of 3D translucent material, and also showing power/communication cables extending through the pre-woven portion of the pocket;

FIG. 47 is a "close up" sectional view of an end portion of the wall shown in FIG. 41, with the space divider utilizing "cattle mattress" material, and with power/communication cables from the rail system extending through the pre-woven pocket;

20 FIG. 48 is a "close up" sectional view of the junction of two space dividers utilizing the "cattle mattress" material, and also showing the power/communication cables extending through the pre-woven pocket;

FIG. 49 is a side elevational view of one of the space dividers of the space division system in accordance with the invention, illustrating the use of internal LED light technology;

FIG. 50 is a sectional end view of details of the internal LED light technology of FIG. 49, taken along section lines 50-50 of FIG. 49, and illustrating the concept of utilizing a pattern having a flexibility of location for color wash or signaling, and further illustrating the concept of channel voids being integral to the fabric;

FIG. 51 is a side elevational view of a partition panel of the space division system in accordance with the invention, illustrating another arrangement for use of internal LED light technology;

FIG. 52 is a sectional end view of a portion of the space divider shown in FIG. 51, taken along section lines 52-52 of FIG. 51;

FIG. 53 is a side elevational view of space dividers of the space division system in accordance with the invention, illustrating another configuration of the internal LED light technology utilized with the space dividers;

FIG. 54 is a sectional end view of a portion of the space divider illustrated in FIG. 53, taken along section lines 54-54 of FIG. 53;

FIG. 55 is a side elevational view of a space divider of the space division system in accordance with the invention, and illustrating another embodiment of the use of internal LED light technology with the space divider;

FIG. 56 is a sectional end view showing a portion of the space divider of FIG. 55, taken along section lines 56-56 of FIG. 55;

FIG. 57 is an alternative sectional end view taken from FIG. 55, and showing the use of the LED light technology in a manner which may be important for emergency directional lighting, and illustrating the use of internal LED lighting on both sides of a space divider;

FIG. 58 is a side elevation view of a space divider of the space division system in accordance with the invention, and illustrating the use of internal LED technology with arrows;

FIG. 59 is a side elevational view of a space divider of the space division system in accordance with the invention, and showing the use of external LED light technology, so as to provide a "color wash" along one side of the space divider;

FIG. 60 is a sectional end view of the space divider illustrated in FIG. 59, and taken along section lines 60-60 of FIG. 59;

FIG. 61 is a side elevational view of space dividers of the space division system in accordance with the invention, and illustrating the use of the space dividers with power and data storage;

FIG. 62 is a side elevational view of the use of space dividers of the space division system in accordance with the invention, and further showing the use of SSL task lighting technology with the space dividers;

FIG. 63 is a front elevational view, illustrating the task lighting technology of FIG. 62;

FIG. 64 is a perspective view showing a curved space divider, and further showing the use of task lighting technology with the space divider;

FIG. 65 is a side elevational view of space dividers of the space division system in accordance with the invention, and showing DC low voltage technologies associated with the space dividers;

FIG. 66 is a side elevation view of space dividers of the space division system in accordance with the invention, illustrating various office environment technologies incorporated with the space dividers, and further illustrating the use of Velcro clips on attachment points;

5 FIG. 67 is a side elevational view of space dividers of the space division system in accordance with the invention, showing the space dividers with use of technology in a temporary work or gathering space, where the technology may comprise data storage switches, headphones, projection screens and the like;

FIG. 68 is a top plan view of a mockup office environment similar to that of FIG. 36, but showing the use of a projector and screen with one of the configurations of the space
10 dividers;

FIG. 69 is a plan view of one embodiment of a shape of space dividers of the space division system in accordance with the invention;

FIG. 70 is a plan view of a further embodiment of the use of space dividers of the space division system in accordance with the invention;

15 FIG. 71 is a plan view of a still further embodiment of the use of the technology curtains of the space division system in accordance with the invention;

FIG. 72 is a plan view of a particular configuration of the space dividers characterized as a "flutter" form;

FIG. 73 is a plan view of a further embodiment of a "flutter" form configuration
20 of the space dividers;

FIG. 74 is a plan view of a configuration of the space dividers, with the configuration illustrating positions of individual and collective space, and with FIG. 74 specifically illustrating a "quad-place" configuration;

FIG. 75 is a plan view of a further embodiment of a "quad-place" configuration, with the embodiments of FIGS. 74 and 75 showing individual and collective space, and moving to more collectivity with a less flexible central passageway, where the space grows so as to accommodate group work;

5 FIG. 76 is a plan view of space dividers of the space division system in accordance with the invention, in a configuration which illustrates a "triplace" configuration, having three spaces;

FIG. 77 is a plan view of an alternative embodiment, illustrating a single space configuration;

10 FIG. 78 is a plan view of a third alternative embodiment, illustrating a configuration with two spaces;

FIG. 79 is a perspective view of a translucent partition panel of the space division system in accordance with the invention, in use;

15 FIG. 80 is a perspective view of a user employing a control wand for purposes of reconfiguring control relationships among technologies associated with the space division system, with the user working on control relationships associated with activation of LED technologies on the space dividers;

20 FIG. 81 illustrates a perspective view of a user employing the control wand for purposes of working on control relationships associated with the task lighting technologies of the space division system;

FIG. 82 is a perspective view of a control wand which may be utilized in accordance with the invention;

FIG. 83 is a plan view of the control wand of FIG. 82;

FIG. 84 is a front elevational view of the control wand of FIG. 82;

FIG. 85 is a perspective view of an arrangement of a partition panel of the space division system in accordance with the invention, using task lighting technologies in an arrangement which could be employed for a library, study hall, restaurant or similar environment;

FIG. 86 is a perspective, diagrammatic illustration of a ceiling system located above a particular spatial area having various functions;

FIG. 87 is a perspective view of a series of shielding elements in accordance with the invention, suspended from a rail system;

FIG. 88 is a perspective view of shielding elements similar to FIG. 87, but with the shielding elements being suspended from cables;

FIG. 89 is a section view of FIG. 87, illustrating certain aspects of the LED lighting and ceiling, with the concept that single or a plurality of LED's may be utilized for possible color changing or the like;

FIG. 90 is a section view of FIG. 87, showing the cable suspensions and further showing aspects of the LED lighting and ceiling;

FIG. 91 is a perspective of ceiling components in accordance with the invention, and comprising what is characterized as an LED or member having a linear LED lighting module associated therewith;

FIG. 92 is a perspective view similar in scope to FIG. 91, but showing the use of a pair of linear LED lighting modules with the LED member;

FIG. 93 is a perspective view similar in scope to FIGS. 91 and 92, but showing the use of the LED member with three linear LED lighting modules;

FIG. 94 is an underside view of the LED member of FIG. 93;

FIG. 95 illustrates a generally elevational view of a linear LED lighting module, detached from the LED member;

FIG. 96 is a side elevation cross section similar in scope to FIG. 89, but showing the use of a power transformer;

FIG. 96A is a sectional end view of the LED lighting module and connector elements associated therewith, taken along section lines 96A-96A of FIG. 96;

FIG. 97 is a perspective view of a first embodiment of a ceiling configuration in accordance with the invention, showing the combination of the actual shields and the LED lighting modules;

FIG. 98 is a cross sectional view of the first embodiment illustrated in FIG. 97;

FIG. 99 is a perspective view of a second embodiment of a ceiling configuration in accordance with the invention;

FIG. 100 is a cross sectional view of the ceiling embodiment illustrated in FIG. 99;

FIG. 101 is a perspective view of a third embodiment of a ceiling configuration in accordance with the invention;

FIG. 102 is a cross sectional view of the ceiling configuration illustrated in FIG. 101;

FIG. 103 is a perspective view of a fourth embodiment of a ceiling configuration in accordance with the invention;

FIG. 104 is a cross sectional view of the ceiling configuration illustrated in FIG. 103;

FIG. 105 is a perspective view of a fifth embodiment of a ceiling configuration in accordance with the invention;

FIG. 106 is a cross sectional view of the ceiling configuration illustrated in FIG. 105;

5 FIG. 107 is a perspective view of a sixth embodiment of a ceiling configuration in accordance with the invention;

FIG. 108 is a cross sectional view of the ceiling configuration illustrated in FIG. 107;

10 FIG. 108A is an enlarged portion of the cross sectional view illustrated in FIG. 108;

FIG. 109 is a perspective view of a seventh alternative embodiment of a ceiling configuration in accordance with the invention;

FIG. 110 is a cross sectional view of the ceiling configuration illustrated in FIG. 109, with marker lights being shown;

15 FIG. 110A is an enlarged portion of the cross sectional view illustrated in FIG. 109;

FIG. 111 is a perspective view of an eighth alternative embodiment of a ceiling configuration in accordance with the invention;

20 FIG. 112 is a cross sectional view of the ceiling configuration illustrated in FIG. 111;

FIG. 112A is an enlarged view of the cross section illustrated in FIG. 112;

FIG. 113 is a perspective view of a ninth alternative embodiment of a ceiling configuration in accordance with the invention;

FIG. 114 is an underside view of the ceiling configuration illustrated in FIG. 113, and showing details of the fabric;

FIG. 115 is a cross sectional view of the ceiling configuration of FIG. 113, illustrating the support structure for the same;

5 FIG. 116 is a perspective view of an orientation of shielding elements which may be utilized in accordance with the invention;

FIG. 117 is an perspective view of an alternative embodiment of an orientation of shielding elements which may be utilized in accordance with the invention;

10 FIG. 118 illustrates the use of one of the embodiments of the ceiling configuration, utilized in combination with a dimmer control switch;

FIG. 118A is an elevation view of an example dimmer control switch;

FIG. 119 is a perspective view of a user exhibiting manual manipulation of a control wand for purposes of controlling the LED lighting modules of a ceiling configuration in accordance with the invention;

15 FIG. 120 is a perspective view of a user exhibiting manual manipulation of the control wand, for purposes of controlling functional relationships between a dimmer control switch and a ceiling configuration;

FIG. 121 is a perspective view of a control wand which may be utilized for the purposes illustrated in FIGS. 119 and 120;

20 FIG. 122 is an elevation view of the control wand illustrated in FIG. 121; and

FIG. 123 is an end view of one end of the wand illustrated in FIGS. 121 and 122.

DETAILED DESCRIPTION OF THE INVENTION

The principles of the invention are disclosed, by way of example, in a switch/light correlation system which is adapted for use with a lighting system 102 as illustrated in FIG. 1. In accordance with the invention, the lighting system 102 is associated with one or more wands 104, with an example embodiment of one of the wands 104 being illustrated in FIG. 1. The wand 104 is utilized with the lighting system 102 so as to initially configure or reconfigure relationships or correlation's among switches and lights of the lighting system 102. That is, the wand 104 provides a manual, handheld means for determining which of the lights of the lighting system 102 are controlled by which of the switches of the lighting system 102. Control of the lighting system 102 in accordance with the invention is provided through the use of relatively inexpensive apparatus, which is readily usable by the layperson.

Turning specifically to FIG. 1, the lighting system 102 includes a plurality of lighting units 106. In the particular embodiment illustrated in FIG. 1, there are n individual lighting units 106. Each lighting unit 106 includes a conventional light 107. The light 107 may be any one of a number of conventional lights, including florescent and LED devices. The light 107 is electrically interconnected to and controlled by a controller 108, with each of the controllers 108 associated with one of the lighting units 106. Each of the controllers 108 may be a conventional programmable controller. Each programmable controller 108 will have a unique address 110 identifiable through the communications network of the lighting system 102.

Each of the lighting units 106 further includes an infrared (IR) sensor 112. The IR sensor 112 is conventional in nature and may be any one of numerous commercially available IR sensor devices. An IR sensor 112 is associated with each of the lighting units 106, and is utilized to receive IR signals from the wand 104 as described in subsequent paragraphs herein.

Each of the IR sensors 112 is adapted to convert IR signals from the wand 104 to electrical signals, and apply the same to the corresponding controller 108 through line 114.

Referring again to each of the controllers 108, each controller has bi-directional communication with a control bus 116 or similar common interface used to provide for control and communication among various devices, such as the lighting units 106 and the switch units to be described in subsequent paragraphs herein. The control bus 116 or a similar communications interface is associated with a communications network 118. Communications network 118 may be sophisticated in design and provide for network control of a number of different devices associated with environmental systems, in addition to switch and lighting apparatus.

Alternatively, communications network 118 may be relatively simplistic in design and provide only a few functions associated solely with switches and lights. Each controller 108 associated with a lighting unit 106 communicates with the control bus 116 through a line 120. Each controller 108 may have the capability of not only storage of a unique address 110 associated with the corresponding light 107, but may also store other information, such as light state and the like.

In addition to the lighting unit 106, the lighting system 102 may also include a plurality of switch units 128. Each of the switch units 128 is utilized to control one or more of the lighting units 106. In the particular embodiment illustrated in FIG. 1, the lighting system 102 includes a series of *m* switch units 128. Referring to the specific switch unit 128 illustrated partially in schematic format in FIG. 1, the switch unit 128 includes a conventional switch 129. A switch 129 is associated with each one of the switch units 128. Each switch 129 can be any one of a number of conventional and commercially available switches.

Each of the switches 129 converts manual activation or deactivation into an output state applied on line 130. The state of switch 129 on line 130 is applied as an input to a conventional controller 132. Controller 132 is preferably a conventional programmable controller of any of a series of commercially available types. Each of the controllers 132 may correspond in structure to the controllers 108 associated with the lighting units 106. As with each of the controllers 108 of the lighting units 106, the controllers 132 each have a unique address 134 associated therewith. Each controller 132 may also include various programmable instructions and memory storage which may comprise a light control list 136 stored in writeable memory.

Each of the switch units 128 also includes an IR sensor 138. Each of the IR sensors 138 may correspond in structure and function to the IR sensors 112 associated with each of the lighting units 106. That is, each of the IR sensors 138 is adapted to receive IR signals as inputs signals, and convert the same to corresponding electrical signals. The electrical signals are applied as input signals on line 140 to the corresponding controller 132. As will be described in subsequent paragraphs herein, the input IR signals to the IR sensor 138 will be received from the wand 104, and will be utilized to compile and modify the light control list 136.

As with each of the controllers 108 associated with the lighting units 106, the controllers 132 associated with the switch units 128 will have bi-directional communication through line 140 with the control bus 116 of the communications network 118. Each of the switch units 128 may be configured (in accordance with methods described in subsequent paragraphs herein) so as to control one or more of the lights 107 of the lighting units 106. The general programmable control as specifically associated with the switch units 128 and the lighting units 106 is relatively straightforward, in that each of the controllers 132 may include, as

part of the light control list 136, identifications of each of the unique addresses 110 of the lighting units 106 associated with the lights 107 to be controlled.

For purposes of controlling correlation or configuration among the lighting units 106 and the switch units 128, the embodiment illustrated in the drawings and in accordance with 5 the invention includes a wand 104 as shown in block diagram format in FIG. 2. The wand 104 may include any type of desired mechanical structure, preferably including a housing 141.

Enclosed within or otherwise interconnected to the housing 141 is a conventional programmable controller 142. The programmable controller 142 may be any of a number of conventional and commercially available controllers, preferably sized and configured for convenience of use 10 within a device such as the handheld wand 104. The wand 104 also preferably includes a trigger switch 144. The trigger switch 144 may be manually operated by the user so as to generate a state signal as an input on line 146 to the controller 142. The state signal on line 146 may be a responsive signal to activation of the trigger switch 144 so as to cause the controller 142 to perform particular functions desired by the user.

15 The wand 104 also includes a mode selector module 148. The mode selector module 148 may preferably comprise a selector switching module adapted for three separate and independent inputs from the user. More specifically, the mode selector module 148 may include a SET switch 150, ADD switch 152 and REMOVE switch 154. The mode selector module 148 is adapted so as to generate and apply a state signal on line 156 as an input signal to the 20 controller 142. The state signal on line 156 will preferably be of a unique state, dependent upon selective activation by the user of any one of the switches 150, 152 or 154. As with other specific elements of the wand 104, the mode selector module 148 may be one of any number of commercially available three switch modules, providing unique state outputs.

In response to state signals from the mode selector module 148 on line 156, and the trigger switch 144 on line 146, the controller 142 is adapted to apply activation signals on line 158, as input activation signals to an IR emitter 160. The IR emitter 160 is conventional in design and structure and adapted to transmit IR signals in response to activation signals from line 158.

In addition to controlling transmission of IR signals from the IR emitter 160, the controller 142 is also adapted to selectively generate and apply activation signals on line 162. The activation signals on line 162 are applied as signals to a visible light 164. As with the IR emitter 160, the visible light 164 may be any of a number of appropriate and commercially available lights for the purposes contemplated for use of the wand 104 in accordance with the invention.

In addition to the foregoing, the wand 104 may also preferably include a lens 166 spaced forward of the visible light 164. The lens 166 is preferably a lens which is transparent to both visible and infrared light. The lens 166 is also preferably a collimating lens for purposes of focusing the visible light 164 into a series of parallel light paths (e.g. a collimated light beam 168). The foregoing describes the general structure of one embodiment of a switch/light correlation system in accordance with the invention. The correlation system may be characterized as correlation system 100, which comprises the lighting system 102 and the wand 104. The operation of the correlation system 100 will now be described with reference to FIGS. 1 and 2.

As earlier stated, a principal concept of the invention is to provide a means for configuring (or reconfiguring) the communications network, so that certain of the switch units 128 control certain of the lighting units 106. For these purposes, a plurality of wands 104 may

be utilized. For example, the wands 104 may be numbered W-1, W-2, W-3...W-a, where a is the total number of wands 104. An individual wand 104 may be characterized as wand W-A, where A is the particular wand number 1 through a.

As earlier described, each of the wands 104 may be utilized to initiate one of three
5 commands, namely SET, ADD or REMOVE, through use of the mode selector module 148, and its switches 150, 152 and 154. More specifically, and as an example, the user may wish to initiate a SET command for purposes of associating one or more of the switches 129 with one or more of the lights 107. The user may first activate the SET switch 150. At the time the SET command is to be transmitted to an appropriate one of the lights 107 or switches 129, the trigger
10 switch 144 is activated by the user. The controller 142 of the wand 104, in response to the SET command signal and the trigger switch signal, will generate appropriate electrical signals to the IR emitter 160. The IR emitter 160, in turn, will transmit IR signals representative of the SET command. These IR signals will be received as input signals by the respective IR sensor 112 or 138 associated with the lighting unit 106 or switch 128, respectively, to which the wand 104 is
15 then currently pointed.

For purposes of describing available configuration sequences for control of the lighting units 106 through the switch units 128, it is advantageous to number the lights 107 and switches 129. As earlier stated, the embodiment illustrated in FIGS. 1 and 2 utilize n lights 107 and m switches 129. An individual light 107 may be characterized as light L-X, where X is an
20 integer from 1 to n. Correspondingly, an individual switch 129 may be characterized as switch S-Y, where Y is an integer from 1 to m.

For operation in accordance with the invention, the lighting system 100 will also maintain memory of each particular command and command number for each of the wands 104.

For purposes of description, each command may be referenced as C-N, where N is the sequential number of the command generated by a specific wand 104. For example, a command referenced herein as W-4, C-3 would reference the third command from the fourth wand 104. To fully identify a particular command, it may be designated as W-4, C-3, SET, meaning that IR signals are generated from the fourth wand 104, indicating that, in fact, the signals are from the fourth wand, they represent the third command from the fourth wand, and they are indicative of a SET command.

If the wand 104 is being "pointed" to, for example, light L-2 when the trigger switch 144 is activated, the complete "directional" command may be characterized as W-4, C-3, SET, L-2. Correspondingly, if the wand is pointed at S-4, for example, the directional command may be characterized as W-4, C-3, SET, S-4. To designate ADD and REMOVE commands, the "SET" designation would be replaced by the designation "ADD" or "REMOVE," respectively.

A specific sequential process will now be described as an embodiment in accordance with the invention to relate or correlate control between a particular one of the switches 129 and the lights 107. Assume that the user wishes to configure the lighting system 100 such that switch S-6 is to control light L-4. Further assume that the sixth wand 104 is being utilized by the user, and the last command transmitted by wand W-6 was the fourteenth command (e.g. C-14). Let it be further assumed that command C-14 from wand W-6 was transmitted to one of the switches 129. The user would first configure the mode selector module 148 for wand W-6 so as to enable the SET switch 150. The wand W-6 is then pointed to the lighting unit 106 associated with light L-4. The directional configuration of the wand 104 is indicated by the collimated light beam 168. With this configuration, the user may activate the trigger switch 144 of wand W-6. To indicate transmittal of the command, the light 164 may

preferably be "blinked" so as to indicate appropriate command transmittal. The command may be characterized as W-6, C-15, SET, L-4. The command is transmitted to light L-4 through transmittal of IR signals from the IR emitter 160 associated with wand W-6. These IR signals will be received by the IR sensor 112 associated with the lighting unit 106 for light L-4. IR signals received by the IR sensor 112 are converted to corresponding electrical signals applied to the corresponding controller 108 through line 114. These signals are then also available to the communications network 118.

Following transmittal of the SET command to light L-4, the user then "points" the wand W-6 to switch S-6 of the set of switches 129. When the wand W-6 has an appropriate directional configuration as indicated by the collimated light beam 168, the trigger switch 144 can again be activated, thereby transmitting IR signals through the IR emitter 160 to switch S-6, indicative of a SET command. This directional command can be characterized as W-6, C-16, SET, S-6. The IR signals transmitted by the IR emitter 160 will be received by the IR sensor 138 associated with the switch unit 128 for switch S-6 of the set of switches 129. IR signals received by the IR sensor 138 from wand W-6 are converted to electrical signals on line 140 and applied as input signals to the corresponding controller 132. Signals indicative of the command are also made available to the communications network 118.

When this particular command is received by switch unit 128 for switch S-6, program control via controllers 108, 132, and communications network 118 will have knowledge that the SET command sent to switch S-6 was the sixteenth command from wand W-6. Programmable processes are then undertaken to determine the particular command corresponding to the fifteenth command from wand W-6, i.e. W-6, C-15. Through the prior storage of data associated with the command W-6, C-15, a determination is made that this

particular command was a SET command transmitted to light L-4. With this information, the communications network 118 is provided with sufficient data so as to configure the lighting system 100 such that switch S-6 is made to control light L-4. Following this determination with respect to command C-15 for wand W-6, a search is made for the fourteenth command (e.g. C-14) transmitted from W-6. If it is determined that command C-14 from wand W-6 was a command transmitted to one of the switches 129, and not to any one of the lights 107, this particular sequence for configuration of the lighting system is then complete. Upon completion, activation of switch S-6 is made to control light L-4.

The foregoing sequence is an example of where a single one of the switches 129 is made to control a single one of the lights 107. In accordance with the invention, the lighting system 100 may also be configured so as to have one of these switches 129 control two or more of the lights 107. To illustrate a configuration sequence for control of three of the lights 107 by a single one of the switches 129, an example similar to the foregoing example using commands from wand W-6 may be utilized. More specifically, it can be assumed that command C-12 from wand W-6 was a command directed to one of the switches 129. It can be further assumed that the user wishes to have switch S-6 control not only light L-4, but also lights L-7 and L-10. Using wand W-6, the user may then transmit a SET command to light L-10 as the thirteenth command from wand W-6. That is, the command will be described as W-6, C-13, SET, L-10. Directional pointing of the wand W-6 toward light L-10 would be in accordance with the prior description herein. After command C-13 is transmitted, a further SET command can be transmitted to L-7. This will be the fourteenth command from wand W-6, and would be indicated as W-6, C-14, SET, L-7. Following this command, the two SET commands C-15 and C-16 for light L-4 and switch S-6, respectively, can be transmitted as described in the prior

example. Following the receipt of command C-16 by the switch unit 128 associated with switch S-6, the communications network 118 and the associated controllers 108, 132 would then be made to search for data indicative of command C-15 from wand W-6. Upon a determination that command C-15 was a SET command to light L-4, switch S-6 would be made to control light L-4.

5 A further search would then be made for command C-14 from wand W-6. Unlike the prior example, the lighting system 100 would make a determination that this particular command was a SET command to light L-7, rather than a command to a switch 129. With command C-14 being transmitted to light L-7, the communications network 118 would be configured so that switch S-6 would be made to control not only light L-4, but also light L-7.

10 Thereafter, the lighting system 100 would be made to search for data indicative of command C-13 from wand W-6. Upon a determination that command C-13 was a SET command to light L-10, the switch S-6 would be further configured through the communications network 118 so as to control not only lights L-4 and L-7, but also light L-10. A search for data indicative of command C-12 from wand W-6 would then be undertaken by the communications network 118. Upon
15 determining that this particular command was a command directed to one of the switches 129, the communications network 118 would determine that this particular sequential configuration is completed. Upon completion, the controller 132 of the switch unit 128 associated with switch S-6 will include a light control list 136 having data indicative of switch S-6 controlling lights L-4, L-7 and L-10. Program control through the appropriate controllers and the communications
20 network 118 will then effect this configuration, so that switch S-6 will have control of all three of the designated lights.

 The foregoing examples of sequential configuration in accordance with the invention have illustrated the setting of control of a single light 107 by a single switch 129, and

the setting of control of three of the lights 107 by a single switch 129. In addition to these functions, the lighting system 100 in accordance with the invention can also operate so as to configure a "master/slave" relationship among two or more of the switches 129. As an example, it can be assumed that wand W-6 was utilized to transmit a series of commands C-12, C-13, C-14, C-15 and C-16 as described in the foregoing paragraphs. It may also be assumed that the commands were exactly as described in the foregoing paragraphs in that the commands C-13 through C-16 were made to cause switch S-6 to control lights L-10, L-7 and L-4. A seventeenth command may then be generated through the use of wand W-6, with the command being a SET command and the wand W-6 being pointed at switch S-8. This command would be designated as W-6, C-17, SET, S-8. This command will be transmitted in accordance with the procedures previously described herein with respect to other SET commands. Upon receipt of IR signals by the IR sensor 138 associated with the switch unit 128 for switch S-8, the controllers and communications network 118 would then be made to search for data indicative of command C-16 from wand W-6. The data indicative of command C-16 from wand W-6 would indicate that this particular command was a SET command to switch S-6. Accordingly, the command C-16, which was immediately prior to command C-17 from wand W-6, was a command directed to a switch, rather than a light. Upon a determination that this immediately prior command C-16 was directed to switch S-6, and a determination that command C-15 was directed to a light L-4, program control through the communications network 118 would configure the lighting system 100 so that switch S-8 will be configured by the communications network 118 as a "master" switch for control of lights L-10, L-7 and L-4, while switch S-6 is "slaved" to switch S-8.

The foregoing commands from one of the wands 104 have been described with respect to SET commands. As earlier described, the mode selector module 148 also includes an

ADD switch 152 and a REMOVE switch 154. Functionality of the lighting system 100 for purposes of these particular functions is similar to the functionality for the SET commands.

Accordingly, relatively simple configuration sequences will be described in the subsequent paragraphs with respect to examples of use of the ADD and REMOVE commands. Continuing

5 with the example of use of wand W-6, and assuming that a SET command would be the eighteenth command C-18, the mode selector module 148 may be set by the user so as to enable7 the ADD switch 152. Assume that the user wishes to add light L-20 to the control list for switch S-10. The user would then point the wand W-6 to light L-20, and activate the trigger switch 144 so as to transmit command W-6, C-18, ADD, L-20. Following transmittal of this command, the
10 user may then transmit a further ADD command by pointing the wand W-6 to switch S-10. The command transmitted would be characterized as W-6, C-19, ADD, S-10. Upon receipt of the ADD command for switch S-10, the controllers 108, 132 and the communications network 118 would then search for data indicative of command C-18 from W-6. Data would be found indicative of command C-18 being an ADD command transmitted to light L-20. Accordingly,
15 the communications network 118 would be configured so as to ADD light L-20 to the list of lights 107 which are under control of switch S-10. A further search would then be made for data indicative of command C-17 from wand W-6. Upon obtaining data indicative of the fact that command C-17 was a SET command to switch S-6, the configuration sequence would then be considered complete. That is, light L-20 would be controlled by switch S-10. Use of the ADD
20 command, instead of the SET command, will cause light L-20 to be added to the lights 107 then currently being controlled by switch S-10.

In accordance with the foregoing description, it is apparent that if command C-17 had been an ADD command associated with a particular light, then not only light L-20, but also

the light associated with command C-17 would also be added to the list of lights 107 controlled by switch S-10.

In addition to the SET and ADD commands, the user may also employ a REMOVE command. The REMOVE mode may be selected by enabling the REMOVE switch 154 of the mode selector module 148 associated with the particular wand 104 to be used.

Functionality of the REMOVE command is similar to the functionality associated with use of the SET and ADD commands. To illustrate use of the REMOVE command, it can be assumed that the user wishes to REMOVE control of light L-30 by switch S-25. Using wand W-6, the user may enable the REMOVE switch 154, point the wand W-6 to light L-30, and activate the trigger switch 144. This causes transmittal of the command W-6, C-20, REMOVE, L-30. Upon completion, the user may then point wand W-6 to switch S-25, and again transmit a REMOVE command. This command may be characterized as command W-6, C-21, REMOVE, S-25.

Upon receipt of the signals indicative of command C-21, the switch unit 128 associated with switch S-25 would then cause the communications network 118 to search for data indicative of

command C-20 from wand W-6. Upon retrieval of data indicating that command C-20 from wand W-6 was a REMOVE command transmitted to light L-30, the communications network

118 would be reconfigured so as to REMOVE light L-30 from control by switch S-25. A further search would then be made for data indicative of command C-19 from wand W-6. Upon

obtaining data indicating that command C-19 was a command directed to switch S-10, the

REMOVE process would be considered complete. Through this reconfiguration, light L-30 would no longer be controlled by switch S-25. It will be apparent from the description of the foregoing configuration processes that control of two or more of the lights 107 may be

REMOVED from a particular one of the switches 129, through processes similar to the foregoing.

The foregoing describes particular embodiments of a lighting system 100 in accordance with the invention. It will be apparent that other embodiments in accordance with
5 the invention may be utilized, without departing from the principal concepts of the invention. For example, it would also be possible to have an IR emitter associated with each of the lighting units 106, and an IR emitter associated with each of the switch units 128. Correspondingly, an IR sensor could then be employed within each of the wands 104. With this type of configuration, each of the wands 104 may be utilized to receive and to transmit IR signals.
10 Correspondingly, each of the switch units 128 and lighting units 106 can also be enabled to transmit IR signals. As an example of commands which can be utilized with this type of configuration, a command could be generated from a wand 104 or a switch unit 128 requesting certain of the lights 107 to "broadcast" their individual addresses. For purposes of undertaking such activities by a switch unit 128, various commands other than merely SET, REMOVE and
15 ADD commands could be transmitted from each of the wands 104. With the foregoing types of configurations, switch units 128 may be made to directly transmit commands to lighting units 106 through spatial signals.

Still further, sensors could be included within switch units 128 and the wands 104 so as to sense visible light itself. With this type of configuration, commands may be transmitted
20 to the lighting units 106 so as to cause the lights 107 themselves to "blink" their own codes, such as their unique addresses. It is apparent that other variations of spatial signal transmission/reception may be utilized in accordance with the invention, without departing from the novel concepts thereof.

In addition to the foregoing, it is also possible in accordance with the invention to include additional features regarding "feedback" to each of the wands 104. That is, it may be worthwhile to include means for indicating successful reception and execution of a command. In this regard, for example, and as earlier described herein, the visible light 164 for each of the wands 104 may be made to "blink" when the trigger switch 144 is activated, indicating the transmission of a command. Other functionality may be included to provide feedback, such as each of the lights 107 which is the subject of a command from one of the wands 104 being made to "blink" or otherwise indicate successful reception or completion of a command. Still further, and as somewhat earlier described herein, it would also be feasible in accordance with the invention to cause a switch unit 128 and the communications network 118 to cause all of the lights 107 which are the subject of a series of commands to "blink" so as to further indicate successful reception and/or completion of a command sequence. Various other means of feedback to the user and to the wands 104 may be employed without departing from the novel concepts of the invention.

As earlier stated, the general concepts of reprogramming or configuring the control correlation in accordance with the invention does not have to be limited to switching and lighting apparatus. Numerous other functional accessories often found at workplaces may also employ the same concept set forth herein with respect to providing relatively simple and manual means of control of various functional components.

Also, other aspects of control systems in accordance with the invention may be employed. For example, various types of algorithms may be utilized with the control wands. It might be possible, for example, to utilize algorithms which do not require the need for transmitting of a wand identification number. On the other hand, it may be worthwhile to

provide a wand identification number as an option, in the event someone wishes to create a “wand” prioritization hierarchy.

Still further, it would be possible to utilize algorithms whereby all of the wands are considered to be identical, and the system to be controlled maintains the last “state” in which it was configured. It is also possible that the system to be controlled could be integrated with a tracking/identification system, and change state based on who (or which wand) was in the room. Further, the wands could be constructed in a manner so that only certain work could be performed in a subset of the rooms in a building (i.e., restriction to one floor of a multi-story building). In general, various types of “logical” relationships could be utilized with the wands.

Other aspects of a control system in accordance with the invention may be utilized. For example, each device to be controlled (e.g., light fixtures, microphones, cameras, monitors, wall sockets and the like) may be provided with standard power and data connections required by the device. In addition, each of the devices may be connected to a control bus. The concept of utilizing controllers and control buses is set forth in prior paragraphs herein, and also is set forth in a commonly assigned U.S. Provisional Patent Application entitled “Rail System” and filed as of even date herewith. Connection to a bus may be made via existing electrical power lines, or separate hardwired or wireless channels. All control units would be connected to the control bus.

Each device could also be provided with at least one global unique identifier. The identifier would preferably be unique from the date of manufacture. The identifier could be broken into portions, with a first portion reflecting the manufacturer, a second portion identifying the type, family or class of device, and a third portion uniquely identifying the particular unit. The control arrangement could commence in operation with the control unit sending a command

to all devices connecting to the bus, so as to identify themselves. Each device would respond by emitting its identifier via a method consistent with its end use. For example, a speaker may emit an audio signal from which the identifier could be determined. A light may flash at the identifier. Alternatively, an IR LED on the device may be utilized to flash the identifier. This
5 would also allow devices such as cameras and heaters, where no clear method exists, to identify themselves.

An identifier recording unit capable of receiving each of these signals and converting them to unique identifiers may then be brought into close proximity with one or more devices, each in succession. The identifier recorder reads the identifier, and then stores it in
10 memory. In the case of devices without convenient access, it may be possible to obtain the identifying signal via a directional microphone or optics.

Once a set of identifiers is obtained, it may be provided to the control unit and assigned to a particular control. This may be achieved by any of the device emitting methods previously described herein, or by means of a serial cable or wireless communications protocol.
15 In the case of a control unit with multiple switches, the user may select the particular control to which the collected identifiers are assigned. It is preferable that the identifier recorder be capable of storing more than one set of identifiers. This would permit more than one set of devices to be mapped to more than one control in a signal pass, simplifying the process of establishing the control scheme.

20 Alternatively, placement of a device indicator near a device may trigger the device to transmit its identifier by means of the control bus to the control unit. The control unit would then record the device identifier as a "tagged" device. The control unit could then be

instructed to map the tagged devices to a particular control. Most simply, the device indicator could be a button on each device.

An approach in accordance with the invention as described herein offers several advantageous over existing systems. Because each device identifier is unique, there is no chance
5 of confusion between the devices. Furthermore, since complicated identifiers need not be changed within the device, remembered or recorded by the user, the system is relatively simple to use. Further, the control arrangement in accordance with the invention allows the user to create a device control scheme in the physical space of the devices. That is, it is not necessary to design a control scheme, convert the scheme to a set of identifiers, and then program a control
10 unit using these identifiers. Instead, the invention allows the user to program a control scheme as the user visualizes it within the workspace.

Further in accordance with the invention, the concepts set forth above may be used to readily map a control to a particular parameter (e.g., lighting intensity, sound intensity and the like) at a particular location within the workspace. In this sense, the invention provides
15 for the direct control of locations, rather than the control of devices.

In addition to use in workspaces, concepts associated with the invention may be utilized in control units associated with residential facilities, theaters, vehicle interiors and the like.

It will be apparent to those skilled in the pertinent arts that other embodiments of
20 operating systems in accordance with the invention may be designed. That is, the principles of an operating system for configuring control among units through the use of a remote device are not limited to the specific embodiments described herein. For example, and as described in previous paragraphs, various configurations of spatial signal transmitters and receivers may be

utilized among the lighting units, switch units and wands. Accordingly, it will be apparent to those skilled in the art that modifications and other variations of the above-described illustrative embodiments of the invention may be effected without departing from the spirit and scope of the novel concepts of the invention.

5 Further principles of the invention are disclosed, by way of example, within a rail system 1100 illustrated in FIGS. 3 – 34. A general layout of the rail system 1100 as used within a series of reconfigurable commercial interiors is illustrated in FIG. 5. Structural layouts of the rail system employing certain of its principal components are also illustrated in FIGS. 16, 19, 23A, 28, 29, 30, 31 and 31A. The rail system 1100 comprises an overhead structure providing
10 significant advantages in environmental workspaces. As examples, the rail system 1100 in accordance with the invention facilitates access to locations where a commercial interior designer may wish to locate various functional elements, including electrical power receptacles and the like. In addition, the rail system 1100 facilitates flexibility and reconfiguration in the location of various functional elements which may be supported and mounted in a releasable and
15 reconfigurable manner with the rail system. Still further, the rail system in accordance with the invention may carry not only AC electrical power (of varying voltages), but also may carry DC/low voltage or communication signals. The communication signals can be used for purposes of relatively well-known communication functions. However, and in accordance with the invention, the rail system 1100 may include a communication bus structure which permits the
20 "programming" of controlled relationships among various commercial interior components. For example, with a bus structure as incorporated within the rail system 1100, "control relationships" may be "reprogrammed" among components such as switches and lights.

More specifically, with the rail system 1100 in accordance with the invention, reconfiguration is facilitated, both with respect to expense, time and functionality. Essentially, the commercial interior can be reconfigured in "real time." In this regard, not only is it important that various functional components can be quickly relocated from a "physical" sense, but
5 relationships among functional components can also be altered. As a relatively simple example, and as described in subsequent paragraphs herein with respect to FIGS. 30 – 34, functional or "control" relationships can be readily modified among various switch and lighting components. In part, it is the "totality" of the differing aspects of a commercial interior which are readily reconfigurable, and which provide some of the inventive concepts of the rail system 1100.

10 With reference first to FIG. 5, the rail system 1100 may be employed within a commercial interior structure 1102. The commercial interior structure 1102 includes a number of workspaces which have been defined in a reconfigurable manner through the use of a series of vertically disposed partitions 1104, an example of which is shown with respect to another exemplary commercial interior in FIG. 28. The vertically disposed partitions 1104 are utilized to
15 reconfigurably separate the commercial interior structure 1102 into workspaces. For example, in the lower left-hand portion of FIG. 5, a workspace 1106 is defined which may be employed as a conference room having a conference table 1108 and chairs 1110. The conference room workspace 1106 may also be somewhat partially open, as also illustrated in FIG. 5.

The commercial interior structure 1102 may include other workspaces, such as the
20 workspace 1112. The workspace 1112 may comprise, for example, a series of computer workstations 1114 which are reconfigurably segregated from each other through one of the vertically disposed partitions 1116, which is configured in a continuous S-shaped configuration. The commercial interior structure 1102 may have other work areas. For example, the area

indicated as room 1118 may be a library reading room. Correspondingly, the area designated as area 1120 may be a teleconferencing area. Continuing with a library concept, the commercial interior structure 1102 may include book stacks 1122. For purposes of providing additional lighting, a skylight 1124 may also be provided. Still further, the structure 1102 may include
5 shared offices 1126 and collaborative work areas 1128. These are merely some examples of areas which may be formed and partitioned within a commercial interior structure 1102.

The rail system 1100 as illustrated in FIG. 5 comprises an overhead rail structure having a series of primary tracks 1130 which are shown as extending horizontally in the view illustrated in FIG. 5. The primary tracks 1130 are shown in FIG. 5 as being spaced apart in a
10 parallel manner and each equidistant from adjacent ones of the primary tracks 1130. The primary tracks 1130 comprise a principal component of the rail system 1100. In part, and as described in subsequent paragraphs herein, the primary tracks 1130 are employed to releasably and reconfigurably support, in an overhead manner, the vertically disposed partitions 1104.

Also in accordance with the invention, the rail system 1100 as illustrated in FIG. 5
15 comprises a series of cross rails 1132. The cross rails 1132, as described in subsequent paragraphs herein, are releasably interconnectable to the primary tracks 1130. Further, as shown in FIG. 5, the cross rails 1132 extend in perpendicular configurations relative to the primary tracks 1130. However, as also described in subsequent paragraphs herein with respect to FIG. 23A, a cross rail 1132 may be interconnected to adjacent primary tracks 1132 at an angular
20 configuration, relative to the longitudinal configurations of the interconnected primary tracks 1130.

The work place structure 1102 may also include ceiling panels 1134 or similar types of ceiling structures which may be supported by the primary tracks 1130 and cross rails

1132 of the rail system 1100. The ceiling panels 1134 are shown, for purposes of clarity, in phantom line format in FIG. 5.

In summary, FIG. 5 illustrates an exemplary rail system 1100 in accordance with the invention, as may be applied as an overhead structure to a commercial interior structure 1102 having a series of reconfigurable and partitioned workspaces 1106. In this regard, one aspect of the rail systems in accordance with the invention relates to increased structural rigidity. In part, this is provided by a staggering relationship for rail system components, as described in subsequent paragraphs herein. This rigidity reduces the probability of inadvertent dislodgment of components and connected items, such as ceiling covers and the like. In addition, the rigidity provides for superior egress for occupants during fires and seismic events.

Turning more specifically to the details of the rail system 1100, a primary track 1130 in accordance with the invention will now be described with respect to FIGS. 3, 4, 6-9, 12 and 12A. Turning specifically to FIG. 3, which illustrates an assembled one of the primary tracks 1130, the primary tracks 1130 may be supported by interconnection to a steel or other metallic overhead support beam 1136. The overhead support beam 1136 is illustrated in cross-sectional configuration in FIG. 3. The overhead support beam 1136 may be load or non-load bearing. The support beam 1136 includes a lower and horizontally extending flange 1138 extending in a substantially horizontal plane. For purposes of supporting the primary track 1130 illustrated in FIG. 3, a series of co-threaded bolts 1140 may be employed. One of the co-threaded bolts 1140 is illustrated in FIG. 3. The co-threaded bolt 1140 extends at its upper end through an aperture (not shown) extending through the lower flange 1138 of the support beam 1136. The co-threaded bolt 1140 is threaded adjacent its upper end and is secured at a desired vertical disposition through the use of a lower hex-nut 1142 and an upper hex-nut 1144. The

hex-nuts 1142, 1144 are threaded onto the co-threaded bolt 1140 on opposing sides of the lower flange 1138. In this manner, the primary track 1130 may be secured to the overhead support beams 1136, in a manner which provides for rigidity, yet also provides for adjustability with respect to vertical positioning relative to the support beam 1136. In addition to the overhead
5 supporting arrangements as described herein, it may also be possible to interconnect the rail systems to other structure, such as connection to structures like concrete floors above the rail system, with the connections occurring through cables and the like.

It should be emphasized that other supporting arrangements may be employed, without departing from the spirit and scope of the novel concept of the invention. For example,
10 in place of the co-threaded bolt 1140 and the support beam 1136 configuration, the bolt 1140 could be replaced by a threaded hangar or similar means, with a threaded rod having a metallic hangar threadably received at an upper end of the threaded rod. The hangar may then be hung on or otherwise releasably interconnected to other overhead supporting components. In any event, it is advantageous to utilize a supporting arrangement which facilitates relocation and vertical
15 adjustability of the interconnected primary track 1130.

The lower end of the co-threaded bolt 1140 is threaded and extends downwardly through an aperture 1146 which, correspondingly, extends vertically through the upper portion of a back half assembly 1148 or "back half" (illustrated in a clarifying manner in FIG. 4). The back half 1148 will be described in greater detail in subsequent paragraphs herein. The co-threaded
20 bolt 1140 is further extended through a threaded bore 1150 of a track connector 1152. The threaded bore 1150 and track connector 1152 are illustrated in a clarifying manner in FIG. 7. Associated with the underside of the threaded bore 1150 is a stationary and self-locking hex nut 1154. For purposes of interconnection of the primary track 1130 to the support beam 1136, the

co-threaded bolt 1140 can first be threadably received within the threaded bore 1150 of the track connector 1152, with the co-threaded bolt 1140 also extending through the aperture 1146 of the back half 1148. After being threadably received within the threaded bore 1150 an appropriate distance, the hex nuts 1142, 1144 can be appropriately tightened and positioned at a desired vertical orientation, so as to provide the appropriate vertical disposition of the primary track 1130 relative to the support beam 1136. As apparent from the nature and scope of the invention, a series of bolts 1140 and associated components are utilized along the longitudinal axis of the primary track 1130, for purposes of appropriate and releasable interconnection to the support beam 1136. In addition to the overhead supporting arrangements as described herein, it may also be possible to interconnect the rail systems to other structure, such as connection to concrete floors above the rail system, with the connections occurring through cables and the like.

The primary track 1130 includes a series of individual elements which form the track itself. More specifically, the primary track 1130 includes a previously referenced back half 1148. The back half 1148 is primarily illustrated in FIGS. 4 and 8, and may preferably be constructed as a steel roll formed section. With reference primarily to FIG. 4, the back half 1148 includes an upper member 1154 having a normal horizontally disposed configuration, and extending in an elongated manner so as to form part of the longitudinal structure of the primary track 1130. The end 1156 of the upper member 1154 is turned inwardly so as to form somewhat of a tongue 1158. The tongue 1158 is utilized so as to assist in securing a cover 1202 of the primary track 1130 to the back half 1148, as described in subsequent paragraphs herein.

The upper member 1154 is integral at one side with a downwardly disposed side member 1160, again as primarily shown in FIG. 4. The side member 1160 extends downwardly a certain distance, and then projects inwardly so as to form a supporting pedestal 1162. As

described in subsequent paragraphs herein, the supporting pedestal 1162 acts so as to support one end of the front half assembly 1180 of the primary track 1130, as described in subsequent paragraphs herein. The side member 1160 continues to extend downwardly from the supporting pedestal 1162, and terminates in an elongated tongue 1164, again as primarily illustrated in FIG.

- 5 4. Although not shown in either FIG. 4 or FIG. 8, the elongated tongue 1164 acts as a support for interconnection of one or more cross rails to the primary track 1130, and for support for ceiling decorative coverings and the like.

The back half assembly 1148 also includes, as illustrated in FIG. 4, a secondary bracket 1166. The secondary bracket 1166 includes an upper member 1168 which curves
10 outwardly and is integral with a vertical member 1170. The secondary bracket 1166 and upper member 1168 also prevent screws or the like from being driven into electrical components. The vertical member 1170 is preferably secured (by weldment or other securing/connecting means) to the side member 1160 of the back half assembly 1148. The secondary bracket 1166 then includes a supporting pedestal 1172A which extends inwardly, and acts so as to facilitate support
15 of the power connector 1340 as described in subsequent paragraphs herein. Further, the support pedestal 1172B extends inwardly, and acts so as to facilitate support of cross rails, vertical partitions, lighting and other accessories. In addition, the cross-sectional configuration of the secondary bracket 1166, as illustrated in FIG. 4, mates with the cross-sectional configuration of the bus strip 1174, as further described in subsequent paragraphs herein.

20 Continuing primarily with respect to FIGS. 4 and 8, the primary track 1130 also includes a front half assembly 1180, also preferably constructed as a steel roll formed section. The front half assembly 1180 includes an upper member 1182 having a normally horizontally disposed configuration, and extending in an elongated manner so as to form part of the

longitudinal structure of the primary track 1130. The upper member 1182 is also utilized to support and secure, in part, the rail connector, as described in subsequent paragraphs herein.

With reference specifically to FIGS. 4 and 8, the right side of the upper member 1182 projects somewhat downwardly and curves back upon itself so as to form a lip 1184. As described in subsequent paragraphs herein, the lip 1184 is utilized, in part, so as to secure the track cover to the assemblage of the primary track 1130. From the lip 1184, the front half assembly 1180 projects downwardly and then outwardly so as to form a projection 1186. From the projection 1186, the front half assembly 1180 continues downwardly and then terminates in a laterally projecting and elongated tongue 1188. As partially shown in FIG. 3, and as described in subsequent paragraphs herein, the elongated tongue 1188 acts as a support for interconnection of one or more cross rails to the primary track 1130 and ceiling decorative coverings.

The front half assembly 1180 further includes, as also illustrated in FIGS. 4 and 8, a secondary bracket 1190. The secondary bracket 1190 includes an upper member 1192 which curves outwardly and is integral with a vertical member 1194. The secondary bracket 1190 and upper member 1192 also prevent screws or similar elements from being driven into electrical components. The vertical member 1194 is preferably secured (by weldment or other securing/connecting means) to a side member 1196 of the front half assembly 1180. The secondary bracket 1190 further includes a supporting pedestal 1198A positioned below the vertical member 1194 and projecting inwardly, so as to facilitate support of a power connector 1340, as described in subsequent paragraphs herein. Correspondingly, support pedestal 1198B extends inwardly, and acts so as to facilitate support of cross rails, vertical partitions, lighting and other accessories. In addition, the secondary bracket 1190 mates with a front bus strip 1200, as further described in subsequent paragraphs herein.

The primary track 1130 further includes a cover assembly 1202 which is utilized to enclose what is characterized as the front side of the primary track 1130. The cover assembly 1202 is primarily shown in FIGS. 4, 8 and 10. With reference primarily to FIG. 6, the cover assembly 1202 includes an upper portion 1204 having an inwardly directed tongue 1206 formed by the upper portion curving back against itself. The upper portion 1204 is integral with a front portion 1208 having a vertical orientation, and shaped so as to enclose a central portion of the primary track 1130. Extending downwardly from and integral with the front portion 1208 is an inwardly projecting shoe 1210 shown in cross sectional configuration in FIG. 4. As illustrated in FIG. 11, the cover assembly 1202 may also include apertures 1212. The apertures 1212 are adapted to receive connectors (such as screws) 1214 illustrated in exploded view in FIG. 4. The screws 1214 (or similar connecting means) are received through the apertures 1212 and through corresponding apertures in the support bracket (as described in subsequent paragraphs herein) for purposes of tightly securing opposing ends of the cover assembly 1202 to the primary track 1130. In addition to the apertures 1212, the cover assembly 1202 may also incorporate knock-outs 1216 spaced at desired intervals along the longitudinal axis of the cover assembly 1202. The knock-outs 1216 are adapted to receive electrical cables and the like, such as the electrical cables 1218 illustrated in FIG. 11. A cable 1218 may be secured through a knock-out 1216 by means of a bushing and collar 1220 (as also shown in FIG. 11) or a similar connecting and securing means.

For purposes of providing releasable interconnection and rigidity for the primary tracks 1130, the assemblage of the primary track 1130 also includes the support bracket or track connector 1152. The structural configuration of the support bracket 1152 is primarily shown in FIG. 7. With reference thereto, the support bracket 1152 includes a primary structure 1222

having, as illustrated in FIG. 7, a substantially rectangular cross sectional configuration and a relatively short length. The primary structure 1222 includes an upper wall 1224, lower wall 1226, back wall 1228 (conforming to the directional naming convention used with the front and back half assemblies 1180 and 1148, respectively) and front wall 1230. Each of the walls 1224, 1226, 1228 and 1230 are preferably integral with adjacent other ones of the walls. As further shown in FIG. 7, the upper wall 1224 includes a threaded bore 1150 previously described herein, and adapted to threadably receive the co-threaded bolt 1140 illustrated in FIGS. 3 and 5. Also situated within the upper wall 1224 are a series of four apertures 1232. As described in subsequent paragraphs herein, the apertures 1232 are adapted to receive securing means for purposes of securing the support bracket to elements of the primary track 1130. As with the upper wall 1224, the lower wall 1226 also includes a series of four apertures 1234 adapted to receive securing means for further securing the support bracket 1152 to other elements of the primary track 1130. Similarly, the back wall 1228 includes a series of four apertures 1236, while the front wall 1230 incorporates a series of four apertures 1238. In addition to the primary structure 1222, the support bracket 1152 also includes a lower plate 1240. The lower plate 1240, as with each of the walls of the primary structure 1222, includes a series of four apertures 1242. When the lower plate 1240 is appropriately positioned below the lower wall 1226 of the primary structure 1222, the apertures 1234 of the lower wall 1226 are substantially concentric with the apertures 1242 of the lower plate 1240. The wall 1182 of the tongue 1188 is squeezed between the primary structure 1222 and lower plate 1240 through the use of pop rivets.

In addition to the aforescribed elements of the primary track 1130, each of the main tracks 1130 also includes a back bus strip 1174 and a front bus strip 1200, as primarily illustrated in an exploded format in FIG. 4. The bus strips 1174, 1200 are fabricated from

extruded PVC plastic, with inserted copper strips. With reference primarily to FIG. 4, the back bus strip 1174 includes an upper member 1244 which terminates in a hook 1246 formed by an arcuate portion of the upper member 1244. Integral with and disposed downwardly from the upper member 1244 is a side member 1248. Longitudinally disposed along the side member 1248 are a series of three spaced apart AC buses 1250. The AC buses 1250 are utilized to provide a continuum of electrical power along the length of the primary track 1130. The AC buses 1250 may carry, for example, 120-volt AC power. In accordance with the invention, the bus configuration employing the AC buses 1250 permits interconnection of functional components to be electrically energized along the continuum of the primary track 1130. Of course, the buses 1250 may carry other voltages, or electrical power other than AC.

From the side member 1248, the back bus strip 1174 projects downwardly to an inwardly projecting supporting pedestal 1252. The supporting pedestal 1252 mates with the corresponding supporting pedestal 1172 of the secondary bracket 1166 of back half assembly 1148. However, the structural design also provides functionality in that the inward projection of the supporting pedestal 1252 provides a physical separation barrier for insuring isolation among buses carrying different voltages or circuits.

In accordance with another aspect of the invention, the back bus strip 1174 may also incorporate low voltage DC/communication buses. More specifically, depending outwardly and downwardly from the supporting pedestal 1252 is a lower member 1254. The lower member 1254 is integral with the supporting pedestal 1252 and carries a pair of low voltage, DC/communication buses 1256 longitudinally along the length of the back bus strip 1174. In accordance with one aspect of the invention, the low voltage, DC/communication buses 1256 may be employed to provide low voltage, DC power and/or communication signals to a variety

of functional components. In this regard, it should be emphasized that the rail system 1100 in accordance with the invention may be employed to provide not only electrical power to conventional, electrically energized devices such as lights and the like, but may also be employed to provide communication signals to apparatus associated with the same devices. As an example, and as described in the commonly assigned U.S. Provisional Patent Application Serial No. 60/374,012, filed April 19, 2002, control relationships between switches and lights may be reconfigured in a "real time" fashion. In this regard, lighting devices may have programmable controllers, memories or other associated apparatus controlled by communication signals. The rail system 1100 in accordance with the invention provides a convenient means for transmitting and receiving these communication signals from devices which may be physically located along a continuum of the primary tracks 1130 of the rail system 1100.

Returning to the structure of the back bus strip 1174, the lower member 1254 terminates in an upwardly projecting hook 1258. In addition to the back bus strip 1174, the primary track 1130 also includes the front bus strip 1200, again as shown primarily in FIG. 4.

The front bus strip 1200 has a structural configuration substantially conforming to a "mirror image" of the back bus strip 1174. More specifically, and with reference primarily to FIG. 4, the front bus strip 1200 includes an upper member 1260, terminating in a downwardly projecting hook 1262. The upper member 1260 is integral with a downwardly projecting side member 1264. As with the back bus strip 1174, the front bus strip 1200 includes a series of three AC buses 1266 extending longitudinally along the length of the side member 1264. As with the AC buses 1250, the AC buses 1266 may, for example, carry 120-volt AC.

Extending downwardly from the side member 1264 and integral therewith is an inwardly projecting supporting pedestal 1268. The supporting pedestal 1268 is a mirror image of

and functions the same as the supporting pedestal 1252. Extending downwardly from the side member 1264 and integral therewith is a downwardly projecting lower member 1270. As with the lower member 1254 of the back bus strip 1174, the lower member 1270 of the front bus strip 1200 may carry a pair of low voltage, DC and/or communication buses 1272. The low voltage, DC/communication buses 1272 may be operable to carry low voltage or DC signals for purposes of energizing certain functional components or, alternatively, may also carry communication signals for purposes of facilitating control of various functional components. The lower member 1270 terminates in an upwardly projecting hook 1274, similar in structure to the hook 1258 of the back bus strip 1174.

In accordance with the foregoing description, the assembly of certain components of a primary track 1130 of the rail system 1100 will now be described. Referring primarily to FIGS. 4, 7, 8, and 11, the back half assembly 1148 and the front half assembly 1180 may be brought together correspondingly with a support bracket 1152. The support bracket 1152 can be positioned at one end of a front half assembly 1180, primarily as shown in FIG. 11. In this configuration, the upper member 1182 of the front half assembly 1180 can be positioned intermediate the lower wall 1226 of the primary structure and the lower plate 1240. This configuration is also illustrated in FIGS. 3 and 4. With this configuration, pop rivets (not shown) or the like may be inserted through apertures (also not shown) in the upper member 1182, and extended through apertures 1234 of the lower wall 1226 and the apertures 1242 of the lower plate 1240. In this manner, the front half assembly 1180 is secured to the support bracket 1152 at one of its ends. A similar interconnection may be utilized at an opposing end of the front half assembly 1180. As an example of a physical realization, the interconnections may be spaced along the front half assembly 1180 at, for example, no more than 60 inches apart. As illustrated

in FIG. 11, the support bracket 1152 is positioned so that only two of the apertures 1242 and 1234 are utilized with the support bracket 1152 for interconnection to the upper member 1182 of one section of the front half assembly 1180. The remaining apertures 1234 and 1242 of the same support bracket 1152 will be utilized for interconnection to an adjacent section of the front half assembly 1180.

With the front half assembly 1180 in place, the back half assembly 1148 can be positioned so that it extends around at least a portion of the support bracket 1152 in a configuration as primarily shown in FIG. 3. In this configuration, apertures (not shown) in the upper member 1154 of the back half assembly 1148 may be positioned so as to be concentric with at least a pair of the apertures 1232 associated with the upper wall 1224 of the primary structure 1222. The upper member 1154 can be secured through pop rivets 1276 (as shown in FIG. 4) or similar connecting or securing means, for purposes of rigidly securing the back half assembly 1148 to a support bracket 1152. As shown in FIG. 3, with this configuration, the supporting pedestal 1162 of the back half assembly 1148 is positioned at one end and below the upper member 1182 of the front half assembly 1180. For purposes of further securing the back half assembly 1148 to the support bracket 1152, pop rivets 1278 may be received through apertures (not shown) in the side member 1160 of the back half assembly 1148, and then further through apertures 1236 (as shown in FIG. 7) of the back wall 1228. With the foregoing interconnection, the back half assembly 1148 is rigidly secured to a support bracket 1152.

As shown in FIG. 11, when a support bracket 1152 is utilized at the end of one section of the back half assembly 1148, pop rivets 1278 are received through only two of the apertures 1236 in the back wall 1228 of the support bracket 1152. The other two apertures 1236

are utilized to receive pop rivets which will secure an adjacent section of the back half assembly 1148 to the support bracket 1152.

The back bus strip 1174 and the front bus strip 1200 can then be secured to the back half assembly 1148 and the front half assembly 1180, respectively. In fact, however, for purposes of facilitation of assembly, the bus strips 1174 and 1200 may be positioned and secured to the assemblies 1148 and 1180, respectively, before the assemblies 1148 and 1180 are actually assembled. More specifically, and primarily with reference to FIGS. 3, 4, and 11, the back bus strip 1174 can be positioned so as to structurally "mate" with the vertical member 1170 of the back half assembly 1148. With this structural mating, the hook 1246 at the upper end of the back bus strip 1174 is positioned so as to engage the upper member 1168 of the secondary bracket 1166 associated with the back half assembly 1148. Correspondingly, the hook 1258 which is located at the terminating lower end of the back bus strip 1174 is made to engage a downwardly depending lower member 1280 of the secondary bracket 1166 of the back half assembly 1148. To provide for this interconnection, the secondary bracket 1166 and the back bus strip 1174 are manufactured with at least some minimal resiliency so as to appropriately engage the bracket 1166 with the bus strip 1174. This structural interconnection is shown in several views of the drawings, including FIGS. 3 and 11.

As with the back bus strip 1174, the front bus strip 1200 is structurally "mated" with the secondary bracket 1190 of the front half assembly 1180. Also as with the back bus strip 1174, the front bus strip 1200 includes a hook 1262 which is made to engage an upper end of the upper member 1192 of the secondary bracket 1190 associated with the front half assembly 1180. Correspondingly, the hook 1274 located at the terminating lower end of the front bus strip 1200 hooks around and engages the terminating end of a lower member 1282 of the secondary bracket

1190 associated with the front half assembly 1180. In this manner, the front bus strip 1200 is secured to the front half assembly 1180.

For purposes of further securing together the elements of the primary track 1130, the supporting pedestals 1172 and 1252 of the secondary bracket 1166 of the back half assembly 1148 and the back bus strip 1174, respectively, may include apertures (not shown) extending there-through, so as to be concentric with one another when the secondary bracket 1166 is structurally mated with the back bus strip 1174. Although the apertures are not shown, the axis line X in FIG. 4 represents the general location of a central axis for the apertures.

Correspondingly, a set of apertures (not shown) may extend through the central portions of the supporting pedestals 1268 and 1198 of the front bus strip 1200 and the secondary bracket 1190 of the front half assembly 1180, respectively.

To more rigidly secure together the elements of the primary track 1130, a bolt 1284, with a conventional hex nut 1286, may be received within the apertures of the supporting pedestals 1172, 1252, 1268 and 1198. These bolts 1284 and nuts 1286 may be spaced periodically along the length of the back half assembly 1148 and front half assembly 1180. To insure separation between these supporting pedestals 1252 and 1268, and so as to further insure that the back half assembly 1148 and front half assembly 1180 are not too tightly secured together so as to cause damage, a sleeve 1288 (as also shown in FIG. 4) may be received on the threaded shaft of the bolt 1284. In addition to securing the back half assembly 1148 to the front half assembly 1180, the bolt 1284 and nut 1286 can also be utilized to removably secure power connectors 1340 to the primary track 1130. This concept is described in subsequent paragraphs herein.

After the back half assembly 1148 and front half assembly 1180 are appropriately interconnected, the cover assembly 1202 may be set in place. More specifically, and as primarily shown in FIG. 3, the cover assembly 1202 may be mounted to the front side of the primary track 1130 so that the tongue 1206 of the upper portion 1204 will engage the tongue 1158 of the end 1156 of upper member 1154 associated with the back half assembly 1148. Correspondingly, the lower shoe 1210 of the cover assembly 1202 may be resiliently secured under the lip 1184 of the front half assembly 1180. Again, this configuration is primarily shown in FIG. 3. In this manner, the cover assembly 1202 may be flexibly and removably secured to the back half assembly 1148 and the front half assembly 1180. This structural interconnection is primarily shown in FIGS. 3 and 8. To more rigidly secure the cover assembly 1202 to the back half assembly 1148 and front half assembly 1180, and as previously described with respect to FIG. 11, the cover assembly 1202 includes a series of apertures 1212 spaced apart along the length of the front portion 1208 of the cover assembly 1202. The screws or other threaded fasteners 1214 can be received through the apertures 1212 and then through the apertures 1238 and the front wall 1230 of support bracket 1152, for purposes of securing the cover assembly 1202 to the support bracket 1152. It should also be noted that, with partial reference to FIG. 11, an elongated section of the cover assembly 1202 may have one end connected through only two of the apertures 1238 of the front wall 1222 of support bracket 1252. The remaining two apertures in front wall 1222 may be utilized to receive screws received through apertures 1212 of an adjacent section of the cover assembly 1202. The enclosure formed when cover assembly 1202 is assembled creates a wireway for AC wires to be passed through, as described in subsequent paragraphs herein.

As previously described primarily with respect to FIGS. 3, 4 and 7, the co-threaded bolt 1140 may be interconnected to the primary track 1130 by threadably receiving the lower end of the co-threaded bolt 1140 through the threaded bore 1150 associated with the support bracket 1152. In addition to being received through the threaded bore 1150, apertures
5 (not shown) may be appropriately spaced apart along the length of the upper member 1154 of the back half assembly 1148. The back half assembly 1148 can be positioned so that these apertures in the upper member 1154 are positioned concentric with at least a pair of the apertures 1232 located in the upper wall of the support bracket 1152, as shown in FIG. 7. The pop rivets 1276 can then be received through the apertures of the upper member 1154 and the apertures 1232 of
10 the support bracket 1152.

With the foregoing assembly, the primary track 1130 provides a means for supplying electrical power and for receiving/transmitting communication signals along a continuum of an overhead infrastructure. Positioning of functional components requiring electrical power or otherwise operating through the use of data communications and signaling
15 may therefore be physically reconfigured and repositioned throughout a commercial interior, without the need of substantial disassembly and reassembly of an infrastructure.

Other infrastructure components may be employed with the rail system 1100 in accordance with the invention. As an example, and with reference primarily to FIGS. 3, 4 and 6, the rail system 1100 may include a pair of cable trays 1290. The cable trays 1290 can comprise a
20 back cable tray 1292 and a front cable tray 1294. The back cable tray 1292 can include a rear portion 1296 having an arcuate shape as shown in FIGS. 3, 4 and 6. The rear portion 1296 can extend downwardly and is integral with a forward portion 1298 having a curved configuration, as also shown in FIGS. 3, 4 and 6. A brace 1300 extends forwardly from the back of the lower part

of the forward portion 1298. The brace includes a support 1302 and a beveled ledge 1304, having the configurations shown in FIGS. 3, 4 and 6. The forward portion 1298 extends upwardly so as to form a downwardly projecting hook 1306 at its termination. A secondary support extends downwardly from the rear of the forward portion 1298.

5 The front cable tray 1294 comprises a forward portion 1310 which is somewhat of a mirror image of the rear portion 1296 of the back cable tray 1292. The forward portion 1310 is integral with, at its lower end, a rear portion 1312 having an arcuate or curved configuration. The rear portion 1312 includes a vertically disposed support 1314 and a brace 1316. The brace 1316 comprises a downwardly extending support 1318, and an undercut beveled ledge 1320. In
10 addition to the foregoing, and as illustrated in FIG. 6, the front cable tray 1294 includes, at its rear portion 1312, a series of spaced apart and arcuate slots 1322.

 In assembly of the cable trays 1290 with the primary track 1130, the front cable tray 1294 can be positioned so that the co-threaded bolts 1140 utilized with the primary track 1130 are received through the arcuate slots 1322. This configuration is primarily shown in FIG.
15 3. The cable trays 1290 are then assembled together as also primarily shown in FIG. 3. More specifically, the upper end of the rear portion 1312 of the front cable tray 1294 is releasably secured within the hook 1306 of the back cable tray 1292. Correspondingly, the beveled ledge 1304 of the back cable tray 1292 is interlocked with the undercut beveled ledge 320 of the front cable tray 1294. The supports 1302 of back cable tray 1292 and 1314, 1318 of front cable tray
20 1294 then rest upon the upper member 1154 of the back half assembly 1148. The cable trays 1290 can be utilized for various functions associated with the rail system 1100. For example, as illustrated in FIGS. 3 and 4, the cable trays 1290 are employed to carry data cables 1324 along the lengths of the primary tracks 1130. Two other aspects of the cable trays 1290 should be

mentioned. First, instead of carrying the data cables 1324, it would be possible for the cable trays 1290 to carry rigid conduit, especially in situations where electrical codes are relatively strict. Further, because the cable trays 1290 essentially comprise a two-sided tray, this configuration provides an opportunity for a separation of various cables or the like, where
5 distortion or other harmful effects may occur as a result of various cables being adjacent to each other.

In accordance with the foregoing, the rail system 1100 in accordance with the invention, comprising the cable trays 1290, provide a means for efficiently and reconfigurably carrying low voltage, electrical, data or communication cables throughout the infrastructure of
10 the rail system 1100. As apparent to the reader, the specific structural configuration of the cable trays 1290 may be modified, without departing from the spirit and scope of the principal concepts of the invention. The particular structure shown herein for the cable trays 1290 provides an efficient and relatively simple means for supporting the cable trays 1290 within the infrastructure of the rail system 1100.

15 In addition to the means for carrying and providing electrical power, data and communication signaling as described in prior paragraphs herein, the rail system 1100 also includes an additional means for carrying desired power, data or other communications signaling. With reference first to FIG. 8, showing the structure of the primary track 1130 comprised by the back half assembly 1148, front half assembly 1180 and cover assembly 1202,
20 an upper chamber or raceway 1326 is formed, as also shown in FIG. 8. The upper chamber 1326 is enclosed and substantially isolated from the cable trays 1290, back bus strip 1174 and front bus strip 1200. Accordingly, the upper chamber 1326 provides an isolated location for carrying cabling or conduit which may be of relatively high voltage. For example, the upper raceway

1326 may carry, as illustrated in FIG. 3, 277-volt AC cables 1328. Other types of relatively high voltage or other power/communications conduit requiring substantial isolation may also be carried within the upper raceway 1326.

An example of "tapping in" to the 277-volt AC cables 1328 is illustrated in FIG.

5 11. The primary elements illustrated in FIG. 11 were previously described herein, and will not be described in any particularly greater detail. As shown in FIG. 11, wires 1330 of an electrical cable 1218 are tapped into the 277-volt AC cables 1328 through the connectors 1332. As previously described herein, the electrical cable 1218 extends through a knockout 1216 within the cover assembly 1202. With the knockouts 1216 appropriately spaced along the length of the
10 cover assembly 1202, power taps can be conveniently provided along the length of the 277-volt AC cables 1328 within the upper raceway 1326. In accordance with the foregoing, the rail system 1100 in accordance with the invention provides a means for safely and efficiently carrying high voltage cabling, while further providing a configuration permitting the user to tap into the cabling at spaced apart intervals along the primary track 1130.

15 In addition to the foregoing elements, the rail system 1100 in accordance with the invention can include means for tapping into the back bus strip 1174 and front bus strip 1200 along a continuum of the bus strips. To provide this function, and as illustrated primarily in FIGS. 3, 4, 10A and 11, the rail system 1100 in accordance with the invention can comprise a power connector 1340. It should be emphasized that the rail system 1100 in accordance with the
20 invention is not limited to the particular power connector 1340 described in subsequent paragraphs herein. That is, various structures of power connectors may be utilized to tap into the bus strips 1174, 1200, without departing from the principal novel concepts of the invention. Turning to the drawings, the power connector 1340 can have a structural configuration as

primarily shown in FIG. 10A. The power connector 1340 comprises an upper chamber 1342 having bores 1344 projecting outwardly in diametrically opposed directions. Projecting from the bores 1344 is a series of AC circuit taps 1346. Although not shown in the drawings, the AC circuit taps 1346 can be electrically connected within the upper cylinder 1342 to AC connectors or wires extending downwardly from the upper cylinder 1342. These AC connectors or wires are represented by the AC conduit 1348 extending outwardly from the bottom of the power connector 1340. The AC circuit taps 1346 can be connected in any conventional manner within the upper cylinder 1342 to electrical circuits or connectors which, in turn, are connected to wires within the AC conduit 1348, as shown in FIG. 11. The AC circuit taps 1346 may be connected, again in a conventional manner, to completely separate and distinguishable AC circuits or, alternatively, certain of the AC circuit taps 1346 may be connected to the same AC circuit.

Depending downwardly from the upper cylinder 1342 is an interconnecting chamber 1350. The interconnecting chamber 1350 is preferably of a relatively smaller diameter than the diameter of the upper cylinder 1342. Depending downwardly from the interconnecting chamber 1350 is a lower cylinder 1352. The lower cylinder 1352 includes two pairs of diametrically opposed bores 1354. Extending outwardly from the bores 1354 are low voltage, DC/communications taps 1356. The taps 1356 are interconnected, within the lower cylinder 1352, to low voltage, DC/communication connectors or wiring (not shown). The interconnections within the lower cylinder 1352 can be made in a conventional and well-known manner, and resultant low voltage, DC or communication signals can be represented by the cable 1358, as shown in FIG. 11. As apparent to those skilled in the art, the AC conduit 1348 and the cable 1358 may actually comprise multiple conduits and cables. Further, the taps 1356 may be each connected to separate circuits or communication signaling apparatus or, alternatively,

certain ones of the taps 1356 may be connected to the same power circuits or communication paths.

5 The lower portion of the power connector 1340 may terminate in an externally threaded sleeve 1360. The AC conduit 1348 and DC/communications cable 1358 are received through the externally threaded sleeve 1360, which is open to the lower cylinder 1352, interconnecting chamber 1350 and upper cylinder 1342. The sleeve 1360 may be externally threaded as illustrated in the drawings, for purposes of securing the power connector 1340 to other desired electrical components such as junction boxes and the like.

10 The releasable interconnection of a power connector 1340 with the primary track 1130 is primarily shown in FIGS. 3, 4 and 11. More specifically, the power connector 1340 can be mounted within the lower portion of the primary track 1130 in a manner such that the upper cylinder 1342 is positioned adjacent the AC buses 1250 associated with the back bus strip 1174 and the front bus strip 1200. As shown expressly in FIGS. 3 and 11, the upper cylinder 1342 is configured so that it is somewhat supported on the supporting pedestals 1252 and 1268 of the bus
15 strips 1174, 1200, respectively, and with the AC circuit taps 1346 mechanically and electrically abutting the AC buses 1250, so as to provide appropriate electrical connections therebetween. For purposes of securing appropriate interconnection, the AC circuit taps 1346 may be spring-loaded so as to be biased against the AC buses 1250.

20 With this configuration, the interconnecting chamber 1350 is positioned intermediate the supporting pedestals 1252 and 1268 of bus strips 1174, 1200, respectively. The lower cylinder 1352 is positioned intermediate the buses 1256 associated with the back bus strip 1174 and the buses 1272 associated with the front bus strip 1200. The power connector 1340 and its lower cylinder 1352 are sized and configured so that with the power connector 1340 in

the position shown in FIGS. 3 and 11, the taps 1356 mechanically and electrically abut the buses 1256 and 1272. Again, for purposes of insuring appropriate electrical interconnection, the taps 1356 may be spring-loaded within the lower cylinder 1352, so as to be biased against the buses 1256 and 1272.

