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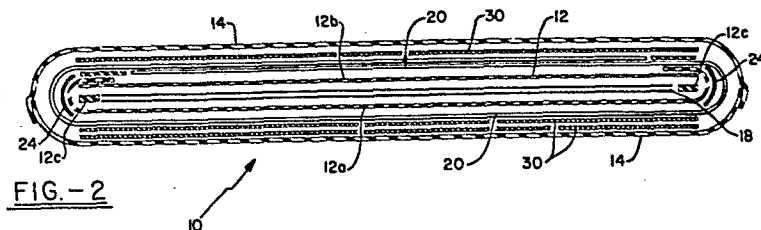
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(54) Pneumatic lift pad.

(57) A pneumatic pad (10) comprises reinforcement fabrics (20,30) of parallel cords pre-formed to a specific radius through the edges of the pad and press-vulcanized to a very flat pre-pressurized configuration. At least two orthogonally oriented reinforcement fabrics (20,30) are embedded in elastomer and have lapped ends positioned in opposite covers of the pad such that each cover comprises at least three cord reinforcement plies two of which are oriented orthogonally with respect to the other.



## PNEUMATIC LIFT PAD

## Background of the Invention

This invention generally relates to fluid pressure devices and more particularly to a flexible, elastomeric, cord-fabric reinforced, inflatable container that functions as an extremely powerful and efficient pneumatic lift pad or jack. The invention discloses a press molded pad structure which results in a very low profiled pre-inflation device that may be positioned in confined spaces and inflated to perform a powerful lifting function.

Pneumatic lift pads of the type alluded to are known and used in the art, there being various types and configurations available which attempt to meet the needs and requirements demanded of this type device. Exemplary of these are lift pads described and illustrated in U. S. Patents to Tezuka (#3,982,731); Orndorff, Jr. (#4,036,472); and Vetter (#4,067,544 and #4,143,854).

This invention provides an improvement in the state of the pneumatic lift pad art by the provision of a press-molded device that: exhibits a very low profile when in its non-inflated condition, provides a high burst strength and increased structural integrity for a greater safety factor when applied to vigorous lifting applications, is extremely abrasion, puncture, and cut resistant, and has a patterned exterior surface for aggressive non-slip stability. Further, the pneumatic pad of the present invention is characterized by a molded-in positioning locator in the cover ply that is of a contrasting color for ease in positioning of the pad in confined spaces.

## Brief Description of the Drawings

Various aspects and advantages of the invention will be better understood from a consideration of the following detailed description and accompanying drawings

in the several figures in which like parts bear like reference numerals and in which:

5 Figure 1 is a plan view of the topside or the bottom side, both sides being identical, of the pneumatic lift pad comprising the invention;

Figure 2 is an elevational view, in section as may be taken on line 2-2 of Figure 1, with the various plies separated for ease in illustrating the pre-cured ply orientation of the laminated pad structure;

10 Figure 3 is an elevational view similar to Figure 2, in section and as may be taken on line 3-3 of Figure 1, illustrating the pre-cured ply orientation of the structure;

15 Figure 4 is a partial elevational view, in section, of the structural components shown in Fig. 2 upon being press vulcanized and partially inflated;

Figure 5 diagrammatically illustrates the arrangement of the reinforcement cord fabric plies;

20 Figure 6 is a perspective view, partially broken away and partially in section, illustrating the valve mounting within the structure of the pad; and

Figure 7 is a diagrammatic plan view of the corner valve mounting illustrated in Fig. 6 showing the reinforcement cord orientation relative to the valve.

## 25 Detailed Description of the Invention

Referring to the drawings, a pneumatic pad in accordance with this invention is generally indicated by reference numeral 10, which pad 10 is a multi-ply integrally laminated construction in a substantially square or rectangular configuration. While it will be  
30 recognized that other geometric shapes may be applied to the pad 10 and these are considered within the scope of the invention a square or rectangular shape is more

conducive to the manufacturing process and therefore this description will be specifically directed to pneumatic pads of a square or rectangular configuration.

5 With particular reference to Figs. 2, 3, 4 and 5, the structural components comprising the pad are clearly illustrated. Basically the pad structure comprises an inner fluid (liquid or air) impervious liner or envelope 12, first and second cord fabric plys 20 and 30, an outer envelope 14, and a valve 16 (shown in Figs. 1  
10 and 6) for pressurizing the pad 10. The elements of liner 12, cord fabric plys 20 and 30 and outer envelope 14 are all common to two integrally laminated covers 11 and 13 as illustrated in Fig. 4.

