United States Patent

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[54] **DUAL WALL FABRIC WITH CIRCULAR CONNECTION POINTS**
8 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **139/384,** 139/410
[51] **Int. Cl.** **D03d 3/00,** D03d 11/00
[50] **Field of Search** ..... 61/37, 38, 35; 139/408—414, 384, 387—389

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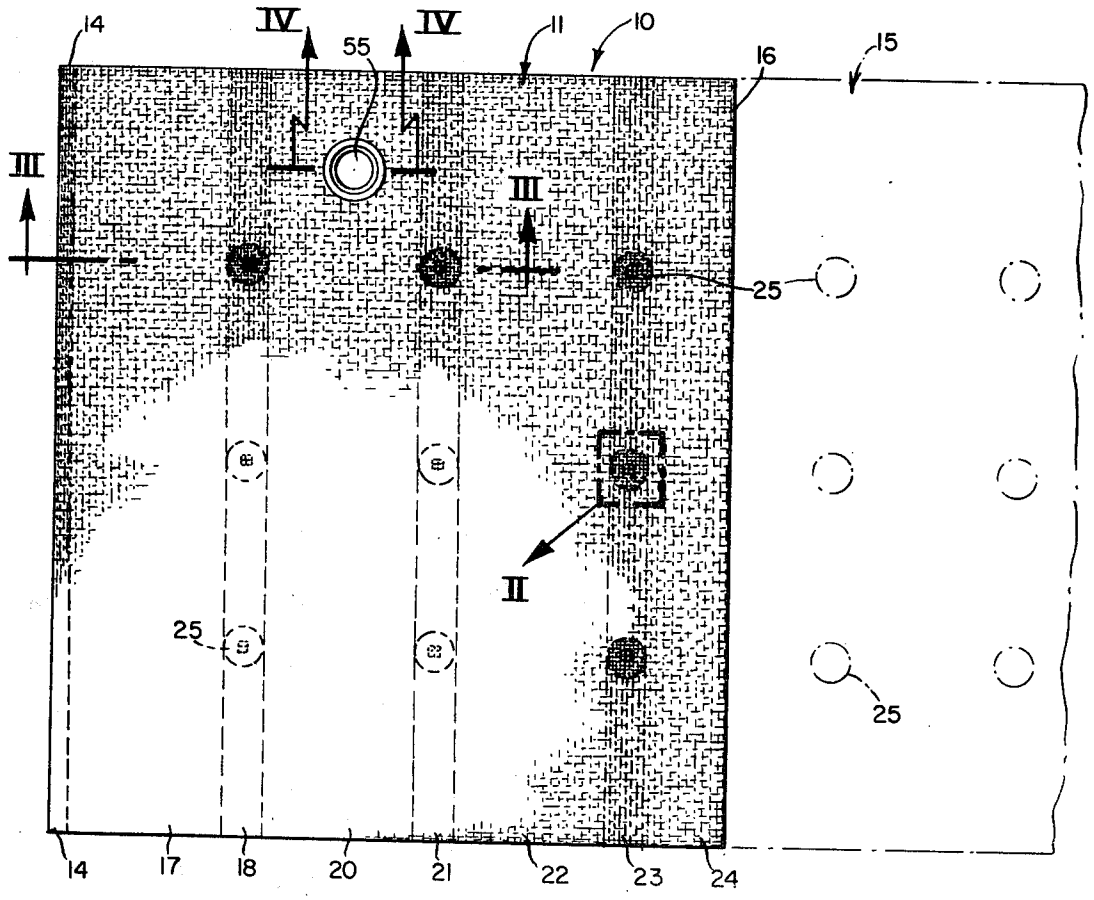
ABSTRACT: A dual wall fabric is provided, having integrally woven connection points, of circular configuration, the fabric being adapted to be filled with concrete or like filler material pumped between the layers. A means is provided for connecting the two layers together in such a fashion, that when concrete is pumped between the layers, a void may be provided, extending through the concrete mat formed upon setting-up of the concrete.