5 With respect to the interconnection of the power connector 1340 within the primary track 1130, the power connector 1340 can be appropriately positioned anywhere along a continuum of the bus strips 1174 and 1200. However, if the power connectors 1340 are to be more fixedly secured to the bus strips 1174, 1200, the power connectors 1340 may include a bore (not shown) through the interconnecting chamber 1350 of the power connector 1340. The power
10 connector 1340 may then be positioned so that the bore within the interconnecting chamber 1350 is concentric with apertures (not shown) extending through the supporting pedestals 1172, 1252, 1268 and 1198 of the supporting brackets and bus strips, as illustrated in FIG. 4. As an example, the bolt 1284 may be received through all of the apertures and through the bore within the interconnecting chamber 1350 of the power connector 1340. In this manner, the power
15 connector 1340 may be more rigidly secured to the primary track 1130.

As set forth in prior paragraphs, the power connector 1340 provides a means for tapping into electrical power, data signals and communication signaling along a continuum of the primary track 1130. Further, with the particular configuration of the power connector 1340 as illustrated in FIGS. 3 and 11, and with the sizing and configuration of the supporting pedestals
20 1252 and 1268 of bus strips 1174, 1200, respectively, it is difficult to accidentally lower or raise the power connector 1340 in a manner such that AC circuit taps would inadvertently abut the low voltage, DC/communication bus strips or, alternatively, the taps 1356 would inadvertently touch the AC bus strips 1250 and 1266. With this particular structure, the power connector 1340

provides means for insuring safety and mechanically and electrically isolating AC power from DC power and communications signals.

With an overhead rail system infrastructure as described herein, the present invention is concerned with many principles, including structural integrity, while maintaining an acceptable weight. To accomplish these structural advantages, it has been discovered that “staggering” certain elements of the primary track enhance the structural integrity, without requiring elements such as strengthening ribs or the like, which increase weight. Due to the length of buildings, it is not practical to pre-assemble long lengths of track, and ship them fully assembled. Accordingly, this problem necessitates assembly of the tracks within the commercial interior.

The principles of this staggering arrangement are illustrated in FIG. 12, and in the diagrammatic illustration of FIG 12A. The elements within FIGS. 12 and 12A are also illustrated in FIG. 8. Returning to FIG. 12 and referring to the left side of the page on which FIG. 12A is illustrated, a first section of the back half assembly 1148 is shown in position and labeled as Section G. Solely for purposes of illustration and description, Section G for the back half assembly 1148 may be presumed to have a length of approximately five feet. Although example lengths of sections of the elements of the primary track 1130 will be presumed within this description, it should be emphasized that none of these lengths should be considered as limiting elements of the invention. That is, without departing from the spirit and scope of the staggering concept in accordance with the invention, various lengths of sections of portions of the primary track 1130 may be utilized.

Referring back to Section G, and presuming that the section is approximately five feet in length, one of the support brackets 1152 (not shown in FIG. 12) may be utilized at the left

end of Section G for purposes of interconnection of the back half assembly 1148.

Correspondingly, a second support bracket 1152 may be utilized at the opposing end of Section G. This other support bracket 1152 may be used, as hereinbefore described, to interconnect Section G of the back half assembly 1148 with Section H of the back half assembly 1148. However, unlike Section G, which is five feet in length, Section H may be ten feet in length. The support bracket 1152 connected to the right side of Section G will interconnect Section H to Section G. Correspondingly, the right side of Section H of the back half assembly 1148 will be connected to the left side of Section I of the back half assembly 1148. Again, a support bracket 1152 will be utilized for this interconnection of adjacent Sections H and I. For purposes of the staggering configuration, Section I of the back half assembly 1148 and other sections of back half assembly 1148 located to the right of Section I will each be ten feet in length.

Continuing to refer to FIGS. 12 and 12A, the front half assembly 1180 located on the left side of the structure illustrated in FIG. 12 is designated as Section E. Section E, in this particular example, will be approximately ten feet in length. Section E of the front half assembly 1180 will be interconnected to an adjacent one of the front half assemblies 1180 through a support bracket 1152. With respect to the sections of the front half assembly 1180, each of these sections, including Sections E and F illustrated in FIG. 12, will each be ten feet in length.

With the foregoing example, the effect of the staggering relationship is readily understood as illustrated in diagrammatic form in FIG. 12A. In this configuration, a support bracket 1152 is utilized to interconnect adjacent Sections A and B of the cover assembly 1202. This same support bracket 1152 will also be utilized to interconnect Sections G and H of the back half assembly 1148. However, at this interconnection location, the front half assembly

includes Section E, which is continuous through the interconnection locations of Sections A, B and Sections G, H of cover assembly 1202 and back half assembly 1148, respectively.

Correspondingly, and continuing to refer to FIG. 12A, Sections B and C of the cover assembly will be interconnected together by a support bracket 1152 which will also interconnect adjacent

5 Sections E and F of the front half assembly 1180. However, at this interconnection location, Section H of the back half assembly 1148 is continuous.

Still further, Section C of the cover assembly 1202 and Section D of the cover assembly 1202 are also interconnected together at their ends with a support bracket 1152. At this same interconnection location, Sections H and I of back half assembly 1148 are also

10 interconnected by the same support bracket 1152. However, at this interconnection location, Section F of the front half assembly 1180 is continuous in structure. In accordance with the foregoing, it is apparent that the longitudinal interconnection locations of sections of the back

half assembly 1148 will be staggered relative to the longitudinal interconnection locations of sections of the front half assembly 1180. This staggered interconnection relationship provides

15 additional strength and rigidity to the entire structure of the primary track 1130, without requiring additional strengthening components, which may add weight and expense to the rail system 1100. Also, it is evident that specific lengths of the sections of the back half assembly

1148 and front half assembly 1180 are not expressly required. That is, other lengths of the sections of the back half assembly 1148 and front half assembly 1180 may be utilized in the

20 staggered relationship, without departing from the spirit and scope of the novel concepts of the invention.

The rail system 1100 can also include additional components for purposes of providing appropriate structure and function for its electrical and communication signaling

components. As an example, the rail system 1100 in accordance with the invention may include primary track caps for purposes of appropriately enclosing ends of the primary track 1130, while still permitting access to electrical power and communications. Such a structure is illustrated as primary track cap 1400 as shown in FIGS. 13, 14 and 15. In prior description with respect to the power connector 1340 and FIG. 11, it was described and illustrated as to how electrical power conduits and communication signaling cables could access the bus strips 1174 and 1200, and be extended downwardly through the power connector 1340. Also, in FIG. 11 and the description associated therewith, explanation was given as to how the electrical cable 1218 could be extended to the front of the primary track 1130 through the cover assembly 1202, and interconnected with the 277-volt AC cables 1328. In contrast, the primary track cap 1400 provides a means of not only enclosing an end of the primary track 1130, but also providing a means for extending power conduits and communications cabling from the ends of the primary track 1130.

More specifically, the primary track cap 1400 is illustrated in FIGS. 13, 14 and 15 as connected to elements of the primary track 1130, but with the elements of the primary track 1130 shown in phantom line format. The primary track cap 1400 includes an end plate 1402 which is secured over the end of elements of the primary track 1130. The end plate 1402 has an upper portion 1404, intermediate portion 1406, and lower portion 1408. The upper portion 1404 has an elevational configuration as illustrated in FIG. 14, and essentially covers the raceway 1326 (illustrated in FIG. 8) previously described as being formed by the cover assembly 1202, back half assembly 1148, and front half assembly 1180. As also previously described herein, the raceway 1326 acts as to carry high voltage cabling, such as the 277-volt AC cables 1328 illustrated in FIG. 11. With the upper portion 1404 of the end plate 1402 covering the raceway

1326, a port 1410 is formed in the upper portion 1404. The 277-volt AC cables 1328 may then be extended through the port 1410. In this manner, the primary track 1130, with the primary track cap 1400, provides a convenient means for extending power cabling through ends of the primary track 1130 and in a direction corresponding to the longitudinal elongation of the primary track 1130. Further, the port 1410 may include appropriate bushings or similar elements so as to provide strain relief support for the cables 1328 extending therethrough.

Correspondingly, the intermediate portion 1406 of the end plate 1402 essentially encloses the area of the primary track that is formed between the back bus strip 1174 and the front bus strip 1200. Like the upper portion 1404, the intermediate portion 1406 also includes a port 1412. As earlier described, the buses 1250 and 1266 associated with the bus strips 1147 and 1200, respectively, may carry conventional 120-volt AC power. Accordingly, as desired by the user, electrical cabling may be interconnected to the buses 1250, 1266, either in a relatively direct manner or, alternatively, through a modified version of the power connector 1340 which would permit the cabling to extend from the power connector along the length of the chamber formed by the bus strips 1174, 1200. With the port 1412 and the intermediate portion 1406, this cabling, identified as cabling 1414 and shown in phantom line format, can comprise wires carrying 120-volt AC power or the like. As with port 1410 and cables 1328, port 1412 may also include means to provide strain relief for cabling 1414.

The lower portion 1408 of the end plate 1402 essentially covers the area located between the low voltage DC/communication buses 1256. As with the intermediate portion 1406 and the upper portion 1404, a port 1416 may be formed in the lower portion 1408. Cable 1358 (previously described with respect to FIG. 11) may be directly or indirectly interconnected to the

buses 1256, 1272, and extended outwardly through the port 1416 in the lower portion 1408.

Strain relief means may be provided with port 1416 and cable 1358.

For purposes of removably securing the primary track cap 1400 to an end of the primary track 1130, rearwardly extending tabs 1418 may be formed so that a pair of tabs 1418
5 extend rearwardly from the upper portion 1404, and corresponding pairs of tabs 1418 extended rearwardly from the intermediate portion 1406 and the lower portion 1408. The tabs 1418 are formed with apertures 1420, and metal screws 1422 or the like may be received within the apertures 1420 and extended through the cover assembly 1202 and walls of the back half assembly 1148 and front half assembly 1180. It is apparent from the foregoing that the primary,
10 track cap 1400 provides a means for enclosing an end of the primary track 1130, while correspondingly providing means for extending power and signaling cables and wires outwardly through the ends of the primary track 1130. These power and communication signaling cables and wires may be readily interconnected to power and communication signals on the buses of the bus strips 1174 and 1200. Further, the rail caps 1400 provide strain relief for cables extending
15 therethrough.

The foregoing description has primarily been associated with the primary track 1130 and related components. As earlier mentioned, FIG. 16 illustrates a configuration of the rail system 1100 within a workspace, identified as workspace 1430 and illustrated in phantom line format in FIG. 16. More specifically, the particular configuration of the rail system 1100 in
20 FIG. 16 illustrates a set of three primary tracks 1130. For purpose of simplicity and clarity in description, the details of the primary tracks 1130 are not shown in FIG. 16, nor are elements showing the hanging interconnection of the primary tracks 1130 to the workspace 1430.

The primary tracks 1130 illustrated in FIG. 16 are preferably arranged in parallel configurations, and may also be preferably spaced apart so that each primary track 1130 is equal distant from adjacent others of the primary tracks 1130. The primary functions associated with the elements of the primary tracks 1130 have been described in prior paragraphs herein.

5 However, to provide even more convenience and flexibility in use and reconfiguration, the rail system 1100 in accordance with the invention may also comprise a series of cross rails. The cross rails may be utilized to provide greater flexibility in positioning and reconfiguring positions of functional components to be energized, as well as providing location convenience for communication signals and the like. An example of one such cross rail in accordance with
10 the invention is illustrated in FIG. 16 as cross rail 1432. Cross rail 1432 is also illustrated in greater detail in FIGS. 17 and 18, and will be described primarily with respect thereto. Further, cross rail 1432 is a cross rail which may be characterized as a “powered” cross rail, in that cross rail 1432 is adapted to carry electrical power and communication signaling buses longitudinally through the cross rail 1432. Further, the particular description of the cross rail 1432, as
15 illustrated in FIGS. 17 and 18, represents the cross rail 1432 as being interconnected to adjacent primary tracks 1132 in a manner so that the cross rail 1432 is characterized as being “level” with the adjacent primary tracks 1130. That is, the cross rail 1432 will be located within the horizontal plane defined by the two adjacent primary tracks 1130. Of course, it is assumed that the two adjacent primary tracks 1130 each reside in substantially the same horizontal plane.

20 Returning to FIGS. 17 and 18, the powered cross rail 1432 includes a first half assembly 1434 as shown primarily in FIG. 18. The first half assembly 1434 includes an upper bracket 1436 extending vertically upward as shown in FIG. 18. The upper bracket 1436 is integral with a downwardly depending portion having a side wall 1438. The side wall 1438

terminates in a laterally projecting section 1440. Connected to the side wall 1438 (by weldment or otherwise) is a secondary bracket 1442. An upper side wall 1444 as illustrated in FIG.18 is attached to the side wall 1438. From the upper side wall 1444, the secondary bracket 1442 extends downwardly and forms a recessed wall 1446. From the recessed wall 1446, the
5 secondary bracket 1442 forms a vertically disposed and downwardly extending portion 1448.

The cross rail 1432 is formed by not only the first half assembly 1434, but also by means of a second half assembly 1450. However, unlike the back and front half assemblies of the primary track 1130 as previously described herein, the first half assembly 1434, when positioned so as to form the cross rail 1432, is essentially a mirror image of the second half
10 assembly 1450. In fact, the second half assembly 1450 can be formed by taking the first half assembly 1434 and rotating the same. Accordingly, for purposes of description, like numerals will refer to like elements of the first half assembly 1434 and the second half assembly 1450. More specifically, the second half assembly 1450 also includes an upper bracket 1436, with a side wall 1438 extending downwardly therefrom. Integral with and extending from the bottom
15 portion of the side wall 1438 of the second half assembly 1450 is a laterally projecting section 1440. A secondary bracket 1442 is connected (by weldment or otherwise) to the side wall 1438. More specifically, it is an upper side wall 1444 of the secondary bracket 1442 which is connected to the side wall 1438. Extending downwardly from the upper side wall 1444 is a recessed wall 1446. Vertically disposed and extending downwardly from the lower portion of
20 recessed wall 1446 is a downward portion 1448, integral with the recessed wall 1446.

As earlier mentioned, the cross rail 1432 is characterized as a "powered" cross rail. Accordingly, and with reference again primarily to FIG. 18, the cross rail 1432 includes a pair of bus strips 1452, comprising a first bus strip 1454 associated with the first half assembly

1430 and a second bus strip 1456 associated with the second half assembly 1450.

Advantageously, the bus strips 1454, 1456 may have a spatial configuration similar to the bus strips 1174, 1200 previously described herein primarily with respect to FIG. 4. That is, each of the bus strips 1452 can include a plurality (such as three shown in FIG. 18) of AC buses 1458
5 and of low voltage, DC/communication buses 1460.

For purposes of interconnection of the bus strips 1452 to the first half assembly 1430 and the second half assembly 1450, the secondary brackets 1442 have a cross sectional configuration as illustrated in FIG. 18. In a manner similar to the connection of the bus strips within the primary track 1130, the bus strips 1452 can be secured to the secondary brackets 1442
10 at their upper ends through the use of hooks 1462 capturing upper ends of the secondary brackets 1442. Correspondingly, lower hooks 1464 can be positioned below the low voltage, DC/communication buses 1460, so as to capture the downward portions 1448 of the secondary brackets 1442. For purposes of further attachment, the recessed walls 1446 of the secondary brackets 1442, along with "mating" recessed walls of the bus strips 1452, may include spaced
15 apart apertures 1466. The apertures 1456 may be adapted to receive a bolt 1468 with an attachment nut 1470. So as to ensure that the first and second half assemblies 1434, 1450, respectively, are not damaged by over-tightening, a sleeve 1472 can be received on the shaft of the bolt 1468, as illustrated in FIG. 18. In addition to interconnection through the use of the bolt 1468 and nut 1470, pop rivets 1476 or similar connecting means may be used to interconnect the
20 first half assembly 1434 and the second half assembly 1450 extending through apertures 1478. It is evident that other types of connecting means may also be utilized for securing together the first half and second half assemblies 1434, 1450, respectively.

For purposes of appropriately securing each end of the cross rail 1432 to an adjacent one of the primary tracks 1130, a cross rail support bracket 1474 may be employed. The cross rail support bracket 1474 includes a pair of opposing wing sections 1478. The wing sections 1478 are on opposing sides of the support bracket 1474 and include apertures 1480
5 which line up concentric with apertures 1482 within a back half assembly or front half assembly of the primary track 1130. The apertures 1480, 1482 are adapted to receive screws 1484 or comparable connecting means for purposes of securing together the cross rail support bracket 1474 with an adjacent primary track 1130.

The cross rail support bracket 1474 also includes a central section 1486 which has
10 an open box-like configuration and extends into the raceway 1488 formed by the first half and second half assemblies 1434, 1450, respectively, of the cross rail 1432. Although not expressly shown in FIGS. 17 and 18, for purposes of clarity, the sides of the central section 1486 may be appropriately secured to corresponding sides of the first and second half assemblies 1434, 1450. Any appropriate connecting means may be utilized for this interconnection.

15 In accordance with the foregoing, a powered cross rail 1432 is provided at a plane substantially corresponding to the plane of interconnected adjacent primary tracks 1130. For purposes of transmitting power (or transmitting data or communication signals) from the bus strips associated with the primary track 1130 to the corresponding bus strips associated with the cross rail 1432, a power connector similar to the power connector 1340 as previously described
20 herein may be employed. With reference to FIG. 17, conduit 1490 may extend downwardly from the power connector 1340 and into appropriate elements (not shown) in the cross rail 1432, for purposes of interconnecting the appropriate wires and cables in the conduit 1490 to the appropriate buses 1458, 1460. Although not shown in the drawings, power connectors similar to

power connector 1340 may be employed within the cross rail 1432. Also, it is apparent that other means for transmitting power between a primary track 1130 and a cross rail 1432 may be employed, without departing from the novel concepts of the invention. As earlier stated, the concept of the powered cross rail 1432 provides a structural means for convenient access to power, along with data and communication signals. In addition, and in accordance with certain aspects of the invention and with the communication signals provided along the cross rail 1432, means for providing programming and signaling among functional components (such as lights, switches, telecommunications, sound masking devices and the like) are also conveniently provided. In addition, not only is convenience of physical location provided, but relatively simple reconfiguration is also provided.

With the particular configuration illustrated in FIGS. 16, 17 and 18, the powered cross rail 1432, as earlier stated herein, is positioned essentially within the same horizontal plane as the interconnected adjacent primary tracks 1130. Accordingly, the powered cross rail 1432 can be characterized as being interconnected to the adjacent primary tracks 1130 in a manner so that it is "level" with the same. However, in certain situations, it may be advantageous to locate a powered cross rail at a location somewhat below the horizontal plane formed by the two interconnecting adjacent primary tracks 1130. An example of such a powered cross rail suspended below the adjacent interconnecting primary tracks 1130 is illustrated as the powered cross rail 1490 in FIGS. 19, 20 and 21. With reference primarily to FIG. 21, the powered cross rail 1490 has a structure which is similar to the previously described powered cross rail 1432, but with some structural differences. More specifically, and primarily with reference to FIG. 21, the powered cross rail 1490 includes a first half assembly 1492. The first half assembly 1492 is somewhat similar in structure to the first half assembly 1434 of the powered cross rail 1432. The

first half assembly 1492 includes a substantially horizontally disposed upper arm 1494 having a hook portion 1496 at its terminating end. Integral with and depending downwardly from the upper arm 1494 is a side wall 1498. Interconnected to the side wall 1498 (by weldment or other appropriate securing means) is a secondary bracket 1500. The secondary bracket 1500 includes
5 a side wall 1502 having an upper finger 1504 extending integrally therefrom. Integral with and depending downwardly from the side wall 1502 is a recessed wall 1506 through which an aperture 1508 extends. The secondary bracket 1500 terminates at its lower end in a vertically disposed downward portion 1510.

The powered cross rail 1490 also includes a second half assembly 1512. As
10 further shown in FIG. 21, the second half assembly 1512 is substantially similar in structure to the first half assembly 1492. More specifically, the second half assembly 1512 includes an upper arm 1514 extending inwardly toward the center of the cross rail 1490 and terminating in a latch portion 1516. The latch portion 1516 can be any of a number of conventional means for interconnecting with the hook portion 1496 of the first half assembly 1492, so as to provide an
15 upper interconnection between the first half and second half assemblies 1492, 1512, respectively. However, it should be emphasized that various coupling means could be utilized for securing the assemblies together at their upper arms 1494, 1514. The second half assembly 1512 also includes a side wall 1518 integral with and depending downwardly from the upper arm 1514. Connected to the inner portion of the side wall 1518 (by weldment or other appropriate securing
20 means) is a secondary bracket 1520. The secondary bracket 1520 includes a side wall 1522 with an upper finger 1524 integral therewith. Extending downward from the side wall 1522 is a recessed wall 1526 having an aperture 1528 extending therethrough. Integral with and depending downwardly from the recessed wall 1526 is a downward portion 1530.

As with the powered cross rail 1432, the powered cross rail 1490 can also include a pair of bus strips, identified as bus strips 1532 in FIG. 21. The configuration of the bus strips 1532 substantially conforms to the configuration of the bus strips 1452. Accordingly, details regarding the bus strips 1532 will not be repeated herein. The upper end of the bus strip 1532 associated with the first half assembly 1492 is interconnected to the first half assembly 1492 by capturing the upper finger 1504. Correspondingly, the bus strip 1532 associated with the second half assembly 1512 is coupled at its upper end to the second half assembly 1512 by capturing the upper finger 1524. At their lower ends, the bus strips 1532 capture the downward portions 1510 and 1530 of the first half assembly 1492 and the second half assembly 1512, respectively. The bus strips 1532 and the first and second half assemblies 1492, 1512, respectively, are secured together through the use of the bolt 1534 and nut 1536 through the apertures 1508, 1528. Corresponding apertures are also located within the bus strips 1532 for receiving the bolt 1534.

For purposes of suspending the powered cross rail 1490 below the plane of the interconnected primary tracks 1130, a convenient type of hanger arrangement is preferably employed. One such type of hanger arrangement is illustrated in FIGS. 20 and 21. Specifically, FIG. 19 illustrates a primary track hanger bracket 1536. The main hanger bracket 1536 includes inwardly extending legs 1538 which essentially sit atop the supporting pedestals 1172 and 1198 of the primary track 1130 as previously described herein with respect to FIG. 4. Integral with and depending downwardly from the legs 1538 are opposing side walls 1540. The side walls 1540 are integral with opposing sides of a horizontally disposed bracket floor 1542. After the primary track hanger bracket 1536 is essentially "slipped on" to the primary track 1130, a bolt 1545 can be received through apertures 1548 of the side walls 1540, and secured with a nut 1546. In this manner, the primary track hanger bracket 1536 can be secured to the corresponding

primary track 1130, at any of a continuum of locations longitudinally along the length of the primary track 1130.

For purposes of interconnecting the primary track hanger bracket 1536 to the powered cross rail 1490, a bolt 1550, threaded at least at its upper and lower ends, is secured through an aperture in the bracket floor 1542 of the primary track hanger bracket 1536. The head of the bolt 1550 is positioned above the bolt bracket floor 1542, and the bolt extends downwardly therefrom. For purposes of rigidly securing the bolt 1550 to the primary track hanger bracket 1536, an upper nut 1552 may be threadably received on the bolt 1550. The bolt 1550 depends downwardly and, at the lower end thereof, is received through an aperture 1554 extending through an upper brace 1556 of a cross rail securing bracket 1558. The bolt 1550 is rigidly secured to the cross rail securing bracket 1558 by means of threadably receiving a pair of nuts 1560 on opposing upper and lower sides of the upper brace 1556.

Depending downwardly from the upper brace 1556 are a pair of opposed clamping arms 1560. The clamping arms 1560 can be capable of sufficient movement so as to open the arms 1560 in opposing directions, and then securing the clamping arms 1560 around the outer perimeter of the powered cross rail 1490. Correspondingly, each of the clamping arms 1560 may include an aperture 1562 (as shown in FIG. 20) through which screws or other connecting means may be utilized to more rigidly secure the clamping arms 1560 to the first half and second half assemblies 1492, 1512, respectively, of the powered cross rail 1490.

The inventors have found that the primary track holding bracket 1536 and the cross rail securing bracket 1558, as described with FIGS. 20 and 21, are currently ones which they believe to be somewhat preferable to certain other securing arrangements. However, it is evident that other types of bracket and securing arrangements may be utilized to releasably

interconnect the powered cross rail 1490 to the primary track 1130, without departing from the spirit and scope of the principal concepts of the invention.

In addition to the mechanical interconnection of the powered cross rail 1490 to the primary track 1130, as set forth in the prior description, a conduit 1562 may extend from a power connector 1340 appropriately positioned in the primary track 1130, and project into the powered cross rail 1490 from the bottom thereof, as also shown in FIG. 20. The conduit 1562 illustrates an example of how electrical power, data or communication signals may be transmitted from the cables and bus strips associated with the primary track 1130 to the cables (if any) and bus strips associated with the powered cross rail 1490. As earlier described with respect to the powered cross rail 1432, and as illustrated in FIGS. 17 and 18, various conventional arrangements may be utilized to electrically interconnect cables and wires within conduit 1562 to appropriate electrical components within the powered cross rail 1490.

It is apparent from the foregoing that a powered cross rail such as powered cross rail 1490 in accordance with the invention, in addition to the connecting components previously described herein with respect to FIGS. 20 and 21, provides a means for transmitting power, data and communications signaling from the primary track 1130 to physical locations located below the plane of a pair of adjacent primary tracks 1130, and laterally from such primary tracks 1130. Still further, and as with the powered cross rail 1432, the powered cross rail 1490 provides a means for supplying electrical power, data and communications signaling along a continuum of the length of the powered cross rail 1490.

In addition to the use of powered cross rails, such as the cross rails 1432 and 1490 previously described herein, the rail system 1100 in accordance with the invention may also employ non-powered cross rails. Such non-powered cross rails would be utilized in situations

where it is unnecessary to supply power, data or communication signals to functional components located in relatively close proximity to the cross rail. An example of such a non-powered cross rail is illustrated in FIGS. 22 and 23. With reference to these drawings, a non-powered cross rail 1566 is releasably secured below a primary track 1130. For purposes of supporting the cross rail 1556, a primary track hanger bracket 1536 (substantially corresponding to the primary track hanger bracket 1536 previously described with respect to FIGS. 20 and 21), and a cross rail securing bracket 1558 (substantially corresponding to the cross rail securing bracket 1558 previously described with respect to FIGS. 20 and 21) are employed. In view of the substantial similarity of the primary track hanger bracket and cross rail securing bracket employed with the non-powered cross rail 1556, to the primary track hanger bracket and cross rail securing bracket 1536, 1558, respectively, described with respect to FIGS. 20 and 21, like elements of these brackets are referenced with identical numerals, and will not be again described in detail.

Primarily referring to FIG. 23, the non-powered cross rail 1566 includes an upper bracket 1568 having an upper wall 1570 at opposing side walls 1572. A lower bracket 1574 comprises the remainder of the non-powered cross rail 1566. As illustrated in FIGS. 22 and 23, the lower bracket 1574 includes a pair of opposing side walls 1576 located externally of the side walls 1572 of the upper bracket 1568. The side walls 1576 are attached to the side walls 1572 and the upper bracket 1568 by appropriate securing means, such as weldment or the like. Also, bolt/nut combinations, connecting screws or the like may also be utilized through apertures extending through portions of the clamping arms 1560, side walls 1572, and side walls 1576. Integral with and projecting downwardly from the side walls 1576 are opposing recessed portions 1578 which project inwardly of the non-powered cross rail 1566. Extending

downwardly from and integral with the recessed portions 1578 is a lower foot 1580 having the cross structural configuration illustrated in FIG. 23. With this structural configuration, the upper bracket 1568 is in the form of an inverted U-shaped configuration, with the lower bracket 1574 attached to and projecting downwardly from the upper bracket 1568.

5 In accordance with the foregoing, the non-powered cross rail 1566 in accordance with the invention provides a means for facilitating connection of non-powered functional components to the rail system 1100, at locations intermediate adjacent ones of the primary tracks 1130. Although a specific structural configuration has been described as an exemplary embodiment in FIGS. 22 and 23, in the form of non-powered cross rail 1566, it is evident that
10 other structures could be employed for providing the non-powered cross rail 1566, without departing from the primary novel concepts of the invention.

 In the foregoing description, and as particularly shown in FIGS. 16 and 19, the cross rails illustrated therein are positioned so as to be substantially perpendicular to the longitudinal axes of the interconnected, adjacent primary tracks 1130. In accordance with one
15 aspect of the invention, the rail system 1100 comprises means for positioning a cross rail at non-perpendicular angles relative to the interconnecting, adjacent primary tracks 1130. An example of such a configuration is illustrated in FIG. 23A. FIG. 23A illustrates the powered cross rail 1490 (previously described with respect to FIGS. 19, 20 and 21) as being suspended below a pair of adjacent primary tracks 1130. However, unlike the suspension shown in FIG. 19, the
20 cross rail 1490 as illustrated in FIG. 23A is positioned at non-perpendicular angles, relative to the interconnecting primary tracks 1130. With reference back to FIGS. 20 and 21, it is apparent that this capability of having an angled configuration for the cross rail 1490 is permitted by the capability of locating the primary track hanger brackets 1536 at various locations along the

length of the primary track 1130. Also, this angled configuration is provided by the use of the cross rail securing bracket 1558 and the manner of interconnecting the securing bracket 1558 to the primary track hanger bracket 1536 through the use of the bolt 1550. With the use of the bolt 1550, the cross rail securing bracket 1558 can be positioned at a continuum of radial angles
5 relative to the axis of the bolt 1550. In accordance with the foregoing, the cross rail 1490 can be readily angled relative to the interconnected primary tracks 1130. Further, this angled configuration can be provided not only with the powered cross rail 1490, but also with the non-powered cross rail 1566.

As previously described herein, the rail system 1100 in accordance with the
10 invention provides means for selectively interconnecting functional components to electrical power supported within or around primary tracks 1130 of the rail system 1100. In addition, the elements of the primary track 1130 provide means for supplying data and communication signals to interconnected functional components, as well as between interconnected functional components.

FIG. 24 illustrates a cross-sectional configuration of various electrical
15 components which may be utilized to interface the primary track 1130 to electrical conduit to be interconnected directly to functional components to be energized. Referring to FIG. 24, a primary track 1130 is illustrated, with a power connector 1340 coupled thereto. The power connector 1340, as previously described herein, provides electrical, data and communications
20 connections to the bus strips 1174, 1190. Connections to appropriate ones of buses of the bus strips 1174, 1190 are made to cables and wires, such as those shown in FIG. 24 as electrical wires 1582. Correspondingly, cables 1584 may also project downwardly from the power connector 1340, after being appropriately coupled to buses of the bus strips 1174, 1190, which

may carry data and/or communication signals. The electrical wires 1582 and cables 1584 extend downwardly into a junction box 1586, as illustrated in FIG. 24. The junction box 1586 can be relatively conventional in design, and secured to the primary track 1130 by means of a junction box hanger 1588. The junction box hanger 1588 may have, as further illustrated in FIG. 24, a pair of opposing clamping arms 1590 which are secured around the lower members 1280, 1282, of the primary track 1130. The junction box hanger 1588 may also have its clamping arms 1590 more tightly secured to the primary track 1130, by means of connecting screws (not shown) or other appropriate securing means. The junction box hanger 1588 includes a pair of side walls 1592 which are secured to the junction box 1586 by appropriate securing means (not shown), such as connecting bolts, screws or the like.

The electrical wires 1582, as previously described herein, may be interconnected to the AC buses of the bus strips 1174, 1190. These electrical wires 1582 (or a sub-set of the same) may be applied through a fuse 1594, for purposes of providing appropriate fusing between the AC buses of the bus strips 1174, 1190, and the electrical devices to be powered.

Following appropriate fusing, the electrical wires 1582 may apply input power to a control module 1596. In addition to the electrical wires 1586, the data/communication cables 1584 may also be interconnected to the control module 1596. These data/communication cables will provide signals to and from the module 1596.

The control module 1596, although not described in great detail herein, provides a means for transmitting and receiving data and communication signals for purposes of controlling the functional components or devices to be interconnected to the junction box 1586. The control module 1596 may include memory, microcode, instruction registers and the like for purposes of control of a device to be interconnected to the junction box 1586. For example, the control

module 1596 may be associated with an interconnected lighting element, whereby control signals may be utilized within the control module 1596 for purposes of determining when AC power from the electrical wires 1586 is to be applied to the lighting element.

5 In accordance with the rail system 1100 in accordance with the invention and further in accordance with the use of the control module 1596 and associated components, control signals can be transmitted to the control module 1596 or data can be transmitted to control module 1596, and the control module 1596 programmed so as to determine an outcome, such that AC power applied on the electrical output wires 1598 within conduit 1600 can be selectively controlled through appropriate switching or the like within the control module 1596.

10 Further, signals indicating the status of a lighting element or other device electrically connected to the junction box 1586 may be generated by the control module 1596. Greater detail regarding controlling of the relationships between controlled and controlling devices (such as switches and lights) can be found in commonly-assigned U.S. Provisional Patent Application Serial No. 60/374,012, filed April 19, 2002.

15 Another example of the use of the junction box 1586 is illustrated in FIG. 25. In this particular example, a junction box 1586 is electrically coupled to the buses 1574, 1190, again through the power connector 1340. The junction box hanger 1588 is again used, for purposes of mechanically connecting the junction box 1586 to the primary track 1130. However, unlike the example illustrated in FIG. 24, the junction box 1586 does not include a control

20 module 1596. Instead, electrical wires extend directly (after going through the fuse 1594) from the power connector 1340 downwardly into the conduit 1600 as electrical power connections to a pair of outlet receptacles 1602. The particular circuits to which the outlet receptacles 1602 are

electrically interconnected will be determined by the connections within the power connector 1304 and the specific connections to the AC buses of the bus strips 1174, 1190.

The configurations in accordance with the invention, as illustrated in FIGS. 24 and 25, utilize a particular junction box 1588, where the only connection between the junction box 1588 and the functional device or accessory is an electrical connection through the conduit 1600 and the electrical output wires 1598. However, in certain instances, it is desirable to have mechanical means for more directly connecting functional accessories to the primary track 1130. For this purpose and in accordance with one aspect of the invention, a universal hanging clip 1604 may be utilized as illustrated in FIGS. 26 and 27. The universal hanging clip 1604 may be employed for suspending, from the primary track 1130, functional components and accessories, such as the lighting fixture 1606 illustrated in FIG. 27. More specifically, the hanging clip 1604 includes an upper left-side bracket 1608. The left-side bracket 1608 consists of a single upwardly depending finger 1610. The finger 1610 is integral with an arcuate section integral with a downwardly depending side wall 1612. As illustrated primarily in FIG. 26, the side wall 1612 is integral with a substantially horizontally disposed member 1614, which extends to the right side of the hanging clip 1604 (the terms "left side" and "right side" being chosen solely for convenience, and in accordance with the illustration of FIG. 27). With reference to the right side of the hanging clip 1604, the clip 1604 includes a pair of right-side brackets 1616 having a substantially parallel configuration. Each of the right-side brackets 1616, in a manner similar to the left-side bracket 1608, includes an upwardly depending finger 1618 which is integral with an arcuate section and, in turn, integral with a downwardly depending side wall 1620. Each of the side walls 1620 of the right-side brackets 1616 is integral with, at their lower ends, a left-extending member 1622.

Depending downwardly from the left-extending members 1622, and integral therewith, is a left-side lower flange 1624. The left-side lower flange 1624, as primarily illustrated in FIG. 27, is downwardly depending and somewhat angled inwardly.

Correspondingly, the member 1614 integral with the side wall 1612 is, in turn, integral with a
5 downwardly depending right-side lower flange 1626. The right-side lower flange 1626 is also angled inwardly. At their lower ends, the left-side lower flange 1624 and the right-side lower flange 1626 are integral with a floor section 1628 having the configuration as substantially shown in FIG. 26. A bore 1630 or similar aperture extends substantially through the center of the floor section 1628. For purposes of interconnecting the lighting fixture 1606 to the universal
10 hanging bracket 1604, a rod 1632 or other similar connecting arrangement may be secured at its upper end through the bore 1630, with the lower portion of the rod 1632 mechanically interconnected to the lighting fixture 1606.

As with other elements of the primary track 1130 as previously described herein, the configuration illustrated in FIG. 27 may also utilize a power connector 1340. In this
15 particular instance, the power connector 1340 is shown as being more directly connected to the control module 1596, with an attendant fuse 1594 also associated therewith. AC power for the lighting fixture 1606 may be applied from the control module 1596 through conduit 1600.

The universal hanging clip 1604 in accordance with the invention provides significant advantage, with respect to its structure and removable interconnection to the primary
20 track 1130. More specifically, the universal hanging clip 1604 is structured so that if manual pressure is exerted inwardly against the left-side lower flange 1624 and right-side lower flange 1626, and with the hanging bracket 1604 being integrally constructed and having appropriate flexibility and resiliency, the fingers 1610, 1618 and side walls 1612, 1620 will move outwardly,

so as to increase the distance between fingers 1610 and 1618. With this distance appropriately increased, the fingers 1610, 1618 can be appropriately positioned within the lower recesses 1634 of the primary track 1130. When manual pressure is released from the left-side lower flange 1624 and right-side lower flange 1626, the fingers 1610, 1618 and side walls 1612, 1620 will be
5 biased inwardly so as to firmly “grasp” the lower portion of the primary track 1130. In this manner, the universal hanging clip 1604 provides a convenient means for firmly being coupled to the primary track 1130, but with the coupling being in a removable manner. Further, the universal hanging clip 1604 is advantageous in that with its configuration along the primary track 1130 not requiring a specific connecting means (such as screws or the like) which would require
10 interconnection at specific positions along the primary track 1130, the universal hanging clip 1604 can be positioned at any of a number of locations along a continuum of the length of the primary track 1130. Further, although the universal hanging clip 1604 is illustrated with a lighting fixture 1606 in FIG. 27, it is evident that the hanging clip 1604 could be utilized for a number of various functional components and accessories.

15 Although the rail system 1100 has been described herein with respect to individual components of the rail system itself, and individually interconnected functional components and accessories, the significant advantages of the rail system 1100 in accordance with the invention, reside in part with its “universal” aspect in providing a convenient and reconfigurable means for locating and “controlling” various accessories. An example, although
20 simplified, of a configuration which may employ the rail system 1100 is illustrated as configuration 1636 in FIG. 28. In this particular configuration, a rail system 1100 is shown which employs three primary tracks 1130. For purposes of description, and in view of details of

the prior description, reference numerals with respect to detailed components of the rail system 1100 will not be illustrated in FIG. 28.

Also, for purposes of clarity and simplicity, the structural interconnections between the primary tracks 1130 and ceiling beams or the like are also not illustrated in FIG. 28. FIG. 28 does illustrate, however, a series of powered cross rails 1432 which, in the particular configuration 1636, are connected in a manner so as to be level with interconnecting, adjacent primary tracks 1130. Accordingly, these cross rails 1432 may be interconnected to the adjacent primary tracks 1130 in a manner as previously illustrated and described with respect to FIGS. 18 and 19.

As further illustrated in FIG. 28, the powered cross rails 1432 may be utilized with the previously described universal hanging clips 1604 to support lighting fixtures 1606 therefrom. In addition to the use of the hanging clips 1604 with the lighting fixtures 1606, FIG. 28 also illustrates the use of the universal hanging clips 1604 within a primary track 1130 and also within a nonpowered cross rail 1566. In the particular configuration illustrated in FIG. 28, the nonpowered cross rail 1566 is also positioned level with its adjacent, interconnecting primary tracks 1130. The nonpowered cross rail 1566 and the associated hanging clip 1604 are illustrated in FIG. 28 as being utilized to support a downwardly depending and vertically disposed partition 1104. The use of such a partition is more specifically described in commonly assigned U.S. Provisional Patent Application entitled "Partition System with Technology" and filed September 4, 2002. The vertical partition 1104 may be relatively opaque, so as to provide an area of relative privacy. Alternatively, the vertical partition 1104 may instead be constructed of a material which permits relatively significant light transmission, while providing diffusion or "color wash" so as to provide a relatively aesthetically pleasing commercial interior. Further,

such vertical partitions 1104 may, by necessity, have to be connected not only to the rail system 1100, but also to floor supports and the like. This may occur where there is a necessity for a more structural vertical element, and where support solely by the rail system 1100 would cause undue stress.

5 Another illustration of a commercial interior which may be configured utilizing the rail system 1100 in accordance with the invention is illustrated as configuration 1638 in FIG. 29. Referring specifically to FIG. 29, the configuration 1638 includes a rail system 1100 having a series of three, parallel primary tracks 1130. A pair of powered cross rails 1432 are each interconnected between a pair of adjacent primary tracks 1130. In this particular instance, the
10 powered cross rails 1432 are illustrated as being perpendicular to the interconnecting cross rails 1130, and parallel to each other. The powered cross rails 1432 are also illustrated as being level with the interconnected primary tracks 1130. FIG. 29 further illustrates a nonpowered cross rail 1566, level with the interconnected primary track 1130.

 Further, in the particular configuration 1638, the powered cross rails 1432 are
15 illustrated as each having a universal hanging clip 1604 supporting a functional accessory 1640. As illustrated in FIG. 29, the functional accessory 1640 may be one of a number of different accessories, further illustrating the relatively wide and reconfigurable use of the rail system 1100 in accordance with the invention. For example, the functional accessory 1640 could be a plain
20 “whiteboard,” requiring no interconnection with electrical power or data or communication signals. In contrast, however, the functional accessory 1640 could be an electronic whiteboard, whereby the whiteboard 1640, through the data and communication components of the primary track 1130, may be utilized to transmit and receive signals representing writings and graphics on the whiteboard 1640 and remotely located whiteboards. Still further, the functional accessory

1640 could represent a flat screen teleconferencing device. Such a device would again use the electrical power and data and communication signals associated with the primary tracks 1130 and the powered cross rails 1432. In summary, a number of different types of accessories may be utilized with the rail system 1100 in accordance with the invention.

5 As earlier described in part, the rail system 1100 provides a means for facilitating control and reconfiguration of controlled relationships among various functional components which may be utilized with the rail system 1100. Reference has been previously made herein to the concept of establishing control relationships among switches and lights, and reconfiguring the same as required. FIG. 30 illustrates a configuration 1642, employing a series of three
10 primary tracks 1130, two powered cross rails 1432 and two lighting fixtures 1606. Also illustrated in FIG. 30 is a user employing a control device, which may be characterized as a control wand 1644. An example of the control wand 1644 is illustrated in FIGS. 32, 33 and 34. With reference thereto, the control wand 1644 may be of an elongated configuration. At one end of the control wand 1644 is a light source 1646 which, preferably, would generate a substantially
15 collimated beam of light. In addition to the light source 1646, the control wand 1644 may also include an infrared (IR) emitter 1648, for transmitting infrared transmission signals to corresponding IR receivers associated with the rail system 1100 and the functional accessories.

 The control wand 1644 may also include a trigger 1650, for purposes of initiating transmission of IR signals. Still further, the wand 1644 may include mode select switches, such
20 as mode select switch 1652 and mode select switch 1654. These mode select switches would be utilized to allow manual selection of particular commands which may be generated using the wand 1644. The control wand 1644 would also utilize a controller (not shown) or similar computerized devices for purposes of providing requisite electronics within the wand 1644 for

use with the trigger 1650, mode select switches 1652, 1654 and the light source 1646 and IR emitter 1648. An example of the use of such a wand, along with attendant commands which may be generated using the same, is described in a commonly assigned U.S. Provisional Patent Application Serial No. 60/374,012 filed April 19, 2002. The contents of the aforescribed
5 patent application are hereby incorporated by reference herein.

Returning back to FIG. 30, the user could employ the wand 1644 to transmit signals to the controller (not shown) associated with either of the lighting fixtures 1606.

Although the user is shown as transmitting an IR signal 1656 specifically to the lighting fixture 1606, the actual IR transmission signal would be picked up by an IR receiver or the like which
10 may be associated with a controller or the like located adjacent the hanging clip 1604. However, this IR signal 1656 would, in fact, be utilized in association with functionality or control associated with the lighting fixture 1606.

This control concept is further shown in FIGS. 31 and 31A. More specifically, each of FIGS. 31 and 31A illustrate a configuration 1658, which substantially corresponds to the
15 configuration 1642 illustrated in FIG. 30. However, the configuration 1658 further shows the concept of a pair of electrical receptacles 1602 (such as those shown in FIG. 25) being electrically interconnected to one of the primary tracks 1130. FIG. 31 illustrates the user employing the control wand 1644 to transmit IR signals to one of the particular lighting fixtures 1606 (or an IR sensor associated with a control module which is further associated with the
20 lighting fixture 1606). Correspondingly, FIG. 31A illustrates the user transmitting IR signals to the structure housing the electrical outlet receptacles 1602. In this particular example, the structure housing the electrical outlet receptacles 1602 is further illustrated as having an IR sensor 1660 directly associated therewith.

For purposes of illustrating a relatively simple control sequence, it can be assumed that the user wishes to have the light switch 1660 control the particular lighting fixture shown in FIGS. 31 and 31A as lighting fixture 1664. The user could first configure the mode selector switches associated with the wand 1644 so as to enable a "control set" sequence. The
5 wand 1644 could then be pointed to the IR sensor (not shown) associated with the lighting fixture 1664. When the wand 1654 is appropriately pointed (indicated by the light source 1646), the user may activate the trigger 1650 on the wand 1644.

The user could then "point" the wand 1644 to the IR sensor 1662 associated with the light switch 1660. When the wand 1644 again has an appropriate directional configuration as
10 indicated by the location of the light source 1646, the trigger 1650 could again be activated, thereby transmitting the appropriate IR signals 1656. Additional signals could then be transmitted through the wand 1644, so as to indicate that the control sequence is complete and the lighting fixture 1664 is to be controlled by the light switch 1660. As apparent from the foregoing, the capability of essentially "programming" controlled relationships among the
15 various accessories associated with the rail system 1100 require the capability of transmitting and receiving communication signals among the various functional accessories. In accordance with the invention, and the features provided by the aforescribed rail system 1100 in accordance with the invention, the rail system 1100 conveniently provides proximity of not only electrical power, but also data and communication signals. Still further, these signals are
20 provided in association with the use of control modules or the like for purposes of providing programmability to various functional accessories. Again, detailed examples of this programmability among functional components is described in the commonly assigned Application Serial No. 60/374,012.

In addition to the foregoing, it is possible that there may be a potential use of RF signaling for purposes of changing the on and off states of various elements. For example, with this type of RF signaling, an individual could possibly turn on all of the elements in an office or other commercial interior, with a general signal rather than with a specific switch.

5 As described in the foregoing, the rail system 1100 in accordance with the invention facilitates flexibility and reconfiguration in the location of various functional or utilitarian elements which may be supported and mounted in a releasable and reconfigurable manner with the rail system. The rail system 1100 also facilitates access to locations where a commercial interior designer may wish to locate various functional or utilitarian elements,
10 including electrical power receptacles and the like. The rail system 1100 may carry not only AC electrical power (of varying voltages), but may also carry DC or communication signals. The communication signals can be used for purposes of relatively well-known communication functions. Further, however, the rail system 1100 in accordance with the invention may include a communications bus structure permitting the "programming" of controlled relationships among
15 various commercial interior components. The programming (or "reprogramming") may be accomplished at the location of the controlled and controlling elements, and may be accomplished by a lay-person without significant training or expertise.

 The rail system 1100 in accordance with the invention facilitates the reconfiguration of the commercial interior in "real time." Not only may various functional
20 elements be quickly relocated from a "physical" sense, but relationships among functional or utilitarian elements can also be altered, in accordance with the prior description relating to programming of control relationships. The rail system 1100 in accordance with the invention presents a "totality" of concepts which provide a commercial interior readily adapted for use with

various utilitarian elements, and with the capability of reconfiguration without necessarily requiring additional physical wiring or substantial rewiring. With this capability of relatively rapid reconfiguration, change can be provided in a building's infrastructure quickly, insuring that the attendant commercial interior does not require costly disassembly and reassembly, and is not
5 "down" for any substantial period of time. Further, the rail system 1100 in accordance with the invention, with attendant utilitarian elements, permit occupants to allow their needs to "drive" the structure and function of the infrastructure layout.

It will be apparent to those skilled in the pertinent arts that other embodiments of rail systems in accordance with the invention may be designed. That is, the principles of a rail
10 system for configuring control among functional accessories and for the physical connection of functional accessories through a rail system are not limited to the specific embodiment described herein. For example, various configurations of certain components of the rail system 1100 may be utilized, without departing from the spirit of the invention. Accordingly, it will be apparent to those skilled in the art that modifications and other variations of the above-described illustrative
15 embodiment of the invention may be effected without departing from the spirit and scope of the novel concepts of the invention.

Further principles of the invention are disclosed, by way of example, in a space division system 2100, incorporating technology. The space division system 2100 utilizes a series of movable and internally reconfigurable vertically disposed partitions for purposes of providing
20 lighting aesthetics, function signaling, privacy, semi-private configurations and the like. In addition, the space division system 2100 in accordance with the invention also provides a space division system which facilitates incorporation of various technologies. Space dividers and other aspects of the space division system 2100 in accordance with the invention are capable of

physical relocation, and comprise lightweight components. Rapid addition/deletion of joined space dividers is provided, through the use of quick-release components.

A number of other advantages also exist with respect to space division systems in accordance with the invention. More specifically, the invention includes the use of spline concepts for joined connection of space dividers. In this manner, formation of various configurations of the space division system 2100 have moved from known line segment configurations, to having the capability of a configuration having a curve of any desired radius. In the same regard, space division systems in accordance with the invention exhibit internal stretch characteristics, with respect to space divider surfaces, battens and frames.

Still further, another aspect of space divider systems in accordance with the invention include the use of digital storage. For example, storage disks can be contained within fabric of the space dividers. These storage disks can be coupled to external equipment such as laptop computers. Such laptops and other powered equipment may be energized through other components associated with the space dividers. Still further, digital storage can be provided in the form of microprocessors or other similar elements, having software for functions such as sound management and the like.

Still further, space divider systems in accordance with the invention can provide digital programming and switching functions. In general, these functions, along with other aspects of space division systems in accordance with the invention harness the effect of the semiconductor development and the effect of miniaturization. In this regard, the space division systems in accordance with the invention provide for embedment and integration of electronic and lighting components.

Still further, space division systems in accordance with the invention can

comprise integration of solid state lighting (SSL). This lighting can be utilized for functions such as providing for color changes of space dividers themselves. Still further, lighting functions can provide for the signaling of interior or exterior circumstances. For example, lighting associated with the space dividers can be utilized to provide wayfinding. Signaling can also be
5 utilized to indicate, for example, that a person is "in" within a particular working space.

Space division systems in accordance with the invention can also comprise integration and distribution of power. In particular, space division systems in accordance with the invention provide for DC power distribution. They also permit flexible use of 12-volt applications.

10 With respect to specifics of space division systems in accordance with the invention, they can include channel voids within space dividers, with the voids being located at differing heights. These voids can be utilized to carry power lines, lighting, digital storage and other components.

Still further, space division systems in accordance with the invention provide for
15 modification and reconfiguration of the appearance of space divider fabrics. Color change can be provided, for example, through the use of solid state lighting embedded within channel voids of the space dividers. In addition, appearance changes can be made to occur through the use of functional control of conventional lighting.

Space dividers employed in space division systems in accordance with the
20 invention can also provide for acoustical ameliorations. For example, space divider fabrics can employ physical sound attenuation material. Also, components associated with the space division system can provide for functional control of sound management systems and the like.

Further, a primary aspect of space division systems in accordance with the invention relates to the totality of the foregoing principles.

Turning to FIG. 35, the particular example of the space division system 2100 illustrated therein shows a space divider 2102 vertically suspended from a rail system 2104. The rail system 2104 includes a rail 2106 with a pair of hanger clips 2108 which are releasably secured to the rail 2106 and capable of being moved along a continuum of the length of the rail 2106. Support rods 2110 depend downwardly from the hanger clips 2108 and are secured to the space divider 2102. Preferably, the support rods 2108 are adjustable in length so that the height of the space divider 2102 may also be adjustable. Connection of the support rods 2110 to the space divider 2102 may be accomplished by any number of suitable means. For example, the lower terminating ends of the support rods 2110 may be located within grommet holes (not shown) at the top portion of the space divider 2102. Such grommet holes may be spaced apart in a manner so as to provide variation in the location of interconnections of the support rods 2110 to the space divider 2102.

As earlier stated herein, the hanger clips 2108 can be characterized as "quick release" and "quick connect" elements. That is, the hanger clips 2108 are advantageous for rapidly reconfiguring the physical locations of space dividers 2102 relative to the rail system 2104. General concepts associated with the rail system 2104, and more specific configurations of elements such as the hanger clips 2108, are disclosed in the commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149, entitled "Rail System" and filed September 4, 2002.

The space divider 2102 may include an upper structural batten 2112. The upper structural batten 2112 provides, in part, for "shape holding" of the space divider 2102.

Extending downwardly from the structural batten 2112 is the main body 2114 of the space divider 2102. The main body 2114 may be of a fabric which is substantially opaque, so as to generally provide a visual privacy curtain. Associated with the main body 2114 is lighting technology, which may be in the form of solid state lighting (SSL) technology, such as LED lights. For example, embedded within the main body 2114, in a manner so as to be visible to a person near the space divider 2102, are a series of LED lights 2116 arranged in a horizontal configuration. Further solid state lighting, which may also be in the form of LED lighting, is structured as arrow lighting 2118 shown near the bottom of the main body 2114. In emergency situations, the arrow lighting 2118 may be activated (in any of a number of appropriate control arrangements) so as to activate all of the arrow lights 2118 or, alternatively, the arrow lights 2118 may be activated in a manner so that they are sequentially "pulsed" so as to create the effect of "pointing" in a particular direction to show an appropriate direction of egress in an emergency situation.

In addition to the concept of using arrow lighting 2118, other types of functional signaling can be provided. For example, solid state lighting or other types of lighting could be utilized in combination with other elements so as to signal various other internal and external situations. For example, solid state lighting associated with the space dividers 2102 could be utilized to indicate if an individual is "in" a particular workspace or, alternatively, is absent. Numerous other types of signaling could be utilized with the solid state lighting associated with the space dividers 2102.

The space divider 2102 also includes a lower hemmed section 2120 having a weighted insert as described in subsequent paragraphs herein with respect to other drawings. The weighted insert within the lower hemmed section 2120 may also be utilized for purposes of

"shape holding." With respect to the rail 2106, hanger clips 2108 and support rods 2110, various types of configurations may be utilized. One type of configuration is disclosed in the commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149, entitled "Rail System" and filed on September 4, 2002.

5 FIG. 36 illustrates a plan view of an office environment showing various configurations of space dividers of a space division system according to the invention, in differing configurations. For example, FIG. 36 illustrates use of a wall curtain 2130 having somewhat of a "hooked" configuration. A further space divider 2132 is illustrated as showing a series of "S-shaped" configurations, which may be utilized to provide a series of computer
10 workstations or the like. Conference tables 2134 are illustrated as being somewhat enclosed through the use of the space dividers 2130, 2132.

 In addition to the foregoing, space divider 2136 is shown as primarily enclosing a privacy station 2138, which may be utilized for telephone calls or the like. Other areas may be partitioned or otherwise have space dividers of the space division system in a manner so as to
15 provide aesthetics, such as space dividers 2140 and 2142. The various configurations of the space dividers illustrated in FIG. 36 can provide for various types of spaces. With the interconnection of space dividers such as 2130, 2132 and 2140, 2142, the interconnections can be provided through the use of splines. The spline interconnections are illustrated within the drawings. With the spline interconnections, reconfigurations of the various space dividers is not
20 limited to movement along specific line segments. Instead, with the use of the splines, movement can occur with respect to the space dividers and the configurations to configurations having a curve of any reasonable radius.

FIG. 37 illustrates a side-elevation view of a space divider in accordance with the invention. FIG. 38 illustrates a partial sectional end view of the same. With reference to FIGS. 37 and 38, the space divider 2150 may be comprised of a translucent and stretchable material. FIG. 38 illustrates how the material 2152 may be woven into the wall configuration. The space divider 2150 may also have a power batten 2154 positioned at the top thereof, for purposes of carrying power such as low voltage DC power. The power batten 2154 may provide power to a DC power cable 2156 or, alternatively, an AC power cable 2158. The DC power cable 2156 may carry DC low voltage power and is accessible through power batten openings 2160. The power batten openings 2160 would be accessible to internal linear voids existing within the three-dimensional knitting of the main body 2150. The linear voids are illustrated as voids 2162 in FIGS. 37 and 38.

FIG. 39 illustrates another space divider 2170 which may be formed of a woven fabric material. For example, one type of woven material which may be utilized is commonly referred to in the industry as "cattle mattress" material. The cattle mattress material of the space divider 2170 provides linearly directed pockets 2172 which may be segmented by the use of brackets 2174, as illustrated in FIG. 40.

FIG. 41 is a perspective view of two curved space dividers, forming a space division system 2180. The space division system 2180 includes a first space divider 2182 and a second space divider 2184. In general, FIG. 41 illustrates a structural configuration which may be achieved with respect to aesthetic curvature, through the use of the space dividers 2182, 2184. Also, FIG. 41 illustrates use of not only the rails 2106, but also the use of a cross rail 2186. The configuration of a cross rail 2186, with the use of vertically disposed partitions, is described in

the commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149, entitled "Rail System" and filed on September 4, 2002.

FIG. 42 illustrates a sectional end view of the space divider 2184. This view shows the structural batten 2112 at the top end thereof, with the fabric extending downwardly therefrom. Linear or substantially horizontal voids 2188 are provided at spaced-apart intervals downwardly along the space divider 2184.

The space divider 2184 terminates at its lower portion with the lower hem 2120. The lower hem 2120 is shown as having a weighted insert 2190. The weighted insert 2190 is utilized to maintain the space divider 2184 in a stable position. That is, the weighted insert 2190 provides for "shape holding" for the space dividers of the space division system 2100. In a particular example illustrated in FIG. 42, the weighted insert 2190 may be a tubular section 2192 fitted within the hem 2120, and filled with material such as sand.

FIG. 42A is similar to FIG. 42, but shows the lower hem 2120 as capturing a tubular insert 2192. The tubular insert 2192 may be a flexible sheath 2194 consisting of rubber or the like. The sheath 2194 may be of relatively substantial weight in and of itself or, alternatively, may be weighted by the use of sand or other materials carried within the sheath 2194. The weighted insert 2192 can include an end tab 2196 which may be interconnected to a cooperating recess or similar connecting means in the weighted insert 2192 associated with an adjacent space divider 2184. In this manner, the weighted inserts of adjacent space dividers may be interconnected together.

FIG. 43 is a sectional end view (taken along section lines 43-43 of FIG. 41) showing an end portion of the space divider 2184. In this particular configuration, a power batten 2200 extends downwardly so as to form an end hem of the space divider 2184. A low

voltage DC power cable 2202 may be extended downwardly through the power batten 2200. In addition, it is also possible to extend a communication cable 2204 through the batten 2200. The batten 2200 is formed by taking the space divider 2184 and turning it rearward upon itself, and then connecting the end of the space divider 2206 to another portion of the space divider 2184 through the use of a spring clip 2208 or a similar releasable securing means.

FIG. 44 illustrates an interconnection between the space divider 2182 and 2184 which may be employed in accordance with the invention. In this particular embodiment, a power batten 2210 (having communication cables 2204) is formed at the intersection of the space dividers 2182 and 2184. The space dividers 2182 and 2184 are releasably coupled together through the use of a pair of spring clips 2208.

In accordance with the foregoing, the space division system 2100 in accordance with the invention provides for the rapid addition and deletion of space dividers. In addition, the elements of the space division system 2100 exhibit internal stretch characteristics, with respect to space divider surfaces, battens and frames. These internal stretch characteristics provide for a continuum of configurations, with the spline interconnections providing for curvature of any reasonable radius.

FIG. 45 is a close up section of the end portion of the space divider 2184, similar in form to FIG. 43. However, FIG. 45 further illustrates the use of 3D translucent material for the space divider 2184. Further, FIG. 45 illustrates communication cables 2212 which may extend through a pre-woven pocket 2214 of the translucent space divider 2184.

FIG. 46 illustrates a "close up" view of the intersection between the space dividers 2182, 2184. FIG. 46 is a view similar in scope to FIG. 44, but further illustrates

power/communication cables 2216 extending through pre-woven pockets 2218 of the space dividers 2182, 2184.

FIG. 47 is a close up section view of an end portion of the space divider 2184 (similar to FIG. 45), but illustrating the space divider 2184 as comprising a woven fabric

5 material 2220. Various types of woven materials may be utilized as material 2220. For example, in the particular embodiment described and illustrated herein, the woven material 2220 may be a material which is characterized as "cattle mattress" material. FIG. 48 is a close up section similar in scope to the close up section illustrated in FIG. 46, but showing the two space dividers 2182, 2184 as employing cattle mattress material 2220.

10 FIG. 49 is an elevational view of space dividers 2230. More specifically, the space dividers 2230 include a series of internal linear voids 2232 through which linear LED lighting strips may be inserted. Referring to both FIGS. 49 and 50, such an LED lighting strip is illustrated in FIG. 50 as LED strip 2234. LED strip 2234 will have a sequential series of LED lights 2236 extending along the lighting strip 2234. The lighting strip 2234 will be positioned
15 within the linear void 2232. For purposes of carrying other elements, such as power cables or communication cables, additional linear voids, such as linear voids 2238 and 2240, may also be horizontally located within the space dividers 2230. FIG. 49 also illustrates the use of a series of LED power supplies 2242 which may be connected to LED power lines 2234. In turn, the LED power lines 2234 may be connected in any appropriate manner to the LED lighting strips 2236.
20 Further, additional power may be provided, such as with the utilization of a 12-volt DC utility power supply line 2246.

The particular LED lighting strips 2234 may comprise, for example, yellow linear flex side LED lighting strips, having a configuration of approximately 2 inches by 24 feet. Other

interconnections may also be employed with the space dividers 2230, such as Internet connections and the like. FIG. 51 is a side elevational view of a similar set of space dividers 2250. The sections 2250 are similar to the sections 2230 previously described with respect to FIG. 49. In addition, these sections carry LED power supplies 2242 and LED power lines 2244, in addition to a DC power line 2246. However, as illustrated in FIG. 52, the LED lighting strips 2260 are turned in a different direction from the LED lighting strips 2234 illustrated in FIG. 50. In this manner, the actual light intensity and light diffusion at the opposing surfaces of the space dividers 2250 will be different than that of the sections 2230. Further, FIGS. 51 and 52 illustrate the use of two LED lighting strips 2260.

FIG. 53 is a further embodiment of a pair of space dividers 2270, with FIG. 53 showing a side elevational view thereof. With respect to FIGS. 53 and 54, a series of LED power supplies 2242 are shown, interconnected to LED power lines 2244. Correspondingly, a DC power line 2246 is also illustrated. With the space dividers 2270, linear voids 2272 are provided, one of which carries an LED lighting strip 2274 having the substantially "flat" configuration illustrated in FIG. 54. In this particular configuration, a differing light intensity and light dispersion will be seen on the left side surface of the space divider 2270 (as viewed in FIG. 54), while a relatively opaque view will be found from the right side of the space divider 2270 (again as viewed in FIG. 54).

FIGS. 55, 56 and 57 illustrate similar space dividers utilizing LED internal lighting technology. FIG. 55 illustrates space dividers 2290, having linear voids 2292 positioned at the lower portion thereof. As illustrated in FIG. 56, each of the linear voids 2292 carries a flat-configured LED lighting strip 2296 facing toward the left side of the space divider 2290 illustrated in FIG. 56. Alternatively, FIG. 57 is similar in form to FIG. 56, and illustrates the

upper LED flat-configured lighting strip 2298 as facing to the right side of the space divider 2290, while the lower LED flat-configured lighting strip 2298 faces toward the left side of the space divider 2290. Again, the particular light intensity, diffusion and color "wash" which will be associated with the space dividers 2290 will be dependent upon the spacing and the configuration of the LED lighting strips. It should be understood that the lighting strip configurations described herein are merely examples of those which may be utilized with a space division system in accordance with the invention. Numerous other LED lighting strip configurations could be utilized, without departing from the spirit and scope of the novel concepts of the invention.

FIG. 58 illustrates a pair of space dividers 2300 having a linear or horizontal void 2302 wherein an LED lighting strip 2304 is embedded. The LED lighting strip 2304 includes a series of arrows which can be utilized for emergency directional lighting, and may be sequentially "pulsed" so as to illustrate a direction of egress for emergency evacuation. For purposes of emergency directional lighting, various additional electrical equipment may be required. For example, it is not uncommon for electrical and other building codes and regulations to require the use of separate power sources for emergency lighting. In such event, such power sources may be required to be electrically interconnected with the LED lighting strip 2304. Also, the lighted arrows of the LED lighting strip 2304 may be utilized for purposes other than emergencies. As an example, the arrows of the LED lighting strip 2304 may be utilized to provide "wayfinding" for purposes of directing visitors to the commercial interior to appropriate locations within the interior, as well as for purposes of emergencies. Along with other appropriate power and lighting equipment, the arrows of the LED lighting strip 2304 may be utilized, for example, to direct visitors in a library to appropriate book classification sections.

Numerous other wayfinding uses may also employ the use of arrows or similar directional indicators of the LED lighting strip 2304. For example, and as earlier mentioned, lighting may be utilized for indication of external and internal situations. For example, lighting may be associated with the space dividers in a manner so as to indicate whether an individual is "in" a particular workspace.

FIGS. 59 and 60 illustrate a pair of space dividers 2310, with LED lighting technology utilized externally of the space dividers 2310. More specifically, the space dividers 2310 include a curtain 2314 mounted from the top portion of the space divider 2310. Depending forwardly and horizontally from the space dividers 2310 is an LED lighting strip support 2316, which may be appropriately secured to a linear void 2312 of the space dividers 2310. Positioned downwardly from the support 2316 is a series of LED lights. The LED lights may be of appropriate colors, and will provide what may be characterized as an external "wash" and a color "wash" over the lower portion of the side surfaces of the space dividers 2310, below the curtain 2314. This color wash can be modified in intensity and with respect to diffusion dependent upon the intensity and color of the LED lights 2318, and of the particular materials from which the space dividers 2310 are constructed.

FIG. 61 illustrates a pair of space dividers 2320 showing a low voltage DC power line 2328, communications cabling 2326, AC power 2322 and AC power line 2324. The AC power line 2324 terminates in a pair of electrical receptacles 2330. A computer 2332 may be energized through the electrical receptacles 2330. Data and communication signals may be transmitted from the computer 2332 through a communications signal junction box or modem 2334, and outwardly through the communications cabling 2326. In this manner, the space dividers 2320 provide power and networking technology. FIG. 62 is a side elevational view of

space dividers 2340, similar in structure to the space dividers 2320 illustrated in FIG. 61. In this particular instance, the space dividers 2340 are illustrated showing use of wall-connected task lighting technology. The configuration employs a task light 2342 illustrated in FIGS. 62 and 63. The task light 2342 utilizes low voltage DC power and LED lighting technology. As illustrated in FIGS. 62 and 63, the LED task light 2342 includes a rectangular LED marker 2344 at the terminus of the task light 2342. Extending downwardly from the marker 2344 is a rigid foam core 2346. The rigid foam core 2346 is adjacent a flexible joint 2348. A fabric cover 2350 extends downwardly and angularly from the flexible joint 2348. The fabric cover 2350 is interconnected to an appropriate securing bracket 2352, which is secured to the space divider 2340 by appropriate means. For example, Velcro or a similar securing means could be employed. The task light 2342 may be utilized to provide appropriate light for use of a computer screen 2354.

In addition to the foregoing, the space dividers and associated channel voids can be utilized with data storage technology. For example, the computer 2332 or other types of computerized or communications equipment could be releasably attached to a data storage device embedded within voids of the space dividers. These data storage devices could be in the form of disks or similar devices. Also, for example, data storage and programming devices such as microprocessors could also be embedded within voids of the space dividers, for releasable interconnection to other types of equipment, such as sound management technology and the like. With respect to all the foregoing, the space division system 2100 in accordance with the invention provides for actual data storage embodied and embedded within the space division system itself. In this manner, the space dividers themselves are not merely fabrics within frames having battens and the like, but are elements which take advantage of today's miniaturization and

advancements in technology, so as to provide data storage, access to programmable devices and the like.

FIG. 64 illustrates a curved configuration of a space divider 2360 showing the use of the task light 2342 therewith. FIG. 65 is an elevational view of a pair of space dividers 2370, showing the use of DC low voltage technologies with a pair of task lights 2342. FIG. 65 further shows the energizing of a coffee maker 2343, through the power supplied to the space dividers 2370. FIG. 66 illustrates another pair of space dividers 2380, showing the space dividers 2380 in use in an office environment with technologies. For example, this office environment may include a telephone 2382, MP3 player 2384, laptop 2386 and fan 2388. FIG. 67 illustrates another pair of space dividers 2390, showing use with technology which may be associated with a temporary work or gathering space. For example, the configuration illustrated in FIG. 67 includes a phone 2382, a set of wireless headphones 2384, teleconferencing screen 2386 and various other accessories.

FIG. 68 is substantially similar to FIG. 36, but further illustrates the use of a projector 2400 in use with a screen 2402 secured to the space divider 2130. The foregoing drawings illustrate interconnections of various types of technological and other functional accessories through the space dividers. Further, the drawings illustrate the use of velcro clips at attachment points. As earlier stated, data storage devices and switches can also be employed with the space dividers.

Still further, other types of equipment may be utilized. For example, both wired and wireless headphones may be employed and energized through the DC power distribution systems. Still further, projection equipment may be utilized, with projection screens releasably attached to fabrics of the space dividers. This was illustrated with respect to projector screen

2402, coupled to the space divider 2130. Still further, however, projection may occur upon fabric surfaces of the space dividers themselves. This can be provided through the use of monofilaments.

FIGS. 69, 70 and 71 illustrate alternative embodiments and configurations of space dividers 2410, 2420 and 2430, respectively, and illustrate various plan views of these space dividers so as to provide visual privacy. These space dividers may be in the form of what is characterized as "technology curtains," and create flexible spaces for individual and small group uses. In addition, the enclosures provided by these space dividers exhibit daily flexibility for project teams. FIGS. 72 and 73 show other configurations of the technology curtains, identified as technology curtains 2432 and 2434. These technology curtains can be characterized as being configured in a "flutter" form configuration. FIGS. 72 and 73 show two alternative embodiments of the "flutter" form configuration. With these configurations of the technology curtains, relatively more efficient place making is provided. In addition, these configurations essentially maximize characteristics which tend to be unique to "hung" fabric. These arrangements also afford a greater variety of space division, and also more or a greater spatial "sense." In addition, these "flutter" form configurations create more receptacle spaces than what are characterized as "booth" walls. The "flutter" form configurations also provide relatively greater flexible niche scale. In general, the embodiments of FIGS. 69, 70 and 71 show movement from "shared" to "separate" configurations. The enclosures formed by the space dividers within these drawings provide for substantial flexibility for project teams and the like. Still further, the configurations in FIGS. 72 and 73 provide for individuals' space along edges, in addition to collective action. That is, adjacency is provided, but with relatively more privacy.

FIGS. 74 and 75 illustrate technology curtain configurations 2436 and 2438.

These configurations may be characterized as "quad-place" configurations. In these illustrations, the spaces shown move collectively to a less flexible, central passageway which grow so as to accommodate group work. The configurations comprise technology curtains which would
5 provide both visual privacy and sound absorption. Advantages associated with "quad-place" configurations relate to the responsiveness to fluid conditions of collaborative work practices. In addition, these configurations provide daily flexibility for project teams, and can be grouped as "sub-centers" around what may be characterized as a "silent center."

FIGS. 76, 77 and 78 illustrate the use of technology curtains 2440, 2442 and
10 2444, respectively, and exemplify what can be characterized as "triplace" configurations. These technology curtain configurations provide both visual privacy and sound absorption. Benefits include responsiveness to fluid conditions of collaborative work practices, in addition to daily flexibility for project teams. In addition, these triplace configurations can be grouped as "sub-centers" around a silent center. More specifically, FIG. 76 illustrates a configuration having
15 three spaces. Correspondingly, FIG. 78 illustrates a configuration with two spaces, while FIG. 77 illustrates a single space configuration.

FIG. 79 illustrates the actual use of a translucent space divider 2450.

As earlier referenced herein, the space division system 2100 with technology provides a means for facilitating control and reconfiguration of control relationships among
20 various functional components which may be utilized with the space division system 2100. For purposes of describing the concept of establishing controlling relationships among various controlled and controlling components which may be associated with the space division system 2100, reference is made to the commonly assigned U.S. Provisional Patent Application Serial

No. 60/374,012, entitled "Switching/Lighting Correlation System" and filed on April 19, 2002.

The contents of the aforescribed patent application are hereby incorporated by reference herein.

In this regard, it is relatively apparent that it would be favorable to establish
5 control relationships among switches and lights, and have the capability of reconfiguring the same. Other control relationships may also be worthwhile. For example, FIG. 80 illustrates a user employing a control wand 2460 (to be described in subsequent paragraphs herein) for purposes of establishing control of an LED lighting strip 2462. FIG. 80 also illustrates the location of a wall-attached task light 2464. These elements are associated with a space divider
10 2466. FIG. 81 is similar to FIG. 80, but further illustrates the user employing the control wand 2460 for purposes of establishing control of the task light 2464. An example of the control wand 2460 is illustrated in FIGS. 82, 83 and 84. With reference thereto, the control wand 2460 may be of an elongated configuration. At one end of the control wand 2460 is a light source 2470 which, preferably, would generate a substantially collimated beam of light. In addition to light source
15 2470, the control wand 2460 may also include an infrared (IR) emitter 2472, for transmitting infrared transmission signals to corresponding IR receivers associated with the LED lights 2462 or task light 2464, in addition to switches or the like which may control these functional accessories.

The control wand 2460 may also include a trigger 2474, for purposes of initiating
20 transmission of IR signals. Still further, the wand 2460 may include mode select switches such as mode select switch 2476 and mode select switch 2478. These mode select switches may be utilized to allow manual selection of particular commands which may be generated using the wand 2460. The control wand 2460 may also utilize controllers (not shown) or similar

computerized devices for purposes of providing electronics within the wand 2460 for use with the trigger 2474, mode select switches 2476, 2478, light source 2470 and the IR emitter 2472.

As earlier mentioned, an example of the use of such a wand, with the attendant commands which may be generated using the same, is described in the commonly assigned U.S. Provisional Patent Application Serial No. 60/374,012, entitled "Switching/Lighting Correlation System" and filed on April 19, 2002.

Referring back to FIGS. 80 and 81, the user may employ the wand 2460 to transmit signals to controllers (not shown) associated with the LED lights 2462 and task light 2464. The capability of essentially "programming" controlled relationships among the various accessories associated with the space division system 2100 requires the capability of transmitting and receiving communication signals among the various functional accessories. In this regard, infrastructure systems may be employed. An example of such an infrastructure system which may be employed with the space division system 2100 in accordance with the invention is described in detail in the commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149, entitled "Rail System" and filed on September 4, 2002.

