



US 20060147270A1

(19) **United States**(12) **Patent Application Publication****Parker**(10) **Pub. No.: US 2006/0147270 A1**(43) **Pub. Date: Jul. 6, 2006**(54) **COIL MATRIX APPARATUS AND METHODS OF USE THEREOF**(76) Inventor: **Alton F. Parker**, Clifton Park, NY (US)

Correspondence Address:
SCHMEISER, OLSEN & WATTS
22 CENTURY HILL DRIVE
SUITE 302
LATHAM, NY 12110 (US)

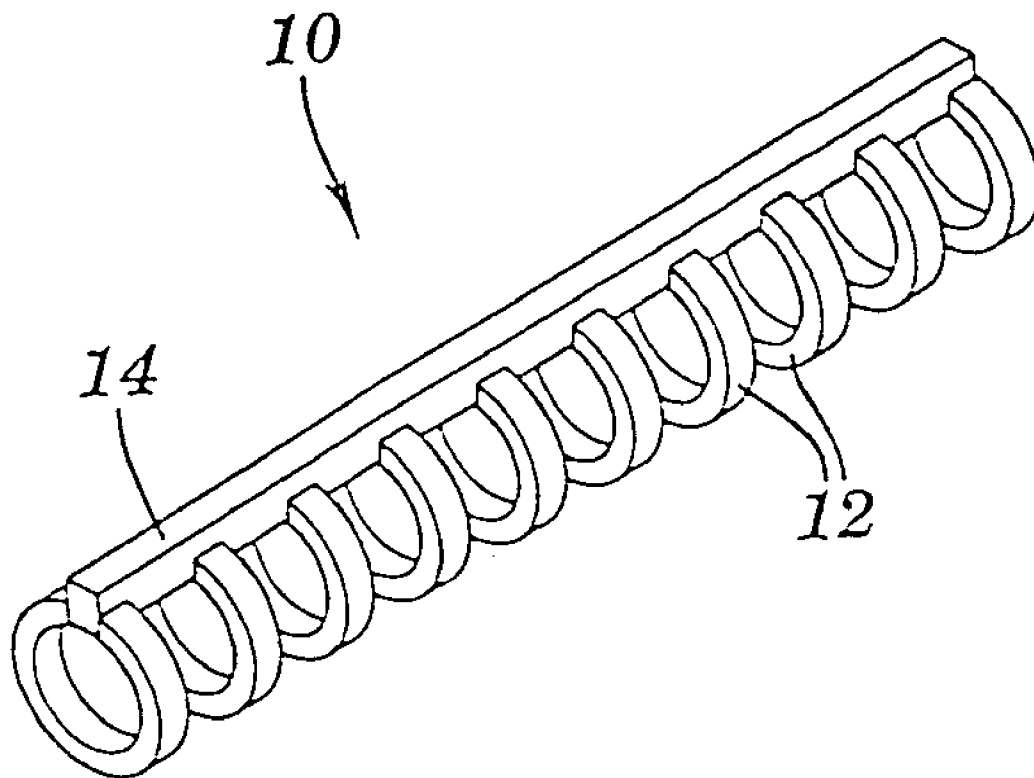
(21) Appl. No.: **11/366,934**(22) Filed: **Mar. 2, 2006****Related U.S. Application Data**

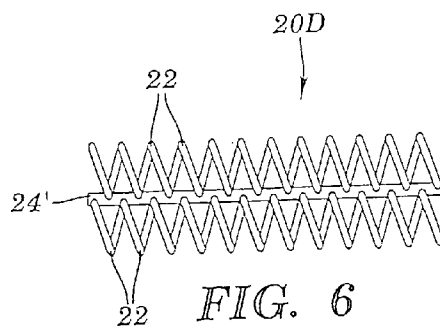
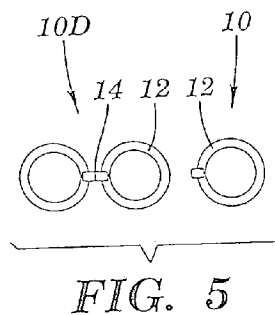
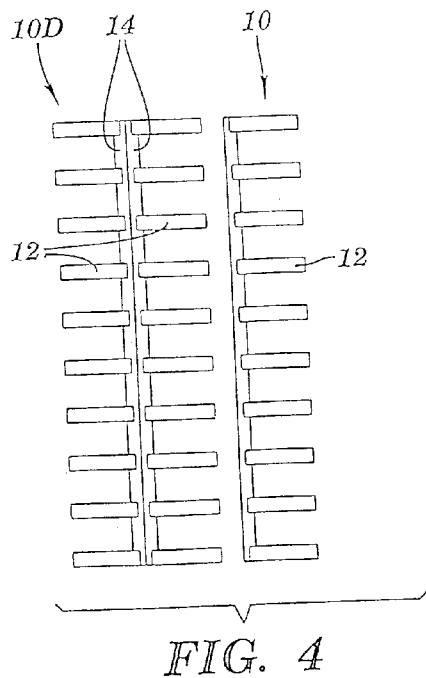
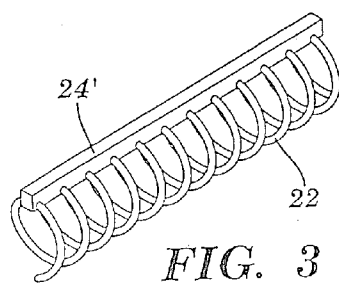
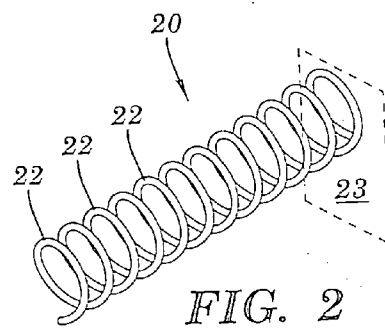
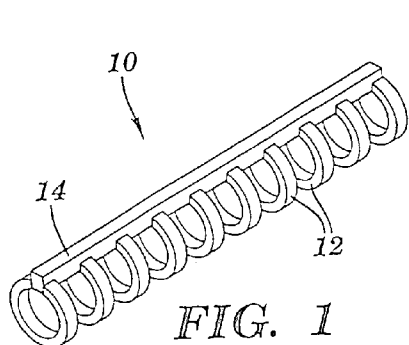
(63) Continuation-in-part of application No. 10/808,641, filed on Mar. 25, 2004, now Pat. No. 7,033,110, which

is a continuation-in-part of application No. 10/775,459, filed on Feb. 10, 2004, now Pat. No. 6,866,447, which is a continuation-in-part of application No. 10/663,110, filed on Sep. 16, 2003, now abandoned.

Publication Classification(51) **Int. Cl.**
E02B 11/00 (2006.01)(52) **U.S. Cl.** **405/50; 405/43**(57) **ABSTRACT**

A coil matrix apparatus is provided. The coil matrix apparatus comprises a composite body including at least one or a plurality of coil strands. Some embodiments of the coil matrix apparatus further include a grid. Methods of spacing, packing, insulating, strengthening, reinforcing and/or shaping include provision of embodiments of the coil matrix apparatus.





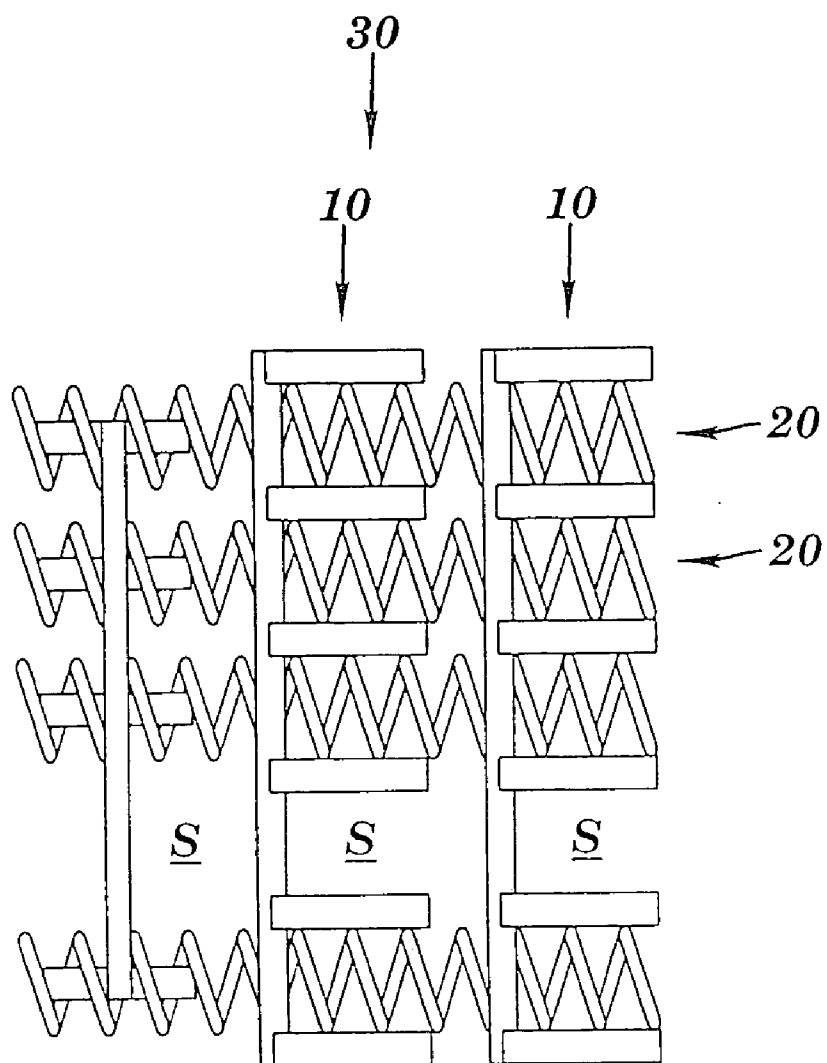
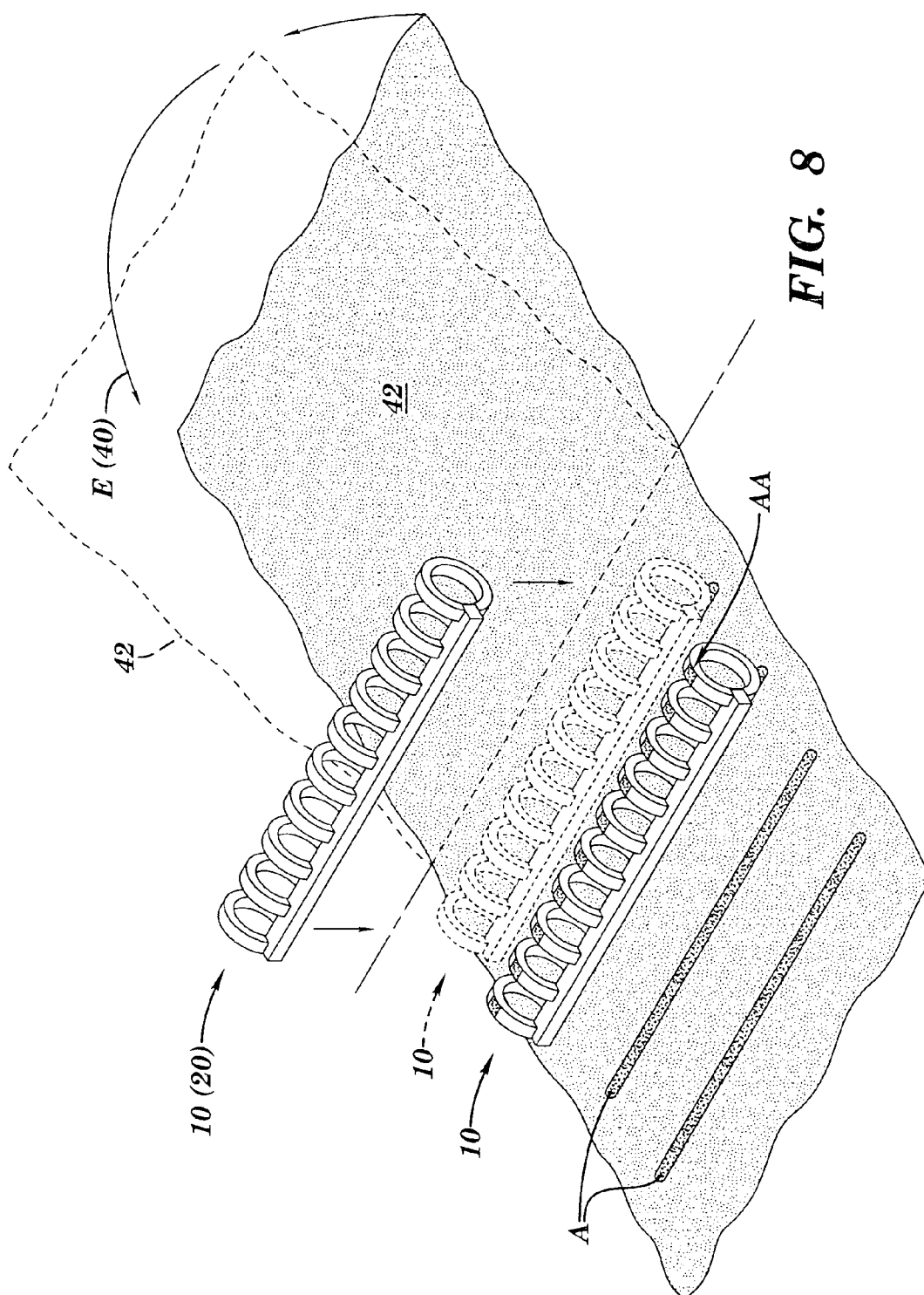
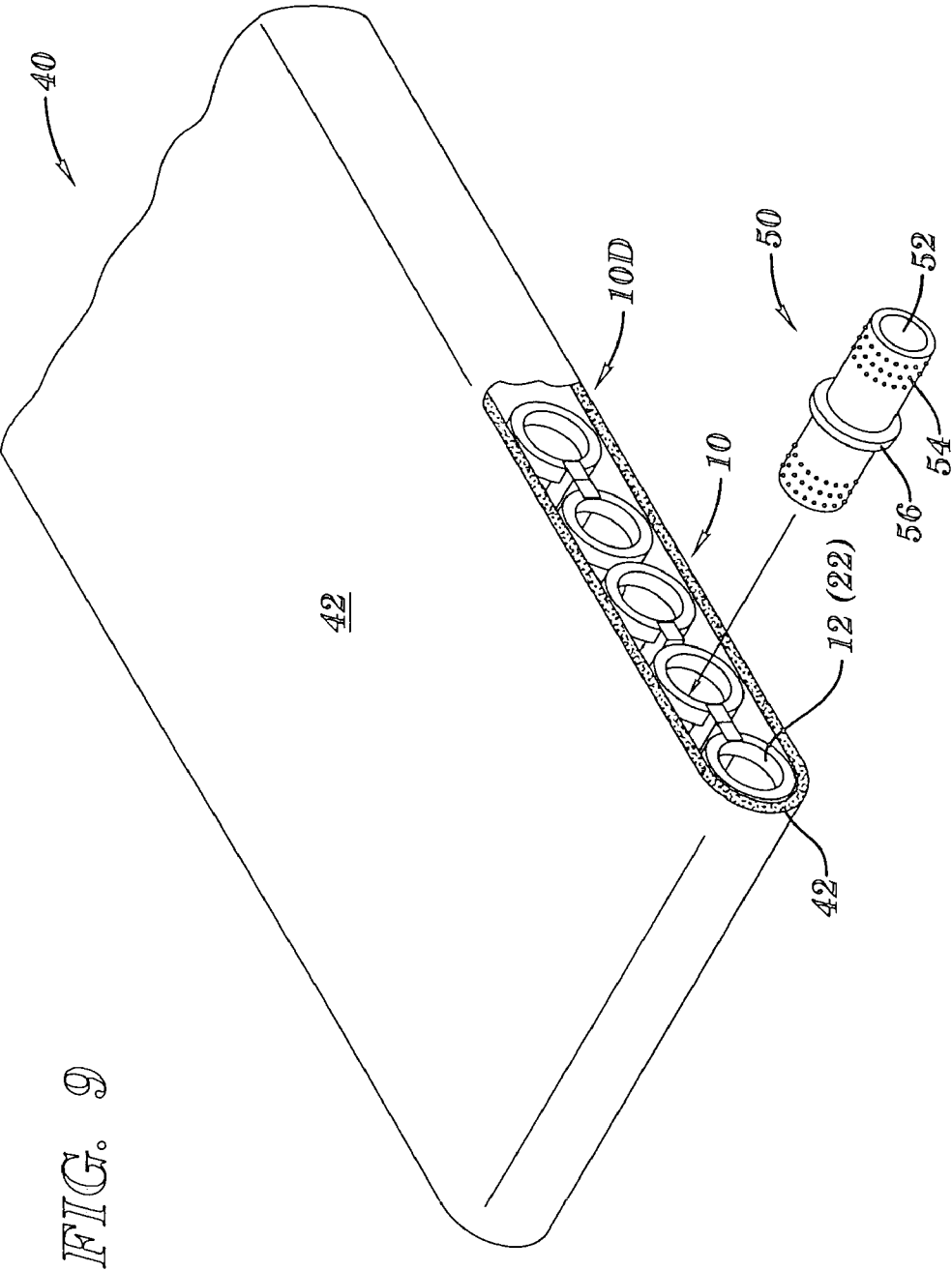


