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CA 2392481 C 2009/07/28

(11)(21) 2 392 481

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 2000/12/04
(87) Date publication PCT/PCT Publication Date: 2001/06/07
(45) Date de délivrance/Issue Date: 2009/07/28
(85) Entrée phase nationale/National Entry: 2002/05/24
(86) N° demande PCT/PCT Application No.: GB 2000/004640
(87) N° publication PCT/PCT Publication No.: 2001/039862
(30) Priorités/Priorities: 1999/12/04 (US09/454,722);
2000/03/02 (US09/517,212)

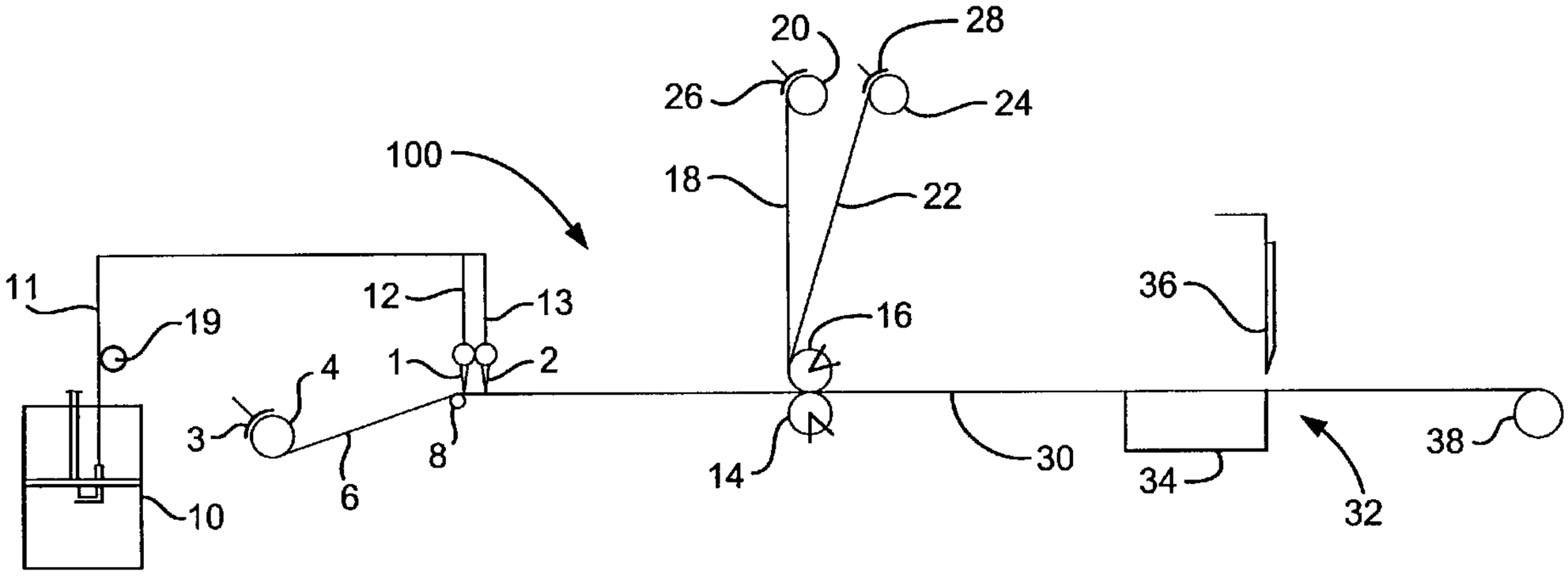
(51) Cl.Int./Int.Cl. *B07B 1/46* (2006.01)

(72) Inventeurs/Inventors:
SEYFFERT, KENNETH WAYNE, US;
ADAMS, THOMAS COLE, US;
LARGENT, DAVID WAYNE, US;
SCHULTE, DAVID LEE, US;
GRICHAR, CHARLES NEWTON, US;
WALKER, JEFFERY EARL, US;
LEONE, VINCENT DOMINICK, US;
MCCLUNG, GUY LAMONT III, US

(73) Propriétaire/Owner:
VARCO I/P, INC., US

(74) Agent: MCFADDEN, FINCHAM

(54) Titre : PROCEDE ET MATERIEL DE FABRICATION DE TREILLIS POUR TAMIS VIBRANTS
(54) Title: A METHOD AND SYSTEM FOR MAKING A SCREEN FOR USE IN SHALE SHAKERS



(57) Abrégé/Abstract:
A method for making a screen assembly for a vibratory separator, the method comprising placing a first layer of screening material below a glue application apparatus, and applying with the glue apparatus an amount of glue in a pattern to a portion of the first layer of screening material.The invention also provides a method for making a screen, said method comprising the step of injecting glue on to a first screening material in a predetermined pattern, pressing at least a second screening material thereon to form a multi-layered screen. The invention also relates to a screen made by the methods and to systems for making a screen in accordance with the methods.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/39862 A1

