

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO	
RAD: 14-68180- -3	FECHA: 2015-05-16 23:03:04
DEP: 2020 DIRECCION DE NUEVAS CREACIONES	EVE: 378 FASE NACIONAL INCLUIDO CAPITULO I
TRA: 11 PCT-PATENTE DE INVENCION CAPITULOS I Y II	FOLIOS: 8
ACT: 430 REQUERSOLICITA	

DIRECCIÓN DE NUEVAS CREACIONES

2020
Bogotá, D.C.,

Abogado(a)/Señor(a)
SILVANA MARÍA LÓPEZ DÍAZ

Asunto: Radicación: 14-68180- -3
Trámite: 11
Evento: 378
Actuación: 430
Oficio: 5201
Folios: 8

Patente de Invención	X			Patente de Modelo de Utilidad	
Vía Nacional					
Vía PCT (Fase Nacional)	X	Capítulo I	X	Capítulo II	
No. Solicitud Internacional	PCT/US2012/053002				
Fecha de Presentación Internacional	30/08/2012				

Como resultado del examen de fondo realizado, con fundamento en el Artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se comunica:

1. Documentos estudiados

Descripción:	Rad. N° 14-068180-00000-0000	31/Marzo/2014
Reivindicaciones:	Rad. N° 14-068180-00000-0000	31/Marzo/2014
Dibujos:	Rad. N° 14-068180-00000-0000	31/Marzo/2014
Prioridad:	US 61/529.167	30/Agosto/2011
	US 13/598.846	30/Agosto/2012

2. Análisis de la Prioridad

Se acepta la reivindicación de prioridad porque ésta solicitud fue presentada dentro del plazo establecido (Art. 9 D 486) y su contenido técnico corresponde con el de la prioridad reivindicada.

3. Objeto de la invención

De acuerdo con lo establecido en el numeral 1.2.2.2 del Capítulo Primero del Título X de la Circular Única para efectos del examen de patentabilidad, se tendrá en cuenta la tasa pagada por el solicitante al momento de comenzar el examen para las reivindicaciones adicionales; esto es que cuando la solicitud contenga más de diez (10) reivindicaciones y no se haya pagado la tasa complementaria, sólo se estudiarán las cubiertas por la tasa pagada. Por lo tanto, se estudiarán las reivindicaciones 1 a 18.

Título de la solicitud: “Sistema de revestimiento de contención para derrames ampliable, modular” (Fl. 1).

El problema planteado en esta solicitud, consiste en lograr un sistema de revestimiento de contención para derrames ampliable, modular para sitios de pozo de gas natural y crudo, sitios de subestación de empresa de suministro eléctrico, sitios de trabajo industrial, sitios de almacenamiento de material, entre otros.

Para resolver este problema técnico, la solicitud en estudio propone un sistema de revestimiento de contención ampliable que comprende una pluralidad de componentes de revestimiento termoplástico que constan de una pluralidad de paneles de cuerpo de revestimiento y una pluralidad de paneles de perímetro.

El objeto de la presente solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): E 02 D 31/00.

4. De la solicitud de patente

Reivindicaciones (Art 30 D 486, Art 22 PCT)

El capítulo reivindicatorio no es claro porque:

- La reivindicaciones 2, y las expresiones: “...formados para que se puedan conectar...”, “...en donde los paneles de cuerpo se forman para conexión sustancialmente hermética a líquidos de dichos paneles de cuerpo (...) y una porción coincidente de borde corriente debajo de otro panel...”, “...en donde los paneles de cuerpo se forman adicionalmente para conexión sustancialmente hermética a líquidos de paneles de cuerpo (...) y una porción coincidente de borde lateral derecho de otro panel de cuerpo...”, “...cada uno formado para conexión sustancialmente hermética a líquidos a un panel de cuerpo...”, “...formada selectivamente para conformarse a por lo menos una de una porción coincidente de borde corriente arriba (...) o porción de borde lateral izquierdo de un panel de cuerpo...”, “...con extremos formados para conexión sustancialmente hermética a líquidos a un extremo coincidente de otro panel de perímetro (...) para formar una nervadura de borde de perímetro...”, “...conectados en forma continua en relación hermética a líquido.” (reivindicación 1), “...en relación sustancialmente hermética a líquido...” (reivindicación 3), “...formadas para coincidir y conectar a por lo menos una de las dichas porciones de borde (...) y porciones de borde lateral derecho de los paneles de cuerpo...”, “...formadas para coincidir y conectar a por lo menos una de las esquinas de los paneles de cuerpo (...) y porciones de borde lateral derecho de los paneles de cuerpo.” (reivindicación 4), “...formada para definir una pluralidad de corrugaciones...”, “...para definir de este modo porciones de borde e panel corriente arriba y corriente abajo que tienen una superficie corrugada...”, “...en donde las porciones de borde de los paneles de perímetro que se forman para

que coincida cualquier porción (...) y las porciones de borde que coinciden con el panel de perímetro.” (reivindicación 5), “...formada para definir una pluralidad de corrugaciones...”, “y definir adicionalmente una superficie plana que se extiende alrededor de la periferia del panel para proporcionar porciones de borde planas (...) en forma similar planos.” (reivindicación 6), “...para conexión con porciones de borde planas que coinciden de los paneles de perímetro...”, “...que se adaptan para almacenamiento y envío en forma de rollo para despliegue y ensamble en el sitio de trabajo (...) de láminas cortadas individuales más cortas.” (reivindicación 7), “...para facilitar la eliminación de una parte de porción de borde.” (reivindicación 9), “...formados para que se puedan conectar cada uno...”, “...formados para conexión sustancialmente hermética de líquidos de dichos paneles de cuerpo entre una porción de borde corriente arriba (...) y una porción de borde lateral derecho de otro panel...”, “...en conexión sustancialmente hermética a líquidos (...) a través de la superficie preparada del complejo industrial...”, “...formados para conexión sustancialmente hermética a líquidos de dichos paneles con un panel de cuerpo...”, “...formada selectivamente para conformarse a por lo menos una de una porción coincidente de borde corriente arriba (...) o porción de borde lateral izquierdo de panel de cuerpo...”, “...en relación sustancialmente hermética a líquido con bordes coincidentes de los paneles de cuerpo ensamblados...”, “...en relación sustancialmente hermética a líquido para que coincida con la porción seleccionada de nervadura (...) para formar una nervadura de borde de perímetro...”, “...y se conecta a este para formar un sistema de revestimiento de contenedor sustancialmente hermético a líquido (...) de revestimiento de contención.” (reivindicación 12), “...que llevan carga para soportar operación de vehículo y equipo industrial estacionario por encima del sistema de revestimiento.” (reivindicación 16), “...conectados para facilitar la eliminación de una porción de borde.” (reivindicación 17), “...formada para definir una pluralidad de corrugaciones...”, “...y define adicionalmente nervaduras de corrugación de desplazamiento (...) derecho o izquierdo...” (reivindicación 18); describen funciones, efectos, ventajas o resultados a alcanzar, los cuales no son aspectos susceptibles de patente. Para mayor claridad, el producto reclamado se debe definir técnicamente mediante sus características estructurales. Se sugiere al solicitante eliminar la reivindicación y expresiones citadas, o en su defecto replantearlas de tal manera que expongan características constructivas.

Cabe agregar, que la reivindicación 2 tampoco no cumple con lo establecido en el artículo 30 de la Decisión 486, por cuanto carece de concisión, toda vez que no las características descritas en la misma ya habían sido reclamadas en la reivindicación 1.

- Las reivindicaciones 10 y 11 son reivindicaciones de producto, y sólo pueden ser definidas en términos de su proceso de fabricación si: el producto es nuevo e inventivo y no se puede definir por sus características estructurales. En este caso, el producto reclamado sí puede definirse por sus características constructivas, por lo cual, estas reivindicaciones no pueden ser aceptadas.
- La reivindicación 12 menciona los pasos de: “...ensamblar una pluralidad de paneles de cuerpo...” y “...conectar dichos paneles de cuerpo...”, lo cual no es claro, toda vez que los términos ensamblar y conectar son sinónimos, por lo tanto, la reivindicación reclamaría dos etapas que describen el mismo paso del procedimiento. Se sugiere al solicitante realizar las aclaraciones y/o correcciones pertinentes.
- Las reivindicaciones 14, 15 y 16 mencionan la superficie donde se va a disponer el revestimiento de contención y las capas y mantas que van a cubrir dicho revestimiento posterior a su instalación, lo cual no está relacionado con el objeto de la invención el

cual es el revestimiento de contención como tal. Por lo tanto, la superficie donde se va a disponer el revestimiento y las capas o mantas que lo cubrirían posterior a su instalación se consideran elementos ajenos a la invención y como tal, no pueden ser aceptados dentro del capítulo reivindicatorio.

- Los términos: “sustancialmente”, “pluralidad” (reivindicación 4) y “selectivamente”, son de carácter impreciso, por lo cual no permite distinguir la invención del estado de la técnica. Se sugiere sustituirlos por un término preciso o en su defecto eliminarlos de las reivindicaciones.

5. Determinación del Estado de la Técnica

El estado de la técnica se determinó con base en la fecha de presentación de la solicitud de prioridad: agosto 30 de 2011, y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Ítem	Documento	Título	Fecha de Publicación
D1	US 5'810.511	'Spill containment system'	22/Septiembre/1998
D2	US 2011/0135392	'Modular, scalable liquid management system'	09/Junio/2011

El documento D1¹ divulga un sistema de contención de derrames que comprende una pluralidad de láminas impermeables operativas. Cada lámina tiene un borde perimetral adaptado a un sellamiento para anexarse al borde perimetral de otra lámina (resumen).

El documento D2² divulga un sistema de manejo de líquido ampliable. El sistema descrito es modulara en que esta ensamblado desde unos componentes primarios. El sistema es ampliable porque los componentes están adaptados para modificar su tamaño y combinados para formar un sistema tan ancho o largo como se necesite (resumen).

Examen de Patentabilidad (Art 14 D486)

Novedad (Art 16 D486)

La reivindicación 1 consiste en: “*Un sistema de revestimiento de contención ampliable, modular para un complejo industrial que comprende: una pluralidad...*” (Ver página 59 del radicado N° 14-068180-00000-0000).

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Características esenciales	D1	D2
Sistema de revestimiento de contención ampliable que comprende:	Sistema de contención de derramamiento que comprende:	Sistema de manejo de fluido caracterizado por:
Una pluralidad de componentes de revestimiento termoplástico, que	Una bandeja o una barrera de fluido formada por una pluralidad de láminas	Componentes base (111) generalmente rectangulares en su forma (Párr. [0041])

1 <https://docs.google.com/viewer?url=patentimages.storage.googleapis.com/pdfs/US5810511.pdf>

2 <https://docs.google.com/viewer?url=patentimages.storage.googleapis.com/pdfs/US20110135392.pdf>

tienen una porción de borde corriente arriba, una porción de borde corriente abajo, una porción de borde lateral derecho y una porción de borde lateral izquierdo.	impermeables (42) unidos en sus bordes (44) (Fig. 2; Col. 2, líneas 42 a 51)	
Una pluralidad de paneles de cuerpo de revestimiento		
Una pluralidad de paneles de perímetro, con una porción de borde y una porción de nervadura de borde de perímetro elevada continua, que se extiende completamente alrededor de un ensamble de paneles de cuerpo.	Las láminas impermeables (42) están rodeadas por la pared (46). La pared (46) comprende un soporte (52a) transverso a la dirección del soporte (52) en las láminas (42). El canal en forma de gancho (58a) soldado al soporte (52a) yace paralelo al borde exterior del canal (58a) (Col. 3, líneas 19 a 25).	Componentes brazo (121) y (131) que comprenden un pie (124) y (134) respectivamente, que está inclinado hacia afuera en un ángulo obtuso respecto al plano del cuerpo principal de los componentes de brazo, para conectar el componente base (Párr. [0044]).

De acuerdo con la tabla anterior, las características esenciales del sistema de revestimiento de la reivindicación 1 habían sido divulgadas previamente en los documentos D1 y D2, por lo tanto, la materia reivindicada no es nueva.

Asimismo, los documentos D1 y D2 divulgan las características de las reivindicaciones dependientes así:

- Reivindicaciones 3: Un espaciador (62) u otro elemento de acuñamiento, que mantiene los miembros de canal en forma de gancho juntos (58a) y (58b). Un balón elongado de goma (64) es insertado en los espacios del canal en forma de gancho, dicho balón elongado (64) puede ser asegurado con adhesivo (D1: Col. 2, líneas 65 a 67; Col. 3, líneas 1 a 10). Los componentes base (111) pueden ser ensamblados con sellante como adhesivo y tornillos (D2: Párr. [0047]).
- Reivindicación 4: Las láminas impermeables (42) están rodeadas por la pared (46). La pared (46) comprende un soporte (52a) transverso a la dirección del soporte (52) en las láminas (42). El canal en forma de gancho (58a) soldado al soporte (52a) yace paralelo al borde exterior del canal (58a) (D1: Col. 3, líneas 19 a 25). Componentes brazo (121) y (131) que comprenden un pie (124) y (134) respectivamente, que está inclinado hacia afuera en un ángulo obtuso respecto al plano del cuerpo principal de los componentes de brazo, para conectar el componente base (D2: Párr. [0044]).
- Reivindicaciones 5 y 6: Nervaduras de corrugación (112) y (113), tanto de los componentes base como de los componentes brazo (D2: Fig. 2, Párr. [0041]). Los omponentes brazo (121) y (131) que comprenden un pie (124) y (134) respectivamente, que está inclinado hacia afuera en un ángulo obtuso respecto al plano del cuerpo principal de los componentes de brazo, para conectar el

componente base (D2: Párr. [0044]).

- Reivindicación 7: Los componentes base (111) pueden ser adaptados para ser cortados (D2: Párr. [0047]).
- Reivindicación 8: Un desagüe para uso de una tubería (D1: Figs. 7 y 11).

La reivindicación 12 consiste en: “*Un método para ensamblar un revestimiento de contención ampliable, modular para un complejo industrial que comprende...*” (Ver página 65 del radicado N° 14-068180-00000-0000).

Comparación de las características técnicas esenciales, con las del estado de la técnica:

Características esenciales	D1	D2
Un método para ensamblar un revestimiento de contención que comprende:	Sistema de contención de derramamiento que comprende:	Sistema de manejo de fluido caracterizado por:
Proporcionar una pluralidad de componentes de revestimiento termoplástico, que tiene una porción de borde corriente arriba, una porción de borde corriente abajo, una porción de borde lateral derecho y una porción de borde lateral izquierdo.	Una bandeja o una barrera de fluido formada por una pluralidad de láminas impermeables (42) unidos en sus bordes (44) (Fig. 2; Col. 2, líneas 42 a 51)	Componentes base (111) generalmente rectangulares en su forma (Párr. [0041])
Ensamblar una pluralidad de paneles de cuerpo de revestimiento.		
Ensamblar una pluralidad de paneles de perímetro de revestimiento con una porción de borde.	Las láminas impermeables (42) están rodeadas por la pared (46). La pared (46) comprende un soporte (52a) transverso a la dirección del soporte (52) en las láminas (42). El canal en forma de gancho (58a) soldado al soporte (52a) yace paralelo al borde exterior del canal (58a) (Col. 3, líneas 19 a 25).	Componentes brazo (121) y (131) que comprenden un pie (124) y (134) respectivamente, que está inclinado hacia afuera en un ángulo obtuso respecto al plano del cuerpo principal de los componentes de brazo, para conectar el componente base (Párr. [0044]).
Conectar las porciones de borde coincidentes de los paneles de perímetro y conectar las porciones de nervadura de perímetro elevadas de los paneles de perímetro. La nervadura elevada continua que se extiende alrededor del ensamble de paneles de cuerpo.		

Asimismo, los documentos D1 y D2 divulgan las características de las reivindicaciones

dependientes así:

- Reivindicaciones 13: Un espaciador (62) u otro elemento de acuñamiento, que mantiene los miembros de canal en forma de gancho juntos (58a) y (58b). Un balón elongado de goma (64) es insertado en los espacios del canal en forma de gancho, dicho balón elongado (64) puede ser asegurado con adhesivo (D1: Col. 2, líneas 65 a 67; Col. 3, líneas 1 a 10). Los componentes base (111) pueden ser ensamblados con sellante como adhesivo y tornillos (D2: Párr. [0047]).
- Reivindicación 18: Nervaduras de corrugación (112) y (113), tanto de los componentes base como de los componentes brazo (D2: Fig. 2, Párr. [0041]). Los componentes brazo (121) y (131) que comprenden un pie (124) y (134) respectivamente, que está inclinado hacia afuera en un ángulo obtuso respecto al plano del cuerpo principal de los componentes de brazo, para conectar el componente base (D2: Párr. [0044]).

Las reivindicaciones 2, 10, 11, 12, 14, 15 y 16 fueron afectadas en el numeral 4 de la presente comunicación.

6. Conclusión

Los requisitos de Patentabilidad de la presente solicitud están afectados así:

Ítem	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US 5'810.511	1 a 18	Novedad/Nivel Inventivo
D2	US 2011/0135392	1 a 18	Novedad/Nivel Inventivo

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de sesenta (60) días contados a partir del día siguiente de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante de sesenta (60) días para dar respuesta a este requerimiento y presentarla por escrito.

Finalmente, se le recuerda al solicitante que si como respuesta a este requerimiento llegara a modificar el capítulo reivindicatorio y éste contenga más de diez (10) reivindicaciones, no pagará la tasa de modificación voluntaria pero sí la correspondiente al pago por reivindicación adicional.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.



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El anterior requerimiento fue notificado por fijación en lista, de fecha 2015-05-19

Elaboró: Monica Andrea Gutierrez Almonacid
Revisó: Sonia Andrea Diaz Pirazan



US005810511A

United States Patent [19]

Schmidt

[11] Patent Number: **5,810,511**
[45] Date of Patent: **Sep. 22, 1998**

[54] **SPILL CONTAINMENT SYSTEM**

[76] Inventor: **Gordon G. Schmidt**, 6824 - 94B
Avenue, Edmonton, Alberta, Canada,
T6B 0Z7

[21] Appl. No.: **544,992**

[22] Filed: **Oct. 30, 1995**

[51] Int. Cl.⁶ **E02D 27/32**

[52] U.S. Cl. **405/52; 405/303; 52/169.7**

[58] Field of Search **405/52, 270, 267,**
405/278, 279, 303; 52/582.1, 264, 270,
284, 169.7; 137/303, 236.1

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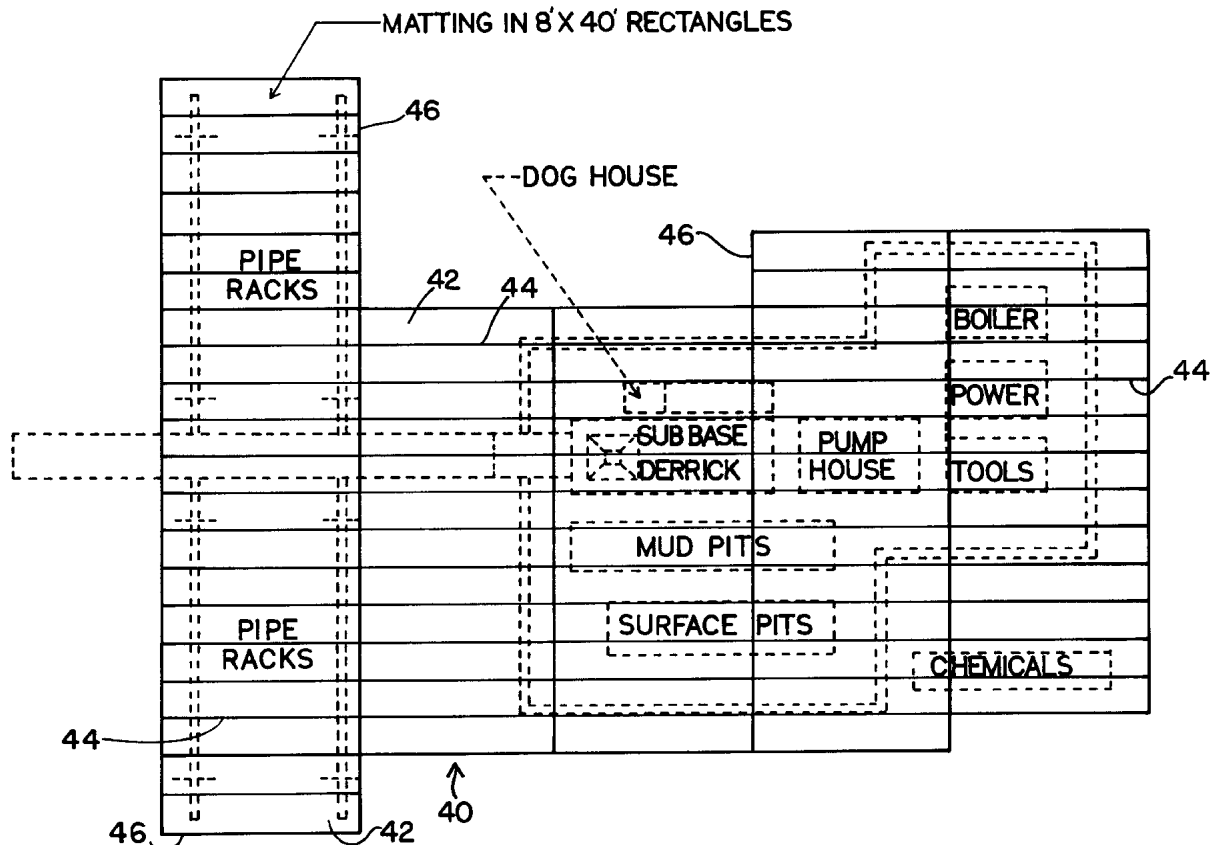
1334680	9/1962	Germany		220/681
286068	10/1988	Germany		405/279
6247522 A	9/1994	Japan		405/55

Primary Examiner—Tamara L. Graysay
Assistant Examiner—Frederick L. Lagman
Attorney, Agent, or Firm—Frank J. Dykas

[57] **ABSTRACT**

A spill containment system has plural fluid impervious sheets. Each sheet has peripheral edges adapted to sealingly couple to the peripheral edge of each other sheet. Plural wall elements each have an edge adapted to sealingly couple to, and uncouple from, peripheral edges of the fluid impervious sheets. The fluid impervious sheets and the wall elements may be sealed together to form a pan like structure.