FIG. 7





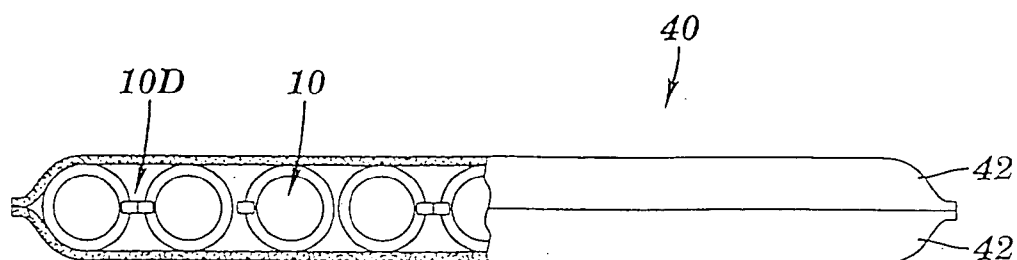


FIG. 10

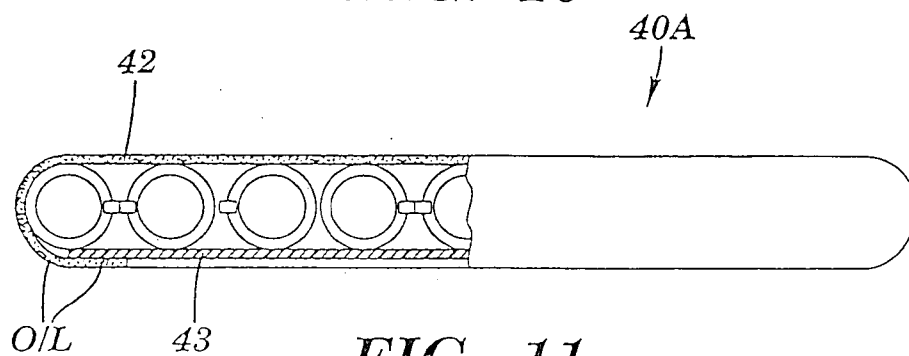


FIG. 11

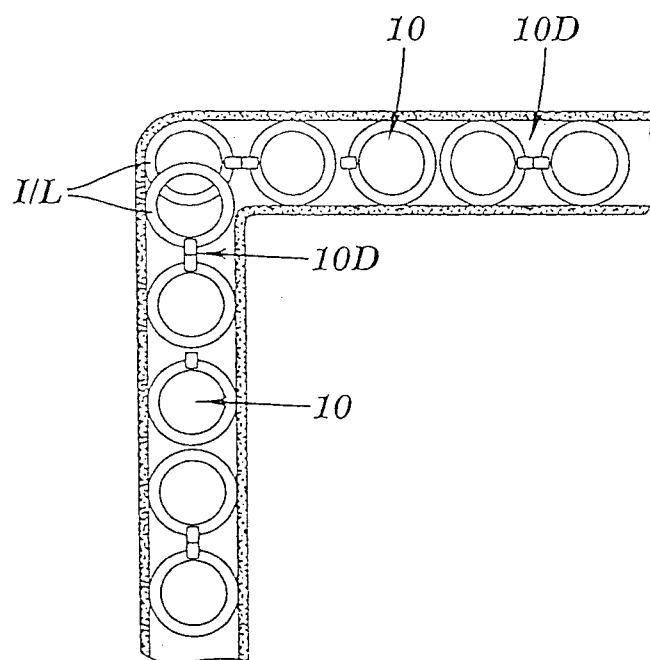


FIG. 12

FIG. 14A

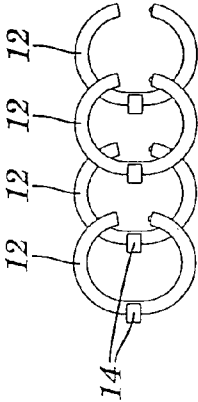


FIG. 14B

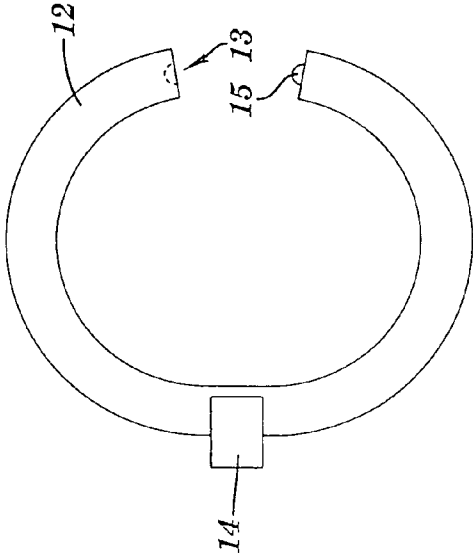


FIG. 14C

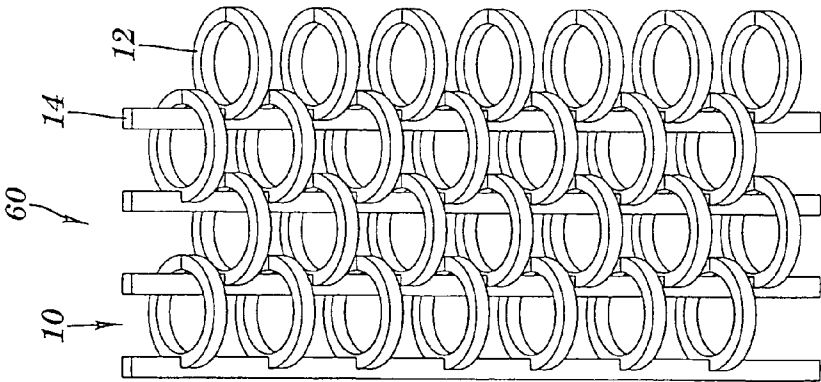
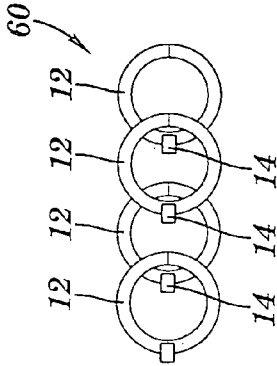