(51) International Patent Classification[7]: B01D 33/03, B07B 1/46

(21) International Application Number: PCT/GB00/04640

(22) International Filing Date: 4 December 2000 (04.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/454,722 4 December 1999 (04.12.1999) US
09/517,212 2 March 2000 (02.03.2000) US

(71) Applicants *(for all designated States except US)*: **TUBOSCOPE I/P INC.** [US/US]; 2835 Holmes Road, Houston, TX 77051 (US). **LUCAS, Brian, Ronald** [GB/GB]; 135 Westhall Road, Warlingham, Surrey CR6 9HJ (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **SEYFFERT, Kenneth, Wayne** [US/US]; 1019 LaMonte Lane, Houston, TX 77018 (US). **ADAMS, Thomas, Cole** [US/US]; Route 1, Box 538 (Teepee Trail), Hockley, TX 77447 (US). **LARGENT, David, Wayne** [US/US]; Route 4, Box 1017M, Cleveland, TX 77327 (US). **SCHULTE, David, Lee** [US/US]; 101 Antietam Avenue, Broussard, LA 70518 (US). **GRICHAR, Charles, Newton** [US/US]; 303 Graceland, Houston, TX 77009 (US). **WALKER, Jeffery, Earl** [US/US]; 205 Camberley, Lafayette, LA 70501 (US). **LEONE, Vincent, Dominick** [US/US]; 13603 Champions Centre Drive, Houston, TX 77069 (US). **MCCLUNG, Guy, Lamont, III** [US/US]; 18007 Pleasant Wood, Spring, TX 77379 (US).

(74) Agent: **LUCAS, Brian, Ronald**; 135 Westhall Road, Warlingham, Surrey CR6 9HJ (GB).

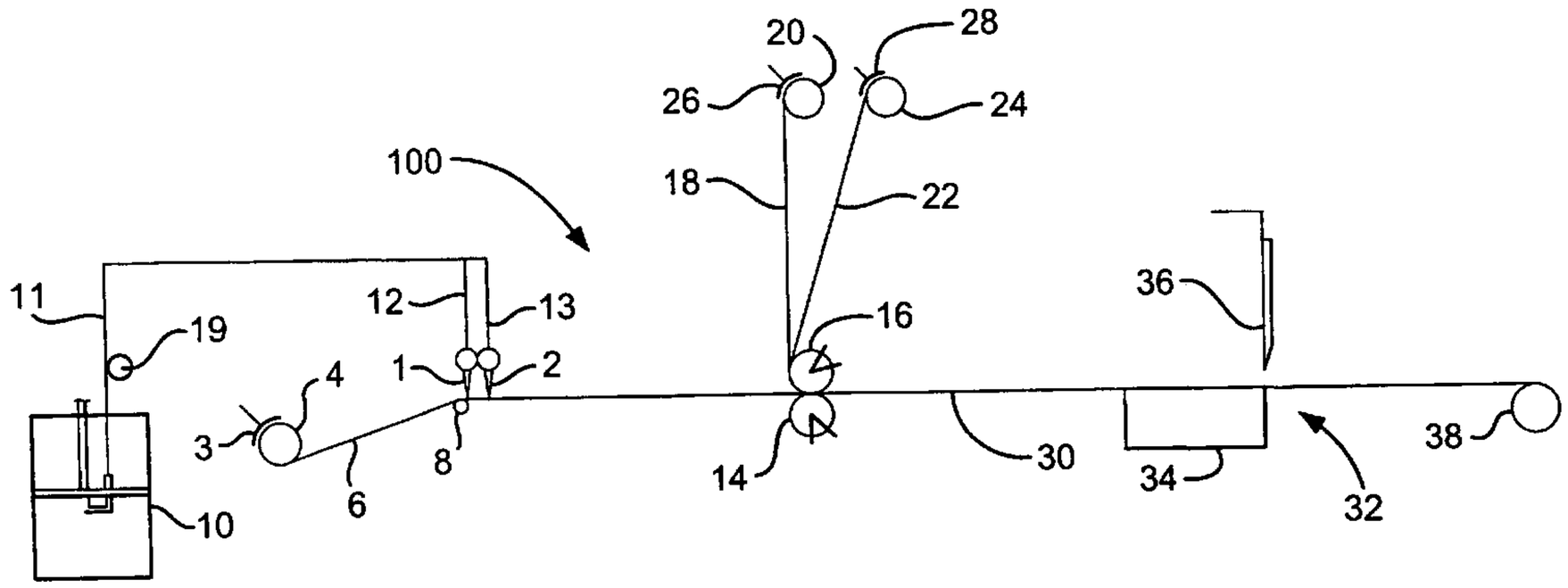
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE,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

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

Published:
— *With international search report.*

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

(54) Title: A METHOD OF MAKING A SCREEN, A SCREEN, AND A SYSTEM FOR MAKING A SCREEN



(57) Abstract: A method for making a screen assembly for a vibratory separator, the method comprising placing a first layer of screening material below a glue application apparatus, and applying with the glue apparatus an amount of glue in a pattern to a portion of the first layer of screening material.The invention also provides a method for making a screen, said method comprising the step of injecting glue on to a first screening material in a predetermined pattern, pressing at least a second screening material thereon to form a multi-layered screen. The invention also relates to a screen made by the methods and to systems for making a screen in accordance with the methods.