15 Claims, 18 Drawing Sheets



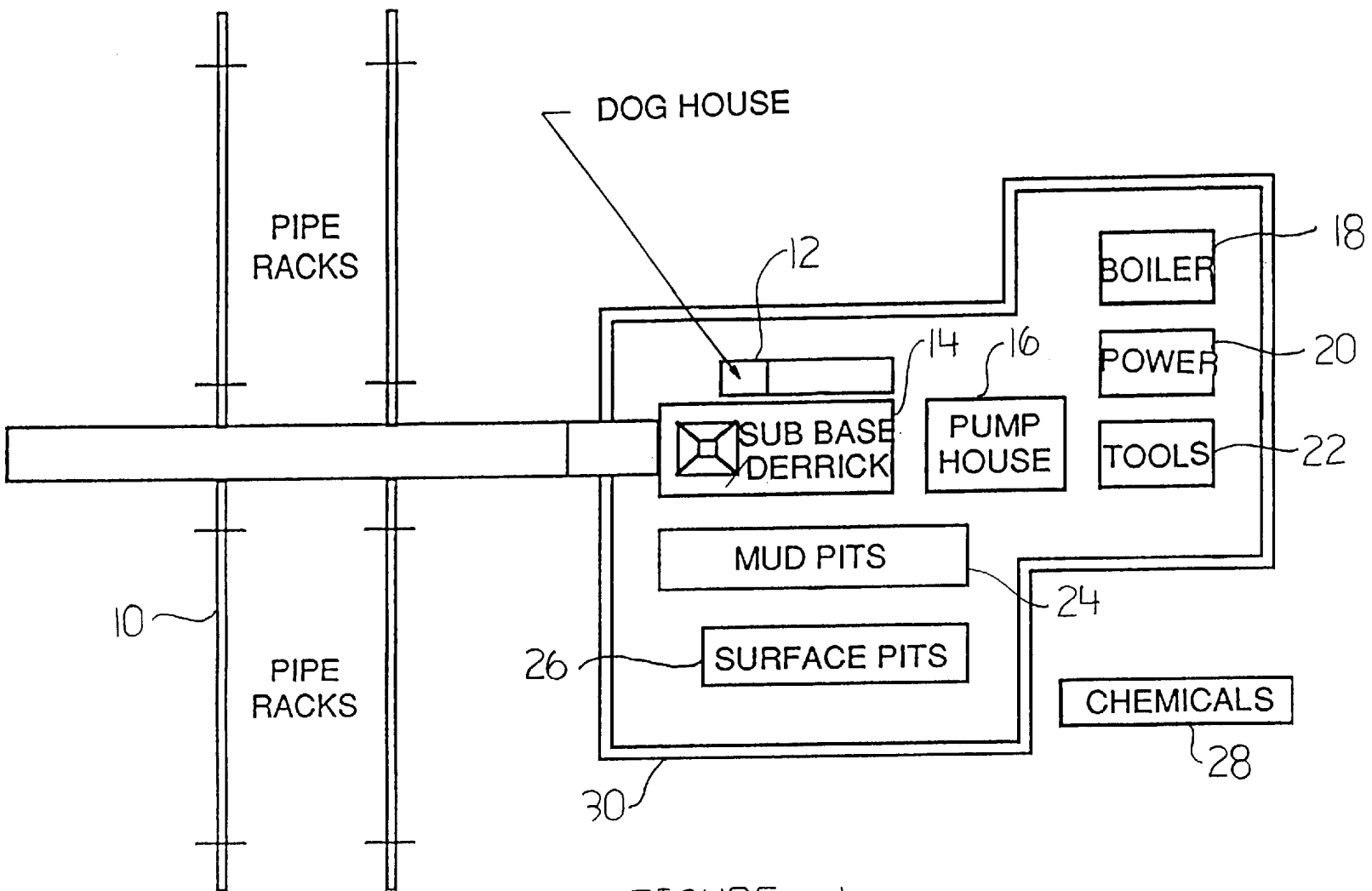
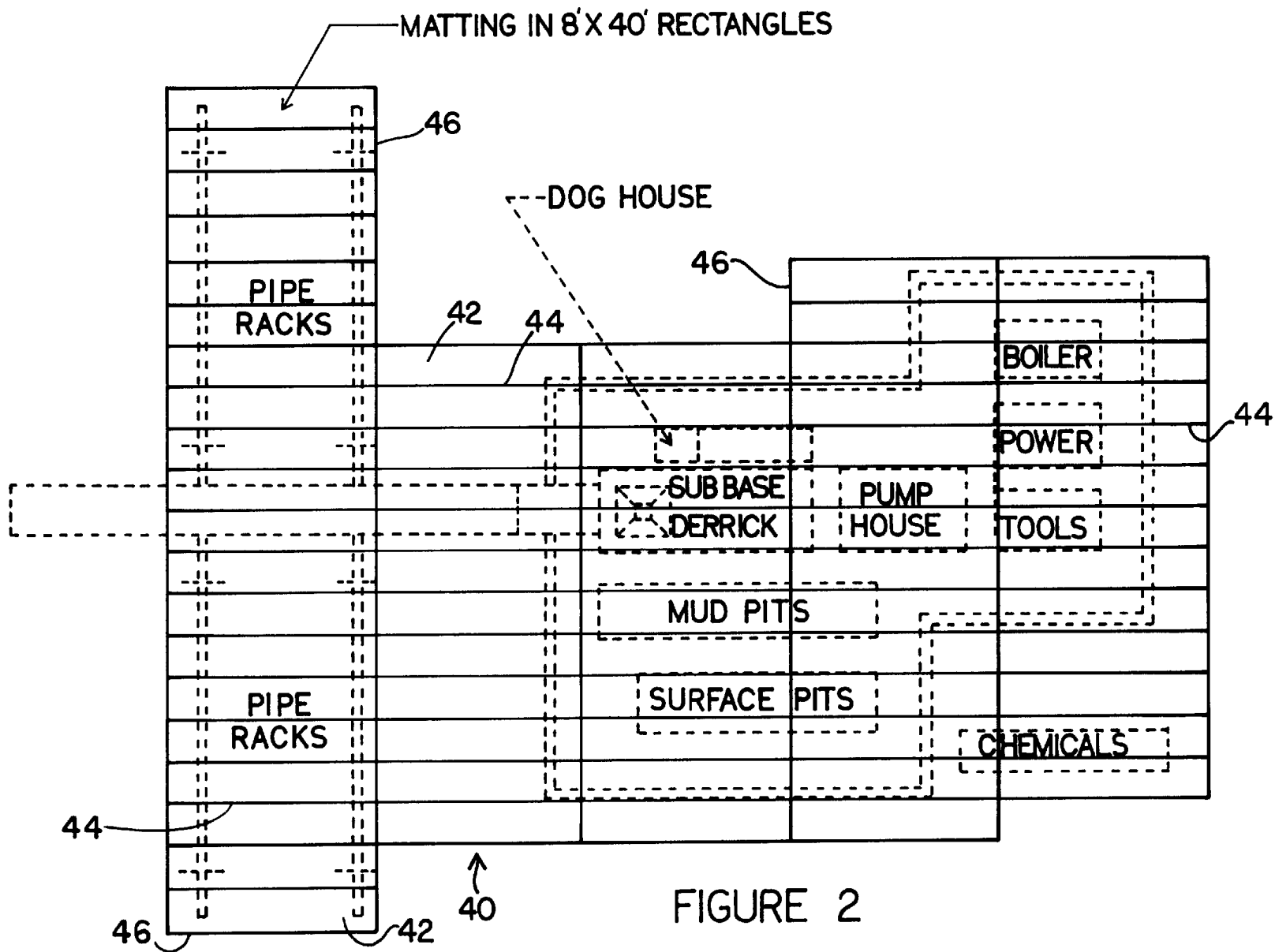


FIGURE 1



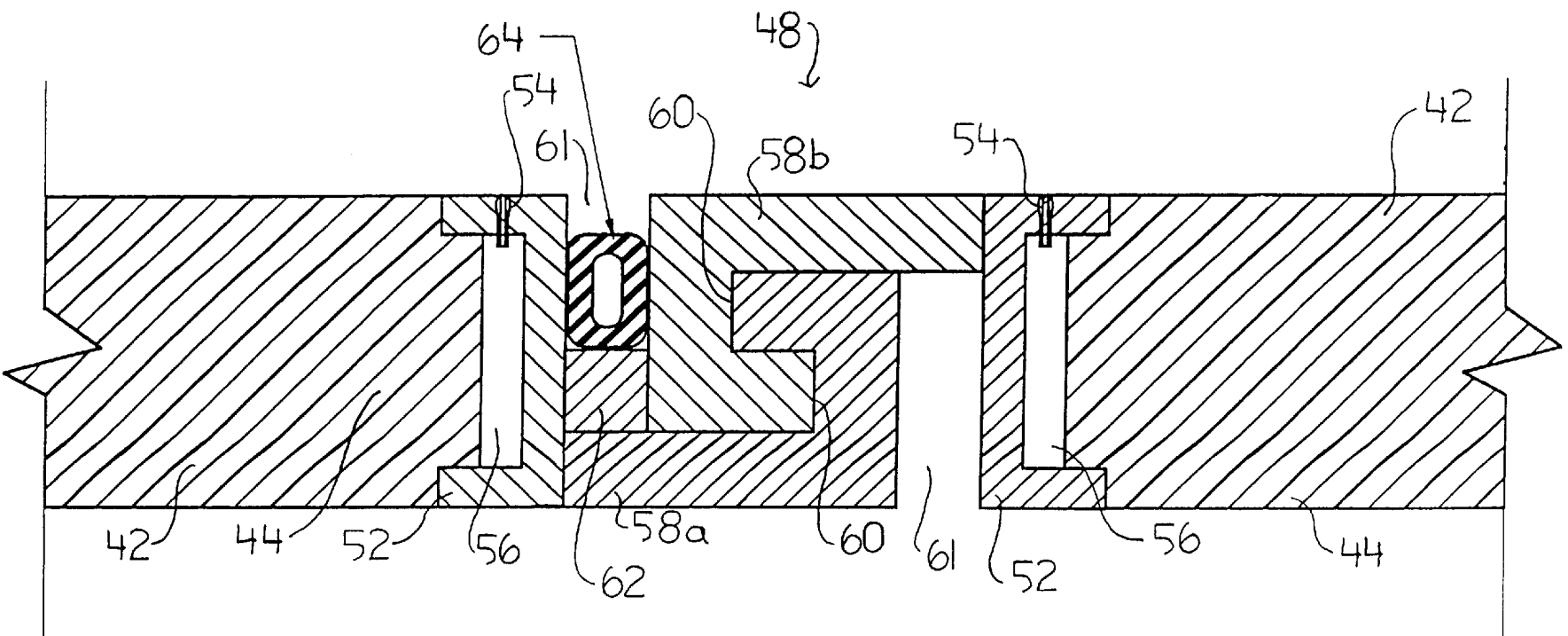
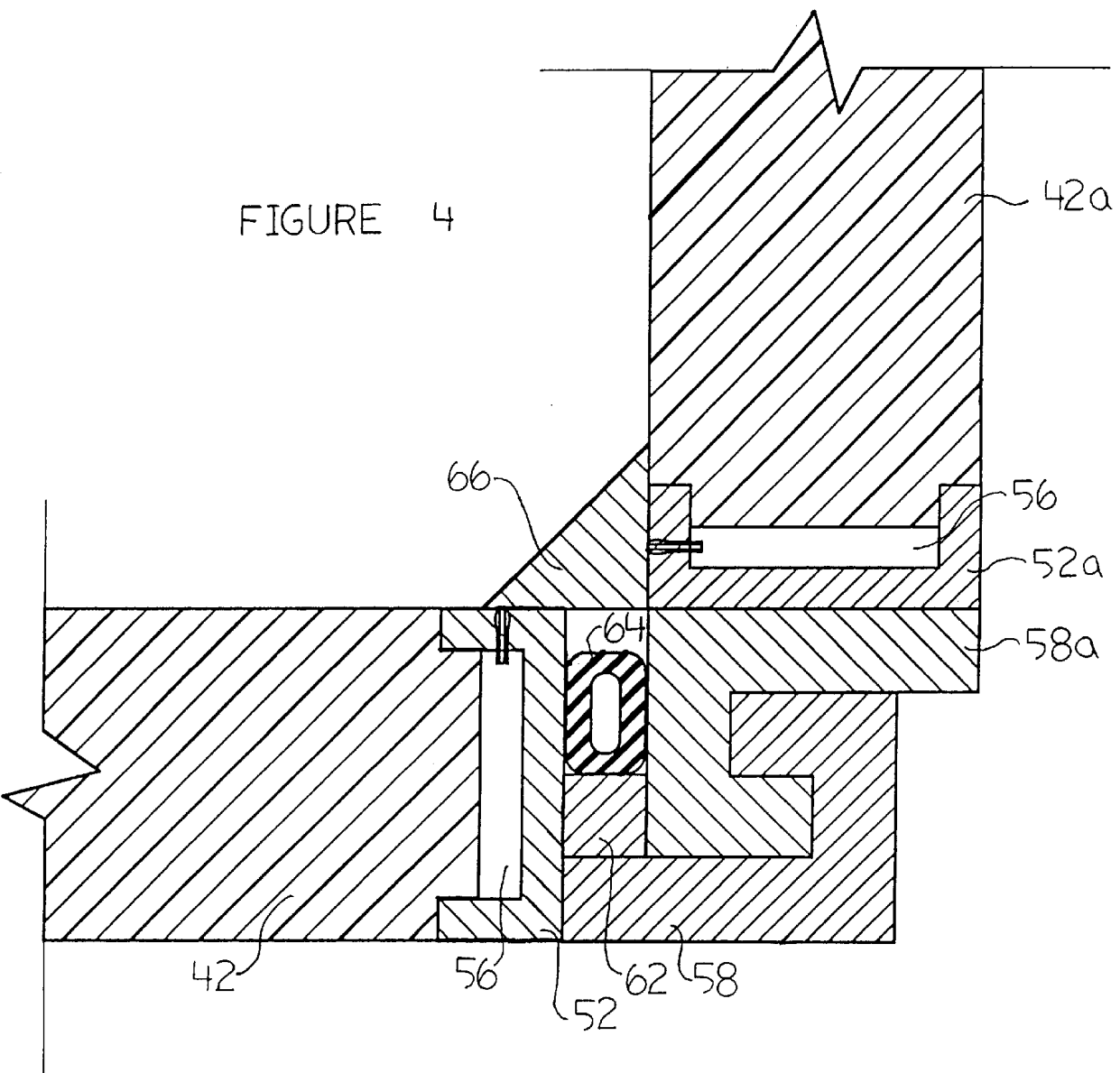