FIG. 13

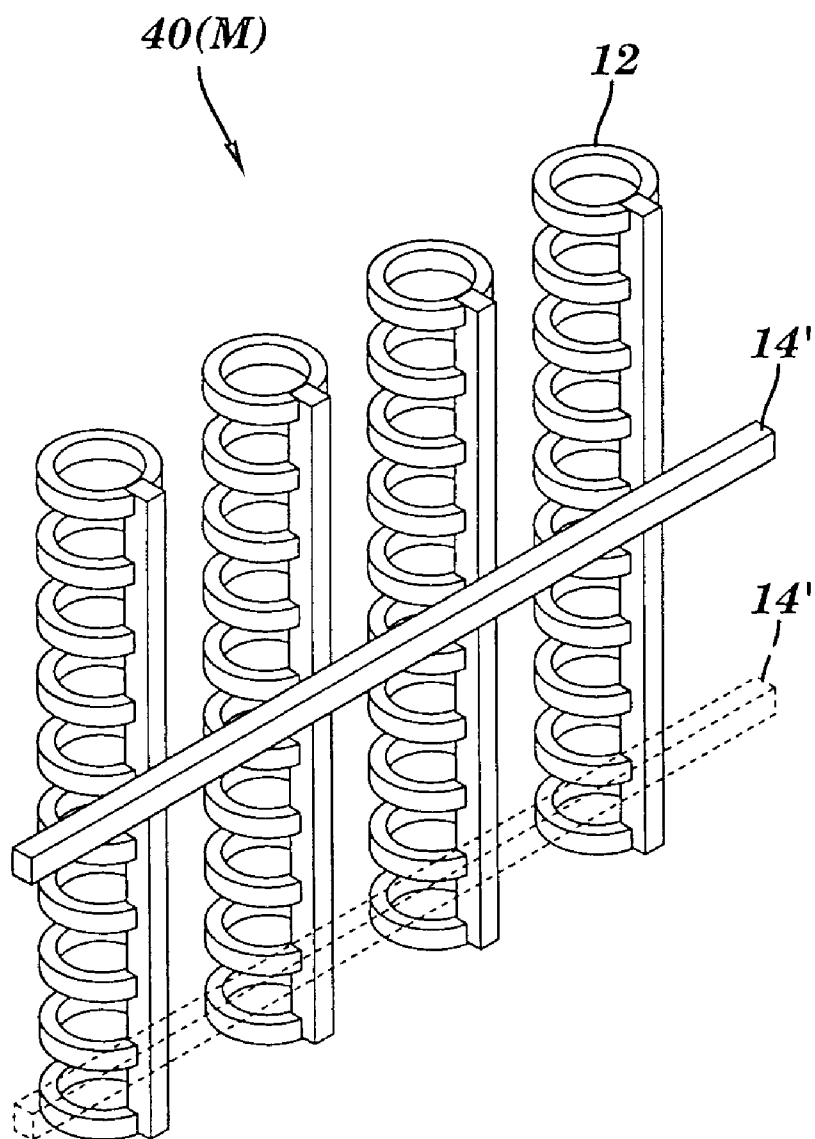


FIG. 15

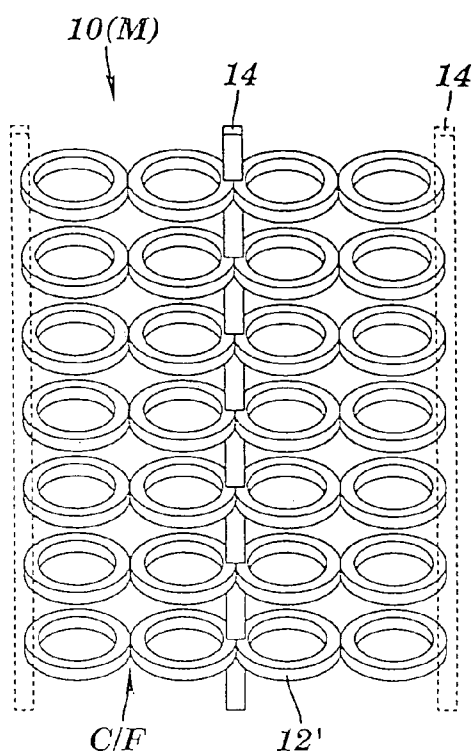


FIG. 16

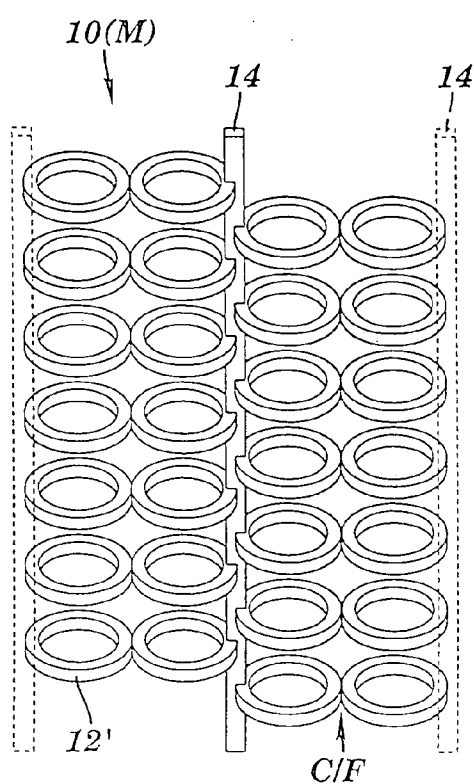


FIG. 18

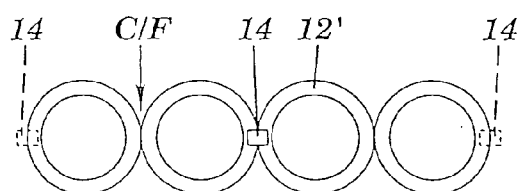


FIG. 17

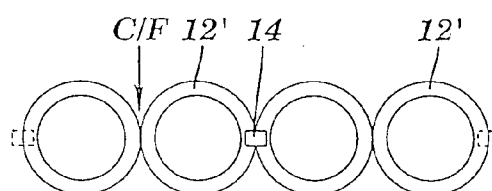


FIG. 19

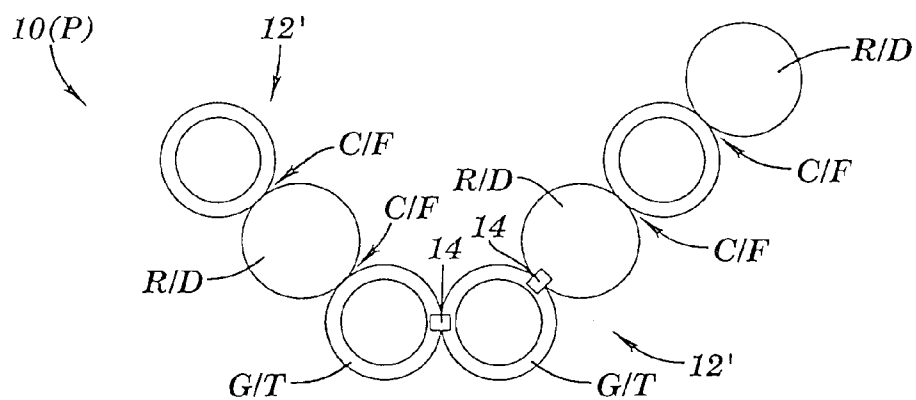


FIG. 20

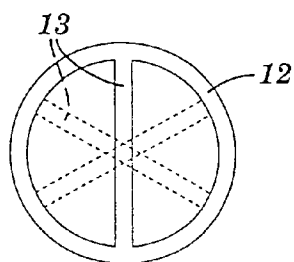


FIG. 21

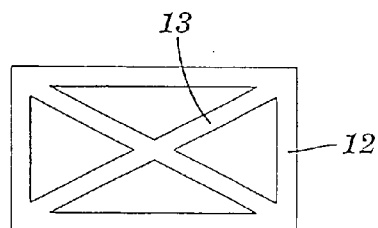


FIG. 22

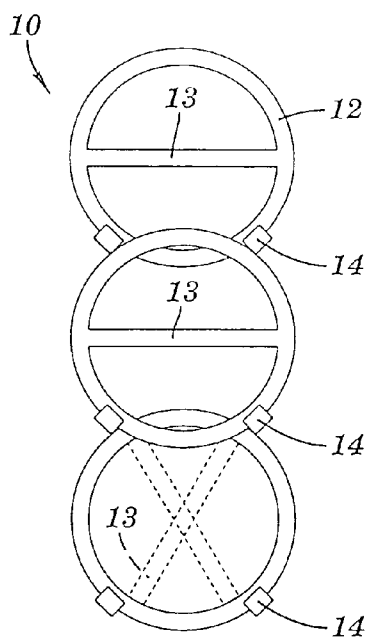


FIG. 23

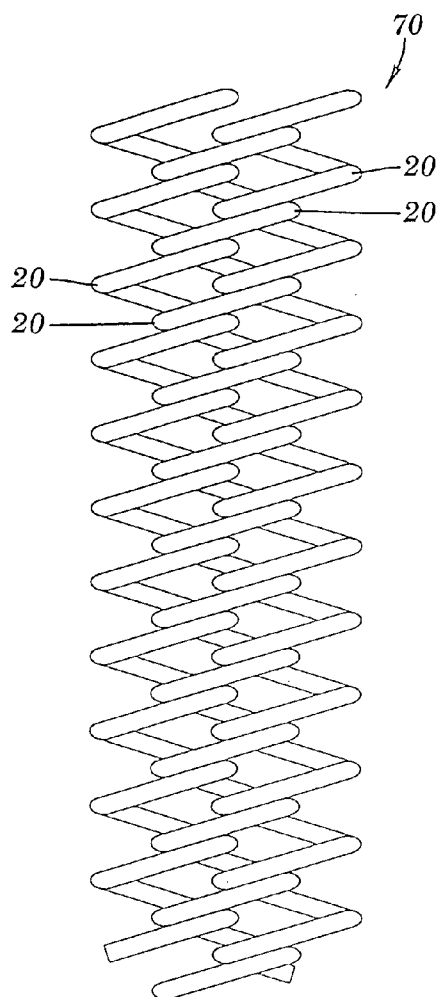


FIG. 24

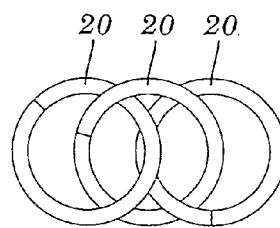


FIG. 25

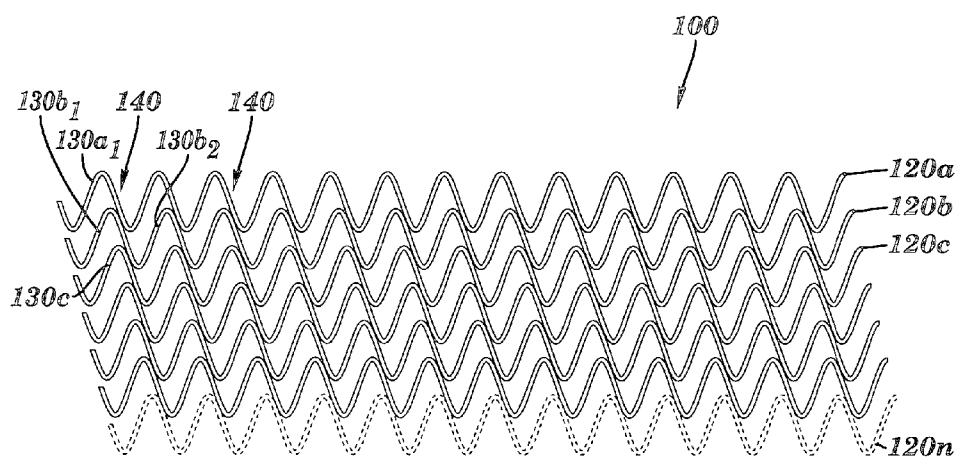


FIG. 26

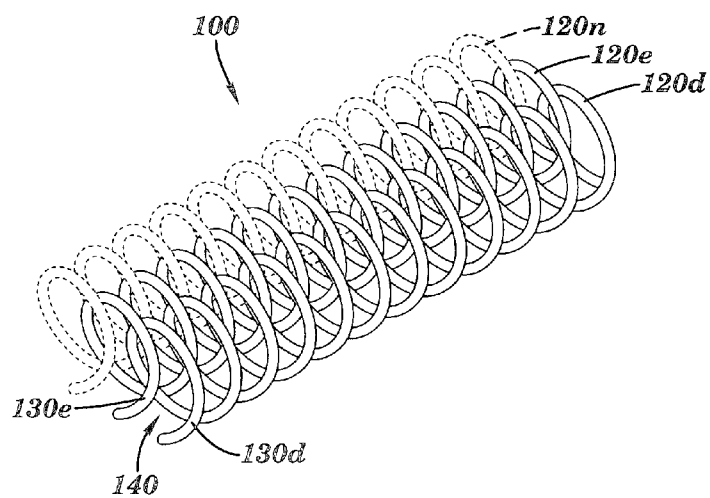


FIG. 27

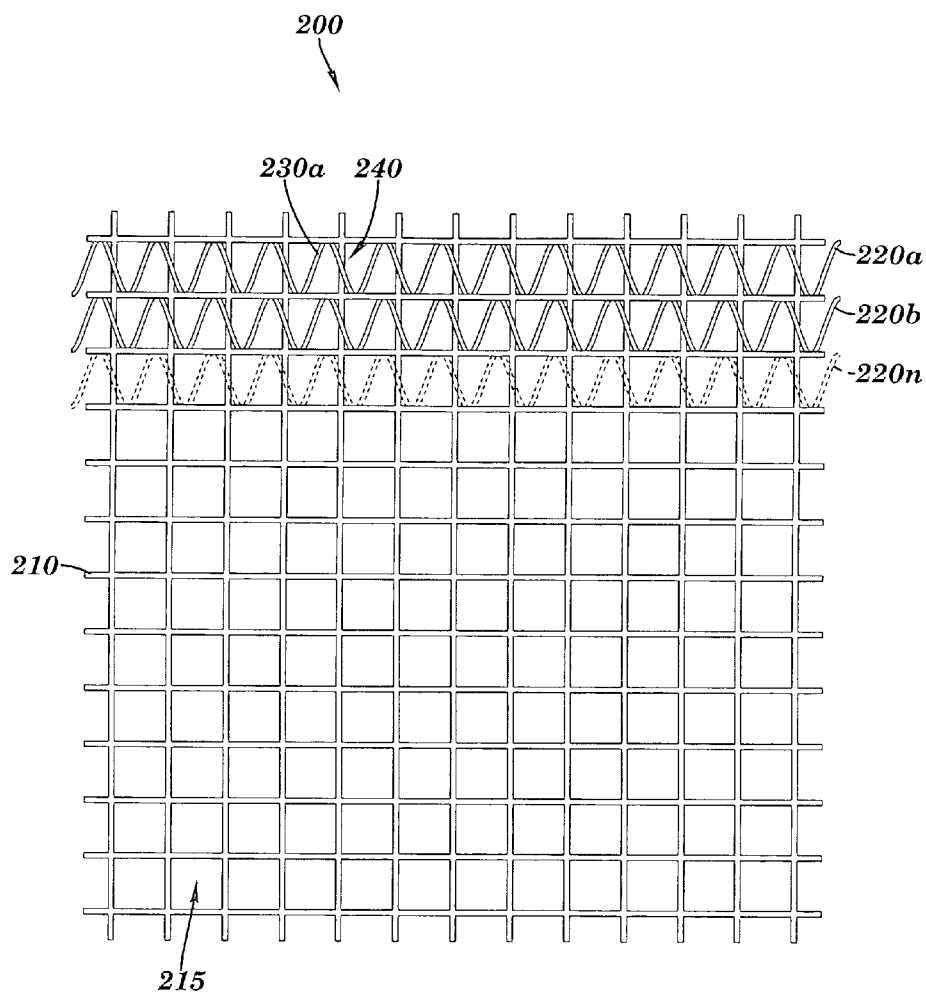


FIG. 28

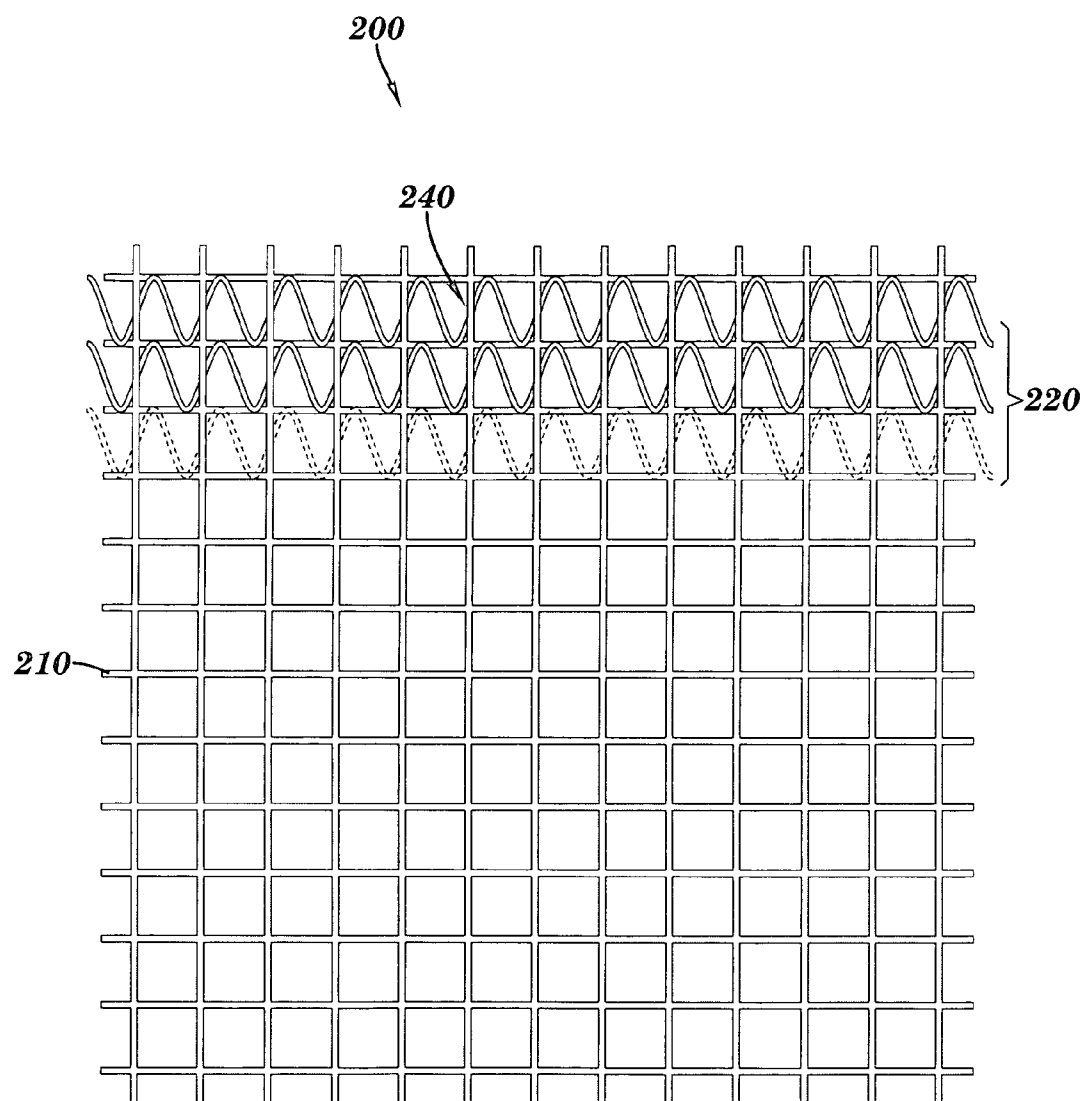


FIG. 29

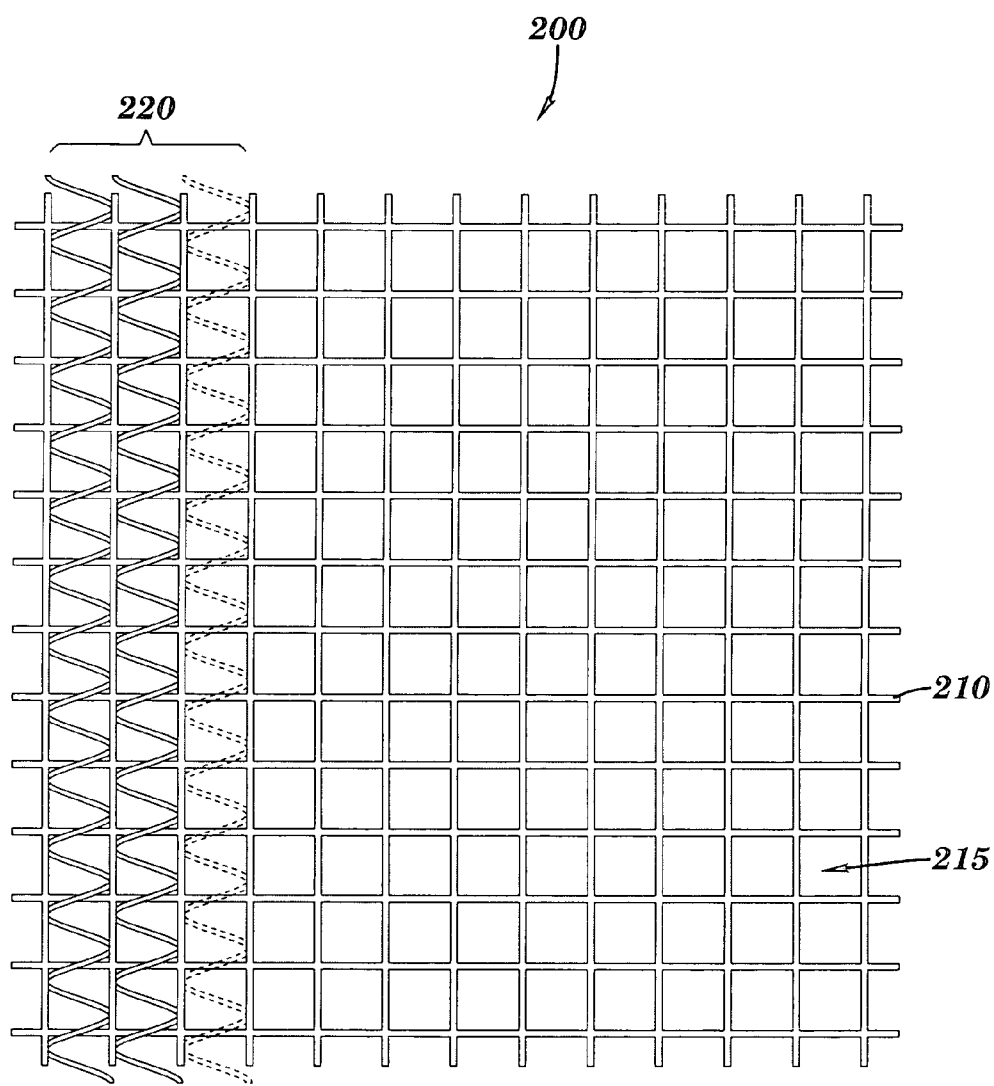


FIG. 30

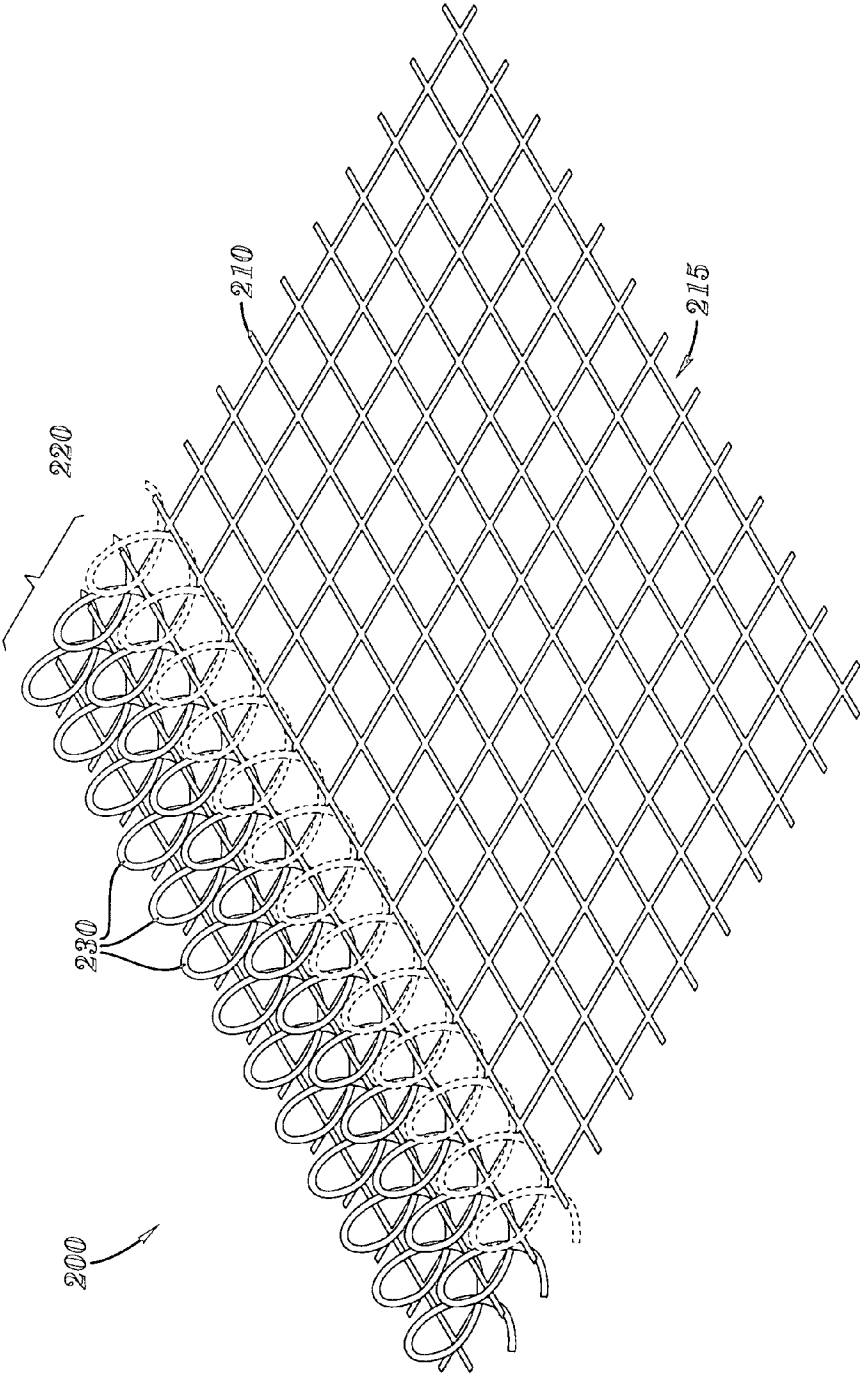


FIG. 31

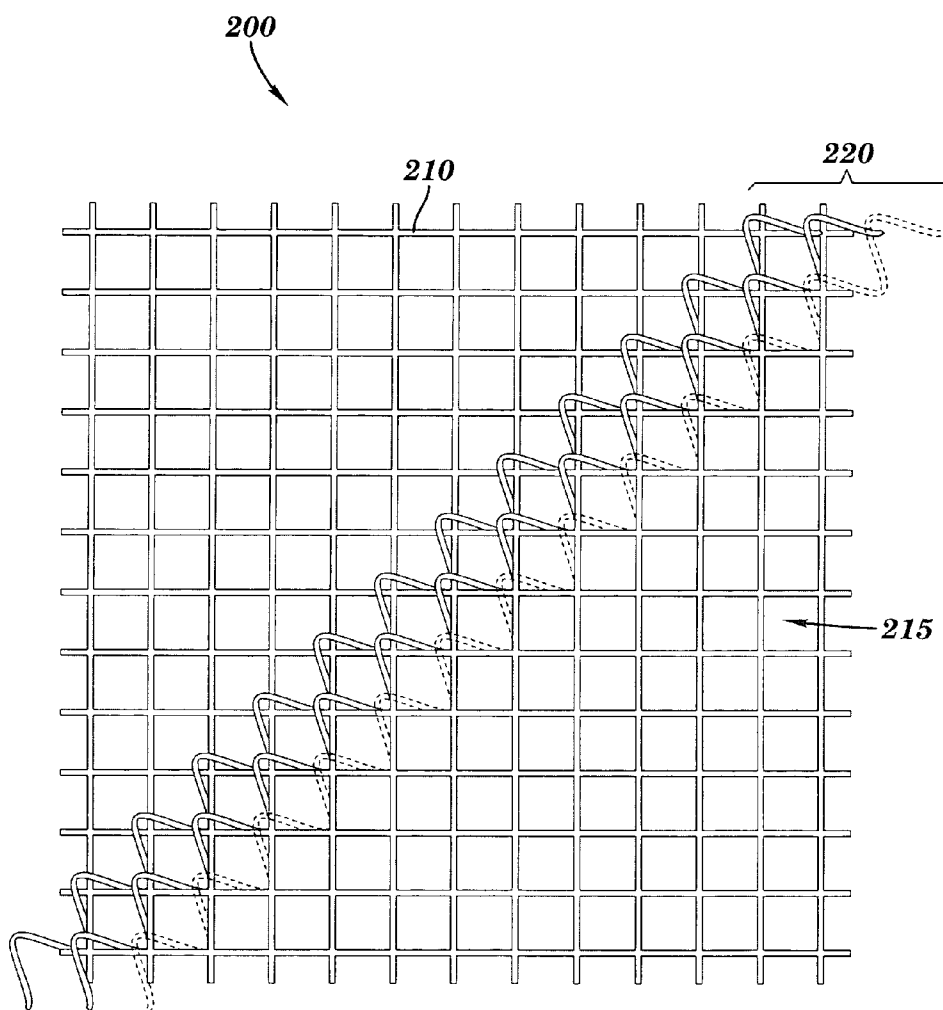


FIG. 32

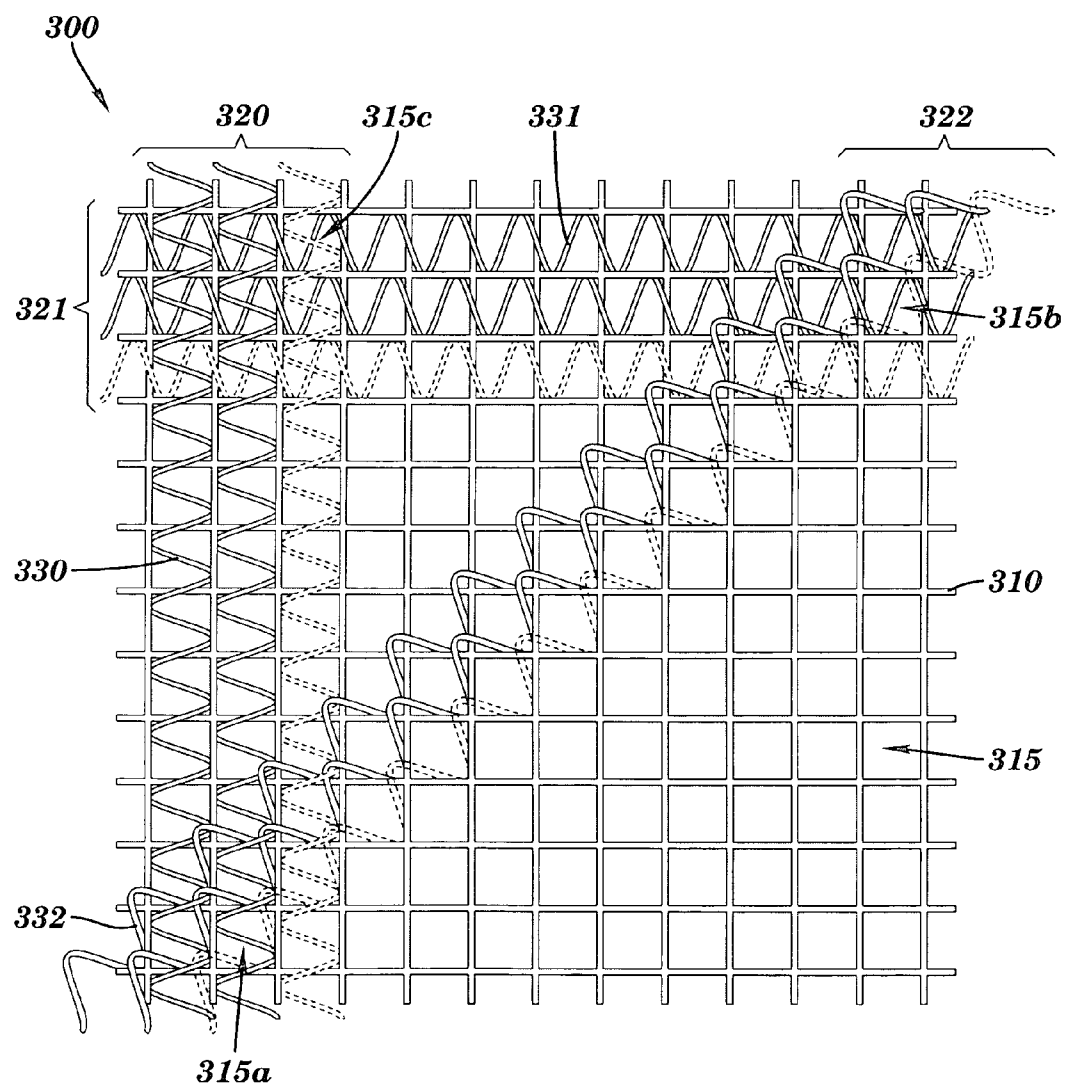


FIG. 33

COIL MATRIX APPARATUS AND METHODS OF USE THEREOF

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims benefit to U.S. patent application Ser. No. 10/808,641, filed on Mar. 25, 2004, which claims benefit to U.S. patent application Ser. No. 10/775,459, now U.S. Pat. No. 6,866,447, filed on Feb. 10, 2004, which claims benefit to U.S. patent application Ser. No. 10/663,110, filed on Sep. 16, 2003, and by the same inventor.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] This invention relates generally to devices and constructs used to enhance subterranean drainage from building structures and entrenchments, such as walls, footings, foundations, as well as drainage from under garage and basement floors, where overburden of concrete exacerbates the collection of water. Specifically, this invention embodies a drain assembly improvement using a simplified support matrix that may be used with membranous covers, stone or other adjuncts. The matrix can sustain great overburden and is inherently pliable enough to be rolled and used as a flexible drain assembly (or "blanket-drain") over and around structures that would otherwise have to be served by more cumbersome and costly drainage systems.