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A METHOD AND SYSTEM FOR MAKING A SCREEN FOR USE IN SHALE SHAKERS

This invention relates to a to a method and system for making a screen for use in shale shakers. The screens are more particularly, but not exclusively, for use in separating solids from circulating oil (mud) used in the drilling of oil and gas wells.

The need for solids control in drilling mud used in hydrocarbon well drilling is well known in the prior art. Drilling mud, typically a mixture of clay, water and various additives, is pumped down through a hollow drill string (pipe, drill collar, bit, etc.) into a well being drilled and exits through holes in a drill bit. The mud picks up cuttings (rock) and other solids from the well and carries them upwardly away from the bit and out of the well in a space between the well walls and the drill string. At the top of the well, the solids-laden mud is discharged over a shale shaker, a device which typically has a series of screens arranged in tiered or flat disposition with respect to each other. The screens catch and remove solids from the mud as the mud passes through them. The mud is then reused. If drilled solids are not removed from the mud used during the drilling operation, recirculation of the drilled solids can create weight, viscosity, and gel problems in the mud, as well as increasing wear on mud pumps and other mechanical equipment used for drilling.

In some shale shakers a fine screen cloth is used with the vibrating screen. The screen may have two or more overlying layers of screen cloth. The layers may be bonded together. A support such as a perforated or apertured plate may be used beneath the screen or screens. The frame of the vibrating screen is resiliently suspended or mounted upon a support and is caused to vibrate by a vibrating mechanism, for example,

the vibrating mechanism may comprise an unbalanced weight on a rotating shaft connected to the frame. Each screen may be vibrated by vibratory equipment to create a flow of trapped solids on the top surfaces of the screen for removal and disposal of solids. The fineness or coarseness of the mesh of a screen may vary depending upon mud flow rate and the size of the solids to be removed.

Many screens used with shale shakers are flat or nearly flat (i.e. substantially two-dimensional). Other screens, due to corrugated, depressed, or raised surfaces are three-dimensional. U.S. Patents 5,417,793; 5,417,858; and 5,417,859 disclose non-flat screens for use with shale shakers. These screens have a lower planar apertured plate with a multiplicity of spaced-apart apertures or openings therethrough. The undersides of troughs of undulating screening material are bonded to the apertured plate. Such screens present a variety of problems, deficiencies, and disadvantages, including: decreased flow area due to area occluded by solid parts of the apertured plate; necessity to either purchase relatively expensive apertured plate or provide for in-house perforating of a solid plate; plate weight increases wear on parts such as rubber screen supports or cushions and can inhibit required vibration; large plate surface area requires relatively large amount of bonding means for bonding screens to the plate; and a finished screen which is relatively heavy increases handling problems, hazards, and cost of shipping.

A vibrating screen may be formed from one or more layers of wire mesh. Wire mesh is generally described with reference to the diameter of the wires from which it is woven, the number wires per unit length (called the mesh count) and the shape or size of the openings between wires. Wire mesh comes in various grades. "Market"

grade mesh generally has wires of relative large diameter. "Mill" grade has comparatively smaller diameter wires and "bolting cloth" has the smallest diameter wire. The type of mesh chosen depends on the application. Smaller diameter wires have less surface and thus less drag, resulting in greater flow rates. Smaller diameter wires also result, for a given opening size, in a larger percentage of open area over the total area of the screen, thus allowing greater flow rates and increased capacity. However, screens of bolting cloth tears more easily than market or mill grade screens, especially when used in harsh conditions such as drilling and mining operations. The smaller diameter wires tend to have less tensile strength and break more easily, and the finer mesh also tends not to retain its shape well. Most meshes suffer from what is termed "near sized particle blinding. During vibration, wires separate enough to allow particles of substantially the same size or slightly larger than the openings to fall between the wires and become lodged, thus "blinding" the openings of the screen and reducing capacity of the screen. If a particle becomes lodged when the wires are at the maximum distance apart, it is almost impossible to dislodge the particle. Sometimes, however, wires will subsequently separate further to release the lodged particle. Unfortunately, some wire mesh, especially bolting cloth, is tensioned. Tensioning restricts movement of the wires. Restricting movement assists in holding the shape of the wire mesh, keeping the size of the openings consistent to create a more consistent or finer "cutting point" and reducing abrasion from wires rubbing against each other. However, restricted movement of the wires reduces the probability that, once a near sized particle becomes stuck, the wires will subsequently separate to allow the particle to pass. Use of smaller diameter

wires, with smaller profiles, helps to reduce blinding. With a smaller diameter wire, a particle is less likely to become lodged midway through the opening.