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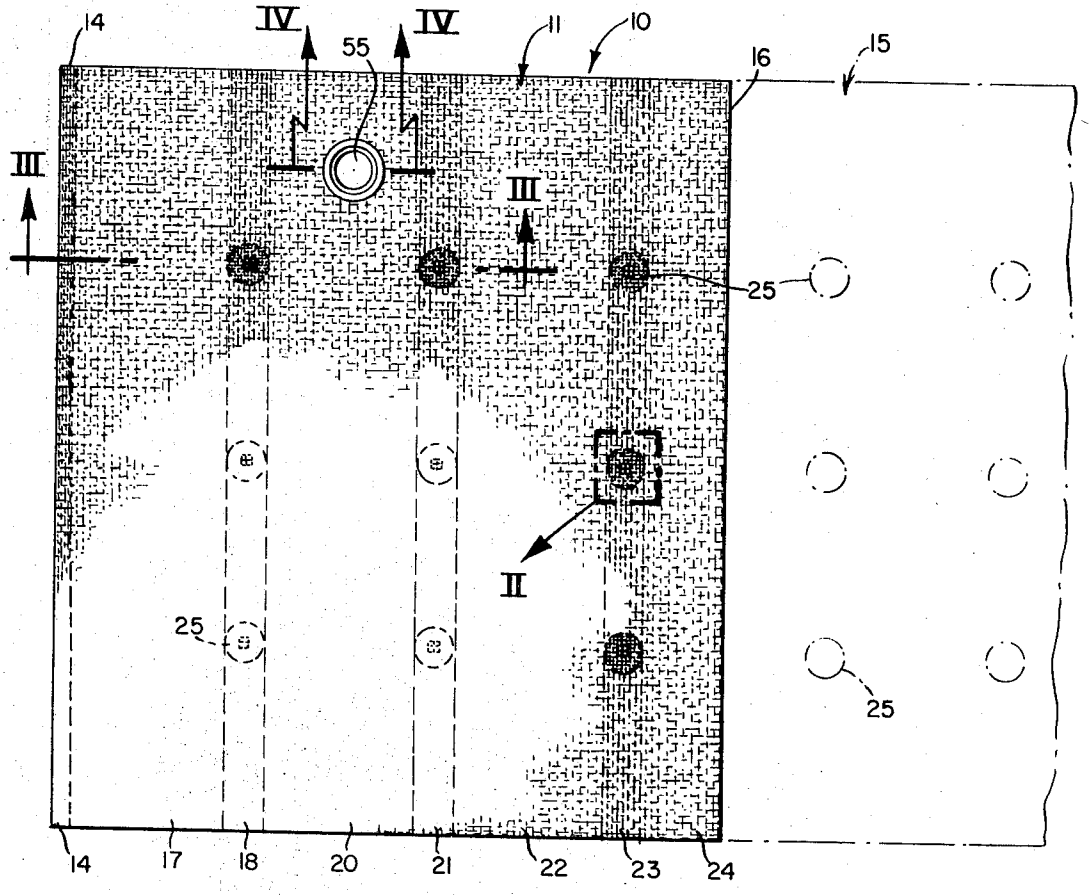