The inner liner 12 is comprised of elastomeric ply  
15 sheets 12a and 12b, the sheet 12b being of a smaller dimension than the sheet 12a and thus providing a lap joint when the peripheral edges of the sheet 12a are folded over the sheet 12b. Because the pneumatic pad of this invention is a press-molded product, two sheets of  
20 a release paper 18 are inserted between the liner sheets 12a and 12b to maintain separation of the two upon vulcanization. Thus, upon being vulcanized, an enclosed envelope 12 is formed by the sheets 12a and 12b. Strips of gum elastomer 12c may also be provided and laid in  
25 along the periphery of the release paper 18 to maintain a uniform thickness of the liner 12 when a valve 16 is positioned in one of the corners as illustrated in Figs. 1 and 6.

The cord fabric plys 20 and 30 are made similarly  
30 to a tire cord fabric and these may be of monofilaments or multifilament yarns of wire, synthetic or natural textiles, or glass embedded in a suitable elastomer to maintain a parallel orientation between adjacent cords. Steel wire, nylon, polyester, or aramid are the preferred  
35 cord materials because of the rigorous type application

for these pads. The cord fabrics 20 and 30 are made in flat sheets to a specific length and width for a particular pad size and these sheets are folded in a press brake such as to impart a specific radius  $R$  to the cords

5 prior to fabrication of the pad structure. For example the fabric may be folded such that a bend radius  $R$  of 4-20 mm is effected to the cords and the ends are overlapped to at least 75% of the length of fabric between the folds. A release liner is inserted to prevent sticking together of the overlapping fabric so that it may be

10 stored for later use. The bend radius  $R$  will thus eliminate kinking of the cords throughout assembly, and cure operations. As illustrated, the cord fabric 20 comprises individual cords 22 folded such that it

15 surrounds the innerliner 12, the ends of the cords 22 starting and ending a short distance in from the edge of the innerliner. In this configuration, the cord fabric 20 is single ply in one cover of the pad but it is double ply in the opposite cover. Similarly, the cord

20 fabric 30 is folded such that individual cords 32 exhibit a radius  $R$  in the area of the fold and this fabric is applied about the cord fabric 20 such that the cords 32 are orthogonal to the cords 22. The cord fabric 30 however is applied oppositely to the cord fabric 20, that

25 is, it is applied such that the lapped ends are positioned in the opposite cover than the lapped ends of the cord fabric 20. In this manner the cord fabric 30 provides a single ply in one cover where the cord fabric 20 is double ply and provides a double ply in the opposite

30 cover where the cord fabric 20 is single ply. The orientation of the cord fabrics 20 and 30 combine to provide at least three plies of cord fabric in each of the covers 11 and 13 of the pneumatic pad 10. More simply stated there are two substantially complete plies

35 of cord fabric 20 and one ply of cord fabric 30 in one cover of the pad while there are two substantially complete plies of cord fabric 30 and one ply of cord fabric

20 in the opposite cover of the pad and the cords 22 are oriented orthogonally to the cords 32.

5 While at least three cord fabric plys are in evidence in what would comprise the top cover 11 and bottom cover 13 of the pad 10, only a single ply of cord fabric would be provided in the edge walls of the pad. In this circumstance, cord fabric inserts 24 are positioned lengthwise along the lateral edges between the innerliner envelope 12 and the cord fabric plys 20 and 30. Thus, 10 and because the cords 22 and 32 are oriented vertically in the edge areas of the pad, the cord fabric inserts 24 provide orthogonal and lateral reinforcement cords in the edges of the pad.

15 The outer envelope 14 comprises a cover ply sheet 14a and a cover ply sheet 14b which are lap joined about their peripheral edges. The outer envelope 14 is comprised of an elastomer such as neoprene that provides excellent weather and abrasion resistance and in addition is resistant to a wide range of chemicals. The 20 envelope is further characterized by a texture illustrated in Fig. 1 that provides a very high friction surface. While there are many texture configurations that may be applied, applicants have found that a small basketweave pattern 26 provides an excellent slip resistant friction surface to the pneumatic pad. This is 25 of course important for the maintenance of the pad in its intended orientation in heavy lifting applications. Because the lift pad of this invention is a press-molded product, the texture may be imparted to the pad exterior covers by means of a suitable textured mold 30 liner. Further, and to provide an aid in positioning of the pad, there is provided a high visibility locator embedded in each cover of the pad. Fig. 1 illustrates the use of an X-pattern locator 28 but others such as 35 concentric circles or a bullseye pattern may also be applied. The locator pattern is preferably comprised

of an elastomer in a high contrast color such as for example yellow or the like that is integrally vulcanized into the cover elastomer of the pad. It will be appreciated from the foregoing that the locator 28 is  
5 advantageous in placing of the pad in confined spaces.