FIGURE 3

FIGURE 4



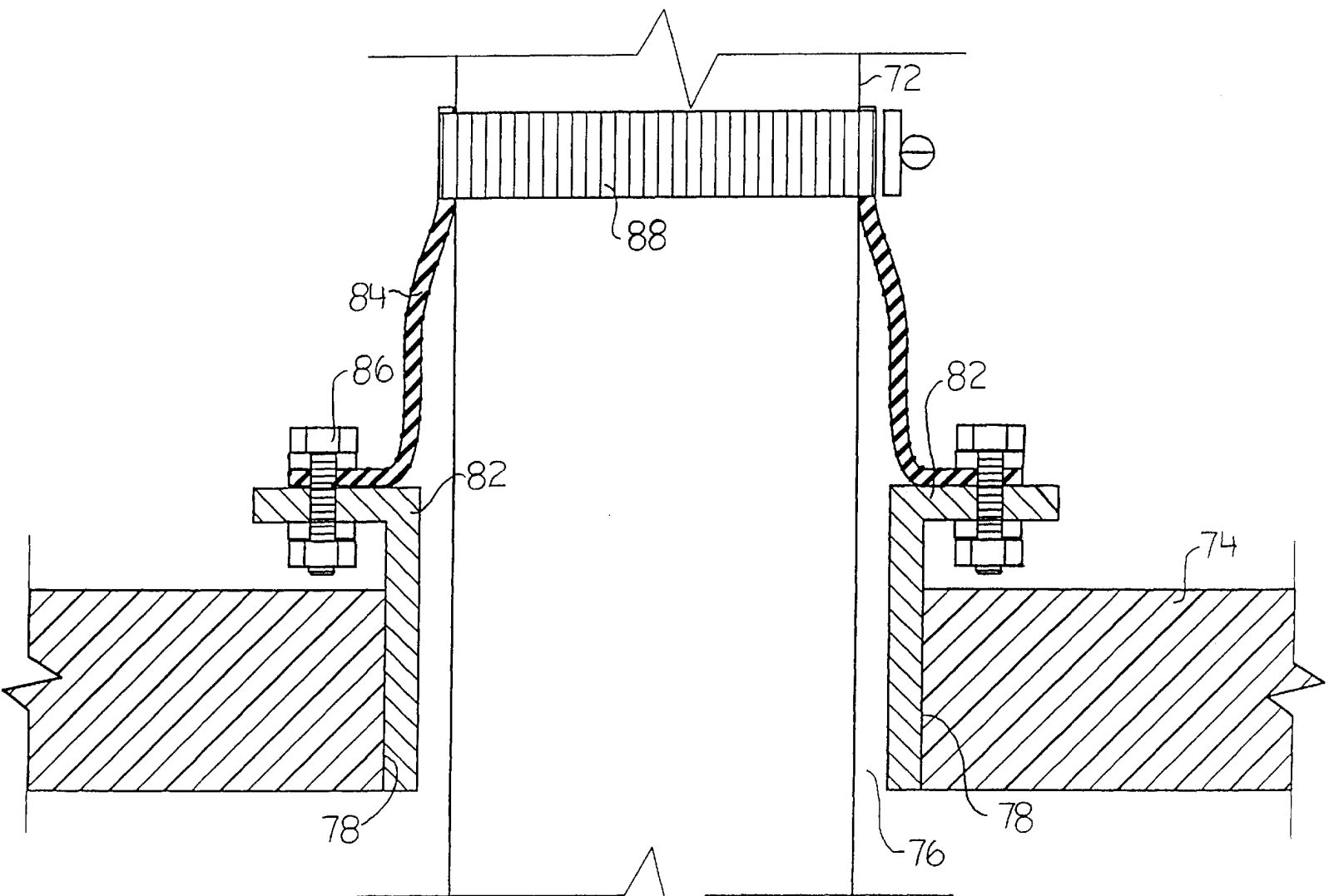


FIGURE 5

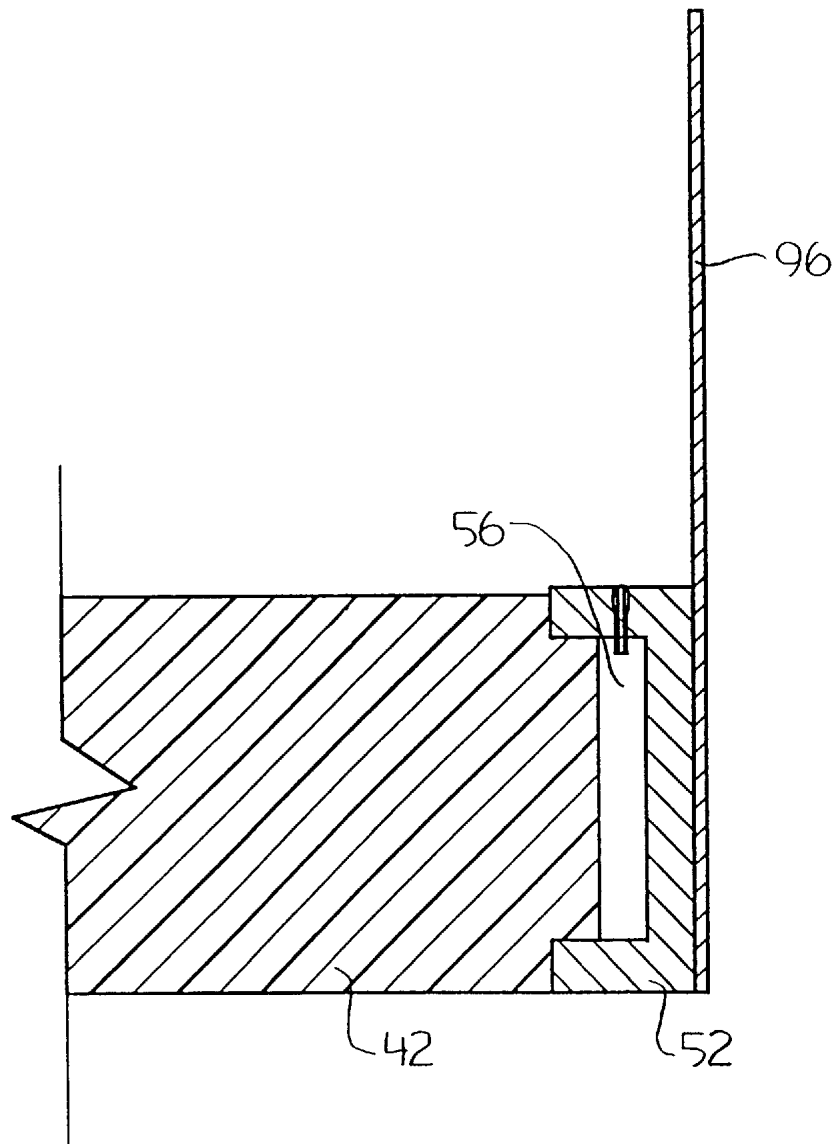


FIGURE 6

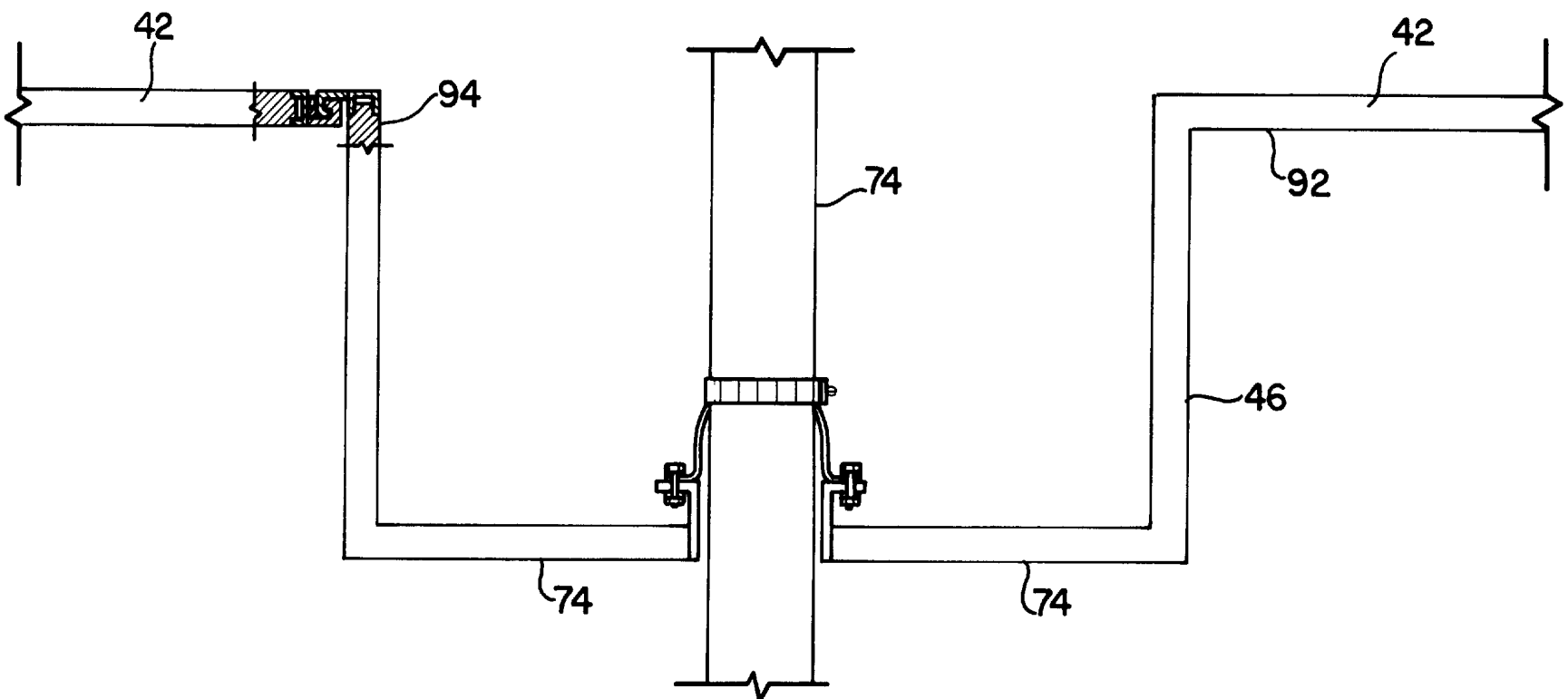
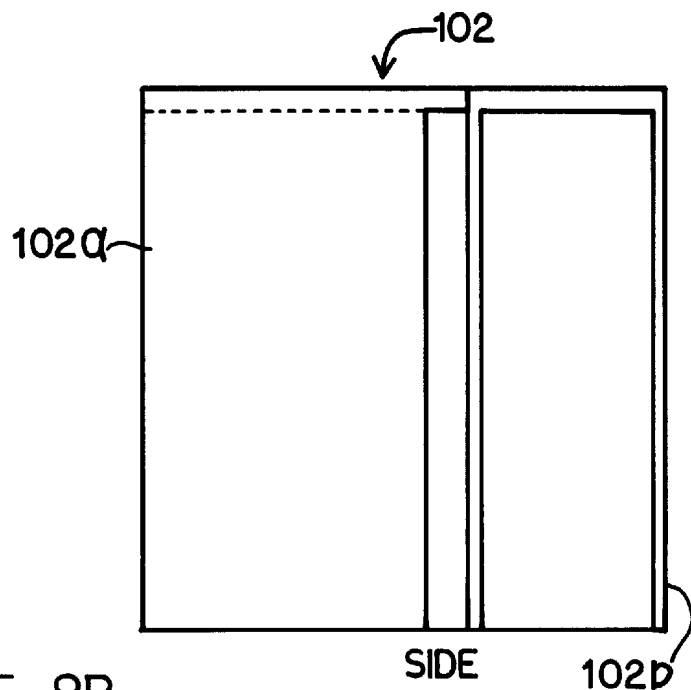
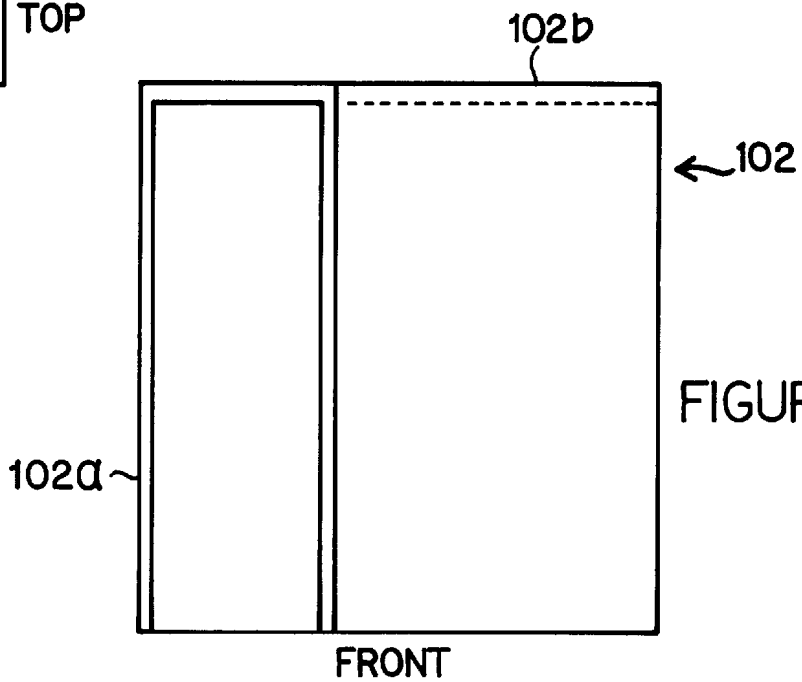
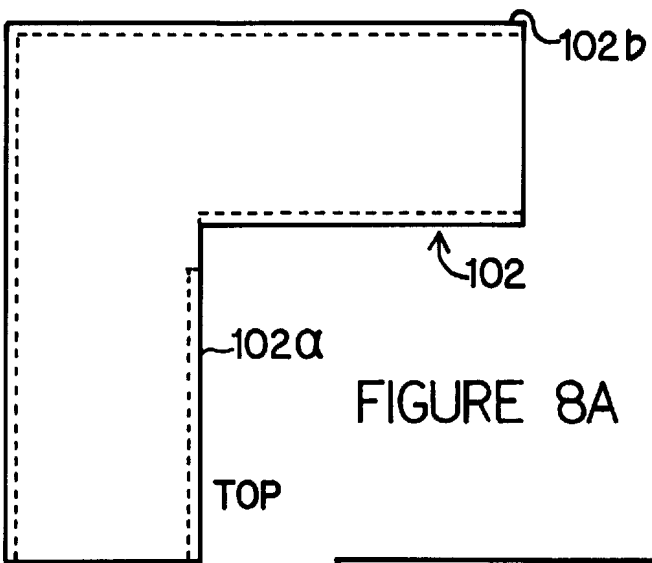
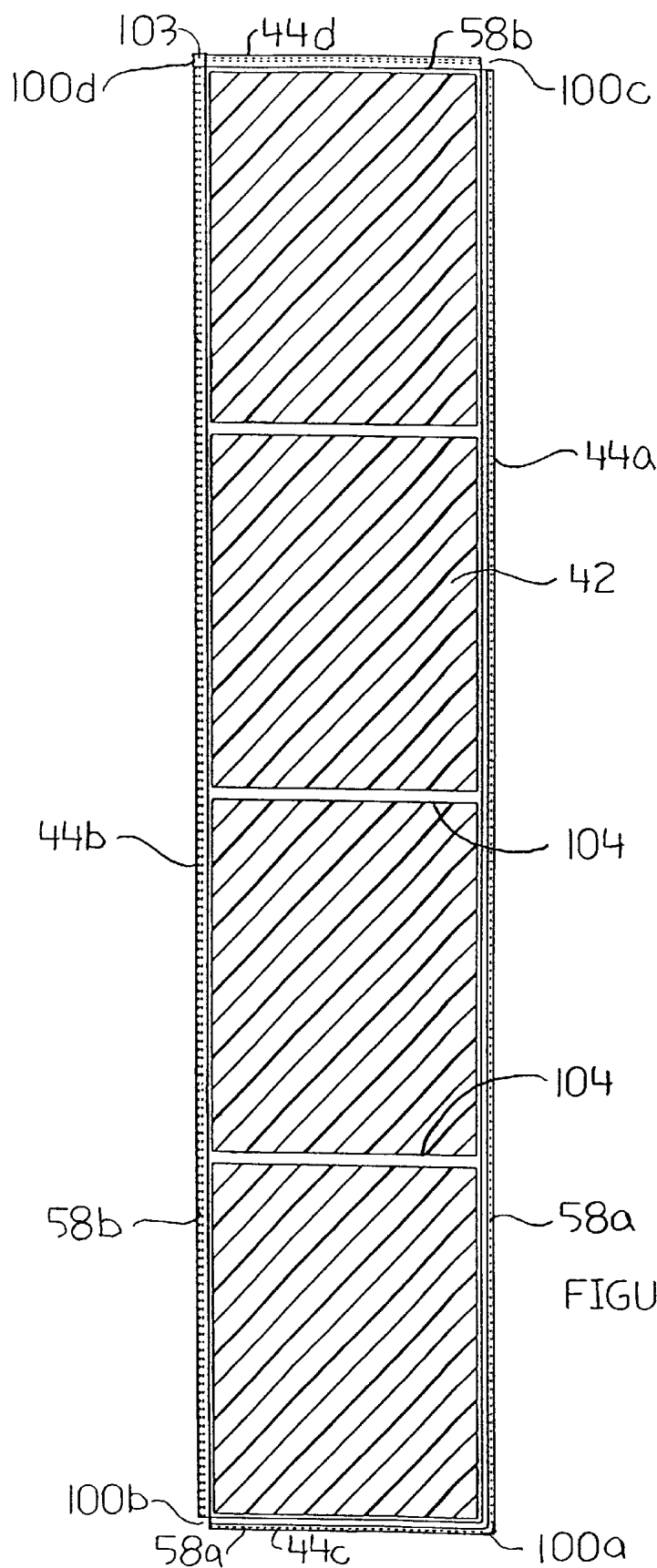