Fig. 1

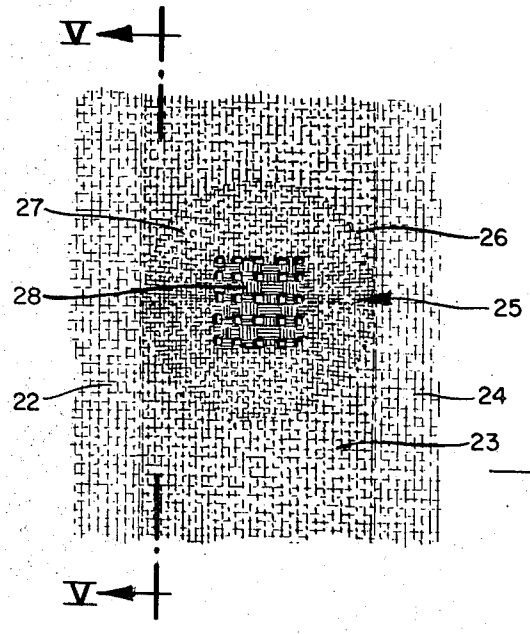

Fig. 2

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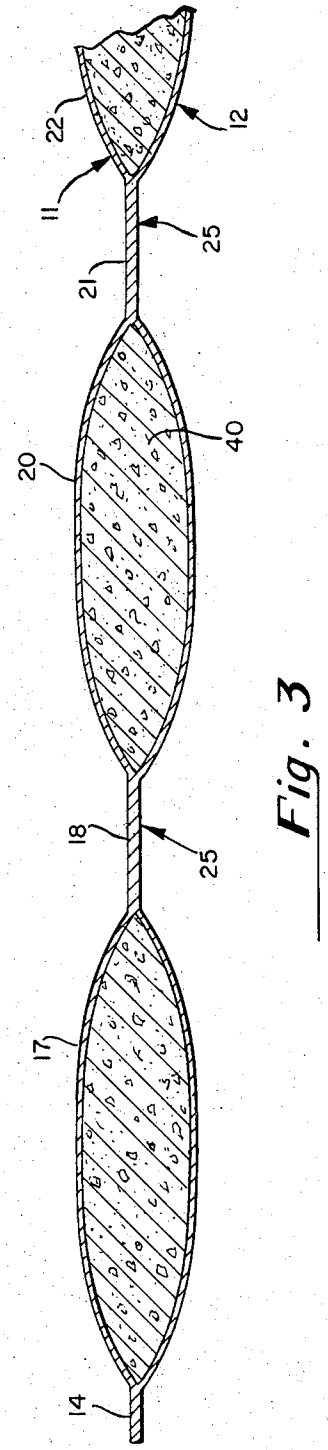

Fig. 3

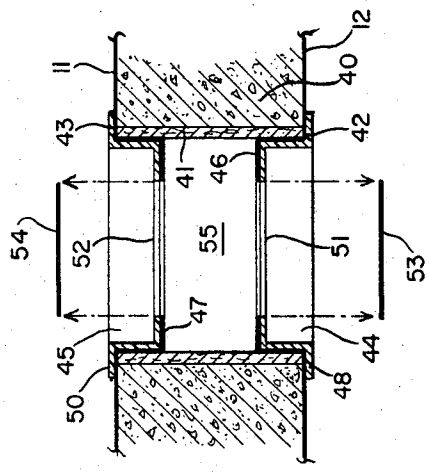

Fig. 4

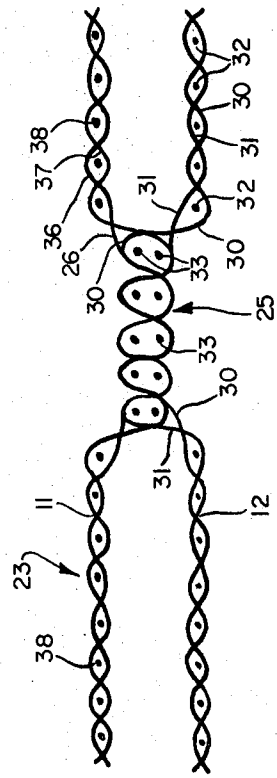

Fig. 5

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DUAL WALL FABRIC WITH CIRCULAR CONNECTION POINTS

BACKGROUND OF THE INVENTION

According to recent developments in the containment art, the technology has advanced to the making of containment fabrics of dual wall construction, for various purposes, such as for p roviding material for mattresses, inflatable or noninflatable, for providing material of mattresslike configuration which may be pumped full of concrete or the like, and generally for providing material adapted for receiving a filler therein, in any application wherein dual wall fabric may be useful.

A principal use for dual wall fabric has been in the area of cement containment, as for example in the formation of erosion dams, in the formation of concrete coverings for river banks, in forming concrete liners for water canals, and like applications. The dual wall fabric has been found to be extremely useful in such applications, in that it has saved the time consuming operations of sewing a plurality of sheets together.

In the course of the development of dual wall cement containment fabrics, it has been found that it has been necessary to make connection points between the opposed fabric layers. The reason for this is that, as concrete, cement or the like is pumped between a "mattress" or like configuration of dual wall fabric, the concrete filler material tends to assume a round configuration, much the same as the configuration assumed by a balloon, upon blowing the same full of air. Thus, in order to maintain the desired flat or mattresslike configuration of a dual wall cement containment fabric, connection points have been placed in the fabric.