Multiple layers of mesh may be used to alleviate blinding. U.S. Patent No. 4,033,865, describes layering two meshes in a manner that results in at least one wire of the lower of the two meshes bisecting each opening in the upper mesh. The openings in each mesh are at least twice as wide as the diameters of the wires and the lower mesh has openings the same size as or slightly larger than the openings in the upper mesh. The lower mesh, when held tightly against the upper mesh, prevents particles from migrating far enough into an opening in the upper mesh to be trapped. Some relative movement of the layers also helps to dislodge particles caught in the upper layer. The two-layer arrangement has the further benefit of a finer "cutting point," allowing smaller particles to be separated out. A third "backing" layer of relatively coarse, mill grade mesh is often used to carry most of the load on the screen and to increase the tensile strength of the screen.

Another problem faced in most applications is the tearing of the screen. The problem can be especially acute in heavy duty applications such as drilling and mining. A torn screen must be replaced or repaired. To facilitate repair, the screen layers are bonded to a rigid or semi-rigid support panel that has a pattern of large openings, forming on the screen a plurality of small cells of wire mesh. When a tear occurs in the screen, the mesh remaining within the cell in which the tear occurred is cut out and the cell is plugged. The capacity of the screen is diminished but its life is extended. Typically, several cells of a screen can be repaired before its capacity drops far enough to require replacement. Unfortunately, bonding the screen to the

support panel further restricts relative movement of the layers and the wires in each mesh layer, thus compounding the problem of blinding.

Blinding and tearing of the screens reduce the capacity of the screen continually through its useful life. Although capacity can be increased by increasing the total area the screens, the size of the screen is limited in most applications, such as on drilling rigs, especially those on offshore platforms. There has thus been generally a trade-off between capacity, longevity, repairability and resistance to blinding of the screens. There is a need for a supported (either non-flat or flat) screen which is consumable, efficient and cost-effective, yet readily and inexpensively made, easy to handle, and relatively inexpensive to transport.

According to the present invention there is provided a method for making a screen for a shale shaker, the method comprising the steps of placing a first layer of screening material below a glue application apparatus, applying with the glue application apparatus an amount of hot flowable glue in a pattern to a portion of said first layer of screening material and subsequently pressing at least a second layer of screening material thereon, and cooling said hot flowable glue to form said screen.

Other features and steps in the method of the invention are set out in claims 2 to 26.

The present invention also provides a screen comprising at least two layers of mesh glued together by the method according to the present invention The present invention also provides a roll of screen made by the method.

The present invention also provides an apparatus for manufacturing a screen for a shale shaker, the apparatus comprising at least one glue dispensing nozzle for applying hot flowable glue, at least one further roll of

mesh and a pressing station for carrying out the method of the invention.

Other features and aspects of the present invention are set out in claims 30 to 36.

For a better understanding of the present invention, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a side schematic view of a system according to the present invention;

Figure 2A is a top schematic view of part of a system as in Figure 1;

Figure 2B is a top schematic view of a part of a system according to the present invention, indicating a path of operation of part of the system;

Figure 3 is a top schematic view of a part of a system according to the present invention, indicating an alternative path of operation of part of the system;

Figure 4 is a top schematic view of a part of a system according to the present invention, indicating an alternative path of operation of part of the system;

Figure 5 is a top schematic view of a part of a system according to the present invention, indicating an alternative path of operation of part of the system; and

Figures 6A to 6D are top views of glue patterns applied by a system according to the present invention.

Referring to Figure 1, there is shown schematically, a system 100 according to the present invention for applying glue in a desired pattern to a screen or screens (or mesh or meshes) and can be used to produce any screen disclosed herein or in any other of our PCT Publications, that employs glue or adhesive between two or more layers of screen(s) and/or mesh(es).

Hot glue for application to screen(s) or mesh(es) or combination thereof is supplied to nozzles 1, 2 from a glue apparatus 10 through lines 11, 12, and 13. Either of the nozzles may be omitted; or, more than two nozzles may be used. The line 11 may be a heated line or a heated hose heated by optional heater apparatus 19. Any suitable known glue system may be used, including but not

limited to, hot glue systems which heat glue and then pump it to a flow line. In one particular aspect BulkMeter Applicators Model 5530, 5540, or 5506 commercially available from the Nordson Corporation of Amherst, Ohio may be used in systems according to the present invention (for example, for the apparatus 10 in the system of Figure 1).

From a rotating roll 4 a sheet of screen or mesh 6 is unwound from the roll 4 and moved over an idler roller 8 to a position beneath the nozzles 1, 2 (or only one of them when one of them is omitted). A brake 3 provides tension on the screen or mesh 6 as it is pulled from the roll 4. In certain aspects a roll of woven wire (screen or mesh) between for example, 30m to 90m (100 to 300 feet) in length is rolled from the roll 4.