FIGURE 7





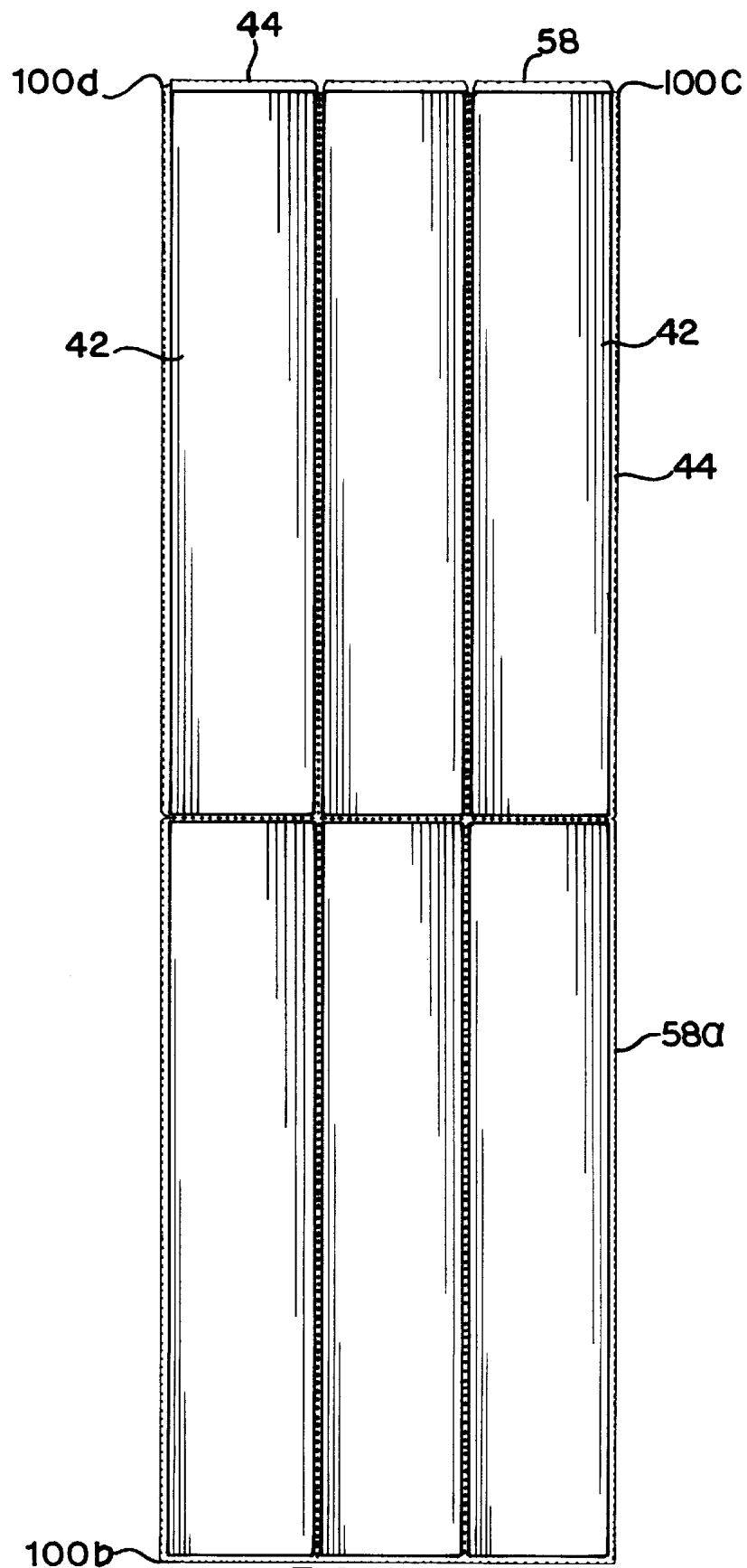


FIGURE 10

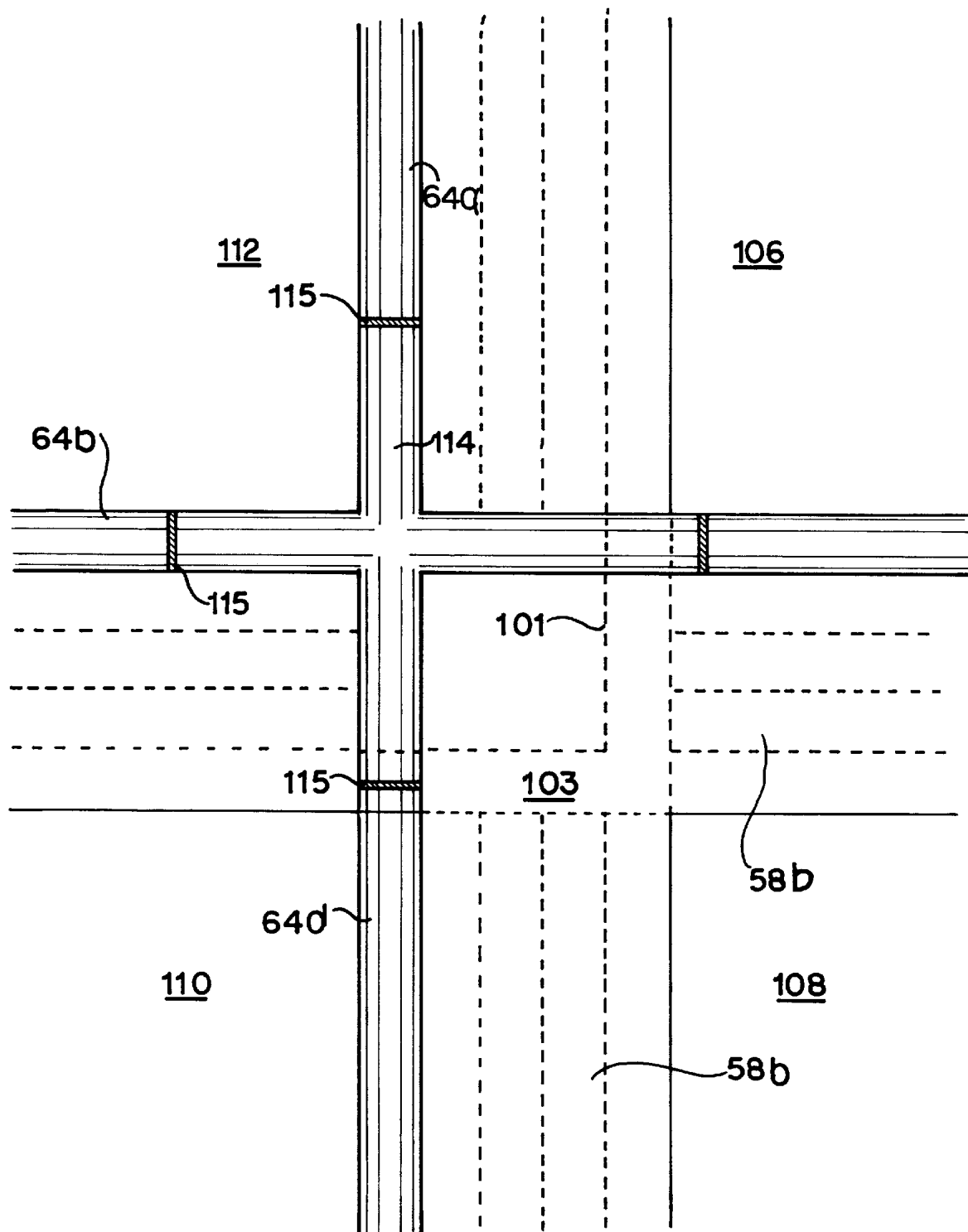


FIGURE 10A

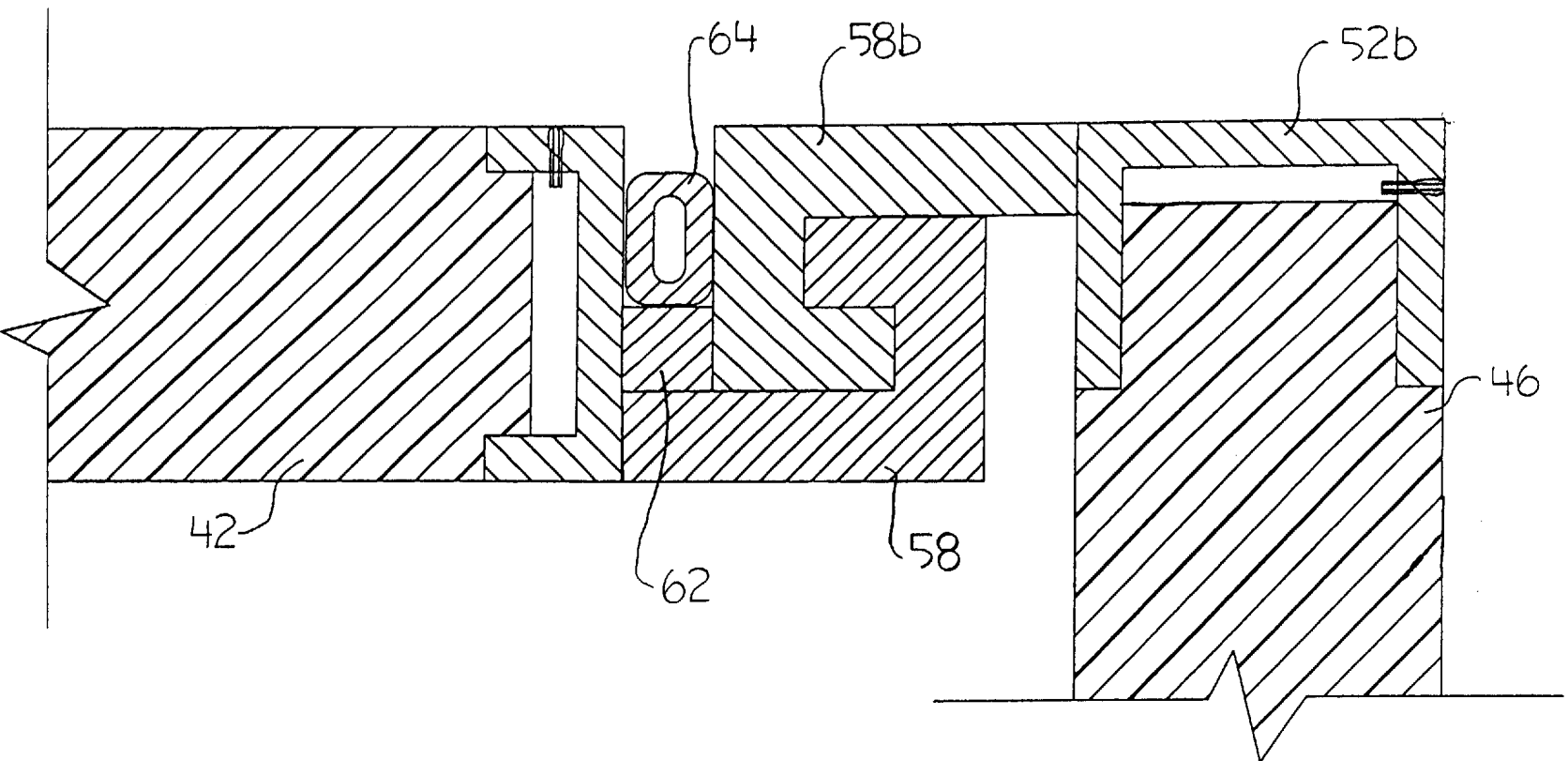


FIGURE II

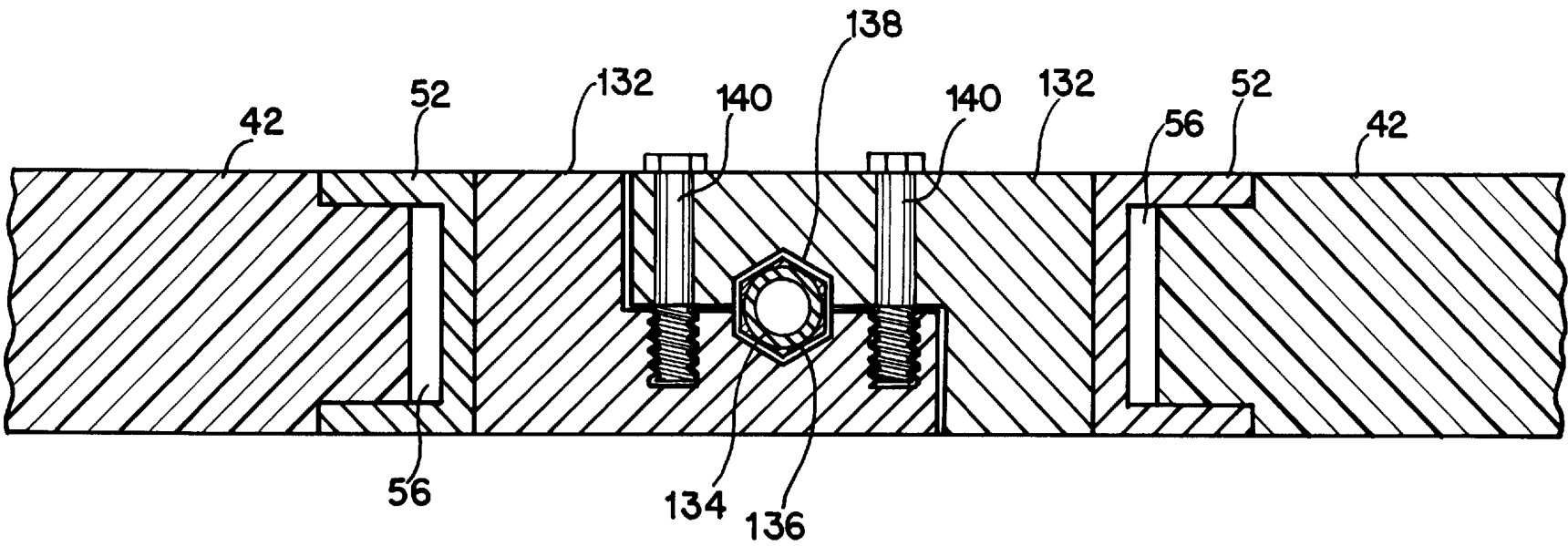


FIGURE 12

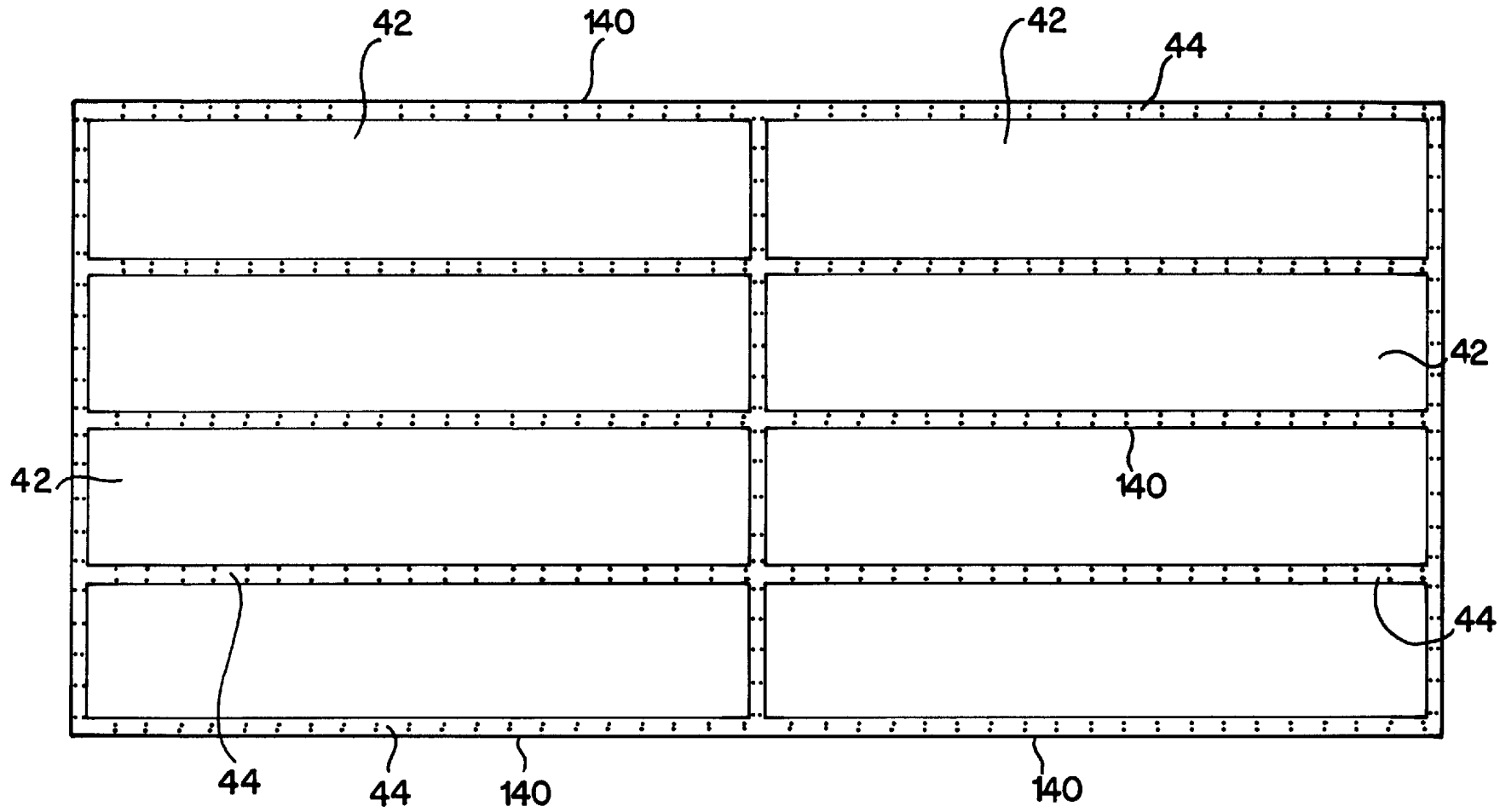


FIGURE 13

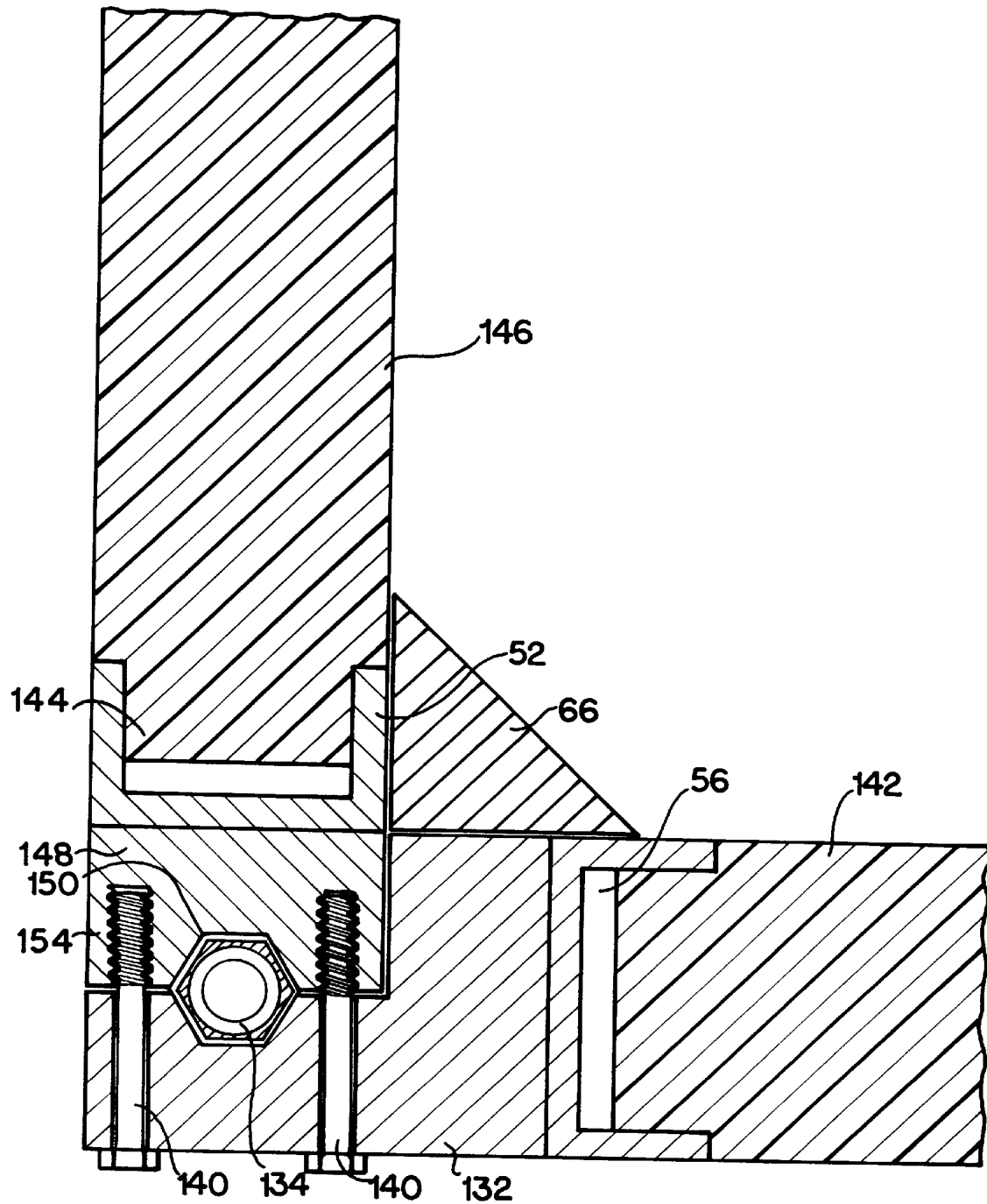


FIGURE 14

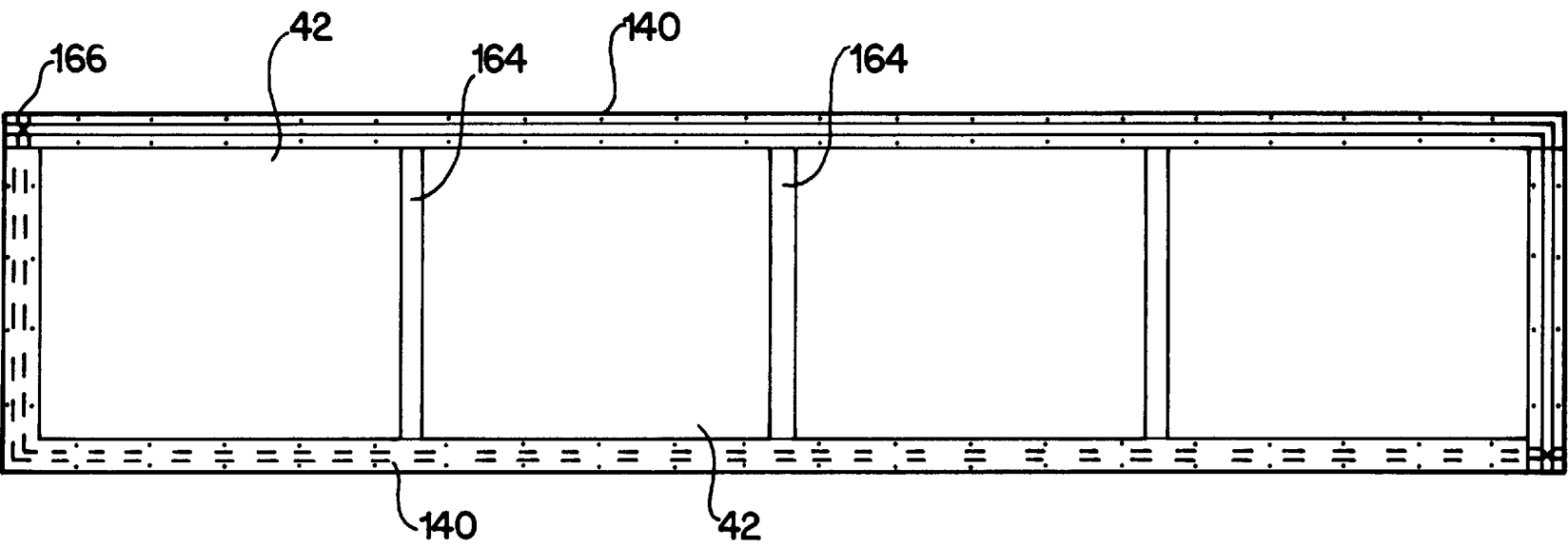


FIGURE 15

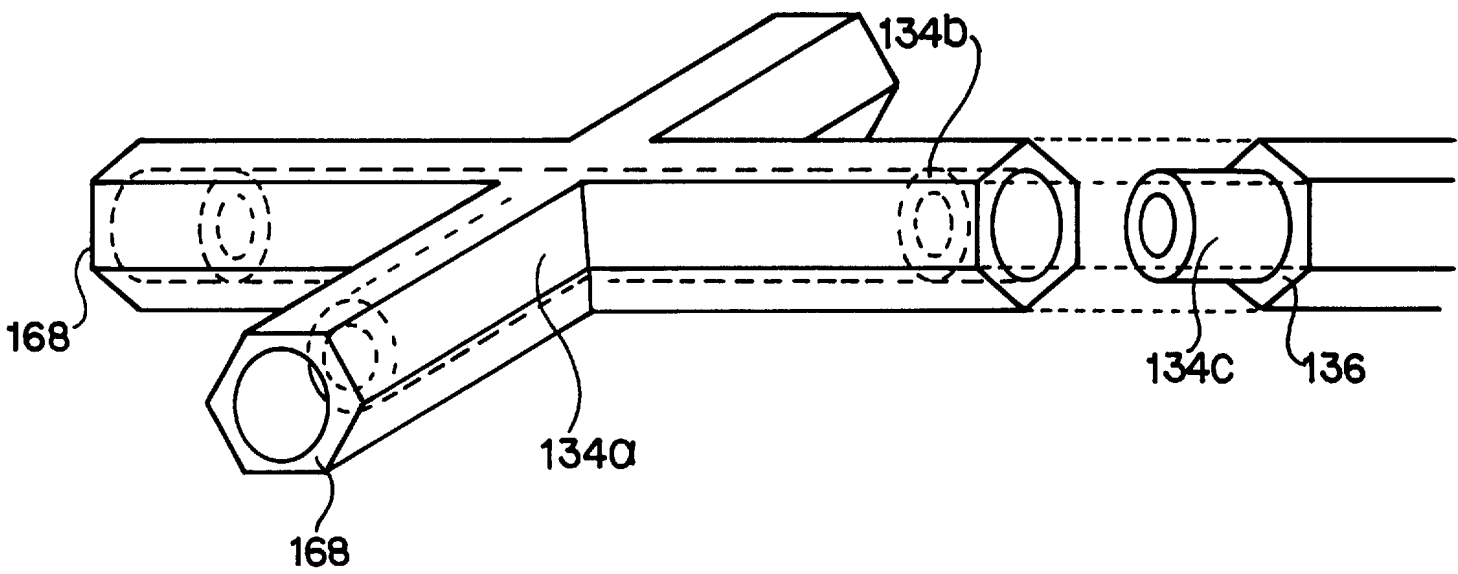


FIGURE 16

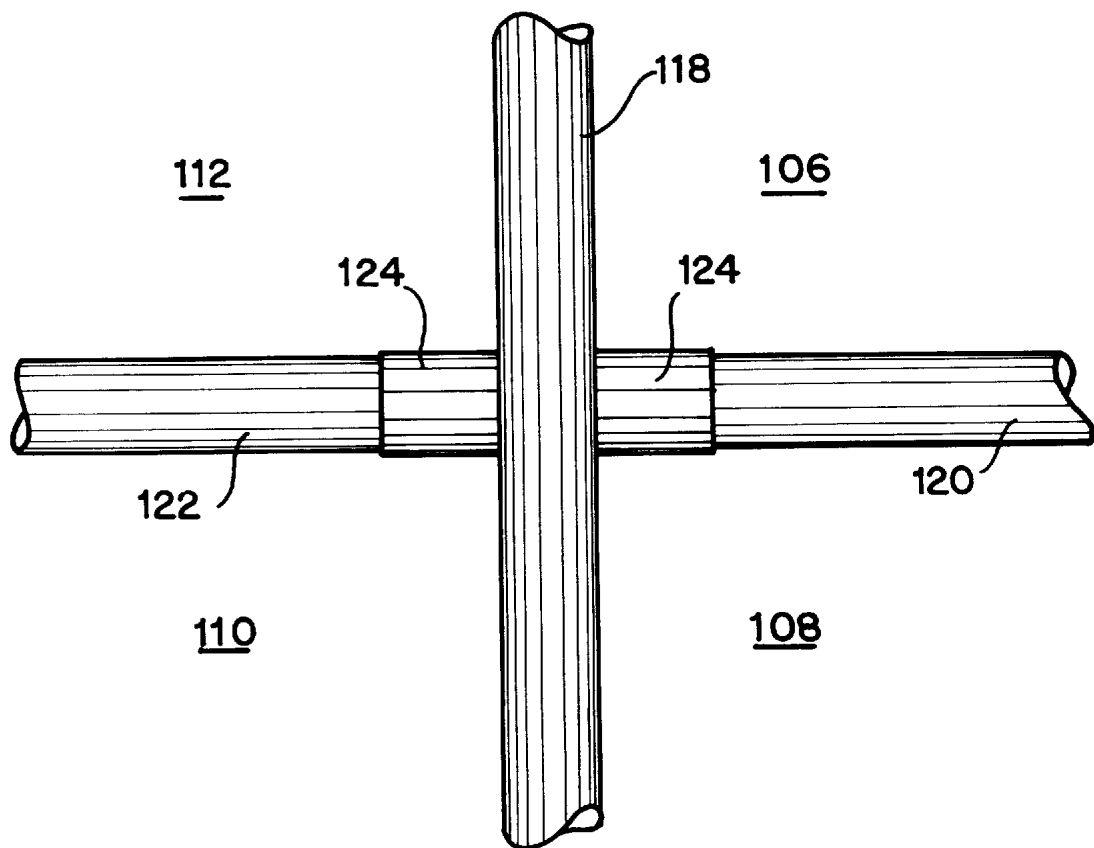


FIGURE 17

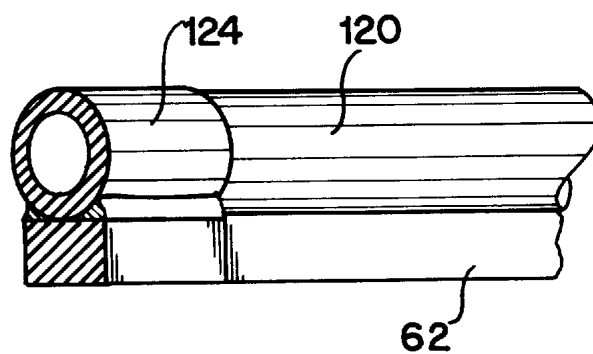


FIGURE 18

SPILL CONTAINMENT SYSTEM

FIELD OF THE INVENTION

This invention relates to spill containment systems.

BACKGROUND OF THE INVENTION

Spill containment systems, as for example described in U.S. Pat. Nos. 5,098,220 of Norman, 4,765,775 of Kroger and 5,354,149 of Breaux, typically are formed of a single impermeable sheet or layer of clay that is formed around an object, such as a tank or oil well, that might spill environmentally hazardous fluids.

SUMMARY OF THE INVENTION

The inventor has identified that it would be desirable to have such a spill containment system for an oil well site, or other temporary location where spills of environmentally hazardous materials may occur, that may spread out over a wide area, and include considerably heavy equipment.

The inventor therefore proposes a modular spill containment system. Each module is formed of a fluid impervious sheet. Each sheet has peripheral edges adapted to sealingly couple to the peripheral edge of each other sheet. Plural wall elements each have an edge adapted to sealingly couple to, and uncouple from, peripheral edges of the fluid impervious sheets. The fluid impervious sheets and the wall elements may be sealed together to form a pan like structure.

In addition, the inventor has noted a need for an effective sealing system between fluid impervious sheets of a spill containment system or other barrier system.

The inventor therefore proposes an impervious sheet module for use in an extensive fluid barrier. The impervious sheet module includes a fluid impervious sheet having peripheral edges and corners between the peripheral edges. Each of the peripheral edges of the sheet includes a sealable coupling member sealed to the sheet, the sealable coupling member extending continuously along the peripheral edges of the sheet between the corners of the sheet. The sealable coupling member forms in cross-section a hook shape complimentary to itself so that the hook of one impervious sheet module may fit in the hook of another impervious sheet module. An expandable member may be placed between respective sealing edges of adjacent sheets to force the sealable coupling members into sealing relationship.

These and other aspects of the invention will now be described in more detail and claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

There will now be described preferred embodiments of the invention, with reference to the drawings, by way of illustration, in which like numerals denote like elements and in which:

FIG. 1 is a schematic plan of a typical oil well site with associated equipment;

FIG. 2 is a plan view of an embodiment of the invention configured for the oil well site of FIG. 1 including plural fluid impervious sheets forming a pan;

FIG. 3 is a cross-section of a seal for sealing adjacent fluid impervious sheets;

FIG. 4 is a cross-section of a seal for use at a wall for the pan of FIG. 2;

FIG. 5 is a cross-section of a seal for use at a pipe penetrating the pan of FIG. 2;

FIG. 6 is a cross-section of an embodiment of a wall for use in the pan of FIG. 2;

FIG. 7 is a cross-section of a sump for use at a pipe penetrating the pan of FIG. 2;

FIGS. 8A, 8B and 8C are respectively a top view, front view and side view of a connection-sealing mechanism for use at a corner of one of the fluid impervious sheet of FIG. 1;

FIG. 9 is a top view of a fluid impervious sheet according to the invention showing re-enforcing bars;

FIG. 10 is a top view of fluid impervious sheets according to the invention;

FIG. 10A is a detail of a corner where several fluid impervious sheets according to the invention meet and shows a seal for such a corner;

FIG. 11 is a cross-section of a down-going corner for use at the sump of FIG. 7;

FIG. 12 is a cross-section of a second embodiment of a seal for use with the pan of FIG. 2;

FIG. 13 is a top view of plural fluid impervious sheets with the seal of FIG. 12;

FIG. 14 is a cross-section of a wall for the pan of FIG. 2 with the sealing system of FIG. 12;

FIG. 15 is a top view of a fluid impervious sheet with the sealing perimeter of FIG. 12 and with re-enforcing bars;

FIG. 16 is a detail showing the corner of the fluid impervious sheet of FIG. 15;

FIG. 17 is top view of an alternative seal for a corner where several fluid impervious sheets meet; and

FIG. 18 is a side perspective view of the seal of FIG. 17.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 1, a typical oil well site includes pipe racks 10, dog house 12, sub-base and derrick 14, pump house 16, boiler 18, power plant 20, tool house 22, mud pits 24, surface pits 26, and chemical storage trailer 28. A berm 30 is typically built around the site to contain spills. The mud pits 24 and surface pits 26 usually have a clay or plastic lining, and require dispersal at the completion of drilling.