It has further been found that it has been most economical to weave such connection points integral with the weaving of the face cloth and back cloth comprising the dual wall fabric, and accordingly, there has been developed the technique of weaving the connection points integrally between the face cloth and back cloth by means of threads which are woven in the warp direction to engage weft threads of the face cloth and back cloth, and to hold the same together against each other.

As a further modification of this state of development, it has been found that, upon filling a "mattress" of dual wall fabric thus formed with concrete, a high degree of stress would be imparted to various portions of the connection points between the opposed fabric layers, inasmuch as such connection points would generally be of rectangular configuration, whereas the concrete being pumped into the fabric tended to assume an oval, circular or other arcuate shape when contained within the fabric. Such rectangular corners on the connection points would thus tend to rip under the pressure of the concrete being applied between the fabric layers, and consequently the pressure of concrete being applied between dual wall fabric had to be carefully controlled, and kept below a predetermined level, in order to avoid ripping the connection points and allowing the concrete to escape. By limiting the pressure which the concrete could attain within the dual wall fabric, the necessary pumping distance of concrete being inserted into the fabric was also limited, in that, as the concrete being pumped traveled to a point between the opposed fabric layers which was remote from its point of entry, the pressure on those connection points most adjacent the point of entry would increase substantially above the concrete pressure at points remote from its point of entry into the fabric. Consequently, severe limitations have been placed upon concrete pumping between opposed layers of dual wall fabric.

Additional problems have been present in dual wall concrete containment fabrics, such as the provision of some means for water seepage or passage, when the same is desirable, between opposite sides of a hardened concrete construction, as well as the provision of some means for easily and economically forming a clearance hole, duct, or like void between opposite sides of a hardened concrete-filled dual wall containment fabric, and the provision of the same with substantial ease, during the formation of such a construction.

SUMMARY OF THE INVENTION

A dual wall containment fabric having integrally woven connection points is provided, wherein the connection points are designed such that each portion of the periphery of each connection point is capable of withstanding the same pressure, in that no zones of stress concentration are provided, in that the connection points are generally of circular configuration. Another principal feature of novelty is that, that portion of fabric which comprises the circular connection points is woven by a Jacquard head motion, whereas the remainder of such fabric is woven by a Dobby head motion, an efficient combination and utilization of the two weaving processes, to yield a single fabric having the desired results.

Accordingly, it is a primary object of this invention to provide a novel dual wall containment fabric capable of receiving a filler material, whereby stress concentration points at fabric layer connections are avoided.

It is a further object of this invention to accomplish the above object, wherein circular connection points are provided between opposed fabric layers.

It is yet another object of this invention to accomplish the above objects, using the novel method of weaving the fabrics together by a combination of Jacquard head weaving and Dobby weaving.

It is a further object of this invention to accomplish all of the objects above, wherein the dual wall fabric connection points are each of two different weaves, one weave surrounding the other, with the innermost weave being of more loose or open construction, to permit the passage of moisture, water or the like therethrough.

It is a further object of this invention to provide a novel device for facilitating the formation of dual wall containment fabrics, wherein the fabrics are to be filled with the filler material, and wherein a means is provided for allowing a void or passageway through the filler material, during the formation of a containment structure.

Other objects and advantages of the present invention will be readily apparent to one of ordinary skill in the art from the reading of the following brief descriptions of the drawing figures, detailed descriptions of the preferred embodiments, and the appended claims.

IN THE DRAWINGS

FIG. 1 is a top plan view of a dual wall containment fabric, looking at a face cloth, and wherein there is illustrated in phantom a portion of another containment fabric adapted for sewing alongside the rightmost edge of the containment fabric shown in full lines, for enlarging the width of such a fabric.

FIG. 2 is an enlarged detailed view of a connection point of the fabric illustrated in FIG. 1, in approximately full scale.

FIG. 3 is an enlarged transverse sectional view, taken through the containment fabric if FIG. 1, generally along the line III–III of FIG. 1, and wherein the fabric is illustrated with a concrete filler material contained therein.