The screen or mesh 6 with a glue pattern deposited thereon (any glue disclosed herein) moves between a rotating stationary (with respect to vertical position) roller 14 and rotating adjustable (with respect to vertical position) roller 16. In certain aspects it is preferred that the rollers 8, 14 are as close together as possible. Any roller in the system or roll can be a "driven" roller or roll, for example, powered by a motor with appropriate gearing, shafts, interconnections, etc., to pull the woven wire (screen or mesh) from the roll 4. In one particular aspect the roll 38 is a driven roll that pulls the woven wire from the roll 4. The driven roll 4 (or other driven roll or roller) can be rotated continuously as glue is deposited on the screen or mesh; or it can be drivingly rotated at intervals so that a desired portion of a layer of wire mesh is positioned beneath the nozzle(s) for glue pattern deposition. Following application of the desired glue pattern to the portion of the layer, the roll is again activated to remove the portion with the glue pattern and to position

a new un-treated portion beneath the nozzle(s).

A second screen or mesh sheet 18 unwound from a rotating roll 20 and, optionally, a third screen or mesh sheet 22 unwound from a rotating roll 24, are also fed between the rollers 14, 16 between which all the sheets are pressed together. Brakes 26, 28 provide tension as desired on the rolls 20, 24, respectively. Pressure on the combination of sheets may be adjusted by adjusting the vertical position of the adjustable roller 16. It is within the scope of this invention to make a screen with any desired number of layers, or sheets of screening material (screen and/or mesh), including, but not limited to a final screen product with two, three, four, five or more layers.

In certain aspects the adjustable roller 16 is positioned so that the sheets moving between the rollers 14 and 16 are bound together and part of the sheets are encapsulated in glue of the glue pattern. Either or both of the rollers 14, 16 can be a driven roller, for example, driven with a motor, to pull the various sheets between the rollers from their respective rolls. The rollers may act as heat sinks removing heat from the glue and/or cooling fluid may be circulated through one or both rollers to cool the glue.

Optionally a screen and/or mesh combination 30 exiting from between the rollers 14, 16 may be cut to length as desired with a shear apparatus 32 including a support 34 and a shear device 36; or the combination 30 may be wound onto a roll 38.

In one particular aspect the sheet 6 is a layer of relatively coarse wire mesh (and, in certain embodiments, may be any coarse wire mesh disclosed herein); the sheet 18 is a layer of medium wire mesh (and may be any medium wire mesh, for example,, but not limited, between 20 mesh and 250 mesh disclosed herein); and the sheet 22 is a

layer of fine wire mesh (and may be any fine wire mesh disclosed herein).

Any suitable known movement mechanism may be used to move the nozzle or nozzles above a layer of screen or mesh. One movement mechanism 40 is shown schematically in Figure 2A and includes a first bar 41 at right angles to a second bar 42 on which is movably mounted a glue nozzle 44. The second bar 42 has a finger 45 that projects down into a guide channel 43 of the first bar 41. As the second bar 42 moves with respect to the first bar 41 the finger 45 moves in the guide channel 43 to guide the movement of the second bar 42. The glue nozzle 44 moves along the second bar 42, for example, a shaft 46 projecting down from a knob 47 moves in an elongated opening 48 to guide movement of the glue nozzle 44 with respect to the second bar 42. Appropriate movement of the second bar 42 with respect to the first bar 41 and simultaneously of the glue nozzle 44 with respect to the second bar 42 makes possible the application of a glue bead in a desired pattern on a screen or mesh below the nozzle 44. One, two, three, four or more glue nozzles may be movably mounted on the second bar; or a plurality of glue nozzles each with its own movement mechanism may be used. Alternatively, and for any embodiment disclosed herein, the layer or layers of screening material may be moved below fixed nozzle(s) to produce a desired glue pattern thereon. For example a portion of a roll of mesh to have a glue pattern deposited thereon is placed on a movable and inextendable table or other suitable support with a nozzle or nozzles mounted thereabove.

Figure 2B shows a system 80 according to the present invention with two nozzle movement mechanisms 81, 82 (like the mechanism of Figure 2A) each with a nozzle AA and a nozzle BB respectively. In one method according to the present invention, nozzle AA is moved from the