As shown in FIG. 2, the invention provides a pan 40 or extensive fluid barrier formed of plural fluid impervious sheets 42 joined together at their edges 44 and surrounded by a peripheral wall 46. Each fluid impervious sheet 42 is about 8 feet by 40 feet and rests directly on the ground, which is preferably prepared by making the ground relatively flat. The equipment shown in FIG. 1 all lies directly on top of the fluid impervious sheets 42 and surrounded by the wall 46. The fluid impervious sheets may be configured in any desirable space filling shape, such as rectangular.

An exemplary seal 48 for joining adjacent fluid impervious sheets is shown in FIG. 3. Each fluid impervious sheet 42 has a peripheral edge 44 on which is compression fit a steel bracket 52. The steel bracket 52 encloses and extends along the peripheral edges of the fluid impervious sheet 42. The bracket 52 is sealed to the peripheral edge 44 of the fluid impervious sheet 42 by injection of sealant through nipple 54 into void 56 left between the C-shaped bracket 52 and the edge 44 of the fluid impervious sheet 42.

A hook shaped channel member 58a extends from the bracket 52 and has a terminal portion 60 spaced from the bracket 52 to allow interlocking of the hook shaped channel members of adjacent fluid impervious sheets as shown in FIG. 3. The hook shaped channel members 58a form sealable coupling members along each peripheral edge of the fluid impervious sheet 42. Each terminal portion 60 is

spaced from the bracket **52** such that there is enough space **61** to fit both the hook shaped channel member **58b** of an adjoining fluid impervious sheet **42** and a spacer **62** or other wedging element. Spacer **62** is preferably rigid, for example made of steel and holds the hook shaped channel members **58a** and **58b** interlocked to each other. An elongated rubber balloon **64** is also inserted into one of the spaces **61** between the top of the hook shaped channel member of one fluid impervious sheet and the bracket of an adjoining fluid impervious sheet. Spacer **62** and inflatable seal **64** may be secured together as for example by adhesive. The elongated rubber balloon or inflatable seal **64** is initially inserted deflated and may be inflated to force the hook shaped channel members **58a** and **58b** together and thus sealingly couple adjacent fluid impervious sheets **42** along their peripheral edges **44**. The hook shaped channel member **58a** may be referred to as a bottom hook shaped channel member and the hook shaped channel member **58b** may be referred to as a top hook shaped channel member.

Around the perimeter of the pan **40** is a wall **46** as shown in FIG. 4. The wall **46** in this instance is made from a similar fluid impervious sheet **42a**, whose bracket **52a** lies transverse to the direction of the bracket **52** on fluid impervious sheet **42** in relation to the respective sheets. The hook shaped channel member **58a** welded to bracket **52a** lies parallel to the outer edge of the channel member **58a**. Otherwise, channel member **58a** is formed in the same manner as channel member **58**. Likewise, spacer **62** and inflatable seal **64** are used to seal the wall **46** and fluid impervious sheet **42** together. An additional wedge **66** may be fastened at the joint between wall **46** and fluid impervious sheet **42** to support the wall **46**. The wall **46** is thus sealingly coupled to, and may be uncoupled from, peripheral edges **44** of the fluid impervious sheets **42**.

The fluid impervious sheets **42** are preferably made of plastic, laminated wood, or steel, with a sufficient compressive strength and thickness to withstand the weight of equipment to be placed on them. For example, the sheets may be laminated wood about 4 inches thick.

Referring to FIG. 5, there is shown an embodiment for use where a pipe **72** penetrates a pan **40**. Fluid impervious sheet **74** is the same as fluid impervious sheet **42** but has a square hole **76** cut in it. The edge **78** of the fluid impervious sheet **42** around the square hole **76** is fastened to an L-shaped bracket **82** forming a wall around the hole **76**. A boot **84** is bolted to the bracket **82** as by bolts **86** and clamped to the pipe **72** by a clamp **88**. As shown in FIG. 7, the sheet **74** may be depressed below the ground surface **92**, and connected to surface fluid impervious sheets **42** by walls **46**. A down going coupling **94** is illustrated in FIG. 11, wherein fluid impervious sheet **42**, with hook shaped channel member **58** are made as shown in FIG. 3, and wall **46** terminates upwardly in a C-shaped bracket **52b** with hook shaped channel member **58b** extending laterally from the side of the C-shaped bracket **52b**. Wedge element **62** and inflatable seal **64** complete the seal. The inflatable seal is hollow, sealed at the ends, and extends the length of the fluid impervious sheet.

A second embodiment of a wall is shown in FIG. 6, in which a steel sheet **96** is fastened, as by bolting or welding, to a C-shaped channel member **52**. The sheet **96** extends perpendicularly up from the fluid impervious sheet **42** and extends along at least one peripheral edge of the fluid impervious sheet. A fluid impervious sheet **42** for use at a corner of an oil well site pan may have walls on two sides, meeting at a corner.

Walls **46** of the type shown in FIG. 4 meeting at a corner of a fluid impervious sheet are connected by a connector **102**

for example as shown in FIGS. 8A, 8B and 8C. The connector **102** is formed from a pair of upside down U-channel **102a** and **102b** joined together at right angles to form an L shape in plan view that fits over the top of the sheets forming the walls **46**.

As shown in FIG. 9, each fluid impervious sheet **42** is preferably reinforced along its length by longitudinally spaced reinforced bars **104** that are fastened to and interconnect C-shaped brackets **52** on opposite edges **44** of the fluid impervious sheets **42**. Each fluid impervious sheet **42** is configured in the manner shown in FIG. 9 so that they can be area filling. Edges **44a** and **44c** have bottom hook shaped channel members **58a**, in which the hook opens upward, and edges **44b** and **44d** have top hook shaped channel members in which the hook opens downward. At the bottom right corner **100a**, the respective bottom hook shaped channel members **58a** join together. At the bottom left corner **100b** and the top right corner **100c**, a bottom hook shaped channel member **58a** and top hook shaped channel member **58b** come close together, but do not extend beyond the C-shaped member **52** defining the edge of the sheet **42**. At the top left corner **100d**, the corner is filled with an extension **103** of the top hook shaped channel members **58b** that form the edges **44b** and **44d**. This extension does not have hooks, but is just is a continuation of the metal of the top of the top hook shaped channel members **58b**. The corners **100a** and **100d** form a pair of opposed corners, and the corners **100b** and **100c** also form a pair of opposed corners.

A set of six adjoining fluid impervious sheets according to the invention are shown in FIG. 10. Each sheet is formed according to the fluid impervious sheet shown in FIG. 9. The material of corner **100d** overlies material of corner **100a**. A detail of one of the corners where four sheets meet is shown in FIG. 10A. Thus, as shown in FIG. 10a, fluid impervious sheets **108** and **112** extend into the gap formed at the corner between the sheets. Extension **103** of the top hook shaped channel members **58b** of fluid impervious sheet **108** overlies the continuation of the bottom hook shaped channel members **58a** of fluid impervious sheet **112** into corner **100a**.

The joint formed between four fluid impervious sheets **106**, **108**, **110** and **112** is sealed by a cross-shaped inflatable seal **114**. This seal is hollow like inflatable seal **64** and joined to inflatable seals **64a**, **64b**, **64c** and **64d**. Seals **64a**, **64b**, **64c** and **64d** seal respectively fluid impervious sheets **106** and **112**, fluid impervious sheets **110** and **112**, fluid impervious sheets **106** and **108** and fluid impervious sheets **108** and **110**. The joint between the inflatable seal **114** and inflatable seals **64a**, **64b**, **64c** and **64d** may be made by overlapping the inflatable seals and gluing them together as shown at **115**.

An alternative form of seal for the corners between fluid impervious sheets is shown in FIGS. 17 and 18. An extended inflatable seal **118** extends along the joint between fluid impervious sheets **106** and **112** and fluid impervious sheets **108** and **110**. This inflatable seal **118** may extend the full length of pan **40**. A pair of inflatable seals **120** and **122** butt up to the inflatable seal **118** to form a cross. Butt joints **124** are formed of self moulding rubber sleeves that are attached to the ends of the inflatable seals **120** and **122**. The butt joints **124**, when inflated, push up against inflatable seal **118** to form a seal. One of the inflatable seals **120**, rather than both, may be used for butting up against inflatable seal **118** at a wall. The inflatable seals **118**, **120** and **122**, like the inflatable seal **64**, may be adhered to the spacer **62** as shown in FIG. 18.

FIG. 12 shows an alternative form of sealing arrangement for the edges of a fluid impervious sheet. Fluid impervious

sheets 42 are the same as in FIG. 3, and likewise sealed C-shaped brackets 52. In this embodiment, the sealing elements are formed of L-shaped members 132 welded or fastened by other means to the C-shaped brackets 52 along the edges 44 of the fluid impervious sheets 42. A seal between the L-shaped members 132 is formed by a steel tube 134 encased in a rubber sleeve 136 that fits in grooves 138 in each of the L-shaped members 132. Bolts 140 compress the L-shaped members 132 together and thus compress the rubber sleeve 136 to form a seal. FIG. 13 shows the seal system of FIG. 12 with the bolts 140 spaced along the peripheral edges 44 of the fluid impervious sheets 42.

A wall 46 for the a pan with the seal of FIG. 12 is shown in FIG. 14. Fluid impervious sheet 142 with L-shaped member 132 is made as shown in FIG. 12. A wall fluid impervious sheet 146 is edged by a C-shaped bracket 52, fastened in like manner to the sheet as bracket 52 of FIG. 3 was fastened to sheet 42, and has a bar 148 running along the peripheral edges 144 of sheet 142. Bar 148 has threaded holes 154 for receiving bolts 140 and recess 150 for receiving rubber encased tube 134. Tightening of bolts 140 seals the wall 146 to fluid impervious sheet 142.

FIG. 15 shows a fluid impervious sheet 42 with the sealing system of FIG. 12, and re-enforcing bars 164 similar to re-enforcing bars 104 of FIG. 12. FIG. 16 shows an edge coupler for a corner 166 of one of the sheets 42. The rubber encased tubes 134a and 134b of respective edges meeting at a corner cross each other. The ends of the tubes 134a and 134b may terminate short of their laminate rubber coverings to form hollow receiving ends 168. The end of a sealing tube 134c lying along the length of one of the sides of the sheet 42 may extend beyond its laminated rubber covering 136, to form a male connection that may be received by one of the hollow receiving ends 168.

The modular sheets may be pinned or keyed in one or more places to prevent them from moving relative to adjacent sheets once the sheets are interlocked.

A person skilled in the art could make immaterial modifications to the invention described in this patent without departing from the essence of the invention.

The emodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A spill containment system comprising; plural fluid impervious sheets, each sheet having peripheral edges; coupling members along each of the peripheral edges of each sheet, the coupling members being adapted to sealingly couple to, and uncouple from, coupling members on the peripheral edges of each other sheet; and plural wall elements, each wall element having an edge adapted to sealingly couple to, and uncouple from, peripheral edges of the fluid impervious sheets, with the plural wall elements extending transversely to the fluid impervious sheets away from the peripheral edges of fluid impervious sheets, whereby the fluid impervious sheets and the wall elements may be sealed together to form a pan like structure having a peripheral wall for the containment of fluid within the pan like structure.
2. The spill containment system of claim 1 in which the sheets are sufficiently thick to support the weight of oil well site equipment.
3. The spill containment system of claim 1 in which the plural fluid impervious sheets are sealed together to form a base for an oil well site.
4. The spill containment system of claim 3 in which the plural fluid impervious sheets are supported by a prepared surface.

5. The spill containment system of claim 1 in which the coupling members of a sheet have the same construction around each of the peripheral edges of the sheet.

6. A spill containment system comprising:

- plural fluid impervious sheets, each sheet having peripheral edges;
- a bracket enclosing and sealed to each of the peripheral edges of the plural fluid impervious sheets;
- a hook shaped channel member extending from each of said brackets, said hook shaped channel members having a terminal portion spaced from the brackets to allow interlocking of hook shaped channel members to the adjacent fluid impervious sheets; and
- plural wall elements, each wall element having an edge adapted to sealingly couple to, and uncouple from, peripheral edges of the fluid impervious sheets, whereby the fluid impervious sheets and the wall elements may be sealed together to form a pan like structure.

7. The spill containment system of claim 6 in which the fluid impervious sheets are sealed together to form a modular pan and further including wedging elements wedged between a hook shaped channel member of a first fluid impervious sheet and a bracket of an adjacent fluid impervious sheet.

8. The spill containment system of claim 7 in which the wedging elements include inflatable seals.

9. The spill containment system of claim 7 in which adjacent fluid impervious sheets meeting at a corner are sealed by cross-shaped seals.

10. An impervious sheet module for use in a fluid barrier, the impervious sheet module comprising;

- a fluid impervious sheet having peripheral edges and corners between the peripheral edges; and
- each of the peripheral edges of the sheet including a sealable coupling member sealed to the sheet, the sealable coupling member extending continuously along the peripheral edges of the sheet between the corners of the sheet;
- the sealable coupling member forming in cross-section a hook shape complimentary to itself;
- the sealable coupling member including a hook shaped channel member formed of a first portion extending parallel to the fluid impervious sheet, a second portion extending transversely to the fluid impervious sheet and a terminal portion extending from the second portion towards the fluid impervious sheet, the terminal portion being spaced from the fluid impervious sheet; and
- the terminal portion being shorter than the spacing between the terminal portion and the fluid impervious sheet to allow interlocking of hook shaped channel members of adjacent fluid impervious sheets by motion transverse to the peripheral edge along which the coupling member extends.

11. The spill containment system of claim 10 in which each scalable coupling member on the peripheral edges of the fluid impervious sheet includes:

- a bracket enclosing and sealed to the peripheral edge of the fluid impervious sheet; and
- the hook shaped channel member extending from the bracket, the hook shaped channel member being space from the bracket to allow interlocking of hook shaped channel members of adjacent fluid impervious sheets.

12. An impervious sheet module for use in a fluid barrier, the impervious sheet module comprising:

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a fluid impervious sheet having peripheral edges and two pairs of opposed corners;

each of the peripheral edges of the sheet including a sealable coupling member sealed to the sheet, the sealable coupling member extending continuously along the peripheral edges of the sheet between adjacent corners of the sheet;

the sealable coupling members extending into each corner of only one of the pairs of corners and including means to sealingly couple the fluid impervious sheet to an adjacent fluid impervious sheet.

13. The impervious sheet module of claim **12** in which the sealable coupling member form in cross-section a hook shape complimentary to itself.

14. A method of forming a pan like structure for containing fluid spills, comprising the steps of:

sealingly coupling plural fluid impervious sheets along peripheral edges of the fluid impervious sheets using coupling elements that may couple and uncouple by motion transverse to the edges of the fluid impervious sheets to form a fluid impervious barrier; and

sealingly coupling plural wall elements to peripheral edges of the fluid impervious sheets with the plural wall elements extending transversely to the fluid impervious sheets away from the peripheral edges of the fluid

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impervious sheets for form a pan like structure having a peripheral wall for the containment of fluid within the pan like structure.

15. A spill containment system comprising:

Plural fluid impervious sheets, each sheet having peripheral edges;

a plurality of coupling members for attachment to the peripheral edges of each sheet, said coupling members being adapted to sealingly couple to and uncouple from coupling members on the peripheral edges of each other sheet; and

means for sealingly attaching the coupling members to the peripheral edges of each sheet; and

plural wall elements, each wall element having an edge adapted to sealingly couple to, and uncouple from, peripheral edges of the fluid impervious sheets with the plural wall elements extending transversely to the fluid impervious sheets away from the peripheral edges of the fluid impervious sheets, whereby the fluid impervious sheets and the wall elements may be sealed together to form a pan-like structure having a peripheral wall for the containment of fluid within the pan-like structure.

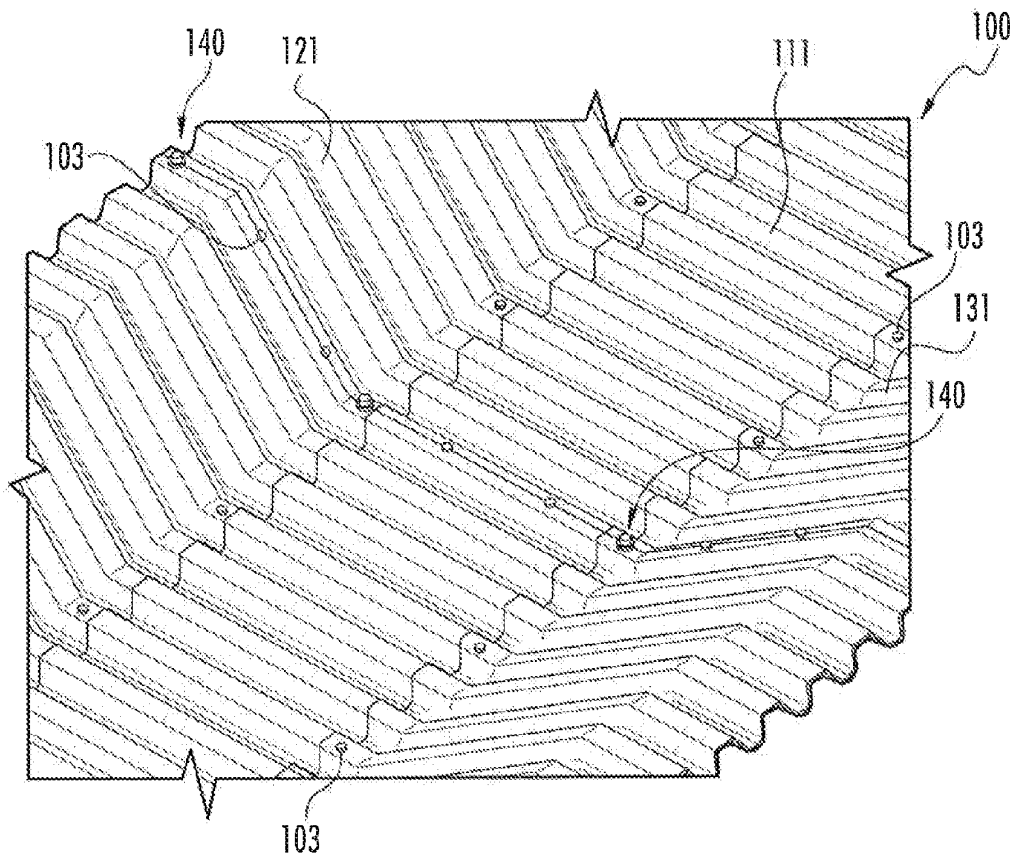
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US 20110135392A1

(19) **United States**(12) **Patent Application Publication**
Zajicek et al.(10) **Pub. No.: US 2011/0135392 A1**(43) **Pub. Date: Jun. 9, 2011**(54) **MODULAR, SCALABLE LIQUID
MANAGEMENT SYSTEM****Publication Classification**(51) **Int. Cl.**
E02B 5/02 (2006.01)(52) **U.S. Cl.** **405/121**(57) **ABSTRACT**

The present disclosure relates to a modular, scalable liquid management system. The disclosed system is modular in that it is assembled from a few primary components. The system is scalable because the primary components are adapted to be re-sized and combined to form a system as wide, deep, and/or long as needed. In various exemplary embodiments, the system is assembled from a plurality of base components and arm components that are tightly connected to form the liquid management system. To resist shifting or separation of system components, the liquid management system is firmly anchored to the ground at multiple locations throughout the system.

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DeForest, WI (US)(73) **Assignee:** **Penda Corporation**, Portage, WI
(US)(21) **Appl. No.:** **12/962,323**(22) **Filed:** **Dec. 7, 2010****Related U.S. Application Data**(60) Provisional application No. 61/267,259, filed on Dec.
7, 2009.