FIG. 85 is a perspective view of a particular configuration utilizing space divider 2500 in a curved configuration, with task lights 2502. Such an arrangement could be utilized within a library, study hall or restaurant configuration. Also, mention should be made that space divider 2500, as well as other space divider configurations illustrated and described herein, may be utilized with various types of ceiling structures. One such ceiling structure is illustrated in the commonly assigned U.S. Design Patent Application Serial No. 29/166,803, entitled "Design for Articulating Ceiling" and filed September 4, 2002.

Various types of appliances and technologies may be utilized with the space dividers of the space division system 2100, in addition to those that have been expressly described in detail herein. For example, sound apparatus such as speakers and the like may be integrated into the various space dividers of the space division system 2100. Such speakers may be energized through power and communication sources described herein, or through other energizing means, including batteries and the like. Still further, the speakers could be selectively enabled as desired, and controlled with the control wand 2460 and control processes described earlier herein.

Still further, noise masking processes could be employed with the use of these speakers, in addition to general acoustical control arrangements. Still further, the noise masking arrangements employing the speakers could be integrated within a virtual structure associated with the space division system 2100. In general, various types of speakers, noise masking, acoustical control and other equipment and processes could be employed with the technologies of the space division system 2100, and powered with the method and apparatus described herein, as well as with other energizing arrangements (e.g. batteries).

Still further, the space dividers of the space division system 2100 may have application in situations which require the employment of security measures. In this regard, it may be advantageous to construct space dividers of the space division systems with materials having a substantial capability of resisting penetration. An example of one such material is known as Kevlar® brand fiber, with the term Kevlar® being a registered trademark of E.I. duPont de Nemours and Company. Kevlar® brand fiber is p-phenyleneterephthalamide. Kevlar® brand fiber combines relatively high strength with light weight. Kevlar® brand fiber is within a family of nylon fibers known as Aramids. Specifically, and is within a polyamide, with amide

groups attached at carbons 1 and 4. For purposes of security, various of the space dividers of the space division system 2100 may be constructed of Kevlar® brand fiber.

Still further, with respect to security and safety, the space dividers of the space division system 2100 may be constructed of fire resistant or fire proof materials. One such material which also falls within the family of Aramids is known as Nomex® brand fiber. The term Nomex® is also a trademark of E.I. duPont de Nemours and Company. Nomex® brand fiber is commonly utilized for purposes of making fire proof clothing. Unlike Kevlar® brand fiber, Nomex® brand fiber has amide groups attached at carbons 1 and 3. It is not uncommon to construct materials which are blends of both Nomex® and Kevlar® brand fibers. It may therefore be advantageous to construct the space dividers of the space division system 2100 with materials employing Nomex® brand fiber or other materials having fire proof properties, in addition to Kevlar® brand fiber or other materials which substantially resist penetration.

Another configuration of the space division system 2100 may also be important with regard to security and safety. Specifically, it may be advantageous to incorporate means in the space division system 2100 for releasably securing space dividers and other elements of the space division system 2100 to a floor structure. Various types of securing means could be employed with the space dividers, lower battens and the like. However, it would be preferable to insure that the means for securing elements of the space division system 2100 to the floor structure still permit release of these elements from the floor structure without significant effort.

Turning to other apparatus and concepts which may be employed with a space division system in accordance with the invention, the lighting configurations described herein (such as LED lighting strip 2462, task light 2464 and the like) may employ various types of controlling apparatus in the form of enabling switches for controlling the state of the lighting

elements or other electrical apparatus, appliances, computerized equipment and the like. In this regard, various types of switches may be employed. These switches may be in the form of conventional switches having differing spatial positions for "on" and "off" states. However, other types of switches may also be employed. For example, the space division system 2100 in accordance with the invention may employ optical switches for controlling lighting elements, electrical appliances and the like. With respect to use of the control wand 2460 previously described herein, the switches may be associated with sensors which can detect spatial signals transmitted from the wand 2460. Further, physically operable switches such as pressure switches may also be employed. Still further, various types of motion sensing devices may be employed to enable and disable switches and associated equipment. These and other types of switches may also be employed with the use of radio frequency identification ("RFID") systems, whereby, for example, an individual entering a room with a specific RFID badge may cause switches and their associated sensors to identify the individual and configure lighting elements and other equipment associated with the space division system 2100 to specific states. Still further, all of these types of switches and other controlling devices may be communicatively coupled to a power and communications network associated with the space division system 2100. Such a network is generally described in the commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149, entitled "Rail System" and filed September 4, 2002.

In summary, a space division system 2100 has been disclosed in accordance with the invention, which provides for movable and internally reconfigurable space dividers, incorporates various technologies and is not limited in size or expansion capability. The system is internally reconfigurable, light weight and employs quick-release elements. In this regard,

joined space dividers can be rapidly added and deleted, and the use of splines provides for movement from line segment configurations to configurations having a curve of any radius.

In the same regard, internal stretch characteristics are exhibited by space divider surfaces, battens and frames. Digital storage is also provided within voids of fabrics associated with the space dividers. Still further, digital programming and switching is also provided. In this manner, space division systems in accordance with the invention harness the effect of miniaturization, through the embedment and integration of electronic components. In addition, solid state lighting is integrated within the system, having capabilities such as changing color appearances of space dividers and the like. In addition, signaling of interior and exterior circumstances is provided. In the same regard, space division systems in accordance with the invention incorporate integration and distribution of power, particularly DC power and the flexible use of 12-volt applications.

With regard to structure, channel voids are provided within space dividers at differing heights. Space divider fabrics can be modified in appearance, such as providing color changes using solid state lighting. Color appearance can also be modified through the functional control of conventional lighting. Space division systems in accordance with the invention can also exhibit acoustical ameliorations, through the use of physical sound attenuation material, functional control of sound management systems and the like.

It will be apparent to those skilled in the pertinent arts that other embodiments of space division systems in accordance with the invention may be designed. That it, the principles of a space division system for configuring control among functional accessories and for the connection of functional accessories through a space division system are not limited to the specific embodiments described herein. For example, various configurations of certain

components of the space division system 2100 may be utilized, without departing from the spirit of the invention. Further, numerous types of technologies may be utilized with the space division system 2100, without departing from the novel concepts of the invention. Such technologies may include the use of sound design, radio frequency identification ("RFID"),
5 infrared spatial transmissions and other technologies. Accordingly, it will be apparent to those skilled in the art that modifications and other variations of the above-described illustrative embodiments of the invention may be effected without departing from the spirit and scope of the novel concepts of the invention.

Still further principles of the invention are disclosed, by way of example, within a
10 visual shield system 3100 initially shown in FIG. 86 and illustrated in various embodiments in FIGS. 86 – 123. FIG. 86 illustrates a general layout of the ceiling system 3100 as it may be utilized above a workplace 3102. The ceiling system 3100 in accordance with the invention provides for an open system to physically change a family of products, including the capability of relocation. In addition, digital control and digital programming is also provided for the ceiling
15 system 3100. This control is utilized to undertake activities such as to change the ceiling system appearance for purposes such as personal design, identity of a particular group, personalization by color change, digital imaging, and projection of images. As described in subsequent paragraphs herein, the ceiling system 3100 may be linked to a digital programming network.

Still further, ceiling systems in accordance with the invention provide for
20 interchangeable shielding elements and interchangeability of other parts, which is essentially what could be characterized as a "mass customization." Unique visuals can be provided within the system. The system can also be fabricated in a relatively efficient manner, with support being provided by frames for the shielding elements. Because of the configuration of ceiling

systems in accordance with the invention, relatively larger shielding elements can be utilized. In this regard, the shielding elements can be constructed of compressed polyester fiber material.

In the same regard, changes can be made to occur based on external environmental characteristics, such as the color of the sky and time of day. Changes in light may also be provided in accordance with the ceiling system during different seasons and the like. It is well known that lighting changes can be beneficial for the health and well being of individuals working under certain lighting structures.

Still further, ceiling systems in accordance with the invention take advantage of advancements in semiconductors and miniaturization of electronic components. That is, ceiling systems in accordance with the invention provide for a harnessing of solid state technology to architectural activities. These advancements in technologies have resulted in changes in the way we work, and it is advantageous for ceiling systems to take advantage of such new work habits.

As illustrated in FIG. 86, the workplace 3102 may include a series of conference tables 3104 and chairs 3106. However, the ceiling system 3100 may be utilized in any of variously configured commercial interiors. As illustrated in FIG. 86, the ceiling system 3100 may include a series of shielding elements 3108 supported in any convenient manner through the use of frames 3110 and cross frames 3112. The ceiling system 3100 may be suspended from a building roof or similar overhead structure (not shown) through the use of suspension cables 3114 or comparable elements.

As described in subsequent paragraphs herein, the ceiling system 3100, and its various embodiments, may employ LED (and other) lighting elements, with selectable materials surrounding lighting elements so as to provide varying degrees of translucence. The materials may be constructed and configured so as to accommodate additional utilities (e.g. sprinklers and

the like) below a ceiling plane. More specifically, the ceiling configurations described herein in accordance with the invention provide a ceiling plane, with lighting elements and materials that are moveably mountable to the ceiling plane. The materials have varying degrees of translucence so as to adjust intensity and diffusion of light projected from the ceiling plane.

5 Still further, and in accordance with the invention, the ceiling system 3100 and its various embodiments may employ lighting elements other than LED elements. For example, where LED lighting elements are described in subsequent paragraphs herein, lighting elements such as fluorescent lighting, metal halide lighting and various other types of lighting may be employed, without departing from the principal concepts of the invention. Still further, as
10 referenced herein, the materials of the ceiling system 3100 may be constructed so as to accommodate additional utilities below a ceiling plane, with the utilities including sprinklers and the like. In addition to accommodating the utilities below the ceiling plane, the materials of which the ceiling system 3100 is constructed may have sufficient openings or porosity so as to permit utilities such as sprinklers and the like to be maintained above a ceiling plane formed by
15 these materials of the ceiling system 3100. In this regard, many building codes provide that sprinklers and the like may be accommodated above the ceiling plane, if the plane exhibits total porosity openings of 70% or more.

 Permeating throughout the inventive concepts of the ceiling system 3100 are the issues associated with what may be characterized as "anticipatory design" or flexibility. That is,
20 at the time that a designer may complete a structural and functional design for a commercial interior (including not only wall structures, but also locations of ceiling shielding elements, electrical fixtures, data nodes, communication outlets and the like), it may be several years before particular tenants occupy the structure. Between the time of the design completion and

the time the particular tenants wish to occupy the structure, the prospective tenants' needs may be substantially different from the designers' anticipatory ideas. However, most commercial interior structures permit little reconfiguration of architectural elements and structure, after completion of an initial design. Reconfiguring a structure for the needs of a particular tenant can be extremely
5 expensive and time consuming. During the structural modifications, the commercial interior is essentially "down" and provides no positive cash flow to the structure's owner.

However, with the ceiling system 3100 in accordance with the invention, reconfiguration is facilitated, both with respect to expense and time. Essentially, the architectural interior can be reconfigured in "real time." In this regard, not only is it important
10 that various functional components can be quickly relocated from a "physical" sense, but also that "functional relationships" among components can be altered. As a relatively simple example, and as described in subsequent paragraphs herein with respect to FIGS. 119 and 120, functional or "control" relationships can be readily modified among various switch and lighting components. With respect to the relationships, alteration can occur with respect to aesthetic
15 appearance. As earlier mentioned, it can be beneficial (from both a physical and mental health view point) to an individual to have certain types of lighting available. These capabilities of changes in appearance aesthetics occur both with respect to the capability of changing shielding planes, and from changing lighting.

More specifically, and with reference to FIG. 87, a perspective view is shown of a
20 pair of shielding elements 3116 which are supported through the use of a rail system which may comprise a pair of parallel and spaced apart rails 3118. An exemplary embodiment of a rail system having rails such as rails 3118 which may be employed with the shielding elements 3116 is described in commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149,

entitled "Rail System" and filed on September 4, 2002. The rails 3118 themselves may be suspended through the use of suspension cables or support rods 3121 to overhead building supports (not shown). As further illustrated in FIG. 87, the shielding elements 3116 may include coverings 3120, examples of which are described in subsequent paragraphs herein. The

5 coverings 3120 may provide various translucence for a series of LED lighting module strips 3122 and other types of lighting elements. Such LED lighting module strips 3122 will also be described in subsequent paragraphs herein. The shielding elements 3116 are supported on the sides of each of the adjacent rails 3118 on a pair of opposing L-shaped brackets 3124. Preferably, the shielding elements 3116 may be releasably secured to the L-shaped brackets 3124

10 through appropriate securing means such as connecting screws and the like.

In addition to the shielding elements 3116 comprising shielding elements having translucent material coverings 3120 and LED lighting modules 3122, the shielding elements 3116 may also comprise other elements. For example, other types of materials may be utilized as the shielding elements 3116. For example, the shielding elements 3116 may comprise air-

15 filled cellular structures. In addition, such shielding elements may comprise 3D-Pongi fabric. Still further, these shielding elements 3116 may comprise rigid fins or, alternatively, heliofon fabric fins. Further, the shielding elements 3116 may be supported on their sides through the use of a frame 3126 which may, for example, consist of various materials, including extruded aluminum.

20 FIG. 88 is similar in scope to FIG. 87, in that it illustrates a pair of shielding elements 3116. However, in place of the use of rails 3118 and support rods 3121, the shielding elements 3116 are supported from overhead building supports through the use of suspension cables 3130 interconnected directly to the shielding elements 3116 rather than through the use of

rails 3118. Preferably, the suspension cables 3130 are adjustable in length. With adjustability of the length of the suspension cables, the supporting infrastructure and/or the shielding elements 3116 themselves may be adjustable in distance from overhead building supports. Still further, interconnection between the shielding elements 3116 and the rails 3118 and support rods 3121
5 may be constructed so that the shielding elements 3116 are adjustable in vertical distance relative to the rails 3118 and support rods 3121.

FIG. 89 is a side elevation cross sectional view of the system shown in FIG. 87. FIG. 89 illustrates the support rod 3121 and rail 3118. The rail 3118 will not be described in great detail herein. In general, the rail 3118 may include cable trays 3132 carrying
10 communication cables 3134 or the like. Support brackets 3136 may be interconnected to a main track 3138 at spaced apart intervals. The L-shaped brackets 3124 may be interconnected to the main track 3138 by any number of conventional securing means, such as bolt-nut combinations, connecting screws and the like. As earlier stated, a rail system having rails 3118 is described in greater detail in the commonly assigned U.S. Provisional Patent Application Serial No.
15 60/408,149, entitled "Rail System" and filed on September 4, 2002.

FIG. 89 also illustrates the cross frames 3126, interconnected to other components through the use of brackets 3140. FIG. 89 further illustrates the positioning of the members 3142 in a spaced apart and parallel configuration along the shielding elements 3116. Mounted below the members 3142 are LED lighting modules 3144, which are mounted in any convenient
20 manner on the underside of the members 3142. Surrounding the LED lighting modules 3144 are a series of "light bags" 3146, which may have various degrees of translucency. It is these light bags 3146 and other embodiments as set forth in subsequent paragraphs herein which provide

modifications to light intensity and varying degrees of translucency and diffusion with respect to the LED lighting modules.

FIG. 90 is a side elevation cross-sectional view of the configuration illustrated in FIG. 88. That is, FIG. 90 illustrates the use of suspension cables 3130. The suspension cables 3130 depend downwardly and are received within apertures in the cross bracket 3140 and in an L-shaped bracket 3148. An end cap 3150 is utilized to secure the suspension cable 3130 to the brackets 3140, 3148.

FIG. 91 is a perspective view (looking from underneath) of one of the elongated LED members 3142 which may be employed with the shielding elements 3116. As illustrated in FIG. 91, the member 3142 is elongated in length and will laterally extend across a shielding elements 3116. Mounted to the lower portion of the LED member 3142 is a linear LED lighting module 3144. The linear LED lighting module 3144 is also elongated in length and secured by any of a number of conventional securing means (such as adhesives, connecting screws or the like) to the underside of the member 3142. The linear LED lighting module 3144 is positioned so that it extends longitudinally along the length of the member 3142. The linear LED lighting module 3144 includes a series of LED's 3152 spaced apart along the length of the linear LED lighting module 3144.

FIG. 92 is an illustration similar to FIG. 91, but illustrates the use of two linear LED lighting modules 3144. Correspondingly, FIG. 93 is similar to FIGS. 91 and 92, but illustrates the use of three linear LED lighting modules 3144 along the length of the member 3142. FIG. 94 is an underside elevation view of the member 3142 and three linear LED lighting modules 3144 as illustrated in FIG. 93. FIG. 95 is an illustration of a linear LED lighting module 3144, separate and apart from any member 3142. FIG. 95 illustrates that the linear LED

lighting module 3144 may be flexible in construction, and may be constructed of any of a number of suitable materials. Also, although not expressly shown in the drawings, low voltage DC power may be applied to the LED's 3152 of the LED lighting module through wires or other conductors embedded within the length of the linear LED lighting module 3144.

5 FIG. 96 is substantially similar in scope to FIG. 89. That is, FIG. 96 illustrates a rail 3118 having cable trays 3132 carrying communication cables 3134. FIG. 96 also illustrates the use of the support rod 3121, which is interconnected to the main track 3138. Support brackets 3136 are utilized to interconnect sections of the main track 3138.

 In addition, FIG. 96, like FIG. 89, illustrates the use of an L-shaped bracket 3124
10 and cross bracket 3140 for interconnection of the shielding elements 3116 to the rail 3118. However, unlike FIG. 89, the configuration illustrated in FIG. 96 also includes a power transformer 3160 which may be interconnected to electrical components in any suitable manner which are either associated with the rail 3118 or otherwise configured around the rail 3118 and shielding elements 3116. The power transformer 3160 may be utilized to supply low voltage DC
15 power through power cord 3162 to the linear LED lighting modules 3144. FIG. 96 illustrates the use of bus bars 3164 to supply low voltage DC power to the linear LED lighting modules 3144 and LED's 3152. However, it may be preferable to employ a series of cables and wires (not expressly shown in FIG. 96) for purposes of providing electrical power to each of the linear LED lighting modules. The interconnection between the power cord 3162 and the bus bars 3164 or
20 appropriate wiring can be made in any conventional manner. Correspondingly, the electrical interconnection between the bus bars 3164 or wiring and the LED's 3152 of the linear LED lighting modules 3144 may also be made in a conventional manner. FIG. 96A illustrates greater

detail with regard to the configuration of FIG. 96, and comprises a sectional end view of certain components of FIG. 96, taken along section lines 96A - 96A of FIG. 96.

As earlier stated, ceiling systems in accordance with the invention may utilize LED and other lighting elements, along with selectable materials which will surround the

5 lighting elements so as to provide varying degrees of translucence. The selectable materials may be digitally cut for purposes of forming the same. The selectable materials will also be utilized to modify the intensity and the diffusion of light projected from the LED or other lighting elements. FIGS. 97 - 115 illustrate various configurations in accordance with the invention. Turning to these drawings, FIGS. 97 and 98 illustrate a ceiling configuration 3200. The ceiling
10 configuration 3200 may be characterized as employing light diffusing fabric fins, with light bags. More specifically, the configuration 3200 includes a series of members 3142, each having a linear LED lighting module 3144 secured to the underside thereof. Each of the linear LED lighting modules 3144 includes a series of spaced apart LED lights 3152. Suspended in any appropriate manner from the members 3142 are a series of light bags 3210. The light bags 3210
15 serve to provide light diffusion and a particular level of translucence. In accordance with one aspect of the invention, the light bags 3210 may comprise light diffusion heliofon fabric. Such fabric is commercially available.

FIGS. 99 and 100 illustrate a second ceiling configuration 3220. In this particular configuration, light diffusing fabric fins again are employed. However, in this case, the fins are
20 in the form of a singular light sheet 3230 which may be "wrapped" around the light members 3142. Ends of the light sheets 3230 may be secured together by any suitable means. In this case, the light sheets 3230 may also comprise light diffusing heliofon fabric. Again, such fabric is

commercially available. However, in addition, the fabric dimensions may be customized through the use of digital cutting by the end user.

FIGS. 101 and 102 illustrate another alternative embodiment of a ceiling configuration in accordance with the invention, identified as ceiling configuration 3240. In this particular configuration, ceilings are utilized which are in the form of rigid fins 3250. The fins 3250 may be secured in any appropriate manner to the lower portions of the LED members 3142. In this case, the rigid fins 3250 form, as illustrated in FIG. 102, what would be characterized as "deep triangles." In this particular instance, the rigid fins 3250 in accordance with the invention may be composed of a translucent Lexan® material.

FIGS. 103 and 104 illustrate a further ceiling embodiment comprising the ceiling configuration 3260. As shown in FIGS. 103 and 104, the ceiling configuration 3260 includes a pair of relatively long rigid fins 3270, which essentially form a rectangular configuration. Intermediate the two rigid fins 3270 associated with each member 3142 is a rigid fin 3290 of intermediate length, and a rigid fin 3280 of relatively shorter length. The fins 3280 and 3290 separate a series of three linear LED lighting modules 3144 from each other. Again, the rigid fins 3270, 3280 and 3290 may consist of a translucent Lexan® material.

FIGS. 105 and 106 illustrate another embodiment of a ceiling configuration, identified as ceiling configuration 3300. In this particular instance, a series of rigid fins 3310 form a rectangular configuration around individual ones of the linear LED lighting modules 3144. However, unlike certain of the other ceiling embodiments described herein, embodiment 3300 is configured so that each linear LED lighting module 3144 is turned on its side, with the strips of LED's 3152 have a different directional configuration. In this case, the ceiling

configuration 3300 includes the rigid fins 3310 in a rectangular configuration, with the fins 3310 also being constructed of a translucent Lexan® material.

FIGS. 107, 108 and 108A illustrate a further ceiling configuration 3320 which may be utilized in accordance with the invention. As illustrated in these drawings, the ceiling configuration 3320 includes a series of parallel and spaced apart linear air tubes 3330. The linear air tubes 3330 are mounted so that a series of members 3142 and attached linear LED lighting modules 3144 are spaced intermediate the linear air tubes 3330. Although not expressly shown in the drawings, the LED members 3142 may be mounted in any appropriate means to the frame 3126. For purposes of providing the linear air tubes 3330, polyethylene air tubes may be utilized. Such air tubes are commercially available.

With respect to each of the ceiling embodiments described herein, it should be emphasized that the specific embodiments do not show details relating to powering of the linear LED lighting modules. However, power can be supplied to the lighting modules as described with respect to previous drawings herein. Further, a number of different arrangements for providing power to the linear LED lighting modules may be utilized.

FIGS. 109, 110 and 110A illustrate a further ceiling configuration 3340. The configuration 3340 is somewhat similar to that illustrated in FIG. 107, in that the configuration 3340 utilizes linear air tubes 3350 for purposes of providing the ceilings. However, unlike FIG. 107, the ceiling embodiment 3340 also utilizes what are referred to as round marker LED lighting modules 3360. Such lighting modules 3360 have a structural configuration as primarily illustrated in FIGS. 110 and 110A. Again, the linear air tubes 3350 may be constructed of polyethylene air tubes.

FIGS. 111, 112 and 112A illustrate a further embodiment of a ceiling configuration in accordance with the invention, identified as ceiling configuration 3400. In this particular instance, the ceiling configuration 3400 employs round marker LED lighting modules 3360, corresponding to the round marker LED lighting modules 3360 previously described with respect to FIGS. 109, 110 and 110A. However, unlike the ceiling embodiment 3340 illustrated in FIG. 109, the ceiling embodiment 3400 employs ceilings which may be characterized as air pillows 3410. Both the round marker LED lighting modules 3360 and the air pillows 3410 are commercially available. Preferably, the air pillows 3410 may be constructed of a polyethylene material. The air pillows 3410 and the round marker LED lighting modules 3360 provide a still different translucency and light diffusion.

FIGS. 113, 114 and 115 illustrate a further embodiment of a ceiling configuration in accordance with the invention. More specifically, FIGS. 113, 114 and 115 illustrate a ceiling configuration 3450 which utilizes a series of woven fabric materials 3460. These woven fabric materials 3460 may be of any of a number of different fabrics, and may be suspended in a manner so as to provide a "wave" pattern as illustrated in FIGS. 113 and 114. In addition, for purposes of aesthetics, forced air may be circulated around the fabrics 3460, and the same may be suspended or otherwise hung so as to generate "pulsing" curvatures as a result of the airflow. Positioned above the fabrics 3460 are members 3142 having any of a number of different types of LED lighting modules 3470 associated therewith. For example, the LED lighting modules 3470 could be in the form of linear LED lighting modules or, alternatively, round marker LED lighting modules, each as previously described herein.

FIGS. 116 and 117 illustrate the concept that the ceiling configurations do not necessarily have to be located in horizontal planes. FIGS. 116 and 117 each show a horizontal

plane A, for purposes of orientation. Each of these drawings also shows a series of shielding elements 3116 (which may incorporate any of the embodiments previously described herein), suspended from suspension cables 3130. As illustrated in FIG. 117, the shielding elements 3116 may be of varied angular orientation, with the shielding elements interconnected through flexible or hinged frames 3500.

As earlier referenced herein, the ceiling configurations may be provided with means for facilitating control and reconfiguration of controlled relationships among various functional components which may be utilized with the ceiling configuration. For purposes of describing the concept of establishing controlling relationships among various controlled and controlling components which may be associated with the ceiling configurations, reference is made to the commonly assigned U.S. Provisional Patent Application Serial No. 60/374,012 entitled "Switching/Lighting Correlation System" and filed April 19, 2002. The contents of the

With respect to the ceiling configurations described herein, most of these configurations made reference to LED lighting elements. That is, the ceiling configurations may be categorized as being available in an "unlit" format and a "lit" format. As earlier described herein, various other types of lighting elements may be utilized, such as fluorescent, metal halide and similar elements. Further, various types of acoustical control or absorption concepts may be employed with ceiling systems in accordance with the invention. Still further, with respect to security and safety, the shielding elements may be constructed of fire resistant or fire proof materials. Still further, the LED lighting elements and other lighting elements which may be utilized in accordance with the invention can comprise various colors. In addition, the colors of the lighting elements can be physically and/or electrically controlled.

In this regard, it would be favorable to establish control relationships among switches and lights, and have the capability of reconfiguring the same. Other control relationships may also be worthwhile. For example, FIGS. 118 and 118A illustrate a ceiling configuration 3520 utilizing light bag elements 3530 similar to those previously described herein. As also shown in FIG. 118, the linear LED lighting modules 3144 may be coupled to a power cord 3530 which, in turn, is coupled to a switch stand 3530. As with other ceiling configurations previously described herein, the ceiling configuration 3520 may employ other types of lighting elements, such as fluorescent, metal halide and similar elements. The switch stand 3530 includes a dimmer configuration 3550, having an enabling switch 3552 and a dimmer control 3554. With respect to this configuration, FIG. 119 illustrates a user employing a control wand 3560 (to be described in subsequent paragraphs herein) for purposes of establishing control of the linear LED lighting modules 3144 associated with the ceiling configuration 3520. In this case, the control wand 3560 may be pointing to an IR receiver (not shown) for executing certain control functions. FIG. 120 illustrates the user projecting the control wand 3560 toward the dimmer configuration 3550. The dimmer configuration 3550 may have an IR receiver, for purposes of receiving IR signals 3562 from the control wand 3560. In this case, and as described in U.S. Provisional Patent Application Serial No. 60/374,012, entitled "Switching/Lighting Correlation System" and filed April 19, 2002, the user may be employing the control wand 3560 so as to establish that the dimmer configuration 3550 will be controlling the linear LED lighting modules 3144 of the ceiling configuration 3520. Further, the control wand 3560 may be used to reconfigure various shielding elements themselves.

With respect to concepts associated with control, it is also possible to utilize ceiling systems in accordance with the invention with systems which employ vertically disposed

space dividers and the like. An example of such a system is disclosed in U.S. Provisional Patent Application Serial No. 60/408,011, entitled "Partition System with Technology" and filed September 4, 2002.

An example of the control wand 3560 is illustrated in FIGS. 121, 122 and 123.

5 With reference thereto, the control wand 3560 may be of an elongated configuration. At one end of the control wand 3560 is a light source 3570 which, preferably, would generate a substantially collimated beam of light. In addition to the light source 3570, the control wand 3560 may also include an infrared (IR) emitter 3580, for transmitting infrared transmission signals to corresponding IR receivers associated with the ceiling configuration 3520 and the dimmer
10 configuration 3550, in addition to other elements which may be utilized with other functional accessories.

The control wand 3560 may also include a trigger 3590, for purposes of initiating transmission of IR signals. Still further, the wand 3560 may include mode select switches, such as mode select switch 3600 and mode select switch 3602. These mode select switches 3600,
15 3602 may be utilized to allow manual selection of particular commands which may be generated using the wand 3560. The control wand 3560 may also use controllers (not shown) or similar computerized devices, for purposes of providing electronics within the wand 3560 for use with the trigger 3590, mode select switches 3600, 3602, light source 3570 and the IR emitter 3580.

As earlier mentioned, an example of use of such a wand, with the control commands which may
20 be generated using the same, is described in commonly assigned U.S. Provisional Patent Application Serial No. 60/374,012, entitled "Switching/Lighting Correlation System" and filed April 19, 2002.

Referring back to FIGS. 119 and 120, the user may employ the wand 3560 to transmit signals to a controller (not shown) associated with the dimmer configuration 3550 and the ceiling configuration 3520. The capability of essentially "programming" controlled relationships among the various accessories associated with the ceiling configurations requires a capability of transmitting and receiving communication signals among the various functional accessories. In this regard, infrastructure systems may be employed. An example of such an infrastructure system which may be employed with the ceiling configurations in accordance with the invention is described in detail in the commonly assigned U.S. Provisional Patent Application Serial No. 60/408,149, entitled "Rail System" and filed September 4, 2002.

It will be apparent to those skilled in the pertinent arts that other embodiments of ceiling systems in accordance with the invention may be designed. That is, the principles of a ceiling system are not limited to the specific embodiments described herein. Accordingly, it will be apparent to those skilled in the art that modifications and other variations of the above-described illustrative embodiments of the invention may be effected without departing from the spirit and scope of the novel concepts of the invention.

CLAIMS

1. A correlation system for configuring and modifying a control relationship between controlling apparatus and controlled apparatus, said correlation system comprising:

programming means comprising a hand-held configuration and manually operable by a user to transmit correlation signals to said controlled apparatus and to said
5 controlling apparatus; and

said controlled apparatus and said controlling apparatus each having sensing means responsive to said correlation signals for effecting said control relationship between said controlled apparatus and said controlling apparatus.

2. A correlation system in accordance with claim 1, characterized in that said correlation signals comprise spatially transmitted signals.

3. A correlation system in accordance with claim 1, characterized in that said programming means comprises:

a wand having a hand-held configuration;

a programmable controller;

5 switching means manually operable by a user so as to generate state signals as input signals to said programmable controller; and

said programmable controller is responsive to said state signals so as to execute particular functions as desired by said user.

4. A correlation system in accordance with claim 3, characterized in that said wand further comprises mode selector means, adapted for receiving separate and independent inputs from said user, and further adapted to generate and apply second state signals as input signals to said programmable controller.

5. A correlation system in accordance with claim 4, characterized in that:
said wand further comprises transmitting means for transmitting said correlation
signals to said controlled apparatus and to said controlling apparatus; and
said programmable controller is responsive to said state signals and to said second
5 state signals for applying activation signals to said transmission means.

6. A correlation system in accordance with claim 5, characterized in that said
transmission means comprises an IR emitter.

7. A correlation system in accordance with claim 1, characterized in that:
said correlation system further comprises a communications network for
electronically coupling said controlling apparatus to said controlled apparatus;
said controlled apparatus comprises at least one controlled programmable
5 controller having a unique address identifiable through said communications network of
said correlation system; and
said controlled apparatus further comprises sensing means responsive to said
correlation signals for applying control signals to said at least one controlled
programmable controller.

8. A correlation system in accordance with claim 7, characterized in that said
controlling apparatus comprises:

at least one controlling programmable controller having a unique address
identifiable through said communications network of said correlation system; and

5 sensing means responsive to said correlation signals, for applying control signals
to said at least one controlling programmable controller.

9. A correlation system in accordance with claim 1, characterized in that said controlling apparatus comprises a plurality of switch units.

10. A correlation system in accordance with claim 1, characterized in that said controlled apparatus comprises a plurality of lighting units.

11. A correlation system in accordance with claim 3, characterized in that said wand further comprises a trigger switch manually operable by said user, so as to generate further state signals as input signals to said programmable controller.

12. A correlation system in accordance with claim 3, characterized in that:
said wand further comprises a visible light having first and second states; and
said programmable controller is adapted to selectively generate and apply
activation signals as input signals to said visible light, so as to change a state of said
5 visible light between said first and second states.

13. A correlation system in accordance with claim 12, characterized in that:
said wand further comprises a lens spaced forward of said visible light, with said
lens being transparent to both visible and infrared light; and
said lens being a collimating lens for purposes of focusing said visible light into a
5 series of parallel light paths.

14. A correlation system in accordance with claim 1, characterized in that said system comprises a plurality of separate and independent programming means.

15. A correlation system in accordance with claim 4, characterized in that said mode selector means is adapted to generate and apply said second state signals to said programmable controller as signals indicative of SET, ADD and REMOVE command signals.

16. A correlation system in accordance with claim 1, characterized in that said

controlled apparatus comprises transmission means for transmitting address code signals to said programming means, where such address code signals are representative of a unique address of said controlled apparatus.

17. A correlation system in accordance with claim 16, characterized in that each of said wands includes means for indicating successful reception and execution of command signals.

18. A correlation system in accordance with claim 17, characterized in that said means for indicating successful reception and execution of command signals comprises a visible light.

19. A correlation system in accordance with claim 1, characterized in that configuring and modifying of said control relationship between said controlling apparatus and said controlled apparatus is performed in the absence of any transmission of signals from said programming means which identify any element of said programming means.

20. A correlation system in accordance with claim 1, characterized in that said programming means further comprises means for transmitting identification signals which expressly identify one or more elements of said programming means.

21. A correlation system in accordance with claim 1, characterized in that:
said programming means comprises a plurality of hand-held and manually operable wands;

each of said wands comprises means for transmitting identification signals
5 indicative of particular identification numbers of said wands; and

said correlation system further comprises means responsive to said identification signals for establishing a wand prioritization hierarchy.

22. A correlation system in accordance with claim 1, characterized in that said system comprises means for storing signals indicative of a last state in which said control relationship was configured.

23. A correlation system in accordance with claim 1, characterized in that said correlation system further comprises means for tracking and identifying which of a plurality of elements of said programming means is within a physical space associated with said correlation system.

24. A correlation system in accordance with claim 1, characterized in that said system further comprises means for limiting capability of said programming means to effect said control relationship, based upon identification of said programming means and/or a particular physical space in which said control relationship is attempting to be effected.

25. A correlation system in accordance with claim 1, characterized in that said controlled apparatus comprises one or more of a group consisting of light fixtures, microphones, cameras, monitors and wall sockets.

26. A correlation system in accordance with claim 25, characterized in that said controlled apparatus are provided with standard power and data connections, and each of the devices of said controlled apparatus are connected to a control bus.

27. A correlation system in accordance with claim 1, characterized in that at least a subset of said controlled apparatus are provided with a unique global identifier.

28. A correlation system in accordance with claim 27, characterized in that said identifier reflects at least the manufacturer, type, class of device and particular unit.

29. A correlation system in accordance with claim 28, characterized in that:

said correlation system further comprises a control unit transmitting command signals to all devices of said controlled apparatus connected to a bus, for purposes of identifying elements of said controlled apparatus; and

5 each element of said controlled apparatus comprises means for responding, by transmitting its identifier as a signal.

30. A correlation system in accordance with claim 29, characterized in that said correlation system further comprises an identifier recording unit capable of receiving said identifier signals and converting said identifier signals to unique identifiers, and storing said identifiers in memory.

31. A correlation system in accordance with claim 30, characterized in that said system further comprises means for determining a set of identifiers, and providing said identifiers to a control unit.

32. A correlation system in accordance with claim 31, characterized in that placement of a device indicator adjacent a device triggers said device to transmit its identifier by means of said control bus to said control unit.

33. A correlation system in accordance with claim 32, characterized in that said control unit comprises means for recording said device identifier as a tagged device, and mapping said tagged devices to a particular control.

34. A correlation system in accordance with claim 33, characterized in that said correlation system comprises means for mapping a control to a particular parameter at a particular location within a workspace, thereby providing for direct control of locations, rather than control of devices.

35. A correlation system in accordance with claim 1, characterized in that all electrical signals transmitted among said programming means, said control apparatus and said controlled apparatus are wireless.

36. A method for use in a correlation system for configuring and modifying a control relationship between controlling apparatus and controlled apparatus, said method comprising:

using a programming means comprising a hand-held configuration manually operable by a user so as to transmit correlation signals to said controlled apparatus and to said controlling apparatus;

sensing, at said controlled apparatus, receipt of said correlation signals;

sensing, at said controlling apparatus, receipt of said correlation signals; and

effecting said control relationship between said controlled apparatus and said

controlling apparatus based on said transmitted correlation signals.

37. A method for use in a correlation system for configuring and modifying a control relationship between controlling apparatus and controlled apparatus, said method comprising:

configuring a programming means comprising a hand-held configuration manually operable by a user so as to transmit correlation signals to said controlled apparatus;

transmitting further correlation signals from said programming means to said controlled apparatus;

determining, through programmable processes, prior sets of correlation signals transmitted by said programming means;

determining a next prior set of correlation signals transmitted to said controlling apparatus; and

effecting a particular control relationship between said controlled apparatus and said controlling apparatus based on a sequential relationship existing between
15 transmission of said correlation signals to said controlled apparatus and said correlation signals to said controlling apparatus.

38. The method in accordance with claim 36, characterized in that said method further comprises means for configuring a particular controlling apparatus so as to control states of a plurality of controlled apparatus.

39. The method in accordance with claim 36, characterized in that said method further comprises steps for effecting a master/slave relationship among two or more of said controlled apparatus.

40. A method for use in a correlation system for configuring and modifying a control relationship between sets of switches and sets of lights, said method comprising:

using a hand-held and manually operable wand having transmission means for transmitting a first particular command signal C to switch S, where C is representative of
5 the sequence number of the command signal from said wand, and S is representative of the particular switch to which the command signal is transmitted;

transmitting a second particular command signal C+1 to light L, where L is representative of a particular one of said lights to which said command signal C+1 is transmitted;

10 transmitting a third particular command signal C+2 to light M, where M is
representative of a particular one of said lights to which said command signal C+2 is
transmitted;

 transmitting a forth particular command signal C+3 to light N, where N is
representative of a particular one of said lights to which said command signal C+3 is
15 transmitted;

 transmitting a fifth particular command signal C+4 to switch T, where T is
representative of a particular one of said set of switches to which said command signal
C+4 is transmitted;

 determining that said command signal C+3 was a command signal to said light N;
20 effecting control of said light N by said switch T;

 determining that said command signal C+2 was a command signal to said light M;
effecting control of said light M by said switch T;

 determining that said command signal C+1 was a command signal to said light L;
effecting control of said light L by said switch T;

25 determining that said command signal C was a command signal to said switch S;
and

 determining that a particular sequential configuration of control has been
completed.

41. A method in accordance with claim 40, characterized in that said method
further comprises the steps of:

 transmitting a sixth particular command signal C+5 to switch U, where U is

representative of a particular one of said switches to which said command signal C+5 is
5 transmitted;

determining that said command signal C+4 is a command signal transmitted to
switch T; and

effecting said control relationship so that switch U is a master switch for control
of said lights L, M and N, and said switch T is slaved to said switch U.

42. A method for use in a correlation system for configuring and modifying a
control relationship between sets of switches and sets of lights, said method comprising:

using a hand-held and manually operable wand having transmission means for
transmitting command signals to certain ones of said lights;

5 transmitting further command signals to particular ones of said switches; and

removing a controlling relationship between said certain ones of said switches and
such certain ones of said lights, based upon said command signals and said further
command signals.

43. A method in accordance with claim 36, characterized in that said method
further comprises configuring and modifying said control relationship between said controlling
apparatus and said controlled apparatus in the absence of any transmission of signals from said
programming means which identify any element of said programming means.

44. A method in accordance with claim 36, characterized in that said method
further comprises transmitting identification signals from said programming means which
expressly identify one or more elements of said programming means.

45. A method in accordance with claim 36, characterized in that said method

further comprises storing signals indicative of a last state in which said control relationship was configured.

46. A method in accordance with claim 36, characterized in that said method further comprises means for tracking and identifying which of a plurality of elements of said programming means is within a physical space associated with said correlation system.

47. A method in accordance with claim 36, characterized in that said method further comprises limiting capability of said programming means to effect said control relationship, based upon identification of said programming means and/or a particular physical space in which said control relationship is attempting to be effected.

48. A correlation system in accordance with claim 36, characterized in that said system further comprises means for generating a unique global identifier for each of at least subset of said controlled apparatus.

49. A method in accordance with claim 36, characterized in that said method further comprises generation of a unique global identifier reflecting at least the manufacturer, type, class of device and particular unit of each of at least a subset of said controlled apparatus.

50. A method in accordance with claim 36, characterized in that said method further comprises:

transmitting command signals from a control unit to all devices of said controlled apparatus connected to a bus, for purposes of identifying elements of said controlled apparatus; and

each element of said controlled apparatus responding by transmitting an identifier as a signal.

51. A method in accordance with claim 36, characterized in that said method

further comprises having an identifier recording unit receiving identifier signals and converting said identifier signals to unique identifiers, and storing said identifiers in memory.

52. A method in accordance with claim 36, characterized in that said method further comprises placement of a device indicator adjacent to a device of said controlled apparatus, and triggering said device to transmit its identifier by means of a control bus to a control unit.

53. A method in accordance with claim 52, characterized in that said method further comprises recording said device identifier as a tagged device, and mapping said tagged devices to a particular control.

54. A method in accordance with claim 36, characterized in that said method further comprises transmission of all signals between said control apparatus and said controlled apparatus as wireless signals.

1. An overhead rail system for supporting and/or energizing a plurality of utilitarian elements which cooperate so as to form a commercial interior primarily depending downwardly from a plane of said rail system, said rail system comprising:

at least one primary track having an elongated configuration;

5 electrical energizing means coupled to said primary track, for providing electrical power signals along said elongated configuration;

said utilitarian elements comprise a set of vertically disposed partitions;

partition connecting means positioned along said track for removably and vertically supporting said partitions along said elongated configuration;

10 said utilitarian elements further comprise a set of electrically energized devices;

electrical connection means positioned along said track for interconnecting said electrically energized devices to said electrical energizing means; and

15 said partition connecting means and said electrical connection means are coupled to said track, and to said vertically disposed partitions and electrically energized devices, respectively, so as to facilitate reconfiguration and relocation of said utilitarian elements as required by users of said commercial interior.

2. An overhead rail system in accordance with claim 1, characterized in that said electrical energizing means is structured so as to provide said electrical power signals substantially along a continuum of said elongated configuration.

3. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises communication means coupled to said primary track, for receiving and transmitting communication signals along said elongated configuration.

4. An overhead rail system in accordance with claim 3, characterized in that said communication means is structured so as to provide reception and transmission of said communication signals substantially along a continuum of said elongated configuration.

5. An overhead rail system in accordance with claim 3, characterized in that:
 said utilitarian elements further comprise at least one controlling device;
 said utilitarian elements further comprise at least one controlled device, said controlled device having at least first and second states; and

5 said communication signals are utilized to effect a logical control relationship between said controlling device and said controlled device.

6. An overhead rail system in accordance with claim 5, characterized in that said logical control relationship between said controlling device and said controlled device is reconfigured at least in part with said communication signals, in the absence of any physical

relocation of any physical wiring associated with said controlling device and said controlled
5 device.

7. An overhead rail system in accordance with claim 5, characterized in that said rail system comprises at least one manually operable programming means for transmitting programming signals so as to effect said logical control relationship.

8. An overhead rail system in accordance with claim 7, characterized in that said programming means comprises a hand-held wand.

9. An overhead rail system in accordance with claim 5, characterized in that said rail system further comprises control means coupled to said communication means and to said controlled device, and responsive to said communication signals so as to effect said logical control relationship.

10. An overhead rail system in accordance with claim 9, characterized in that: said rail system further comprises at least one manually operable programming means for transmitting programming signals so as to effect said logical control relationship; and

5 said control means comprises sensor means responsive to said programming signals for generating control signals and effecting said logical control relationship.

11. An overhead rail system in accordance with claim 10, characterized in that said control means is coupled to said communication means so that said control signals are generated at least partially in response to said communication signals.

12. An overhead rail system in accordance with claim 1, characterized in that

said partition connection means and said electrical connection means are structured so that at least certain of said utilitarian elements are manually releasable from said partition connection means and said electrical connection means.

13. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises a plurality of primary tracks, with at least a first set of said plurality of primary tracks extending along a single axis, with each of said first set of primary tracks interconnected to adjacent ones of said first set of said primary tracks.

14. An overhead rail system in accordance with claim 1, characterized in that said electrical energizing means comprises a set of electrical buses, positioned within said primary track, and extending along said elongated configuration.

15. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises low voltage/DC means coupled to said primary track, for generating relatively low voltage or DC electrical signals along said elongated configuration.

16. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises low voltage/communication means coupled to said primary track, for providing low voltage or DC signals along said elongated configuration, and/or receiving and transmitting communication signals along said elongated configuration.

17. An overhead rail system in accordance with claim 3, characterized in that said communication means is located within said primary track, said electrical energizing means is located within said primary track, and said electrical energizing means and said communication means are physically and electrically isolated from one another.

18. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises an enclosed raceway electrically isolated from said electrical

energizing means and adapted to carry high voltage electrical cables or wires along said elongated configuration.

19. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises a cable tray removably mounted at an upper portion of said primary track, and adapted to carry power cables or communication cables.

20. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises:

a plurality of primary tracks; and

5 support means coupled to upper portions of said primary tracks and to a building structure of said commercial interior, for releasably supporting said primary tracks from said building structure.

21. An overhead rail system in accordance with claim 20, characterized in that said support means comprises means for adjusting the distance of a plane of said primary tracks from a floor of said building structure.

22. An overhead rail system in accordance with claim 1, characterized in that: said primary track comprises a back half assembly forming a part of said elongated configuration;

5 said primary track further comprises a front half assembly forming a part of said elongated configuration, said front and back half assemblies being manufactured as physically separate elements, and when mated together form a part of said primary track with a lower spacial area therewithin;

said electrical energizing means comprises elongated electrical power buses

adapted to be mounted within said lower spacial area formed by said back half and said
10 front half assemblies; and

said manufacture of said front and said back half assemblies as physically
separate elements functions so as to permit positioning of said elongated electrical power
buses within said lower spacial area prior to said back and said front half assemblies
being coupled together, thereby permitting said elongated buses to be positioned within
15 said spacial area without requiring said elongated buses to be slid through an end of said
primary track into said lower spacial area.

23. An overhead rail system in accordance with claim 1, characterized in that:

said primary track comprises a back half assembly forming a part of said
elongated configuration;

said primary track further comprises a front half assembly forming a part of said
5 elongated configuration, said front and back half assemblies being manufactured as
physically separate elements, and when mated together form a part of said primary track
with a lower spacial area therewithin;

said rail system further comprise elongated low voltage, DC or communication
buses adapted to be mounted within said lower spacial area formed by said back half and
10 said front half assemblies; and

said manufacture of said front and said back half assemblies as physically
separate elements functions so as permit positioning of said low voltage, DC or
communication buses within said lower spacial area prior to said back and said front half
assemblies being coupled together, thereby permitting said elongated low voltage, DC or
15 communication buses to be positioned within said spacial area without requiring said

elongated buses to be slid through an end of said primary track into said lower spacial area.

24. An overhead rail system in accordance with claim 22, characterized in that said primary track further comprises an elongated cover, said cover being adapted to be coupled to said back half assembly and said front half assembly, so as to form an upper raceway within said primary track.

25. An overhead rail system in accordance with claim 24, characterized in that said cover comprises apertures through which electrical means may be extended so as to electrically interconnect said electrical means to electrical cables or wires extending through said upper raceway.

26. An overhead rail system in accordance with claim 1, characterized in that: said primary track comprises a spacial area forming an upper raceway through which electrical cables or wires are extended;

5 said rail system further comprises at least one rail cap for enclosing an end of said primary track, while still permitting access to electrical power signals; and

said rail cap further comprises means for providing strain relief for wires or cables extending through apertures of said rail cap.

27. An overhead rail system in accordance with claim 1, characterized in that: said primary track comprises first and second sets of elongated sections adapted to be interconnected together so as to form a part of said elongated configuration of said primary track;

5 said elongated sections are staggered so that ends of each of said first set of

elongated sections are positioned intermediate ends of said second set of elongated sections, when said first set of elongated sections are interconnected to said second set of elongated sections; and

said staggered relationship is such that ends of each of said second set of elongated sections are positioned intermediate ends of said first set of elongated sections when said first and second sets of elongated sections are interconnected together.

28. An overhead rail system in accordance with claim 1, characterized in that:

said primary track comprises an elongated back half assembly having a plurality of back half sections, each of said sections having a length X;

said primary track further comprises an elongated front half assembly having a plurality of front half sections, each of said front half sections having a length X;

said back half sections and said front half sections are interconnected together, so as to form a substantial portion of said primary track;

said interconnection of said back half sections and said front half sections occurs with an end of each of said back half sections positioned substantially equidistant opposing ends of a corresponding one of said front half sections, and an opposing end of each of said back half sections being positioned substantially equidistant opposing ends of an adjacent one of said front half sections; and

said back and front sections are further interconnected together so that an end of each of said front half sections is positioned substantially equidistant opposing ends of a corresponding one of said back half sections, and an opposing end of each of said front half sections is positioned substantially equidistant opposing ends of an adjacent one of said back half sections.

29. An overhead rail system in accordance with claim 13, characterized in that at least certain of said primary tracks are spaced apart in parallel relationships, and form a substantially horizontal primary track plane.

30. An overhead rail system in accordance with claim 29, characterized in that said rail system comprises at least one cross-rail, adapted to be coupled between adjacent ones of said primary tracks.

31. An overhead rail system in accordance with claim 30, characterized in that said rail system comprises means for interconnecting said cross-rail to adjacent ones of said primary tracks, with such connection being substantially within said primary track plane of said primary tracks.

32. An overhead rail system in accordance with claim 30, characterized in that said overhead rail system comprises means for interconnecting said cross rail to parallel and adjacent ones of said primary tracks, so that said cross rail is positioned in a plane located below said primary track plane of said adjacent ones of said primary tracks.

33. An overhead rail system in accordance with claim 30, characterized in that said rail system comprises means for interconnecting said cross-rail to adjacent and parallel ones of said primary tracks, so that said cross-rail is positioned in a perpendicular configuration relative to said adjacent ones of said primary tracks.

34. An overhead rail system in accordance with claim 30, characterized in that said rail system comprises means for interconnecting said cross-rail to parallel and adjacent ones of said primary tracks, in a manner so that said cross-rail is in a non-perpendicular configuration, relative to said adjacent ones of said primary tracks.

35. An overhead rail system in accordance with claim 30, characterized in that

said rail system further comprises:

electrical energizing means coupled to said cross-rail, for providing electrical power signals along an elongated configuration of said cross-rail;

5 a second set of vertically disposed partitions;

partition connecting means positioned along said cross-rail for removably and vertically supporting said second set of vertically disposed partitions along said elongated configuration of said cross-rail;

a second set of electrically energized devices;

10 electrical connection means positioned along said cross-rail for interconnecting said second set of electrically energized devices to said cross-rail electrical energizing means; and

said partition connecting means and said electrical connection means are coupled to said cross-rail, and to said vertically disposed partitions and electrically energized devices, respectfully, so as to facilitate reconfiguration and relocation of said vertically
15 disposed partitions and said electrically energized devices as required by users of spacial areas containing said cross-rail.

36. An overhead rail system in accordance with claim 30, characterized in that said cross-rail is releasably interconnectable to adjacent ones of said primary tracks.

37. An overhead rail system in accordance with claim 30, characterized in that said rail system comprises means for supporting ceiling panels on said primary tracks and a plurality of said cross rails.

38. An overhead rail system in accordance with claim 13, characterized in that said rail system further comprises connector means for releasably interconnecting adjacent ones

of said primary tracks, so that said connected primary tracks are maintained in a longitudinal configuration.

39. An overhead rail system in accordance with claim 1, characterized in that:
said primary track forms a substantially enclosed upper raceway through which
high voltage electrical cables may be extended; and

5 said primary track comprises a cover assembly having knock-out apertures spaced
along the length of said cover assembly, so that power taps provided along the length of
said high voltage cables within said upper raceway.

40. An overhead rail system in accordance with claim 3, characterized in that:
said electrical connection means comprises a power connector adapted to be
releasably and electrically coupled to said electrical energizing means along a plurality of
positions of said primary track; and

5 said power connector comprises communication connection means for releasably
and electrically coupling to said communication means, for providing said
communication signals to certain of said utilitarian elements.

41. An overhead rail system in accordance with claim 1, characterized in that:
said rail system further comprises low voltage energizing means coupled to said
primary track, for providing low voltage or DC signals along said elongated
configuration; and

5 said electrical connection means comprises at least one power connector adapted
to be electrically coupled to said electrical energizing means for interconnecting at least
certain of said utilitarian elements to said electrical energizing means so as to provide
said low voltage or DC signals to certain of said utilitarian elements.

42. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises:

a plurality of said primary tracks;

a plurality of cross-rails, with said cross-rails mechanically coupled to adjacent ones of said primary tracks, and carrying cross-rail electrical energizing means coupled to said cross-rails, for providing electrical power signals along elongated configurations of said cross-rails; and

connector means for electrically coupling said electrical energizing means of said primary tracks to said cross-rail electrical energizing means.

43. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises:

a plurality of said primary tracks;

hanging means for supporting certain of said utilitarian elements, and where said certain of said utilitarian elements comprise whiteboards requiring no interconnection with electrical power or data or communication signals.

44. An overhead rail system in accordance with claim 1, characterized in that said rail system further comprises:

a plurality of primary tracks;

mechanical means for releasably supporting certain of said utilitarian elements from said primary tracks;

said certain of said utilitarian elements comprise an electronic whiteboard;

communication means coupled to said primary tracks, for receiving and transmitting communication signals along said elongated configuration; and

connection means for electrically coupling said communication means to said
10 electronic whiteboard.

45. An overhead rail system in accordance with claim 1, characterized in that
said rail system further comprises:

a plurality of primary tracks;

mechanical connection means for supporting certain of said utilitarian elements
5 from said primary tracks;

said certain of said utilitarian elements comprise a teleconferencing device;

communication means coupled to said primary tracks, for receiving and
transmitting communication signals along said elongated configuration; and

connection means for electrically connecting said teleconferencing device to said
10 electrical energizing means and to said communication means.

46. An overhead rail system for supporting and/or energizing a plurality of
utilitarian elements which cooperate so as to form a commercial interior primarily depending
downwardly from a plane of said rail system, said rail system comprising;

a plurality of primary tracks, each of said tracks having an elongated
5 configuration;

electrical energizing means coupled to said primary tracks, for providing
electrical power signals along said elongated configurations;

communication means coupled to said primary tracks, for receiving and
transmitting low voltage or communication signals along said elongated configuration;

10 said utilitarian elements comprise a plurality of vertically disposed partitions;

partition connecting means positioned along said primary tracks for removably

and vertically supporting said plurality of partitions along said elongated configurations;
said utilitarian elements further comprise a plurality of electrically energized
devices;

15 electrical connection means positioned along said primary tracks for removably
and electrically interconnecting said electrically energizing devices to said electrical
energizing means; and

 said partition connecting means and said electrical connection means are coupled
to said primary tracks, and to said vertically disposed partitions and electrically energized
20 devices, respectfully, to as to facilitate reconfiguration and relocation of said utilitarian
elements as required by users of said commercial interior, in the absence of any
substantial physical relocation of any physical wiring associated with said rail system and
said utilitarian elements.

47. An overhead rail system in accordance with claim 46, characterized in
that:

 said utilitarian elements further comprise at least one controlling device;

 said utilitarian elements further comprise at least one controlled device, said
5 controlled device having at least first and second states;

 said communication signals are utilized to effect a logical control relationship
between said controlling device and said controlled device; and

 said logical control relationship between said controlling device and said
controlled device is effected with said communication signals in the absence of any
10 physical relocation of any physical wiring associated with said controlling device and
said controlled device.

48. An overhead rail system in accordance with claim 47, characterized in that said rail system comprises at least one manually operable and hand-held wand for transmitting programming signals so as to effect said logical control relationship:

49. An overhead rail system in accordance with claim 48, characterized in that:

said electrical energizing means comprises a set of electrical buses, positioned within said primary tracks, and extending along said elongated configurations;

5 said communication means comprises a set of communication buses, positioned within said primary tracks and located below said electrical buses, and extending along said elongated configuration;

10 said rail system further comprises an enclosed raceway formed at an upper portion of said primary tracks, and electrically isolated from said electrical buses and adapted to carry high voltage electrical cables or wires along said elongated configurations; and

said rail system further comprises a cable tray removably mounted above said enclosed raceway and adapted to carry electrical or communication cables.

50. An overhead rail system in accordance with claim 49, characterized in that:

each of said primary tracks comprises a back half assembly forming a part of said elongated configurations;

5 each of said primary tracks further comprises a front half assembly forming a part of said elongated configurations, said front and back half assemblies being manufactured as physically separate elements, and when mated together form a part of said primary tracks with lower spacial areas therewithin;

10 said electrical buses adapt to be mounted within said lower spacial areas formed
by said back half and said front half assemblies; and

15 said manufacture of said front and said back half assemblies as physically
separate elements functions so as to permit positioning of said elongated buses within
said lower spacial areas prior to said back and said front half assemblies being coupled
together, thereby permitting said elongated buses to be positioned within said spacial
15 areas without requiring said elongated buses to be slid through ends of said primary
tracks into said lower spacial areas.

51. An overhead rail system in accordance with claim 50, characterized in that
said primary tracks further comprise elongated covers, said covers being adapted to be coupled
to said back half assemblies and said front half assemblies, and so as to form said upper raceway
within each of said primary tracks.

52. An overhead rail system in accordance with claim 51, characterized in that
interconnection of said front half and said back half assemblies is staggered so as to provide a
strengthening function for said primary tracks.

53. An overhead rail system in accordance with claim 1, characterized in that
said rail system comprises a universal clip for attaching utilitarian elements to the rail system,
and where said universal clip facilitates reconfiguration.

1. A space division system for use with a supporting infrastructure, with the
supporting infrastructure providing for distribution of electrical and communication signals, said
space division system comprising:

a plurality of vertically disposed space dividers;

5 support means coupled to said supporting infrastructure and to said space dividers
for moveably supporting said space dividers from said supporting infrastructure;
means for relocating said space dividers at selected locations relative to said
supporting infrastructures; and
means for effecting a plurality of spatial configurations among said space
10 dividers.

2. A space division system in accordance with claim 1, characterized in that
said space dividers comprise pocketed dividers within a three dimensional knit in a layered
structure.

3. A space division system in accordance with claim 1, characterized in that
said space division system comprises splines for interconnecting space dividers in a manner so
that said space dividers can be configured with varying radius.

4. A space division system in accordance with claim 1, characterized in that
said means for effecting a plurality of spatial configurations among said space dividers
comprises means for effecting non-modular and flexible configurations.

5. A space division system in accordance with claim 1, characterized in that
at least one space divider comprises a three-dimensional knit having relatively large pockets.

6. A space division system in accordance with claim 1, characterized in that
said plurality of spatial configurations comprises a plurality of said space dividers having a
curvilinear structure as a function of stretching material of said space dividers.

7. A space division system in accordance with claim 1, characterized in that
a subset of said plurality of configurations comprises a plurality of said space dividers having a
curvilinear structure.

8. A space division system in accordance with claim 1, characterized in that said supporting means are adjustable in a manner so that a height of at least a subset of said plurality of space dividers may be adjustable.

9. A space division system in accordance with claim 1, characterized in that at least one of said plurality of space dividers comprises:

an upper structural batten;

a main body extending downwardly from said structural batten; and

5 said main body being constructed of a fabric which is substantially opaque.

10. A space division system in accordance with claim 8, characterized in that said space divider comprises a lower hemmed section having a weighted insert.

11. A space division system in accordance with claim 1, characterized in that said space dividers comprise at least one space divider having a hook configuration.

12. A space division system in accordance with claim 1, characterized in that said partitions comprise at least one space divider having a configuration with a series of S-shaped curvatures, where said S-shaped curvatures form partially enclosed workstations.

13. A space division system in accordance with claim 1, characterized in that said space dividers comprise at least one space divider consisting of a translucent and stretchable material.

14. A space division system in accordance with claim 1, characterized in that at least one of said space dividers comprises a space divider formed of a woven material.

15. A space division system in accordance with claim 13, characterized in that said woven material consists of a cattle mattress material.

16. A space division system in accordance with claim 1, characterized in that

at least one of said space dividers comprises a space divider having a weighted insert consisting of a tubular section fitted within a lower hem of said at least one partition.

17. A space division system in accordance with claim 16, characterized in that said tubular section is filled with sand.

18. A space division system in accordance with claim 16, characterized in that said tubular section comprises a flexible sheath consisting of rubber.

19. A space division system in accordance with claim 16, characterized in that said weighted insert comprises an end cap interconnected to a cooperating means of a weighted insert associated with an adjacent space divider.

20. A space division system in accordance with claim 1, characterized in that at least two adjacent ones of said space dividers are releasably coupled together through a quick release and quick connect mechanism.

21. A space division system in accordance with claim 20, characterized in that said mechanism comprises spring clips.

22. A space division system in accordance with claim 1, characterized in that at least one of said space dividers comprises a space divider consisting of three-dimensional translucent material.

23. A space division system in accordance with claim 1, characterized in that at least one of said space dividers comprises a space divider structured in a flutter form configuration.

24. A space division system in accordance with claim 1, characterized in that at least one of said space dividers comprises a space divider having a quad-place configuration.

25. A space division system in accordance with claim 1, characterized in that

at least one of said space dividers comprises a space divider having a tri-place configuration.

26. A space division system for use with a supporting infrastructure, with the supporting infrastructure providing for distribution of electrical and communication signals, said space division system comprising:

a plurality of vertically-disposed space dividers;

5 support means coupled to said supporting infrastructure and to said partitions for supporting said space dividers from said supporting infrastructure;

means for relocating said space dividers at selected locations relative to said supporting infrastructure; and

10 electrical and communication connection means for transmitting and/or receiving said electrical and communication signals from said supporting infrastructure, and so as to apply said electrical and communication signals to functional accessories releasably coupled to said subset of said space dividers.

27. A space division system in accordance with claim 26, characterized in that said subset of said space dividers comprises main bodies having lighting means embedded within said main bodies, in a manner so as to be visible to a person substantially adjacent said space dividers.

28. A space division system in accordance with claim 27, characterized in that said lighting means comprises solid state lighting technology.

29. A space division system in accordance with claim 28, characterized in that said solid state lighting technology comprises a plurality of LED lights.

30. A space division system in accordance with claim 28, characterized in that

said solid state lighting technology comprises arrow lighting positioned adjacent a lower portion of said main bodies.

31. A space division system in accordance with claim 30, characterized in that said space division system further comprises means for simultaneously activating all arrow lights of said arrow lighting or, alternatively, activating said arrow lights of said arrow lighting in a manner so that said arrow lights are sequentially pulsed so as to create an effective pointing in a particular direction;

32. A space division system is accordance with claim 31, characterized in that said connection means comprises means for interconnecting telephone apparatus to communication signaling of said supporting infrastructure.

33. A space division system is accordance with claim 26, characterized in that said subset of said space dividers comprise space dividers having power battens positioned at a top portion thereof, for purposes of carrying power.

34. A space division system in accordance with claim 33, characterized in that said power comprises both low voltage DC and AC power.

35. A space division system in accordance with claim 33, characterized in that said power battens have openings accessible to internal linear voids existing within knitting of said main bodies, and power cables may be extended within said voids.

36. A space division system in accordance with claim 26, characterized in that said subset of said space dividers comprises space dividers consisting of a structural batten at the top ends thereof, with fabric extending downwardly therefrom, and with linear voids formed within said fabric, in spaced apart intervals downwardly along said space dividers.

37. A space division system in accordance with claim 26, characterized in that

said subset of said space dividers comprise space dividers having power battens extending downwardly so as to form end hems of said space dividers, with low voltage DC power strips and/or communication cables extending through said power battens.

38. A space division system in accordance with claim 37, characterized in that said power battens are formed by taking sections of said space dividers and turning them rearward upon themselves, and then connecting ends of said space dividers to other portions of said space dividers through the use of releasable securing means.

39. A space division system in accordance with claim 26, characterized in that said subset of said space dividers comprises space dividers formed of translucent material and having communication cables extending through pre-woven pockets of said translucent space dividers.

40. A space division system in accordance with claim 26, characterized in that said subset of said space dividers comprises space dividers having a plurality of internal linear voids through which first linear LED lighting strips are inserted.

41. A space division system in accordance with claim 40, characterized in that said internal linear voids are horizontally located within said space dividers, and further carry power cables and communication cables.

42. A space division system in accordance with claim 41, characterized in that said first LED lighting strips comprise linear flex side LED lighting strips.

43. A space division system in accordance with claim 41, characterized in that said space dividers include global communications interconnections.

44. A space division system in accordance with claim 41, characterized in that

said space dividers further comprise a second set of LED lighting strips turned in a different direction from said first LED lighting strips, so that actual light intensity and light diffusion at opposing surfaces of said space dividers may differ depending upon the particular sections.

45. A space division system in accordance with claim 35, characterized in that said linear voids carry LED lighting strips having a substantially flat configuration, with a particular light intensity and light dispersion as viewed on one surface of said space divider, while a relatively opaque view is produced on an opposing surface of said space divider.

46. A space division system in accordance with claim 26, characterized in that said subset of said space dividers comprises space dividers having LED lighting technology employed externally of said sections.

47. A space division system in accordance with claim 46, characterized in that said space dividers include curtains mounted from top portions of said space dividers, and LED lighting strip supports extend forwardly from said space dividers, and are appropriately secured to linear voids of said space dividers.

48. A space division system in accordance with claim 47, characterized in that positioned downwardly from said supports is a series of LED lights, having appropriate colors so as to provide an external color wash over a lower portion of said side surfaces of said space dividers, below said curtain.

49. A space division system in accordance with claim 47, characterized in that said color wash can be modified in intensity and with respect to diffusion dependent upon intensity and color of said LED lights, and dependent upon the particular materials from which said space dividers are constructed.

50. A space division system in accordance with claim 26, characterized in that

said subset of said space dividers comprises space dividers having low voltage DC power lines, communications cabling, AC power and AC power lines.

51. A space division system in accordance with claim 50, characterized in that at least one of said AC power lines terminates in a pair of electrical receptacles, and conventional electrical appliances may be energized through said electrical receptacles.

52. A space division system in accordance with claim 50, characterized in that at least one of said AC power line terminates in a pair of electrical receptacles, and computerized apparatus may be energized through said electrical receptacles.

53. A space division system in accordance with accordance with claim 52, characterized in that data and communication signals are transmitted from said computerized apparatus through a communications signal junction box and outwardly through said communications cabling.

54. A space division system in accordance with claim 53, characterized in that said space dividers comprise electrical interconnections of at least one task light to said electrical signals of said supporting infrastructure.

55. A space division system in accordance with claim 54, characterized in that said task light comprises:

a rectangular LED marker at a terminus of said light;

a flexible joint ;

5 a fabric cover extending downwardly and angularly from said flexible joint; and
said fabric cover is interconnected to a securing bracket which, in turn, is secured
to one of said space dividers.

56. A space division system in accordance with claim 26, characterized in that

said subset comprises space dividers having projection screens releasably secured thereto.

57. A space division system in accordance with claim 26, characterized in that at least a subset of surfaces of said space dividers comprises surfaces adapted for use as projection screens, with monofilaments.

58. A space division system in accordance with claim 26, characterized in that said system further comprises means for visually indicating external and internal circumstances associated with said space division system.

59. A space division system in accordance with claim 58, characterized in that said means for indicating external and internal circumstances comprises light means for visually indicating when an individual is within a particular workspace formed by said space dividers.

60. A space division system in accordance with claim 26, characterized in that said system further comprises data storage devices associated with said space dividers and releasably interconnectable to external electronic components.

61. A space division system in accordance with claim 26, characterized in that:

said system further comprises utilitarian elements associated with said space dividers, with said utilitarian elements comprising at least one controlling device;

5 said utilitarian elements further comprise at least one controlled device, with said controlled device having at least first and second states; and

said communications signals are utilized to effect a logical control relationship between said controlling device and said controlled device.

62. A space division system in accordance with claim 61, characterized in that

said logical control relationship between said controlling device and said control device is reconfigured at least in part with said communications signals, in the absence of any physical relocation of any physical wiring associated with said controlling device and said controlled
5 device.

63. A space division system in accordance with claim 61, characterized in that said system comprises at least one manually operable programming means for transmitting programming signals so as to effect said logical control relationship.

64. A space division system in accordance with claim 26, characterized in that:

said system further comprises a set of utilitarian elements associated with said space dividers; and

5 at least certain of said utilitarian elements are manually releasable from said space dividers.

65. A space division system in accordance with claim 26, characterized in that said system further comprises audio apparatus integrated with at least a subset of said plurality of vertically-disposed space dividers.

66. A space division system in accordance with claim 65, characterized in that said audio apparatus comprises a plurality of speakers energized from said electrical signals.

67. A space division system in accordance with claim 66, characterized in that:

said speakers comprise controlled devices;

said system further comprises at least one controlling device; and

5 said communication signals are utilized to effect a logical control relationship between said controlling device and said speakers.

68. A space division system in accordance with claim 67, characterized in that said system further comprises at least one manually operable programming means as said controlling device, for transmitting programming signals so as to effect said logical control relationship with said speakers.

69. A space division system in accordance with claim 26, characterized in that said system further comprises sound management apparatus for providing means for controlling perceptions of sound at spatial locations adjacent said space division system.

70. A space division system in accordance with claim 69, characterized in that said sound management apparatus is powered at least in part though said distribution of electrical signals.

71. A space division system in accordance with claim 66, characterized in that said speakers are utilized to generate noise masking audio signals for purposes of providing sound management at spatial locations around said space division system.

72. A space division system in accordance with claim 1, characterized in that said space division system is adapted for use with an articulating ceiling.

73. A space division system in accordance with claim 1, characterized in that at least a subset of said space dividers is constructed at least in part of materials having substantial capabilities of resisting penetration.

74. A space division system in accordance with claim 73, characterized in that said subset of said space dividers consist at least in part of materials within the group of Aramids.

75. A space division system in accordance with claim 74, characterized in that said subset of said space dividers are constructed at least in part of Kevlar® brand fiber.

76. A space division system in accordance with claim 1, characterized in that said plurality of partitions comprises at least a subset of said space dividers constructed at least in part of materials having substantial fire-resistant or fire-proof properties.

77. A space division system in accordance with claim 76, characterized in that said subset of said space dividers consist at least in part of materials within the group of Aramids.

78. A space division system in accordance with claim 77, characterized in that said subset of said space dividers are constructed at least in part of materials consisting of Nomex® brand fiber.

79. A space division system in accordance with claim 1, characterized in that said plurality of space dividers comprises at least a subset of said partitions consisting at least in part of materials comprising a blend of Kevlar® and Nomex® brand fibers.

80. A space division system in accordance with claim 1, characterized in that said system comprises means for securing at least a subset of said plurality of space dividers to a lower floor structure.

81. A space division system in accordance with claim 26, characterized in that said space division system further comprises switch means for controlling functional accessories associated with said partitions.

82. A space division system in accordance with claim 81, characterized in that said switch means comprise switches having differing spatial positions for generating “on” and “off” states.

83. A space division system in accordance with claim 81, characterized in that said switch means are electrically responsive to spatial signals so as to change between control states.

84. A space division system in accordance with claim 81, characterized in that said switch means comprise pressure switches.

85. A space division system in accordance with claim 81, characterized in that said switch means are responsive to signals indicative of motion within areas surrounding said switch means, for switching between control states.

86. A space division system in accordance with claim 81, characterized in that said switch means are responsive to radio frequency signals for switching between control states.

87. A space division system in accordance with claim 81, characterized in that said switch means are responsive to infrared signals for switching between control states.

88. A space division system in accordance with claim 61, characterized in that said at least one controlling device comprises at least one switch.

89. A space division system in accordance with claim 26, characterized in that said system further comprises means for generating and for sensing radio frequency identification signals.

1. A ceiling system for use with a supporting infrastructure, said supporting infrastructure providing for distribution of electrical power and comprising a plurality of frames, said ceiling system comprising:

a plurality of shielding elements supported within said plurality of frames;

5 a series of lighting elements electrically coupled and energized through said
electrical power distribution, said lighting elements adjacent to or otherwise incorporated
within said shielding elements; and
said shielding elements being movably mounted to said ceiling structure, and
constructed of materials having varying degrees of translucence, so as to adjust intensity
10 and diffusion of lighting projected from said lighting elements.

2. A ceiling system in accordance with claim 1, characterized in that
said ceiling system and supporting infrastructure are suspended from a building roof or similar
overhead structure through the use of cable elements.

3. A ceiling system in accordance with claim 2, characterized in that
said cable elements may be adjusted so as to adjust the height of said ceiling system, relative to
the height of said building roof or said similar overhead structure.

4. A ceiling system in accordance with claim 1, characterized in that
said materials are constructed and configured so as to permit commercial interior utilities to
extend downwardly below a plane substantially formed by said plurality of shielding elements.

5. A ceiling system in accordance with claim 1, characterized in that said
materials are constructed and configured so as to have sufficient porosity to permit commercial
interior fire safety utilities to be positioned above a plane substantially formed by said plurality
of shielding elements.

6. A ceiling system in accordance with claim 1, characterized in that said
series of lighting elements and said plurality of shielding elements are manually removable from
said supporting infrastructure.

7. A ceiling system in accordance with claim 1, characterized in that said series of lighting elements comprises a series of LED lighting module strips.
8. A ceiling system in accordance with claim 1, characterized in that said supporting infrastructure comprises parallel and spaced apart rails, and said shielding elements are supported on sides of adjacent rails on pairs of opposing L-shaped brackets.
9. A ceiling system in accordance with claim 8, characterized in that said shielding elements are releasably secured to said L-shaped brackets through securing means.
10. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise acoustic ceiling shielding elements having materials for providing sound absorption.
11. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise acoustic ceiling shielding elements having materials for providing sound reflection.
12. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise air-filled cellular structures.
13. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise 3D-Pongi fabric.
14. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise rigid fins.
15. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise heliofon fabric fins.