indicated position 1a to a new position 2a, depositing a first glue bead on the screen or mesh 6 (like that in Figure 1) along a path from position 1a to position 2a. The nozzle BB is moved (and may be moved before the nozzle AA is moved) from its initial position 4a to a new position 5a, depositing as it moves a glue bead on the screen or mesh 6 along the path from position 4 to position 5. The screen or mesh 6 is then moved a predetermined increment (to the right or to the left as viewed in Figure 2B) and nozzle AA is moved back to position 1a (depositing a new glue bead on the screen or mesh as it moves, the new glue bead spaced-apart from the first glue bead) and, similarly, the nozzle BB moves back to position 4a depositing a corresponding glue bead. Alternatively, both nozzles may move on to a subsequent position (instead of moving back to positions 1a and 4a, respectively); position 3a for nozzle AA and position 6a for nozzle BB. It is within the scope of this invention for the nozzles to then move back to their initial positions following a movement or indexing of the screen or mesh, depositing a new glue bead when traversing the screen or mesh in the reverse direction (or not depositing a glue bead). The position 1a to 2a to 3a (nozzle AA) and position 4a to 5a to 6a (nozzle BB) movements can then be repeated. Alternatively only one of the nozzles may be used, moving to a second position and, optionally, on to a third position, and, optionally, then back to the second and then the first position. Although the nozzle paths shown in Figure 2B are substantially straight it is within the scope of this invention for either or both paths to be curved, zig zag, or wavy as viewed from above.

Typically a deposited glue bead has a width as viewed from above of between 0.12cm and 0.24cm (3/64ths and 3/32nds of an inch), and, in one particular aspect

this width is about 0.16cm (1/16 inch). In certain aspects the distance of a glue nozzle above a layer of screen or mesh is between 0.95cm to 1.6cm (3/8 inch to 5/8 inch) and the nozzle (or nozzles) are moved at a rate of 1.3 to 2 metres per min (4 to 6 feet per minute) (or the layer of screen or mesh is moved below a stationary nozzle or nozzles at this rate).

Figure 3 shows a system 50 according to the present invention like the system of Figure 1 in which the nozzles 1, 2 are initially positioned on opposite sides of a stationary portion of a layer of screen or mesh 6. Nozzle 1 moves from a position A to a position B laying down a glue bead X and then reverses direction and moves from position B to position C laying down a glue bead Y. Simultaneously the nozzle 2 moves from a position D to a position E laying down a glue bead P and then reverses direction and moves to a position F laying down a glue bead Q. As these movements of the nozzles are repeated a pattern R of glue is deposited on the screen or mesh 6. When the nozzles have covered the desired portion of the layer of screen or mesh with the desired pattern, the layer is moved beneath the nozzles so that they are then positioned above a new layer portion to which the pattern is to be applied. Once the new portion is correctly positioned, the nozzles begin applying the glue pattern as before. Alternatively, the screen or mesh also moves below the nozzles as the glue is being dispensed.

Figure 4 shows a system 60 according to the present invention like the system of Figure 1 with a single glue nozzle 61 that dispenses a glue bead onto the screen or mesh 6 and moves from a position G, to a position H, then to a position I, to a position J, and then to a position K. By repeating this cycle of movement a pattern S of glue is applied to the screen or mesh 6. When the desired pattern has been applied to a portion of the

screen or mesh 6, the glue flow is (optionally) shut-off, the screen or mesh 6 is moved beneath the nozzle 61 so that glue may be applied to another portion of the screen or mesh 6. Alternatively, the layer of screen or mesh 6 also is moved beneath the nozzle 61 as glue is being applied thereto; or, in another aspect, following nozzle movement (for example, from points G to H to I) the screen or mesh is moved (for example, indexed a desired distance) below the nozzle and then the nozzle is moved in a reverse path (for example, from points I to J to K).

Figure 5 shows a system 70 according to the present invention like the system of Figure 1 with a bank of glue nozzles 72 and a glue nozzle 71. The bank of nozzles 72 applies a plurality of glue beads 73 to the screen or mesh 6. The nozzle 71 moves above the screen or mesh 6 to apply a plurality of glue beads 74, producing a pattern T of glue on the screen or mesh 6. Either the bank of nozzles is moved with respect to the layer of screen or mesh 6, or the layer is moved below the bank of nozzles, or both. It is also possible to move the entire bank of nozzles at an angle to the direction of movement of the layer of screen or mesh 6. Also, a bank of nozzles may be used on the side of the layer 6 instead of a single nozzle like the nozzle 71.

Figures 6A to 6D show possible glue patterns that may be applied by systems according to the present invention (including, but not limited to, systems as in Figure 2, Figure 2B and Figs. 3 - 5). These patterns can be achieved by appropriate control of rate of movement of the screen or mesh and/or by the rate and/or direction of travel of the nozzle(s). In Figures 6A to 6D, angle measurements are in degrees (either "°" or "deg"), length measurements are in inches ("inches" or "in" or a number, for example, Figure 6A "1.38" is 1.38 inches) and area measurements ("sq. in.") are in square inches. It is

also within the scope of this invention: to substitute any patterning roller described herein for any bank of nozzles (for example, but not limited to the bank of nozzles in the system 70); to substitute any patterning roller described herein for any nozzle in any system in Figures 1 to 5; and to use a roller to deposit any glue bead deposited by any nozzle in any system in Figures 1 to 5.