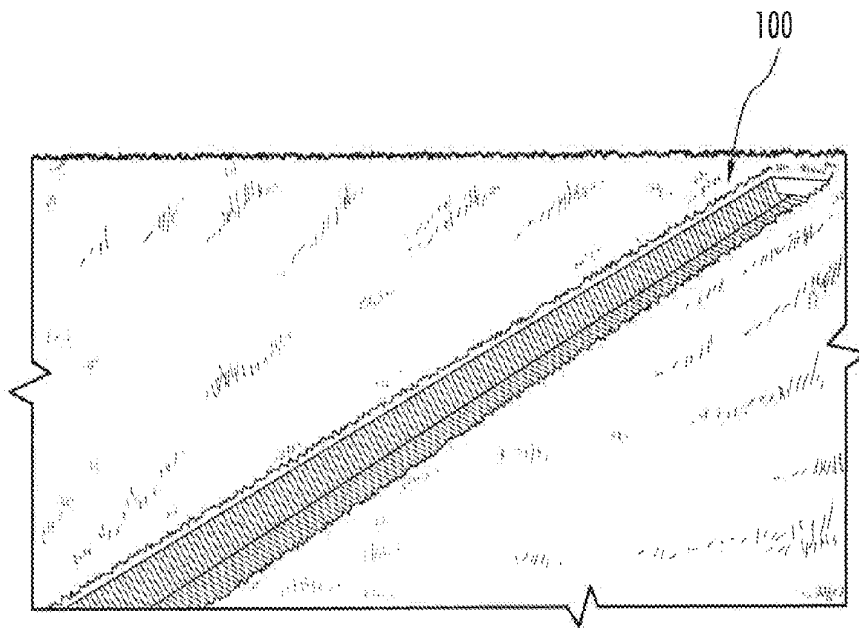


FIG. 1

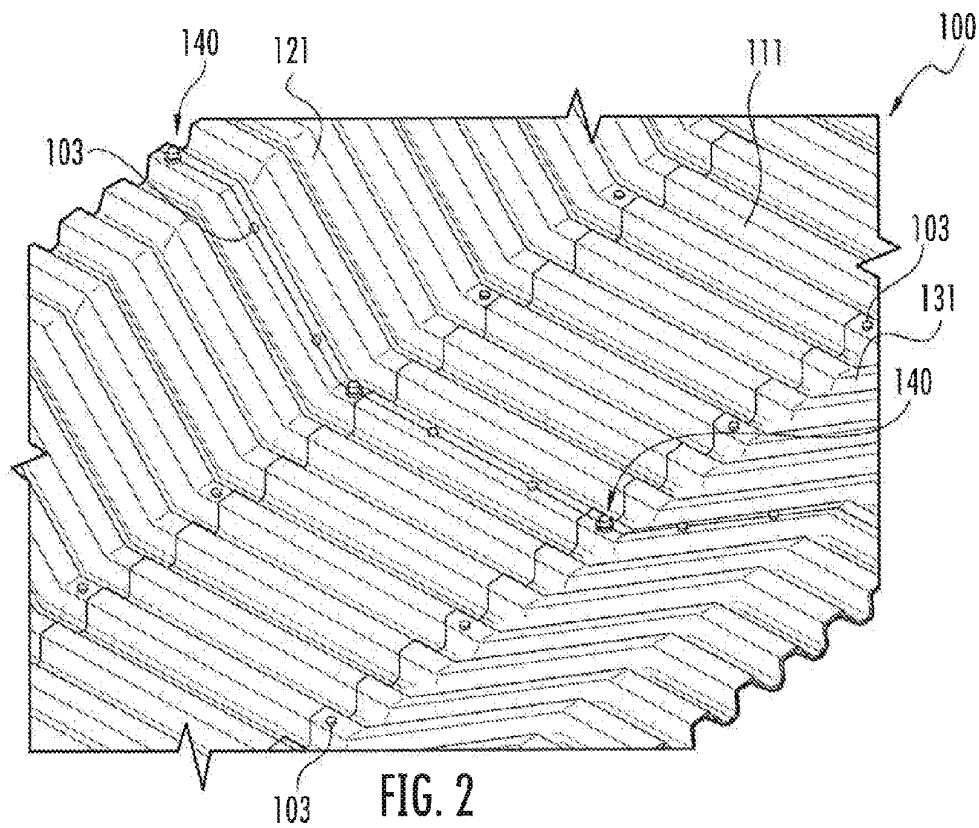
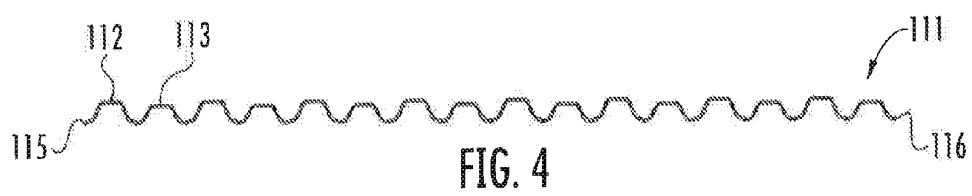
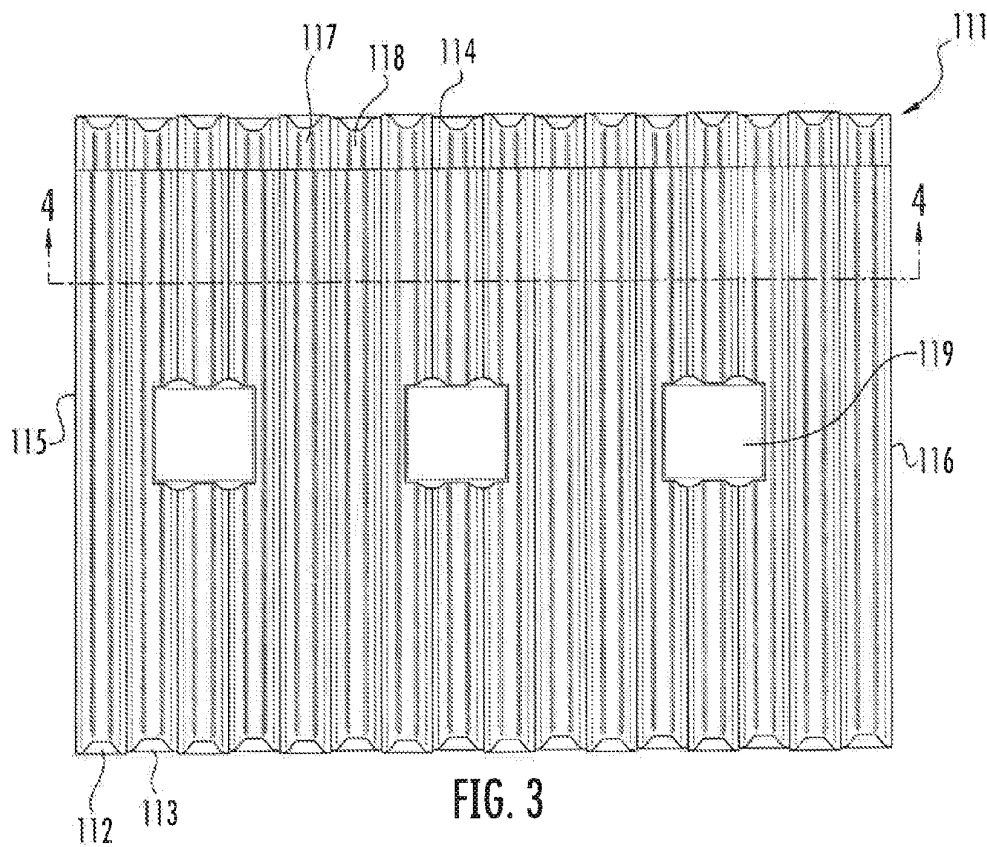
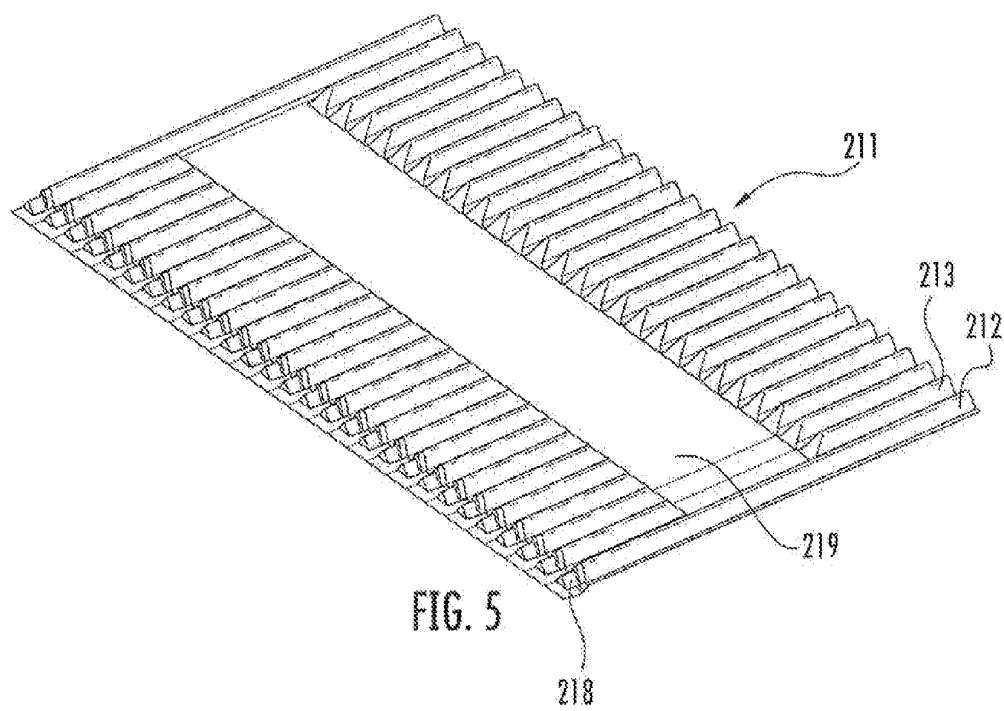
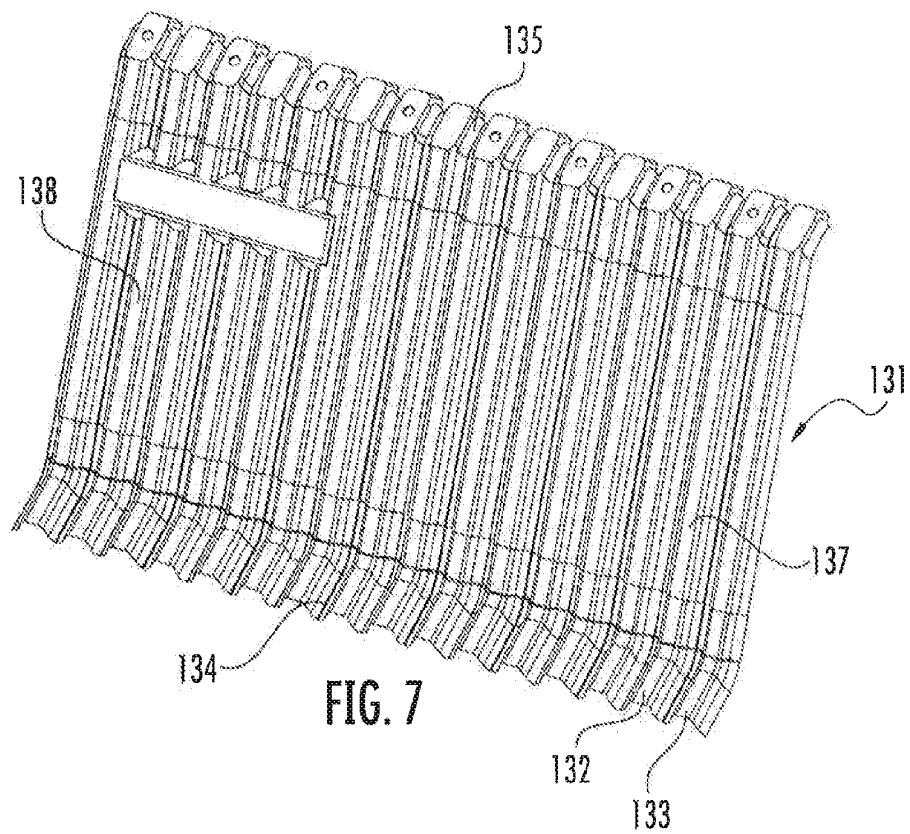
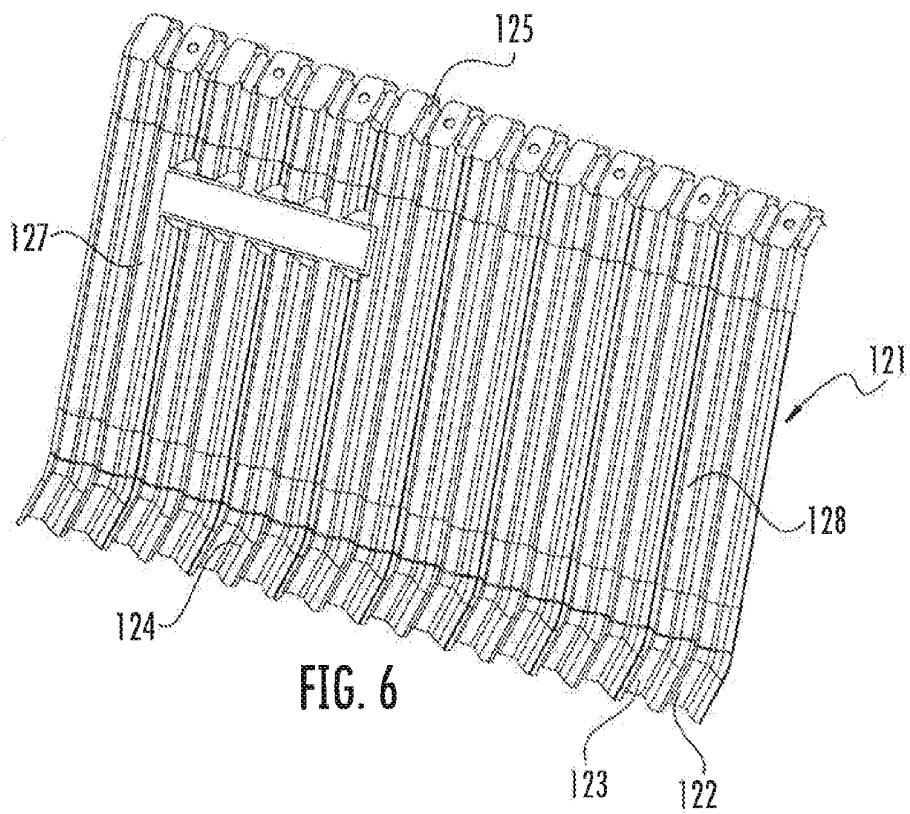
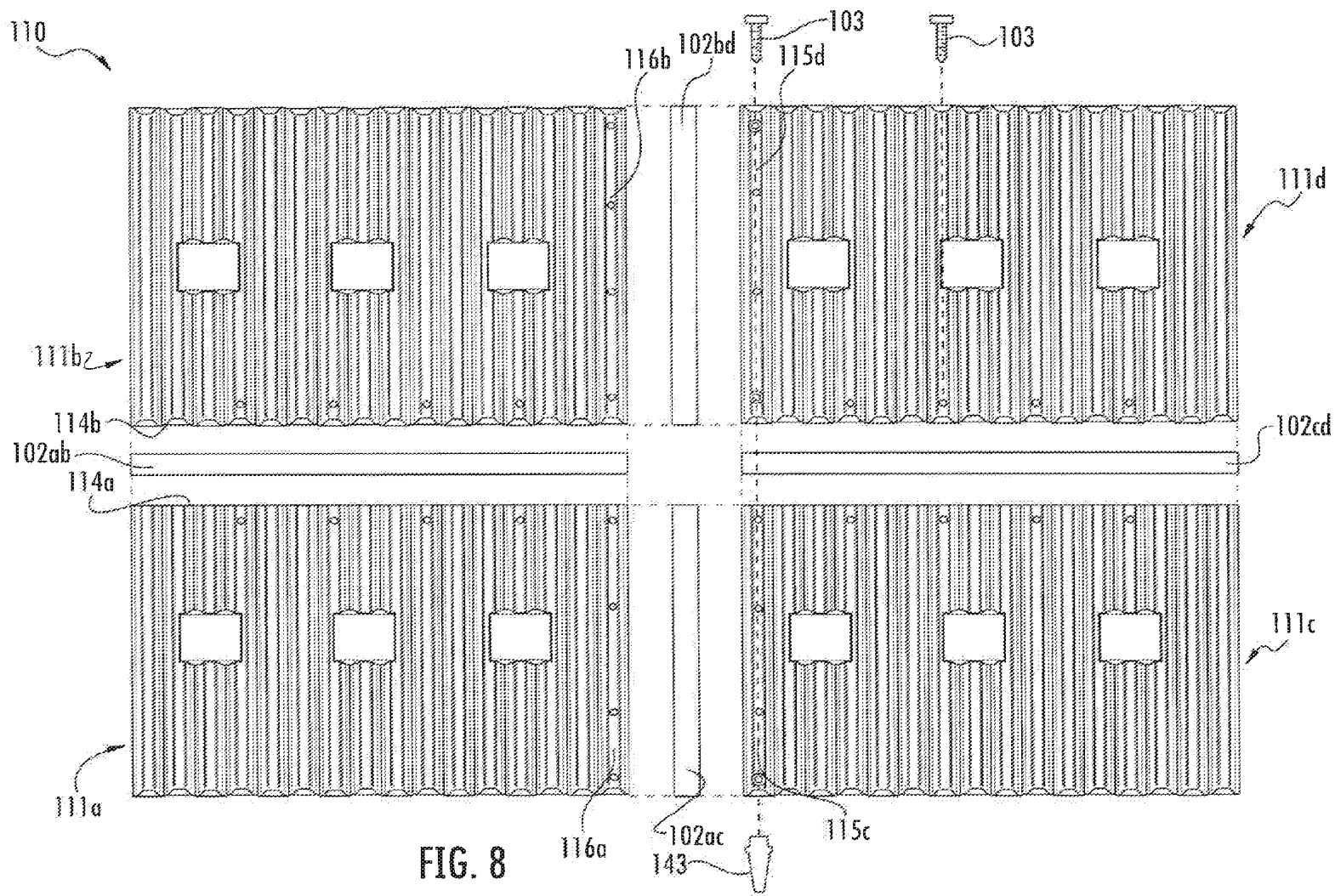