16. A ceiling system in accordance with claim 1, characterized in that said shielding elements are supported on opposing lateral sides through the use of said frames of said supporting infrastructure, with said frames constructed of extruded aluminum.

17. A ceiling system in accordance with claim 1, characterized in that said shielding elements are supported from overhead building supports through the use of suspension cables interconnected directly to said shielding elements.

18. A ceiling system in accordance with claim 17, characterized in that said suspension cables are adjustable in length.

19. A ceiling system in accordance with claim 1, characterized in that:
said cross frames are interconnected to other components of said ceiling system
through the use of brackets;

a plurality of members are positioned in a spaced apart and parallel configuration
along said shielding elements; and

said lighting elements comprise LED lighting modules mounted on undersides of
said members.

20. A ceiling system in accordance with claim 19, characterized in
that said shielding elements comprise a series of light bags having varying degrees of
translucency.

21. A ceiling system in accordance with claim 20, characterized in
that said light bags provide modifications to light intensity and varying degrees of translucency
and diffusion with respect to said LED lighting modules.

22. A ceiling system in accordance with claim 20, characterized in
that:

each of said members is elongated in length and laterally extends across at least one of said shielding elements;

5 each of said LED lighting modules is linear in configuration, and mounted to an underside of a corresponding one of said members; and

each of said LED lighting modules includes a series of LED's spaced apart along a length of a corresponding one of said linear LED lighting modules.

23. A ceiling system in accordance with claim 20, characterized in that a plurality of said LED lighting modules are coupled to at least one of said members.

24. A ceiling system in accordance with claim 1, characterized in that said lighting elements comprise linear LED lighting modules flexible in construction and to which low voltage DC power is applied from said distribution of electrical power of said supporting infrastructure.

25. A ceiling system in accordance with claim 24, characterized in that said system further comprises power transformers interconnected to said distribution of electrical power and to said lighting elements for supplying low voltage DC power to said lighting elements.

26. A ceiling system in accordance with claim 25, characterized in that said system further comprises at least one bus bar for supplying low voltage DC power to said lighting elements.

27. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise light diffusing fabric fins, and light bags.

28. A ceiling system in accordance with claim 27, characterized in

that:

said lighting elements comprise a series of LED members, each having a linear LED lighting module secured to an underside thereof;

5 each of said linear LED lighting modules comprises a series of spaced apart LED lights; and

suspended from said members are a series of said light bags.

29. A ceiling system in accordance with claim 28, characterized in that said light bags comprise light diffusion heliofon fabric.

30. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise light diffusing fabric fins.

31. A ceiling system in accordance with claim 29, characterized in that said light diffusing fabric fins are in the form of a singular light sheet.

32. A ceiling system in accordance with claim 31, characterized in that said light sheets comprise light diffusing heliofon fabric.

33. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise rigid fins having a "deep triangle" configuration.

34. A ceiling system in accordance with claim 33, characterized in that said rigid fins are constructed of a translucent Lexan® material.

35. A ceiling system in accordance with claim 1, characterized in that said shielding elements comprise:

a pair of relatively long rigid fins, essentially forming a rectangular configuration;

a rigid fin of relatively intermediate length, positioned intermediate said pair of

5 relatively long rigid fins;

a rigid fin of relatively shorter length, positioned intermediate said pair of relatively long rigid fins; and

said relatively long rigid fins and said rigid fins of relatively intermediate and shorter length separate a series of linear LED lighting modules from each other.

36. A ceiling system in accordance with claim 35, characterized in that said relatively long rigid fins and said rigid fins of relatively intermediate and shorter lengths are constructed of a translucent Lexan® material.

37. A ceiling system in accordance with claim 1, characterized in that: said shielding elements comprise a series of rigid fins forming a rectangular configuration around individual ones of linear LED lighting modules; and

5 said linear LED lighting modules are turned on their sides, so that strips of individual LED's have different directional configurations.

38. A ceiling system in accordance with claim 37, characterized in that said rigid fins are constructed of a translucent Lexan® material.

39. A ceiling system in accordance with claim 1, characterized in that: said shielding elements comprise a series of parallel and spaced apart linear air tubes; and

5 said lighting elements comprise linear LED lighting modules spaced intermediate said linear air tubes.

40. A ceiling system in accordance with claim 39, characterized in that said linear air tubes comprise polyethylene air tubes.

41. A ceiling system in accordance with claim 1, characterized in that: said shielding elements comprise a series of parallel and spaced apart linear air

tubes; and

said lighting elements comprise a series of round marker LED lighting modules,
5 positioned adjacent said linear air tubes.

42. A ceiling system in accordance with claim 1, characterized in that:

said shielding elements comprise a series of air pillows; and

said lighting elements comprise a series of round marker LED lighting modules
positioned adjacent said air pillows.

43. A ceiling system in accordance with claim 42, characterized in that

said air pillows are constructed of a polyethylene material.

44. A ceiling system in accordance with claim 1, characterized in that:

said shielding elements comprise a series of woven fabric materials, suspended
from said supporting infrastructure in a manner so as to provide a "wave" pattern; and

said lighting elements comprise a series of LED lighting modules positioned
5 above said woven fabric materials.

45. A ceiling system in accordance with claim 44, characterized in that

said system further comprises means for circulating forced air around said fabric materials, and
said woven fabric materials are coupled to said supporting infrastructure in a manner so as to
permit generation of "pulsing" curvatures of said woven fabric materials in response to said

5 circulated forced air.

46. A ceiling system in accordance with claim 1, characterized in that

said shielding elements may be coupled to said supporting infrastructure through flexible or
hinged means, so that said shielding elements may be suspended in varying angular orientations.

47. A ceiling system in accordance with claim 1, characterized in that:

said system further comprises utilitarian elements associated with said shielding elements, with said utilitarian elements comprising at least one controlling device;

said utilitarian elements further comprise at least one controlled device, with said
5 controlled device having at least first and second states; and

said system comprises means for generating communication signals utilized to effect a logical control relationship between said controlling device and said controlled device.

48. A ceiling system in accordance with claim 47, characterized in that said logical control relationship between said controlling device and said controlled device is reconfigured at least in part with said communication signals, in the absence of any physical relocation of any physical wiring associated with said controlling device and said controlled
5 device.

49. A ceiling system in accordance with claim 48, characterized in that said system comprises at least one manually operable programming means for transmitting programming signals so as to effect said logical control relationship.

50. A ceiling system in accordance with claim 1, characterized in that said ceiling system comprises means for effecting color control of said series of lighting elements.

51. A ceiling system in accordance with claim 47, characterized in that said means for generating communication signals comprises means for effecting color control of said series of lighting elements.

52. A ceiling system in accordance with claim 1, characterized in that:

said system further comprises a set of utilitarian elements associated with said ceilings; and

at least certain of said utilitarian elements are manually releasable from said shielding elements.

53. A ceiling system in accordance with claim 1, characterized in that:

said system further comprises at least one utilitarian element comprising at least one controlling device;

said shielding elements have at least first and second states; and

said system further comprises means for generating communication signals utilized to effect a logical control relationship between said controlling device and said shielding elements.

54. A ceiling system in accordance with claim 49, characterized in that

said controlled device comprises at least a subset of said lighting elements.

55. A ceiling system in accordance with claim 1, characterized in that

said plurality of said shielding elements comprises at least a subset of said shielding elements constructed at least in part of materials having substantial fire resistant or fire proof properties.

56. A ceiling system in accordance with claim 1, characterized in that said

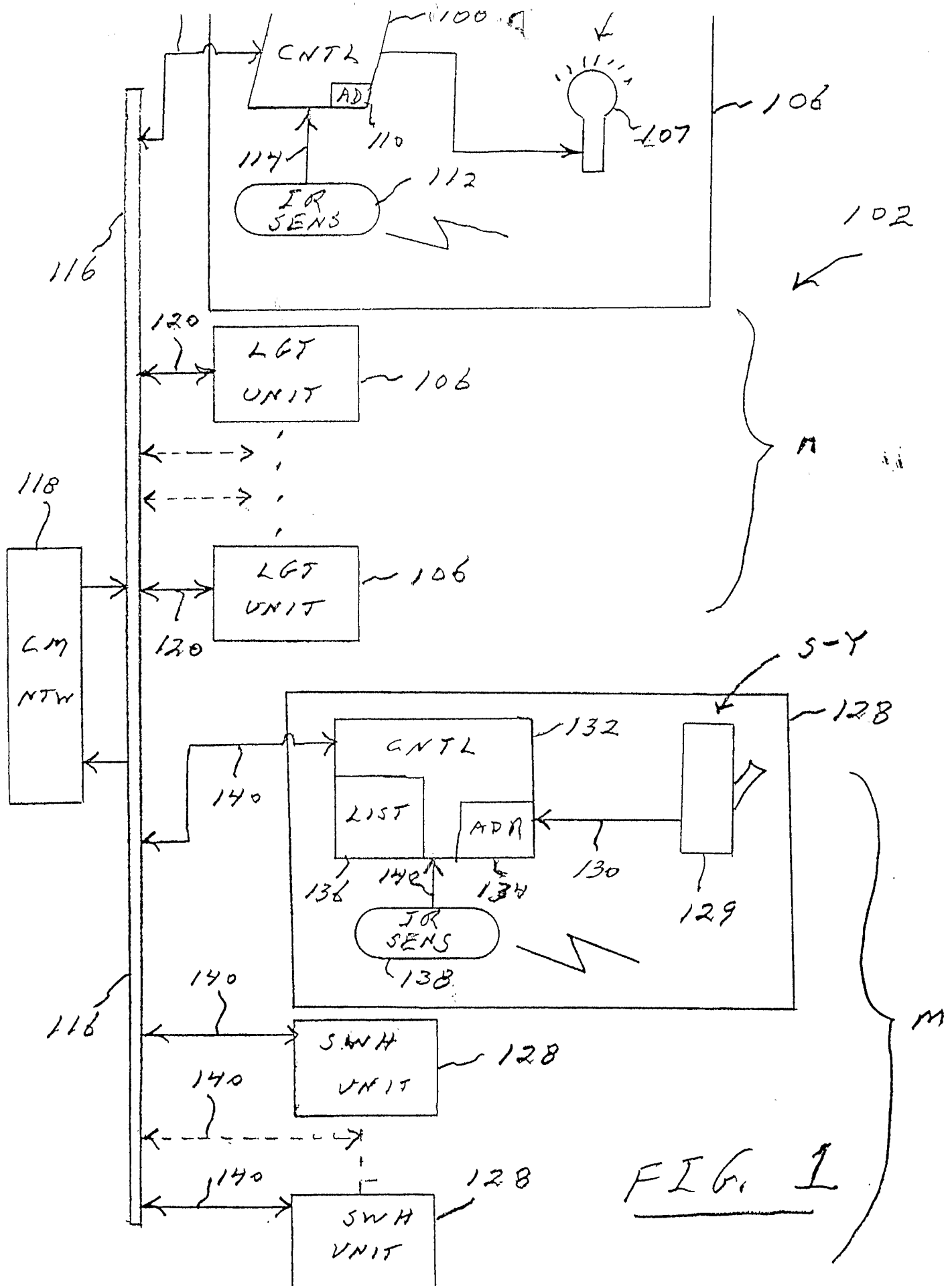
system comprises means for modifying lighting characteristics based upon time of day.

57. A ceiling system in accordance with claim 1, characterized in that said

system comprises means for modifying lighting characteristics based on seasonal changes.

58. A ceiling system in accordance with claim 1, characterized in that said

system comprises means for modifying lighting in accordance with physical and mental health characteristics for lighting color and intensity.



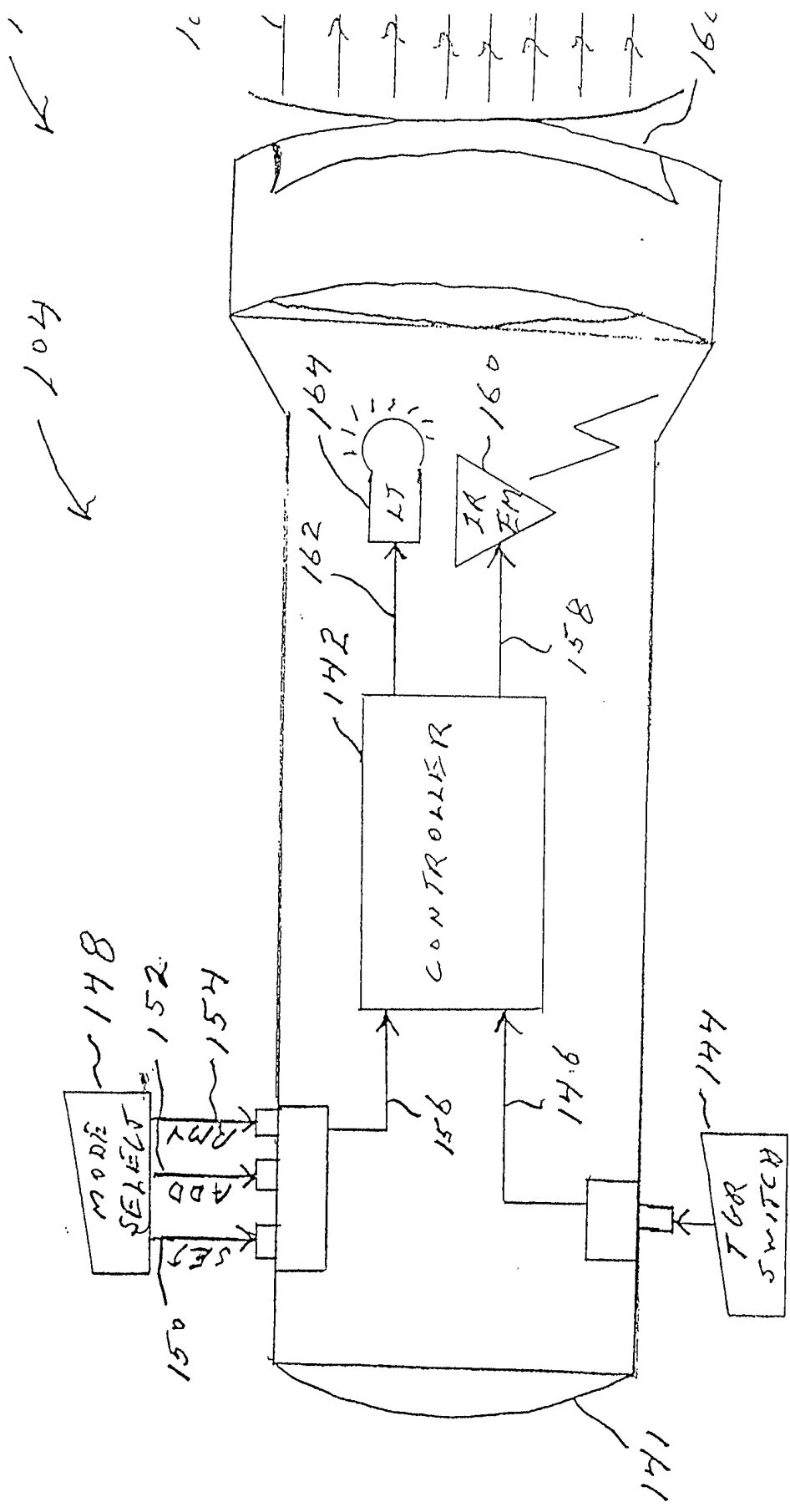
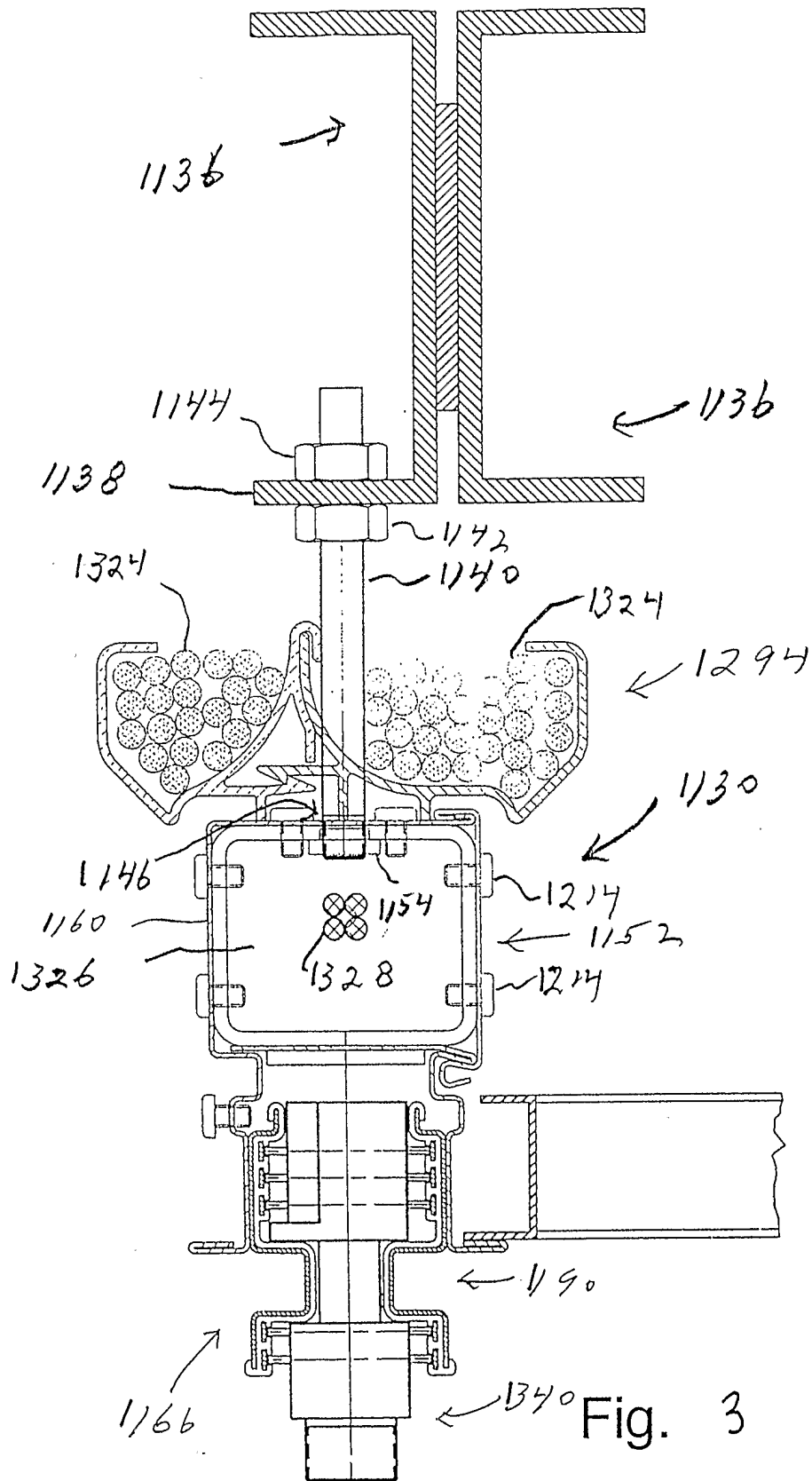


FIG. 2



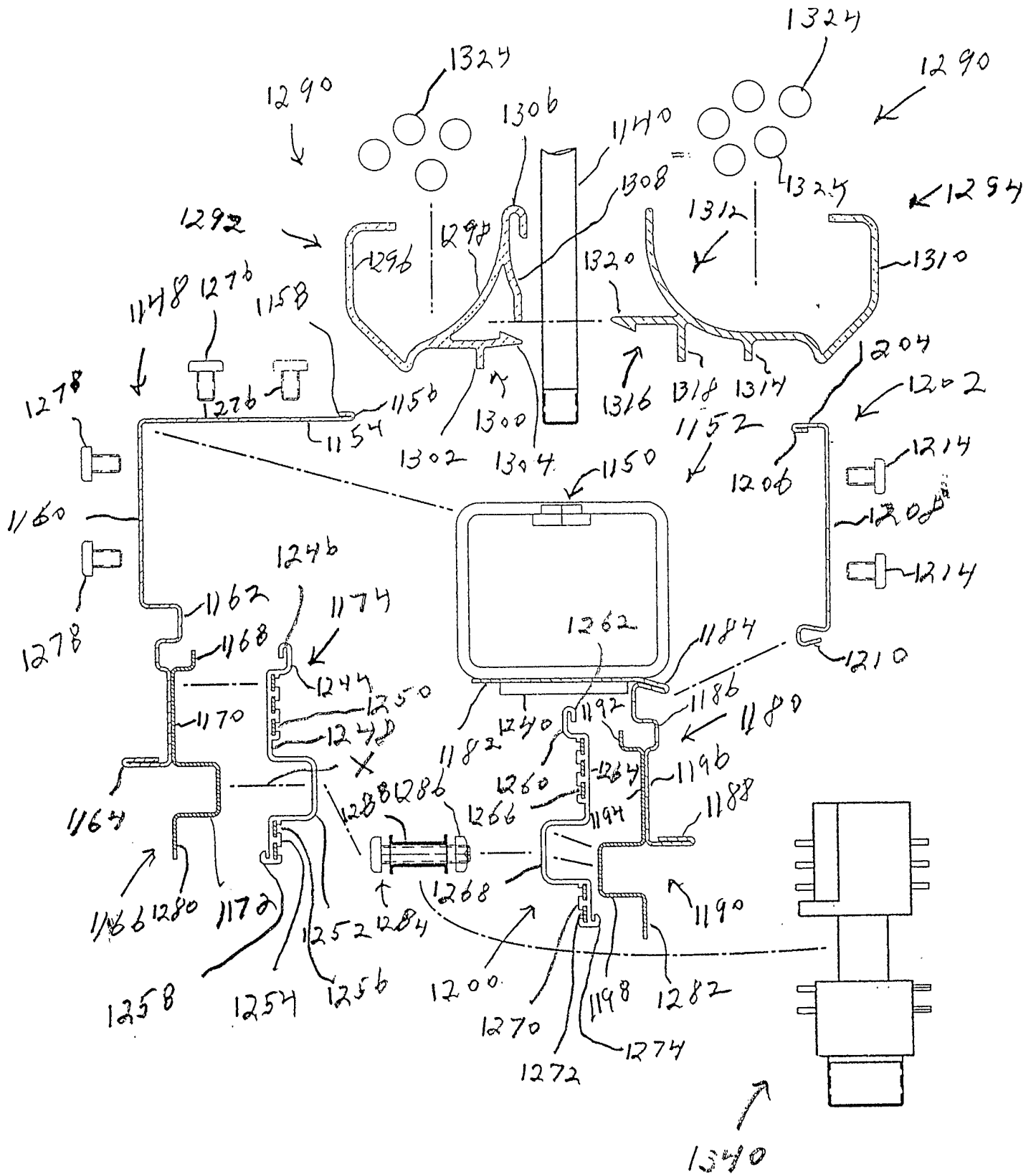


Fig. 4

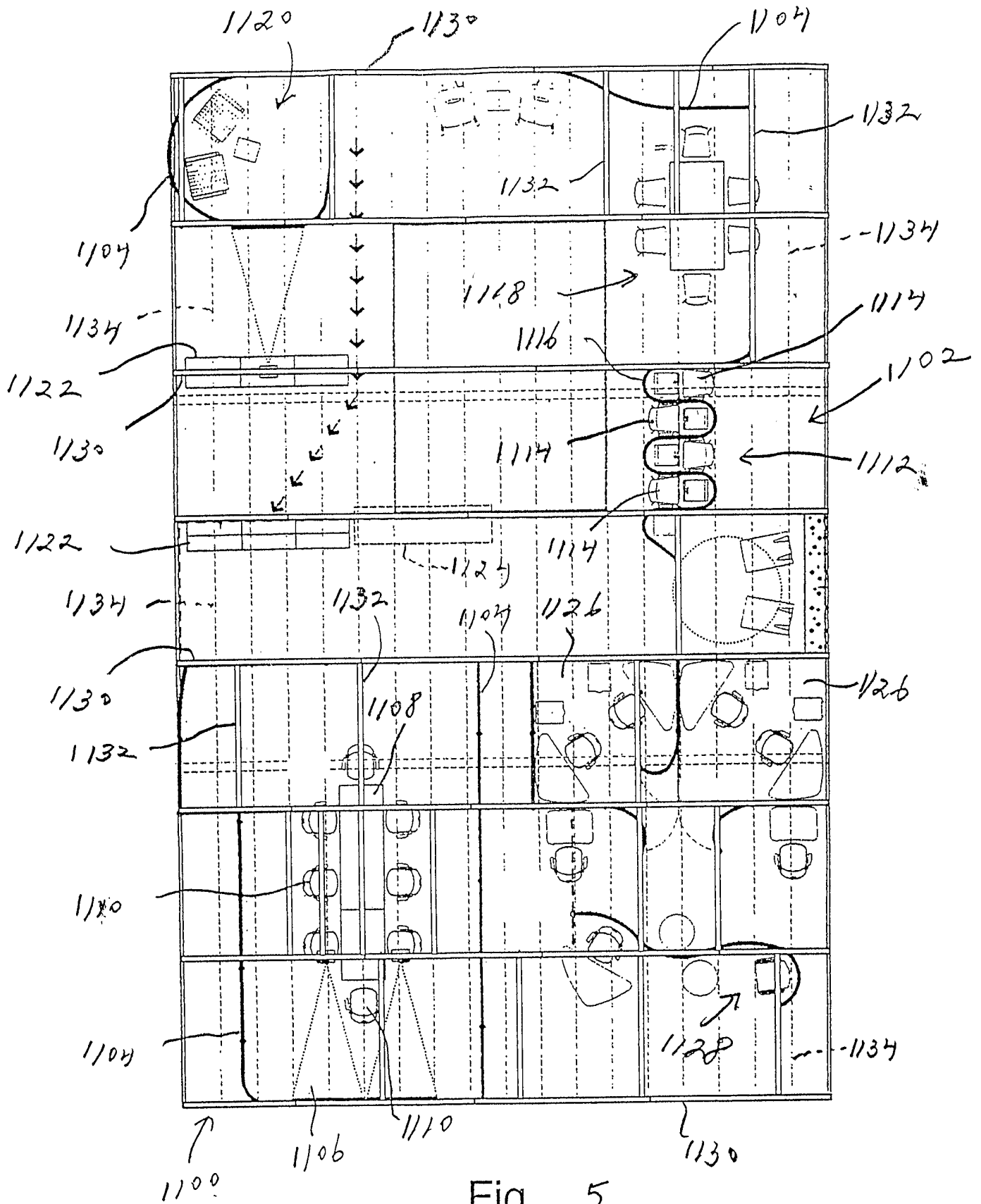


Fig. 5

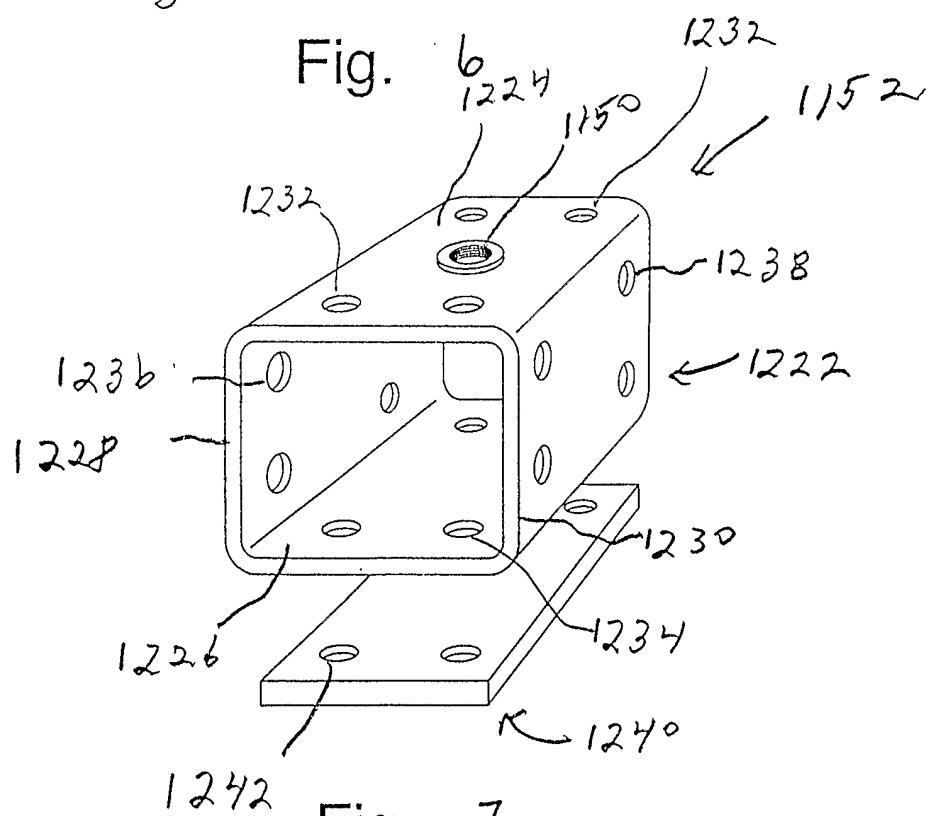
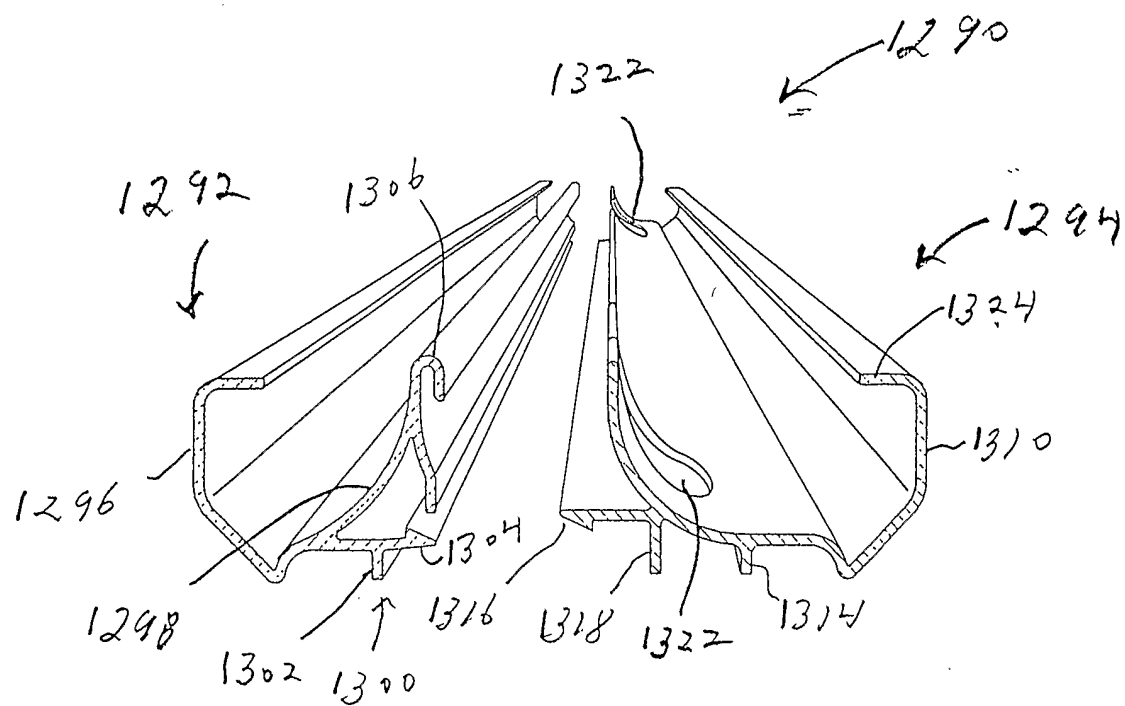


Fig. 7

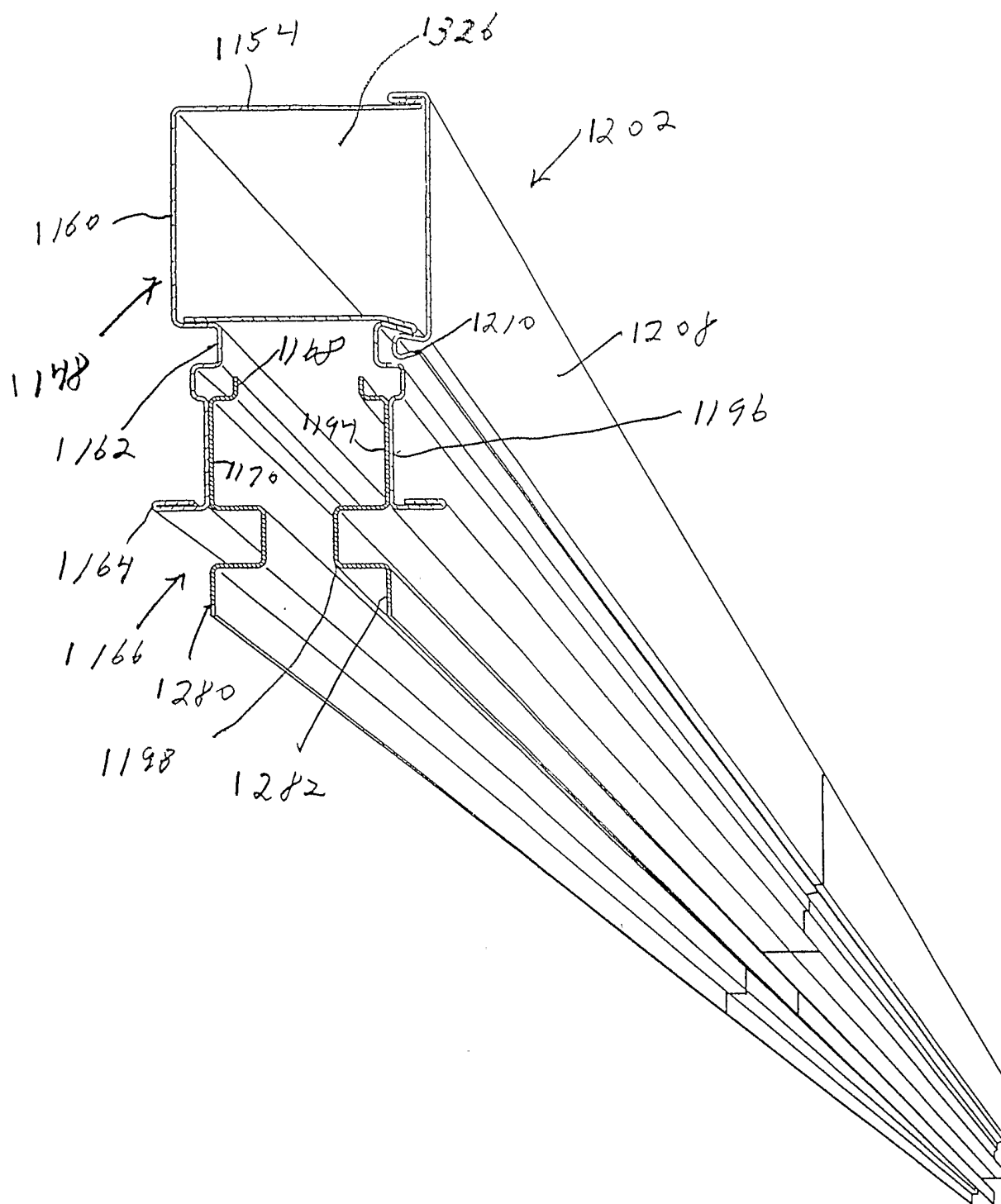
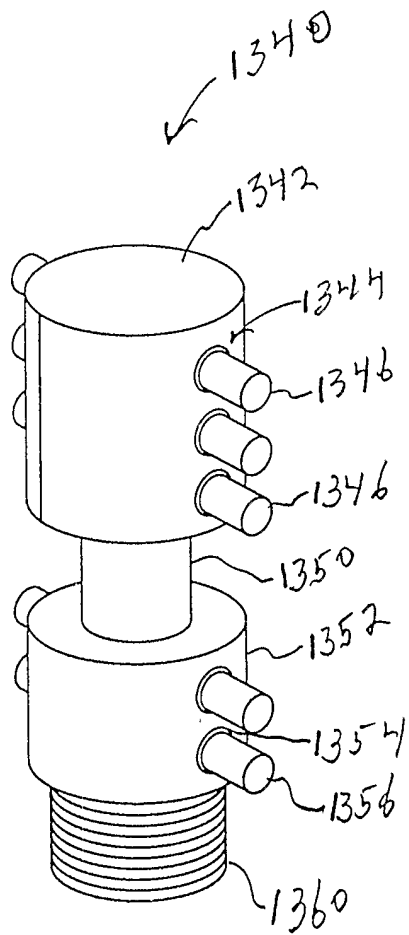
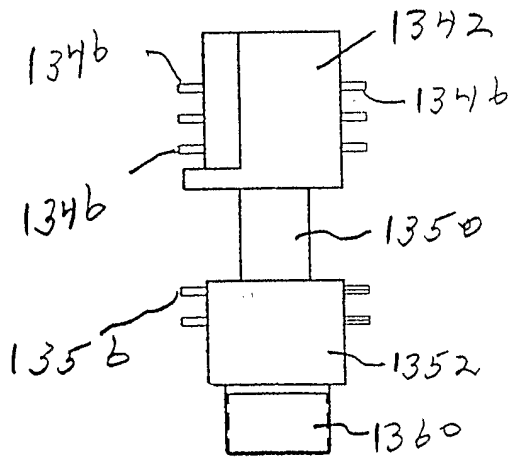
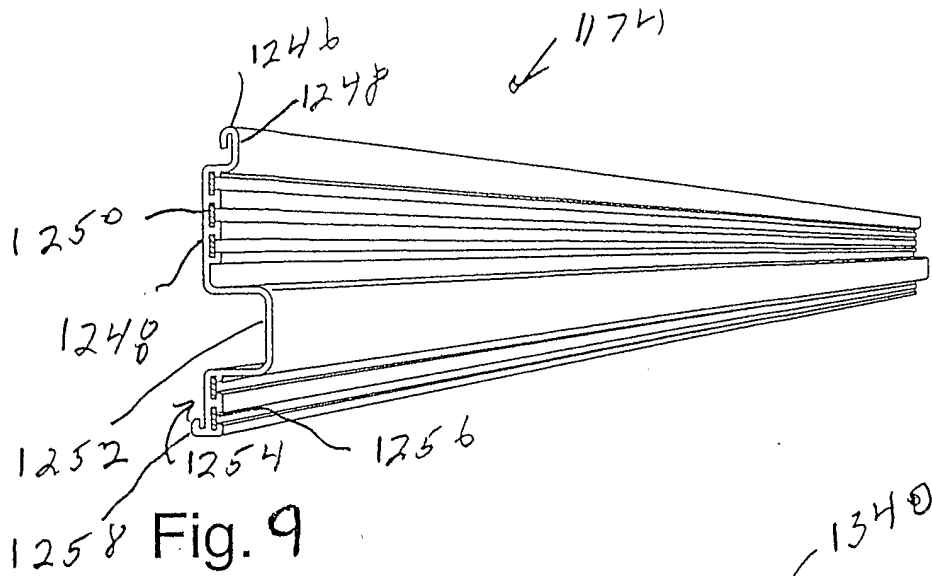


Fig. 8



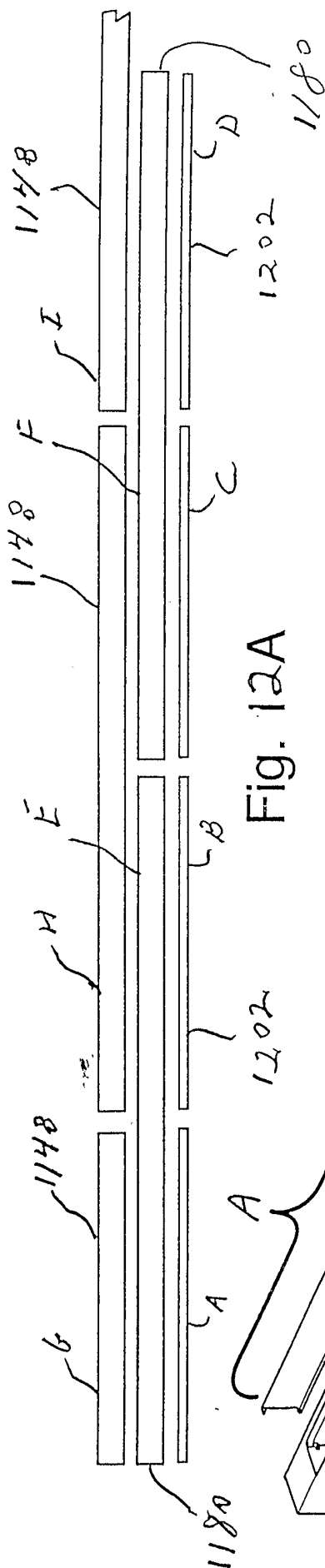


Fig. 12A

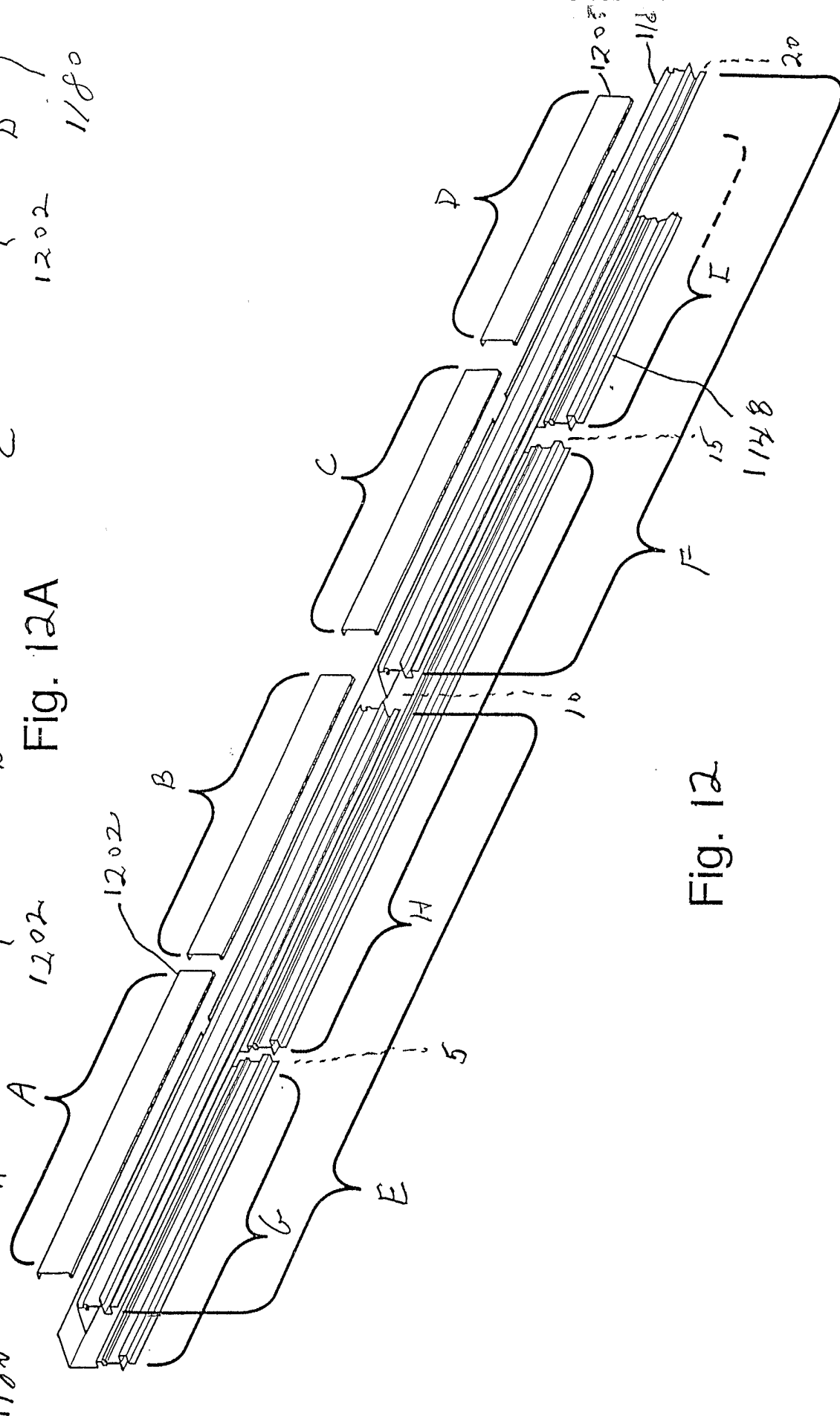


Fig. 12

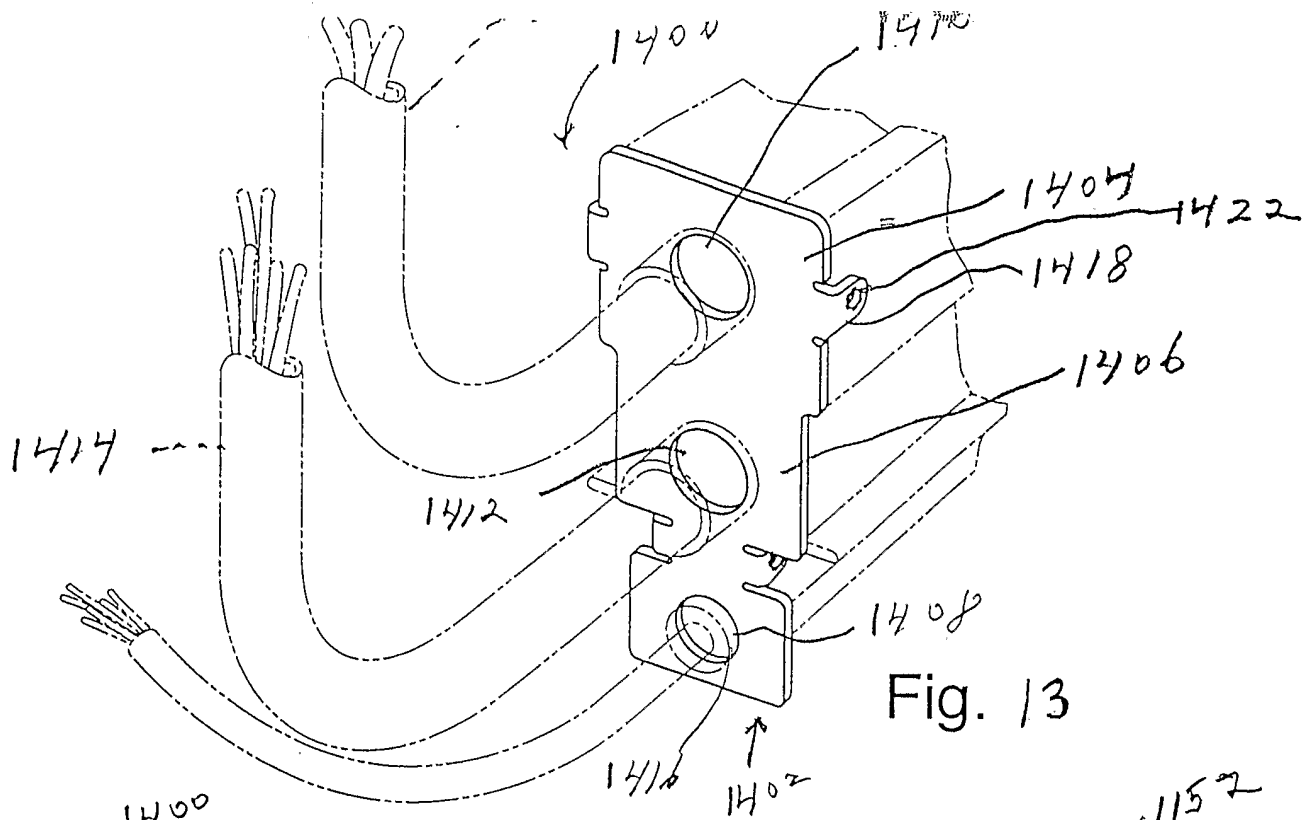


Fig. 13

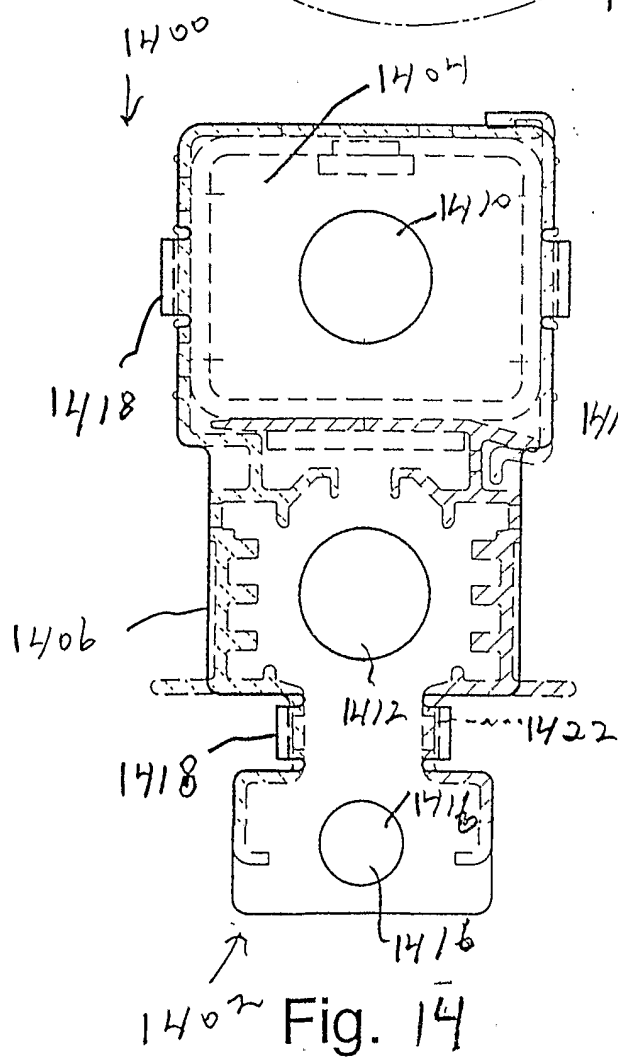


Fig. 14

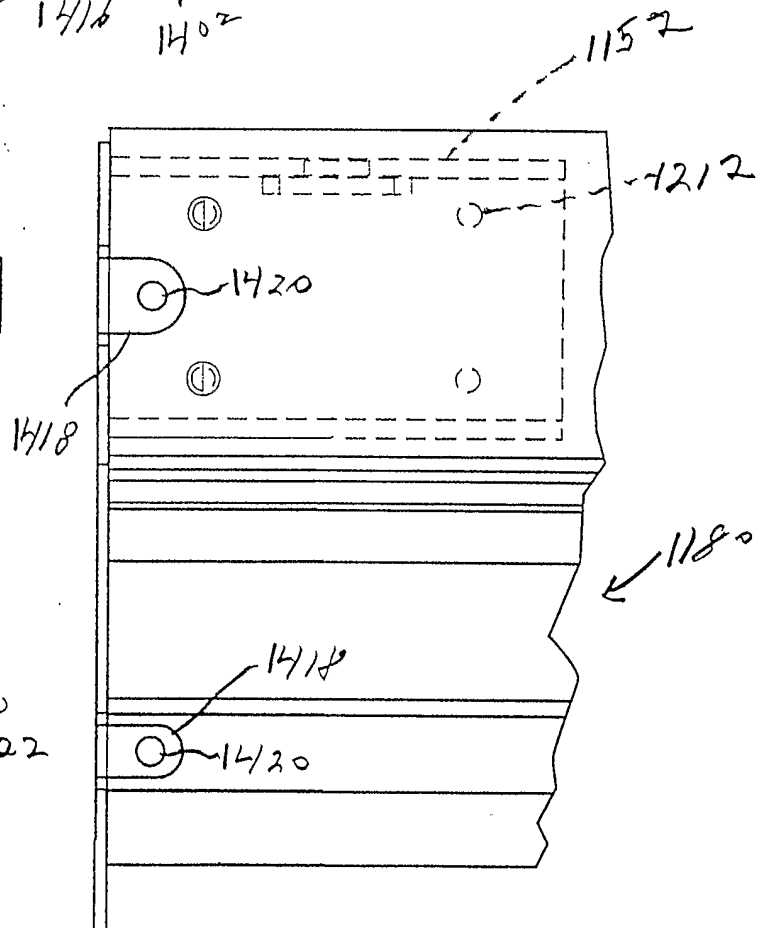


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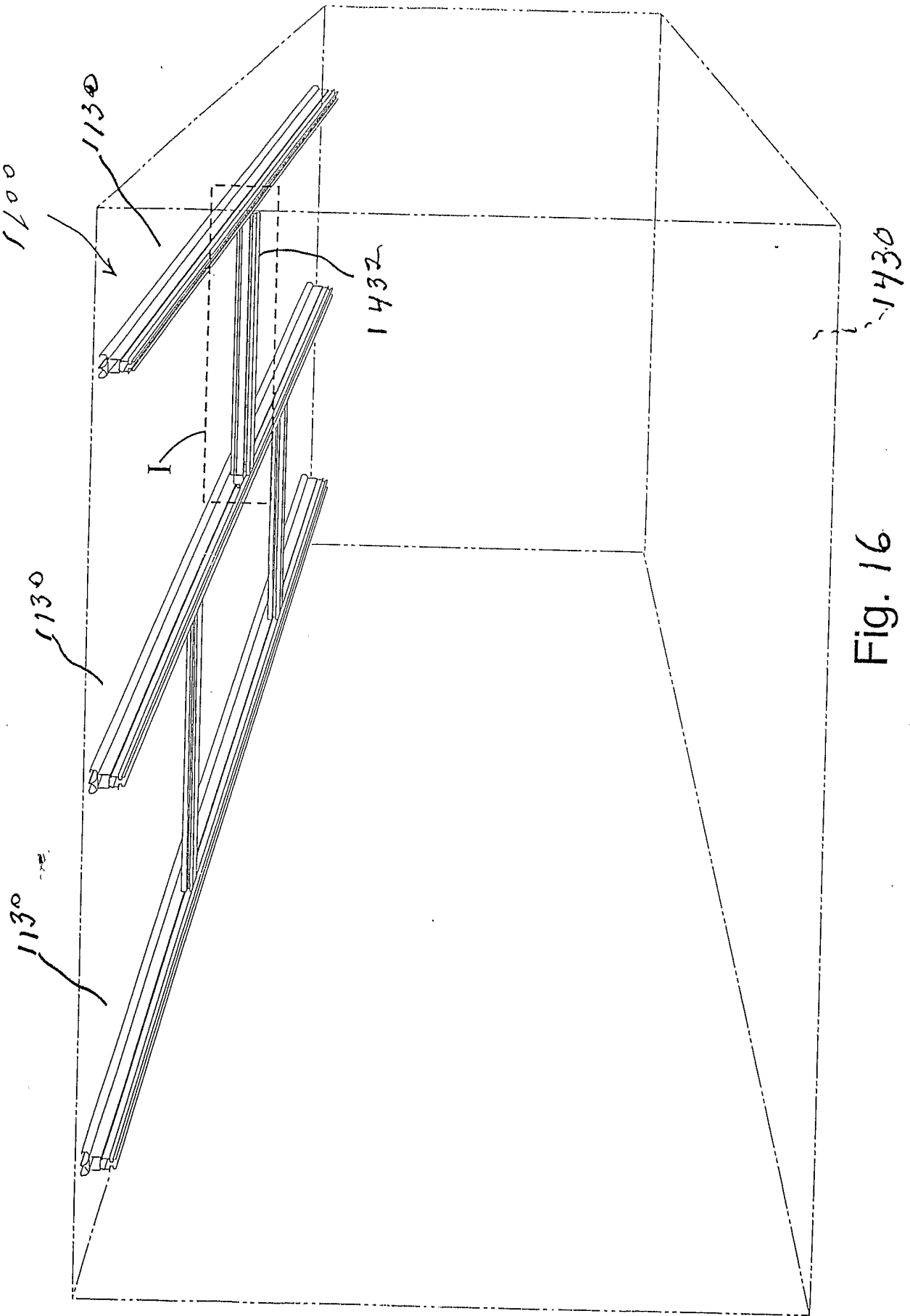
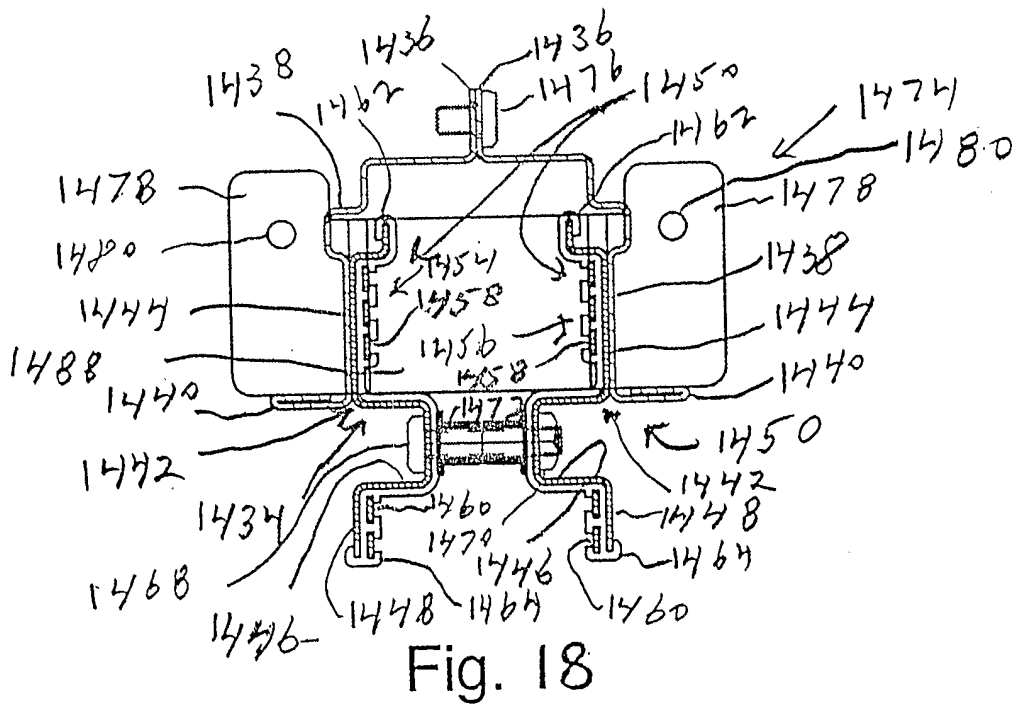
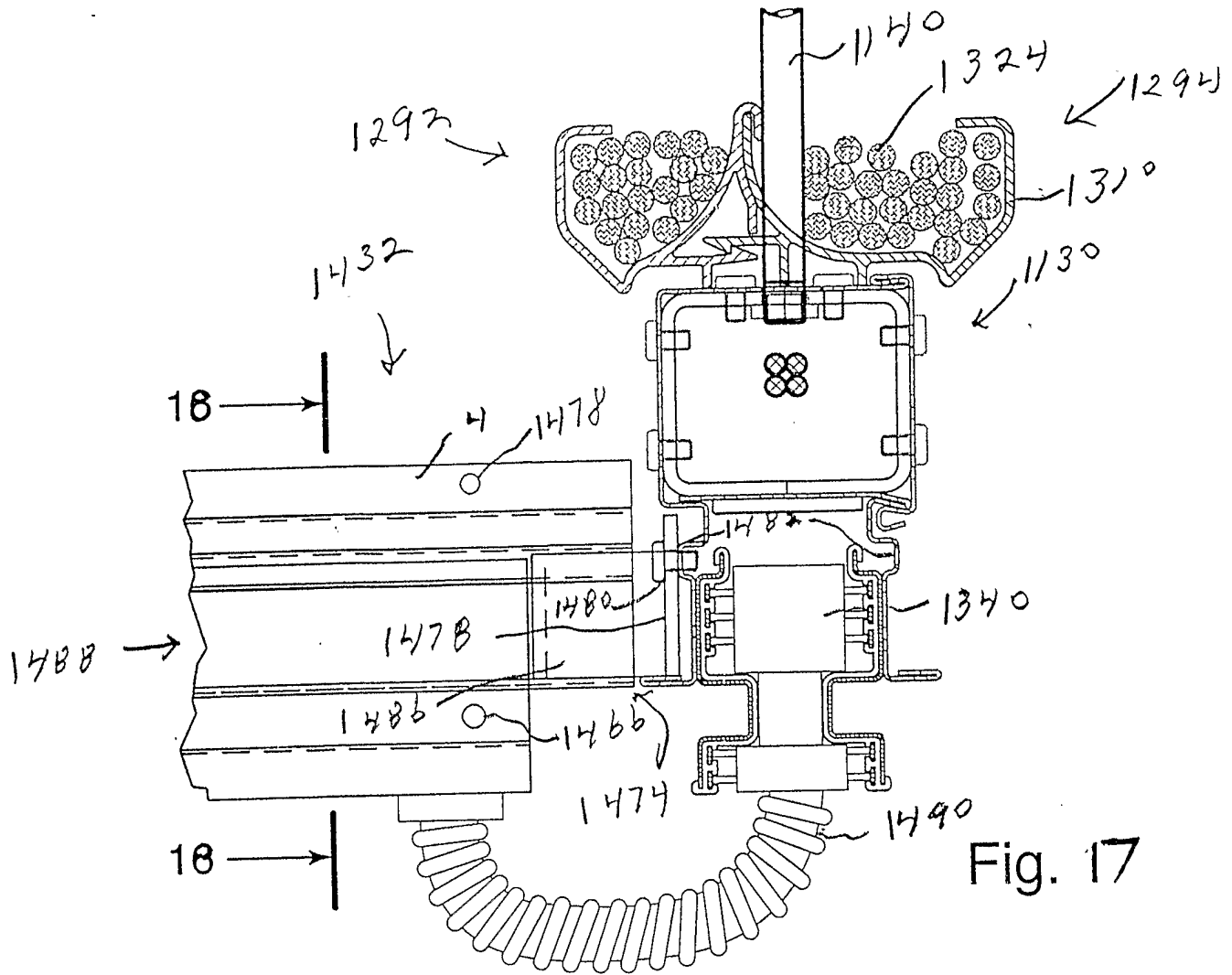


Fig. 16



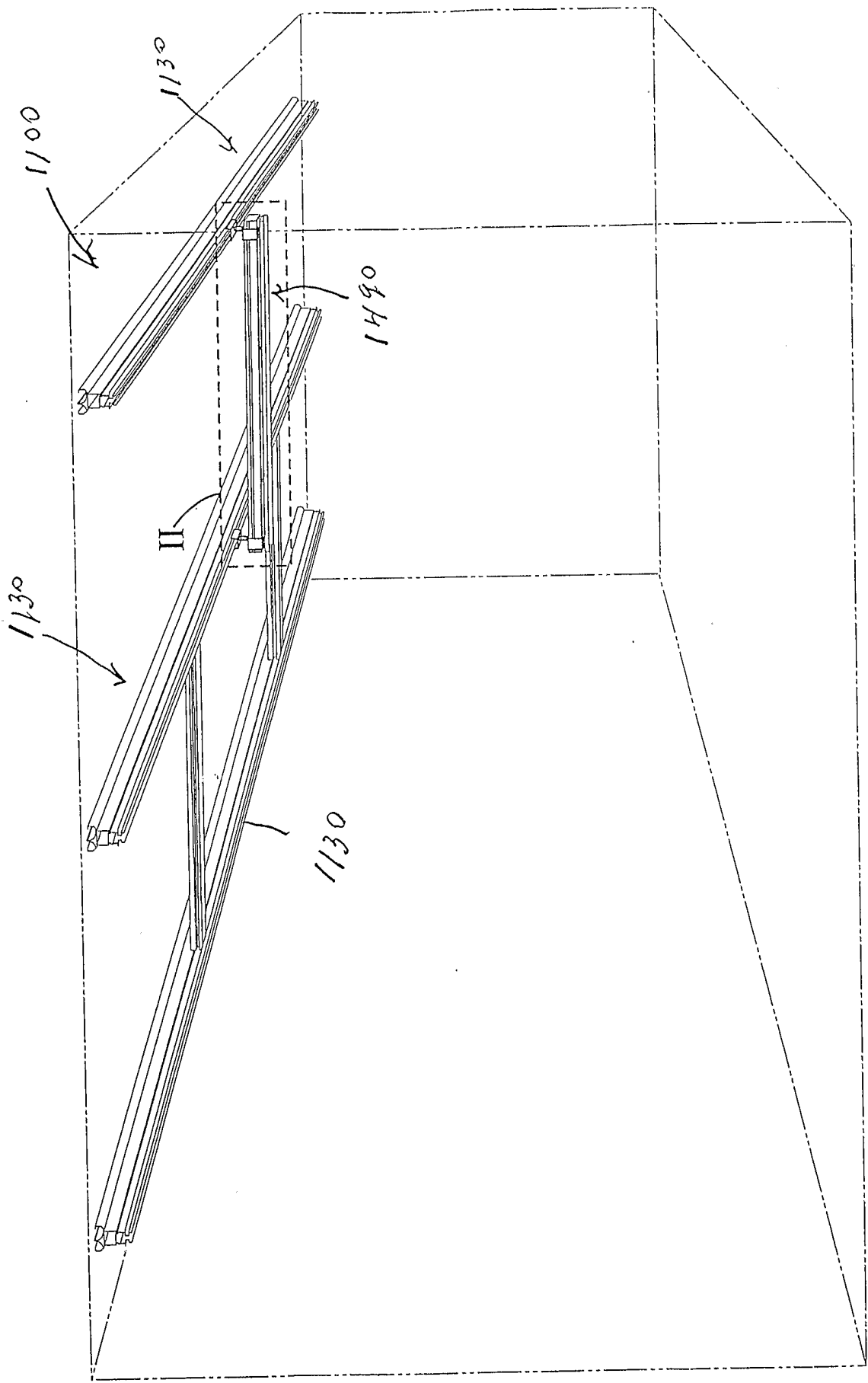


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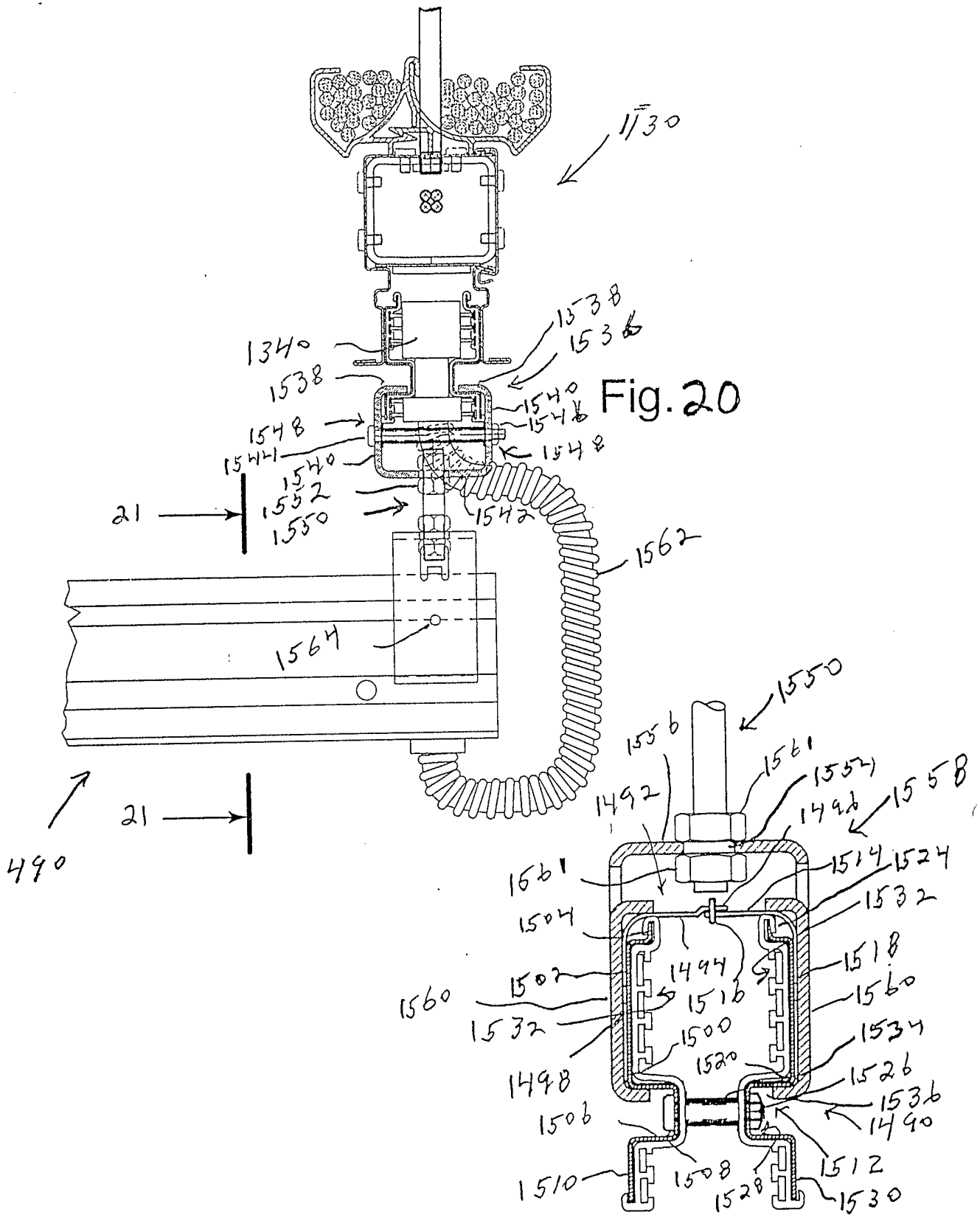


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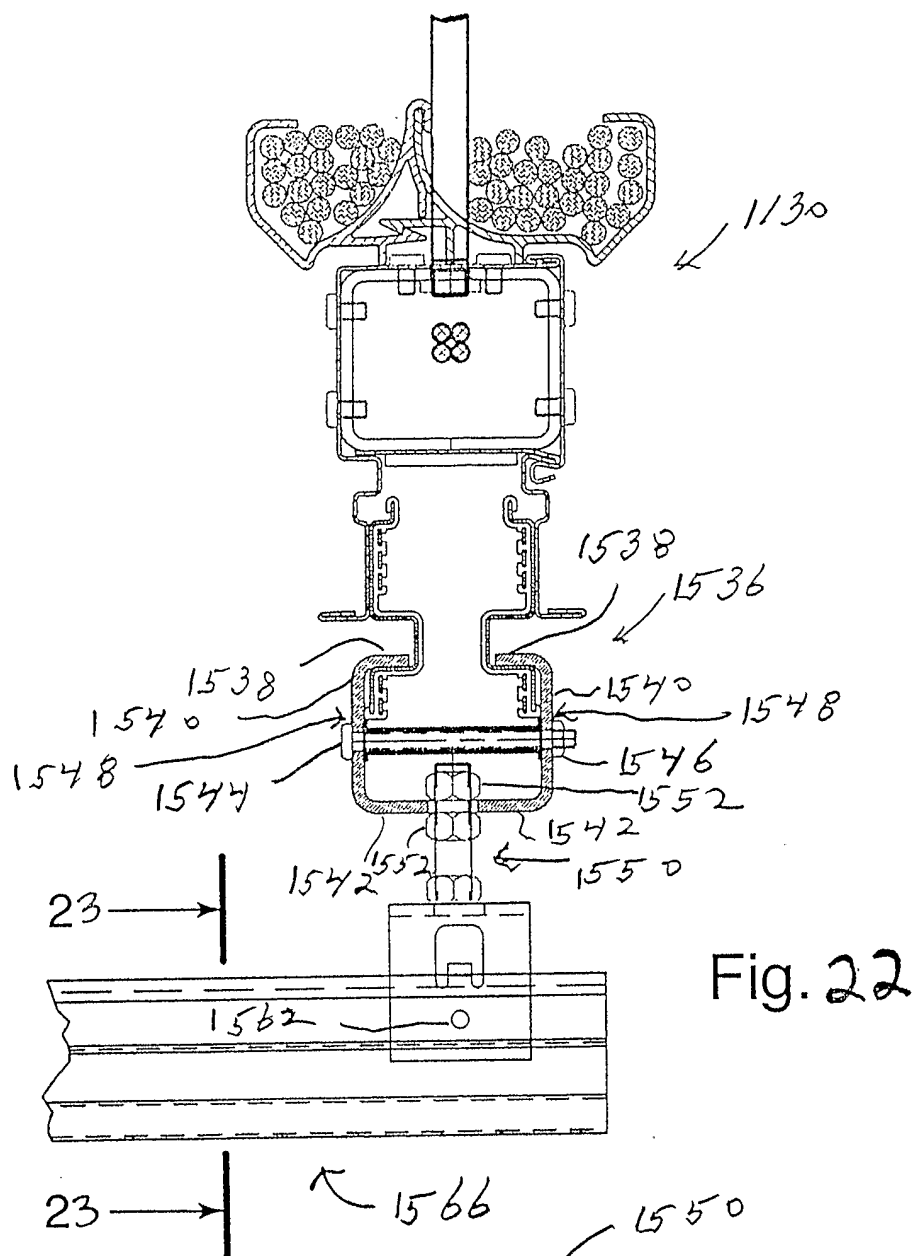


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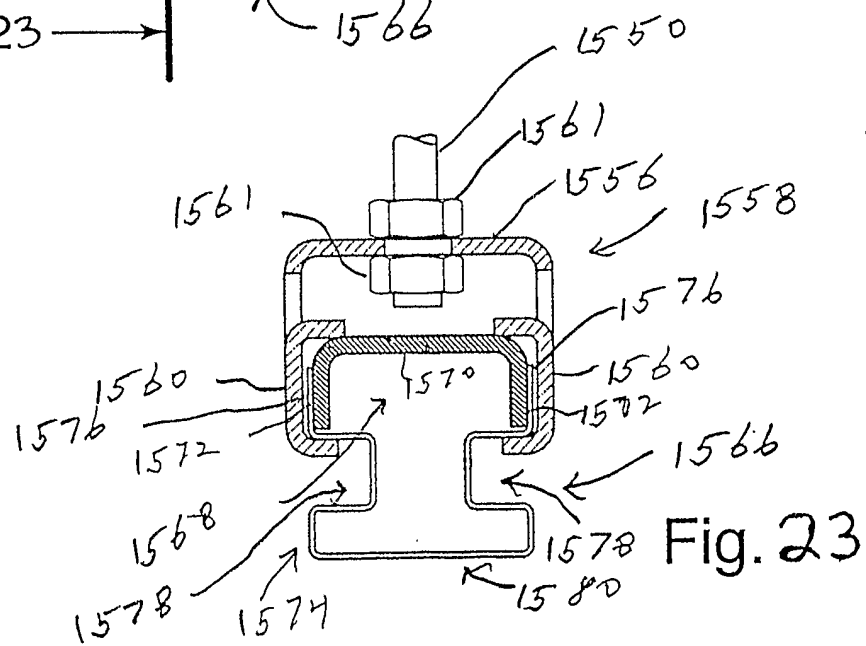