[0005] 2. Discussion of Relevant Art

[0006] It has long been a practice, in the construction industry, to provide some form of drainage to subterranean structures. Ground water seepage remains a problem in most non-raised regions of the world; and, building footings, garage floors (multi-level) and walls, facing surface and subsurface waters, have been most susceptible to water incursions. Many drainage devices have been provided, as well as adjuncts thereto, in order to provide adequate carry-off or transport of these undesired waters. Other patents, secured by the instant inventor, adequately cover the use of membranous coverings, such as filter fabric and impermeable sheeting. This paper will deal primarily with supporting structures for use with such coverings and expand on the basic concepts disclosed in the earlier, priority document.

[0007] Five disclosures are germane to this discussion, relative to the extant art: U.S. Pat. Nos. 3,965,686 ('686), issued Jun. 29, 1976, entitled DRAIN SHEET MATERIAL; 4,995,759 ('759), issued Feb. 26, 1991, entitled DRAINAGE TUBE CONSTRUCTION; 6,527,474 ('474), issued Mar. 4, 2003, entitled PAVEMENT DRAIN; 4,019,326 ('326), issued Apr. 26, 1977, entitled NONWOVEN HORIZONTAL DRAINAGE SYSTEM; and, 5,152,892 ('892), issued Oct. 6, 1992, entitled SPIRAL FILTER ELEMENT. All of these patents show, to some degree, the functionality of the coiled or spiral element in providing a conduit for fluids and having a relatively low or limited deformation character. However, it is in the careful study of each disclosure that one perceives, albeit suitability for intended

purpose, its limitations when compared to the ready adaptability of the instant invention.

[0008] Issued to Saito et al. '686 details a compound sheet apparatus wherein a plurality of coils or internally strengthened tubules are parallel-arrayed, embedded in a non-woven fibrous material and disposed between two thin sheets of filter fabric. The apparatus' outer sheets are both porous and not suitable for placement against vertical walls. Most limiting is the necessity for the fibrous "filling" in which the tubules are embedded. When used for the specific purpose shown in '686, and notwithstanding the "filling", the apparatus appears to enjoy some flexibility; however, it seems intuitive that doubling the thickness of the "sandwich" would render such flexibility problematical. A characteristic of its construction, the use and dependence upon flow direction-constraining fibers, obviates a bi-directional emplacement of the apparatus on surfaces that may change in pitch direction or present a configuration that will not allow the use of a constrained-flow device.

[0009] A single-purpose drainage tube, for use in entrenchments, is shown in '759. The apparatus consists of a length of drain formed by a fixed tangential connection of parallel, equal-length sections of tubing, on a longitudinal axis that is perpendicular to the axes of the sections. The tubing consists of corrugated pipe; and, the assembly is completed by enveloping the above apparatus in a filter fabric. Although more stylized emplacements can be conceived for the apparatus, it appears that in the vertical drainage mode, turning of corners is impossible because the longitudinal fixation denies flexibility, as defined and required by the instant inventor.

[0010] Although not intended to flex, the pavement drain member of '474 is remarkable in that it is essentially a plain resin coil, albeit composed of two arcuate strands in fixed adjacency. The coil possesses a minimal gap between each annular section so as to obviate infusion of macadam, when it is set onto the asphalt medium. Water will infuse readily into the coils and be transported from the tarmac base. The primary motivation for the use of a stylized resin coil is to provide a structure having high overburden sustainability, a tunnel-like effect for transporting fluids and a possession of pseudo-homogeneity with the tarmac. The latter characteristic obviates coil interference during destruction (by grinding) of the tarmac.

[0011] The subsurface soil drainage system of '326 employs a porous mat, of non-woven fibers, in which is centrally embedded a tunnel-shaped agglomeration of heat-spun filaments of spiral or coil geometries. Subsurface waters, infusing the mat, are carried off through the tunnel of filaments, thus draining the surrounding soil. This apparatus requires a considerable thickness (and amount) of non-woven mat, making it unsuitable for the purposes of draining most structures. It also appears to lack the degree of flexibility required by the instant inventor.

[0012] Final to this review of relevant art is patent '892, for a spiral filter element possessing a special expansion-compression character. It is essentially a filter-covered spring, the coils of which are formed so that the gaps between the (analogical) annuli gradually increase in size from one coil end to the other. This predisposition of the element assures that, when vertically and operatively oriented, each discrete section of the coil is capable of sustain-

ing the mass of the coil sections above it. Placed in a horizontal position, the spring gap variations of this element would defeat its purpose in any planar filtration ensemble.

[0013] Although for the most part, structure and soil draining, with concomitant filtration, is still performed using tiles, large amounts of stone and paper/fabric overlay (such as in drywell and septic usages), it is the instant inventor's contention that conscientious builders should transition to more efficient, effective and reliable draining and filtering modalities.

[0014] The instant invention provides an easily manipulated, flexible device that can be emplaced both adjacent to and beneath concrete structures and earthen constructs, as well wrapped about articles such as pipes, cylinders, comers and generally planar surfaces.

INCORPORATION BY REFERENCE

[0015] Because they show both the present state of the art in drainage devices having an internally channeled structure, as well as disclosing filtering adjuncts or various stand-off mechanisms, U.S. Pat. Nos. 3,965,686, 4,995,759, and 6,527,474, with the aforesaid priority application, are hereby incorporated by reference.

[0016] Generally throughout this disclosure, words of description and claim shall have meanings given by standard English usage; however, certain words—preponderantly nouns—will be used that may have a more stylistic (in bold-face) meaning and are defined as follows:

[0017] arrangement—herein, the placement of basic support elements of the invention that will compose a duct-like member;

[0018] array—the order of two or more members, not necessarily planar;

[0019] blanket-drain—a term of art used herein to refer to the assembly/ensemble for, or method of, providing below grade/structure drainage using the inventor's preferred and alternate planar array embodiments;

[0020] construct—generally, an article or a building structure;

[0021] continual—having intermittent, or periodic, breaks or discontinuities;

[0022] continuous—having no breaks or discontinuities;

[0023] continuum—suggesting a continuity of some feature, such as a covering;

[0024] cross-link—the attribute of joining/communicating between support elements or members of the invention;

[0025] coupling—herein, a physical fixed, rigid or movable linking of elements or members of the invention;

[0026] duct—a unit used for fluid transport, having generally an axially void, elongated, skeletal appearance, and typifying the member of the invention;

[0027] element—the basic constituent of the invention having a particular geometry (shape) that has ordinarily a central void, the void optional in arcuate or curved elements, and wherein the element itself comprises one or more of the geometries;

[0028] gang(ing)—a group(ing) of elements, of any shape, into one or more configurations in order to arrange the resultant members into other than purely planar arrays;

[0029] hoop—an element having (particularly) a generally circular geometry, also ring and annulus(lar) and, concatenated in a coil member;

[0030] integral—necessary to complete or in itself complete;

[0031] longeron—a longitudinal element that connects parts of a series, such as the centrally void, geometrical (elemental) parts of the invention;

[0032] member—a part of the invention consisting of an arrangement of its constituent elements, generally in-line;

[0033] membrane or membranous—of or pertaining to a porous/non-porous, thin sheet of material, irrespective of its composition, as opposed to mat or matted;

[0034] nodule—a projection of indefinite shape that can be, simply, a detent or dimple;

[0035] permeable—the quality of allowing a fluid, to pass through;

[0036] polyform—any form, assembly or construct using support elements or members of the invention;

[0037] quasi-tubular—the character of a support member that emulates a duct, but only to the extent that it is skeletal, elongated and sustains an axial void;

[0038] rigid—a physical property of an object wherein the object substantially resists deflection in a particular dimension (direction) or plane;

[0039] sandwich—the configuration made by placing one planar surface over, but set apart from a second surface, and wherein either may be virtual or referenced as face(s);

[0040] skeleton(tal)—the arrangement of elements of the invention manifesting a multi-aperture character;

[0041] stagger(ed)—the arrangement of members in a parallel posturing so that the elements of each may interleave with the other/others;

[0042] Standoff—a spacing support element or device that facilitates the setting apart of articles, e.g., membranes or stone;

[0043] stringer—generally, but not necessarily, an elongated structure that effects connection between the members (Cf. longeron);

[0044] support—generally used as an adjective with elements and members of the invention;

[0045] tubule—item (member) of the invention having a duct-like, skeletal appearance;

[0046] unitary—having wholeness, as in a single unit or monolith composed of plural members;

[0047] composite—v. made up of distinct components;

[0048] grid—structure comprising a pattern of regularly spaced crisscrossed elements, such as, for example, a mesh of parallel vertical and horizontal members;

[0049] interconnect(ed)—to join or fasten together;

[0050] interleave(d)—to insert something alternately and regularly between the parts of;

[0051] interlock—to unite or join closely as by hooking or dovetailing;

[0052] intersect(ed)—to come in contact with or overlap each other;

[0053] intertwined—to become twisted, interlaced, or interwoven;

[0054] matrix—structure comprising a network of intersections of elemental components;

[0055] node—the smallest repeating structural unit comprised by the crisscrossed members of a grid; and,

[0056] strand—a patterned structural element forming a unity within a larger structural whole.

[0057] The above listing is not exhaustive. Certain other stylized terms, used previously or hereafter, are defined at the time of their first usage or placed in quotation marks and used with conventional wording.

BRIEF SUMMARY OF THE INVENTION

[0058] The present invention provides a coil matrix apparatus and related methodology that offers improved reliability.

[0059] A first general aspect of the invention provides a coil matrix apparatus comprising a composite body including plurality of interconnected coil strands, said interconnected coil strands having adjacent hoops, wherein the adjacent hoops of the interconnected coil strands are not interlocked.

[0060] A second general aspect of the invention provides a coil matrix apparatus comprising a grid, said grid including a pattern or regularly spaced nodes; at least one coil strand, said coil strand having hoops sized to interconnect with a portion of corresponding nodes of the grid, wherein the at least one coil strand is interleaved with the grid.

[0061] A third general aspect of the invention provides a method of spacing comprising providing a coil matrix apparatus including at least one coil strand incorporated with a grid; and securely positioning the coil matrix apparatus between two objects to separate the objects.

[0062] A fourth general aspect of the invention provides a method of spacing comprising providing a coil matrix apparatus including an array of interconnected coil strands; and securely positioning the coil matrix apparatus between two objects to separate the objects.

[0063] A fifth general aspect of the invention provides a method of reinforcing a hardening mixture, said method comprising providing a coil matrix apparatus, said coil matrix apparatus including void space located between and within a plurality of interconnected coil strands; inserting the coil matrix apparatus into a form; and filling the form with a hardening mixture, wherein the hardening mixture intersperses into the void space of the coil matrix apparatus.