As with other systems described herein, the cooling of hot glue deposited by a nozzle or nozzles can be effected by the use of one or more fans or coolers and/or by circulating cooling fluid through one or more rollers and/or rolls that contact and/or are adjacent hot glue.

CLAIMS:

1. A method for making a screen for a shale shaker, the method comprising the steps of placing a first layer of screening material below a glue application apparatus, applying with the glue application apparatus an amount of hot flowable glue in a pattern to a portion of said first layer of screening material and subsequently pressing at least a second layer of screening material thereon, and cooling said hot flowable glue to form said screen.

2. The method according to Claim 1, wherein the first layer of screening material is removably wound onto a first rotatable roll, the method further comprising unrolling the first layer of screening material from the first roll and positioning a portion of the first layer beneath the glue application apparatus.

3. The method according to Claim 1 or 2, wherein said second layer of screening material is removably wound onto a second roll, the method further comprising unrolling part of the second layer from the second roll and positioning the part of said second layer adjacent part of the first layer to which glue has been applied, and moving the part of the second layer and the part of the first layer between opposed rotatable spaced-apart rollers to press together the part of the second layer and the part of the first layer to form a pressed together layer of first and second layers of screening material.

4. The method according to Claim 3, further comprising continuously moving the second layer and the first layer between the opposed spaced-apart rollers producing a continuous sheet of pressed together screening materials.

5. The method according to Claim 4, further comprising the step of cutting the continuous sheet of pressed together screening material to form sub-sheets of pressed together screening material.

6. The method according to Claim 4 or 5, wherein a third layer of screening material is removably wound onto a third roll, the method further comprising unrolling part of the third layer from the third roll and positioning the part of the third layer adjacent part of the first and second layers, and moving the part of the third layer and the parts of the first and second layers between the opposed rotatable spaced-apart rollers to press them together to form a pressed-together layer of first, second and third layers of screening material.

7. The method according to Claim 6, further comprising the step of continuously moving the layers between the opposed spaced-apart rollers producing a continuous sheet of pressed-together screening material.

8. The method according to Claim 7, further comprising the step of cutting the continuous sheet of pressed-together screening material to form sub-sheets of pressed-together screening material.

9. The method according to any one of Claims 4 to 8, comprising the step of winding the continuous sheet of pressed together screening material onto a roll.

10. The method according to any one of Claims 1 to 9, wherein the hot flowable glue is applied to a portion of said first layer of screening material by at least one glue dispensing nozzle.

11. The method according to Claim 10, further comprising the step of injecting glue through said glue dispensing nozzle on to said first layer of screening material.

12. The method according to Claim 10 or 11, wherein the at least one glue dispensing nozzle is a plurality of spaced-apart glue dispensing nozzles.

13. The method according to Claim 10, 11 or 12, the method further comprising moving the at least one glue dispensing nozzle above the first layer of screening material to form the pattern of glue thereon.

14. The method according to Claim 10, 11 or 12, the method further comprising moving the first layer of screening material beneath the at least one glue dispensing nozzle to form the pattern of glue on the first layer of screening material.

15. The method according to any one of Claims 10 to 14, further comprising moving the at least one glue dispensing nozzle above the first layer of screening material to form the pattern of glue thereon, and moving the first layer of screening material beneath the at least one glue dispensing nozzle to form the pattern of glue on the first layer of screening material.

16. The method according to any one of Claims 1 to 15, wherein the first layer of screening material comprises coarse mesh.

17. The method according to any one of Claims 1 to 16, wherein the first layer is coarse mesh, and the second layer is medium mesh.

18. The method according to Claim 6, wherein the first layer is coarse, the second layer is medium mesh, and the third layer is fine mesh.

19. The method according to any one of Claims 1 to 18, wherein the pattern forms a series of a plurality of adjacent similarly-shaped repeating closed shapes with an open central area and glue bead sides, said series extending across substantially all the portion of the first layer of screening material to which glue is applied in the pattern.

20. The method according to Claim 19, wherein each closed shape comprises a four-sided figure as viewed from above.

21. The method according to Claim 20, wherein the four-sided figure is a parallelogram.

22. The method according to Claim 21, wherein the parallelogram has interior angles of about 60°, 60°, 120°

and 120°.

23. The method according to Claim 20, wherein the four-sided figure is a rectangle.

24. The method according to Claim 20, wherein the four-sided figure is a square.

25. The method according to Claim 3, wherein at least one of the two opposed rotatable spaced-apart rollers is a driven roller.

26. The method according to any one of Claims 1 to 25, further comprising the step of heating the amount of glue.

27. A screen comprising at least two layers of mesh glued together by the method as claimed in any one of Claims 1 to 26.

28. A roll of screen as made by the method claimed in Claim 9.

29. An apparatus for manufacturing a screen for a shale shaker, said apparatus comprising at least one glue dispensing nozzle for applying hot flowable glue, and a pressing station for carrying out the method as claimed in any one of Claims 1 to 26.