Figures 6 and 7 illustrates the valve mounting within the pad structure and as shown the valve assembly 16 is a solid metal fitting of brass or the like having a tapered butt end 16a that is embedded in the corner elastomer of the pad structure. The valve comprises a  
10 substantially triangular shaped butt end 16a having a nipple end 16b that protrudes from the corner of the pad. Integral with the nipple is a hex 16c having internal threads that facilitate connection to a supply of high  
15 pressure air for inflation of the pad. The valve unit 16 is firmly seated with the base end 16a tapering to its larger extent toward the center of the pad and in this configuration may not be easily pulled out of the pad elastomer by reason of the crossed cords 22,32 as  
20 illustrated diagrammatically in Fig. 7. In order to further embed the valve 16 in elastomer, wedge strips 40 may be positioned along either side of the butt end 16a. As indicated by the ghost line showing of the corner portion of the innerliner sheet 12b the valve 16  
25 is positioned between the innerliner sheets 12a and 12b prior to vulcanization.

In addition to the structural components named above, applicants envision that in some applications additional cord fabric plys may be desired. In this circumstance,  
30 additional flat sheets may be applied to the covers 11 and 13 prior to application of the cover plys 14a and 14b. Further, and to provide increased strengthening of the innerliner 12, square woven fabric inserts 34 may be inserted laterally to cover the edge areas as illustrated  
35 by the dash-dotted line showing in Fig. 4. The purpose of the square woven cloth is to contain the liner

elastomer 12 upon being inflated under high pressures and to limit splitting of the innerliner elastomer and possible loss of pad integrity by migration of the inflation fluid into the laminated structure.

5           Thus, it will be appreciated by those knowledgeable  
in the lift pad art that applicants have provided an  
improved pad capable of handling various heavy lifting  
applications and while certain representative embodi-  
ments and details have been shown for the purpose of  
10 illustrating the invention, it will be apparent to those  
skilled in the art that various changes and modifica-  
tions may be made therein without departing from the  
spirit or scope of the invention.



## What Is Claimed Is:

1. A pneumatic lift pad characterized by two substantially rectangularly shaped cord reinforced, elastomeric, covers enclosing an expansion chamber and having valve means  
5 mounted in at least one of the corners thereof for connection to a source of high pressure fluid; a first reinforcement fabric comprised of a plurality of parallel cords, said cords being continuous from one cover through two opposite peripheral edges with the ends terminating in the opposite cover  
10 and overlapping for the substantial length of the cover from one edge to the other; a second reinforcement fabric comprised of a plurality of parallel cords, said cords being continuous from one cover through the remaining two opposite peripheral edges with the ends terminating in the opposite cover and  
15 overlapping for the substantial length of the cover from one edge to the other, the cords of the second reinforcement fabric being orthogonally oriented with respect to the cords of the first reinforcement fabric and the lapped ends of each of the reinforcement fabrics being embedded in elastomer of  
20 the opposite cover such that each cover is comprised of at least three reinforcement cord plies and the cords of two of the plies being oriented orthogonally with respect to the other of the plies.

2. The pneumatic pad as set forth in Claim 1 further characterized by at least one additional ply of reinforcement fabric embedded in the peripheral edges of the pad, said fabric comprised of a plurality of cords oriented  
5 laterally along the edge so as to be orthogonal to the cords of the first and second fabric reinforcements passing through the edges from cover to cover.

3. The pneumatic pad as set forth in Claim 1 characterized by a ratio of the lapped reinforcement fabric to the total length between the opposite cover edges that is greater than 0.75.

4. The pneumatic pad as set forth in Claim 1 wherein the cords of the reinforcement fabric are characterized by steel.

5. The pneumatic pad as set forth in Claim 1 wherein the cords of the reinforcement fabric are characterized by synthetic yarns.