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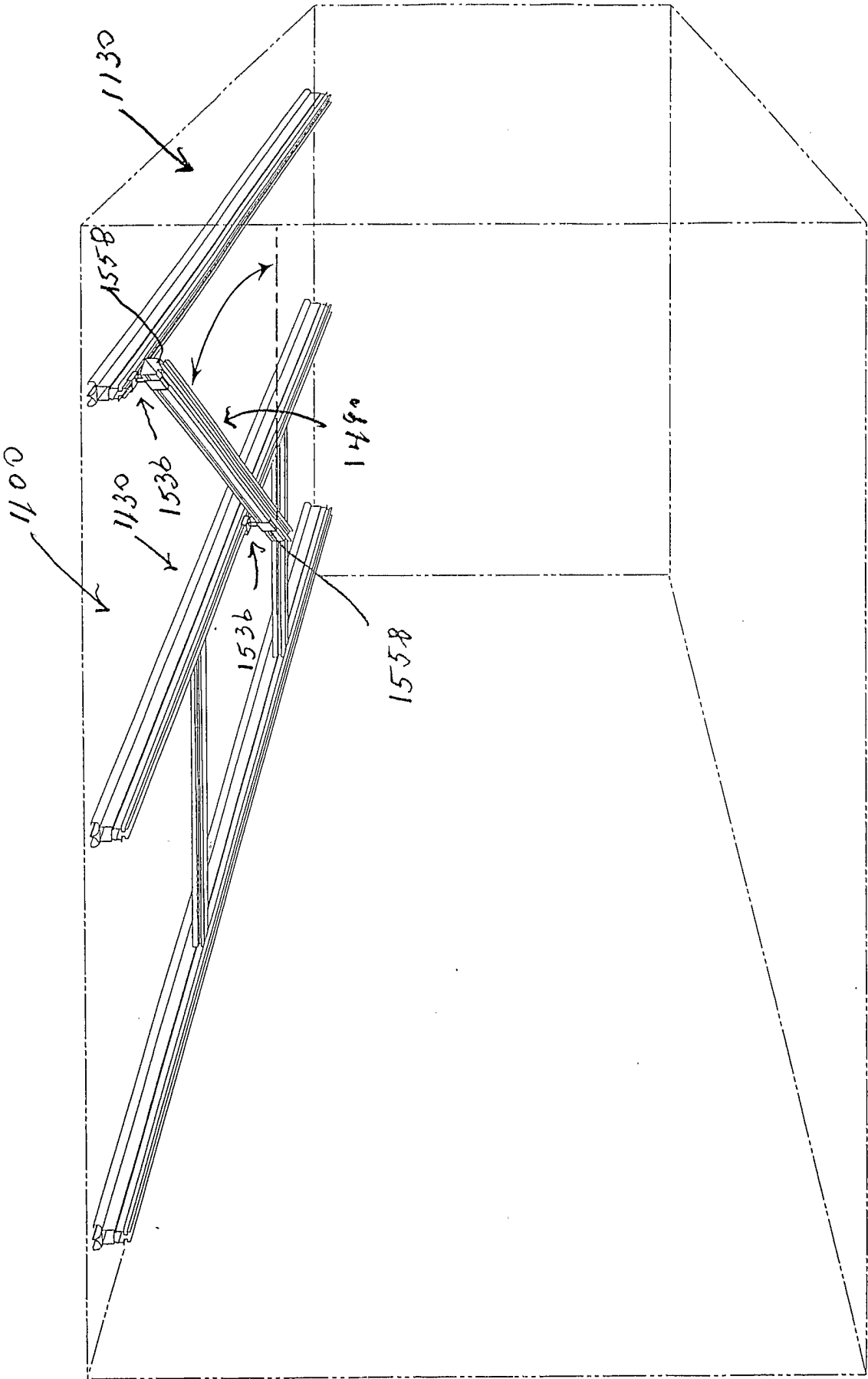


Fig. 23A

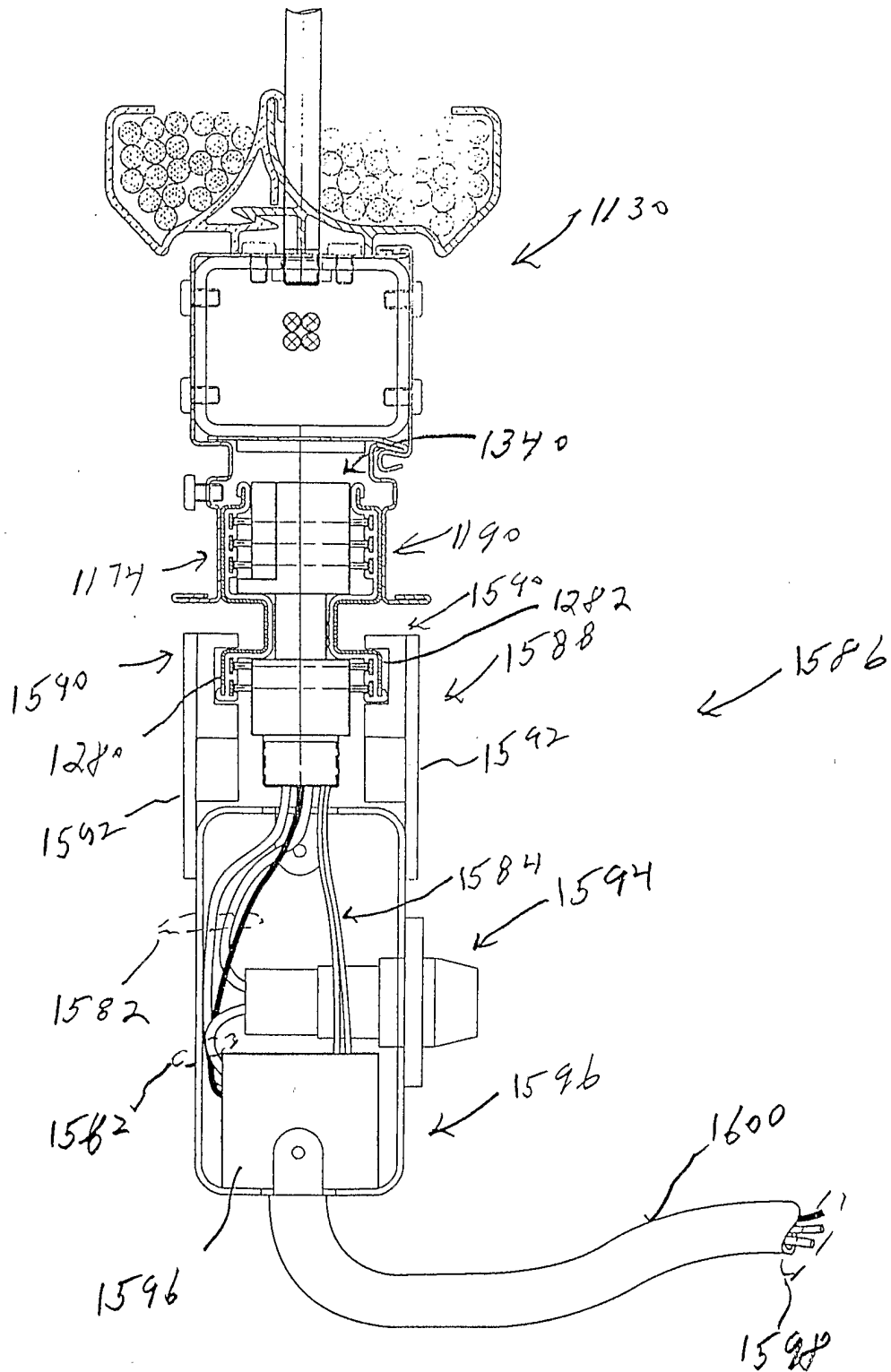


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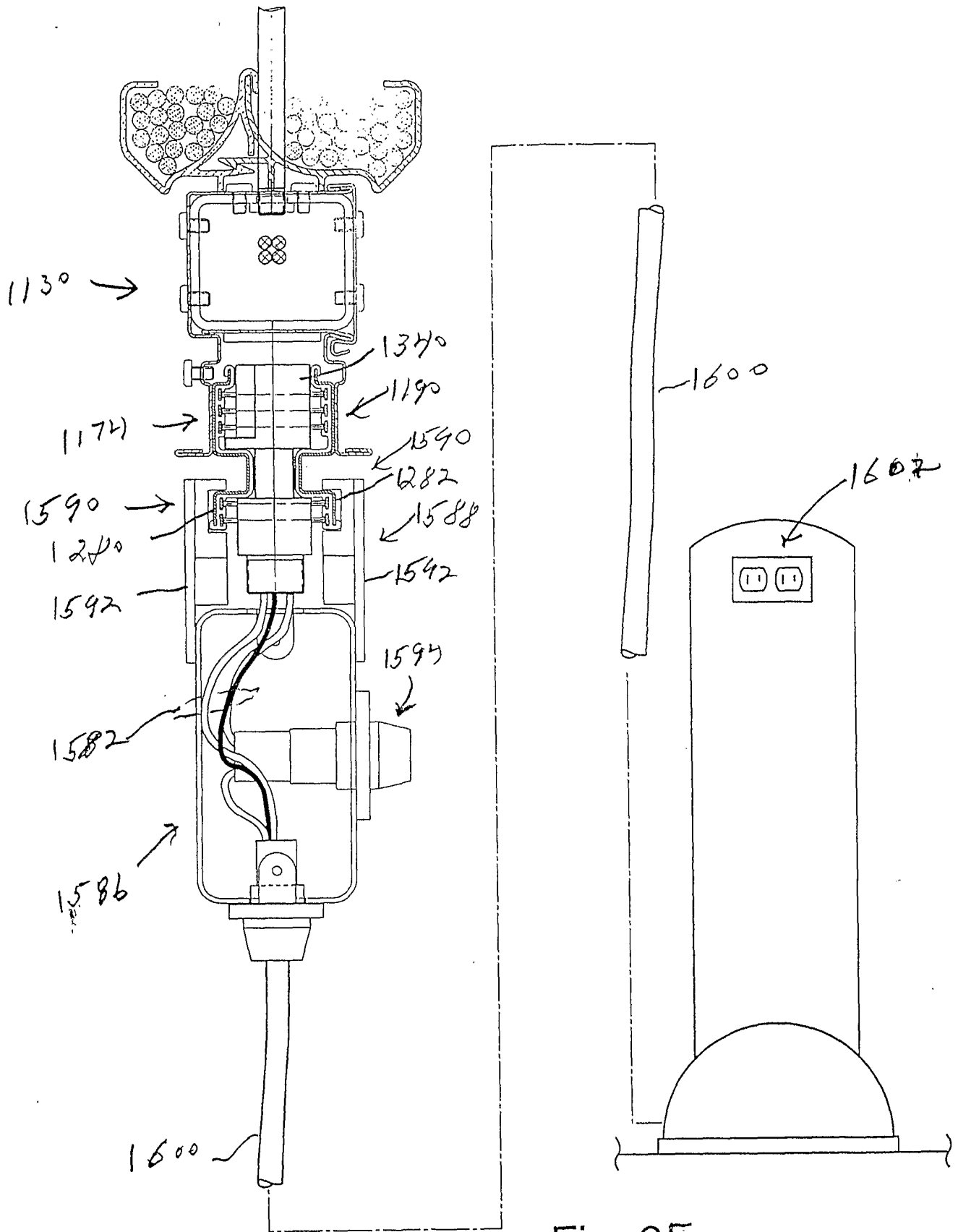
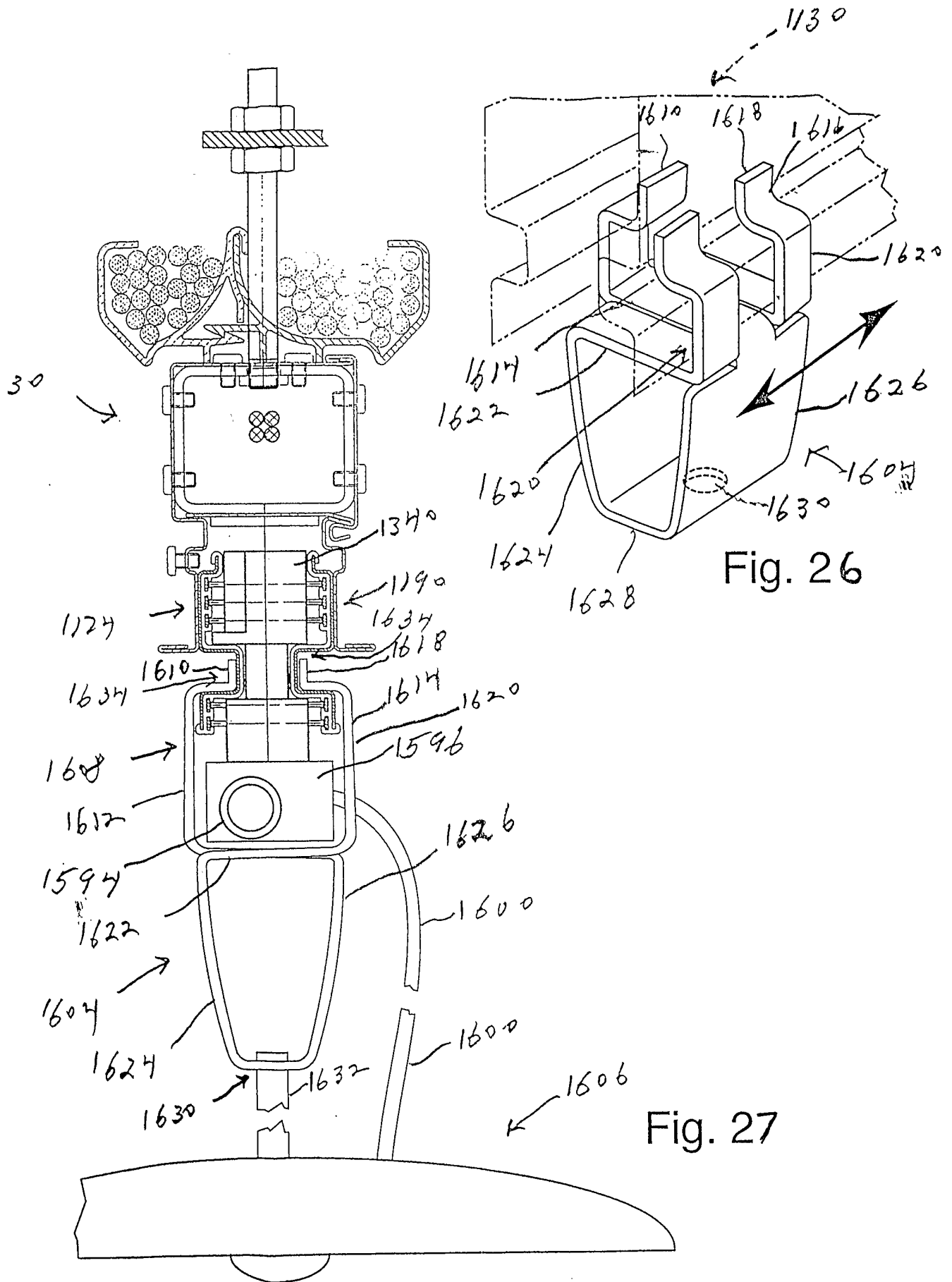


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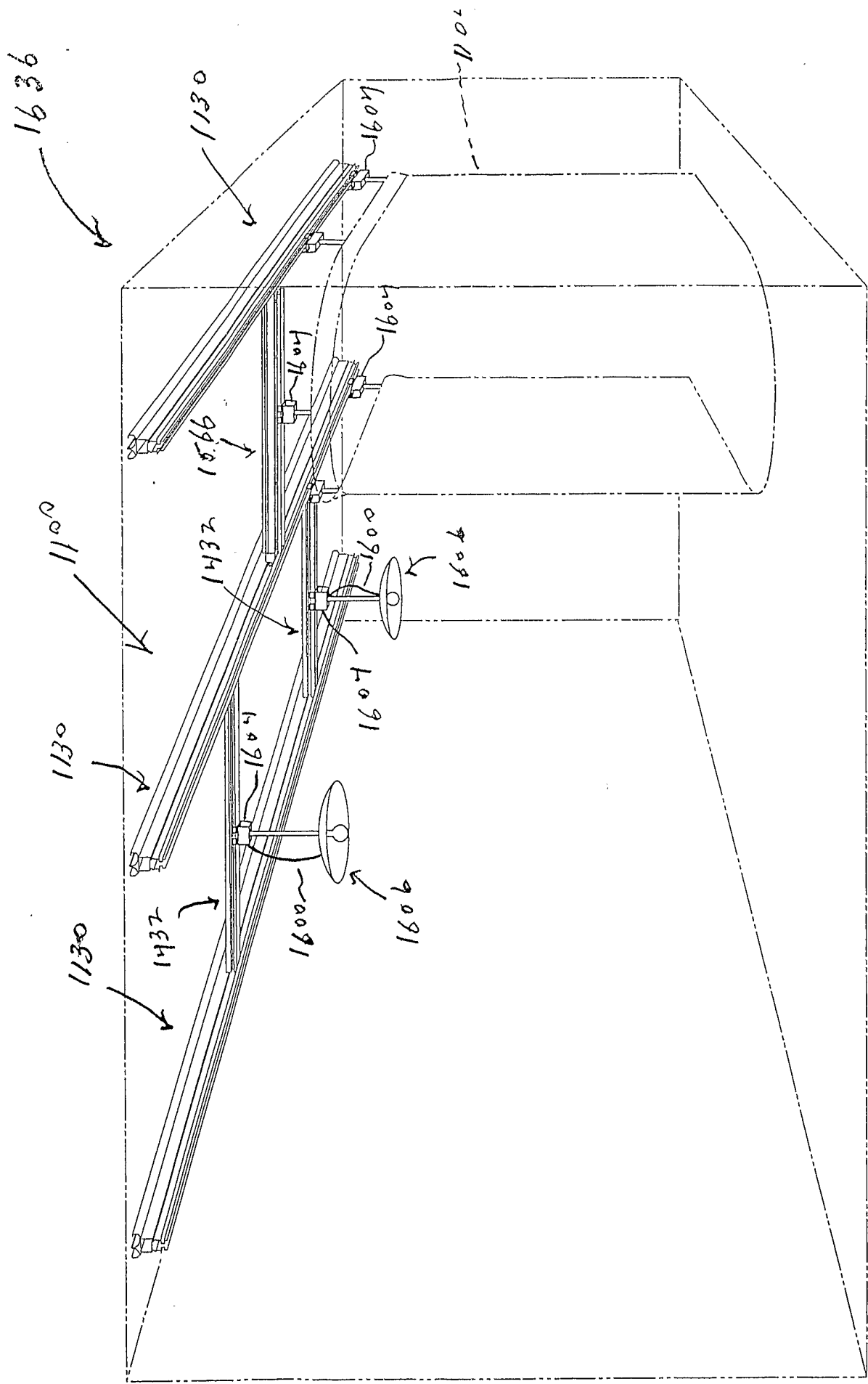


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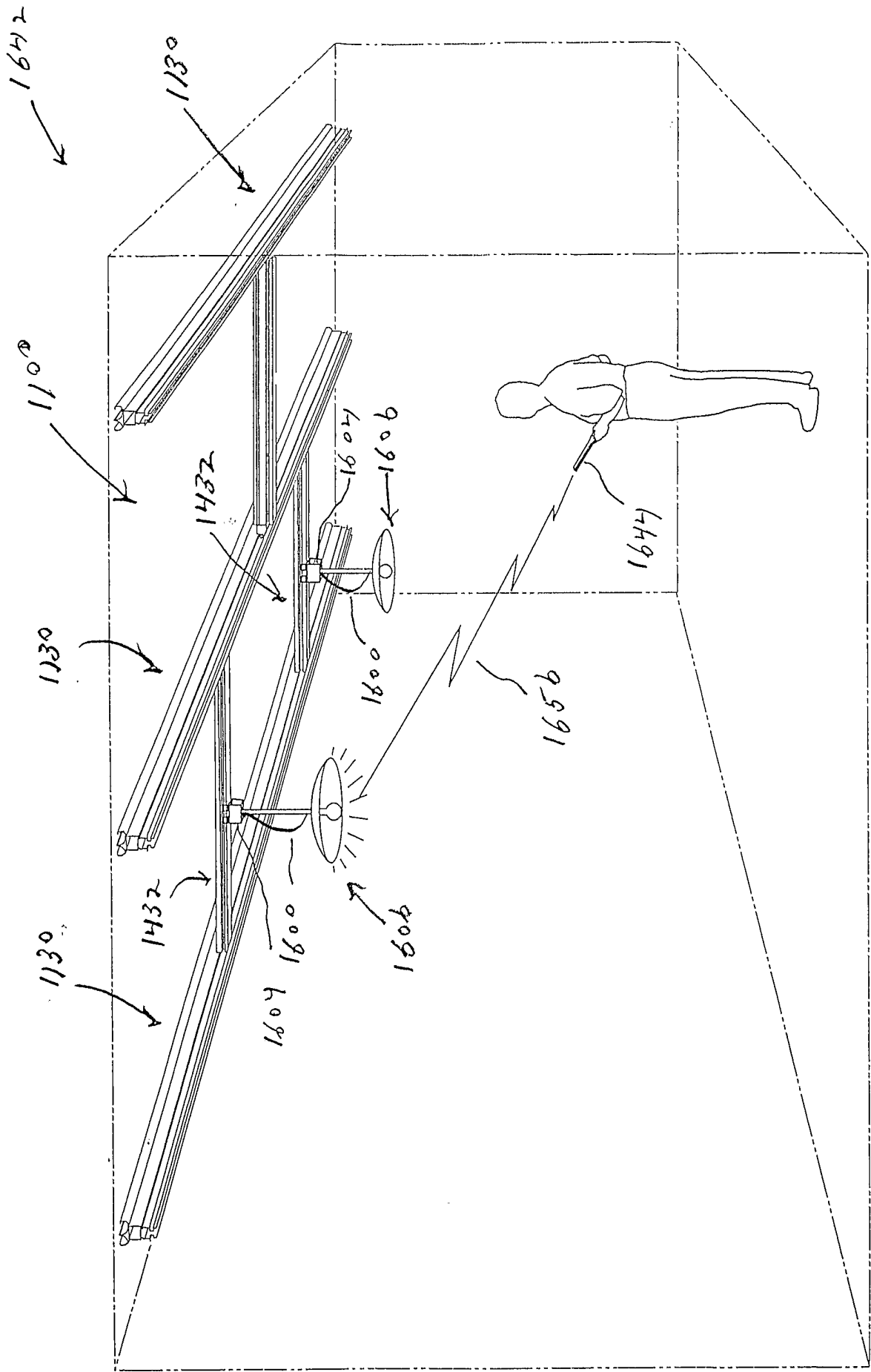


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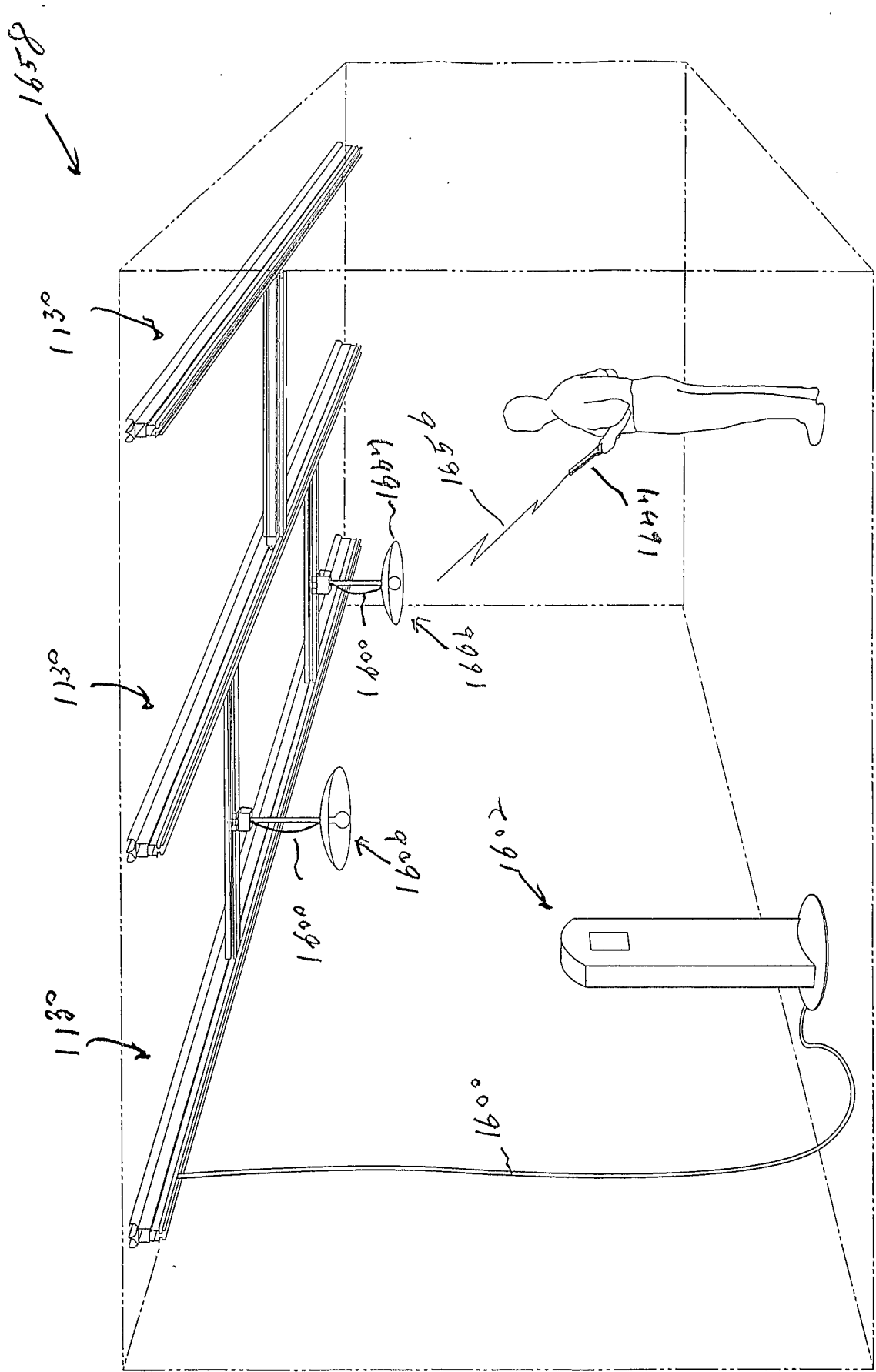


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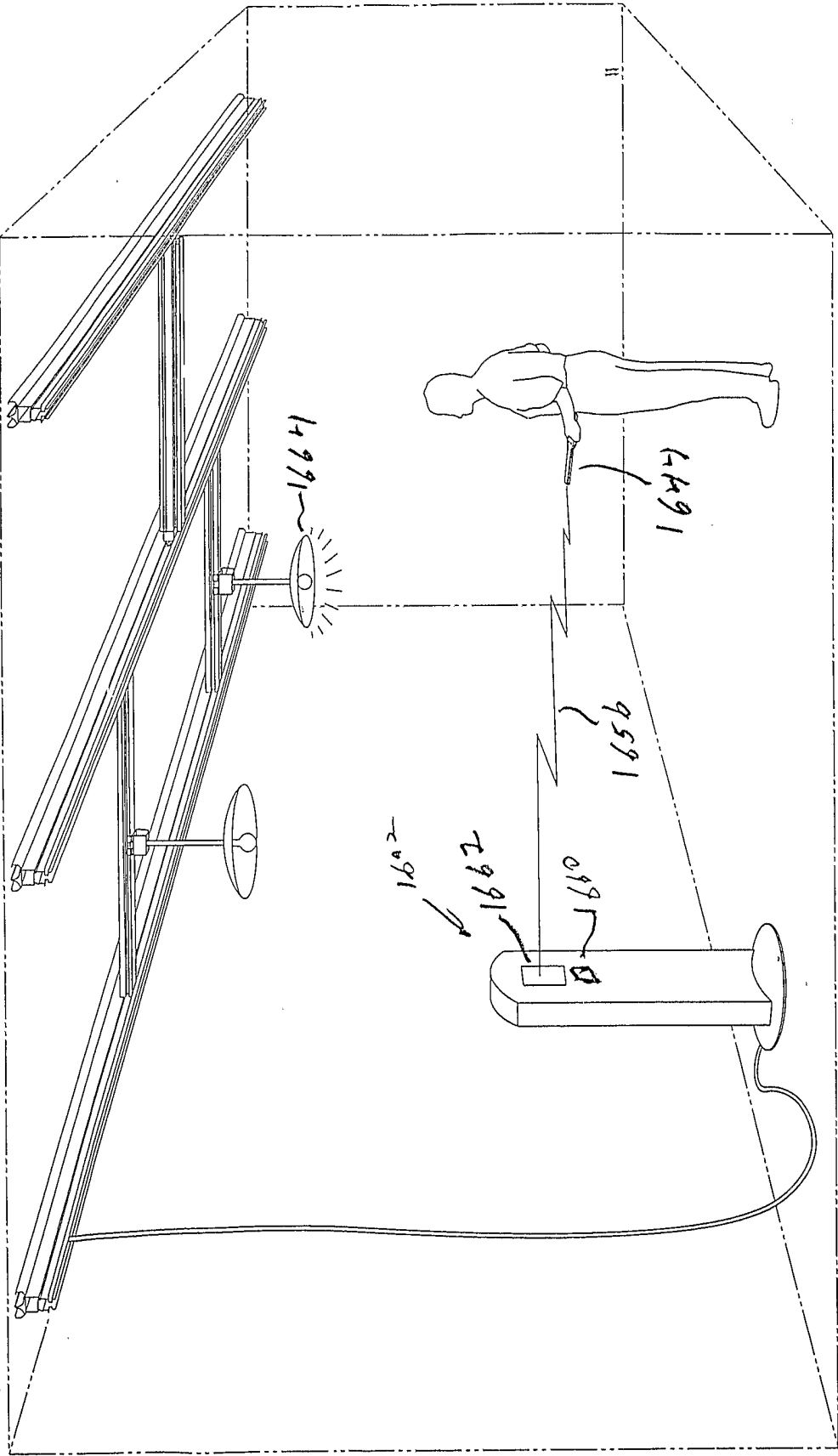


Fig. 31A

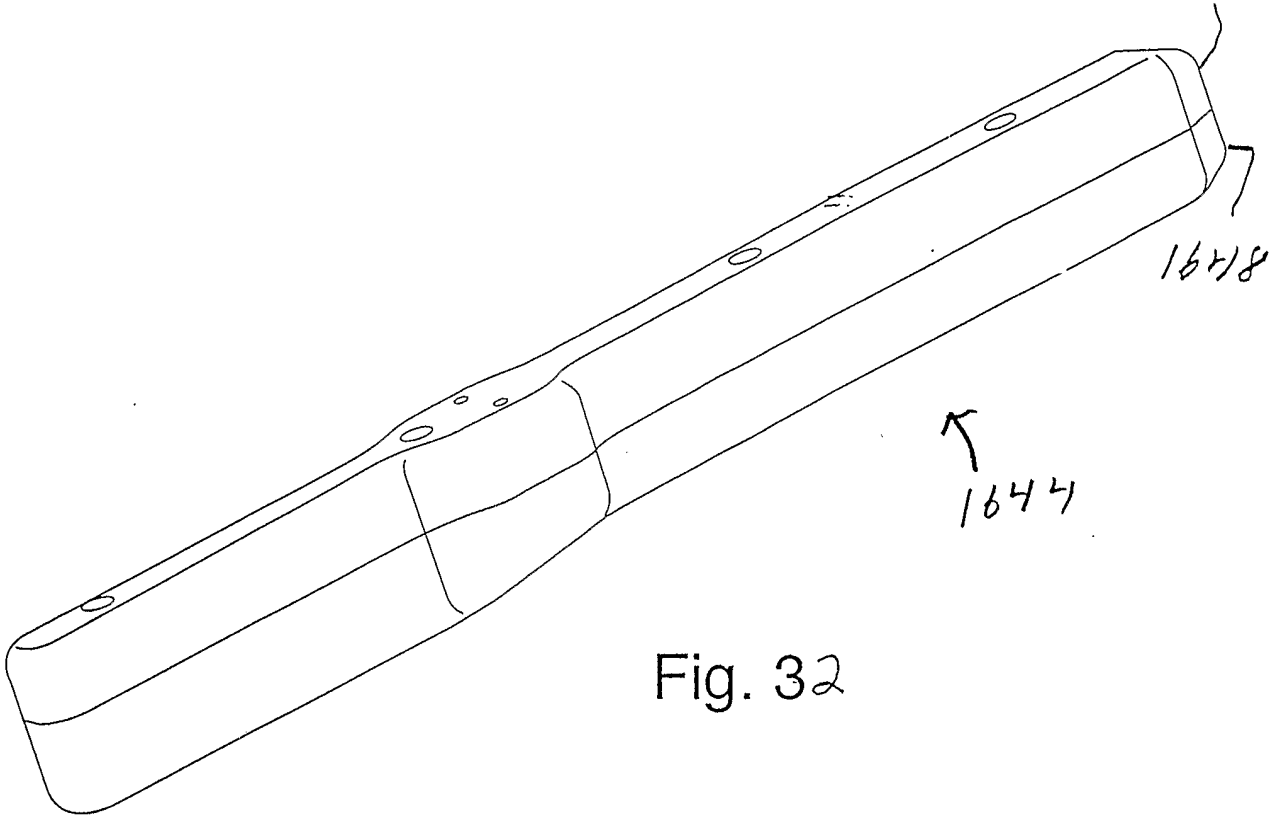


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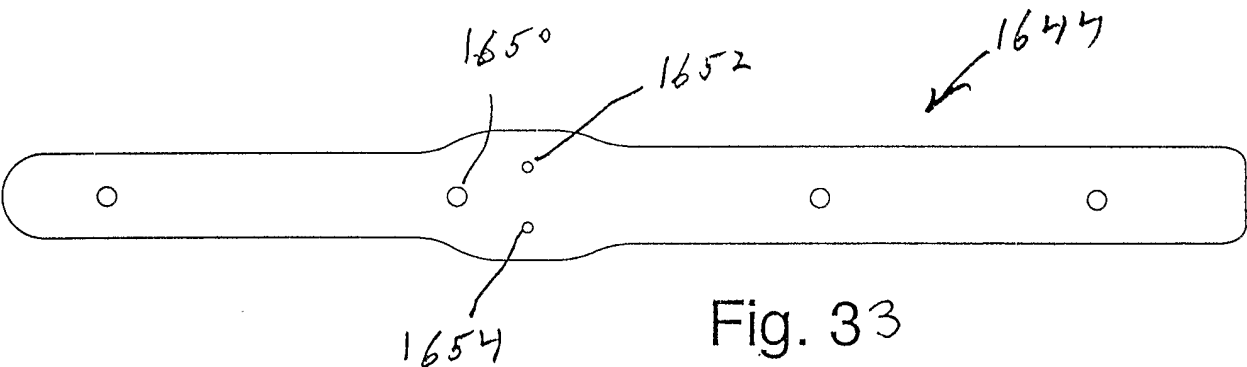


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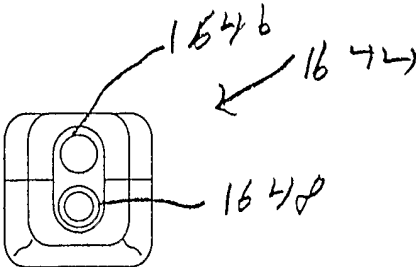


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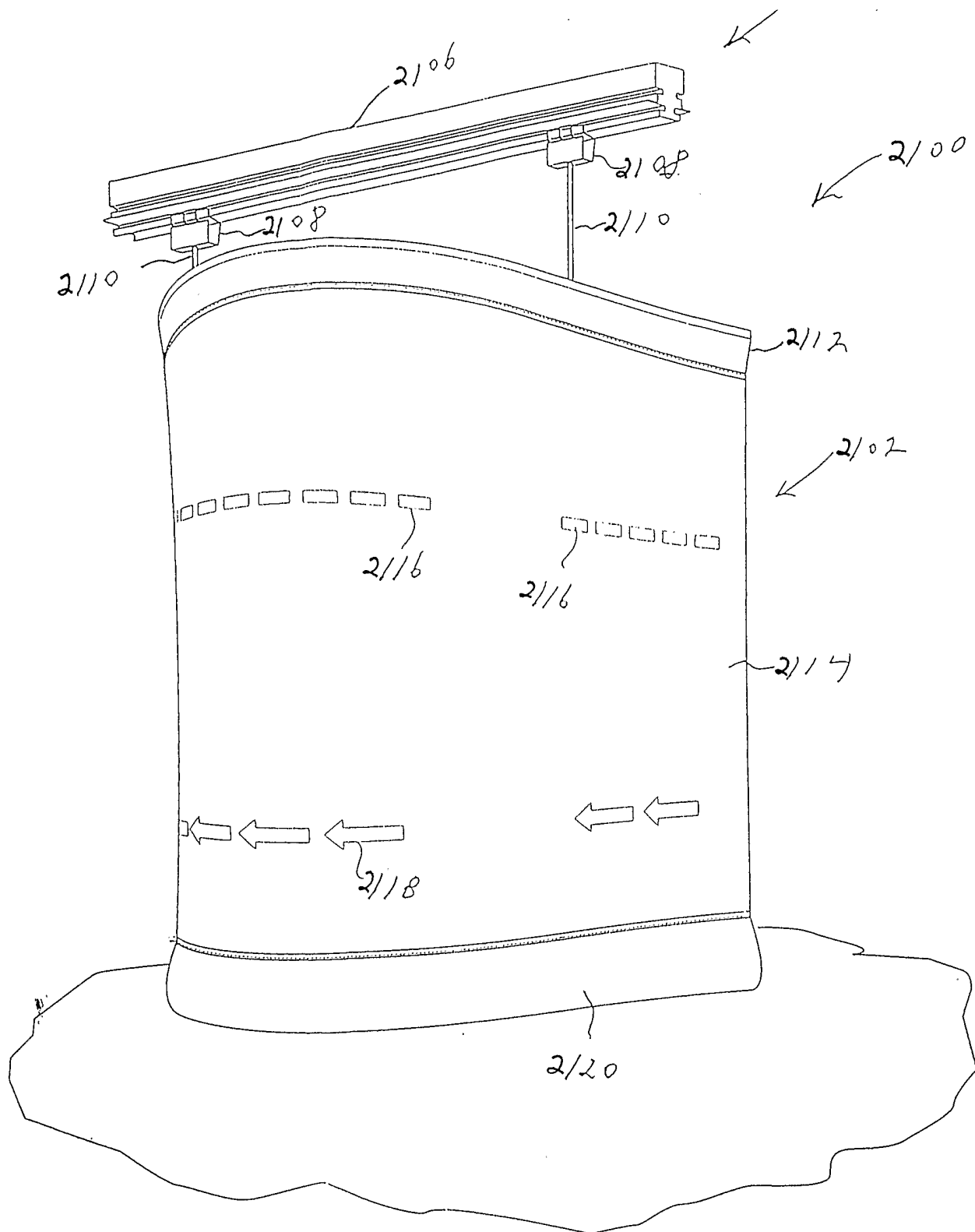


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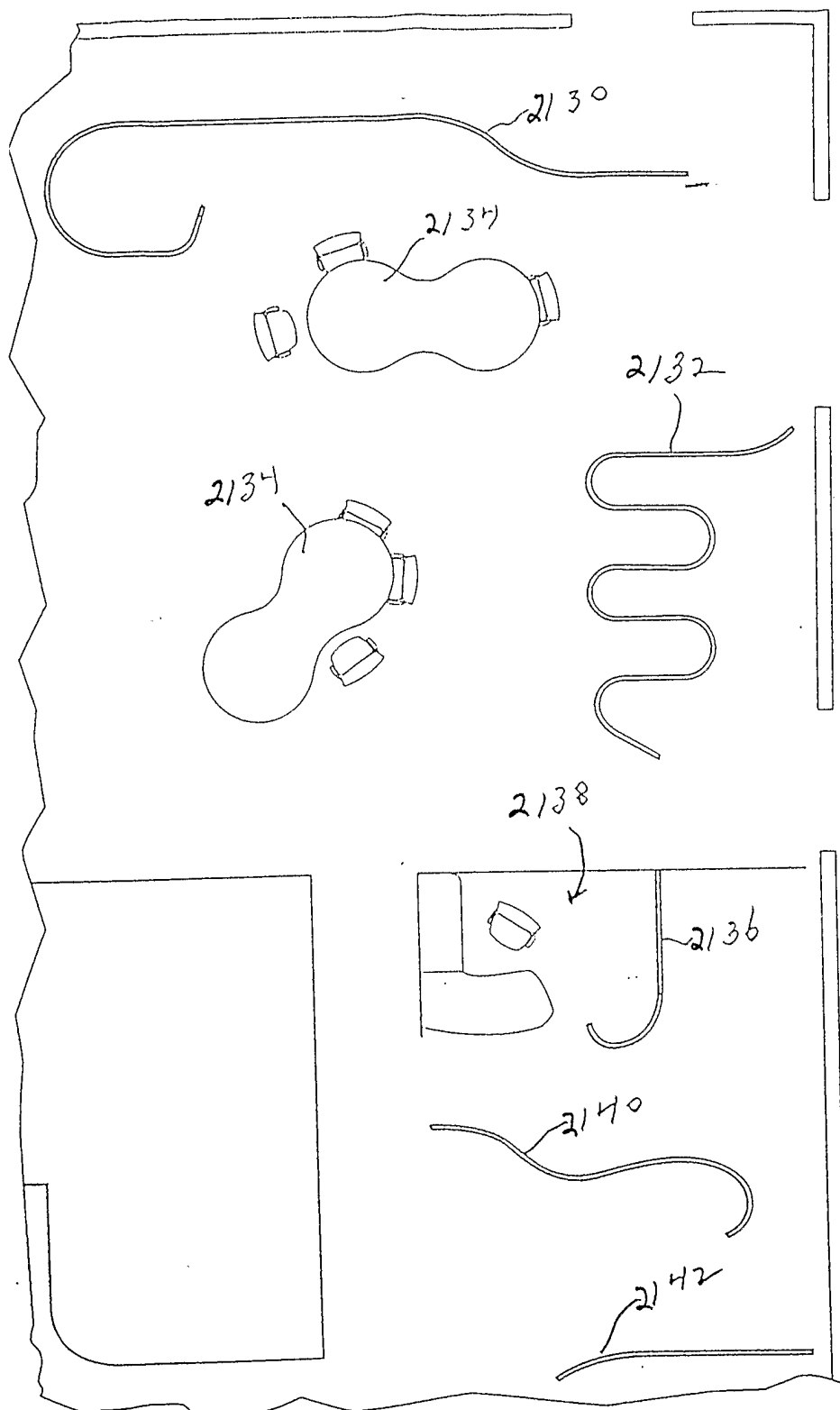


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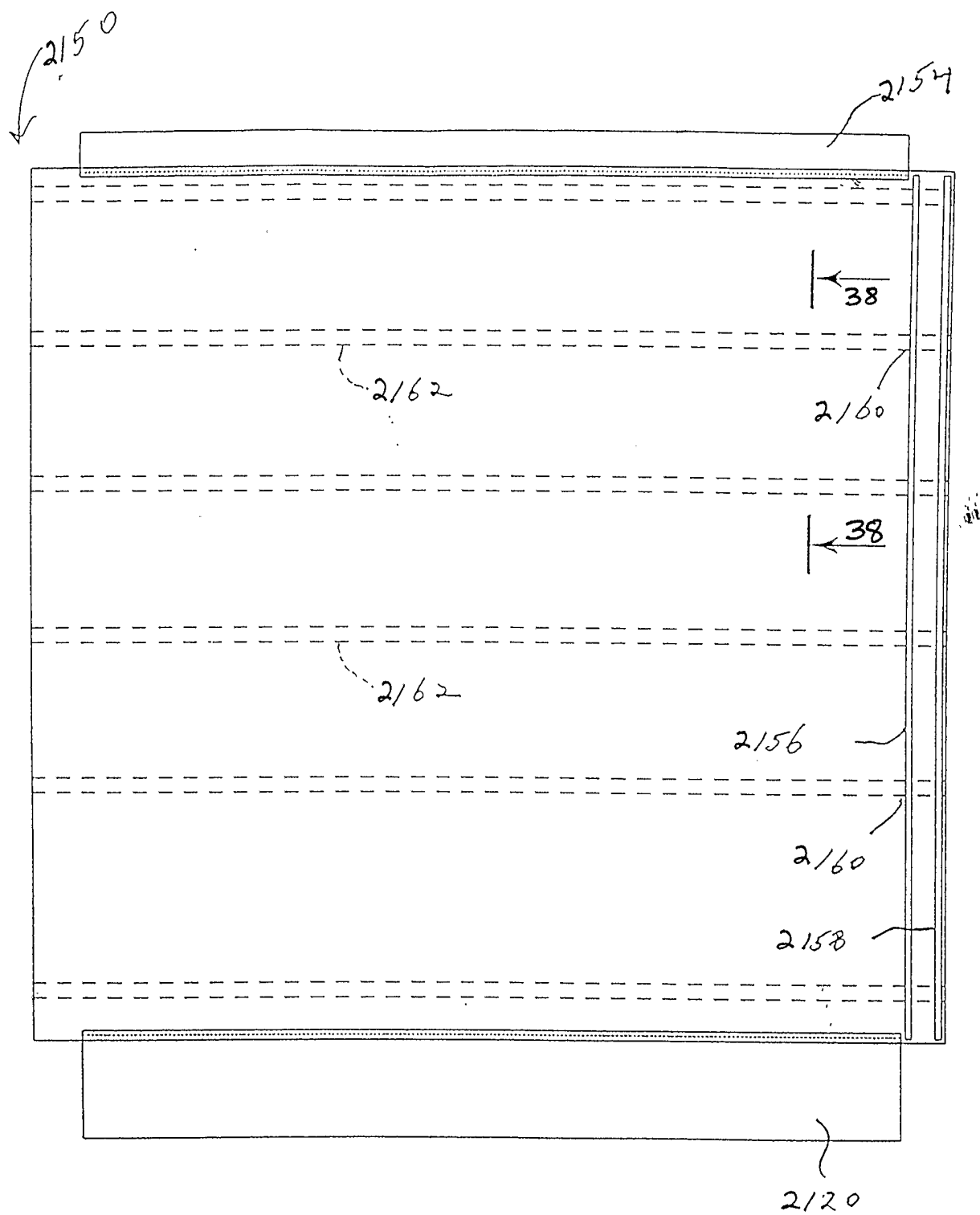


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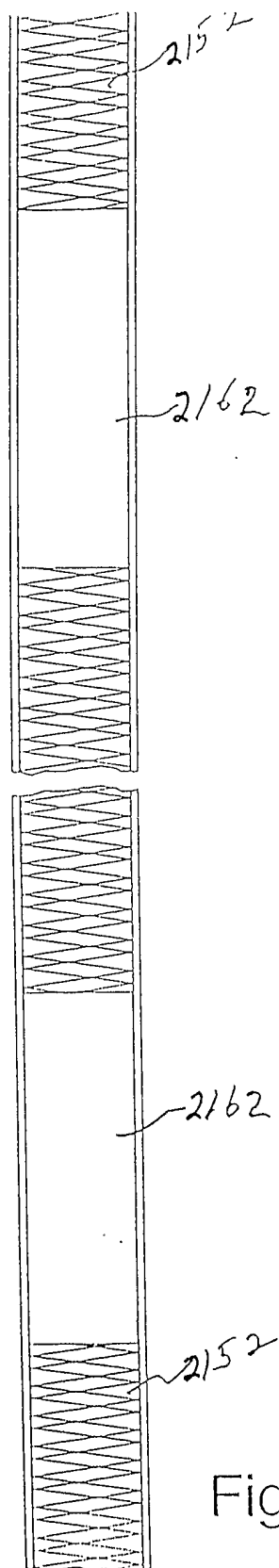


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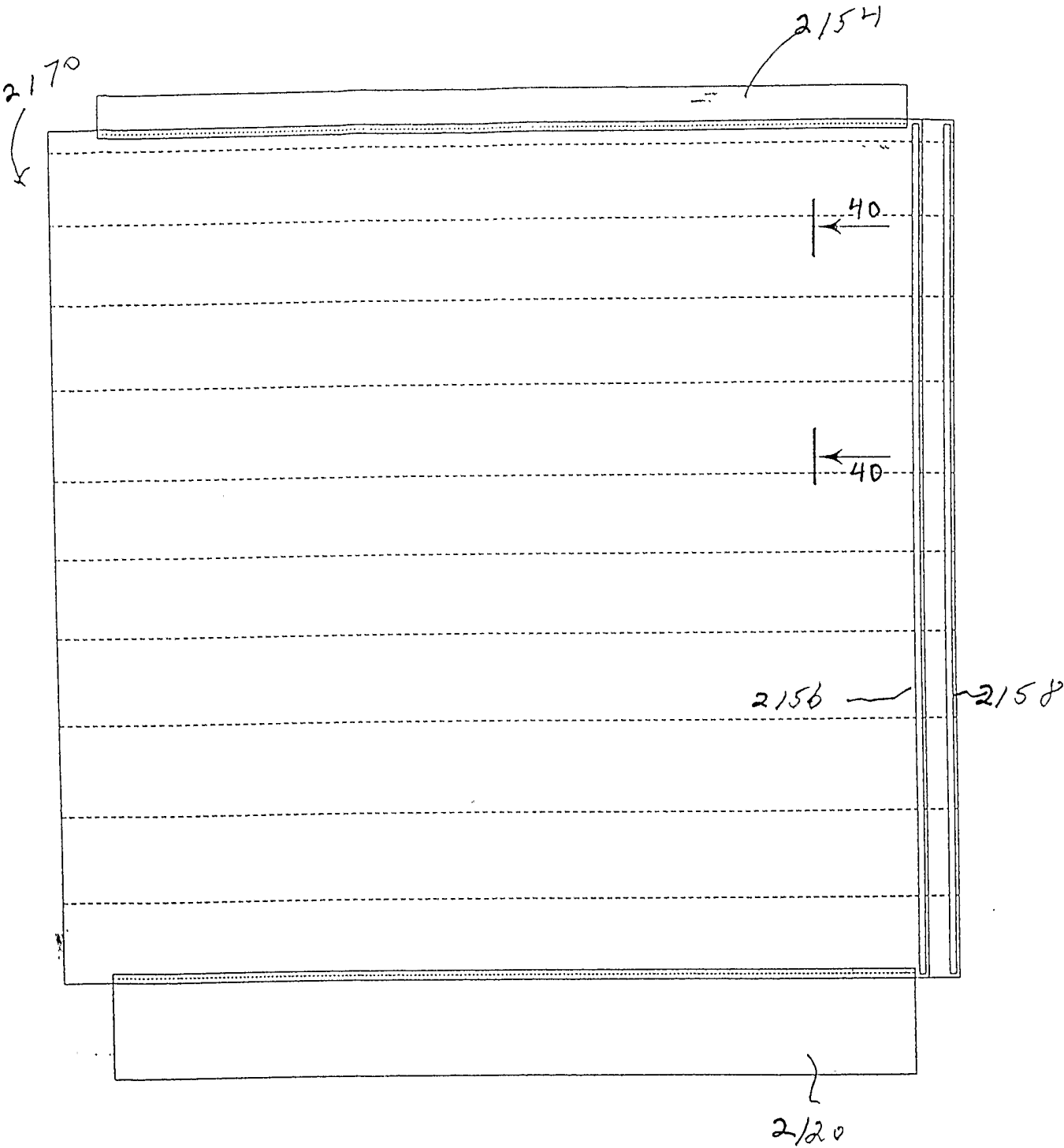
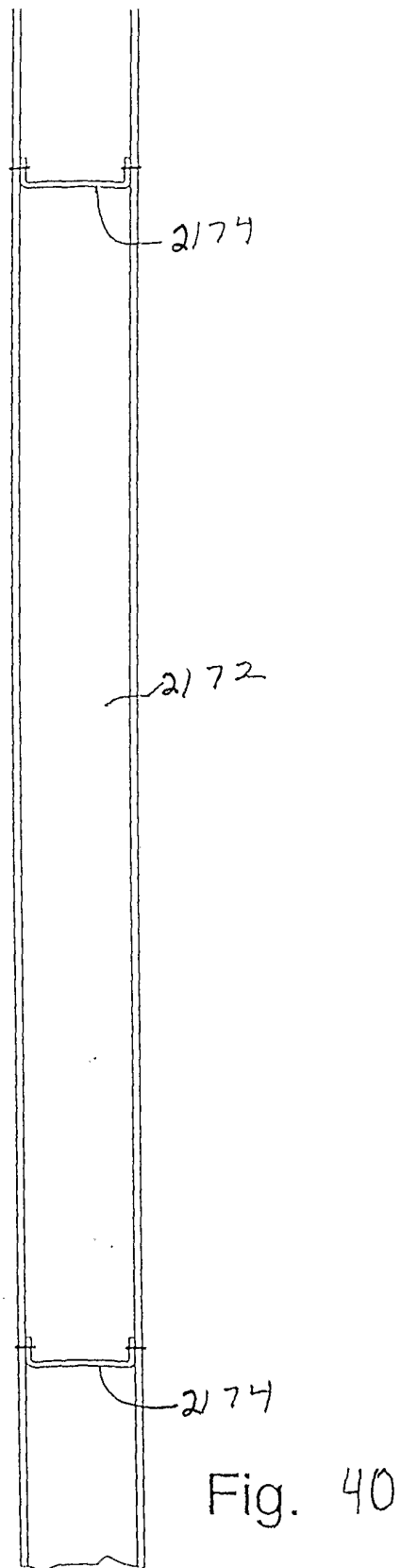


Fig. 39



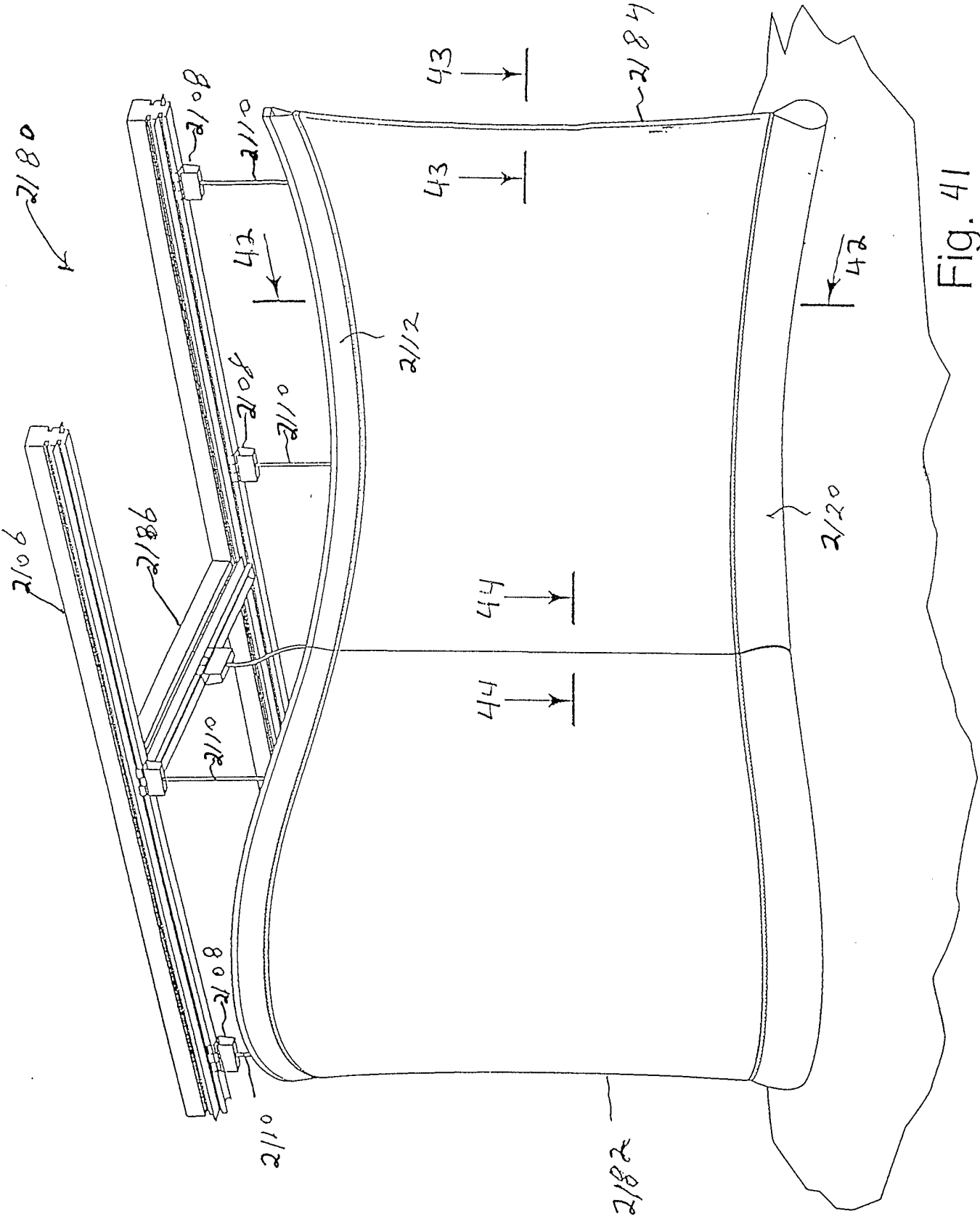
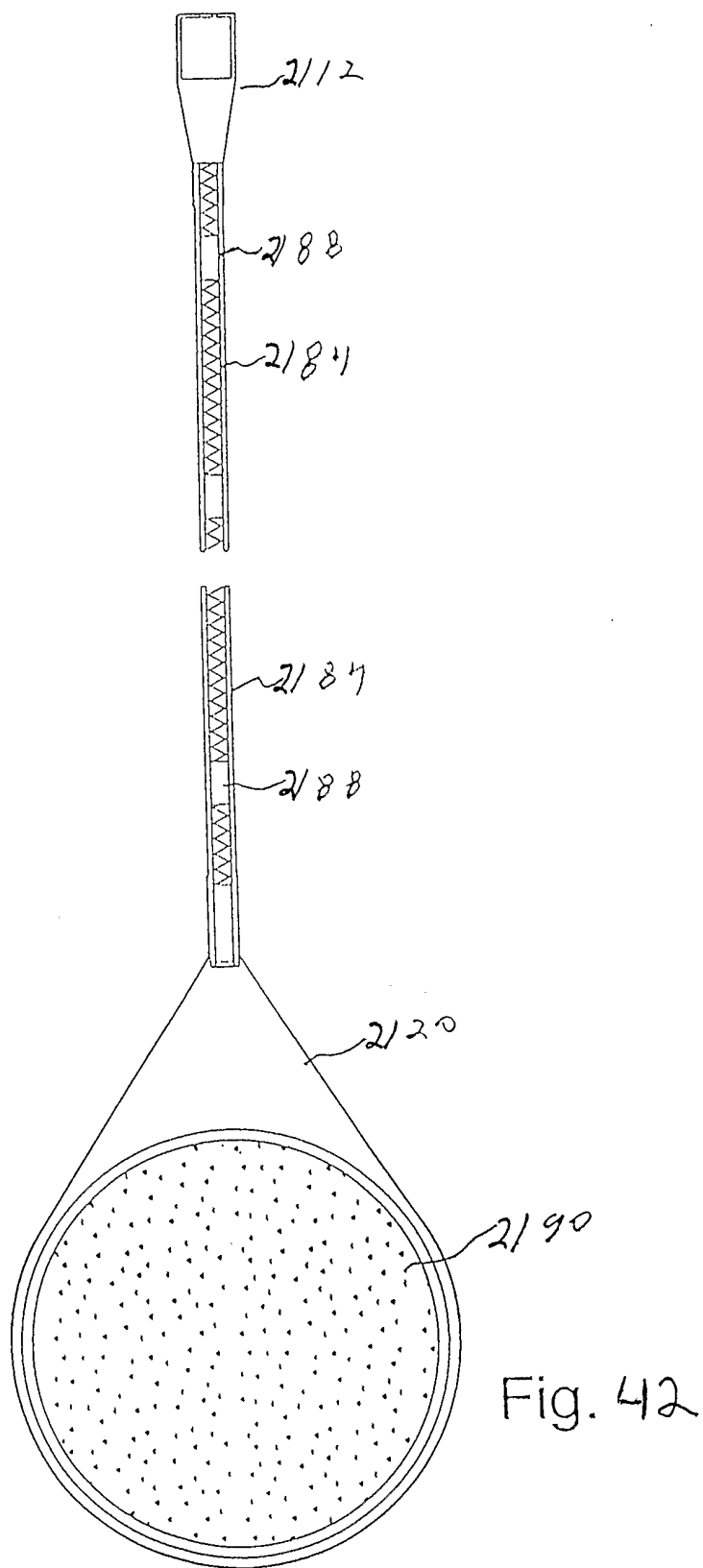
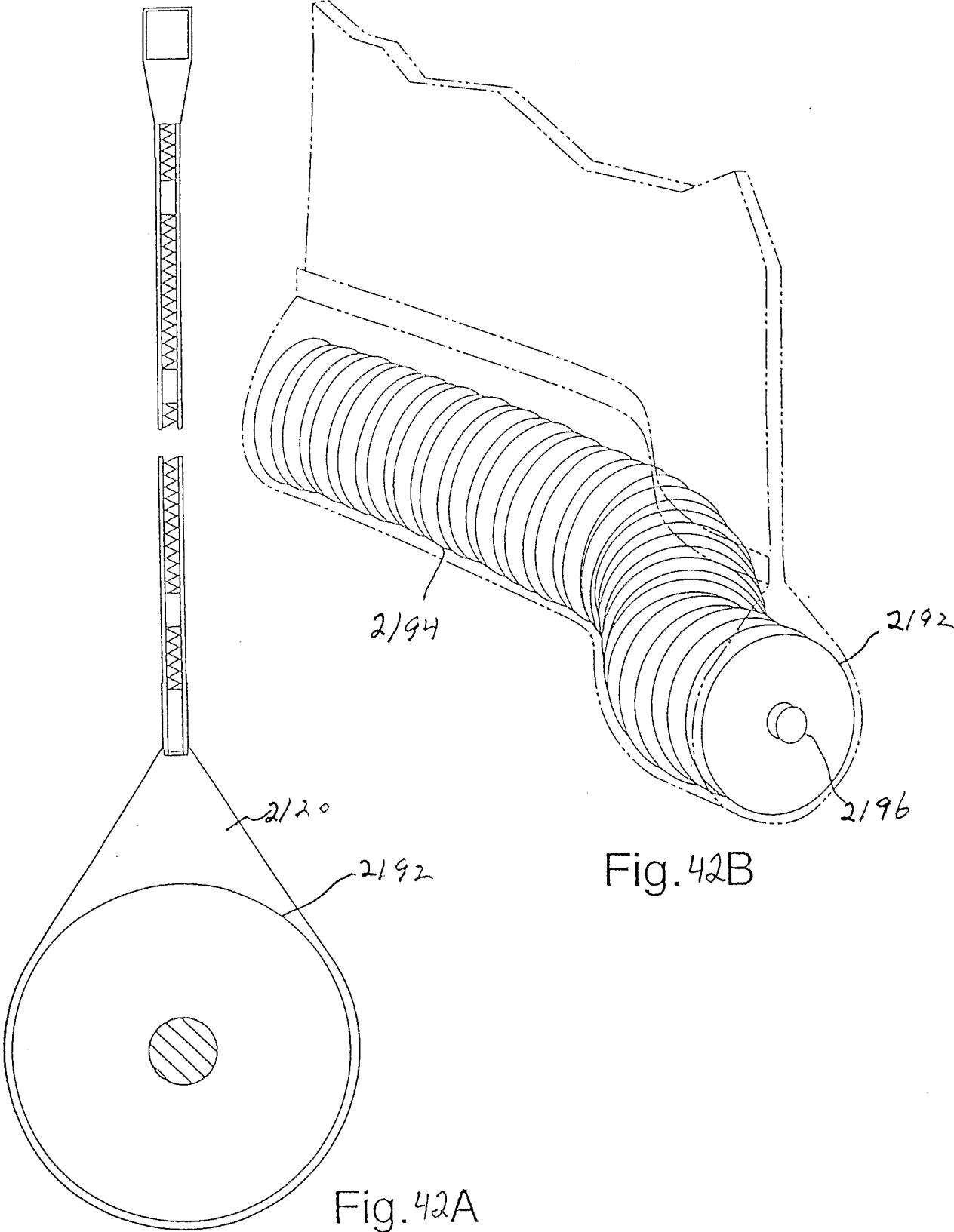


Fig. 41





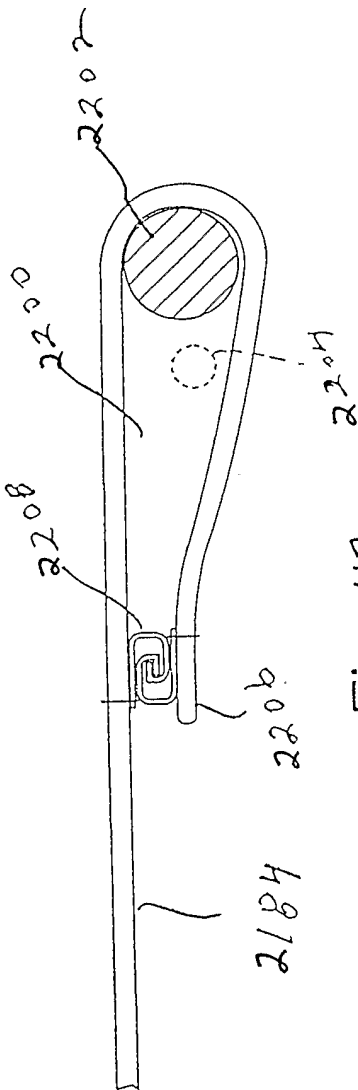


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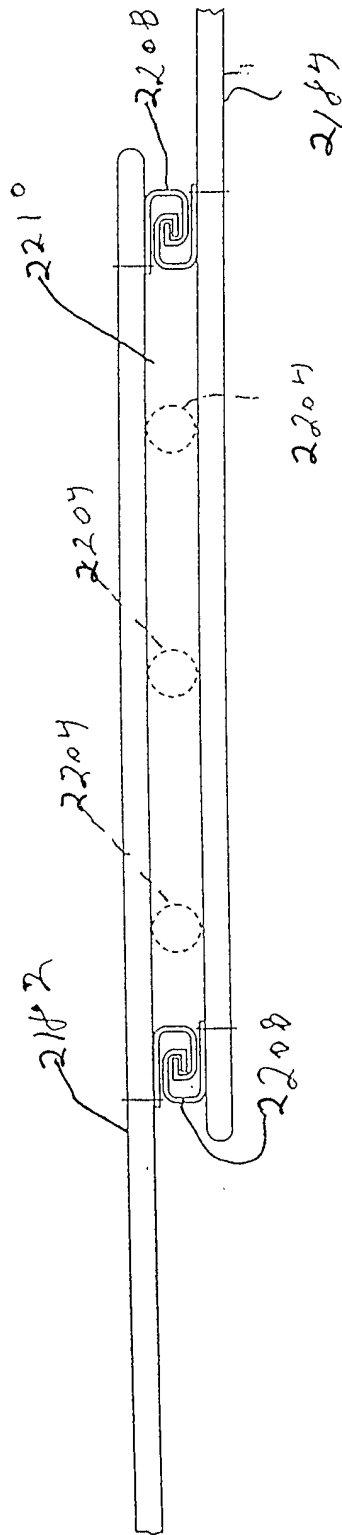


Fig. 44

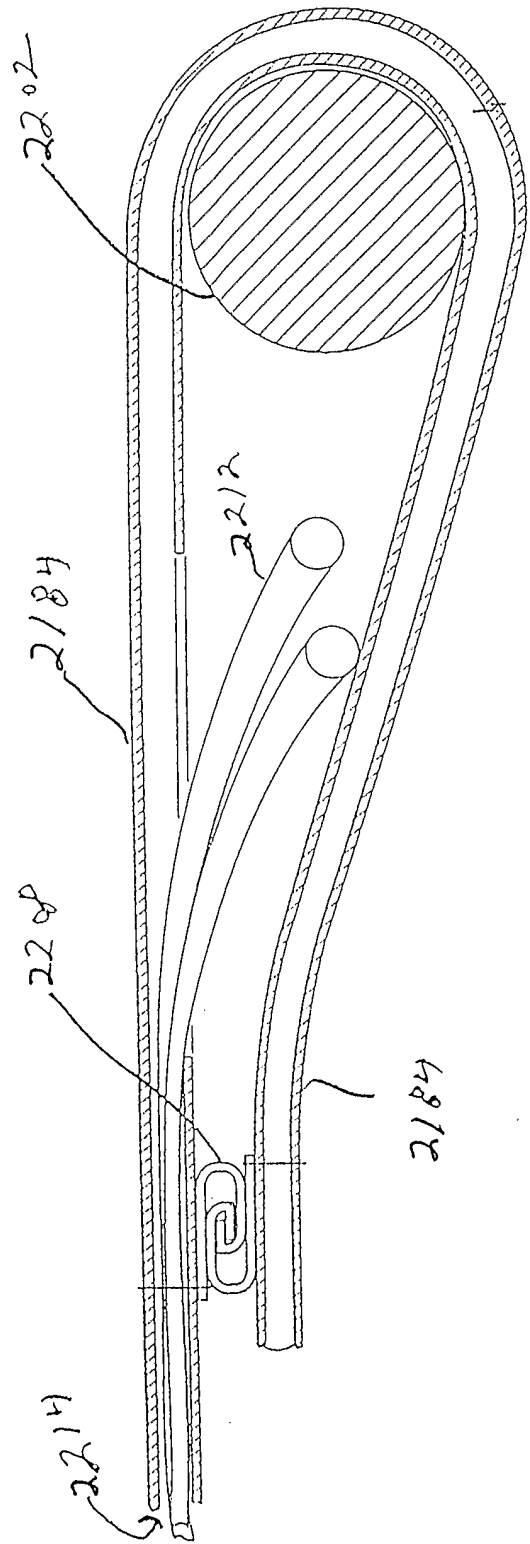


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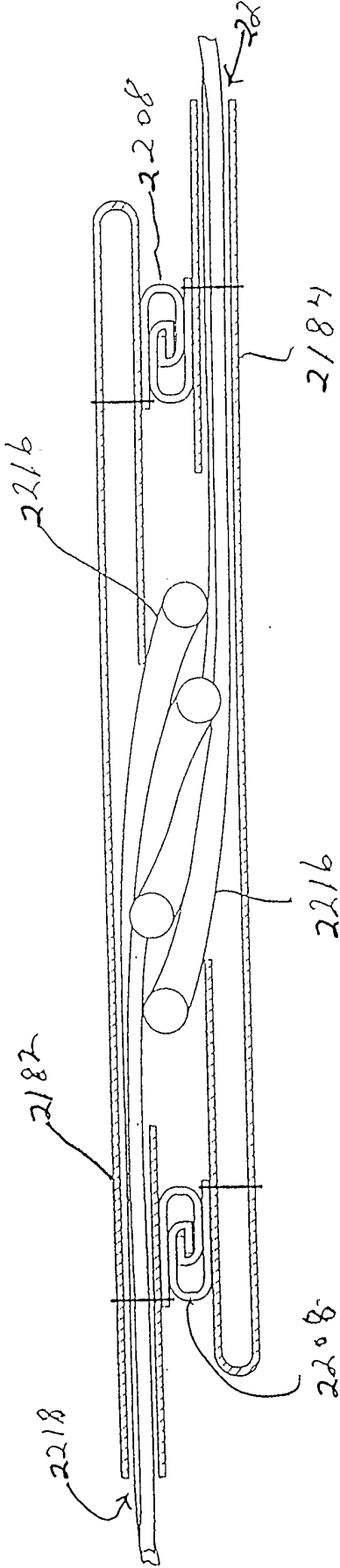