FIG. 4 is an enlarged transverse sectional view, taken through the port or void illustrated in FIG. 1, generally along the line IV–IV of FIG. 1, and wherein the manner of attachment of the end structures to the sleeve which forms the void in the filled containment fabric is clearly illustrated.

FIG. 5 is an enlarged schematic view of a portion of the circular tie point weave illustrated in FIG. 2, and its connection to the opposed fabric layers, taken generally along the line V–V of FIG. 2.

Referring now to the drawings in detail, reference is first made to FIG. 1, wherein there is illustrated a dual wall fabric of this invention, generally designated by the numeral **10**, and with reference also to FIG. 3, comprising opposed fabric layers **11** and **12** which comprise the face cloth and the back cloth, respectively.

In the embodiment illustrated in FIG. 1, the leftmost side of the face cloth **11** is illustrated as having a selvage **14**, which in-

tegrally connects the upper end lower or face cloth and back cloth layers 11 and 12.

The selvage 14 is shown only on the leftmost side of the fabric 10, extending in the warp direction, and is absent from the rightmost side thereof, in order to facilitate sewing of the dual wall fabric 10 to a similar but mirror-imaged section of dual wall fabric 15, as for example that illustrated in phantom lines in FIG. 1, such that the connection between tie points thereof (to be described in greater detail hereinafter) will be approximately the same between connection points of different dual wall fabrics as between connection points of the same dual wall fabric. Thus, the dual wall fabrics 10 and 15 are connected together along a stitching line 16, which does not connect opposed fabric face cloths to back cloths and the converse.

Traversing the dual wall fabric 10 in the weft direction, it is seen that, starting with the selvage strip 14, a plurality of alternate strips are provided, each woven in the warp direction. Adjacent to the strip 14, is a strip 17, of any suitable weave, for providing a fabric layer. The strip 17 is woven by a Dobby head motion, by the conventional technique. Simultaneously with the weaving of the strip 17, the strip 18, disposed adjacent thereto is woven by a Jacquard head motion, to also comprise a portion of a single fabric layer, spaced from an adjacent portion of the back cloth 12 disposed therebeneath (not shown). Similarly, alternate strips 20, 21 and 22, 23 are provided woven in a similar manner to those 17 and 18, respectively. The end strip 24, between the strip 23 and the free edge 16 may be of the thickness of either of the strips 17, 20 or 22, but is illustrated as comprising approximately half that thickness for the purpose mentioned above, of facilitating the connection of the fabric 10 to the fabric 15.

Each of the strips 18, 21 and 23 is illustrated as having a plurality of connection points or zones 25, aligned within the strips 18, 21 and 23, and spaced equidistantly therefrom in a warp direction. Also, the connection points 25 are spaced so as to be in alignment in the weft direction, although such is not necessary, in that a staggered effect may be obtained, if desired.

With particular reference to FIG. 2, the circular connection point 25 is seen to have a periphery 26 of generally circular configuration. Such a configuration is one which allows minimum chances of stress concentration, although it is to be understood that an oval or other arcuate peripheral configuration would be more advantageous in this regard than a rectangular configuration, but less advantageous than a circular configuration. The connection points 25 also each comprise two basic weave patterns, to complete the tie point pattern. An outermost portion 27 is provided, comprising a compact rib weave, and surrounds an innermost portion 28 which is of square configuration and comprises an open mock leno weave.

This particular design with a circular tie point combines maximum strength of the rib weave at the circumference of the circle with an open center portion 28 which allows filtering of water under hydrostatic pressure between the back cloth 12 and the face cloth 11.

With particular reference to FIG. 5, there is illustrated a portion of the strip 23 as viewed, looking in the weft direction, across a circular tie point 25. Warp strands 30 and 31 are illustrated being woven in a rib weave about the weft strands 32, to comprise the back cloth, with the strands 30 and 31 separating as they enter the periphery 26 of the circular connection point 25, the strands 30 and 31 then being woven around opposite sides of weft strands 33, through the zone 25, in the manner illustrated, to reenter the back cloth 12 as illustrated beneath of connection point 25. The warp strands 36 and 37 which comprise components of the face cloth 11 are similarly woven about the weft strands 38, the weft strands 33, passing through the connection zone 25 and the weft strands 38 at the lower end of the schematic illustration of FIG. 5. It will be noted that the view of FIG. 5 is taken at the point that it does not include a schematic cross section of the rectangular portion 28 of the connection point 25, for clarity of illustration.