6. The pneumatic pad as set forth in Claim 1 wherein the cords of the reinforcement fabric are characterized by synthetic monofilaments.

7. The pneumatic pad as set forth in either of Claim 5 or Claim 6 wherein the cords are characterized by nylon.

8. The pneumatic pad as set forth in either Claim 5 or Claim 6 wherein the cords are characterized by polyester.

9. The pneumatic pad as set forth in either Claim 5 or Claim 6 wherein the cords are characterized by aramid.

10. The pneumatic pad as set forth in Claim 1 wherein the valve is characterized by a nipple portion protruding from a corner of the pad, exteriorly of the pad and having a hex nut connector mounted thereon for connection to a source of fluid pressure, said nipple terminating in a substantially triangular shaped base embedded in elastomer, the taper of the base being substantially parallel to the edges of the pad such that the cords of the fabric reinforcement form crossed cords entrapping the triangular shaped base within the pad structure.

11. The pneumatic pad as set forth in Claim 1 wherein the reinforcement fabrics are characterized by being folded prior to curing of the elastomer so as to impart a definite radius to the fabric cords in the area of the pad edge.

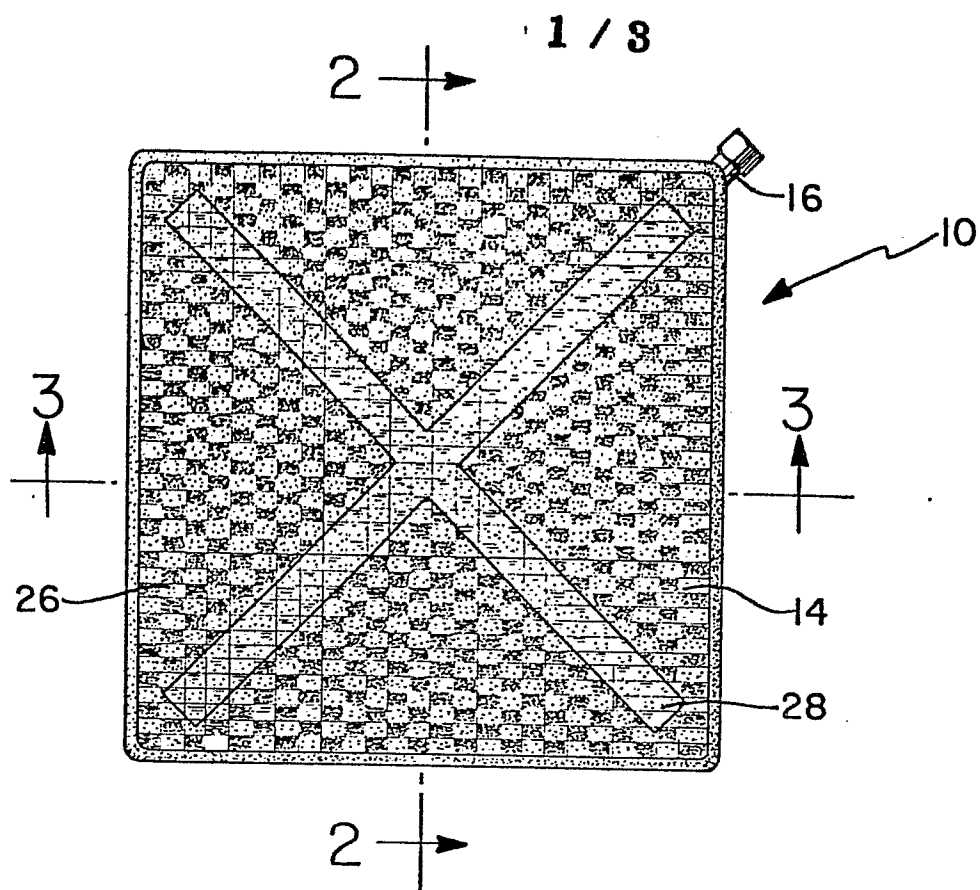
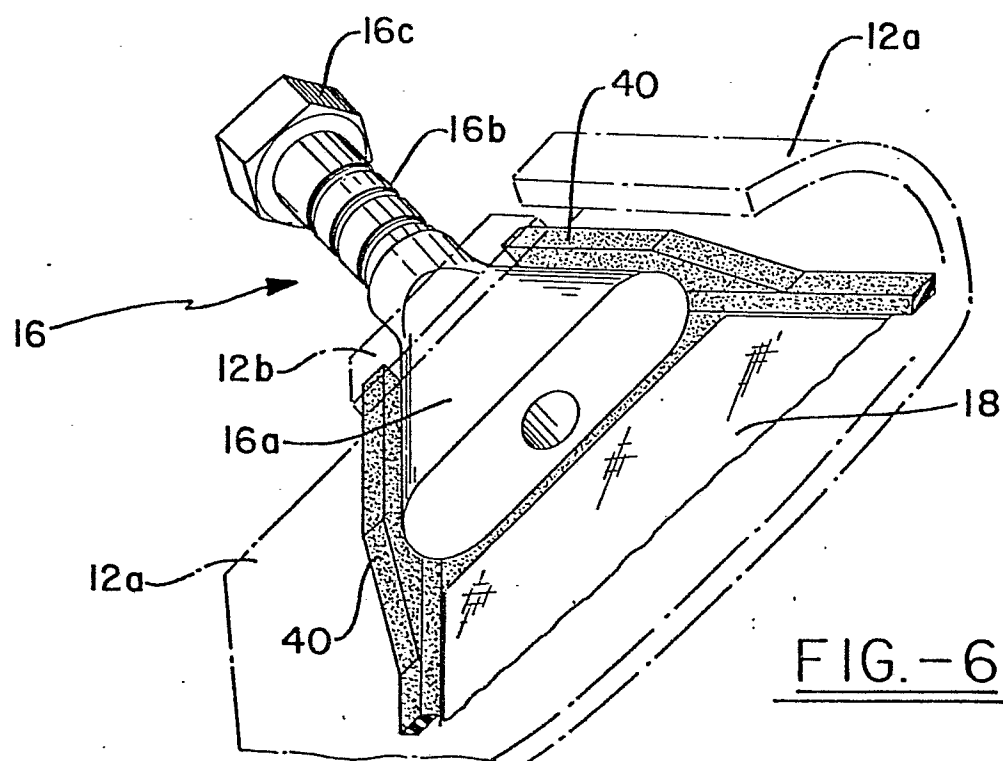
12. The pneumatic pad as set forth in Claim 11 characterized by radii of the cords at the fold of at least 4mm.