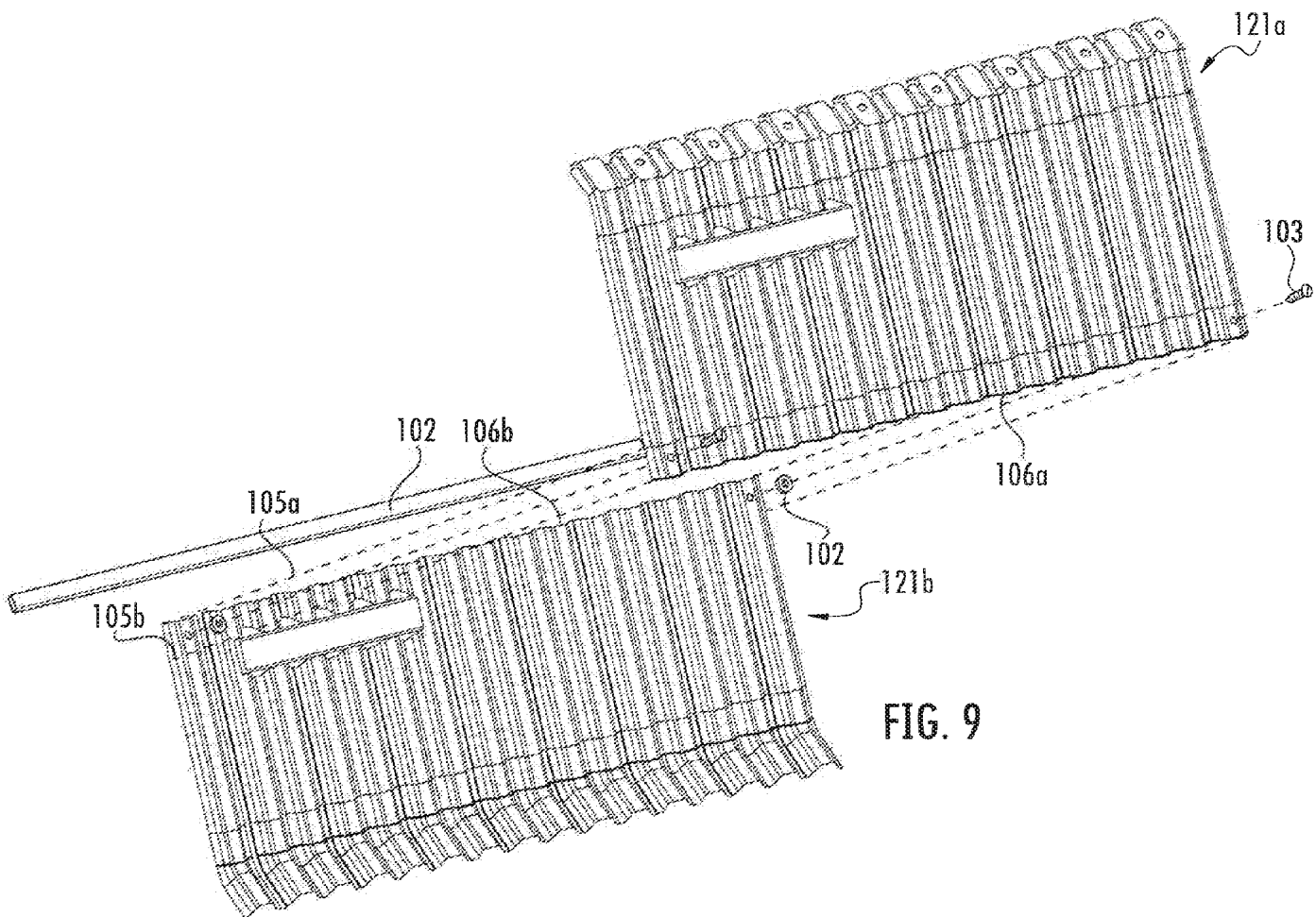
FIG. 2

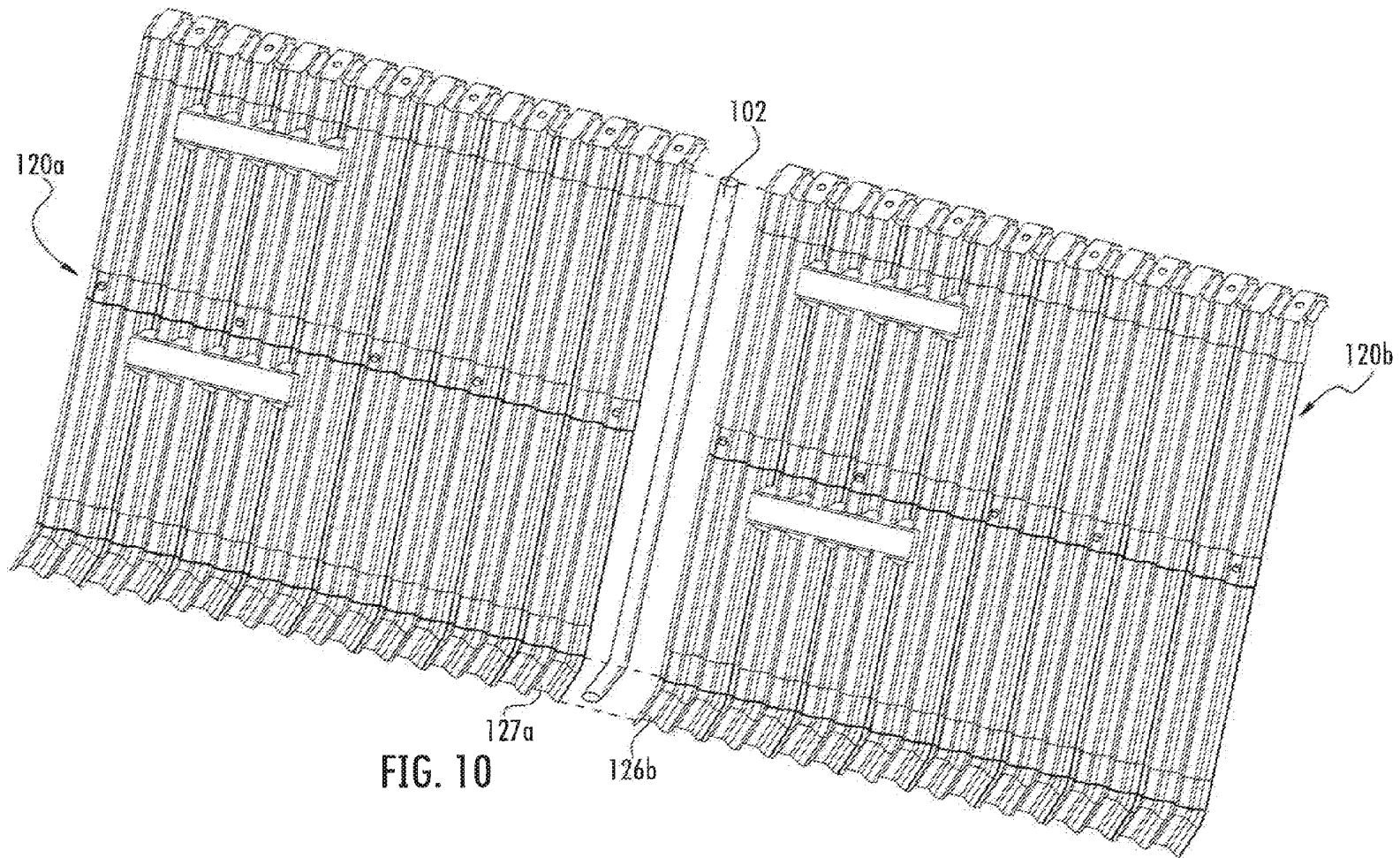


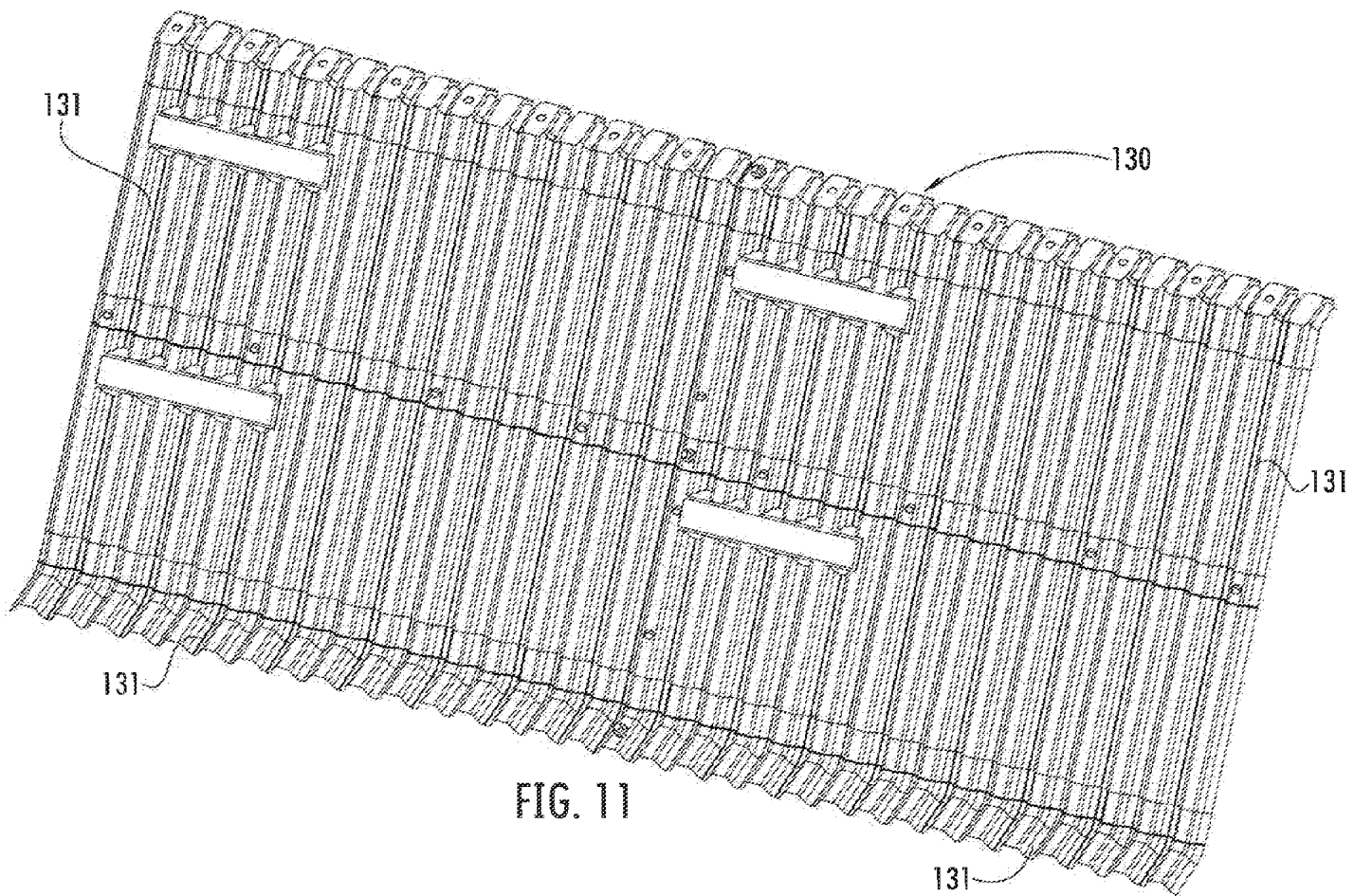


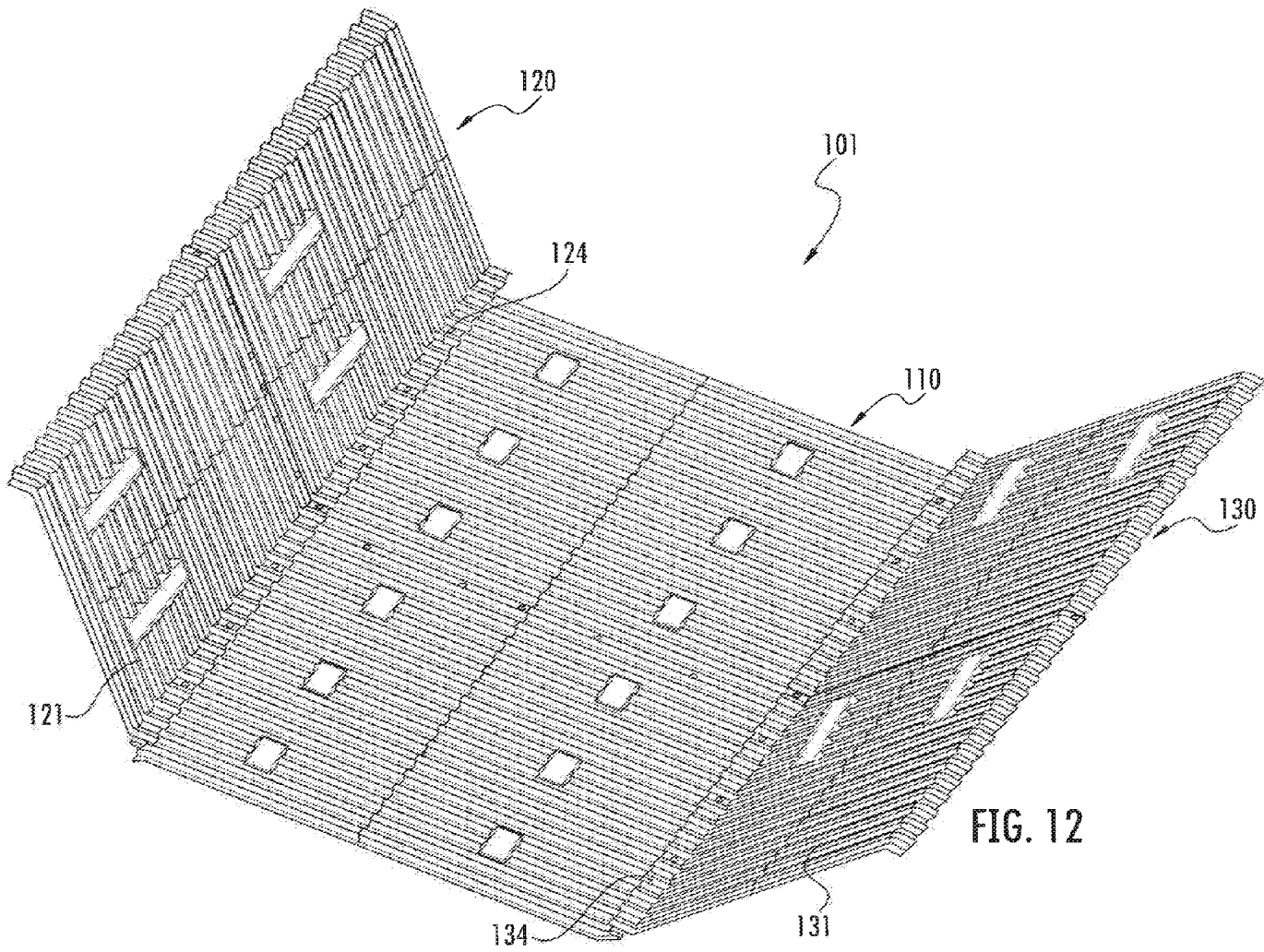












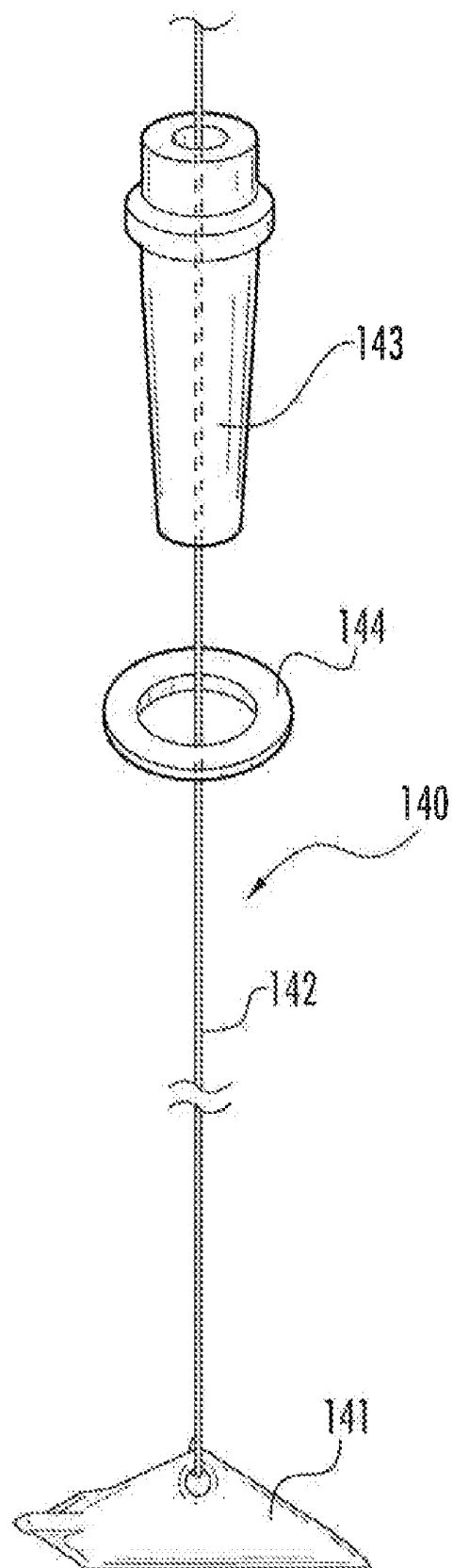
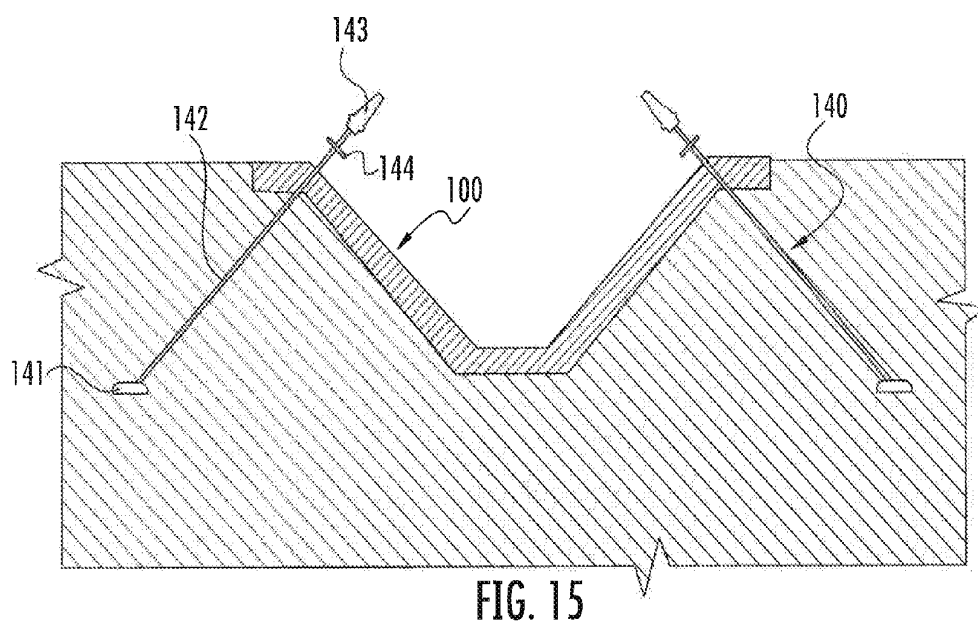
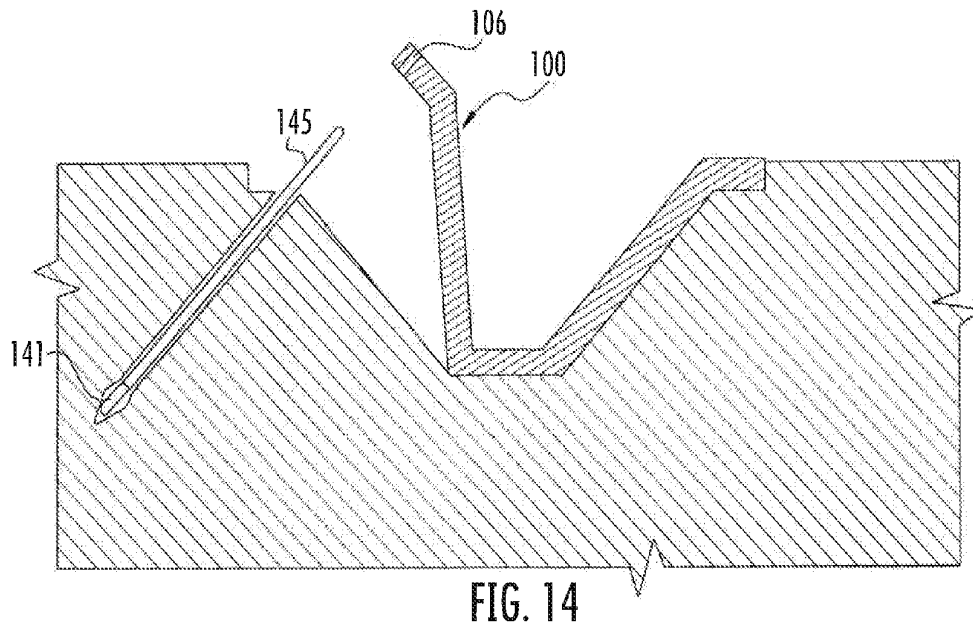


FIG. 13



MODULAR, SCALABLE LIQUID MANAGEMENT SYSTEM

PRIORITY

[0001] This application claims priority to U.S. Provisional Application 61/267,259 filed Dec. 7, 2009, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] 1. Field of the Invention

[0003] The present disclosure relates to a modular, scalable system for lining a ditch or other channel for transporting water.

[0004] 2. Related Art

[0005] Ditches have been commonly used to transport water from one point to another for millennia. For example, earthen ditches have been used to transport irrigation water, potable water, and drainage water. Because they are relatively easy and inexpensive to construct in nearly any kind of terrain, earthen ditches are still commonly used today. As used herein, the term "ditch" signifies any channel whether dug in the earth and/or completely or partially built above earth level, and includes structures that may be referred to as, for example, drains, culverts, canals, or channels.

[0006] When water is transported through an earthen ditch, significant loss of water can occur in a variety of ways, e.g., seepage, evaporation, and leaks (collectively described herein as "seepage loss"). Depending on a variety of factors, as much as 80-90% of the water entering a ditch may be lost rather than reaching its intended destination. The most significant causes of seepage, losses appear to be related to non-evaporative causes where the water is lost into the surrounding soil, which loss may be accelerated by erosion (particularly for fast moving water), excessive vegetation and/or tree root systems, and rodent burrows. It is known that lining ditches with material that resists seepage dramatically decreases seepage losses.

[0007] Earthen ditches also require regular cleaning and maintenance to minimize water loss caused by problems such as, for example, ditch wall collapses, erosion, rodent activity, and accumulation of debris or sediment. Maintenance and repair of earthen ditches can be costly because it is labor intensive and can require large equipment.

[0008] Where drainage water flows over the ground, there may be serious erosion problems threatening structures or damaging property. This is especially true where the water is draining down a steep embankment, such as along a road or highway interchange.

[0009] Because of seepage loss or erosion damage, and the maintenance costs associated with earthen ditches, various methods of lining ditches have been proposed. The suggested lining materials include concrete, metal, and polyvinyl chloride. However, such solutions have not fully resolved these problems or have created additional maintenance and installation problems that limit their effectiveness or implementation.

OUTLINE OF BASIC AND OTHER ADVANTAGEOUS FEATURES

[0010] It would be desirable to provide a liquid management system or the like of a type disclosed in the present application that includes any one or more of these or other advantageous features:

[0011] is assembled from a relatively small number of different production components to be modular;

[0012] Is capable of being easily modified to fit different size channels without requiring production of components that differ only in size or scale;

[0013] Is capable of being easily modified to fit the shape of existing channels;

[0014] Has component junctures that are tightly sealed to prevent leakage;

[0015] Is securely held in place, particularly on slopes; and

[0016] Is able to be installed in a variety of different soil types and locations.

[0017] These and other features and advantages of various embodiments of systems and methods according to this invention are described in, or are apparent from, the following detailed: description of various exemplary embodiments of various devices, structures, and/or methods according to this invention.

SUMMARY

[0018] An exemplary embodiment relates to a modular, scalable liquid management system, comprising a plurality of corrugated, connectable ditch liner components, comprising at least one base and at least one arm wherein the ditch liner components are adapted to be cut to change their shape or reduce their length and/or width without compromising their connectability, the ditch liner components are adapted for connection to components of the same type for increasing one or more dimensions of the liquid management system, and the ditch liner components are adapted for side-to-side coupling of components and end-to-end coupling of components; a sealant for placement between adjacent components at or about the point of connection; a plurality of fasteners for coupling ditch liner components together; and at least one anchoring system attachable to one or more ditch-liner components for securing the liquid management system in place wherein the ditch liner components are adapted to be assembled into the liquid management system by connecting a plurality of base components side-to-side and/or end-to-end to form the base of a liquid management system, connecting a plurality of arm components end-to-end and/or side-to-side to form a first wall of a liquid management system, connecting a plurality of arm components end-to-end and/or side-to-side to form a second wall of a liquid management system; and connecting the first wall to a first side of the base and connecting the second wall to a second side of the base to form a liquid management system.

[0019] Another exemplary embodiment relates to a method of assembling a modular, scalable liquid management system, comprising providing a plurality of corrugated, connectable ditch liner components, comprising a plurality of base components wherein the ditch liner base components have corrugations adapted for side-to-side connecting and end-to-end connecting of base components and a plurality of arm components wherein the ditch liner first arm components have corrugations adapted for side-to-side connecting and end-to-end connecting of first arm components; wherein the liquid management system is scalable by removing a portion of a ditch liner component and/or connecting two or more of the same components side-to-side; assembling the liquid management system by forming a base segment, comprising one or more base components sized to a chosen shape by cutting the base components and/or connecting the base com-

ponents side to side, extending the base segment by connecting one or more additional base components end-to-end to the base segment, connecting a first arm segment to the base segment, wherein the first arm segment comprises one or more arm components sized to a chosen size by cutting the arm components and/or connecting the arm components side to side, connecting a second arm segment to the base segment, wherein the second arm segment comprises one or more arm components sized to a chosen size by cutting the arm components and/or connecting the arm components side to side, placing a sealant in or at the connecting points of connected ditch liner components, and extending the liquid management system by connecting additional base components, first arm components, and second arm components to the liquid management system; and anchoring the liquid management system in place with an anchoring system.

[0020] These and other features and advantages of various embodiments of systems and methods according to this invention are described in, or are apparent from, the following detailed description of various exemplary embodiments of various devices, structures, and/or methods according to this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Various exemplary embodiments of the systems and methods according to the present disclosure will be described in detail, with reference to the following figures, wherein:

[0022] FIG. 1 is a perspective view of an exemplary embodiment of a liquid management system according to the present disclosure;

[0023] FIG. 2 is a perspective view of a segment of liquid management system of FIG. 1;

[0024] FIG. 3 is a top perspective view of a first exemplary embodiment of a ditch liner base component according to the present disclosure;

[0025] FIG. 4 is a side cross-sectional view of the base component of FIG. 3;

[0026] FIG. 5 is a top perspective view of a second exemplary embodiment of a ditch liner base component according to the present disclosure;

[0027] FIG. 5 is a front perspective view of a first exemplary embodiment of a ditch liner arm component according to the present disclosure;

[0028] FIG. 7 is a front perspective view of a second exemplary embodiment of a ditch liner arm component according to the present disclosure;

[0029] FIG. 8 is an exploded top plan view of an exemplary embodiment of a base segment being formed by cutting and/or connecting four of the base components of FIG. 3 according to the present disclosure;

[0030] FIG. 9 is an exploded perspective view of a first exemplary embodiment of an arm segment being formed by cutting and connecting two of the arm components of FIG. 6 according to the present disclosure;

[0031] FIG. 10 is an exploded perspective view of an exemplary embodiment of an arm segment assembled from two of the arm segments of FIG. 9 according to the present disclosure;

[0032] FIG. 11 is a perspective view of a second exemplary embodiment of an arm segment assembled by cutting and connecting two of the arm components of FIG. 7 according to the present disclosure;

[0033] FIG. 12 is an exploded end perspective view of an exemplary embodiment of a ditch liner segment assembled

from the base segment of FIG. 8, the first arm segment of FIG. 10, and the second arm segment of FIG. 11 according to the present disclosure;

[0034] FIG. 13 is a partial exploded view of an exemplary embodiment of an anchor system according to the present disclosure;

[0035] FIG. 14 is a cross-sectional view of the anchor system of FIG. 13 being installed in the ground;

[0036] FIG. 15 is an end view of the liquid management system of FIG. 1 being anchored by the anchor system of FIG. 13;

[0037] It should be understood that the drawings are not necessarily to scale. In certain instances, details that are not necessary to the understanding of the invention or render other details difficult to perceive may have been omitted. It should be understood, of course, that the invention is not necessarily limited to the particular embodiments illustrated herein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] The present disclosure relates to a scalable, modular system for surface transportation of liquid for any purpose. Unlike many prior systems that require partially filling or enlarging the ditch to fit the liner, the disclosed system may be scaled up or down in size and length to accommodate virtually any size ditch. The system's components are compactly stored for transportation and easily installed. In various exemplary embodiments, the disclosed system comprises a plurality of corrugated sheets that overlap and are connected to one another.