With reference to FIG. 3, there is illustrated the manner in which concrete 40 tends to assume an oval configuration when pumped between opposed fabric layers 11 and 12 which are connected by connection points 25. It will be understood that any type of filler material, such as plastic foam or the like, in addition to concrete or cement may be utilized, all to be encompassed within the term "concrete," as used herein. Furthermore, other similar materials which lend themselves to conforming to a desired configuration in situ, such as water extended polyester may also be used.

With particular reference to FIG. 4, there is illustrated the manner in which a void may be formed in a solid concrete mat. A sleeve 41, having open ends 42 and 43 may be disposed between the opposed fabric layers 11 and 12, with the open ends 42 and 43 in abutment with inner surfaces of the layers 12 and 11 respectably. A pair of opposed cups 44 and 45 are then provided, disposed over the ends of the sleeve 41, to engage fabric portions 46 and 47 and to clamp the same between the cups 44 and 45 and the inner bore of the sleeve 41, at the ends 42 and 43 thereof. Flanges 48 and 50, extending outwardly from the cups 44 and 45 limit the entry of the cups 44 and 45 into the sleeve 41.

The cups 44 and 45 are provided with inner bores 51 and 52 respectively, such that the associated encircled fabric layer portions 53 and 54 may readily be removed at this time, if the same is desired. In the alternative, the concrete 40 may be pumped into the space between the opposed layers 11 and 12, after the sleeve 41 is in place and the end caps or cups 44 and 45 secured in position, and after the concrete 40 sets up or hardens, the cups 44 and 45 may be removed and those portions 46 and 47 of the fabric layers 12 and 11 respectively may then be cut away. In either instance, whether the cups 44 and 45 remain within the sleeve 41, or are withdrawn, a void or port 55 is provided, through the containment construction of FIG. 4, through which water, power, or like utility lines may be installed, should the construction comprise a part of an assembly requiring utilities of this type. In the event that the fabric construction 10 is utilized to form a moveable bunker, it may be desirable to attach a cable or the like to the construction through the void 55, for dragging the same from one position to another.

It will be apparent from the foregoing, that various modifications may be made in the details of construction, as well as in the use and operation of the various features of this invention, all within the spirit and scope of the invention, as claimed. It will further be apparent that the term "connection point" comprises a connection zone. It will further be apparent that any desired strand material may be used to comprise the warp and weft yarns, such as nylon, polypropylene, or split film yarns. Additional yarns may also comprise polyvinylchloride and polyolefin yarns of various types.

We claim:

1. A dual wall containment fabric for use in containing a hardenable filler therein during setup having integrally woven thread strands connecting opposed fabric layers of double cloth weave wherein a plurality of said connecting strands cooperate to define a connection zone of generally circular configuration, with the opposed fabric layers in said zone being disposed against each other.

2. The fabric of claim 1, wherein the circular connection zone forms a repetitive pattern in both warp and weft directions of the double cloth fabric.

3. The fabric of claim 2, wherein each said connection zone comprises an outermost portion of tight weave construction which surrounds an innermost portion of loose weave construction relative to said outermost portion.

4. The fabric of claim 3, wherein said innermost portion is of rectangular configuration.

5. The fabric of claim 3, wherein said outermost portion comprises a rib weave.

6. The fabric of claim 3, wherein said innermost portion comprises an open mock leno weave.

7. A dual wall containment fabric having integrally woven connection points between opposed layers of the fabric, for

use in receiving a solid-forming filler material applied under pressure between said layers, said connection points providing a means to restrain separation of the fabric layers as the filler material is being applied therebetween, said connection points each comprising a predetermined area having a peripheral configuration which defines means for preventing stress concentration at portions of connection point periphery during insertion of filler material between said layers, wherein said peripheral configuration comprises a substantially circular configuration.

8. The fabric of claim 7, wherein each said connection point is of generally circular configuration.