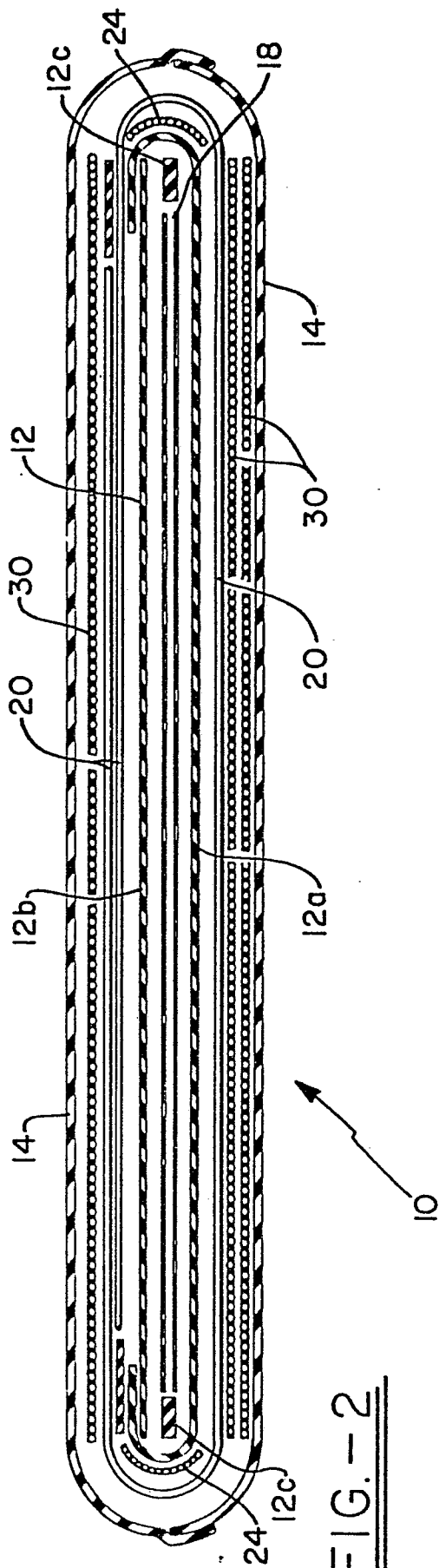
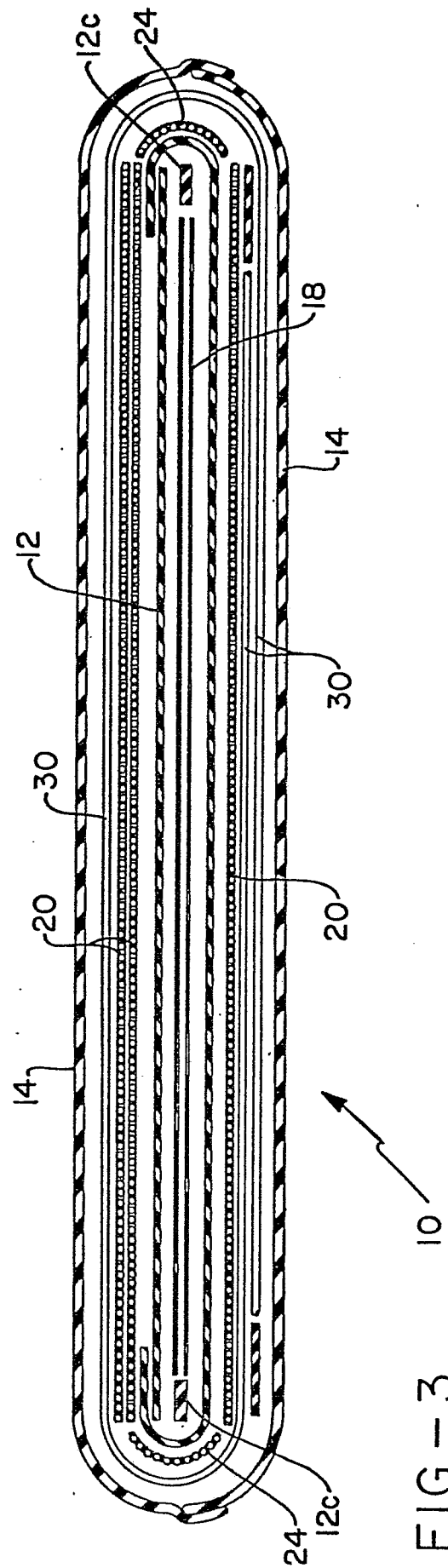
13. The pneumatic pad as set forth in Claim 1 wherein the covers are characterized by a high friction exterior surface texture.