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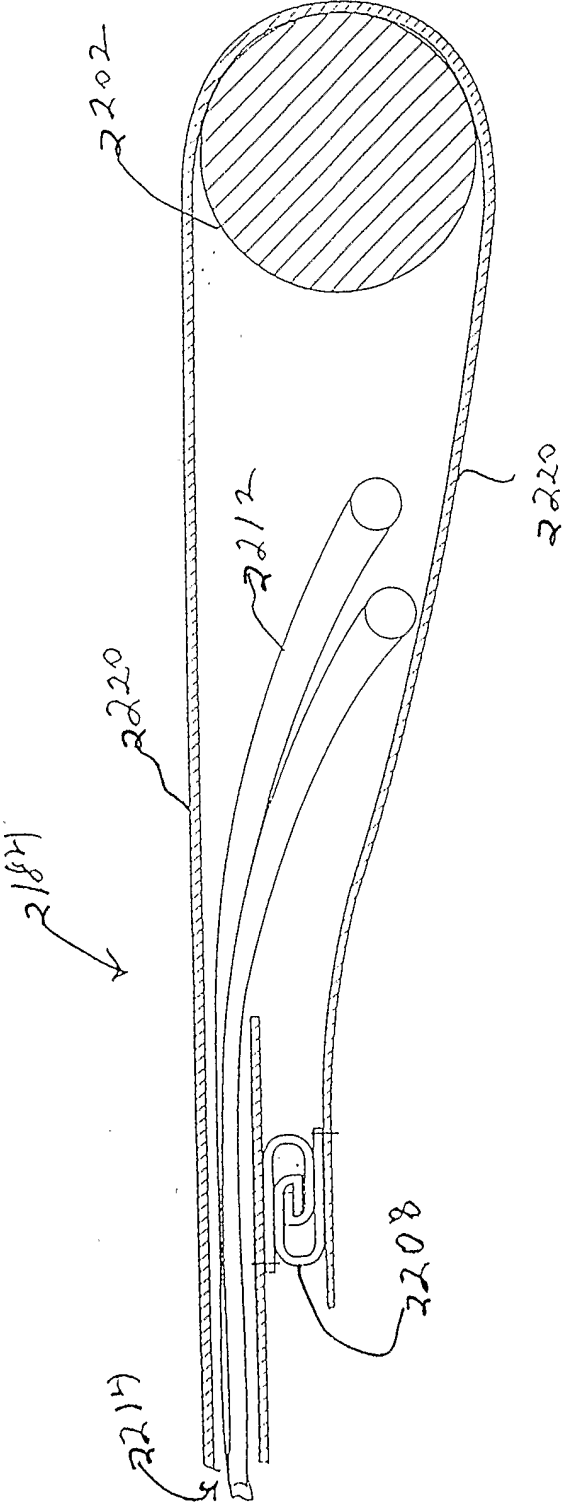
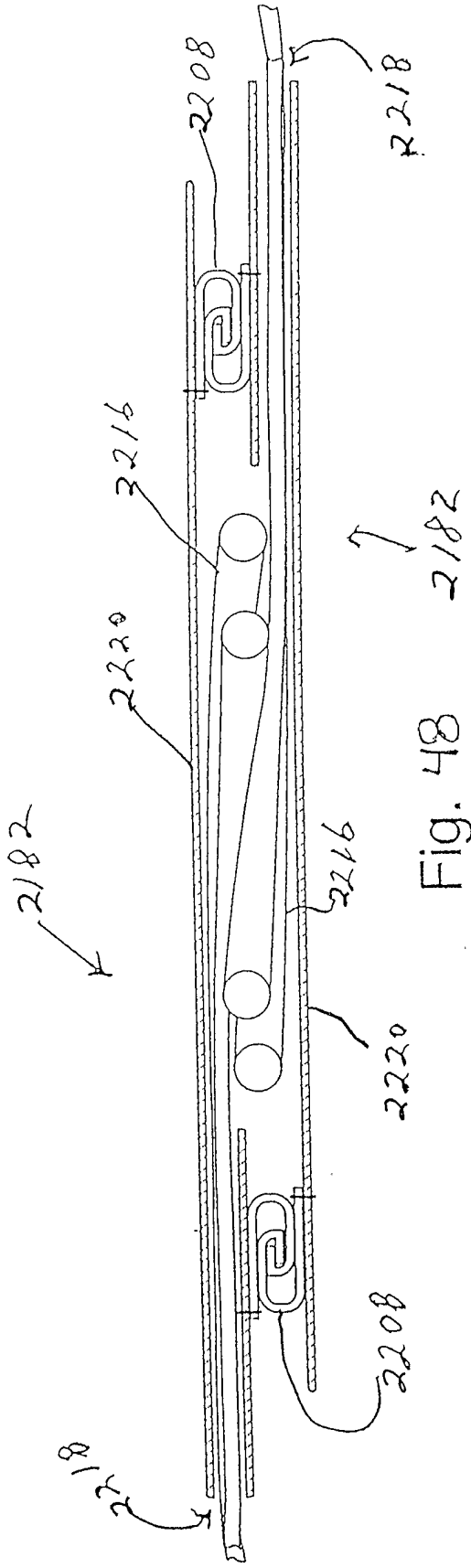
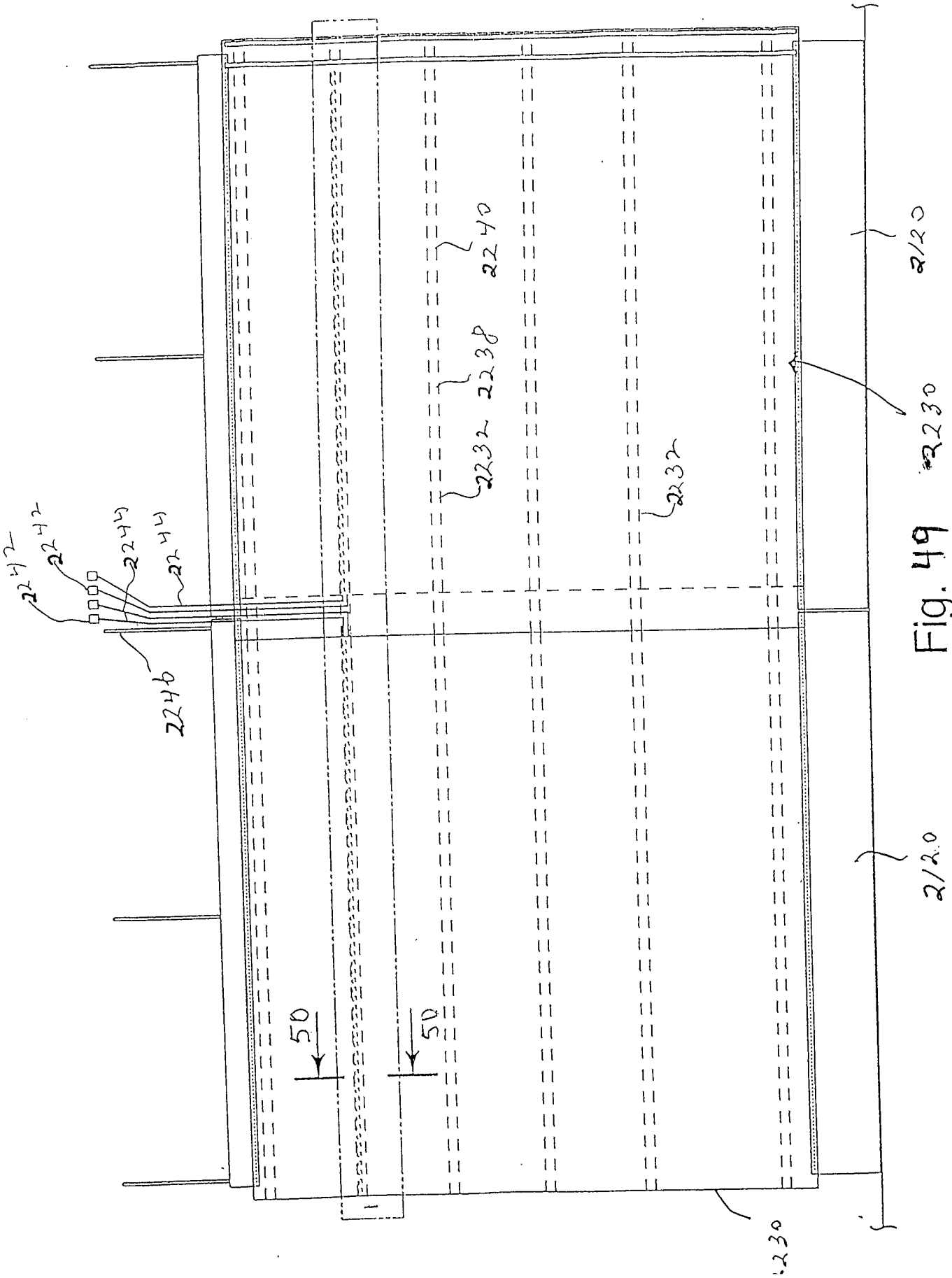


Fig. 47





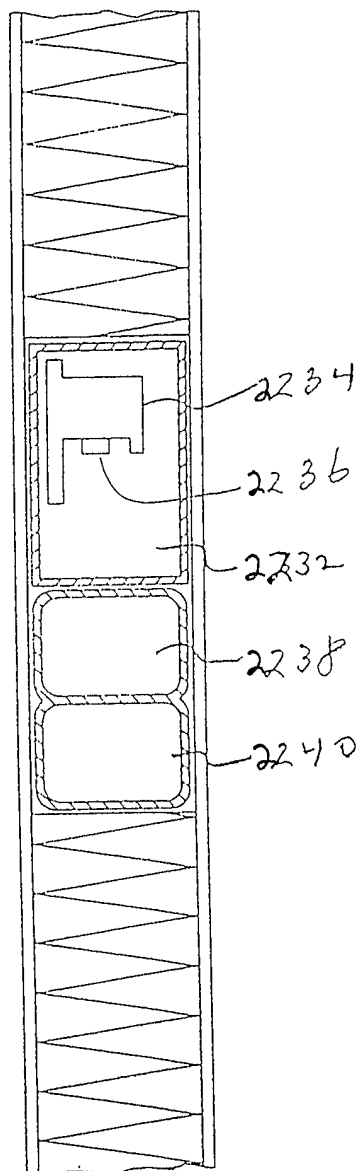
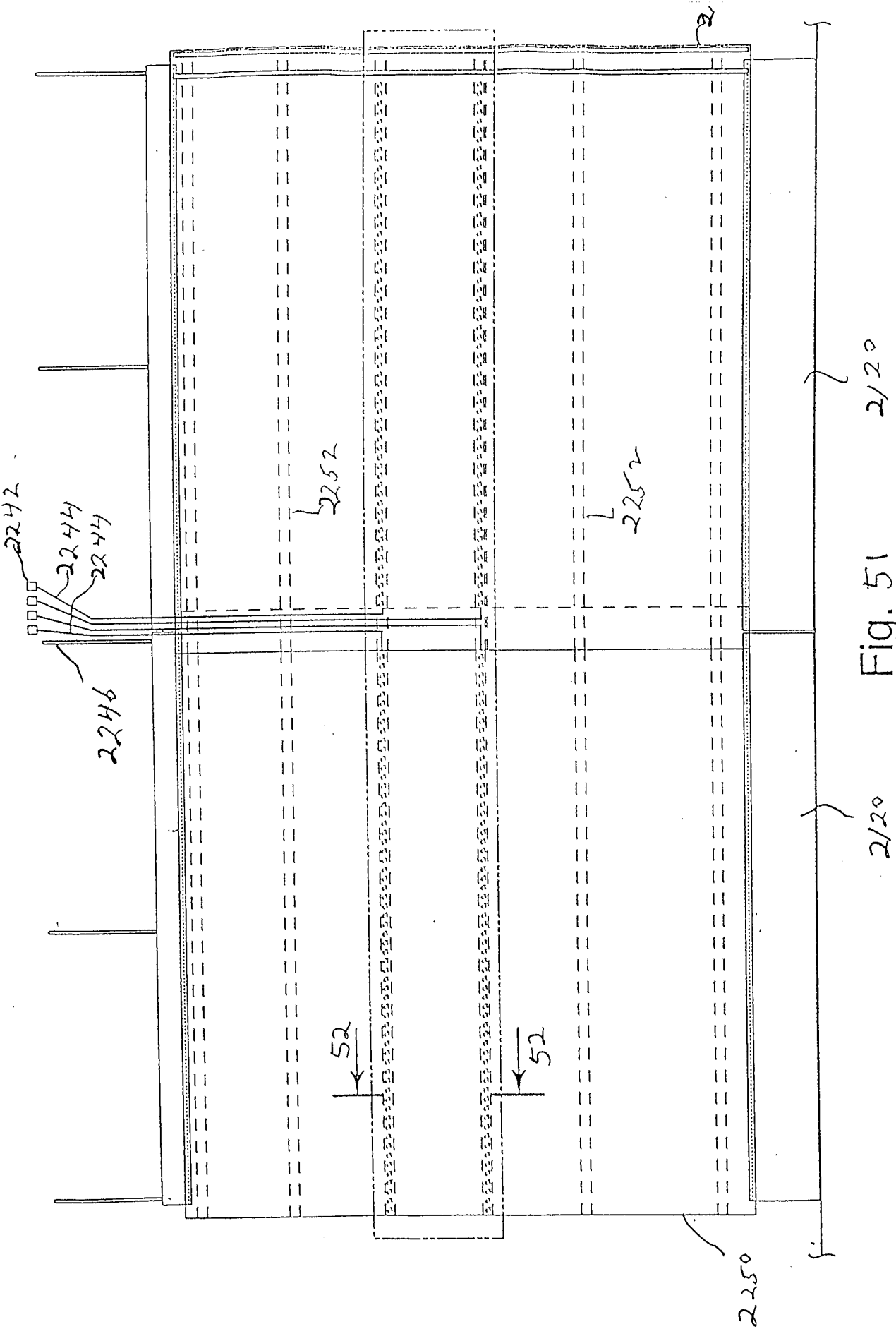


Fig. 50



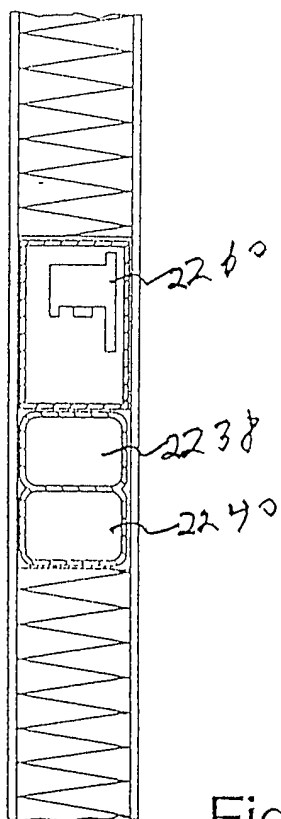
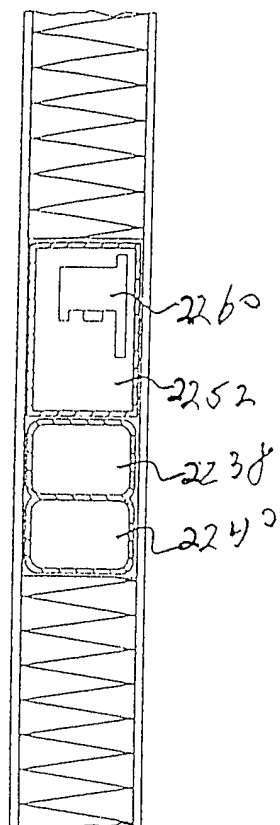


Fig. 52

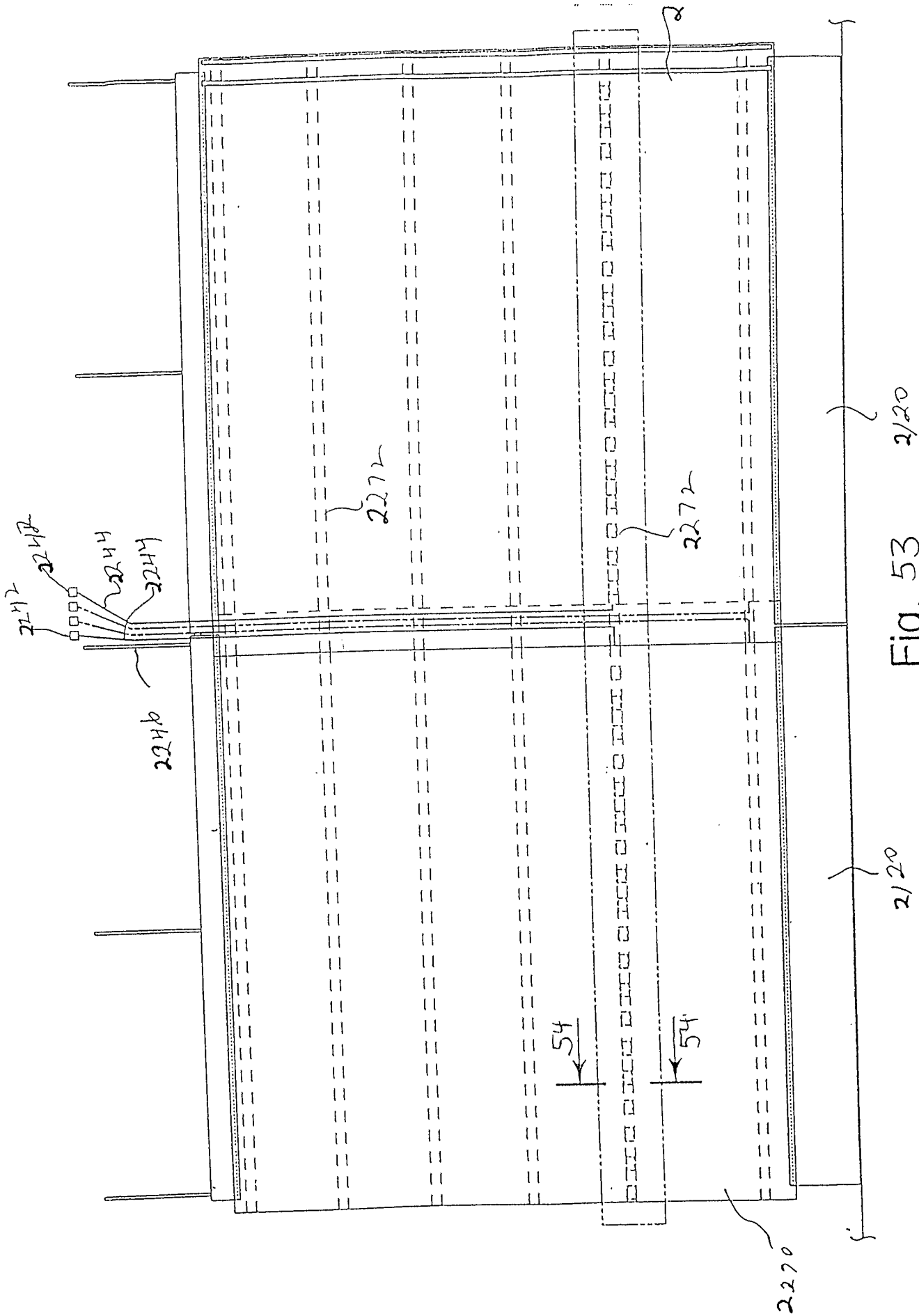


Fig. 53 2120

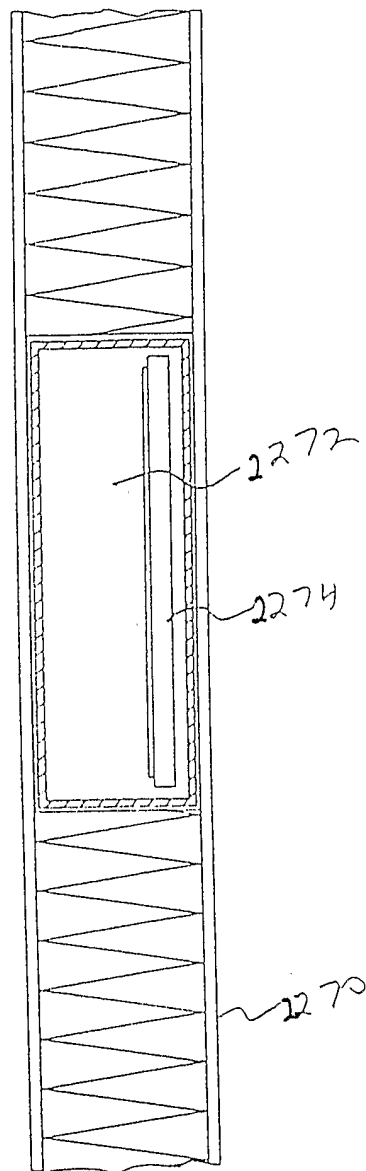


Fig. 54

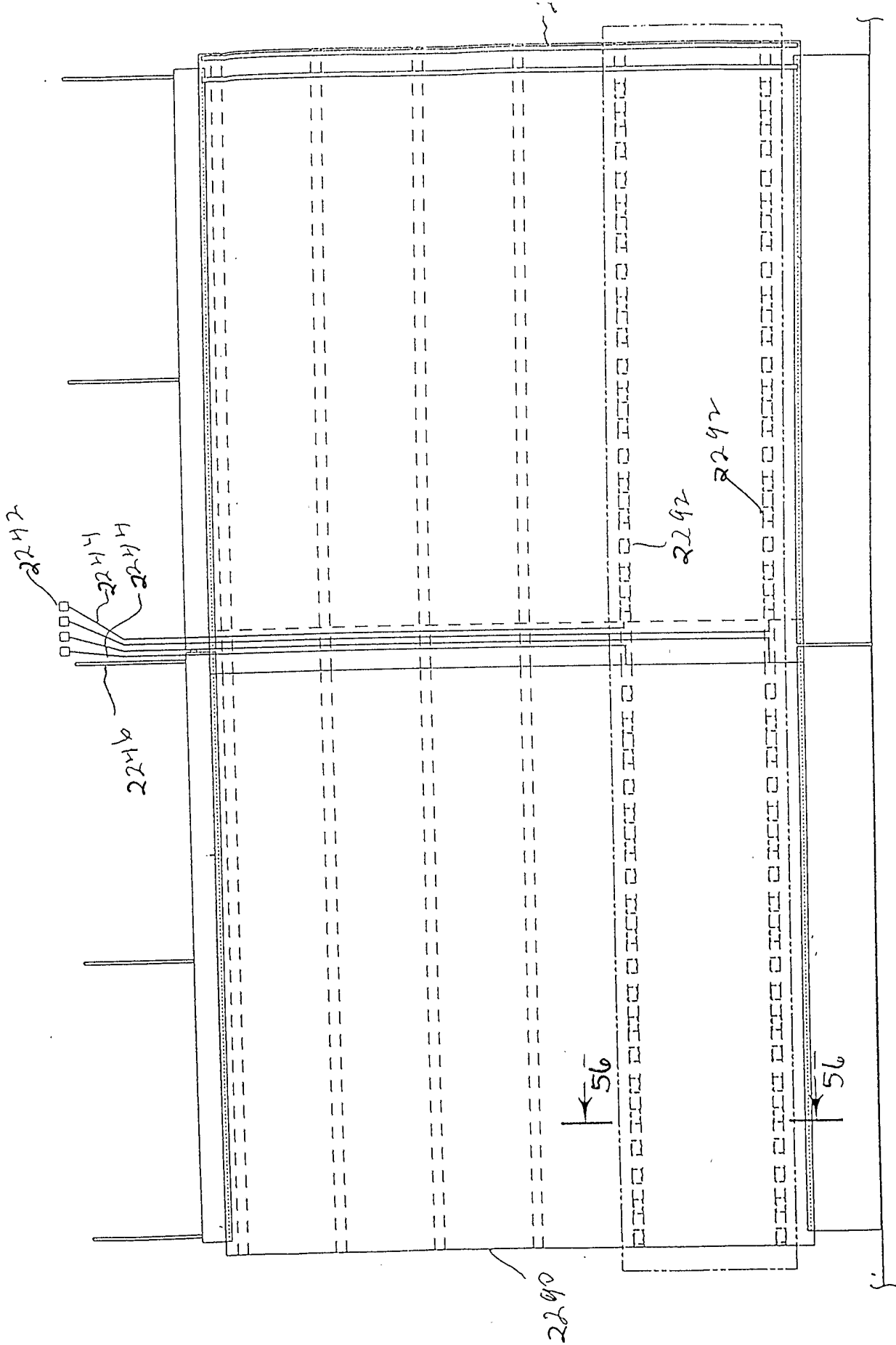


Fig. 55

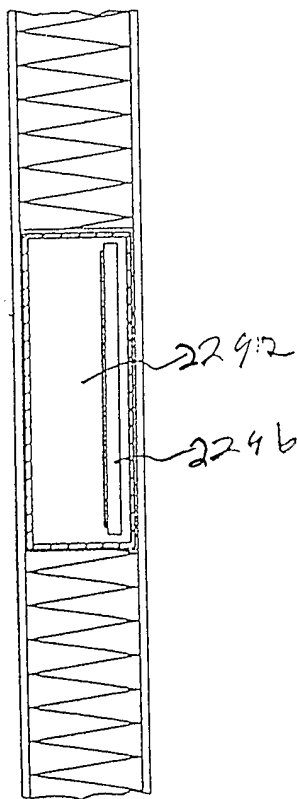
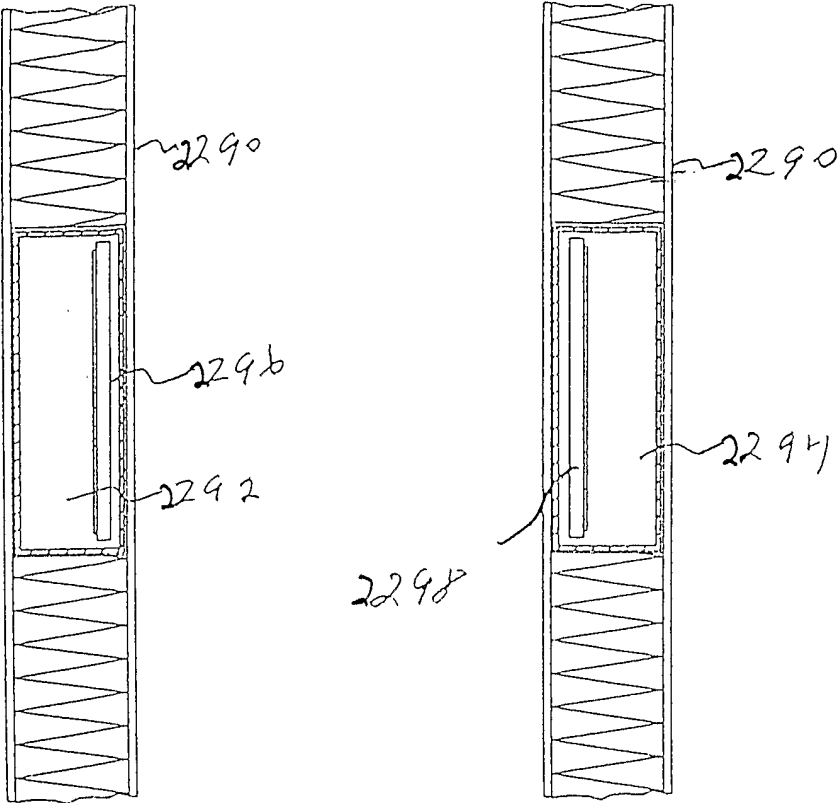


Fig. 56

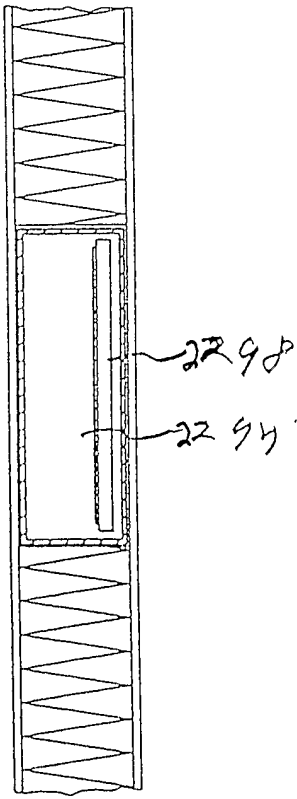
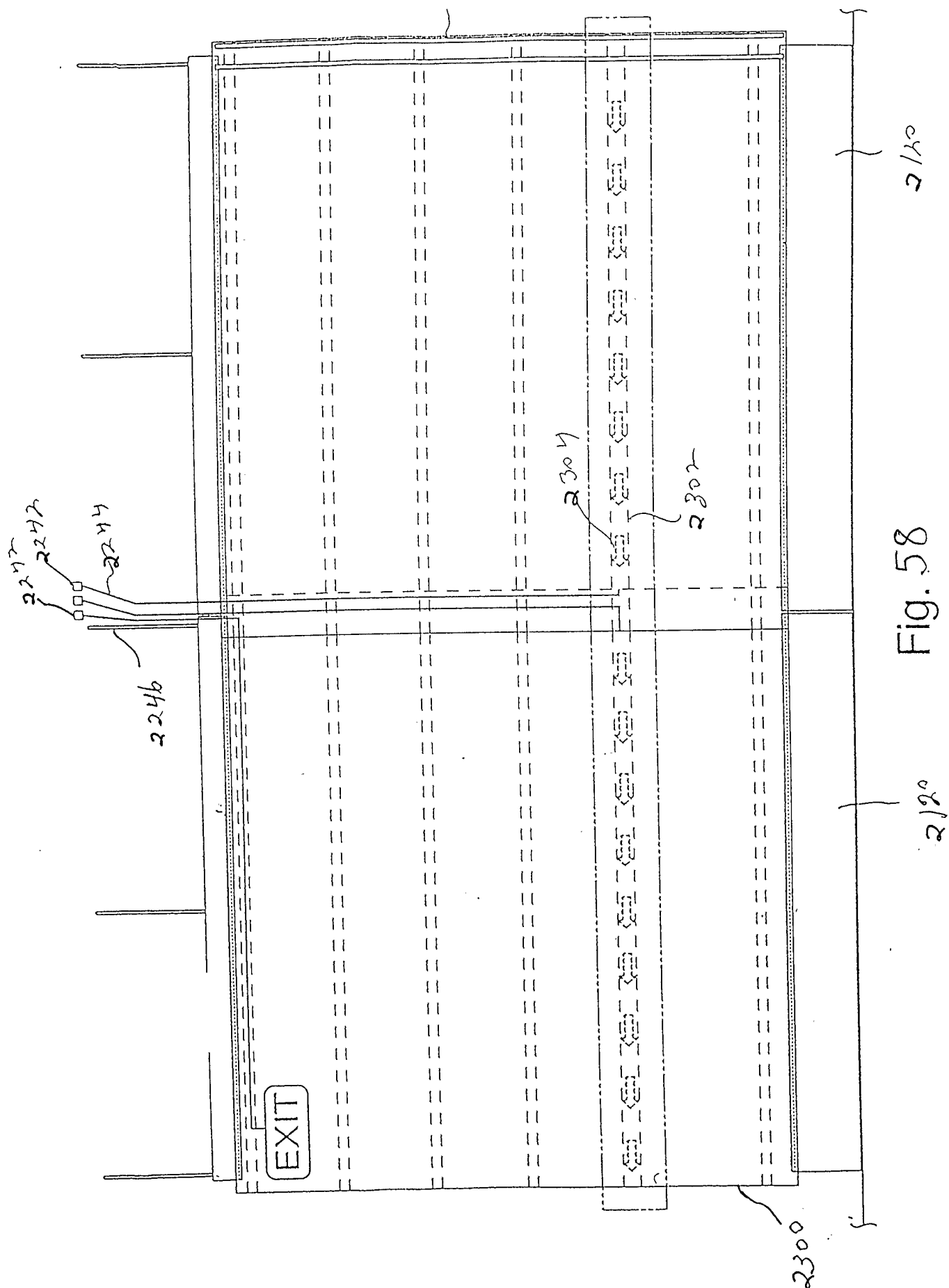
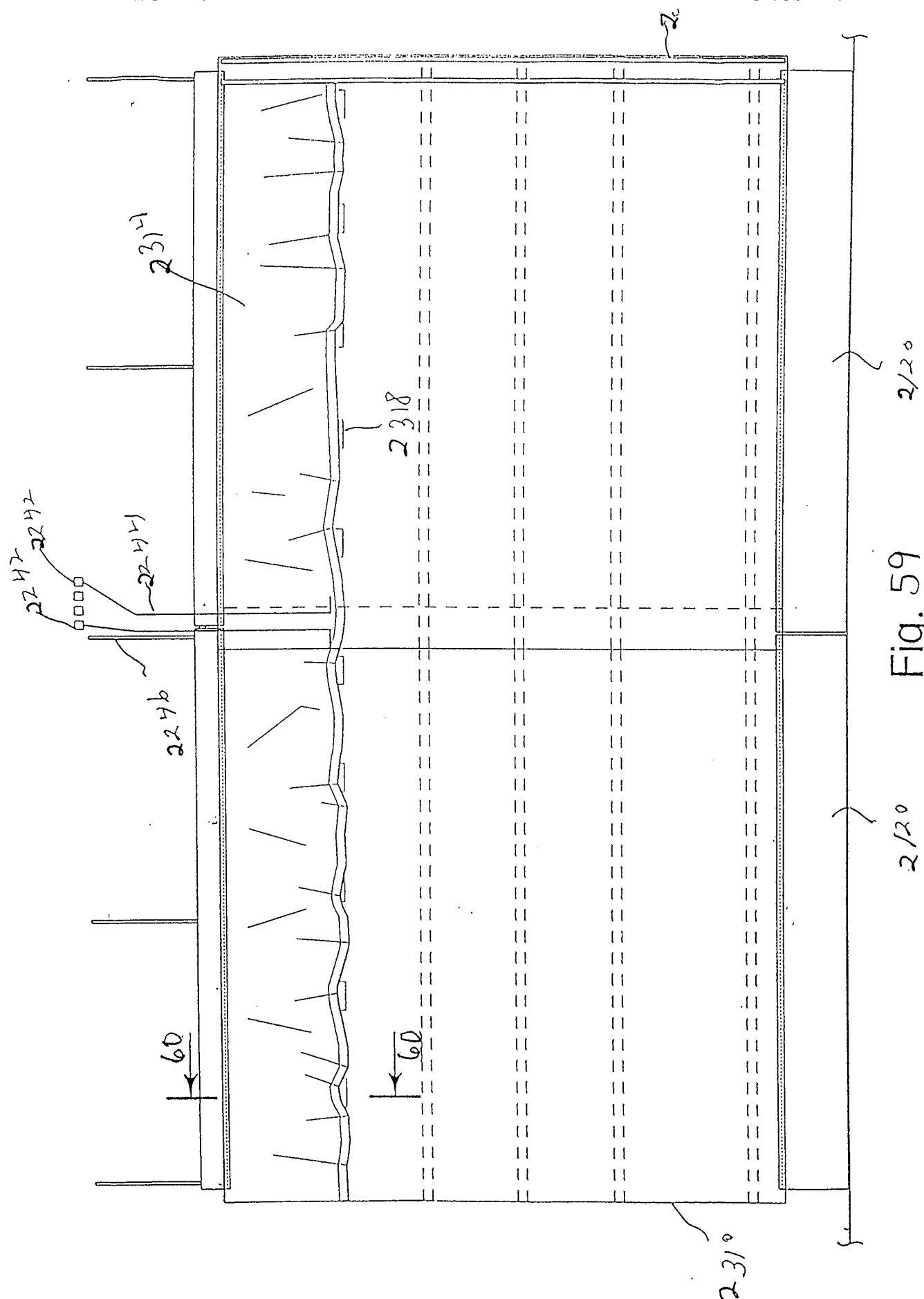


Fig. 57





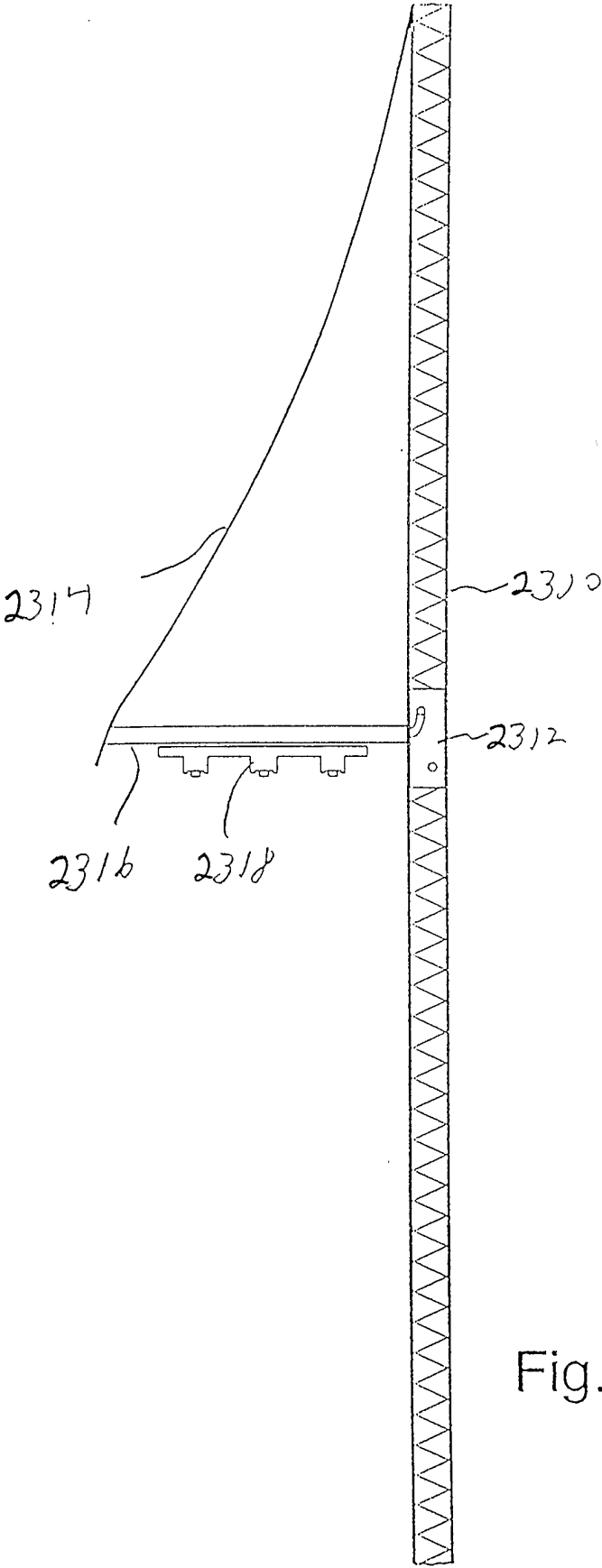


Fig. 60

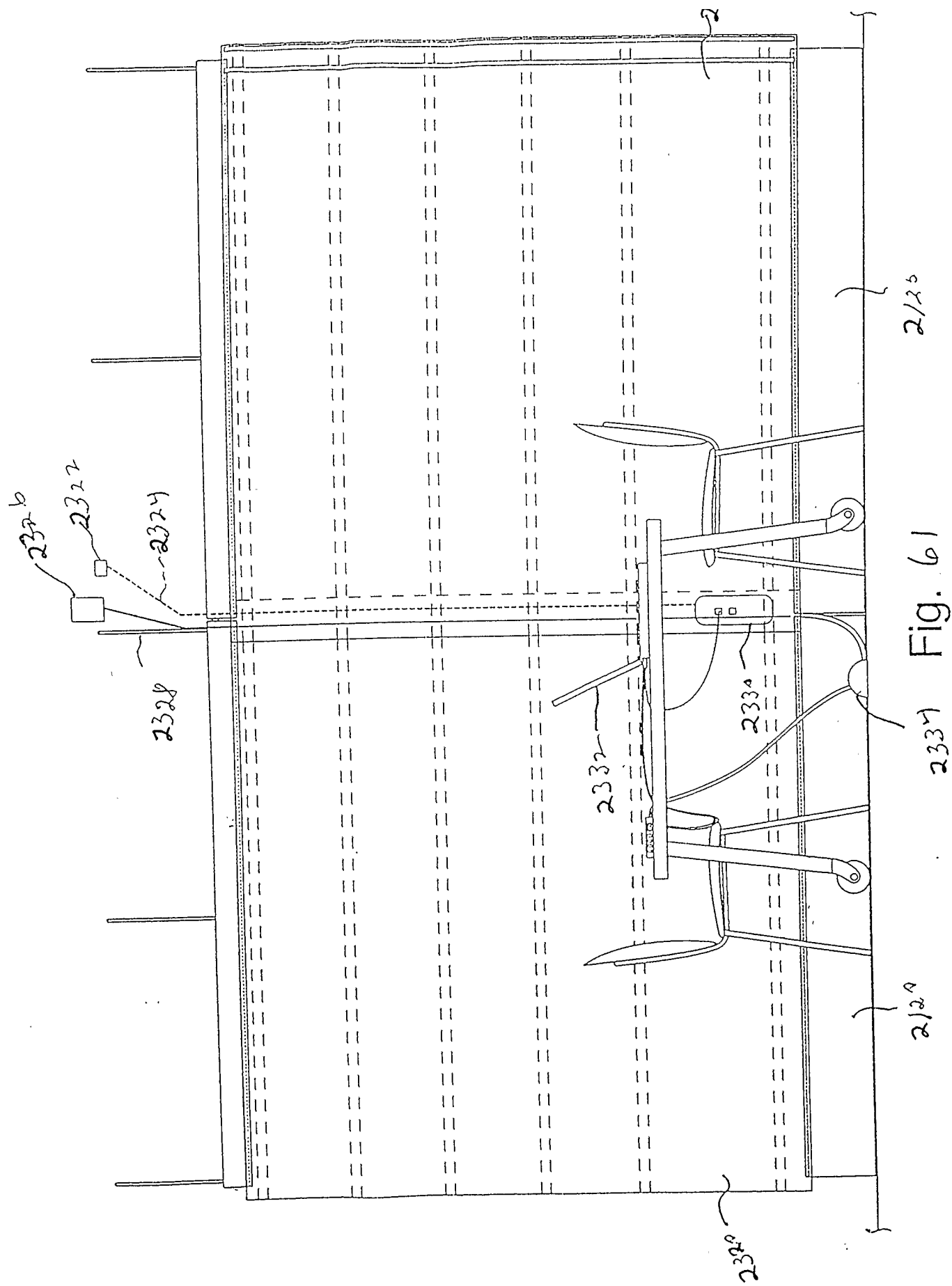


Fig. 61

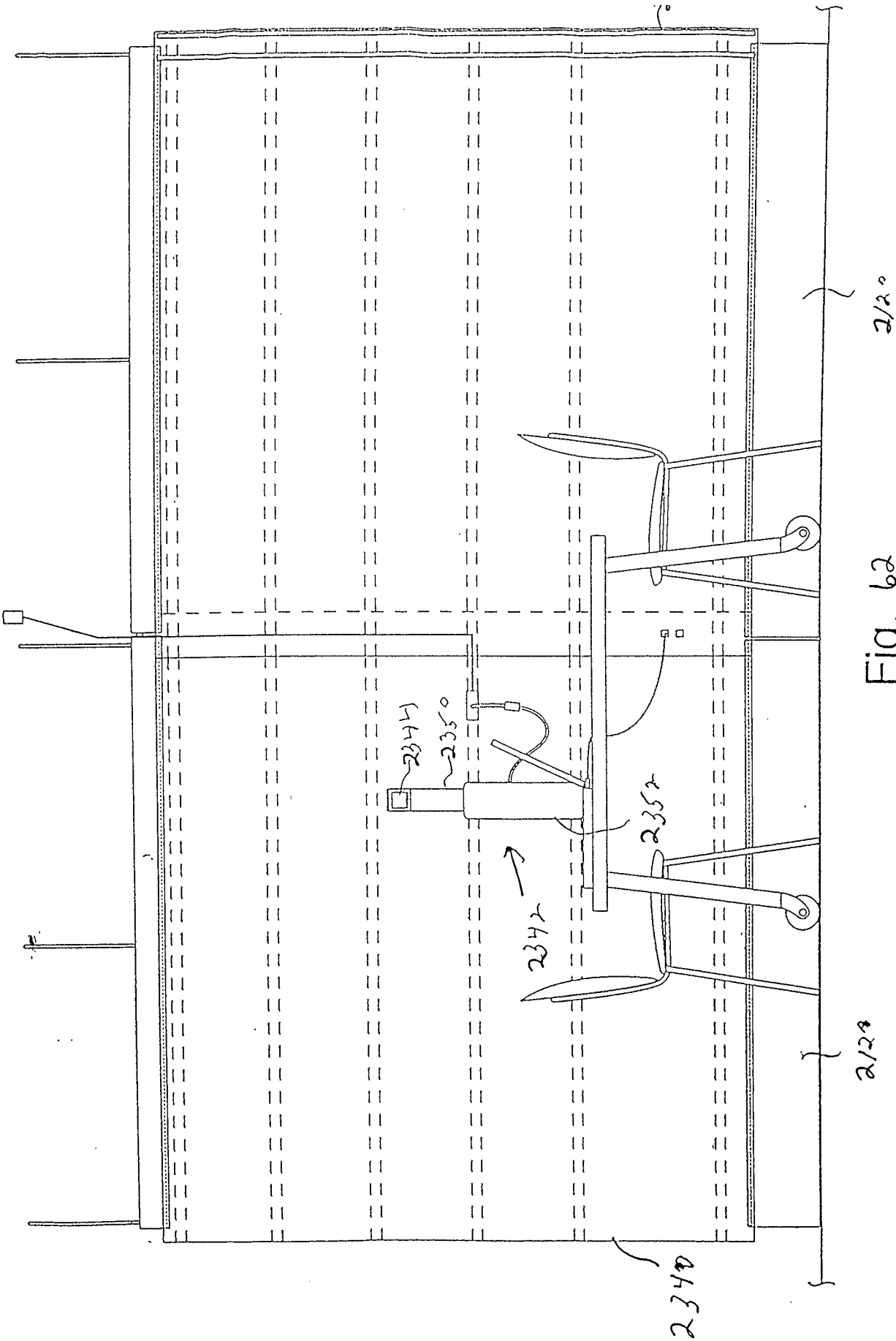


Fig. 62

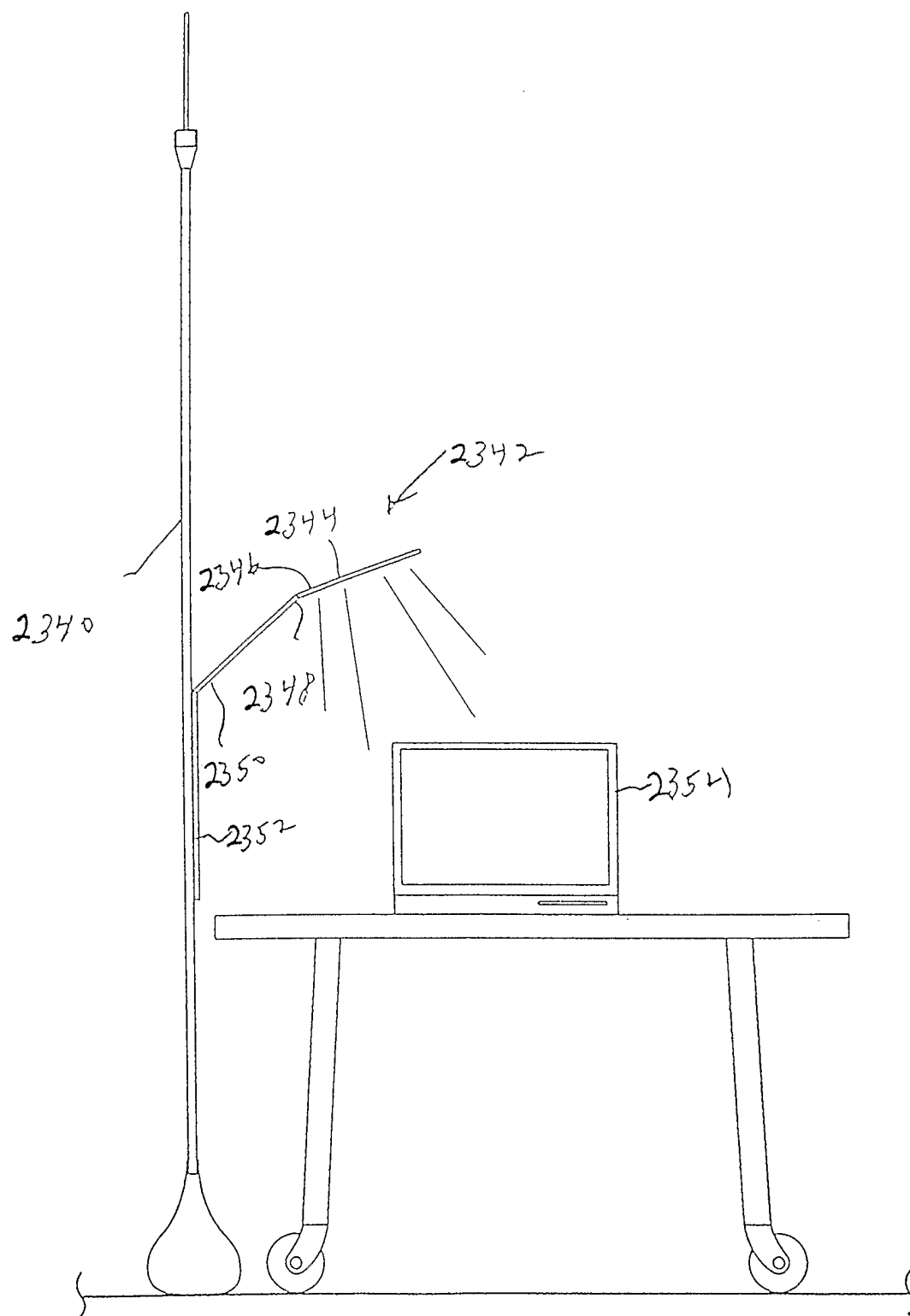


Fig. 63

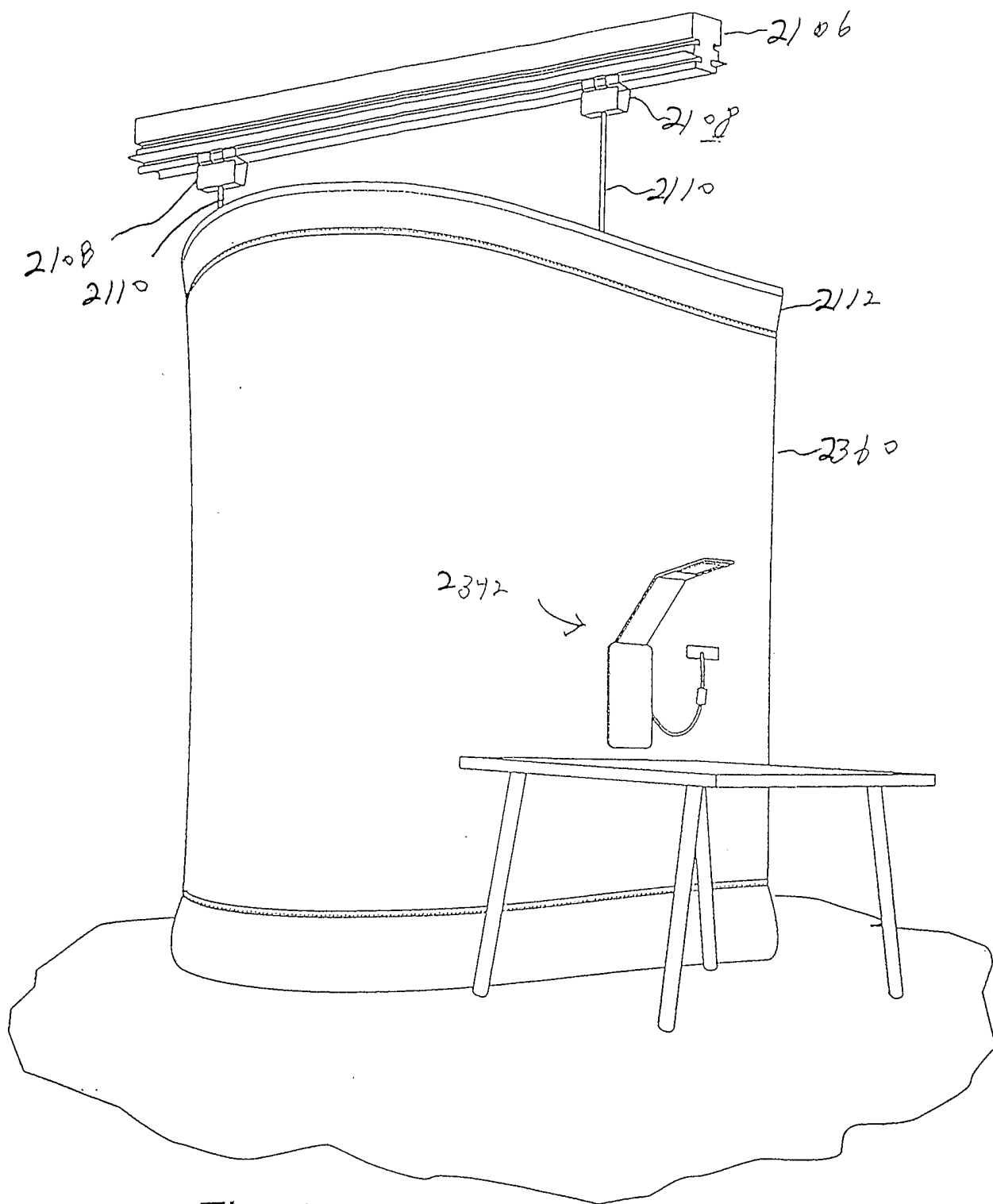


Fig. 64

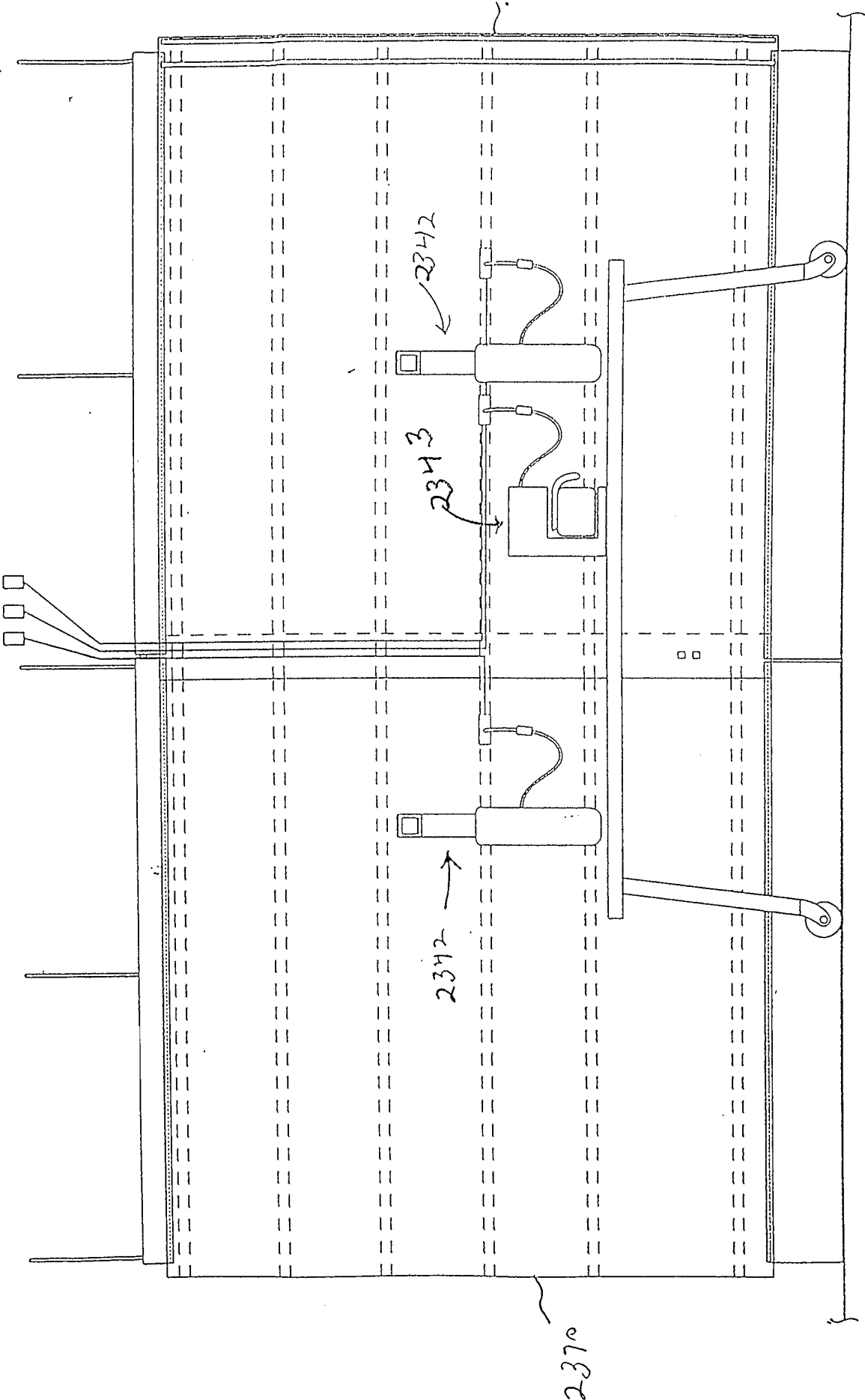
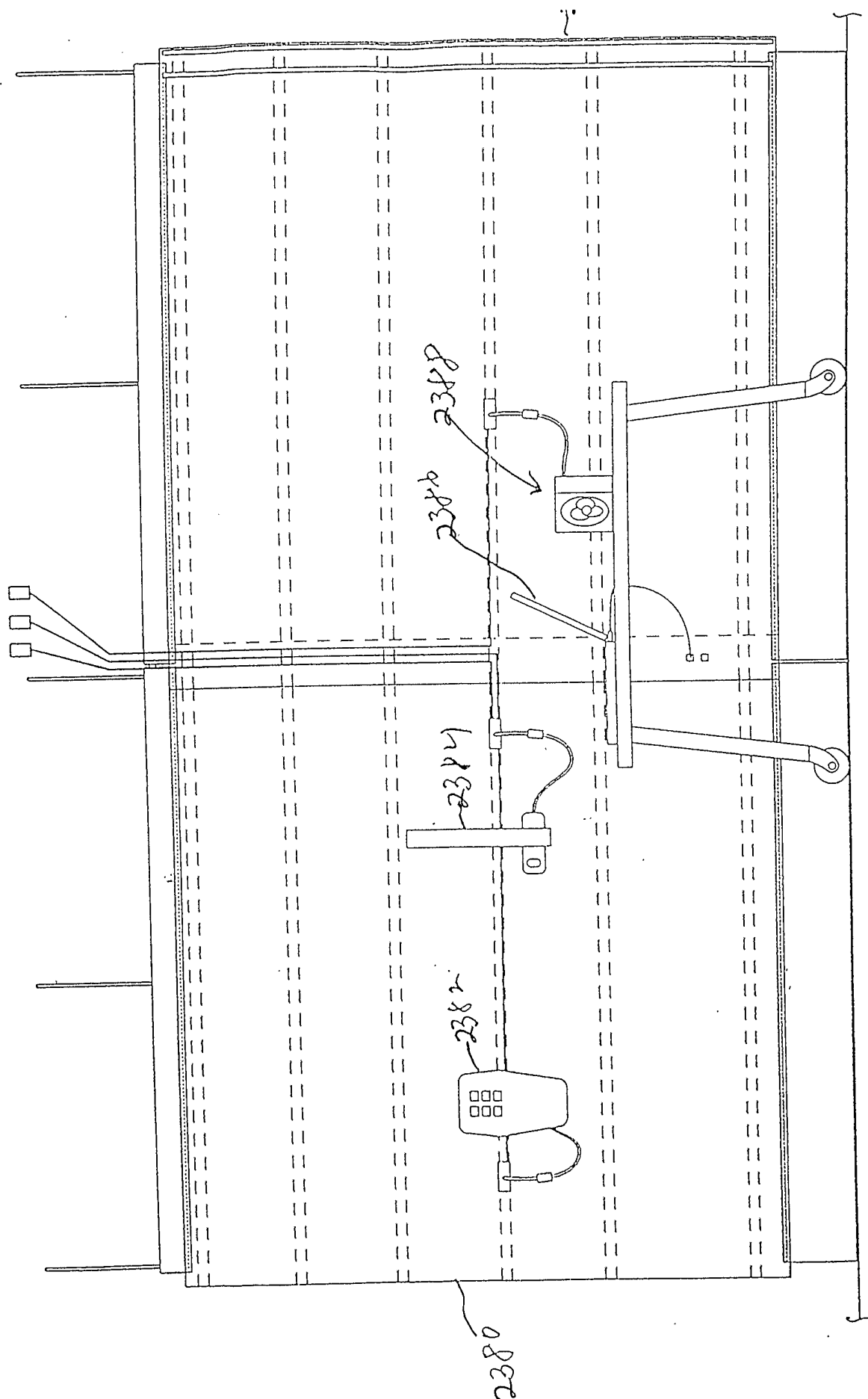


Fig. 65



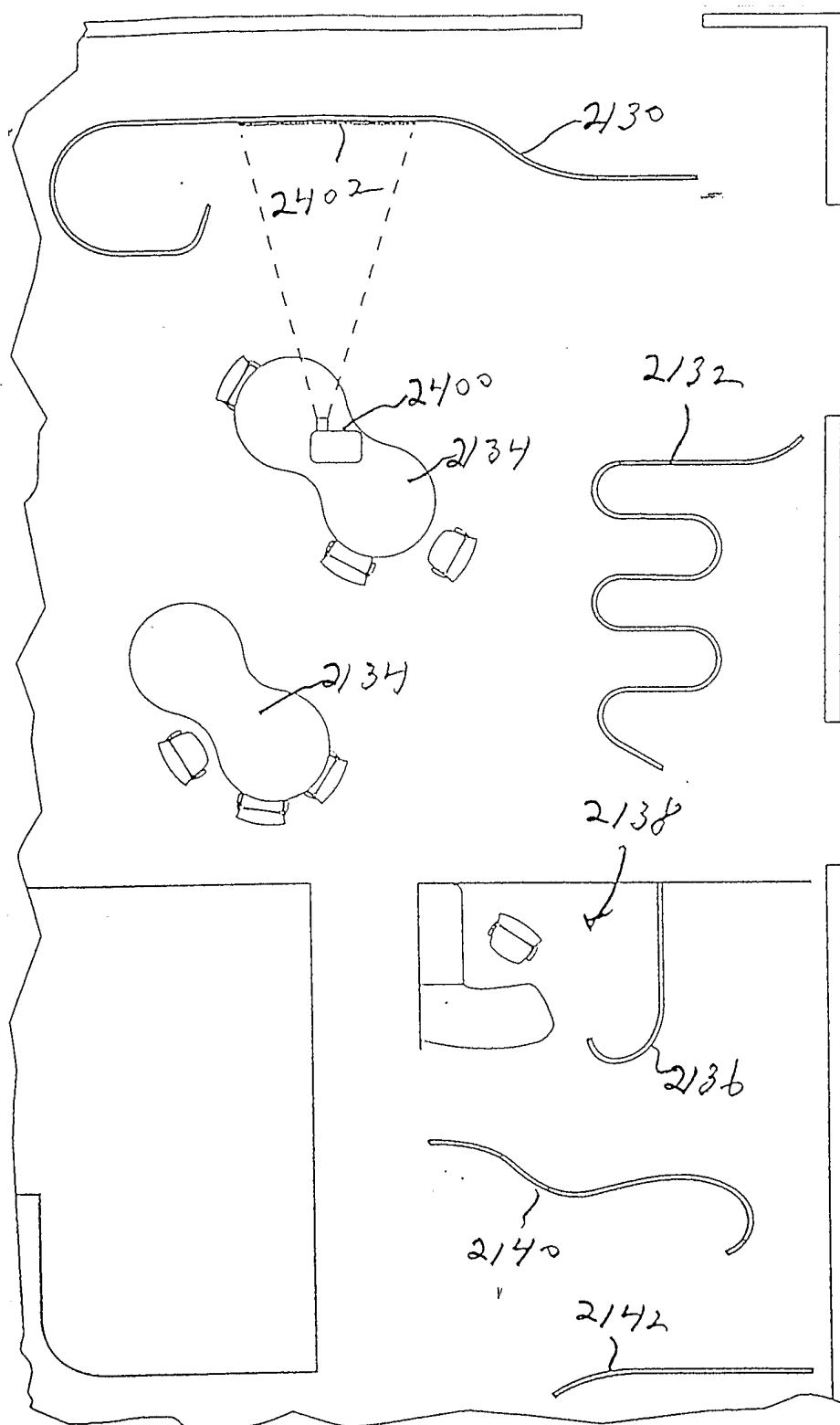


Fig. 68

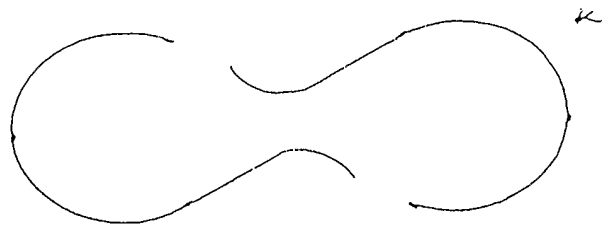


Fig. 69

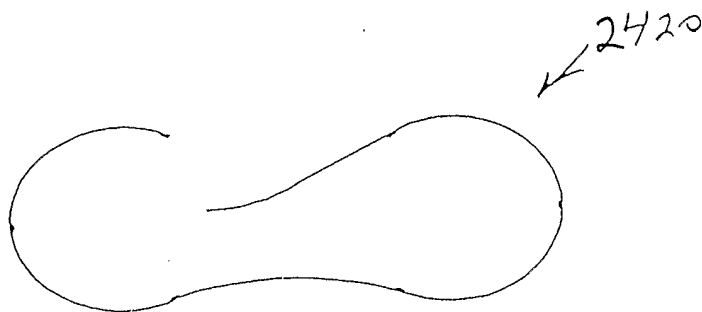


Fig. 70



Fig. 71

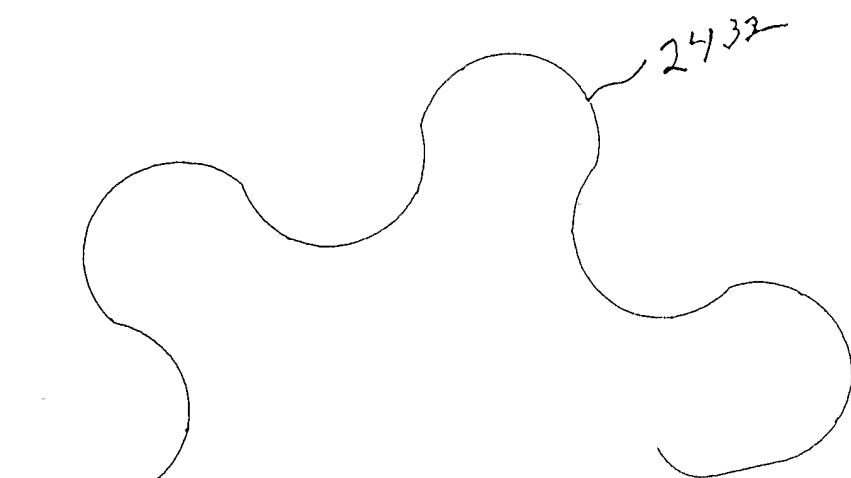


Fig. 72

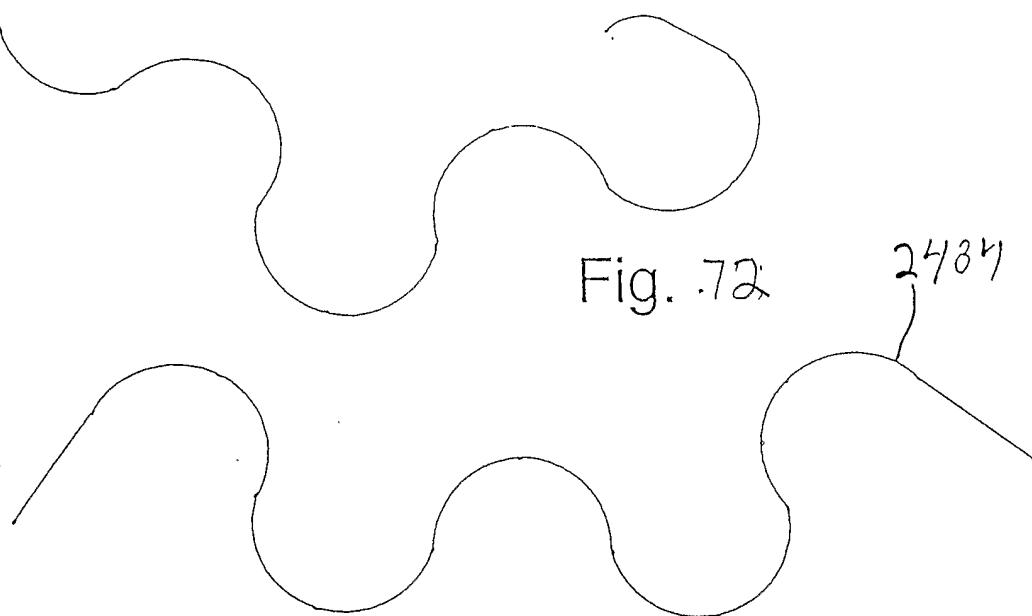
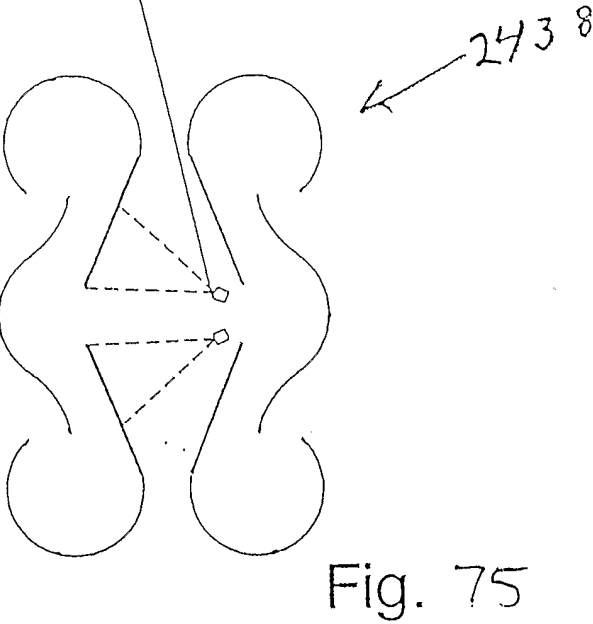
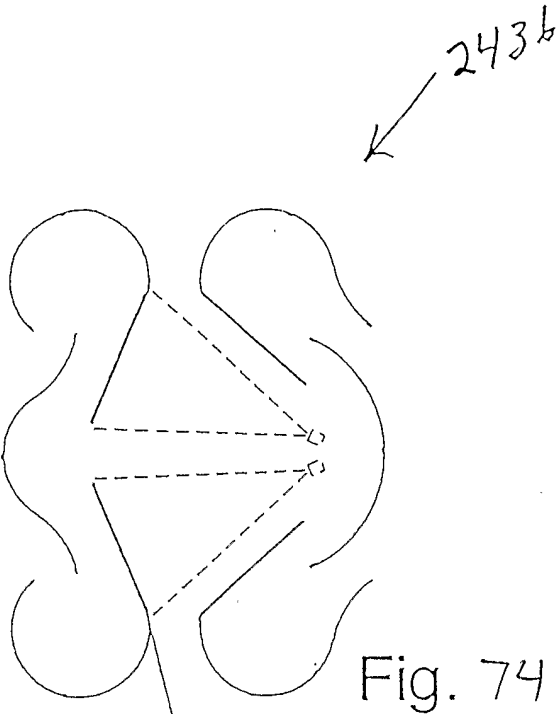
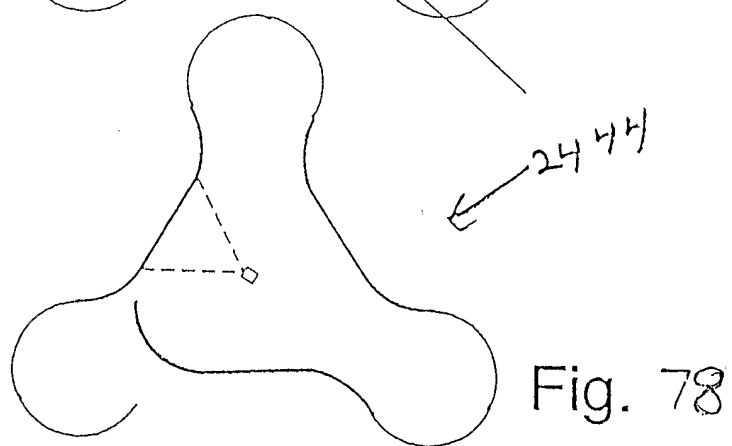
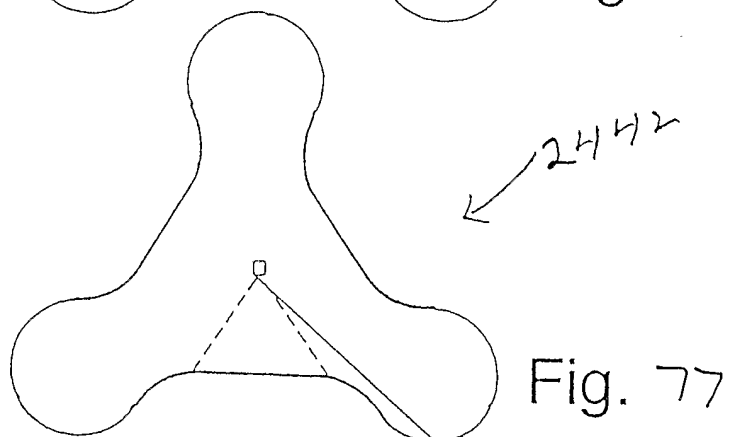
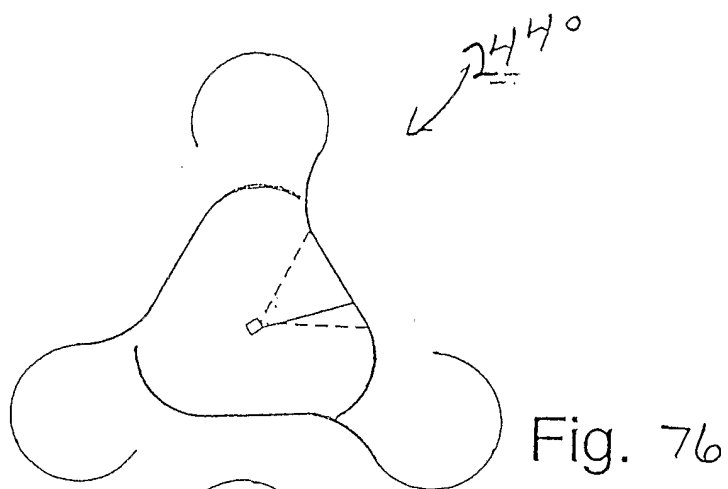