[0064] The foregoing and other features of the invention will be apparent from the following more particular description of various embodiments of the invention

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0065] Of the Drawings [Caveat—the following illustrations are for explanation only and no sizes nor dimensions should be inferred unless explicitly stated]:

[0066] **FIG. 1** is a representation of the preferred embodiment for a standoff or support member of the invention;

[0067] **FIG. 2 a** representation of an alternate to the preferred embodiment of the standoff or support member of the invention;

[0068] **FIG. 3** is a drawing of the **FIG. 2** member having a structural reinforcement, termed a longeron;

[0069] **FIG. 4** is a plan view of the **FIG. 1** member, in-place and adjacent a compounded version (“doublet”) thereof;

[0070] **FIG. 5** is an end elevation of the **FIG. 4** assembly;

[0071] **FIG. 6** is a plan view of the **FIG. 2** member, in-place and adjacent a doublet version of the **FIG. 3** member;

[0072] **FIG. 7** is a plan view of an optional arrangement of one or both elemental embodiments of **FIGS. 1-3**;

[0073] **FIG. 8** is an illustration of the confection technique for a small section of the invention sandwich assembly;

[0074] **FIG. 9** is a drawing of a model of the invention, diminutive only in its surface area;

[0075] **FIG. 10** is a sectionalized end elevation of the **FIG. 9** model;

[0076] **FIG. 11** is a sectionalized end elevation of the **FIG. 9** model, bearing an optional partial covering;

[0077] **FIG. 12** is an end view depicting the ability of the **FIG. 9** device to negotiate an around-the-corner emplacement;

[0078] **FIG. 13** shows an alternate construction of the preferred embodiment requiring no coupling membrane;

[0079] **FIGS. 14A and 14B** depict, respectively, the support elements preparatory to their engagement with a longeron of an adjacent member and a detail of the discrete element; while, **FIG. 14C** presents an end elevation of the **FIG. 13** construct;

[0080] **FIG. 15** shows the construct of **FIG. 8** employing stringer(s), in lieu of coupling membrane(s);

[0081] **FIG. 16** depicts a modification, a further compounding, of the **FIG. 4** “doublet”, and

[0082] **FIG. 17** an end elevation thereof;

[0083] **FIGS. 18 and 19** are correlative illustrations, respectively, of the **FIGS. 16 and 17** modification in the staggered arrangement of compounded members;

[0084] **FIG. 20** illustrates an arbitrary poly-formation of invention;

[0085] **FIGS. 21 and 22** depict end elevations of suggested support elements (geometric shapes) of the invention, with optional bracing features;

[0086] **FIG. 23** presents an end elevation of stacked members of the invention;

[0087] **FIGS. 24 and 25** show, respectively, a plan view and end elevation of the **FIG. 2** member in a compound construct;

[0088] **FIG. 26** depicts a top-perspective view of an embodiment of a coil matrix apparatus, in accordance with the present invention;

[0089] **FIG. 27** depicts a side-perspective view of an embodiment of a coil matrix apparatus, in accordance with the present invention;

[0090] **FIG. 28** depicts a bottom view of an embodiment of a coil matrix apparatus incorporating a grid, wherein the coil strands run horizontally, in accordance with the present invention;

[0091] **FIG. 29** depicts a top view of an embodiment of a coil matrix apparatus incorporating a grid, wherein the coil strands run horizontally, in accordance with the present invention;

[0092] **FIG. 30** depicts a bottom view of an embodiment of a coil matrix apparatus incorporating a grid, wherein the coil strands run vertically, in accordance with the present invention;

[0093] **FIG. 31** depicts a top-side perspective view of an embodiment of a coil matrix apparatus incorporating a grid, wherein the coil strands run horizontally, in accordance with the present invention;

[0094] **FIG. 32** depicts a bottom view of an embodiment of a coil matrix apparatus incorporating a grid, wherein the coil strands run diagonally, in accordance with the present invention; and,

[0095] **FIG. 33** depicts a bottom view of an embodiment of a coil matrix apparatus incorporating a grid, wherein the coil strands run horizontally, vertically and diagonally, in accordance with the present invention;

DETAILED DESCRIPTION OF THE INVENTION

[0096] Before commencing this description, the reader is referred to the DEFINITIONS, given above. The materials of construction are well known in the industry and no further mention will be made of them other than that the filter fabric is in common usage, in sheet ("membrane") and mat forms, and the support or stand-off members may be composed of any strong, non-biodegradable resin or polymeric, such as polyamide, polyester or polyvinyl chloride. In short, the physical characteristics of the materials comprising the standoff members should be heat-melt formable to facilitate manufacture by extrusion, casting or injection molding processes. The heat melt character also facilitates fusing of the various elements.

[0097] Referring now to **FIG. 1**, there is depicted, in the preferred embodiment, a support/standoff member **10** of the invention. It is, substantially, a duct-like or quasi-tubular item comprised of a series of hoop or ring elements **12** that are axially aligned on and integral with a longeron **14**. The member is generally produced by injection molding as a unitary item. The particular annular shape is chosen because

of its resistance to deformation likely to be caused by centripetal forces, such as overburden of soil or concrete.

[0098] The alternate support/standoff member is shown in **FIG. 2**, and is described simply as a coil **20**. As is readily apparent, a series of hoops/annuli **22** are, by the nature of a coil, axially aligned, but not discretely closed. Although being made of similar material, the coil lacks the inherent strength of the preferred embodiment support member **10** because there is no structure to confine any one annulus to its median plane **23**. To compensate for a hoop's tendency to contract or expand out of its median plane, the **FIG. 3** modification is made. Therein, a longeron **24'**, peculiar to the coil **20**, is added. Whereas the coil is readily made by extrusion techniques, the element of **FIG. 3** requires secondary processes that require its alternate embodiment nomenclature, in the instant invention. As was discussed in the above discussion of relevant art, a coil without an intermediate support, such as the filler medium of U.S. Pat. No. 3,965,686, will simply be unable to sustain the great overburdens anticipated in most subsurface emplacements. It is, however, desirable and used where feasible, because of its inherent flexibility—generally as a cross-linking (entwinement) element or when adequately constrained (see **FIGS. 7 and 24**).

[0099] **FIG. 4** introduces an optional use of the support member **10D**, also referred to as a "doublet". The doublet is a cohesion of two member units **10** generally, but not necessarily, along their respective longerons **14**. Here, in plan view, the doublet is postured proximate the member unit **10** and parallel to it. Although not shown here, this unit may be axially rotated 180° and the hoops of the unit interleaved with those of the doublet. This arrangement is known as "staggered array". It will be seen in the **FIG. 12** description, concerning around-the-corner emplacements.

[0100] **FIG. 5** presents an end elevation of the **FIG. 4** array. The members **10/10D** may be arrayed in either unit, doublet or mixed assemblage; likewise they may be in parallel, staggered or non-staggered registry, so long as a close proximity is maintained, i.e., there are no intervening or intermediate constraints, such as filler materials. **FIG. 6** shows a coil doublet **20D**, in plan view. It, along with its unit of **FIGS. 2 or 3** enjoys almost the same versatility and may be mixed with them, or with the preferred embodiment **10** in standoff arrays.

[0101] The aforesaid versatility is clearly seen in **FIG. 7**, where a highly supportive standoff array **30**, comprised of a mix of the preferred embodiment **10** (in parallel arrangement), is cross-linked with the alternate embodiment **20**. The coil usage, in this array, neither uses nor requires the strengthening longeron. Other arrangements may be made of either embodiment, with the coil modality free of, or bearing, the longeron **14 (24')**. In a production run, the actual arrangement of the hoop members **10/20**, as well as their mix and size, will be selected according to the function to be performed. For example, where a "pour through" of concrete is desired, spacing of elements to create voids in the array may be provided. A (small) model of such spacing **S** is depicted in the figure. Such a provision would, of course, necessitate removal and sealing of any covering, over and under the array at the selected void areas; such would be done in production or at the site of installation.

[0102] From a production standpoint, **FIG. 8** shows the assembly of one aspect of the invention **40** (see, **FIG. 9: 40**)

to be straight forward: (1) the desired covering membrane **42** is laid or run out to receive, along desired and discrete portions thereof, a suitable adhesive A for fixing support members **10** (**20**) to it; (2) the adhesive is disposed on the membrane, in the selected array pattern; (3) the support members are joined to the membrane on the adhesive; (4) additional adhesive AA is deposited on the tops of the fixed members; and, (5) another layer of membrane is folded E(**40**) over or otherwise placed onto the ensemble to complete the assembly. Such an assembly process is familiar to manufacturers.

[**0103**] Depiction is seen, in **FIG. 9**, of a model of the assembled invention **40**. In this partial cut-away drawing, the supports/stand-offs are a mix of the preferred embodiment, in unit **10** and doublet **10D** modes. The membranous covering **42** is a geo-textile filter fabric, now used throughout the industry; it envelops the array. In some installations, and depending on the sizing of the production models, it may be desirable to concatenate the arrays of the invention **40**. This being the case, a connector **50** is provided to mate a tubular member with its corresponding member in the concatenated array (not shown). The connector consists of a straight tube **52**, a plastic or resin, that is designed to fit snugly into the tubular members' hoops **12**(**22**). To assure that the tubes are not easily retracted during installation manipulation, a number of detents **54** are provided around the ends of the tube. Too deep an insertion, into the member, is precluded by the presence of a flange **56**, circumscribing the middle of the tube **52**. In most instances of use, an installer requiring concatenation to ensure continuity of fluid passage through the arrays, need only open ends of the invention, thereby creating "flaps". Concatenation, using only a few of the connectors, can then be finished by sealing the flap ends over the adjoining assemblies. Alternatively, connectors need not be used if the covered, abutting ends of an assembly **40** are taped over with a durable, non-biodegradable adhesive or sealing tape.

[**0104**] Remaining drawings, **FIGS. 10-12**, illustrate two options featured in the invention **40/40A**, with **FIGS. 10 and 11** directed to covering options, and **FIG. 12**, to a standoff arrangement. It will be noted that **FIG. 10** shows the invention **40**, enveloped in the filter covering **42** over the top and bottom of the quasi-tubular array, which is comprised of unit **10** and doublet **10D** members. For the sake of clarity, no adhesive or alternate stand-off(s) are shown, in any of these three drawings, but it should be reckoned that any of the aforementioned features of the invention are, or could be, used.

[**0105**] **FIG. 11** discloses another option in the invention **40A**. Here, a partial membranous covering of filter fabric **42** is complemented by a non-biodegradable, water impervious membrane **43**. This option finds utility, particularly, when the invention **40A** is to be placed onto a surface that is to be sealed against water infusion, e.g., outside basement walls. The amount of actual overlap O/L depends on a particular usage, manufacturers preferences and the membrane bonding techniques to be used.

[**0106**] **FIG. 12** shows an end elevation of the invention featuring yet another optional arrangement of standoff/support members **10** and **10**). The inventor's specifications call for a parallel arrangement of quasi-tubular supports in near or close proximity, that is, eschewing any filler medium

between adjacent supports and yet fully contemplating a physical communication between these members (ibid. **FIG. 7**). In **FIG. 12**, the referenced optional arrangement is termed a parallel, interleaved I/L disposition. The arrangement is simply an alternating, forward-back ("staggered") placement of the supports, of either type (two doublets shown) throughout the array, in pre-selected periodicity. This option facilitates an easier folding or bending of the invention around a corner, thus allowing sharper turns in its placement. Of course, adjustments in either adhesive application (fixture) or membrane looseness may be necessary for such a feature; but they are well within the competence of modern manufacturers.

[**0107**] It should be recognized that the fundamental aspects of this invention can be realized with, for example, quasi-tubular stand-offs of different nomenclature, such as rigid, perforated pipes/tubules/rods—but, flexibility may be lost to some degree; a trade-off for the ability to sustain heavier overburdens (see, e.g., **FIG. 20** and description).

[**0108**] The clear advantage of using the standoff elemental structures of the invention is seen in the fact that the gap between adjacent hoop planes (**FIG. 2: 23**), of either embodiment, can exceed the nominal thickness of the discrete hoops. Such advantage is not shared by the multitude of extant drain tubes. Also, reading this disclosure, one may rightly infer that the planar array (**FIG. 7**) may take on any planar geometry, flex to the degree allowed by stand-off size and arrangement, and be covered by both permeable/non-permeable membranes, on either one or both faces of the array. Used not merely to facilitate around-the-corner installation, as depicted in **FIG. 12**, the interleaved element arrangement, in either embodiment **10/20**, is used by the inventor to augment the support members' strength. This strengthening becomes necessary under very high overburden conditions and, as an option, provides a dual function to the interleaving practice.

[**0109**] Having discussed the fundamental aspects of the invention, it becomes incumbent upon this inventor to offer the reader some insight as to the versatility inherent in the use of the invention's tubule/duct members **10/20**, as well as their hybridizing potential with rods, perforate tubes and other drainage adjuncts. The latter portion of this disclosure is therefore directed to the combinational modalities that become apparent once the invention is understood.

[**0110**] Turning now to **FIGS. 13-14C**, the basic interlinked mode **60** of members **10** is acquired by encirclement of the longeron **14** (hoop) of one member **10** by the elements **12** of the adjacent member; the end elevation of this modality being shown in **FIGS. 14A** (open) and **14C** (closed). The hoop elements are made in the manner of a book ring binder, in that they are a relatively thick, but bendable polymer. As shown in **FIG. 14B**, the hoop elements **12** are afforded breaks to facilitate opening, for the potential encirclement of a longeron **14** of another member (**FIG. 14A**). Subsequently, the elements are closed and a snap-in detent **15** is inserted into depression **13**, thus securing the encirclement.

[**0111**] **FIG. 15** is an illustration depicting an array **40(M)** akin to that of **FIG. 8**, but lacking the coupling membrane—in favor of stringer **14'** coupling. The number, as well as dimensions, of stringers used will depend on manufacturers and users objectives. This embodiment will find high value in installations that require in situ preparation of the drain-

age system. This matrix can be cut and stacked, after many a fashion, and covered with stone and/or fabric. The various options shown in **FIGS. 16-20** are particularly suitable for such installations.

[0112] Referring specifically to **FIGS. 16 and 17**, there are seen, respectively, a modification **10(M)** of the **FIG. 4** “doublet” and an end elevation thereof. In orthogonal extension from off the common longeron **14**, the uniquely distinct, multiple element **12** nonetheless has the same characteristics as a singular geometric shape of the **FIG. 4** article. The multiple elements can be made by casting, molding or by stamping and cementing/fusing C/F the individual shapes or members. **FIGS. 18 and 19** differ from the previous two drawings only in that one of the elemental arrangements is staggered with respect to the other. In both variations of this modification, the elements can be readily extended by concatenating the geometric shapes outward in their same (common) plane. As will be seen in the following drawing, one is not restricted to a simple planar array, nor a single type element.

[0113] The flexibility in design and assembly of this invention can be better appreciated with reference to **FIG. 20**. Here an end elevation of a poly-formation (“polyform”) **10(P)** of the invention reveals a “U” formation of the elements **12**. Using the invention to its fullest potential, and in keeping with all disclosure made herein, one readily sees that the various elements and members can be had to form many varied formations such as “L”, “T”, “U”, “V”, “W”, “X” and “Y” patterns and combinations thereof, these patterns effect “oblique-planar” structures and can be formed using cementing or fusing C/F.