14. The pneumatic pad as set forth in Claim 1 characterized by a high visibility pattern embedded in the cover elastomer to provide a locator for the pad center.

15. The pneumatic pad as set forth in Claim 14 wherein the pattern is characterized by an X-pattern, the center of which coincides with the center of the pad.

16. The pneumatic pad as set forth in Claim 14 wherein the pattern is characterized by a circular pattern the center of which coincides with the center of the pad.

FIG. -1FIG. -6

FIG. - 2FIG. - 3

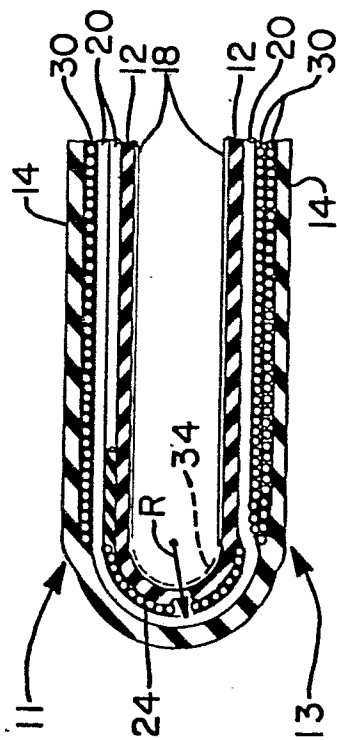


FIG. -4

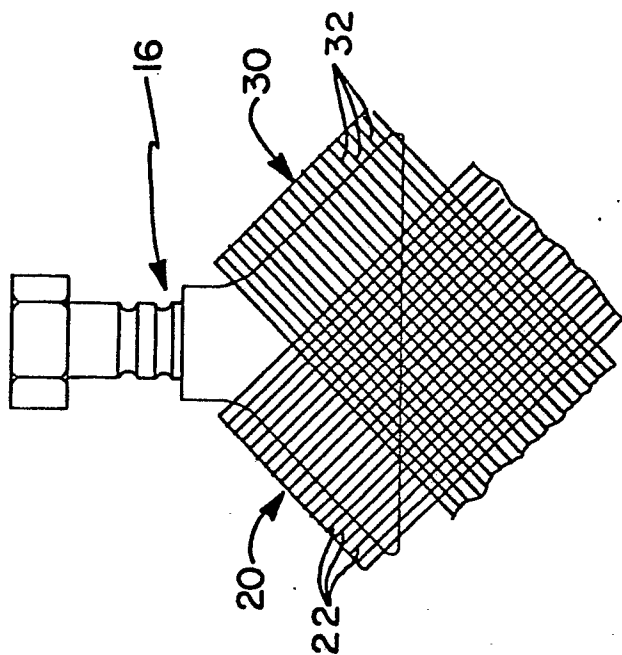


FIG. -7

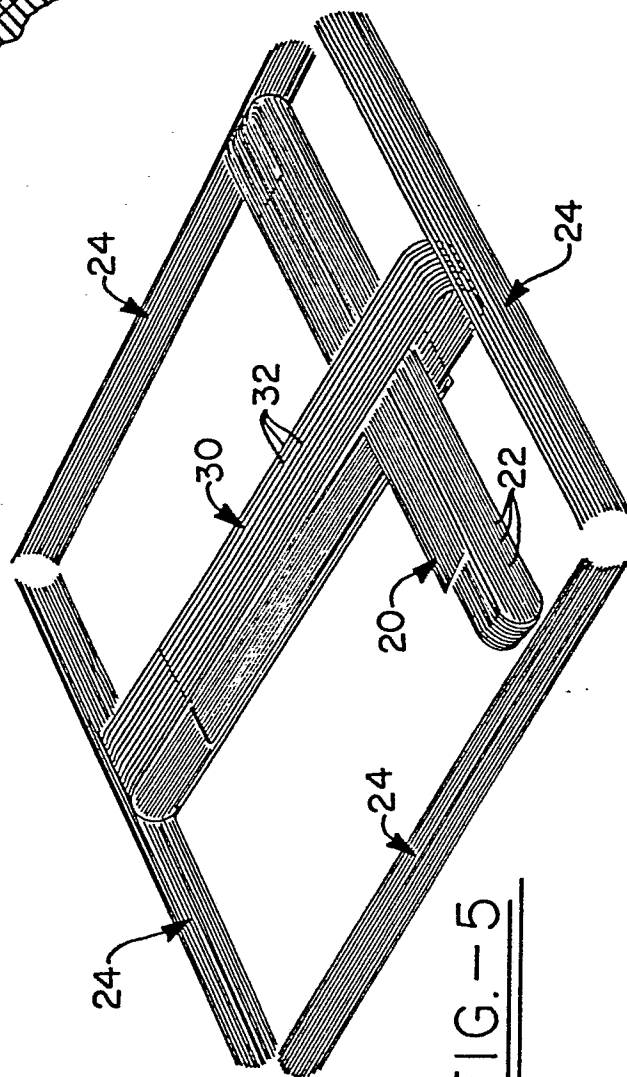


FIG. -5



DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	<u>GB - A - 1 169 023</u> (MICHELIN) * Page 1, lines 14-27; page 2, lines 1-6; figures 6,8 *	1,4,5,6	B 66 F 3/35
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	<u>FR - A - 2 305 381</u> (KLEBER-COLOMBES) * From page 1, line 31 to page 2, line 31; page 3, lines 11-18; figures 1,2 *	1,2,4,5,6,7	
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D	<u>US - A - 4 143 854</u> ( VETTER) * Column 3, lines 52-58 *	5-8	TECHNICAL FIELDS SEARCHED (Int. Cl.)
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D	<u>US - A - 4 067 544</u> (VETTER) * Claim 5 *	10	B 66 F B 29 H E 21 D F 15 B
	--		
	<u>NL - A - 66 02558</u> (SEEGERS) * Page 3, lines 7-14; figures 1-3 *	10	
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A	<u>AU - B - 453 143</u> (GOODYEAR) -----		CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
<input checked="" type="checkbox"/> The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search	Date of completion of the search	Examiner	
The Hague	10-08-1981	FERRANTI	