Fig. 73





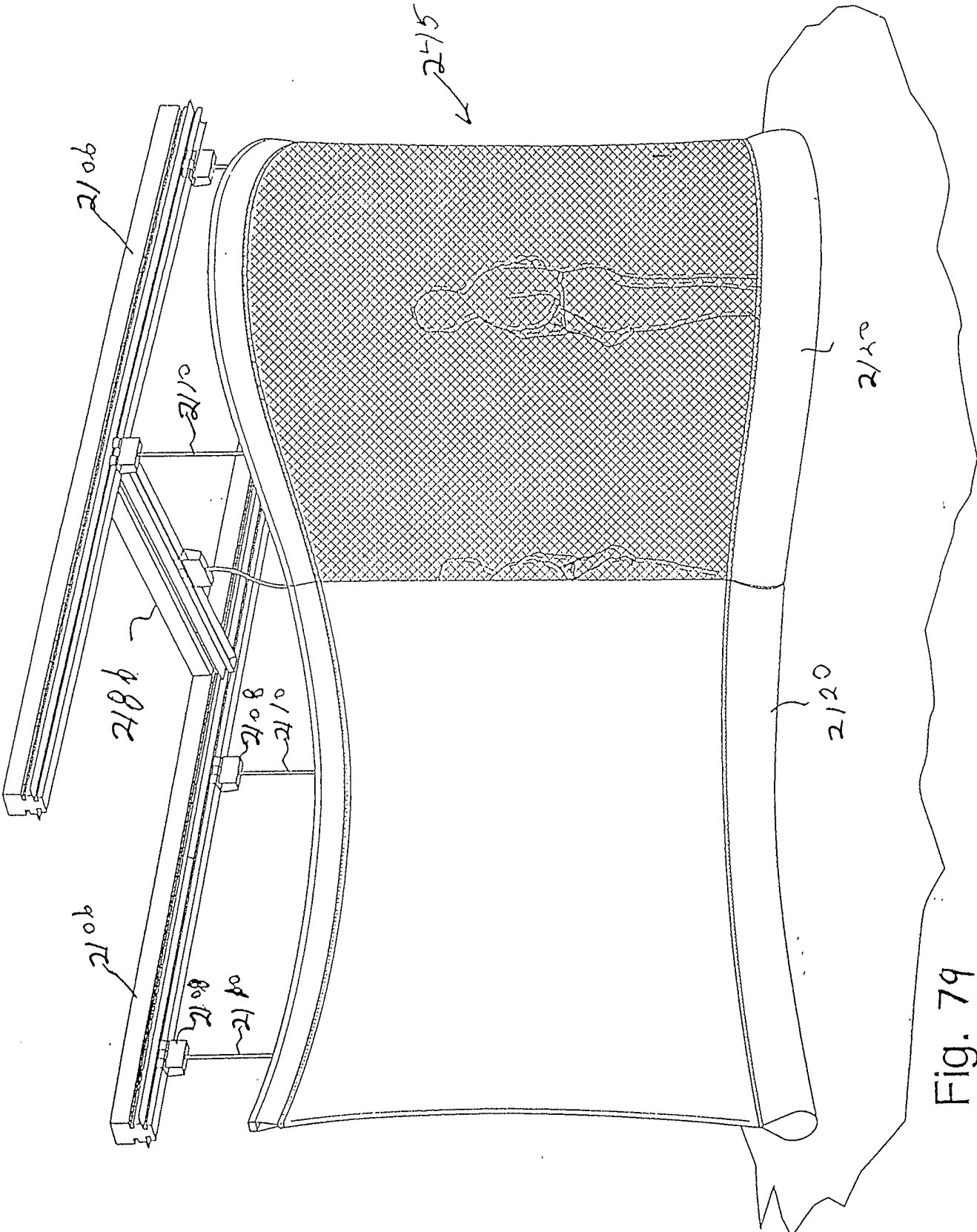


Fig. 79

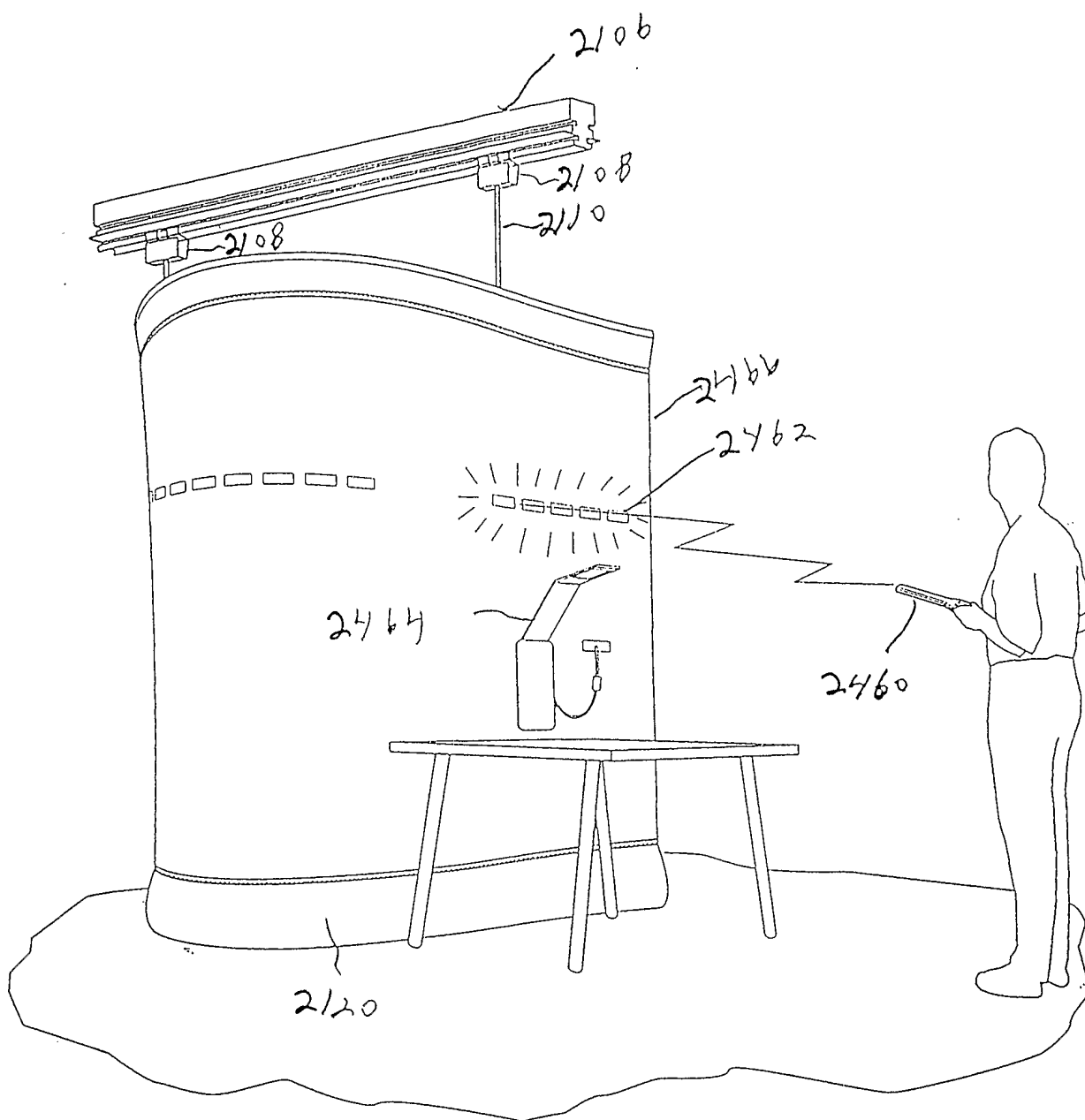


Fig. 80

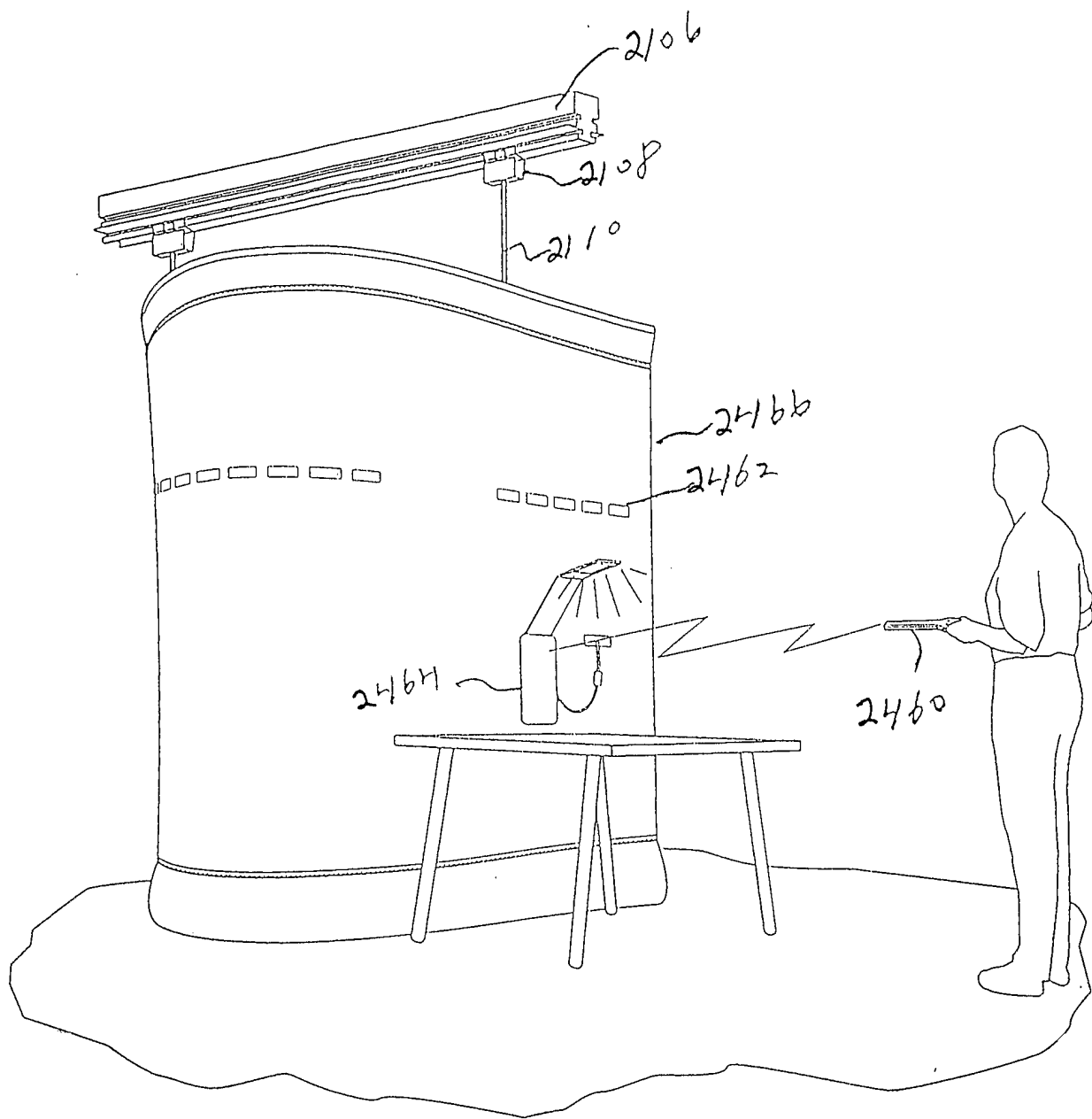


Fig. 81

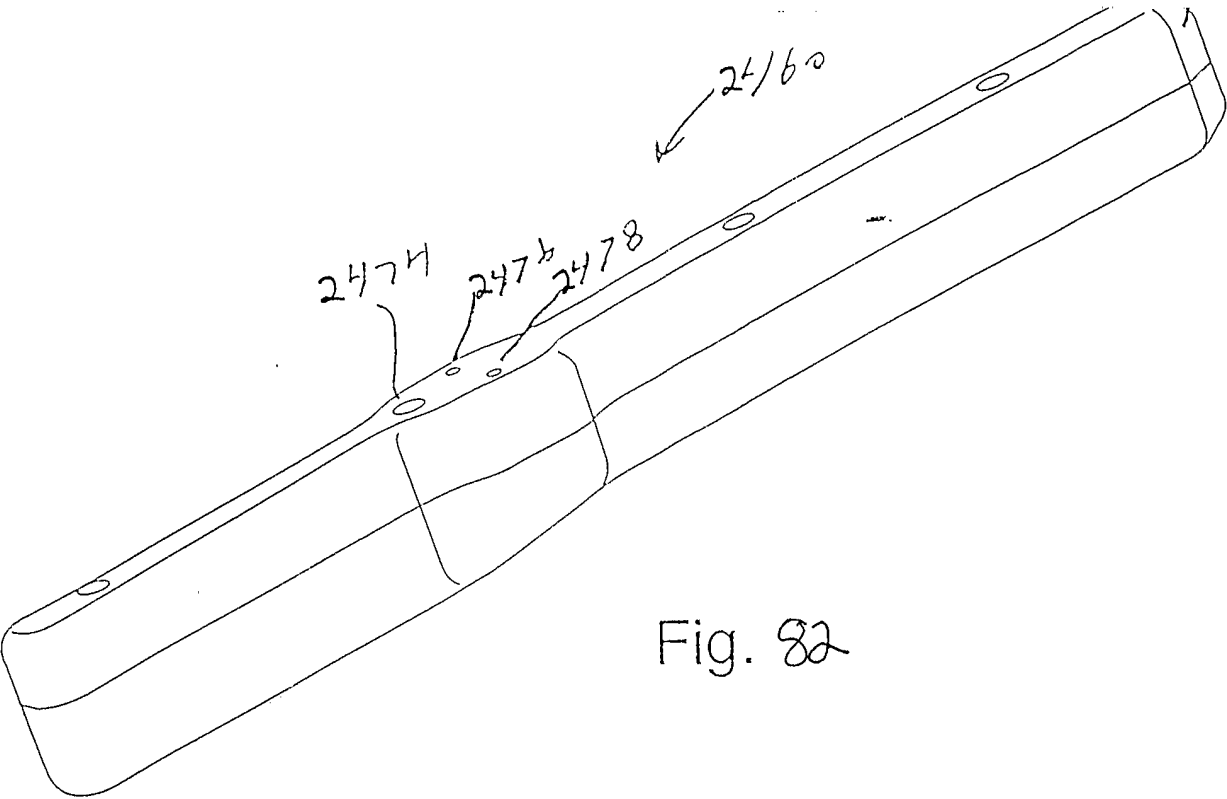


Fig. 82

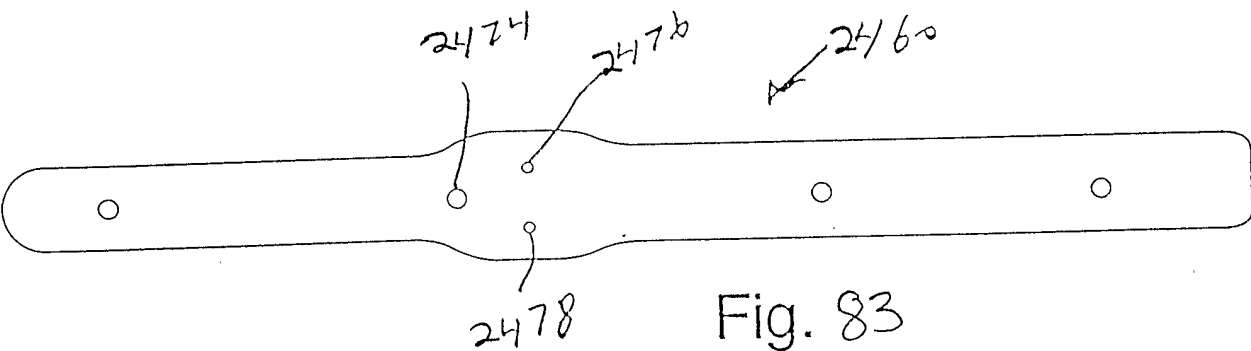


Fig. 83

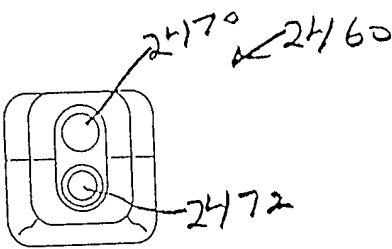


Fig. 84

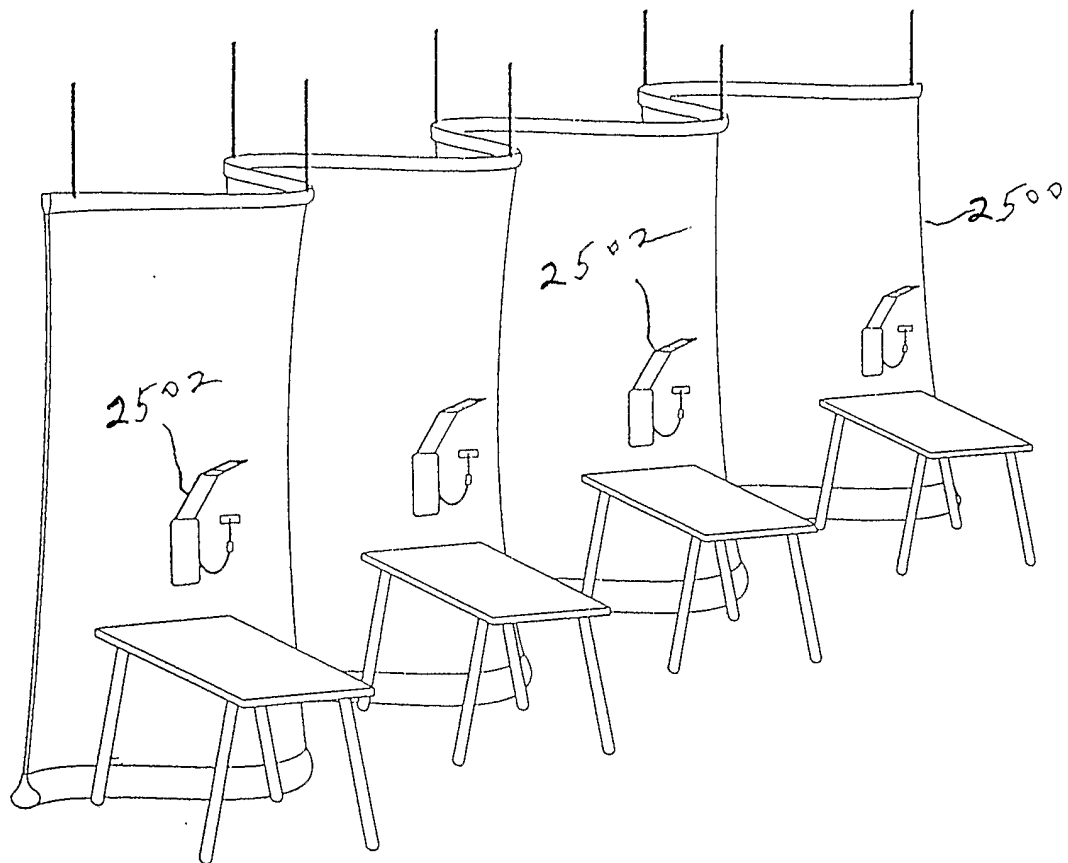


Fig. 85

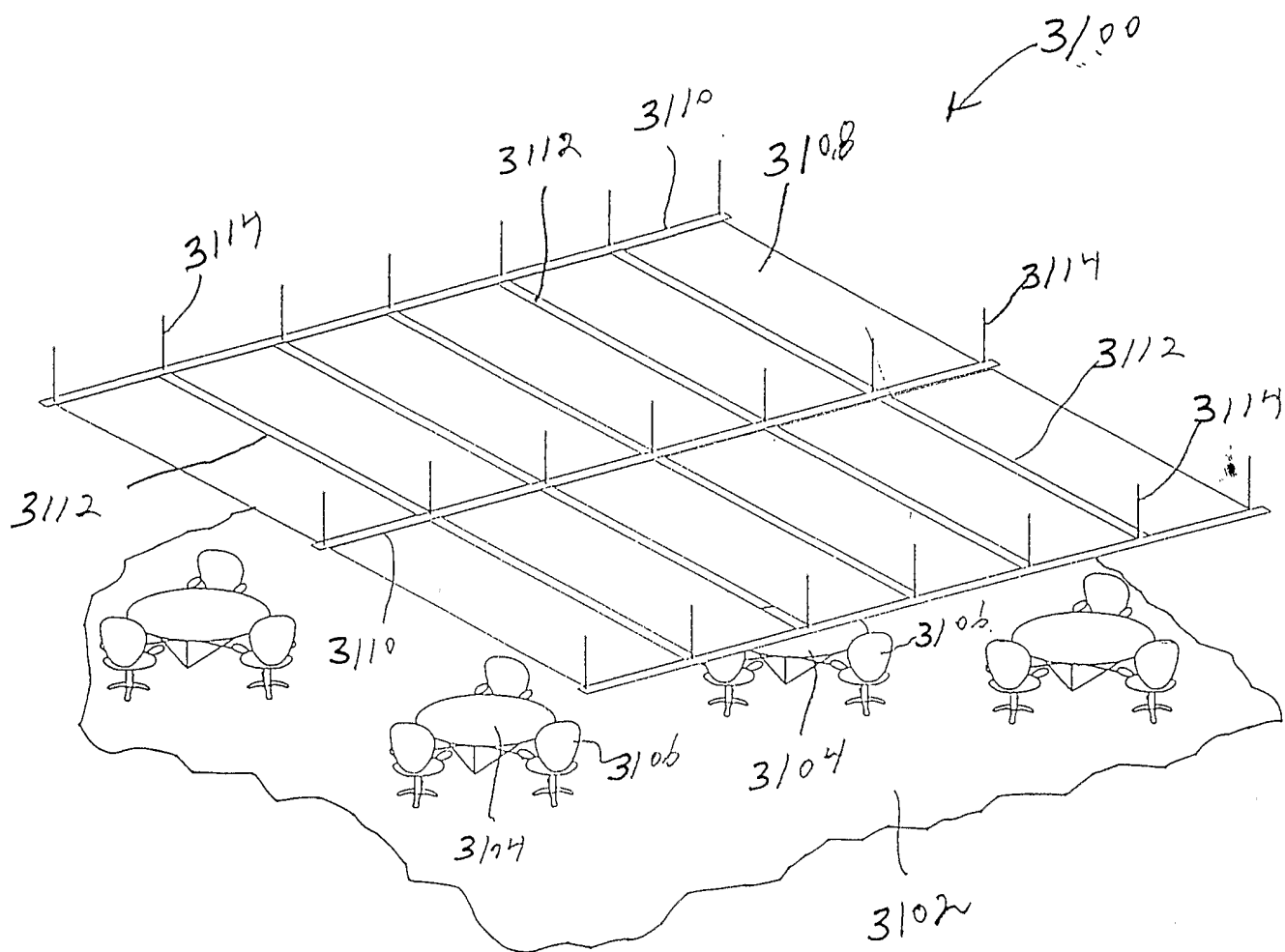


Fig. 86

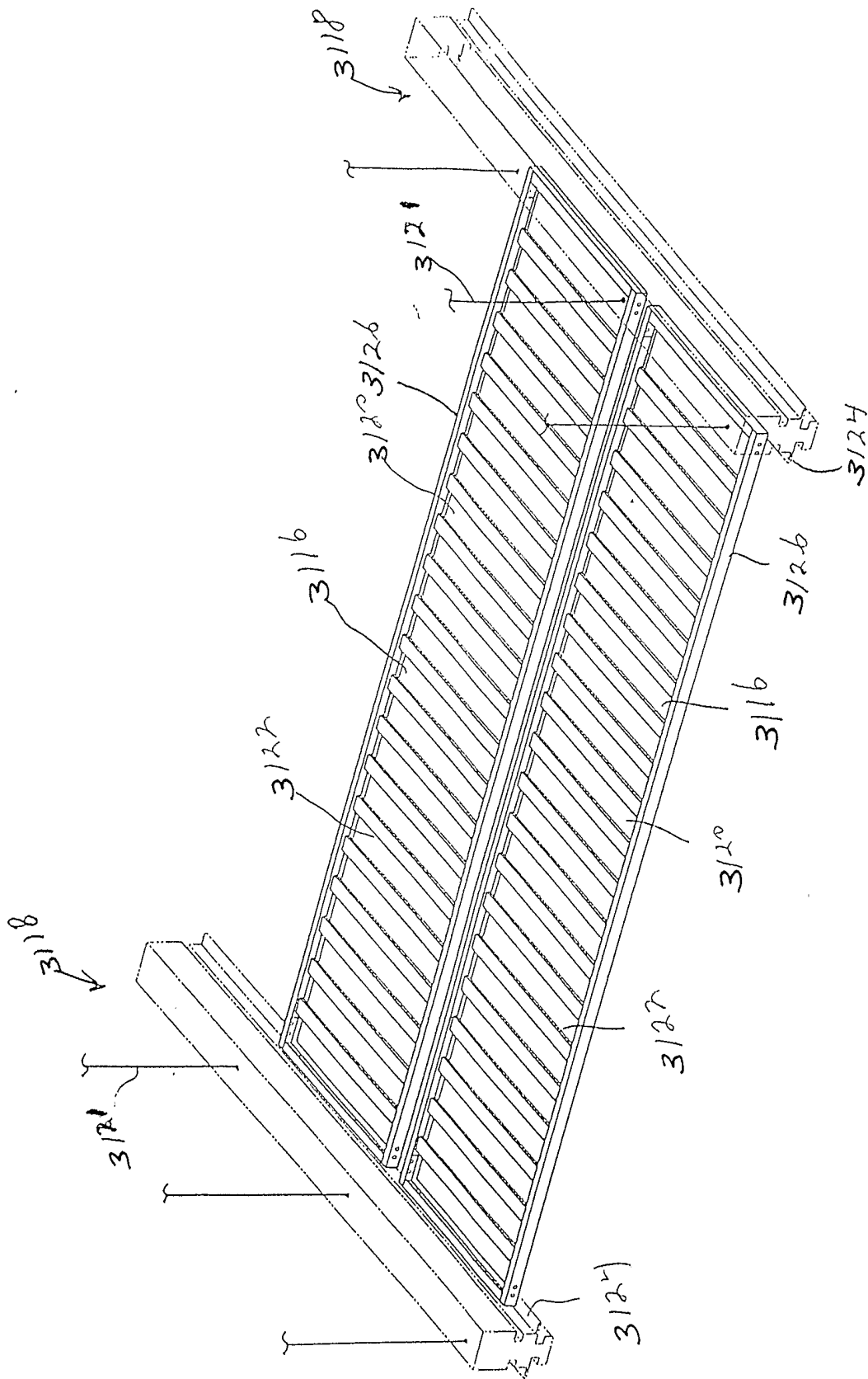


Fig. 87

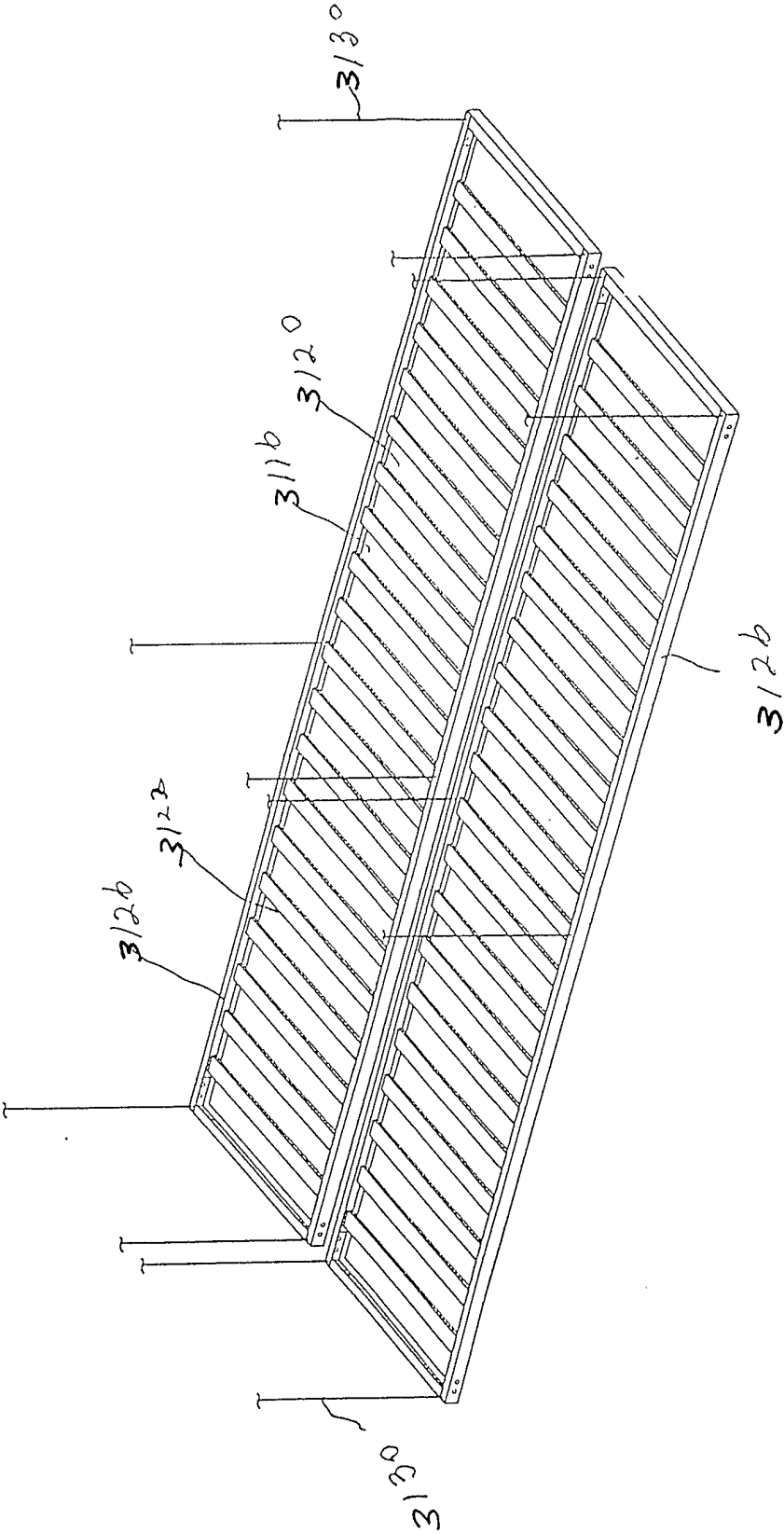


Fig. 88

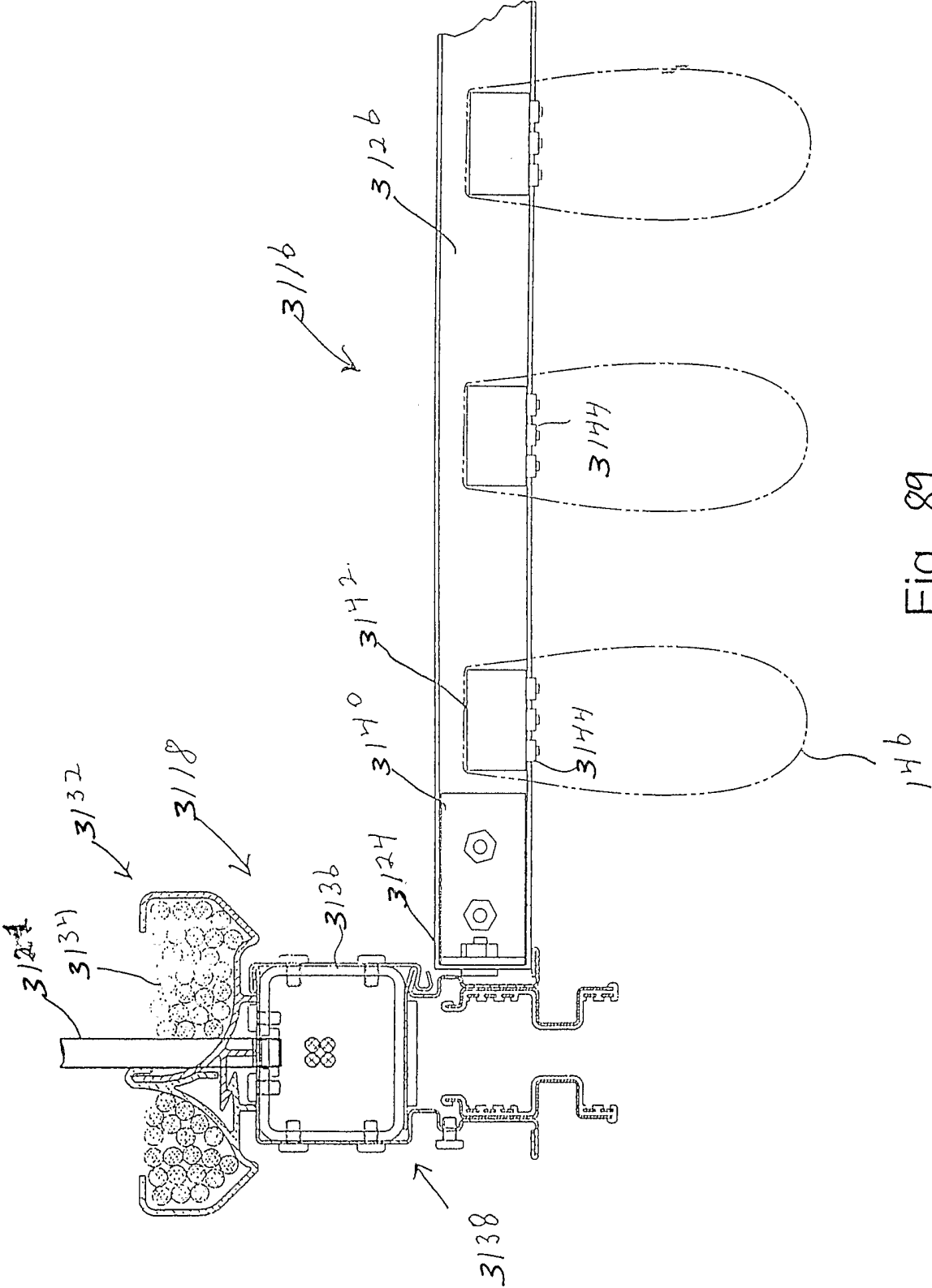


Fig. 89

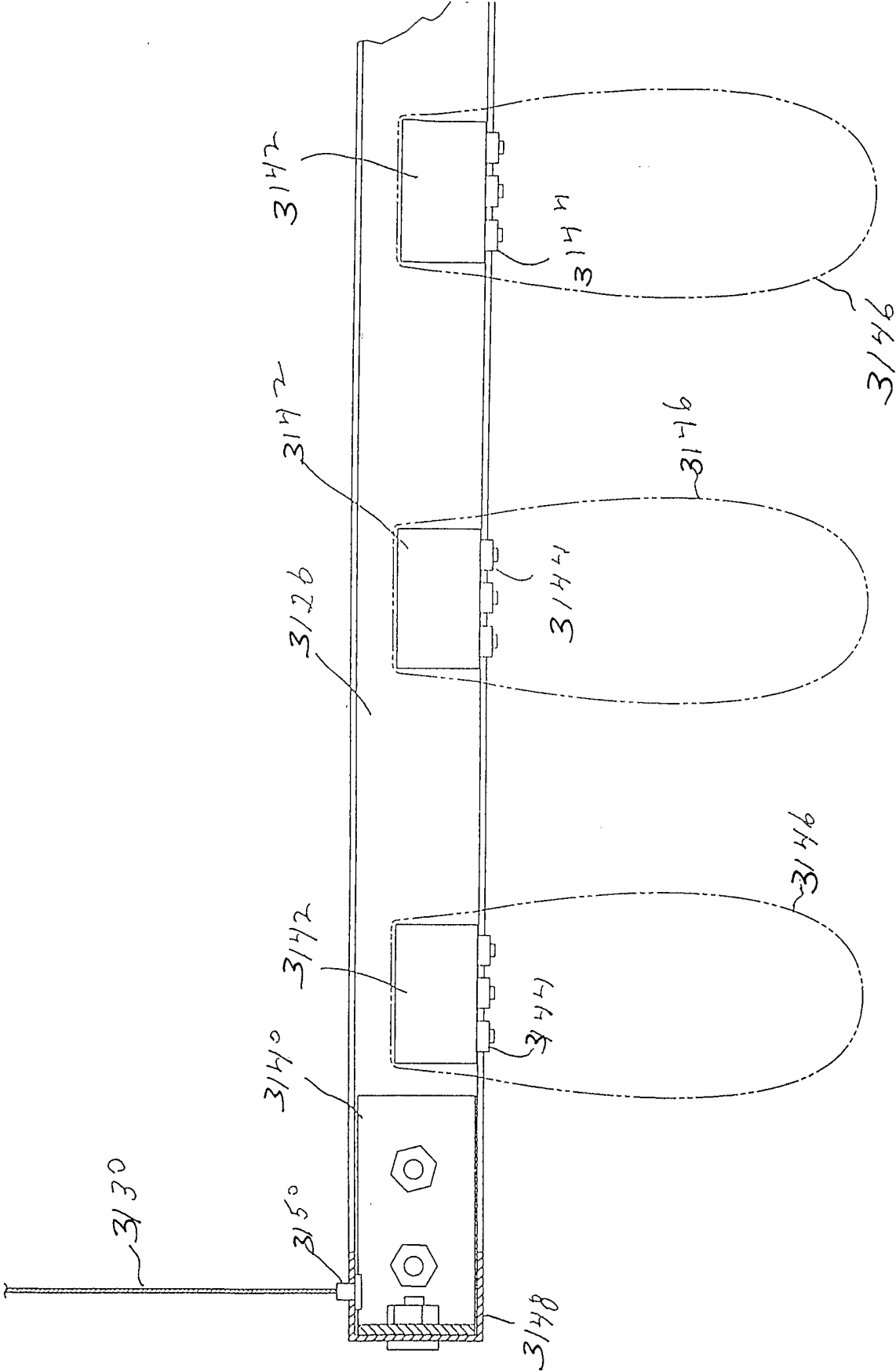


Fig. 90

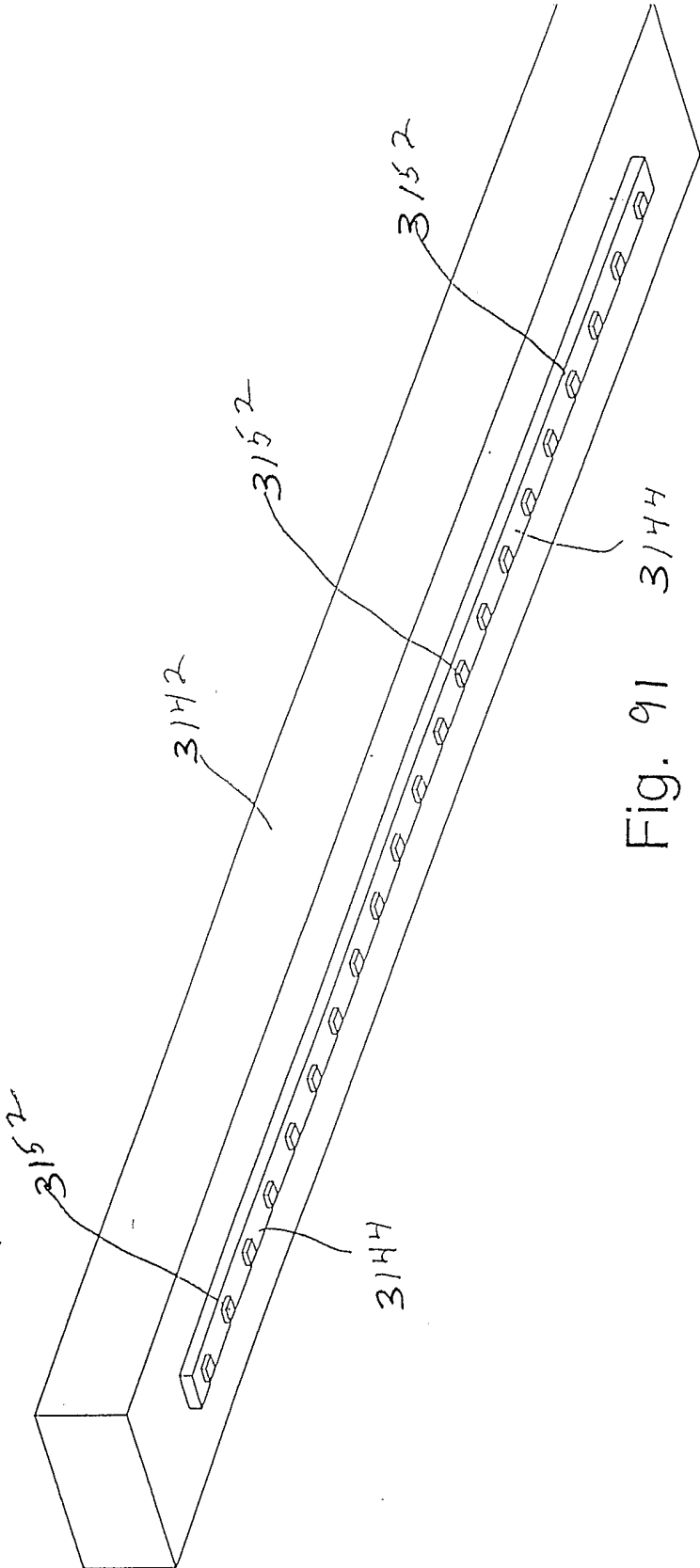


Fig. 91 3144

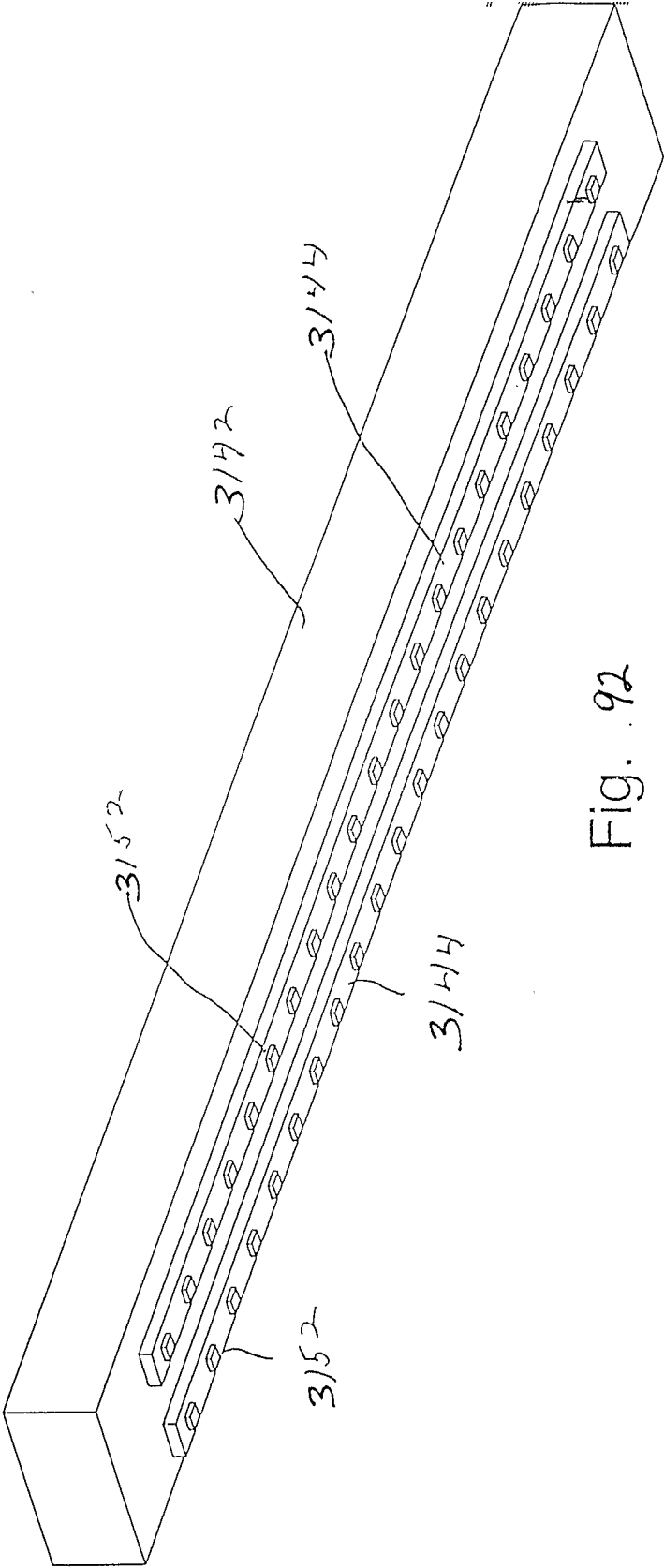


Fig. 92

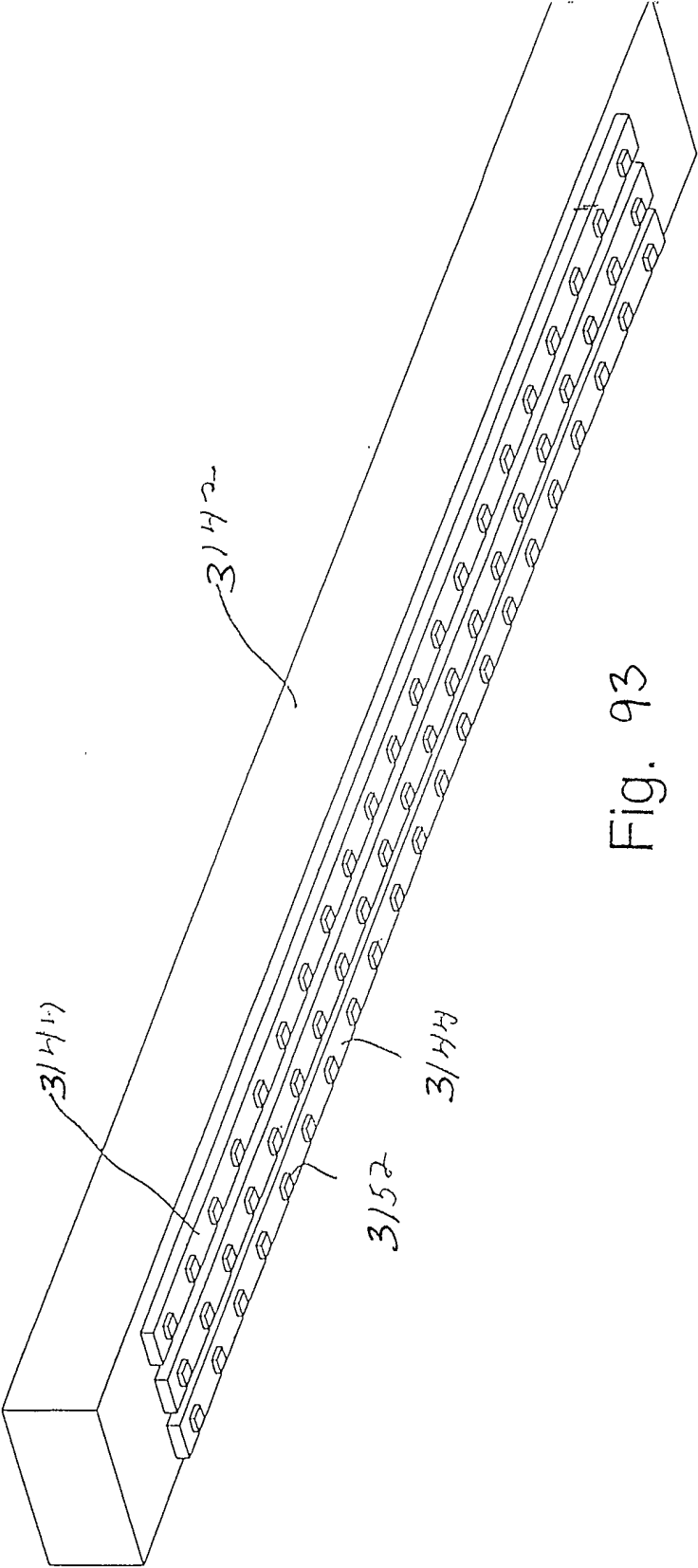
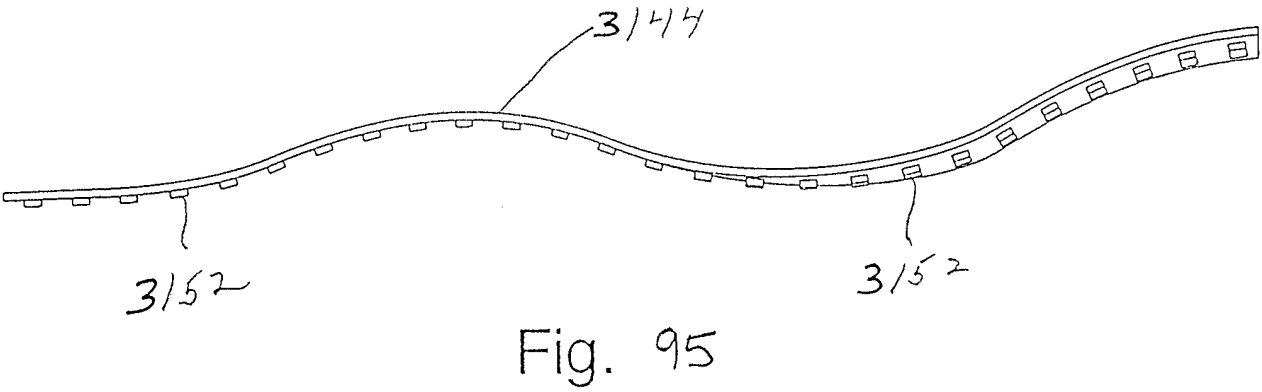
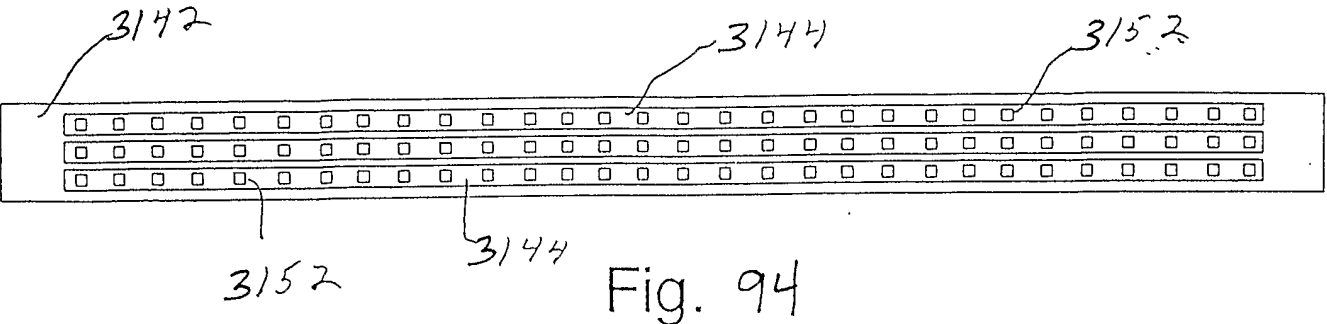


Fig. 93



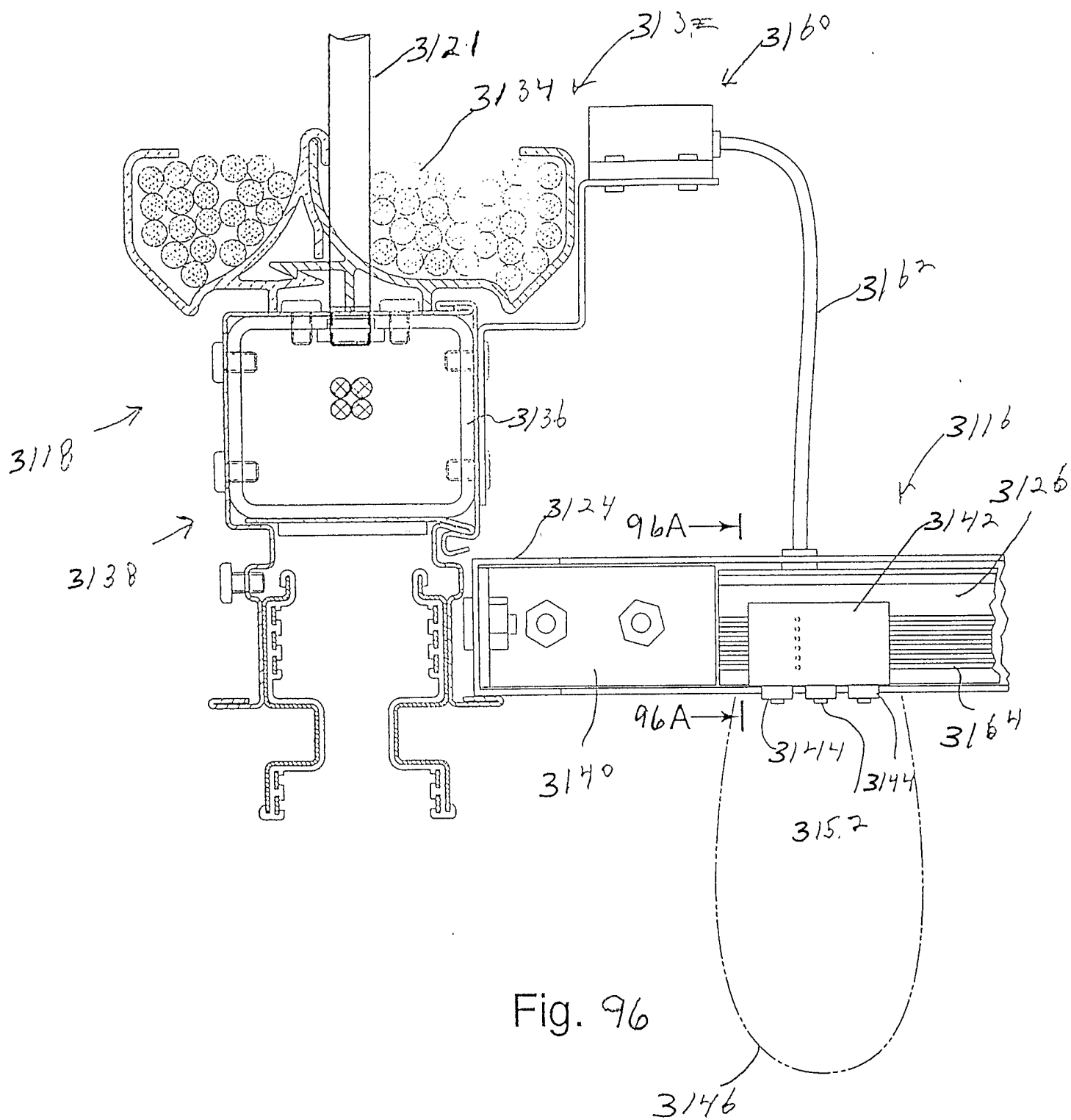
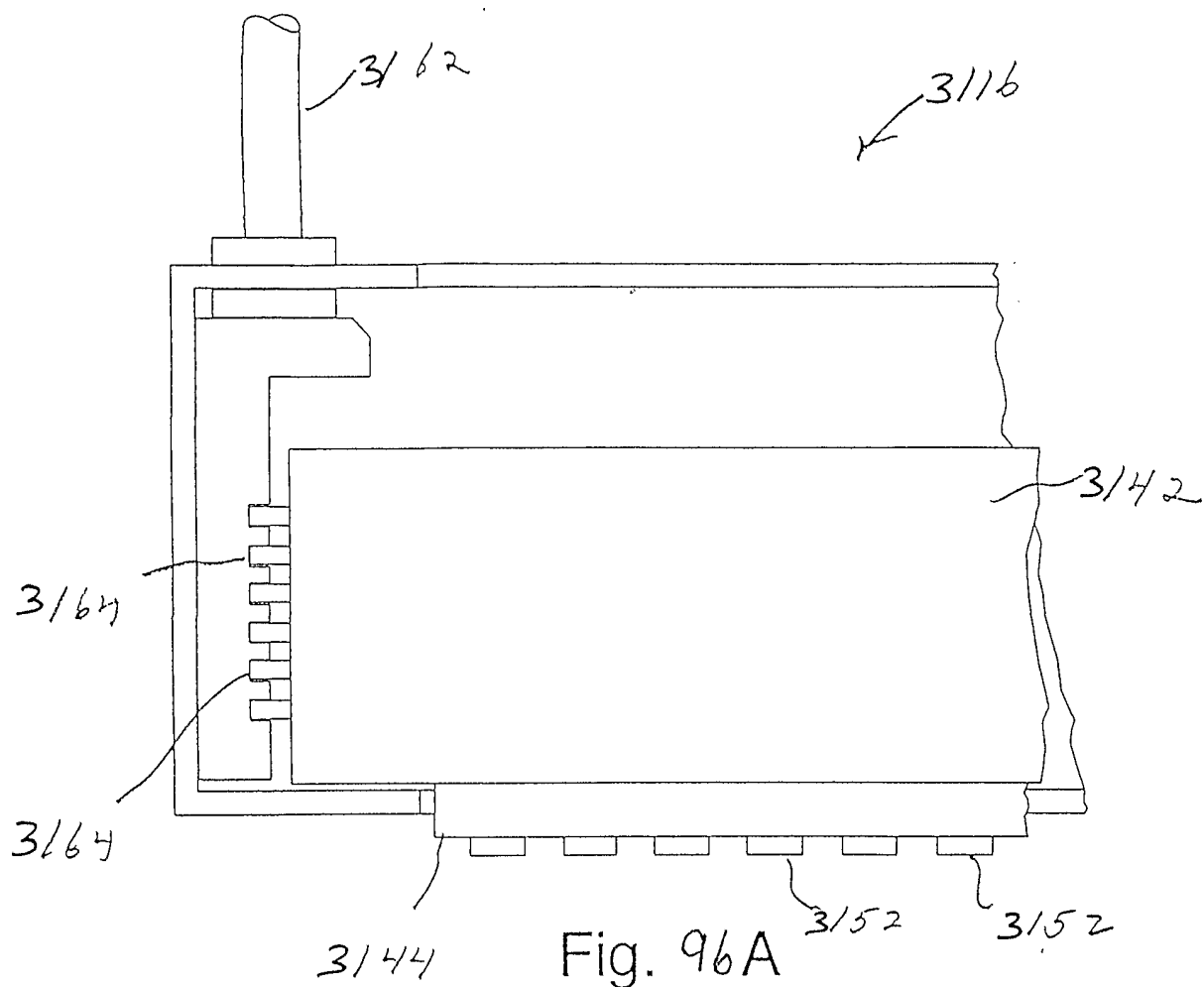


Fig. 96



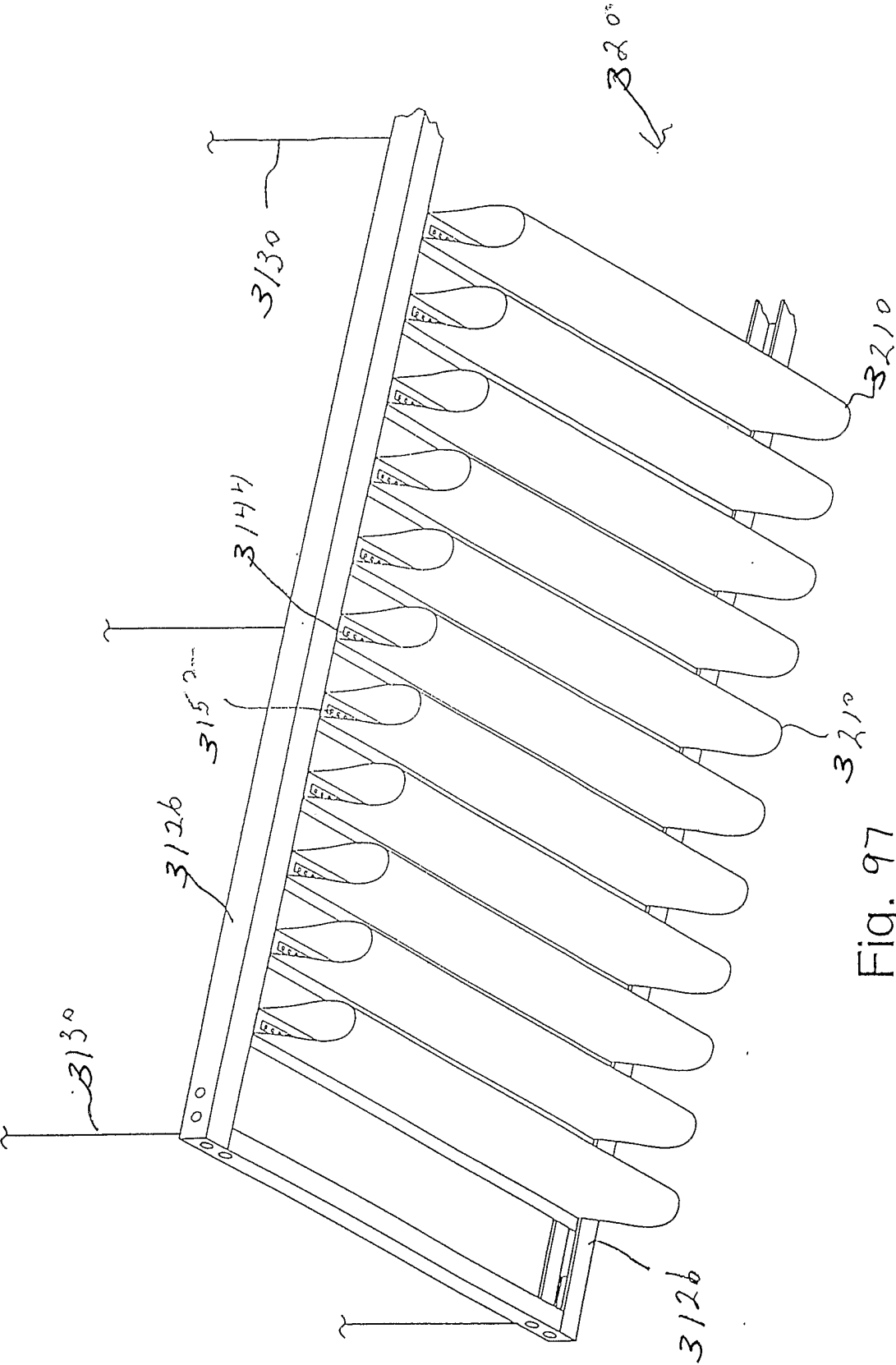


Fig. 97

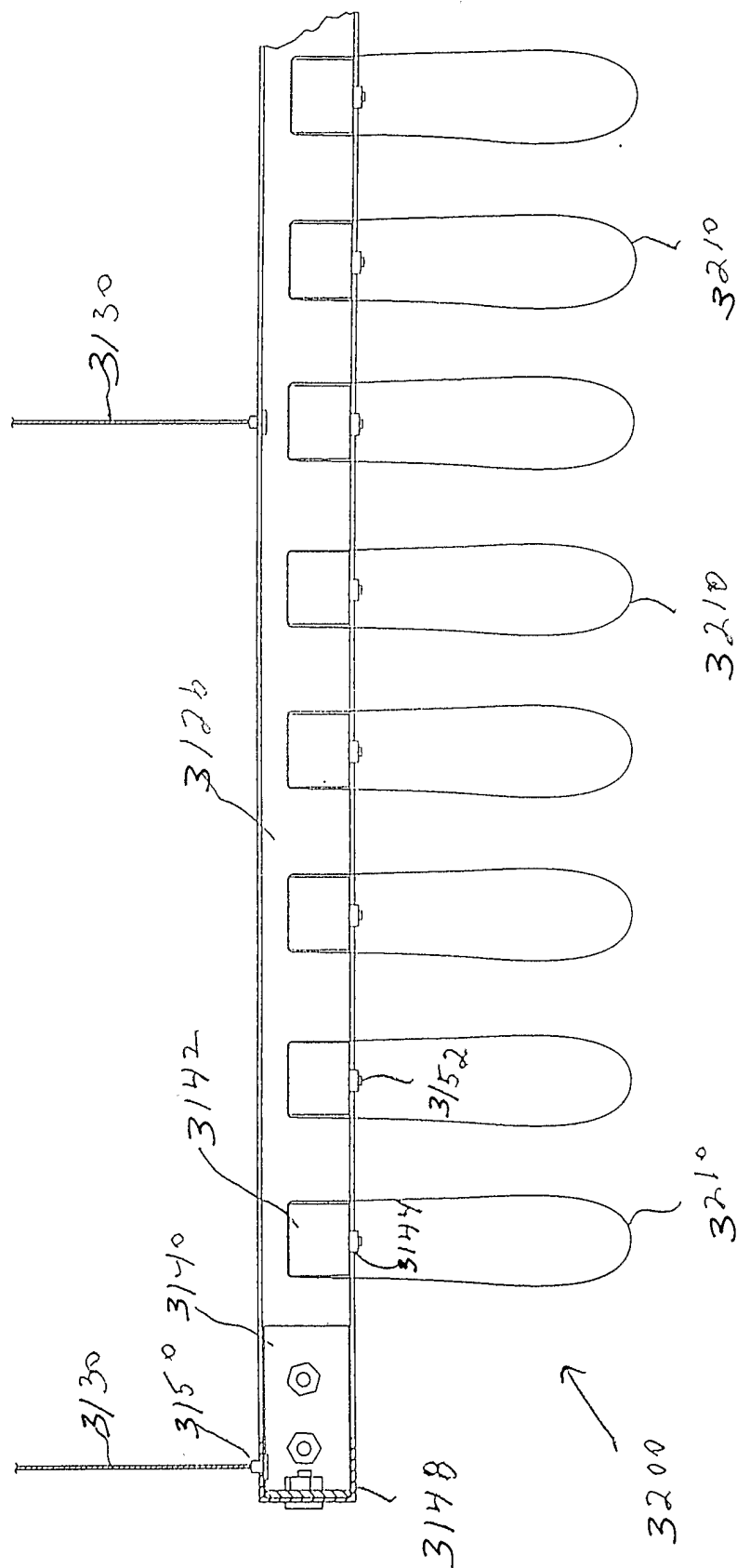


Fig. 98.