[0114] Aside from the fact that, in **FIG. 20** one planar array is no longer co-planar the other, but in an angular relationship (oblique plane) therewith, a very great distinction is presented in the geometric shapes themselves. The preferred embodiment, arrays of coils or tubules, the latter using elements created by employing geometric shaped articles, is by now quite familiar. Although a plan view is not shown, **FIG. 20** and its description suffice to explain, in conjunction with the invention structures now known, namely **FIGS. 8-12**, how the familiar three-dimensional matrix plane (ordinary planes or oblique intersecting) is acquired using other structures, with or without the heretofore disclosed elements/members. **FIG. 23**

[0115] The reader’s attention is called to the members R/D of **FIG. 20**. As an option, these may be solid discs (the D) used with the ring or hoop shapes **12**. Moreover, in a totally different modality, these R/D members are polymeric rods (the R), to be used in conjunction with the shown G/T elements, which consist of tubules **10** (the G) or perforated tubing (the T). The resultant array is essentially planar, somewhat less flexible, capable of sustaining much greater overburden than the designs of **FIGS. 1-19**. Turning now to **FIGS. 21 and 22**, there is shown, respectively, a circular or arcuate element **12** and a rectilinear. The novelty shown here is the structural reinforcements **13**, which may be indicated when the invention is designed to sustain heavy burdens such as rock/stone or concrete.

[0116] **FIG. 23** discloses employment of the devices of **FIGS. 21 and 22** using members of the invention **10**, but crafted with two longerons **14** and the interleaving technique. This stacking of elongated members contemplates a

larger scale installation in ditches, against subsoil walls and the like. The invention appears here in a more massive form and is usually assembled member-by-member, in situ; thus, the elements bear reinforcement structures **13**.

[0117] Final to this disclosure, **FIGS. 24 and 25** show in plan view and end elevation, respectively, an embodiment **70** alternate to the preferred, using the plain coil **20**. Two or more such coils are intertwined by a spiral threading of one through the other. The result is a flexible, adjustable planar matrix characteristic of the invention. As with all embodiments herein, this also may be cloaked with the earlier designated membranous covers.

[0118] With continued reference to the drawings, **FIG. 26** depicts a top-perspective view of an embodiment of a coil matrix apparatus **100**, in accordance with the present invention. The coil matrix apparatus **100** may be a composite body including a plurality of coil strands **120**, such as strands **120a** and **120b**. The composite body may include two oppositely spaced substantially planar surfaces comprising an array of intersecting coil strands **120**. The coil strands **120** may be adjacent each other, wherein the outer edges of the coil strands may intersect each other or adjoin each other. Moreover, the coil strands **120** may be interleaved with each other. For example a hoop **130a₁** of one coil strand **120a** may be alternately positioned between a hoop **130b₁** and a hoop **130b₂** of another coil strand **120b**. The coil strands **120a-b** may also intersect **140** with each other at various interleaved points along the hoops **130a-b** of the coil strands **120a-b**. For example, a hoop **130a₁** of one coil strand **120a** may intersect **140** with a different hoop **130b₁** of a different coil strand **120b**. Moreover, each hoop **130a** of a coil strand **120a** may intersect **140** with each corresponding alternating interleaved hoop **130b** of a different coil strand **120**. Still further, the hoops **130a** of a coil strand **120b** may intersect **140** with the hoops **130b** of coil strand **120b** while the hoops **130b** may concurrently intersect with different hoops **130c** of a different coil strand **120c**. This pattern of intersecting hoops **130** of interleaved coil strands **120** may be repeated amongst as many coil strands **120** as are present in a coil strand **120** array of the coil matrix apparatus **100** comprising a composite body including a plurality of interconnected coil strands **120**. Hence a coil matrix apparatus **100** may have an array of as many adjacent coil strands **120n** as necessary to form a coil matrix apparatus **100**.

[0119] The various coil strands **120** of the coil matrix apparatus **100** may be interconnected. For example, the hoops **130a** of coil strand **120a** may be joined or fastened together with the adjacent or interleaved hoops **130b** of coil strand **120b**. The joining or fastening may be accomplished without interlocking, intertwining, interlacing, hooking or dovetailing the hoops **130** of the plurality of coil strands **120**. Rather, fastening of the interconnections **140** of the coil strands may be accomplished by securing the plurality of coil strands **120** into adjacent or interleaved position with each other by means such as adhesives, welds, epoxies, glues, friction welds, melting, wrapping fastening elements around intersected **140** hoops **130**, utilizing bolts and nuts, nails, screws, rivets and other similar mechanical fastening elements, and/or other similar means for fastening the intersected hoops **130** into secure interconnected position one with another.

[0120] Referring further to the drawings, **FIG. 27** depicts a side-perspective view of an embodiment of a coil matrix

apparatus **100**, in accordance with the present invention. The various coil strands **120** of the coil matrix apparatus may be aligned such that they are substantially parallel with respect to the axis of the coil strands **120**. However, those in the art should recognize that the coil strands **120** need not be aligned in latitudinal or longitudinal linear parallel relationship. For example, the coil strands **120** may be bent or curved. In addition, while bent or curved the plurality of coil strands **120** may still be adjacent or interleaved and also interconnected one with each other. Moreover, the coil strands **120** do not need to be identical in size and dimension. For example, strand **120** thickness, diameter, length and hoop spacing and frequency may all vary in accordance with the present invention. Furthermore, the coil strands **120** may be comprised of different materials, such as plastics, metals, metal alloys, foams, glass, rubber, paper, composite materials, and other like materials, and/or combinations thereof. For instance, coil strand **120d** may be formed from an extruded plastic material, while coil strand **120e** may be formed of a rolled and shaped metal material. Still further, coil strand **120n** may be formed of a different material. The various coil strands **120**, though formed of different materials, may still be securely fastened and interconnected together, such as, by way of example, an epoxy weld formed at the intersection **140** of interleaved hoop **130d** of coil strand **120d** and hoop **130e** of coil strand **120e** may be formed of a rolled and shaped metal material. Still further, coil strand **120n** may

[0121] As depicted in **FIGS. 26-27** the various hoops **130** of the coil strands **120** of the coil matrix apparatus **100** are not interlocked, intertwined, interlaced, hooked or dove-tailed together. Instead the coil matrix apparatus **100** incorporates a plurality of coil strands **120** into a structure or body comprising a network of intersections of united elemental component strands **120**.

[0122] The coil matrix apparatus **100** may bend perpendicular with respect to the axis of the plurality of coil strands **120**. For example, the interconnected hoops **130** may flex in unison as interconnected together. Hence, the coil matrix apparatus **100** may be utilized in applications involving curved surfaces. Moreover, the coil strands **120** of the coil matrix apparatus **100** may be coated with protective coatings, conductive coatings, non-conductive coatings, adhesive coatings, or other coatings in accordance with the present invention. Furthermore, the coil strands **120** of the coil matrix apparatus **100** may be differently colored. Still further, the coil matrix apparatus **100** may be covered with and/or operate in conjunction with an outer film layer or be attached to an object. For example, the coil matrix apparatus **100** may have a layer of foil or other highly reflective material attached to an outer composite surface of the body including a plurality of coil strands **120**. In addition, the coil matrix apparatus may be attached to a flexible pad, a rigid board, or wrapped, partially or fully, in a textile or other prefabricated material such as a plastic sheet.

[0123] With continued reference to **FIGS. 26-27**, embodiments of the coil matrix apparatus **100** may be utilized in various spacing, packing or insulating applications. For example, a method of packing, insulating or protecting may include the provision of a coil matrix apparatus **100** as a packing material. Due to the inherent geometric shape of the plurality of coil strands **120** included in the coil matrix apparatus **100**, an air void or pocket may be produced

between two objects on opposite composite surfaces of the coil matrix apparatus **100**. Where the coil matrix apparatus **100** is comprised of foam material, additional air may be included in the void or pocket attributable to the geometry of the coil matrix apparatus **100**. The coil matrix apparatus **100** may protect object by creating a cushion space. Moreover, the coil matrix apparatus **100** may insulate materials by creating a thermal barrier, including the air void, hindering the transfer of heat across the coil matrix apparatus **100**. Additionally, the void may be filled with a fluid that may facilitate cooling or insulation. Hence, a coil matrix apparatus may, by way of example, be utilized as a method of cooling or insulating a cup having hot liquid, such as by forming a cup sleeve heat separator including the coil matrix apparatus.

[0124] In addition, various methods of accomplishing things involving ventilation/drainage of liquids and/or gases may include the provision of a coil matrix apparatus **100**. For instance, the coil matrix apparatus **100** may be provided as a core material in seating or flooring that is exposed to liquid. Hence, the coil matrix apparatus **100** may be utilized in the flooring of a boat deck, or a marina docking floor to allow for drainage of water should the boat decking or docking floor be exposed to water through waves or heavy rain or other means. Still further, the coil matrix apparatus **100** may be provided in methodology pertinent to medical uses. For example, the coil matrix apparatus **100** may be incorporated into bedding/seating or partitioning systems that involve airflow. Even further still, the coil matrix apparatus **100** may be provided in methodology involving the formation of subsurface cavities thereby allowing drainage on multi-storied buildings. Moreover, the coil matrix apparatus **100** may be included in roofing ventilation methodology, wherein the coil matrix apparatus may facilitate the venting and/or passage of gases into and or out of a roof structure.

[0125] Another application involving the coil matrix apparatus **100** may involve methods of strengthening concrete, plaster, mortar, adobe or stucco structures. For example, a coil matrix apparatus **100** may be provided as a mesh (concrete, or other hardening material, reinforcement) or a support spacer for reinforcement steel bars and meshes (if not being the mesh type reinforcement itself) when the coil matrix apparatus **100** is made out of metal or metal type material, such as alloys or composites like carbon fiber products. The coil matrix apparatus **100** may then be inserted into a form into which a hardening material, such as concrete, may be poured so that the material might harden into a particular shape. With the open geometric spacing or the coils concrete, or other hardening material, may flow into and/or intersperse around and between the coil strands **120**, depending on the size (spacing) of material and may also work well in keeping the reinforcement off the bottom (spaced) during the pouring or placement of the concrete, or other hardening material. In addition, a coil matrix apparatus **100** may be used in various applications as a core material for reinforcement of polymeric resin molding applications.

[0126] With continued reference to the drawings, **FIG. 28-29** depict a bottom view and top view respectively of an embodiment of a coil matrix apparatus **200** incorporating a grid **210**, wherein the coil strands **220** may, but need not be, adjacent one another and may run horizontally with the grid **210**, in accordance with the present invention. The grid **210**,

may be a structure comprising a pattern of regularly spaced crisscrossed elements, such as, for example, a mesh of parallel vertical and horizontal members. The smallest repeating structural unit comprised by the crisscrossed members of the grid 210 may be a node 215. The node 215, may appear in form like a picture frame or quadrilaterally-shaped member. However, those in the art should recognize that other grid embodiments may include crisscrossed structures having members crossed to form other polygonal shaped nodes such as triangles, pentagons, and hexagons.

[0127] The coil matrix apparatus 200 may include at least one coil strand 220. Each hoop 230 of a coil strand 220 may be sized to interconnect 240 with a portion of a node 215 of grid 210. The interconnections may involve the interlocking, intertwining, interlacing, hooking, or dovetailing of a hoop 230 with a portion of the node 215 of grid 210. Moreover, the at least one coil strand 220 may be interleaved with the grid 210. Furthermore, a hoop 230 may be configured to be press fit through a the opening of a node 215, wherein a portion of the hoop 230 remains on one side of the grid 210 while the rest of the hoop 230 resides or is located on the other side of the grid 210. When the coil matrix apparatus 200 is formed via press fitting hoops 230 of coil strands 220 through the nodes 215 of a grid 210, then it may be possible for the coiled elements to be interconnected with the grid without the employment of adhesives, welds, epoxies, glues, friction welds, melting, wrapping fastening elements around intersected 240 hoops 230 and grid 210, utilizing bolts and nuts, nails, screws, rivets and other similar mechanical fastening elements, and/or other similar means for fastening the intersected hoops 230 into secure interconnected position with the grid 210. However those in the art should appreciate that the interconnections 240 between the hoops 230 of coil strands 220 with the grid 210 of the coil matrix apparatus 200 need not only involve interlocking component members and may instead, or in addition to, utilize fastening of members and fastening means as described above to securely interconnect the hoops 230 of coil strands 220 into operable position with the grid 210. For example, the hoops 230, may be sized to project part way through a node 215, such that a support may be passed through the hoops 230 to maintain a secure position with respect to the grid 210.

[0128] The grid 210 may be comprised of various materials such as plastics, metals, paper products, wood, glass, rubber, twine, rope, string, wire, cable, composite materials and/or foam products and or combinations thereof. Moreover, the grid 210 may be rigid, semi-rigid, or flexible. Furthermore, the elements of the grid 210 may be woven, interlaced, coupled, or joined together or may be molded from a single integral element. The various nodes 215 of the grid 215 of the coil matrix apparatus 200 may be aligned such that they are substantially parallel with respect to each other. Hence, the coil strands 220 may be located adjacent to one another and may be configured to run horizontally in parallel with each other corresponding to the nodes 215. However, those in the art should recognize that the coil strands 220 need not be aligned horizontally. For example, as shown in FIG. 30, the coil strands 220 may run vertically in parallel with respect to corresponding nodes 215. Nevertheless, those in the art should also recognize that the coil strands 220 may, but need not be, adjacent one another and need not run in vertical or horizontal linear parallel relationship. For instance, as depicted in FIG. 32, the coil strands 220 may run diagonally corresponding to the nodes

215 and with respect to the grid 210. Still further, the coil strands may also run in zigzag or curvilinear alignment with respect to corresponding nodes 215. Moreover, the coil strands 220 and corresponding nodes 215 do not need to be identical in size and dimension. For example, coil strand 220 thickness, diameter, length and hoop spacing and frequency may all vary in accordance with nodal spacing of the grid 215 in accordance with the present invention.

[0129] The coil strands 220 may be comprised of different materials, such as plastics, metals, metal alloys, foams, glass, rubber, paper, composite materials, and other like materials, and/or combinations thereof. For instance, coil strand 220a may be formed from an extruded plastic material, while coil strand 220b may be formed of a rolled and shaped metal material. Furthermore, coil strand 220n may be formed of a different material. Still further, the coil strands 220 may comprise standoffs, stringers and/or longerons. Hence, in embodiments of a coil matrix apparatus 200 the coil strands 220 may be connected and work in conjunction with each other while at the same time remaining operable for interconnection with the grid 210.