[0039] In various exemplary embodiments, the disclosed ditch liner system is assembled from two basic components: base components and arm components (i.e., side components). In some embodiments, there may be different arm components for opposite sides of a ditch (e.g., left arm components and right arm components). As will be described in greater detail below, the pieces are corrugated and adapted to overlap and connect with one another. According to various exemplary embodiments, the corrugations may comprise a relatively larger rib and relatively smaller rib that are adapted to be joined by overlapping the large rib over the small rib for a watertight seal between components.

[0040] FIG. 1 shows an exemplary embodiment of a portion of a liquid management system 100. A liquid management system 100 according to the present disclosure may include a single channel or multiple channels. FIG. 2 shows a segment of an exemplary liquid management system 100. In various exemplary embodiments, a liquid management system 100 comprises a plurality of components including bases 111 and arms 121 and/or 131. As will be shown in more detail below, liquid management system 100 may be varied in size by varying the number and arrangement of base components 111 and arm components 121 and/or 131 used to assemble the liquid management system 100.

[0041] FIGS. 3 and 4 show a first exemplary embodiment of a base 111. In various exemplary embodiments, as shown in FIG. 3, the base component 111 is generally rectangular in shape. The corrugation ribs 112 and 113 are generally perpendicular to the side edges 114 of the base component 111 and are generally perpendicular to the upper base component end edge 115 and lower base component end edge 116. In various exemplary embodiments, as shown in FIG. 3, the ends of the corrugation ribs 112 and 113 are closed. In such an

embodiment, an end may be “opened” by removing a portion of the base **111** (e.g., by cutting it). In various exemplary embodiments, the base **111** includes reduced large ribs **117** and reduced small ribs **118**. Ribs **117** and **118** are smaller than ribs **112** and **113**, respectively, and are sized to fit under and attach to ribs **112** and **113** or to ribs on other components.

[0042] According to various exemplary embodiments, as shown in FIG. 4, base component **111** has an alternating pattern of relatively large ribs **112** and relatively small ribs **113**. In some exemplary embodiments, base component **111** includes optional footsteps **119** that facilitate workers walking on the liquid management system **100** (e.g., during installation or maintenance) without damaging the system and/or causing leaks. According to various exemplary embodiments, the base component **111**, as well as other component, is designed to be cut to reduce its width and/or shape.

[0043] FIG. 5 shows a second embodiment of a base **211**. The discussion of base **111** above is applicable, except for the following. In various exemplary embodiments, the corrugations ribs **212** and **213** of base component **211** comprises small tips **218** to facilitate side-to-side connection of components. Base **211** also comprises foot path **219** to protect the base component **211** when walked on.

[0044] FIG. 6 shows a first exemplary embodiment of an arm component **121**. FIG. 7 shows a second exemplary embodiment of an arm component **131**. In various exemplary embodiments, the first arm component **121** and second arm component **131** are virtual mirror images, at least with respect to the size and alignment of large ribs **122** and **132** and small ribs **123** and **133**. Arm components **121** and **131** each further comprise a foot **124** and **134** respectively that is inclined outwardly at an obtuse angle to the plane of the main body of the arm component **121** or **131** for connecting to a base component **111**. The angle of the foot to the plane of the main body of the arm component may vary depending on the intended application and desired dimension. For example, the angle in the embodiments of FIGS. 6 and 7 is about 135°, but the angle may be as low as about 90°. In other embodiments, the selected angle may be fall between these two examples (e.g., 115°) or may be higher than 135°. Arm components **121** and **131** also each comprise a knuckle **125** and **135** respectively that is adapted for placement along the edge of a ditch. Arm components **121** and **131** may, be formed by different tools or may be molded in the same tool and configured for use by trimming one or the other end of the arm.

[0045] According to various exemplary embodiments, arm component **121** and **131** includes a recessed section **128** and **138** with large recessed ribs **126** and **136** and small recessed ribs **127** and **137**. Large recessed ribs **126** and **136** and small recessed ribs **127** and **137** are slightly different in size from the ribs **122** and **123** on or near the foot **124** and knuckle **125**. The recessed ribs **126** and **127** are sized to fit with ribs **122** and **123** to facilitate connecting multiple arm components **121** or **131**. In various exemplary embodiments, large recessed ribs **126** and **136** are slightly smaller than large ribs **122** and **132**, and small recessed ribs **127** and **137** are slightly smaller than small ribs **123** and **133**. In various other exemplary embodiments, the relative sizes are reversed.

[0046] In various exemplary embodiments, as will be shown below, any number of bases **111** and/or arms **121** and **131** may be combined to achieve a desired set of dimensions for a liquid management system **100**. There are two types of connections between components: end-to-end connections and side-to-side connections. The term “end” is used in refer-

ence to the ditch liner components **111**, **121**, and **131** to refer to the edges of the component that are perpendicular to the direction of the flow of liquid in the system.

[0047] FIG. 8 is an exploded view of a bottom segment **110** assembled from four base components **111** and four sealants **102**. In various exemplary embodiments, the base components **111** are adapted to be cut (see, e.g., FIG. 1) to alter their size and/or shape to fit a channel (e.g., canal, ditch, etc.). In various exemplary embodiments, two or more base components **111** may be connected side-to-side to increase the width of the liquid management system **100**. One side edge **114a** of a base component **111a** is placed overlapping side edge **114b** of base component **111b** with a sealant **102ab** (e.g., a gasket or an adhesive) placed between. Fasteners **103**, such as, for example, screws, are used to securely and tightly connect the base components **111a** and **111b** compress sealant **102ab** therebetween for a watertight seal. Base component **111c** and base component **111d** are connected using sealant **102cd** in the same manner. For side-side-connections between components of the same type (e.g., connecting two base components, as shown here), either component may be placed on top of the other.

[0048] Referring still to FIG. 8, sealants **102ae** and **102bd**, which may be a single sealant, are placed on small end ribs **116a** and **116b** of base components **111a** and **111b**. The large end ribs **115c** and **115d** of the connected base components **111c** and **111d** are placed over small end ribs **115e** and **115f** and securely connected with fasteners (not shown) as described above. It should be noted that the base components **111** need not be assembled in any specific order and that fasteners may be applied at various stages during the process or only after all the base components **111** and sealants **102** are in position. In various exemplary embodiments, as described in more detail below, additional steps may need to be taken before and/or during the connection process to anchor the system in place. For example, cable locks **143** tethered to an anchor may engage the components at the corners where two or more base or arm components overlap) and anchor them in place.

[0049] In various exemplary embodiments, two components **111**, **121**, and/or **131** are connected side-to-side by placing two components side-to-side with one component **111**, **121**, and/or **131** overlapping the other and placing a sealant **102** between. Fasteners (e.g., screws, adhesives, etc.) are used to connect the components. The fasteners bind the components together compressing the sealant therebetween to create a watertight or leak resistant seal, in various exemplary embodiments, the fasteners may pass through the sealant **102** or be located to either or both sides of the sealant **102**.

[0050] FIGS. 9 and 10 show an arm segment **120** formed from four arm components **121**. As shown in FIG. 9, two arm components **121a** and **121b** being connected side-to-side to create an arm segment that is longer than a single arm. Arm component **121a** is adapted for connecting by removal of at least foot **124** (shown in FIG. 6). Arm component **121b** is adapted for connection by removal of at least knuckle **125b**. The cut edges **128a** and **128b** of arm components **121a** and **121b** are overlapped with sealant **102** placed between and securely connected with fasteners. Although either arm component **121a** or **121b** may be placed over the other, it is generally preferred that the upper arm component **121a** be placed over the lower arm component **121b** to help reduce the likelihood of leakage through the seam between them.

[0051] Referring now to FIG. 10, two arm segments **120a** and **120b** are connected by placing large end rib **126b** over

small end rib **125a** with sealant **102** therebetween. As described above, fasteners (not shown) are used to securely connect arm segments **120a** and **120b**.

[0052] FIG. **11** shows a second arm segment **130** formed by connecting four arm components **131**. Arm segment **130** is a mirror image of arm segment **120**, just as arm component **131** is a mirror image of arm component **121**. As will be shown below, this is helpful in attaching the arm segments **120** and **130** to the base segment **110**. According to other various exemplary embodiments, arm segments **120** and **130** may be identical.

[0053] FIG. **12** shows an exemplary embodiment of a ditch liner segment **101** assembled by connecting the side segments **120** and **130** to base segment **110**. The foot portions **124** and **134** of the lower arm components **121** and **131** in side segments **120** and **130** are placed over the side edges (not visible in FIG. **12**) of base segment **110** with a sealant (not shown in FIG. **12**) between. The foot portions **124** and **134** are connected to the base **110** with fasteners (not shown) as discussed previously. In various exemplary embodiments, the large ribs **122** and **132** and small ribs **123** and **133** of the side segments **120** and **130** are somewhat larger than the large ribs **112** and small ribs **113** of the base segment **110**. This helps provide a better fit and tighter seal between side segments **120** and **130** and base segments **110**.

[0054] Any sealant that will resist liquid leakage may be used. In some exemplary embodiments, the sealant is a compressible gasket. The gasket's shape may vary and will depend in large part upon the shape of the space where it will be placed. For example, a thin rectangular gasket is preferably used between overlapping end ribs in end-to-end connections of the exemplary embodiment because both the top surface of the small rib and the bottom surface of the large rib are both flat. In other exemplary embodiments the gasket may be larger or smaller and have a different shape (e.g., a cylinder or tube). A gasket may also have an adhesive on all or a portion of its surface. In various other exemplary embodiments, the sealant is an adhesive, such as, for example, 3M 740 adhesive, or other adhesives that are liquid insoluble and will resist leakage. In various exemplary embodiments, a bead of adhesive is laid down on a component that is to be overlapped for connecting. An adhesive sealant is especially preferred for side-to-side connections where the irregular shape (going up and down over ribs) makes it impractical or difficult to effectively install a gasket. In addition, in some exemplary embodiments, a bead of caulk may be applied along the side edge of the uppermost of the two components.

[0055] In some exemplary embodiments, such as the base shown in FIG. **5**, the ribs **212** and **213** along one edge of a component may be adapted to fit under the other component by using small toes **218** that are reduced in size compared to the ribs.

[0056] An exemplary anchor system is shown in FIG. **13**. Ground anchor **141** is attached to a cable **142**. The anchor system also includes a cable lock **143**. The cable **142** and cable lock **143** are adapted to interact by inserting the cable **142** through the cable lock **143** and the cable lock **143** functions by allowing the cable **142** to pass through the cable lock **143** in only one direction.

[0057] As shown in FIG. **14**, in various exemplary embodiments, the anchor **141** is inserted into the ground using drive bar with the cable (not visible in FIG. **14**) extending out of the ground. In some applications, such as when installing the system in a cement lined ditch, it may be necessary to open a

hole for the anchor prior to installing a section of the liquid management system **100**. As illustrated in FIG. **15**, the cable **142** is passed through an opening in the liquid management system **100**. The cable **142** is then inserted through a washer **144** and the cable lock **143**, which is adapted to fit onto the cable **142** and move in one direction relative to the cable **142**. The cable **142** is pulled through the cable lock **143** until the cable lock is secured against the liquid management system **100** (e.g., until the cable **142** is taut and the cable lock **143** cannot be advanced thither). In addition, the anchor **141** is designed such that pulling on the cable **142** also causes the anchor **141** to rotate in the ground such that it will not pull out of the ground through the hole through which it was installed.

[0058] In various exemplary embodiments, the cable lock **142** and/or washer **144** are designed and/or sized so that they are larger than the opening **106** in the liquid management system **100** and will tightly fit against the surface of the liquid management system **100** entirely covering the opening in the liquid management system **100**. In various exemplary embodiments, a sealant (e.g., an adhesive) may be placed between the cable lock and the ditch liner component and/or caulk may be applied around the circumference of the interface between the cable lock **142** and/or washer **144** and the liquid management system **100** to provide a watertight seal. In various exemplary embodiments, the liquid management system **100** may be anchored at any location in the system. In some exemplary embodiments, the anchor system **140** is attached to the liquid management system at locations where two or more components overlap to provide the greatest stability to all liquid management system components.

[0059] Although the system is shown using an exemplary anchor system, any anchor system may be used to secure the liquid management system in place. The selection of a particular anchor system will depend in large part on the type(s) and characteristics of soil on which the liquid management system is installed. Where the liquid management system is installed over an existing lining system (e.g., a concrete ditch or canal), an anchor that is designed to anchor to the existing bed or lining may be chosen.

[0060] In various exemplary embodiments, the disclosed system is modular because it assembled from at most primary components that can be manufactured with as few as two mold tools. In various exemplary embodiments, the disclosed system is scalable because it is adaptable for assembly in preexisting channels of virtually any size or dimensions. Prior systems had at most a few available sizes and preexisting channels had to be funneled to fit the available systems. Also, larger systems would require multiple parallel channels when the largest available system was not large enough to handle peak flows.

[0061] In various exemplary embodiments, components of different sizes can be manufactured from the same tool by trimming pieces to any desired size. In various exemplary embodiments, the system components are preferably formed from recyclable materials such that material removed from the components during manufacturing or installation can be used to manufacture additional components. In various exemplary embodiments, high density polyethylene (HDPE) material can be readily thermoformed to desired shapes determined by molds using well-known methods to produce durable, long-lasting components. In various other exemplary embodiments, any material that will not deteriorate

under operating conditions (e.g., that will not be absorbed into or corroded by the fluid in the system) may be used, such as other polymeric materials.

[0062] Although the liquid management system is described herein for use with water, the disclosed liquid management system may be used with any flowing or flowable (e.g., fine granular materials) material including, but not limited to water, hydrocarbons (e.g., oil or gasoline), slurries, suspensions, or mixtures (e.g., contaminated water). The disclosed system may be used to transport liquids for various purposes including, but not limited to, transportation of drinking or irrigation water, storm water control, waste water discharge, industrial safety systems (e.g., for collecting spilled liquids in the case of a spill, such as at a processing plant), collection of liquids for treatment or processing contaminated water).

[0063] As utilized herein, the terms “approximately,” “about,” “substantially,” and similar terms are intended to have a broad meaning in harmony with the common and accepted usage by those of ordinary skill in the art to which the subject matter of this disclosure pertains. It should be understood by those of skill in the art who review this disclosure that these terms are intended to allow a description of certain features described and claimed without restricting the scope of these features to the precise numerical ranges provided. Accordingly, these terms should be interpreted as indicating that insubstantial or inconsequential modifications or alterations of the subject matter described and claimed are considered to be within the scope of the invention as recited in the appended claims.

[0064] It should be noted that references to relative positions (e.g., “top” and “bottom”) in this description are merely used to identify various elements as are oriented in the figures. It should be recognized that the orientation of particular components may vary greatly depending on the application in which they are used.

[0065] For the purpose of this disclosure, the term “connected” means the joining of two members directly or indirectly to one another. Such joining may be stationary in nature or moveable in nature. Such joining may be achieved with the two members or the two members and any additional intermediate members being integrally formed as a single unitary body with one another or with the two members or the two members and any additional intermediate members being attached to one another. Such joining may be permanent in nature or may be removable or releasable in nature.

[0066] It should be appreciated that the construction and arrangement of the liquid management system, as shown in the various exemplary embodiments, is illustrative only. While the liquid management system, according to this invention, has been described in conjunction with the exemplary embodiments outlined above, various alternatives, modifications, variations, improvements, and/or substantial equivalents, whether known or that are or may be presently unforeseen, may become apparent. Accordingly, the exemplary embodiments of the liquid management system, according to this invention, as set forth above, are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the invention. Therefore, the description provided above is intended to embrace all known or later-developed alternatives, modifications, variations, improvements, and/or substantial equivalents.

What is claimed is:

1. A modular, scalable liquid management system, comprising:
 - a plurality of corrugated, connectable ditch liner components, comprising:
 - at least one base; and
 - at least one arm;
 wherein:
 - the ditch liner components are adapted to be cut to change their shape or reduce their length and/or width without compromising their connectability;
 - the ditch liner components are adapted for connection to components of the same type for increasing one or more dimensions of the liquid management system; and
 - the ditch liner components are adapted for side-to-side coupling of components and end-to-end coupling of components;
 - a sealant for placement between adjacent components at or about the point of connection;
 - a plurality of fasteners for coupling ditch liner components together; and
 - at least one anchoring system attachable to one or more ditch-liner components for securing the liquid management system in place;
 wherein the ditch liner components are adapted to be assembled into the liquid management system by:
 - connecting a plurality of base components side-to-side and/or end-to-end to form the base of a liquid management system;
 - connecting a plurality of arm components end-to-end and/or side-to-side to form a first wall of a liquid management system;
 - connecting a plurality of arm components end-to-end and/or side-to-side to form a second wall of a liquid management system; and
 - connecting the first wall to a first side of the base and connecting the second wall to a second side of the base to form a liquid management system.
2. The modular, scalable liquid management system of claim 1, wherein the ditch liner components further comprise:
 - a first smaller corrugation; and
 - a second larger corrugation;
 wherein the ditch liner components may be connected end-to-end by overlapping two components with second corrugation atop the first corrugation.
3. The modular, scalable liquid management system of claim 1, wherein the ditch liner components further comprise:
 - a first side;
 - a second side adapted for connection to the first side of another component;
 wherein the first side and second side are connectable by overlapping the first side over the second side.
4. The modular, scalable liquid management system of claim 1, wherein the first arm component and the second arm component each further comprise:
 - a main body section; and
 - a foot section at a first side of the arm component that is inclined upwardly at an obtuse angle to the plane of the main body of the arm component for connecting to a base section.
5. The modular, scalable liquid management system of claim 1, wherein the arm component further comprises:

a main body section; and
 a knuckle section at a second side of the arm component that is inclined downwardly at an acute angle to the plane of the main body section to form an overhang at a side of the liquid management system.

6. The modular, scalable liquid management system of claim wherein the anchoring system further comprises:

an anchor adapted for insertion into the ground;
 a cable attached to the anchor; and
 a cable lock adapted to attach to the cable such that the end of the cable not attached to the anchor is passed through the cable lock and can be advanced down the cable toward the anchor, but not away from the anchor;

wherein the anchor system is adapted to secure the liquid management system in place by:

inserting the anchor into the ground;
 passing the cable through the one or more ditch liner components;
 inserting the cable into the cable lock between the anchor and the cable lock; and

securing the cable lock against the one or more ditch liner components by advancing the cable through the cable lock until the cable is taut.

7. The modular, scalable liquid management system of claim 1 wherein the sealant comprises a gasket and/or adhesive.

8. A method of assembling a modular, scalable liquid management system, comprising:

providing a plurality of corrugated, connectable ditch liner corn orients, comprising:

a plurality of base components wherein the ditch liner base components have corrugations adapted for side-to-side connecting and end-to-end connecting of base components; and

a plurality of arm components wherein the ditch liner first arm components have corrugations adapted for side-to-side connecting and end-to-end connecting of first arm components;

wherein the liquid management system is scalable by:
 removing a portion of a ditch liner component; and/or
 connecting two or more of the same components side-to-side;

assembling the liquid management system by:

forming a base segment, comprising one or more base components sized to a chosen shape by cutting the base components and/or connecting the base components side to side;

extending the base segment by connecting one or more additional base components end-to-end to the base segment;

connecting a first arm segment to the base segment, wherein the first arm segment comprises one or more arm components sized to a chosen size by cutting the arm components and/or connecting the arm components side to side;

connecting a second arm segment to the base segment, wherein the second segment comprises one or more arm components sized to a chosen size by cutting the arm components and/or connecting the arm components side to side;

placing a sealant in or at the connecting points of connected ditch liner components; and

extending the liquid management system by connecting additional base components, first arm components, and second arm components to the liquid management system; and

anchoring the liquid management system in place with an anchoring system.

9. The method of claim 8, the anchoring system further comprising:

an anchor adapted for insertion into the ground;
 a cable attached to the anchor; and
 a cable lock adapted to attach to the cable such that the end of the cable not attached to the anchor is passed through the cable lock and can be advanced down the cable toward the anchor, but not away from the anchor;

wherein the anchor system is adapted to secure the liquid management system in place by:

inserting the anchor into the ground;
 passing the cable through the one or more ditch liner components;
 inserting the cable into the cable lock between the anchor and the cable lock; and

securing the cable lock against the one or more ditch liner components by advancing the cable through the cable lock until the cable is taut.

10. The method of claim 9, further comprising:
 inserting an anchor connected to a cable into the ground;
 passing the cable through an opening in one or more of the ditch liner components;

passing the anchor cable into the cable lock;
 wherein the opening in one or more of the ditch liner components is sized such that the cable lock will not pass through the opening; and

pulling the anchor cable through the cable lock until the cable lock abuts the one or more of the ditch liner components and the anchor cable is taut.

11. The method of claim 9, wherein the liquid management system is anchored at locations where two or more component corners are connected.

12. The method of claim 8, wherein the liquid management system is assembled starting at a downstream or outlet end of the system and adding components to extend the system to an upstream or inlet end of the system.

13. The method of claim 8, wherein the connecting of two or more ditch liner components together comprises the use of one or more fasteners.

14. The method of claim 8, wherein the step of applying a sealant comprises:

placing a gasket and/or adhesive between overlapping ditch liner components; and
 connecting the ditch liner components with a fastener;
 wherein the gasket and/or adhesive is compressed between the ditch liner components to provide a tight seal.

15. The method of claim 8, wherein the step of applying a sealant comprises applying caulking to connected components along a line formed between the edge of the ditch liner component that overlaps onto another ditch liner component to which it is connected.

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