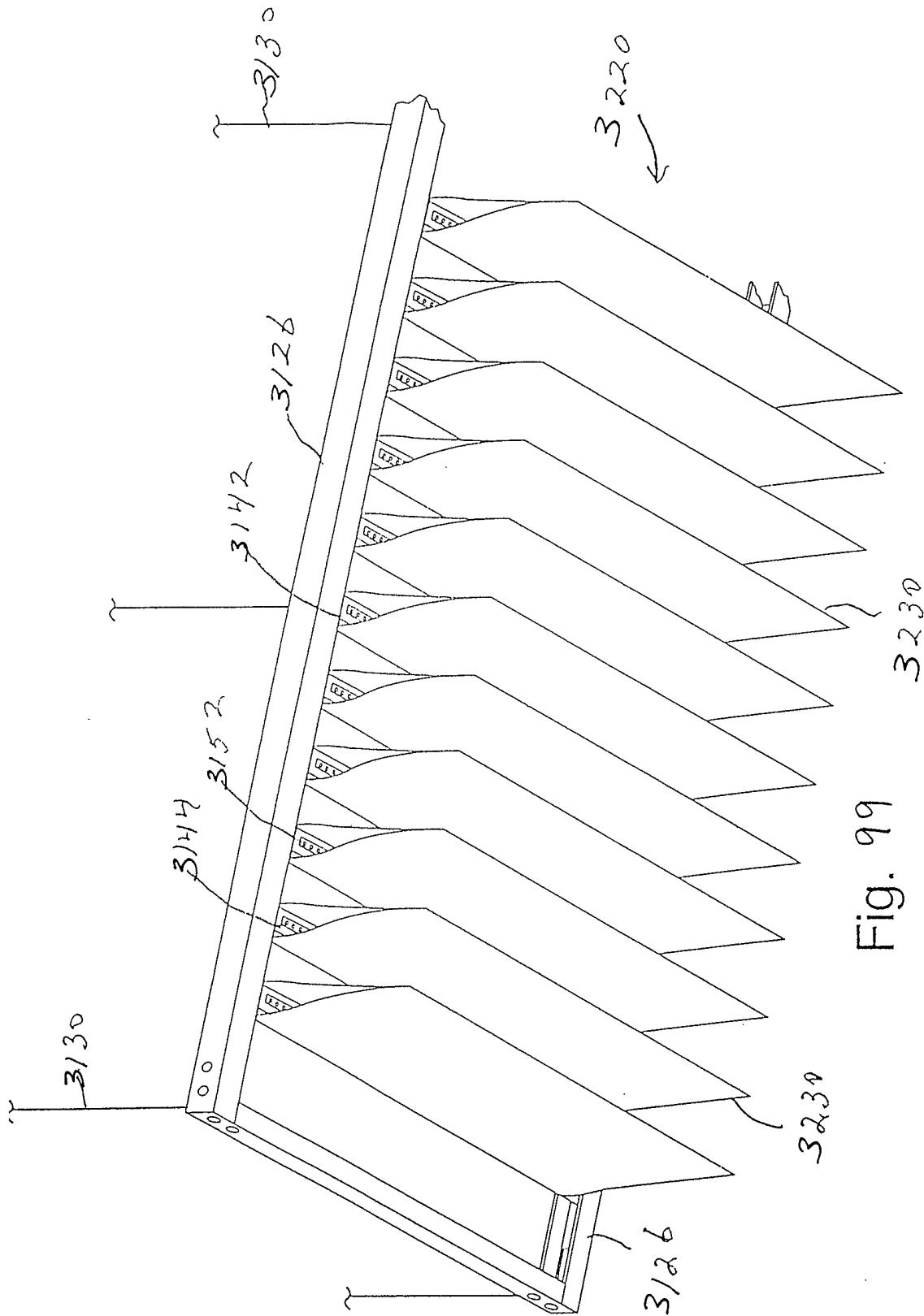


Fig. 99

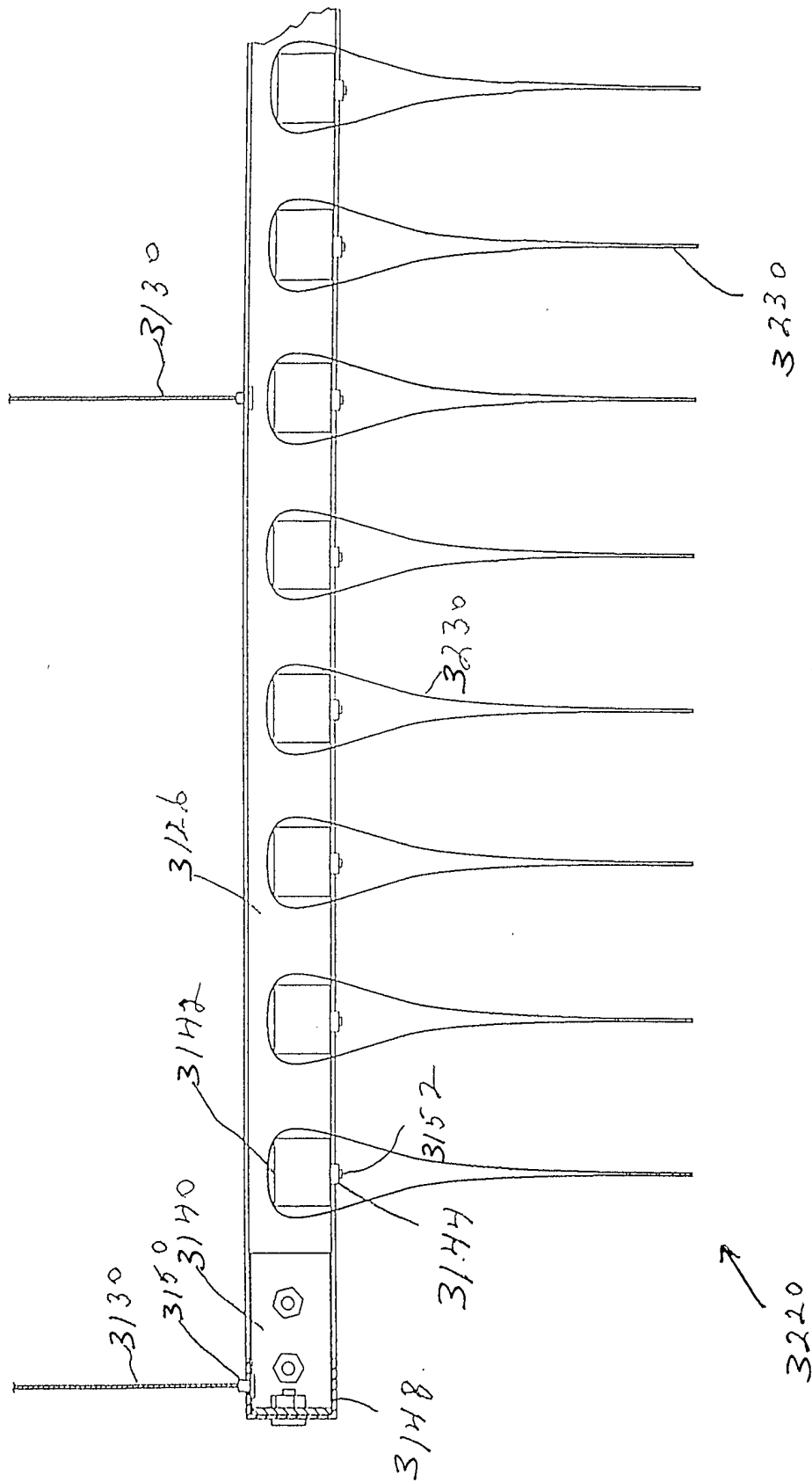


Fig. 100

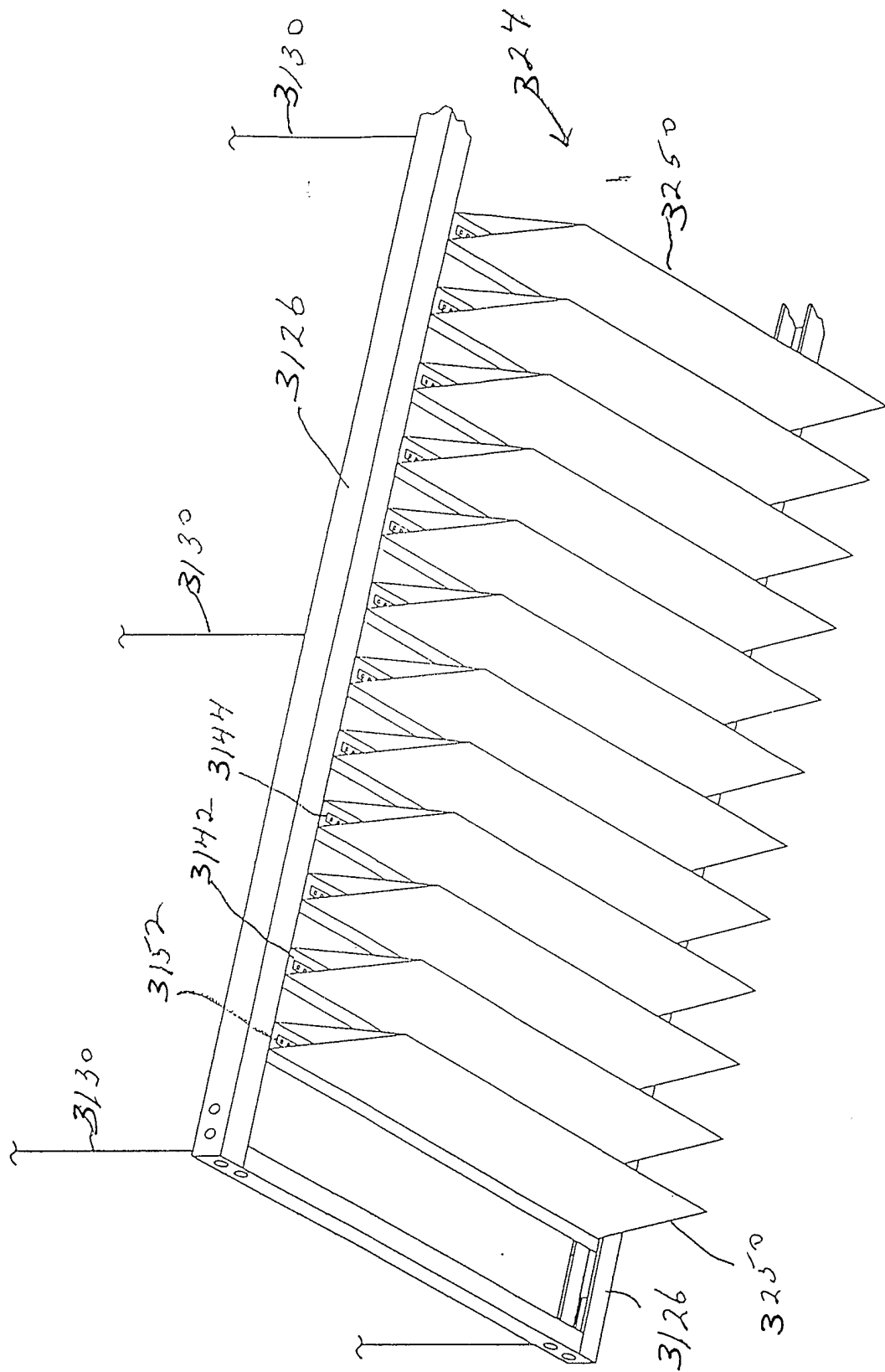


Fig. 101

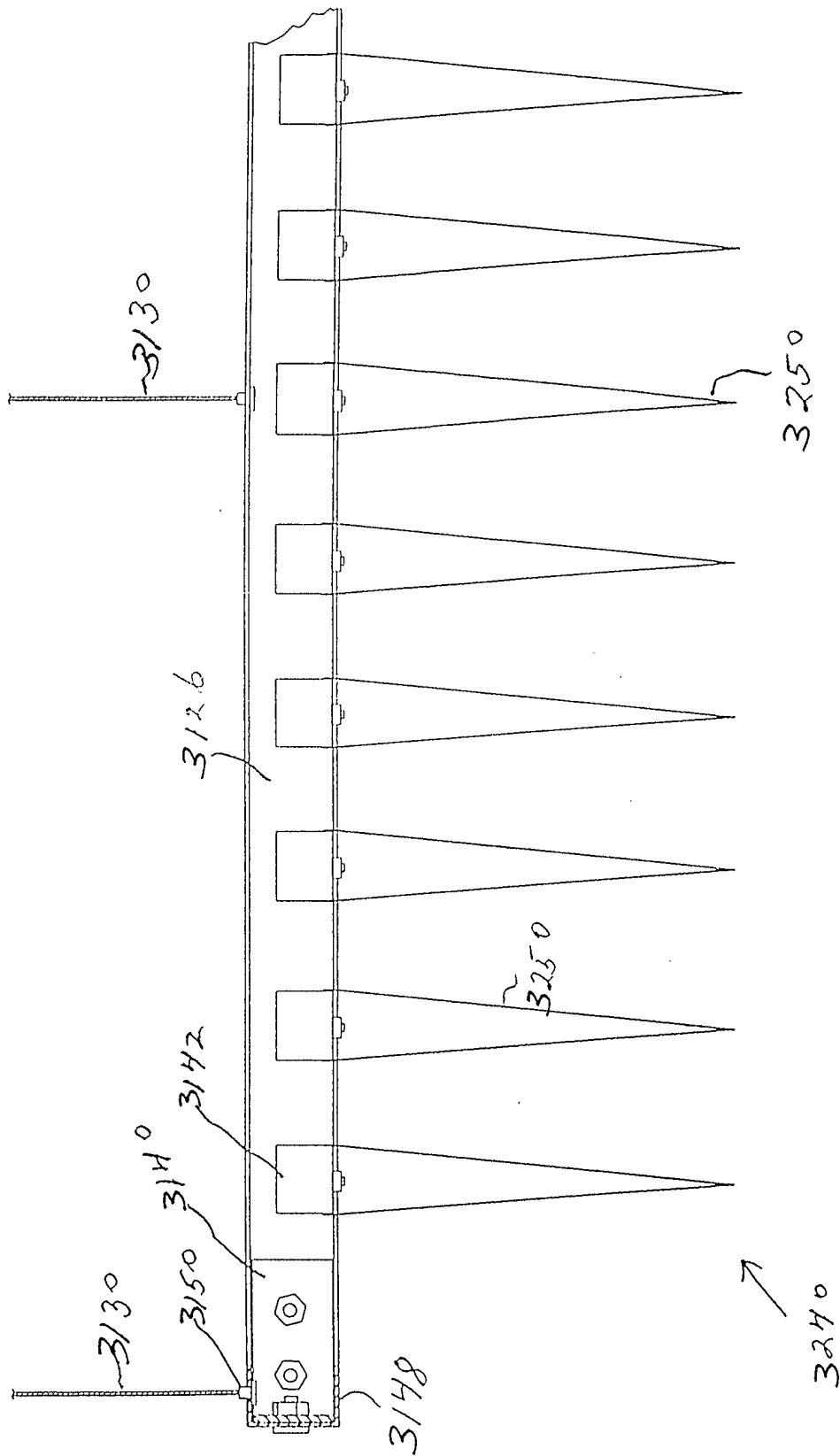


Fig. 102

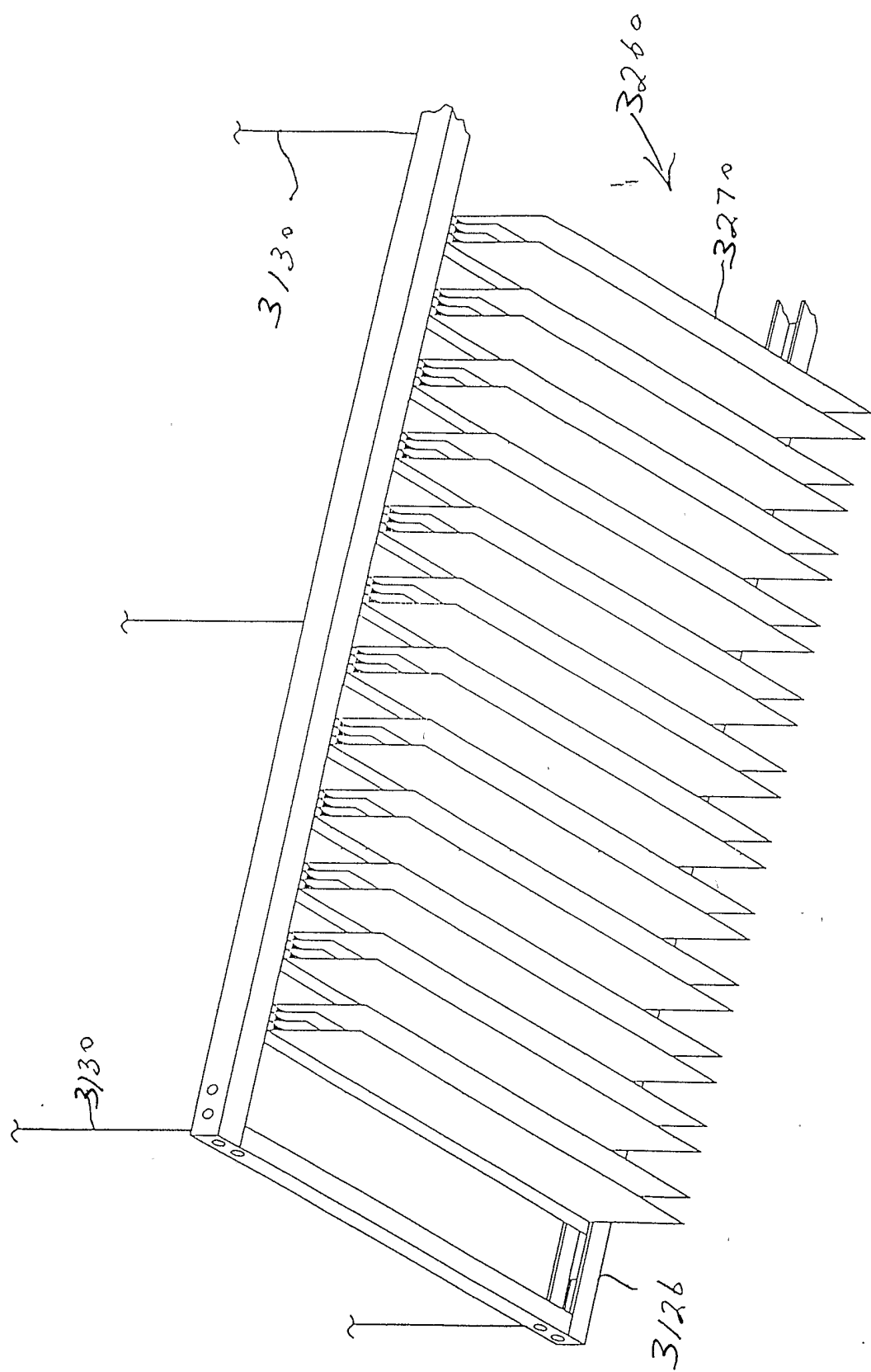


Fig. 103

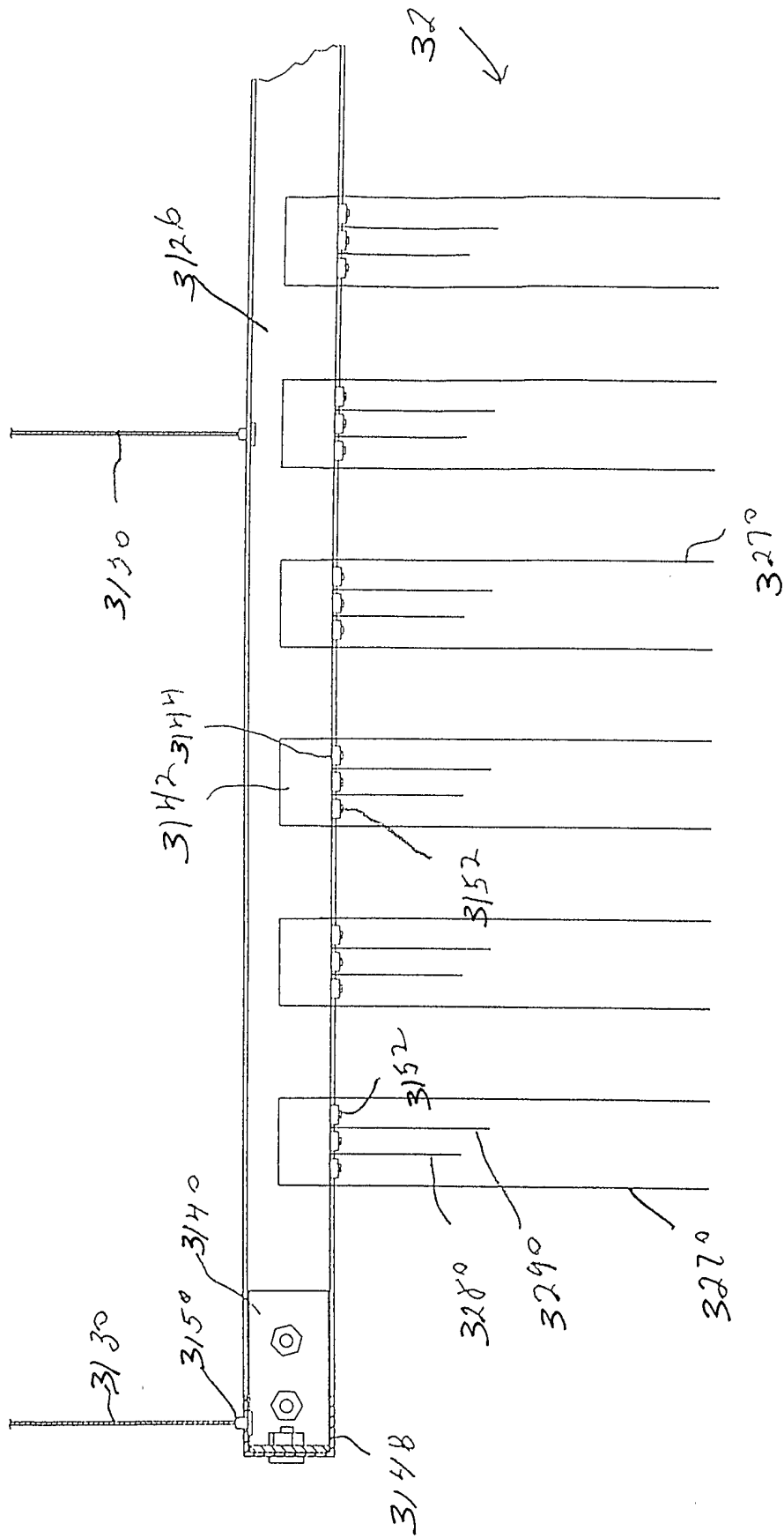


Fig. 104

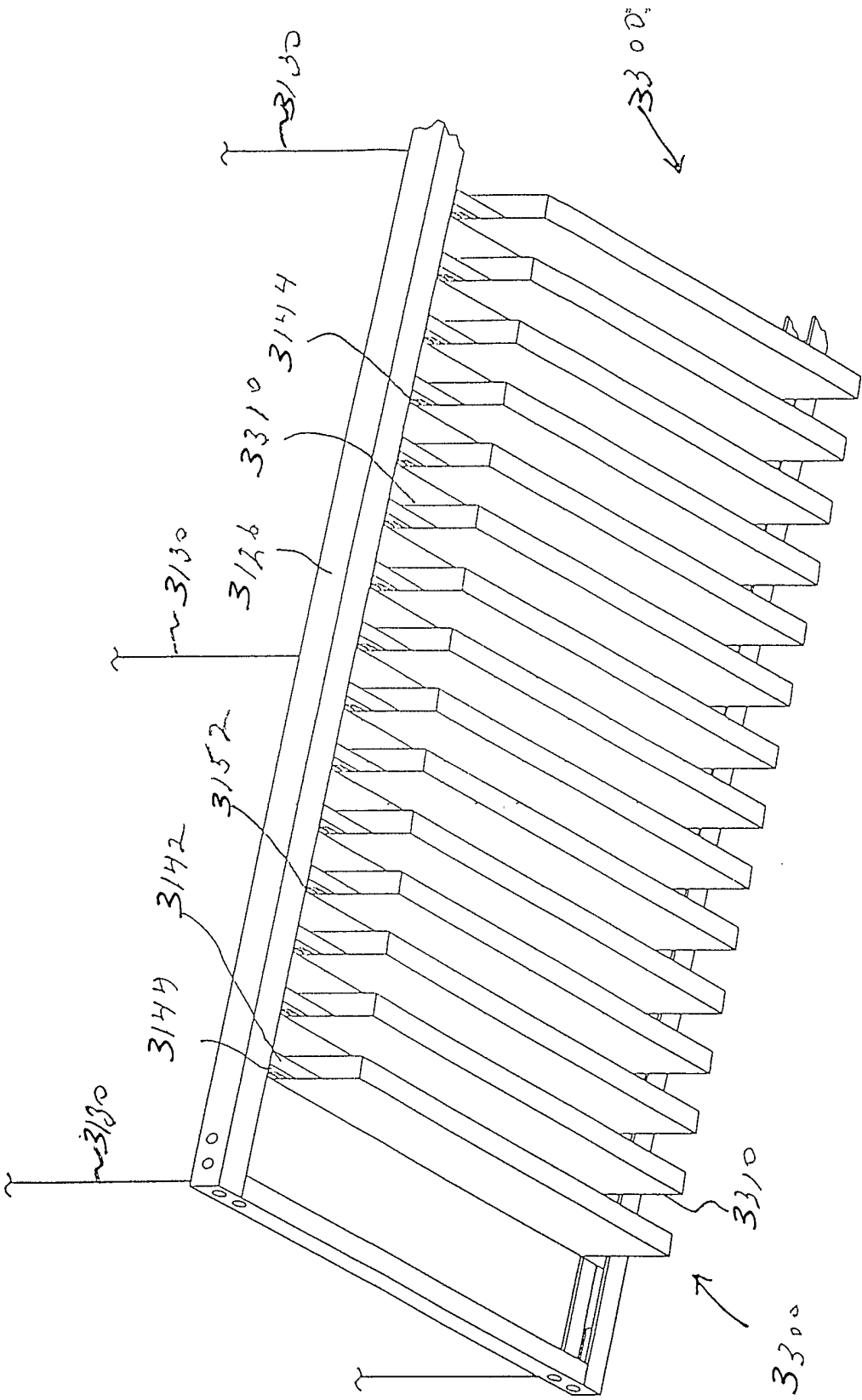


Fig. 105

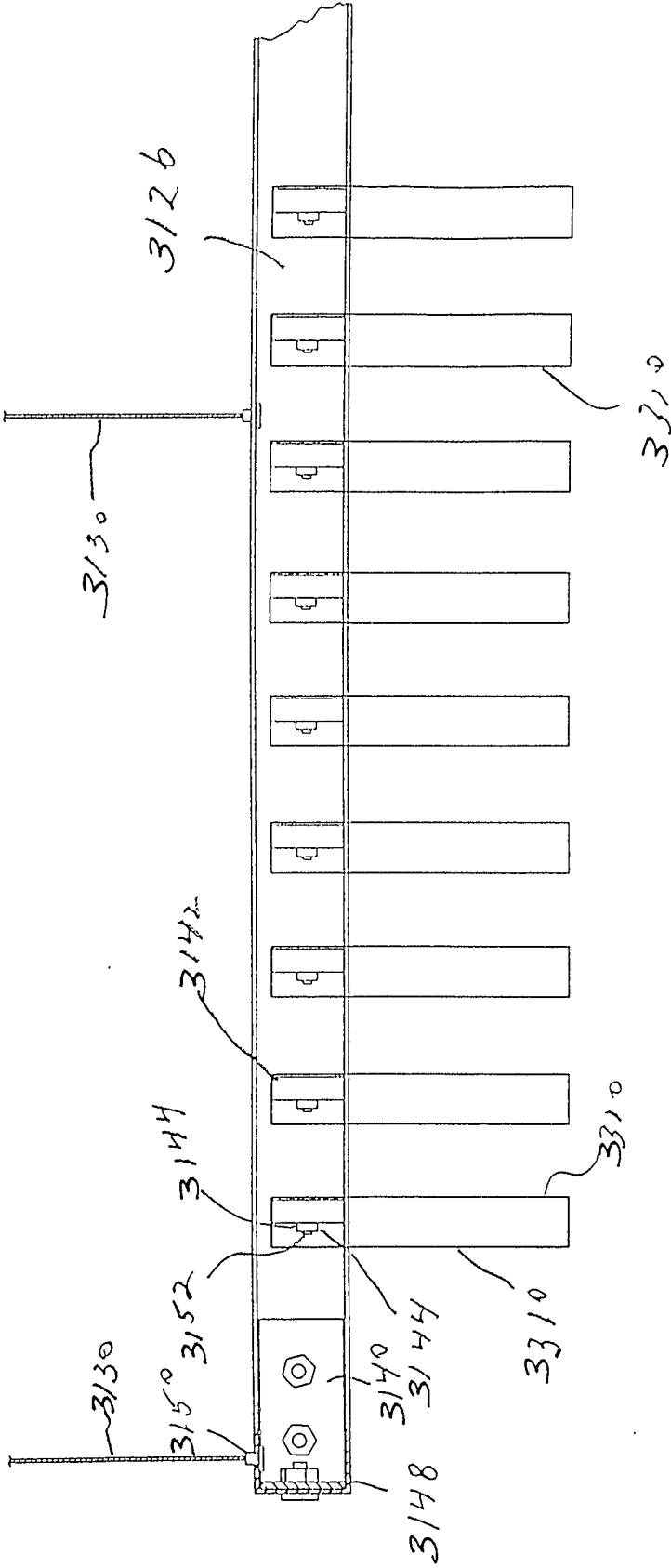


Fig. 106

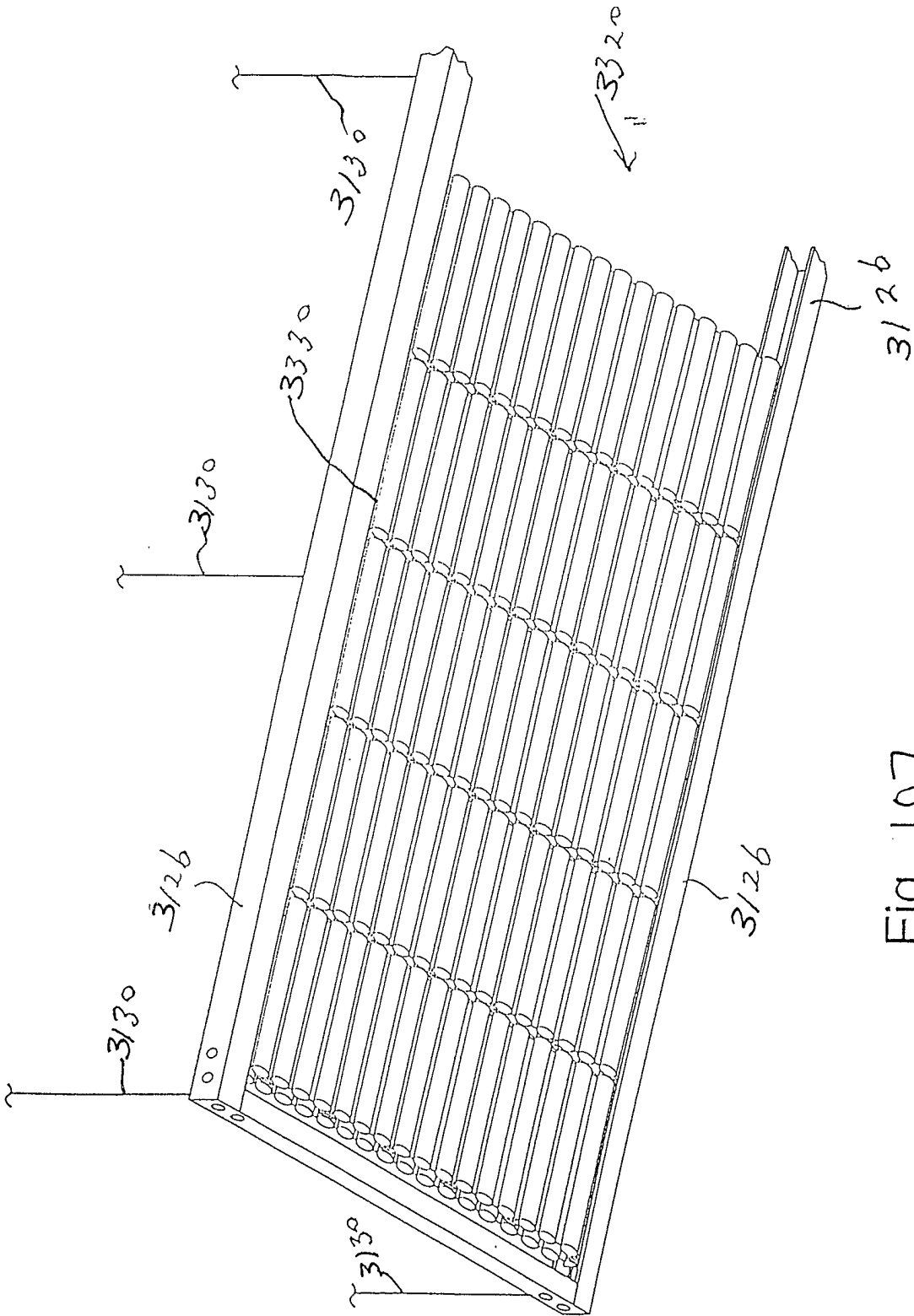


Fig. 107

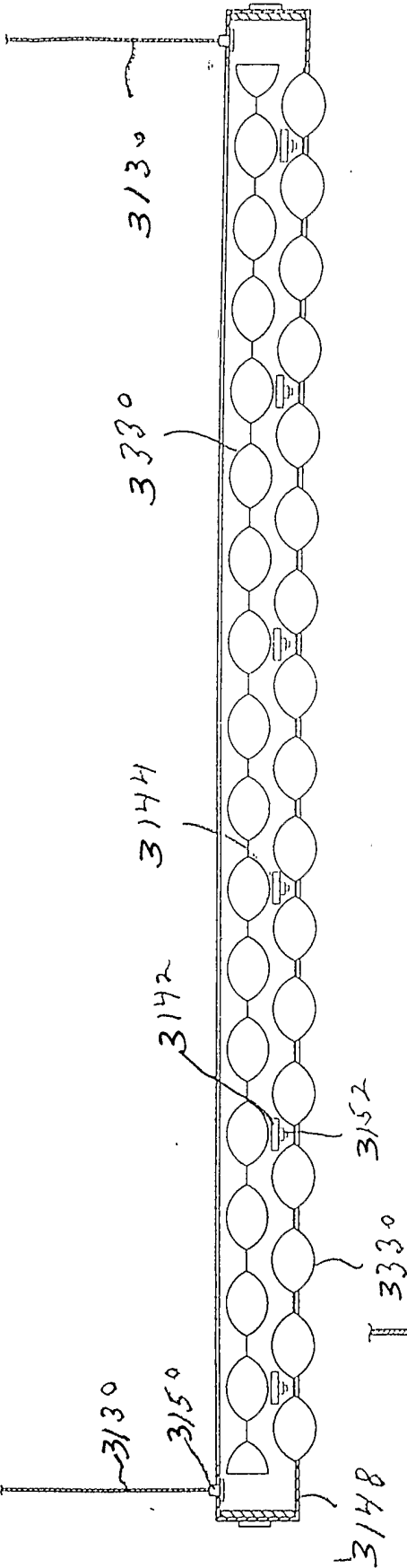


Fig. 108

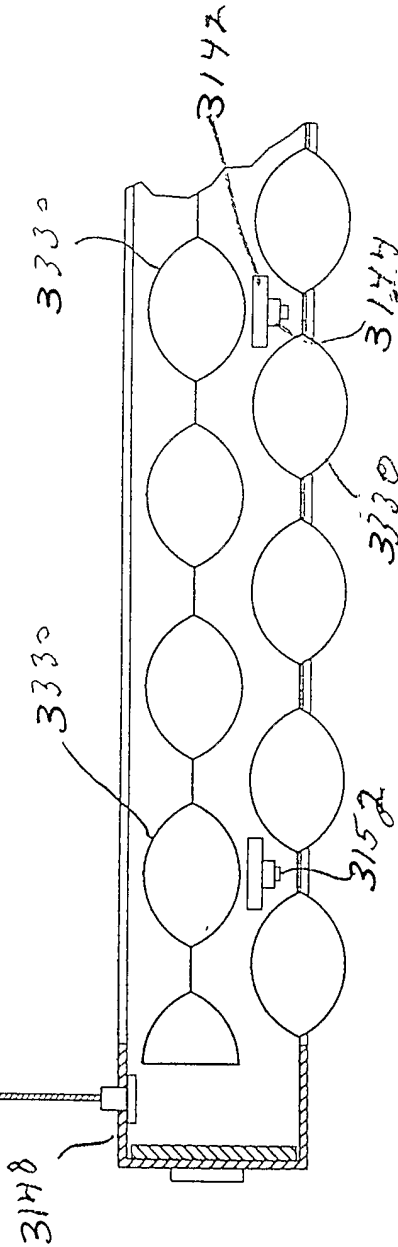


Fig. 108A

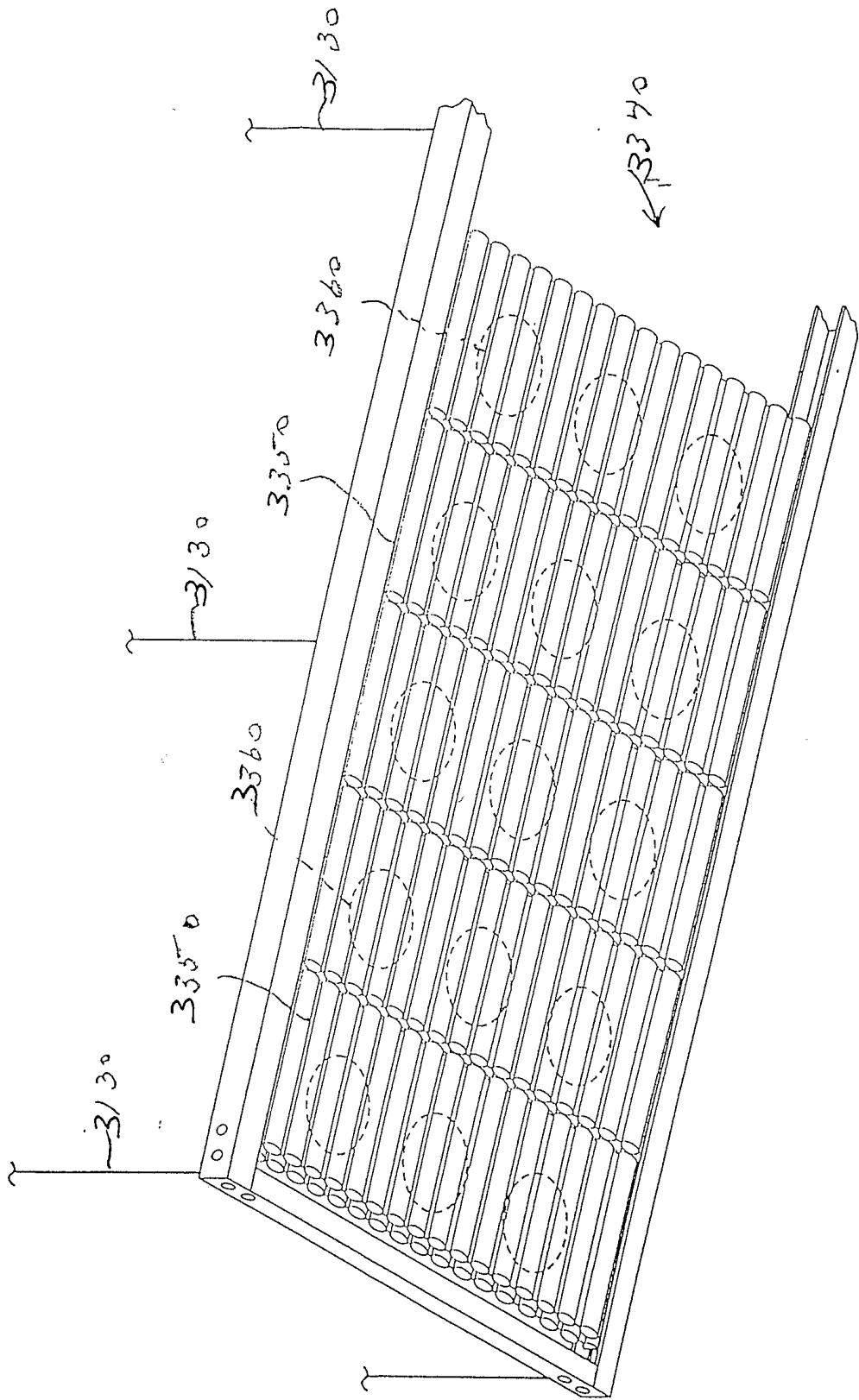


Fig. 109

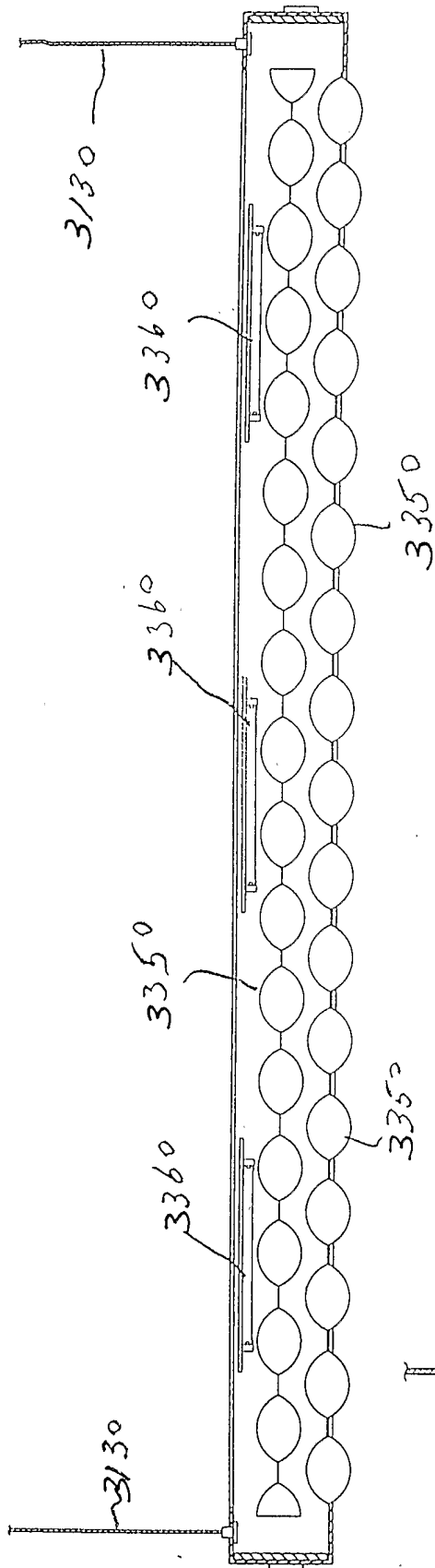


Fig. 11b

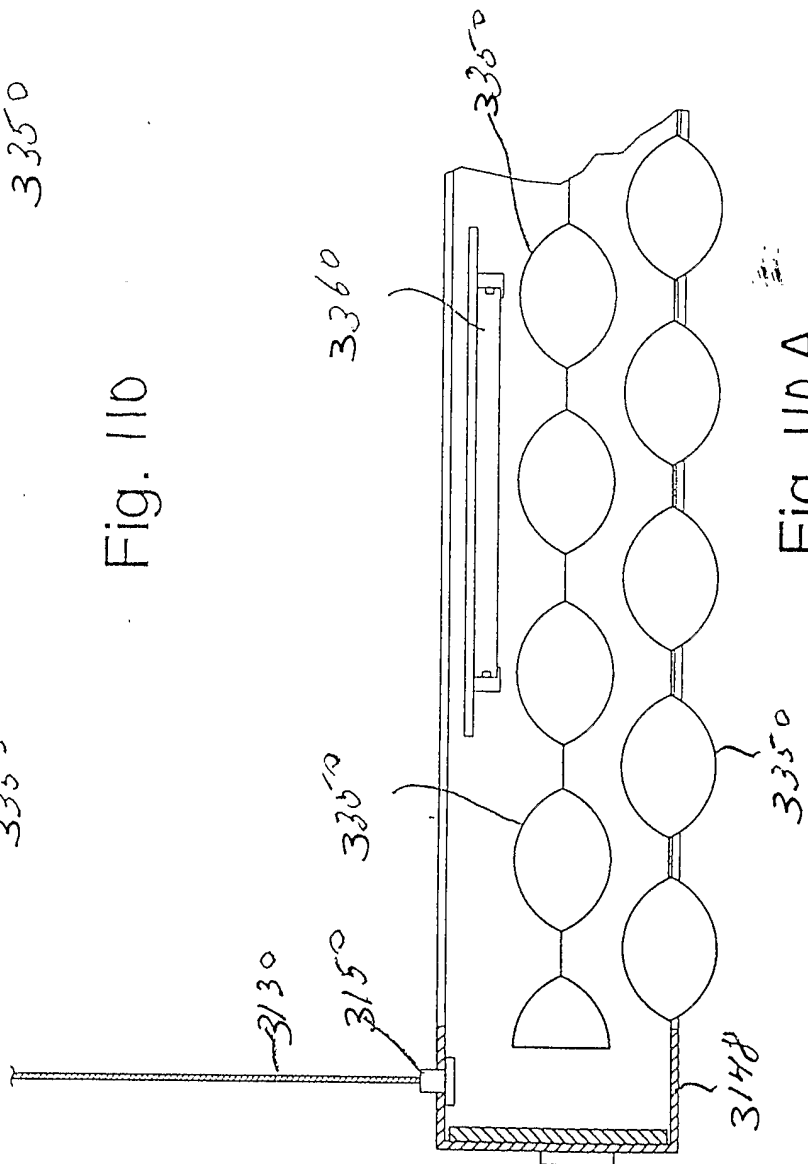


Fig. 11b A

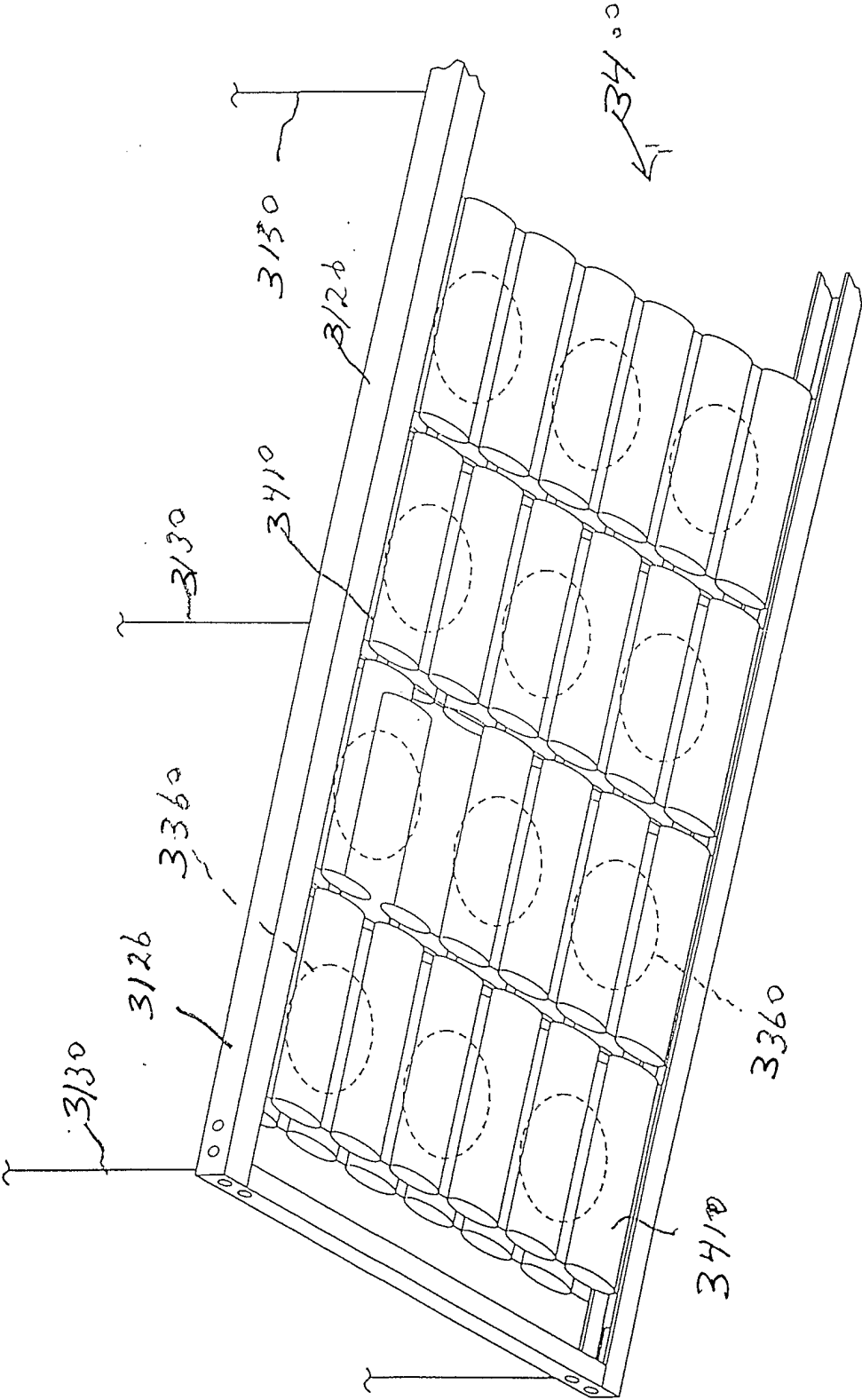


Fig. 11

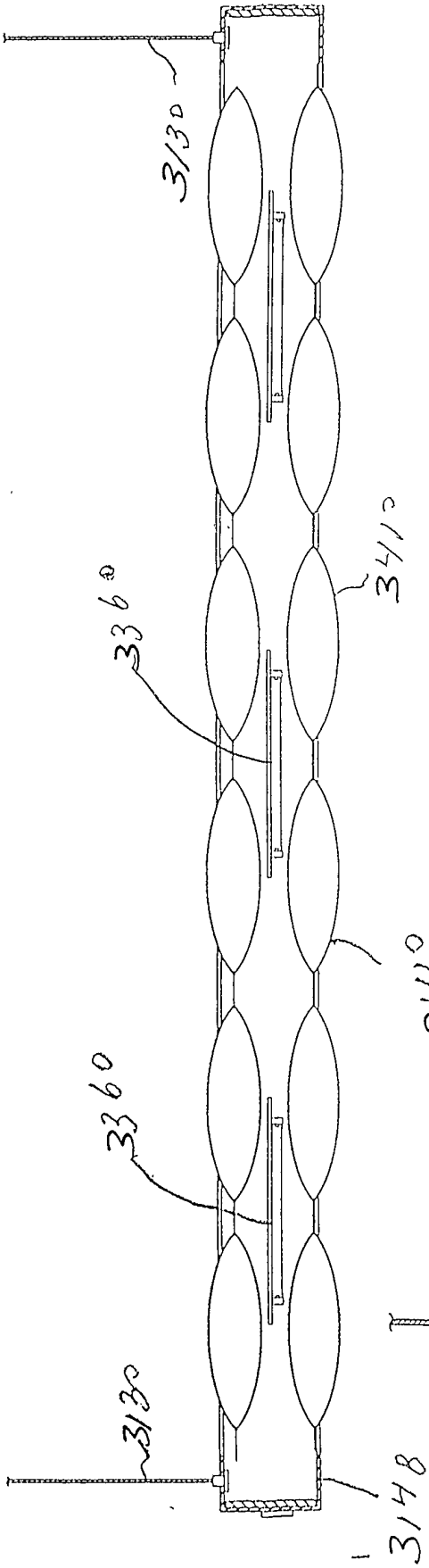


Fig. 112

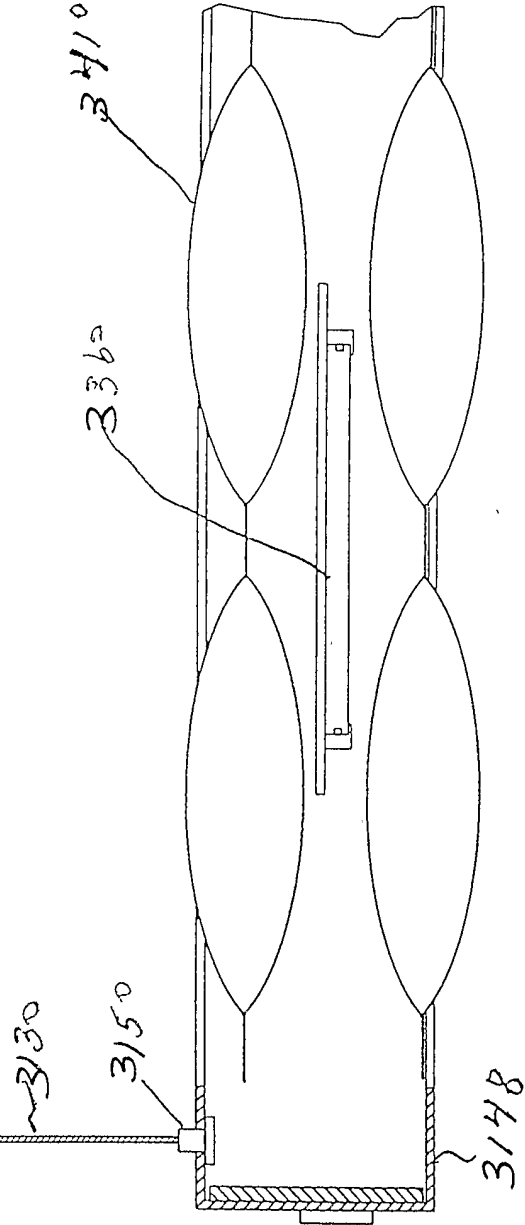


Fig. 112A

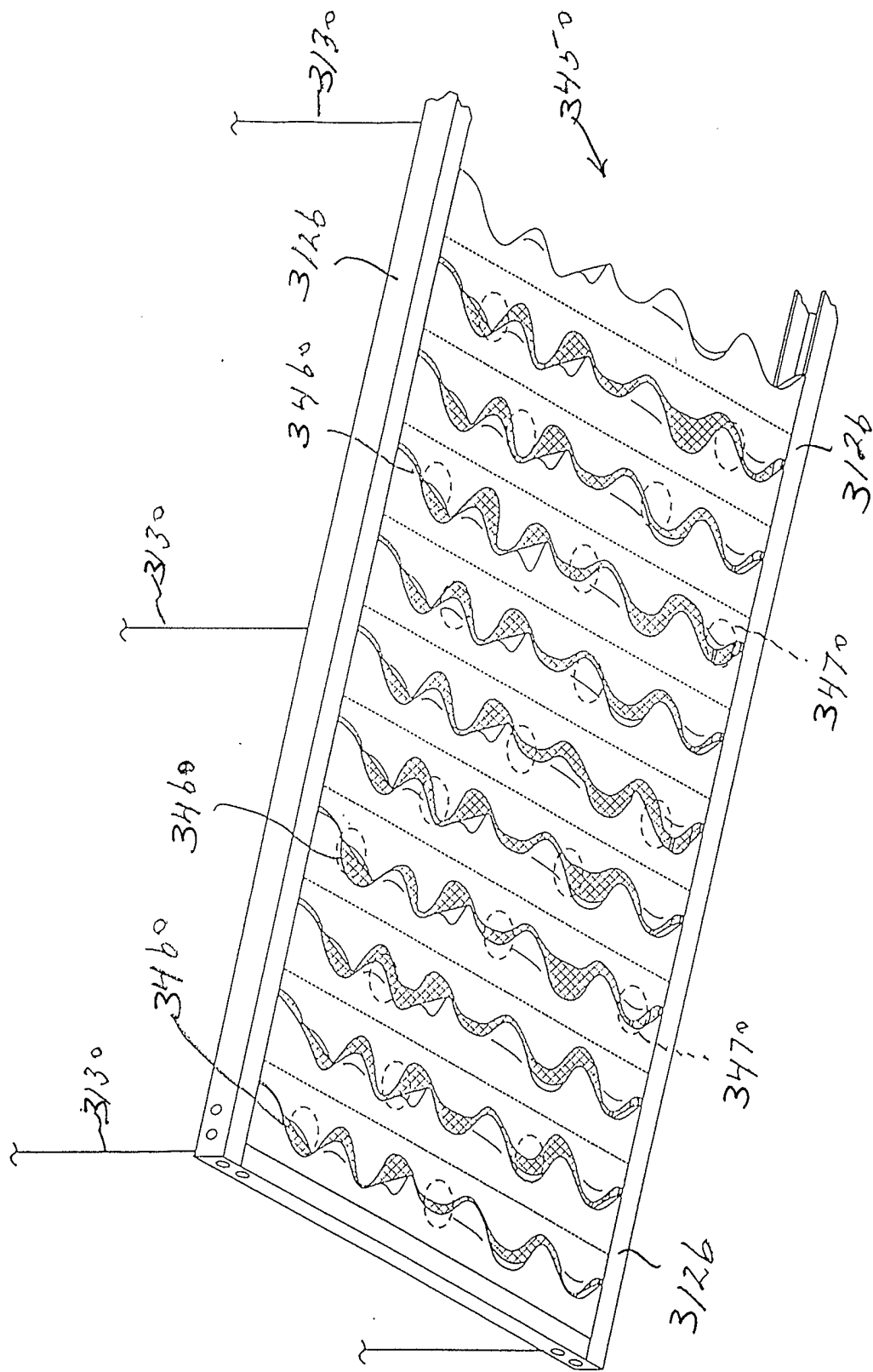
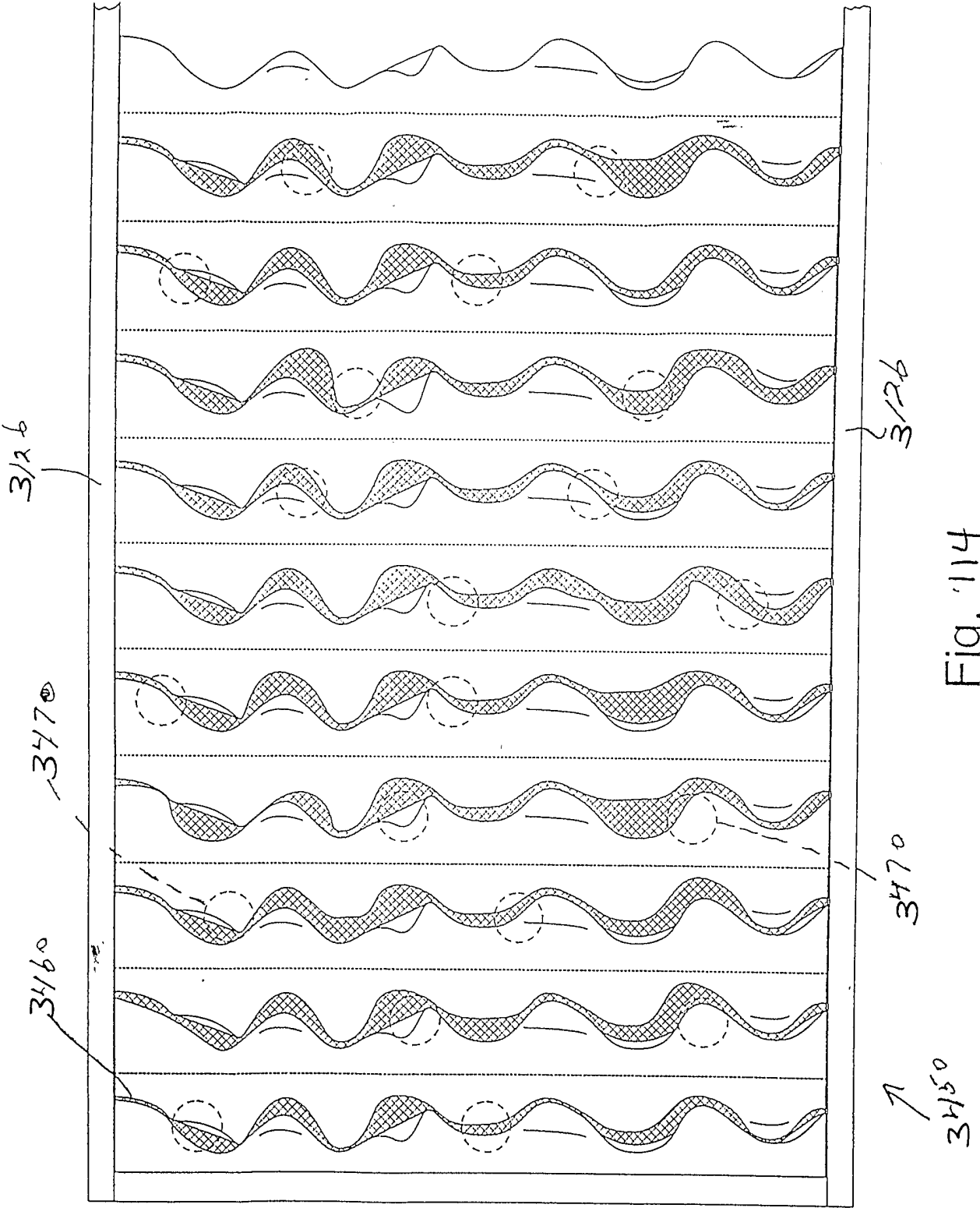


Fig. 113



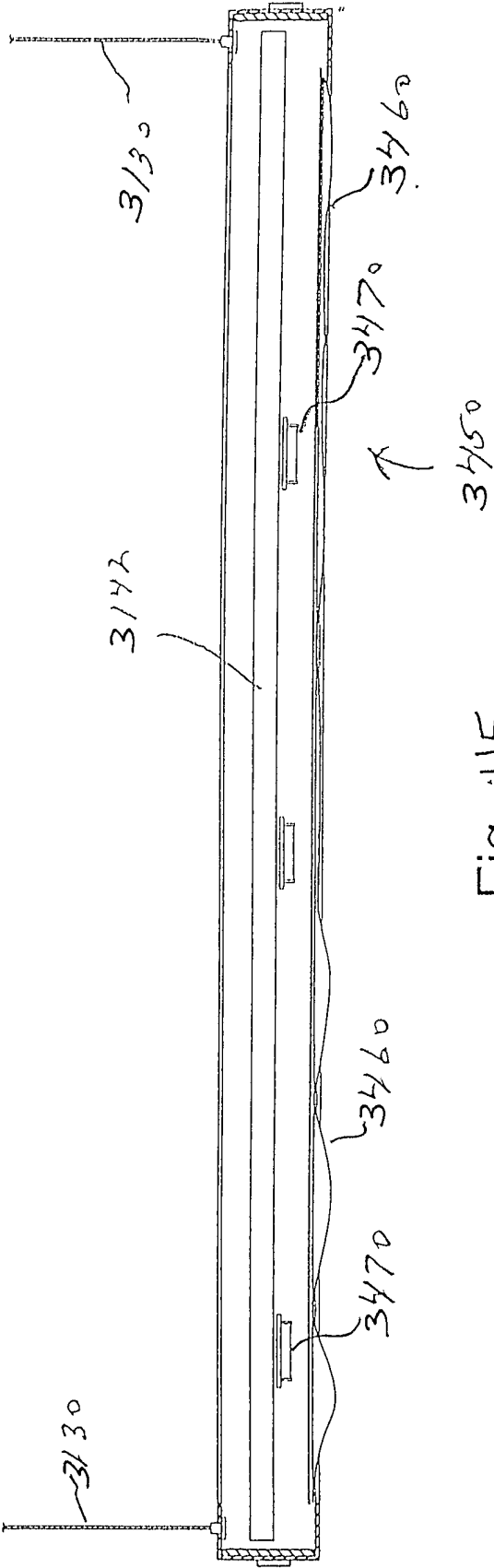
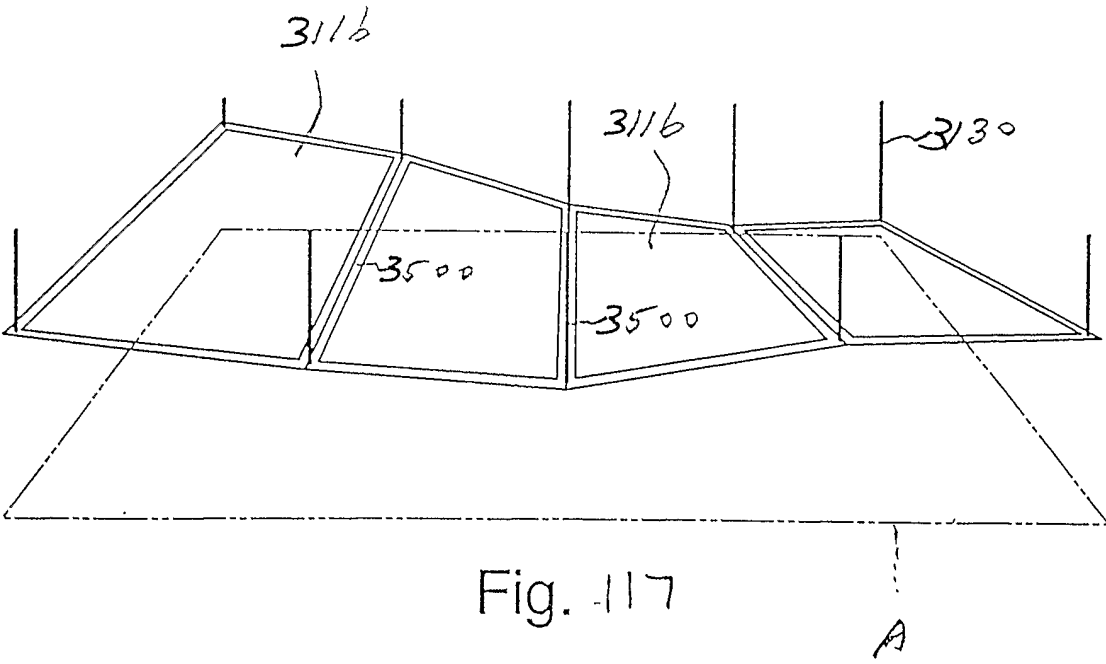
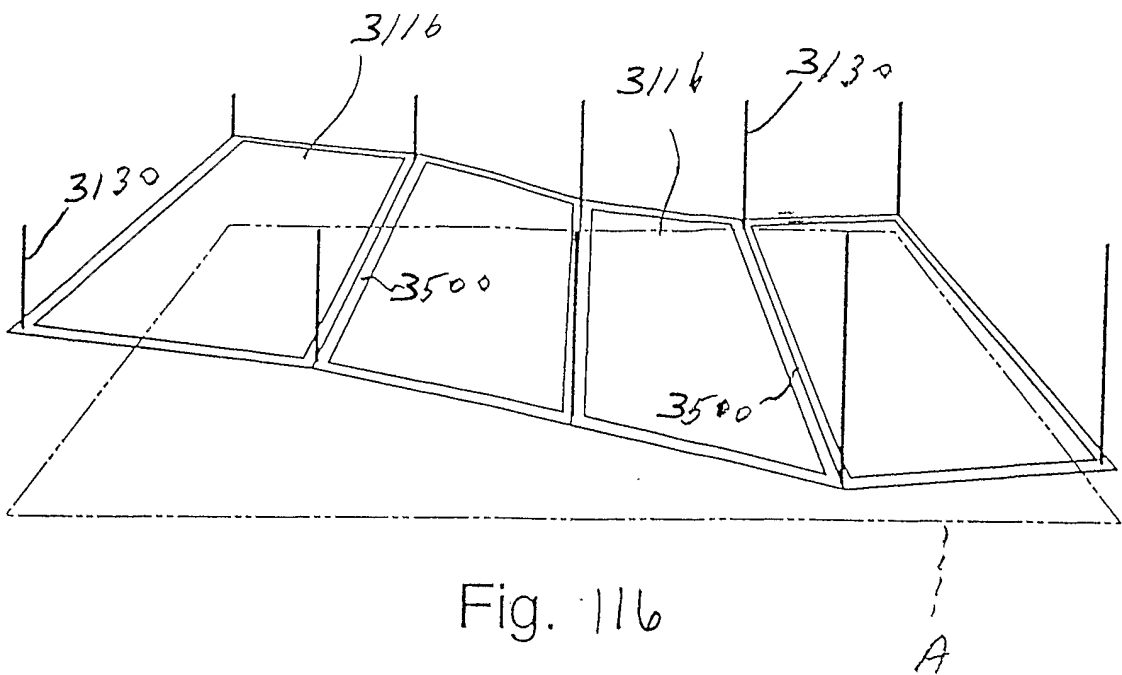


Fig. 115



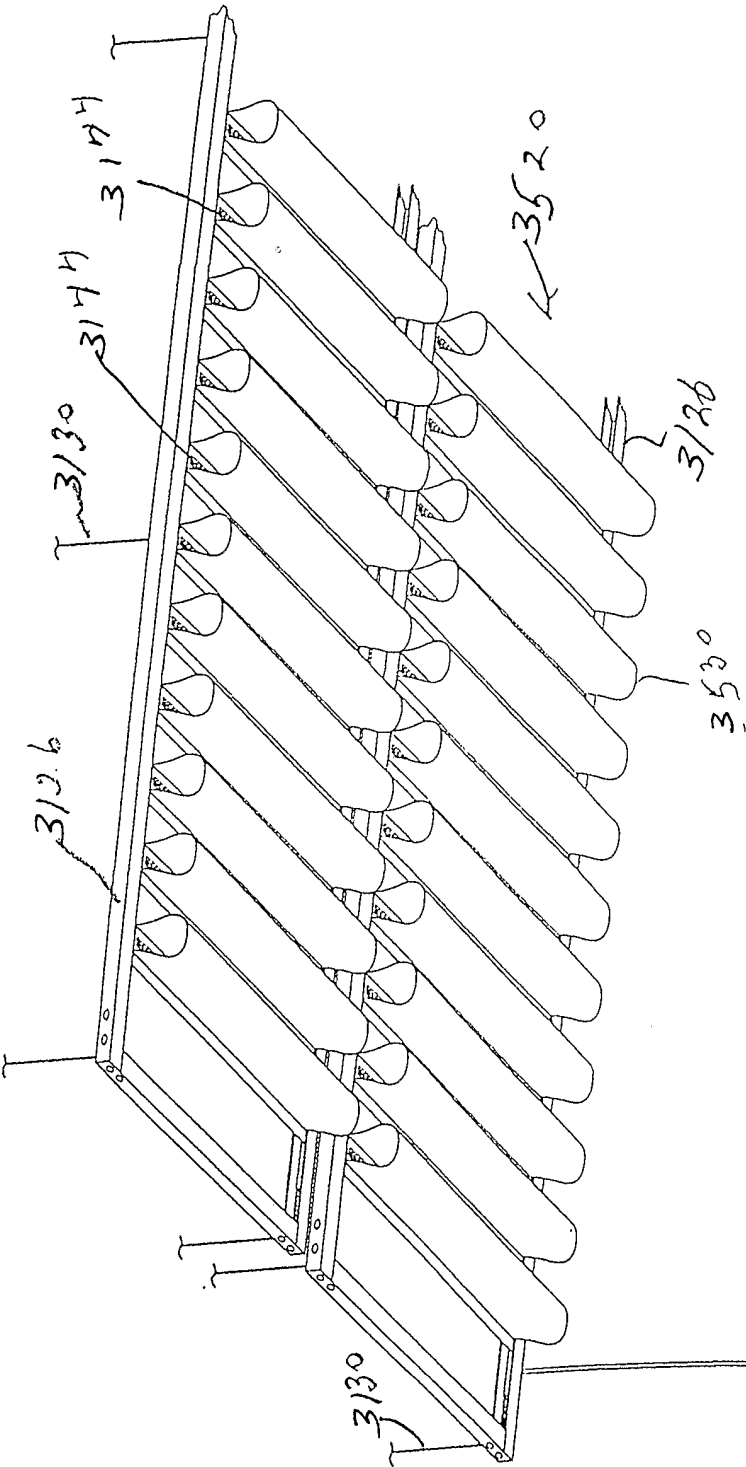


Fig. 118

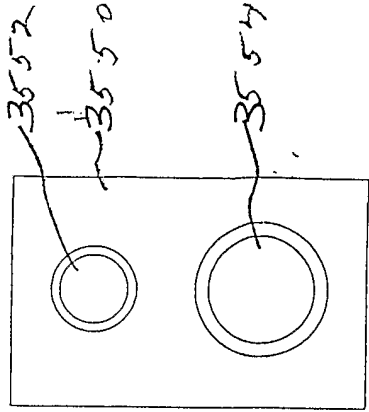
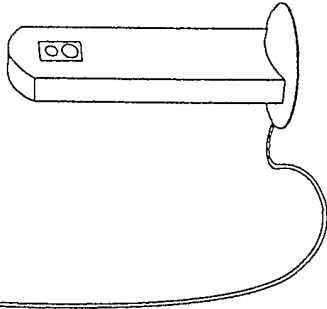


Fig. 118A



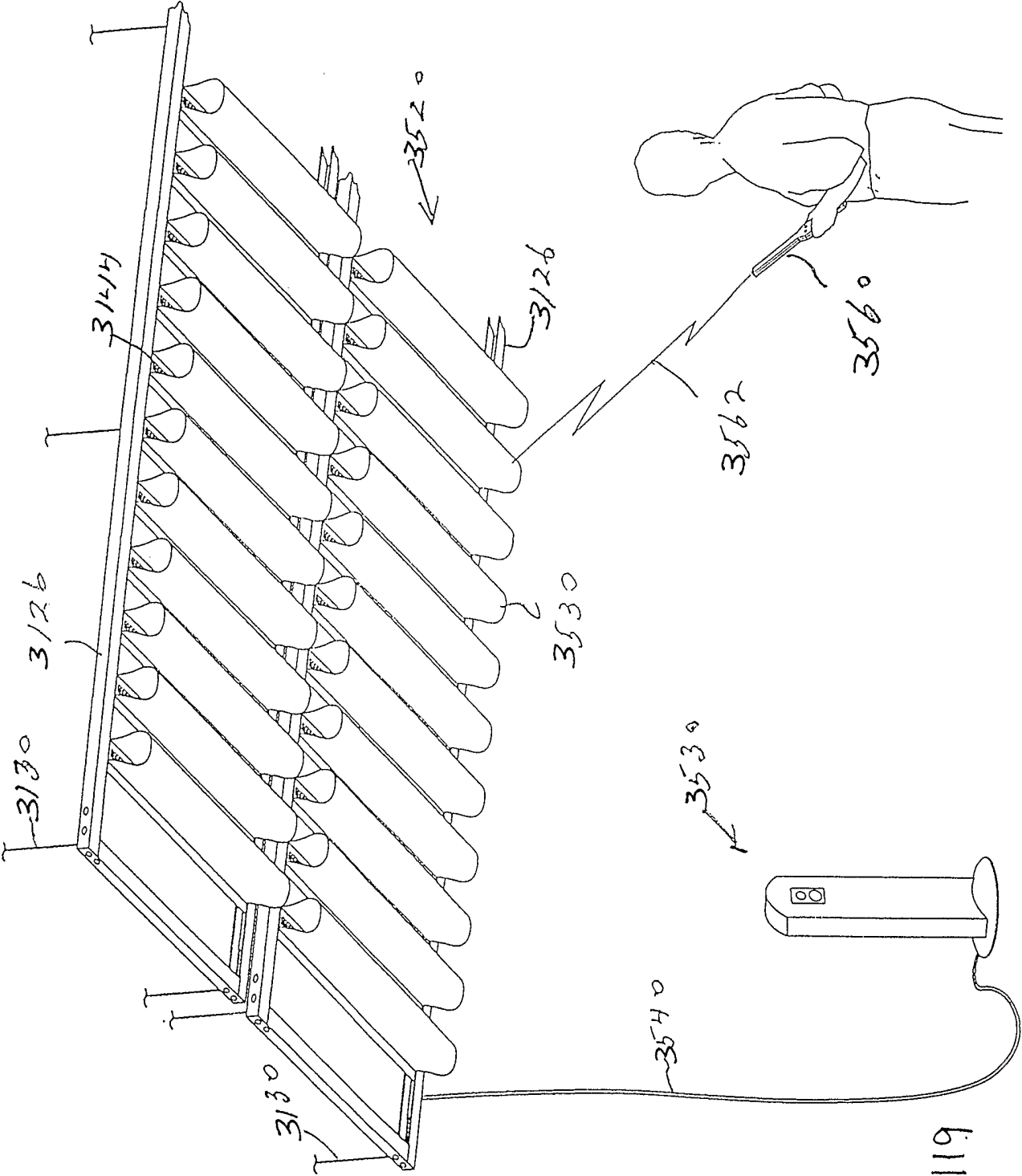


Fig. 119

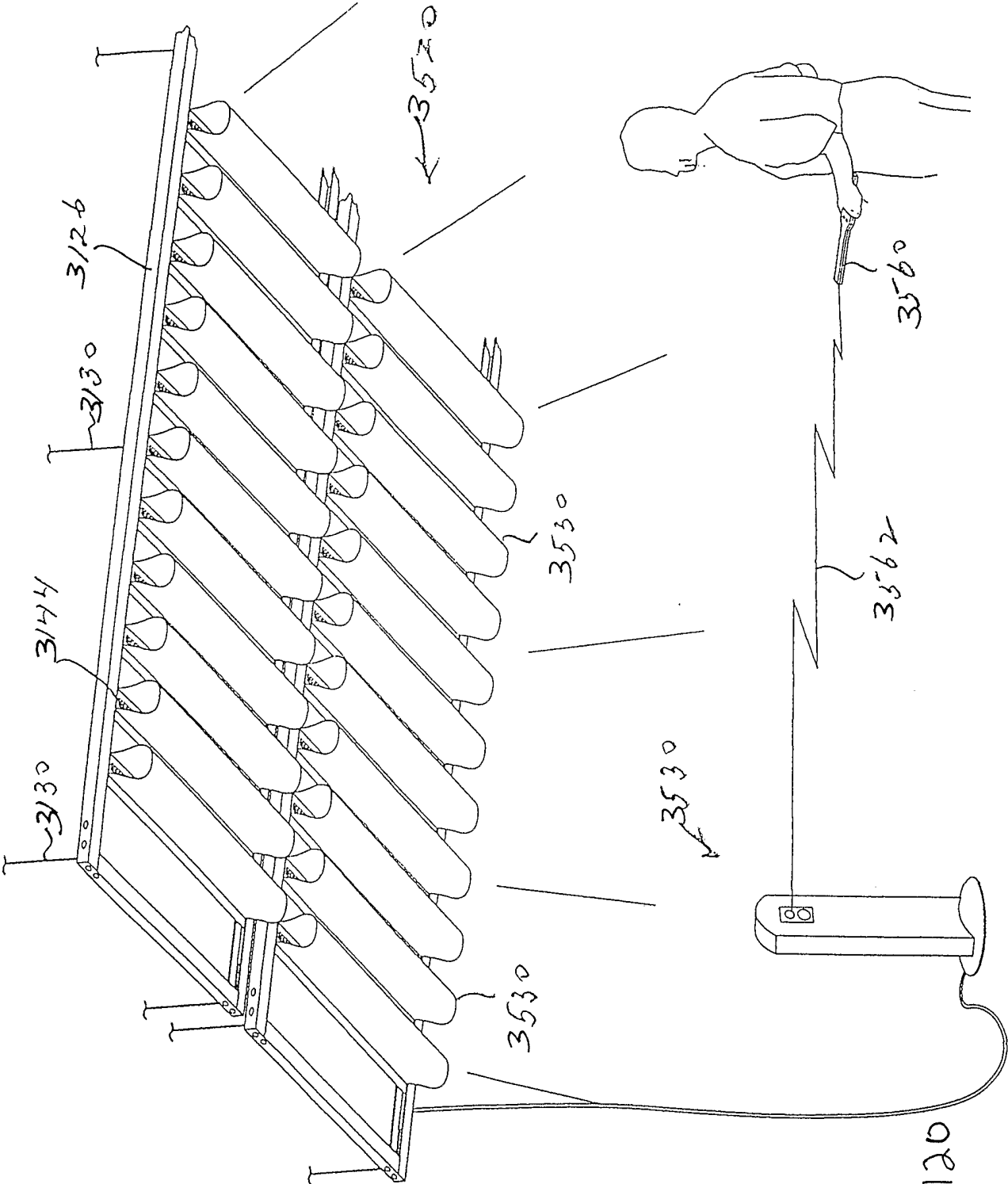


Fig. 120

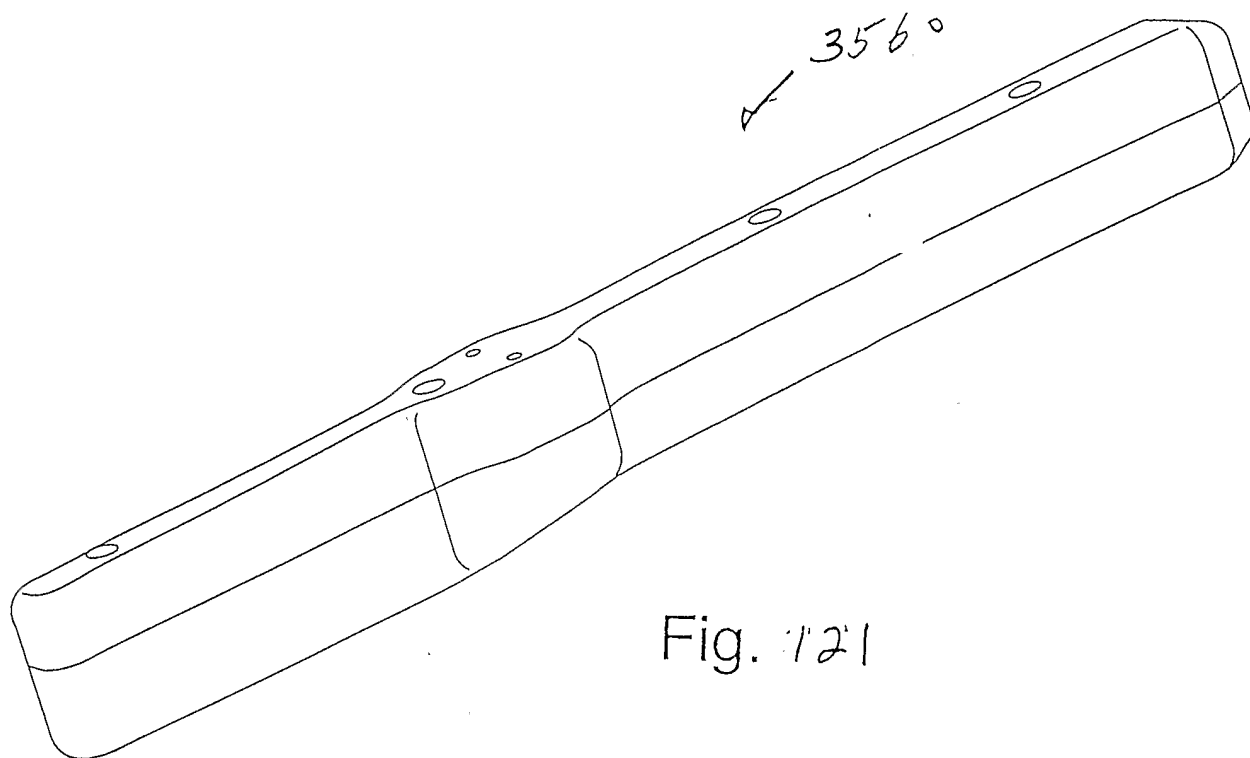


Fig. 121

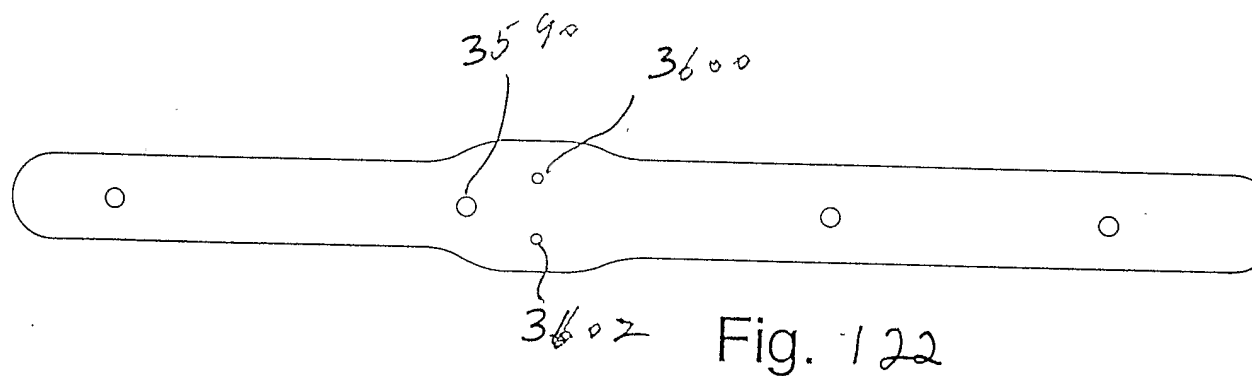


Fig. 122

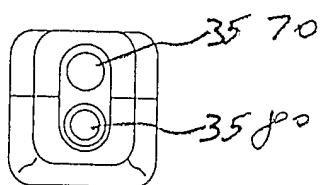


Fig. 123