[0130] Referring further to the drawings, FIG. 31 depicts a top-side perspective view of an embodiment of a coil matrix apparatus 200 incorporating a grid 210, wherein the coil strands run horizontally, in accordance with the present invention. As depicted, the coil strands 220 extend above a substantially planar surface corresponding to grid 210. The grid 210 may facilitate the attachment of a film layer or other object. For example, the coil matrix apparatus 200 may have a layer of foil or other highly reflective material attached to the grid 210 surface. In addition, the coil matrix apparatus 200 may be attached to a flexible pad, a rigid board, or wrapped, partially or fully, in a textile or other prefabricated material such as a plastic sheet. Moreover, a film layer or other object may also be attached to the surface of the coil matrix apparatus defined by the plurality of hoops 230 of coil strands 220 extending above the grid 210. Furthermore, the grid 210 or plurality of hoops 230 may have attached to it a pre-impregnated composite material, such as carbon fiber or Kevlar pre-preg. The inclusion of a grid 210 may facilitate greater strength and firmer structure of an embodiment of a coil matrix apparatus 200 because the coil strands 220 may operate with the grid 210 to maintain a composite relationship of interconnected component elements. Additionally, the coil matrix apparatus 200, may facilitate greater strength for structures utilizing the matrix 200 as a volumetric spacer between attached high strength materials. For example, embodiments of a coil matrix apparatus 100, 200, or 300 (as discussed further below), may be used as a spacer between composite materials much like a typical honeycomb matrix material.

[0131] With still further reference to the drawings, FIG. 33 depicts a bottom view of an embodiment of a coil matrix apparatus 300 incorporating a grid 310, wherein the coil strands 320-322 run vertically, horizontally and diagonally, respectively, in accordance with the present invention. This embodiment of a coil matrix apparatus 300 may have multiple hoops 330-332 respectively corresponding to the coil strands 320-322. As depicted, a node 315 may include more than one hoop 330-332. For example, a node 315a may include a hoop 330 of a coil strand 320 running vertically with respect to the grid 310 and also include a hoop 332 of a coil strand 322 running diagonally with respect to the grid

310. Moreover, a node **315b** may include a hoop **331** of a coil strand **321** running horizontally with respect to the grid **310** and also include a hoop **332** of a coil strand **322** running diagonally with respect to the grid **310**. Still further, a node **315c** may include a hoop **331** of a coil strand **321** running horizontally with respect to the grid **310** and also include a hoop **330** of a coil strand **320** running vertically with respect to the grid **310**. All the coil strands **320-322** may be included in the coil matrix apparatus **300** concurrently. The placement and alignment of multiple coil strands **320-322** running in multiple directions with respect to the grid **310** provides an ability to tailor the coil matrix apparatus to specific uses. For example, when used in flooring, it may be advantageous to employ multiple coil strands **320-322** running in multiple directions to increase the compression strength of the coil matrix apparatus **300**. Furthermore, the coil strands **320-322** may comprise standoffs, stringers and/or longerons. Hence, in embodiments of a coil matrix apparatus **300** the coil strands **320-322** may be connected and work in conjunction with each other while at the same time remaining operable for interconnection with the grid **310** while running in multiple directions.

[0132] With continued reference to **FIGS. 26-33**, embodiments of the coil matrix apparatus **200** or **300** may be provided in methods of accomplishing things involving ventilation/drainage of liquids and/or gases. For instance, the coil matrix apparatus **200** or **300** may be provided as a core material in seating or flooring that is exposed to liquid. In particular the grid **210** or **310** may be instrumental in defining the flooring or seating surface. Still further, embodiments of the coil matrix apparatus **200** or **300** may be provided in methodology pertinent to medical uses. For example, the coil matrix apparatus **200** or **300** may be incorporated into bedding/seating or partitioning systems that involve airflow to help cool or warm a space or apparatus or to help remove toxic gases or bring in oxygen or other beneficial gases. Even further still, embodiments of the coil matrix apparatus **200** or **300** may be provided in methodology involving the formation of subsurface cavities thereby allowing drainage on multi-storied buildings. Additionally, embodiments of a coil matrix apparatus **100**, **200** or **300** may be used to facilitate sound control structures and assist sound control applications. For example, embodiments of a coil matrix apparatus **200** or **300** may facilitate sound control when using concrete underlayments such as Gyp-Crete. Moreover, embodiments of the coil matrix apparatus **200** or **300** may be included in roofing ventilation methodology, wherein the coil matrix apparatus may facilitate the venting and/or passage of gases into and or out of a roof structure. In particular, the grid **210** or **310** may work well in conjunction with tar paper, shingling, or other roofing materials and may provide good contact for attachment with a bare roof.

[0133] Referring further to **FIGS. 28-33**, embodiments of the coil matrix apparatus **200** or **300** may be utilized in various spacing, packing or insulating applications. Spacing may be accomplished by providing a coil matrix apparatus **100**, **200** or **300** to separate or keep apart two objects. For example, a coil matrix apparatus **100**, **200** or **300** may be positioned between an outer wallboard and internal wall supports to space the wallboard apart from the wall supports. Hence the spacing would be widthwise, wherein the wallboards in spaced apart from internal wall supports via the width of the coil matrix apparatus **100**, **200** or **300**. By way

of example, a coil matrix apparatus **200** or **300** may space reinforcing supports, wherein the supports may be encompassed by coil strands **220** or **320** on either side of the width of the coil matrix apparatus **200** or **300**. Furthermore, methods of packing, insulating or protecting may include the provision of an embodiment of a coil matrix apparatus **100**, **200** or **300** as a packing material. Due to the inherent geometric shape of the plurality of coil strands **220** or **320** included in the coil matrix apparatus **100**, **200** or **300**, an air void or pocket may be produced between two objects on opposite composite surfaces of the coil matrix apparatus **100**, **200** or **300**. Where the coil strands **100**, **220** or **320** and/or grids **210** or **310** of a coil matrix apparatus **200** or **300** are comprised of foam material, additional air may be included in the void or pocket attributable to the geometry of the coil matrix apparatus **200** or **300**. Embodiments of the coil matrix apparatus **100**, **200** or **300** may protect an object by creating a cushion space wherein the matrix **100**, **200** or **300** may be resiliently compressed. Moreover, a coil matrix apparatus **200** or **300** may insulate materials by creating a thermal barrier, including the air void, hindering the transfer of heat across the coil matrix apparatus **200** or **300**. Additionally, a void may be filled with a fluid that may facilitate cooling or insulation. Hence, embodiments of a coil matrix apparatus may, by way of example, be utilized as a method of insulating or cooling a cup having hot liquid, such as by forming a cup sleeve heat separator including the coil matrix apparatus.

[0134] Additional spacing methodology comprising the provision of a coil matrix apparatus **200** or **300** may involve lengthwise spacing, wherein objects are positioned along the length of a coil matrix apparatus **200** or **300**. Such embodiments may include coils strands **220** or **320** interleaved with the grid **200** or **300**, wherein the grid may be configured as a fence or a portion of a shelf. Accordingly embodiments of the coil matrix apparatus **200** or **300** may be used as a lateral spacer for supports interacting with the grid **210** or **310**, as in a fence grid, shelving grid, concrete grid for harnessing encompassing posts, re-bar etc. (mesh), wherein the coil strands **220** or **320** may be configured to encompass/harness supports, or a portion of supports, the supports positioned at spaced intervals along the length of such grids **210** or **310** making for ease of installation. For example, supports, such as fence posts, may be extended axially, or otherwise be positioned through coil strands **220** or **320** such that the coil strands encompass all or a portion of the supports, such as fence posts. The coil strands **220** or **320** may be interconnected with a grid **210** or **310**, wherein the grid is configured as a fence is and supported by the corresponding fence posts as interacting with the coil strands **220** or **320**. By way of further example, nails may be driven through portions of coil strands **220** or **320** as interconnected with a grid **210** or **310** thereby holding the grid **210** or **310** configured as a portion of a shelf in a secure position to support additional objects. Thus, the coil matrix apparatus **200** or **300** may facilitate spacing methodology in conjunction with shelving. Spacing of objects in relation to the provision of a coil matrix apparatus **100**, **200** or **300** may include a regular spacing pattern, such as the placing of supports, such as fence posts, every three feet along the length of the coil matrix apparatus **100**, **200** or **300**.

[0135] Another application involving provision of embodiments of a coil matrix apparatus **200** or **300** may involve methods of strengthening or reinforcing hardening

materials such as plastics, epoxies, concrete, plaster, mortar, adobe or stucco structures or polymeric structures. For example, a coil matrix apparatus, **200** or **300** may be provided as a mesh reinforcement for concrete, or other similar hardening materials, or may be a support spacer for reinforcement steel bars and meshes (if not being the mesh type reinforcement itself) when the coil matrix apparatus **200** or **300** is made out of metal or metal type material, such as alloys or composites like carbon fiber products. Moreover, the coil matrix apparatus **200** or **300** may be positioned in a form or mold into which a hardening material, such as concrete or resin, may be poured so that the material might harden into a particular shape. The positioning of the coil matrix apparatus **100**, **200** or **300** in a form or mold may occur concurrently with the provision of the coil matrix apparatus **100**, **200** or **300**, as in applications involving insulated foam forms, or may occur after the coil matrix apparatus **100**, **200** or **300** has been provided such as by subsequently inserting the coil matrix apparatus **100**, **200** or **300** into a mold prior to the insertion of the hardening material. With the open geometric spacing or the coils, concrete, or other hardening material, may flow and/or intersperse into around and between the coil strands **220** or **320**, depending on the size (spacing) of material and may also work well in keeping the reinforcement off the bottom (spaced) during the pouring or placement of the concrete, or other hardening material. Moreover, the grid **210** or **310** may also facilitate reinforcement of concrete or other hardening material and may serve to evenly distribute the material when provided on a structure. Still further, embodiments of the coil matrix apparatus **100**, **200** or **300** may be provided as a lattice or framework for an electrical wiring separator (harness) when there are multiple wires that need to be separated on a run, such as commercial buildings, entertainment systems, security cameras, or other multiple wire systems.

[0136] While this invention has been described in conjunction with the specific embodiments outlined above, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the embodiments of the 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 as defined in the following claims.

What is claimed is:

1. A coil matrix apparatus comprising:
 - a composite body including plurality of interconnected coil strands, said interconnected coil strands having adjacent hoops,
 - wherein the adjacent hoops of the interconnected coil strands are not interlocked.
2. The coil matrix apparatus of claim 1, wherein the plurality of interconnected coil strands are substantially parallel with respect to each other.
3. The coil matrix apparatus of claim 1, wherein the composite body includes two oppositely spaced substantially planar surfaces.
4. The coil matrix apparatus of claim 1, wherein the interconnected coil strands are securely fastened together via an adhesive.

5. The coil matrix apparatus of claim 1, wherein the interconnected coil strands are securely fastened together via mechanical fasteners.

6. The coil matrix apparatus of claim 1, wherein the coil strands are coated.

7. The coil matrix apparatus of claim 1, further comprising an outer film layer.

8. A coil matrix apparatus comprising:

- a grid, said grid including a pattern or regularly spaced nodes; and,

- at least one coil strand, said coil strand having hoops sized to interconnect with a portion of corresponding nodes of the grid,

- wherein the at least one coil strand is interleaved with the grid.

9. The coil matrix apparatus of claim 8, wherein the nodes of the grid are quadrilaterally shaped.

10. The coil matrix apparatus of claim 9, wherein at least one coil strand runs horizontally in relation to the grid.

11. The coil matrix apparatus of claim 9, wherein at least one coil strand runs vertically in relation to the grid.

12. The coil matrix apparatus of claim 9, wherein at least one coil strand runs diagonally in relation to the grid.

13. The coil matrix apparatus of claim 8, wherein at least one coil strand is press fit into interlocking position with the grid.

14. The coil matrix apparatus of claim 8, further comprising a film layer attached to the grid.

15. The coil matrix apparatus of claim 8, wherein the at least one coil strand encompasses a support.

16. The coil matrix apparatus of claim 15, wherein said support is a reinforcement bar

17. The coil matrix apparatus of claim 15, wherein said support is a post.

18. The coil matrix apparatus of claim 8, wherein said grid is configured as a fence.

19. The coil matrix apparatus of claim 8, wherein said grid is configured as a portion of a shelf.

20. The coil matrix apparatus of claim 8, wherein said at least one coil interleaved with the grid are spaced apart.

21. The coil matrix apparatus of claim 20, wherein the spacing apart comprises a regular pattern.

22. A method of spacing comprising:

- providing a coil matrix apparatus including at least one coil strand incorporated with a grid; and,

- securely positioning the coil matrix apparatus between two objects to separate the objects.

23. The method of spacing of claim 22, wherein the coil strands are interconnected.

24. The method of spacing of claim 22, wherein the coils strands are interlocked with the grid.

25. The method of spacing of claim 22, wherein the at least one coil strand encompasses a support.

26. The method of spacing of claim 22, wherein the spacing is widthwise, said separated objects positioned on opposite sides of the width of the coil matrix apparatus.

27. The method of spacing of claim 22, wherein the spacing is lengthwise, said separated objects positioned along the length of the coil matrix apparatus.

28. A method of spacing comprising:

providing a coil matrix apparatus including an array of interconnected coil strands; and,

securely positioning the coil matrix apparatus between two objects to separate the objects.

29. The method of spacing of claim 18, wherein the interconnected coil strands are interleaved with each other.

30. A method of reinforcing a hardening mixture, said method comprising:

providing a coil matrix apparatus, said coil matrix apparatus including void space located between and within a plurality of coil strands;

positioning the coil matrix apparatus in a form; and

filling the form with a hardening mixture, wherein the hardening mixture intersperses into the void space of the coil matrix apparatus.

31. The method of reinforcing a hardening mixture of claim 19, wherein the coil strands are interconnected with a grid.

* * * * *