30. The apparatus as claimed in Claim 29, wherein said at least one glue dispensing nozzle comprises a plurality of dispensing nozzles.

31. The apparatus as claimed in Claim 29 or 30, further comprising a first roll which, in use, receives a first roll of mesh.

32. The apparatus as claimed in Claim 31, further comprising a second roll which, in use, receives a second roll of mesh.

33. The apparatus as claimed in Claim 32, further comprising a third roll which, in use, receives the first roll of mesh.

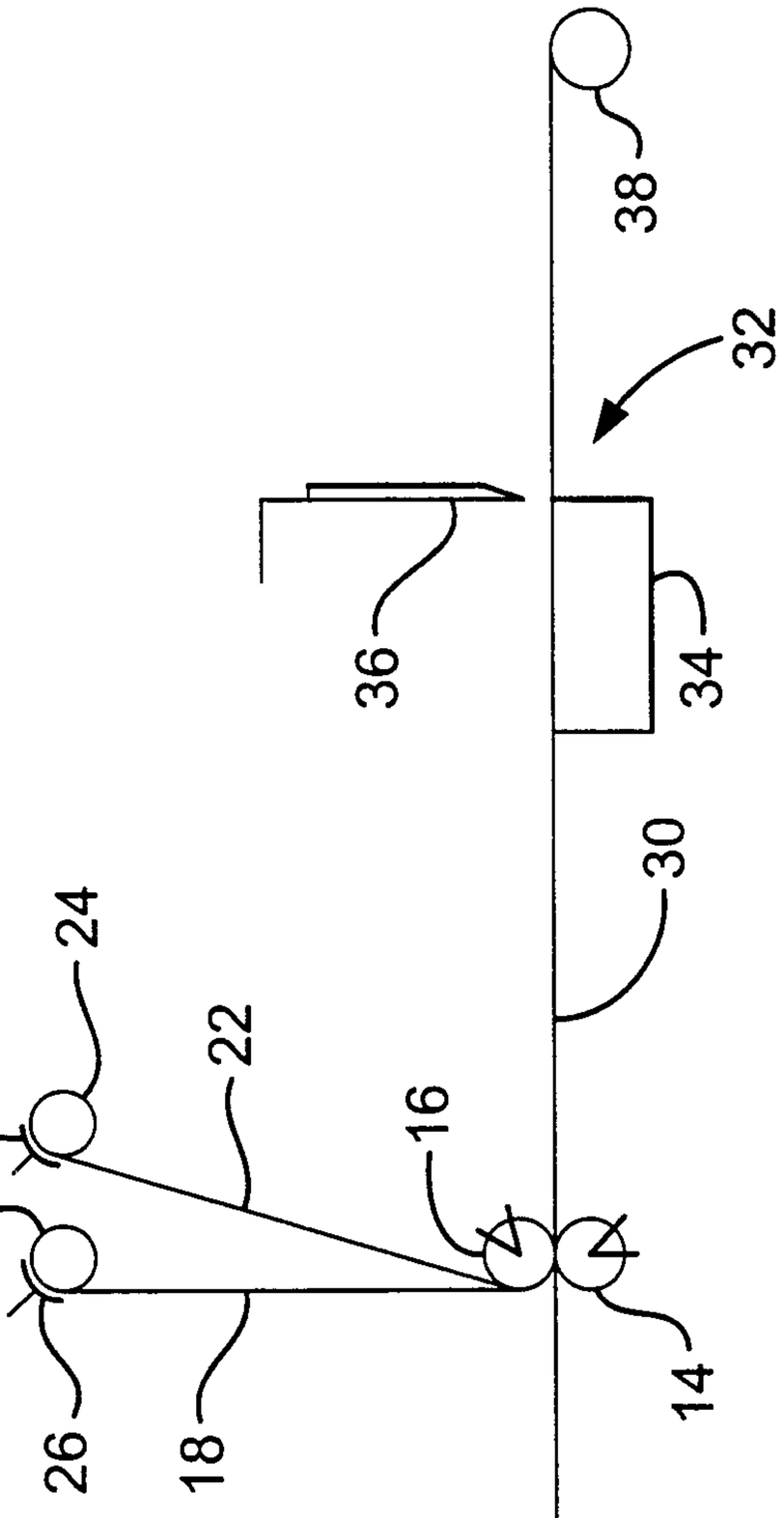
34. The apparatus as claimed in any one of Claims 29 to 33, further comprising a roll onto which the screen is

wound.

35. The apparatus as claimed in any one of claims 29 to 34, wherein said pressing station comprises opposed spaced-apart rollers.

36. The apparatus as claimed in Claim 35, wherein at least one of said two opposed rollers is a driven roller

37. The apparatus as claimed in any one of Claims 29 to 36, further comprising heating apparatus for heating said hot flowable glue.


100
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24
22
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Fig. 1

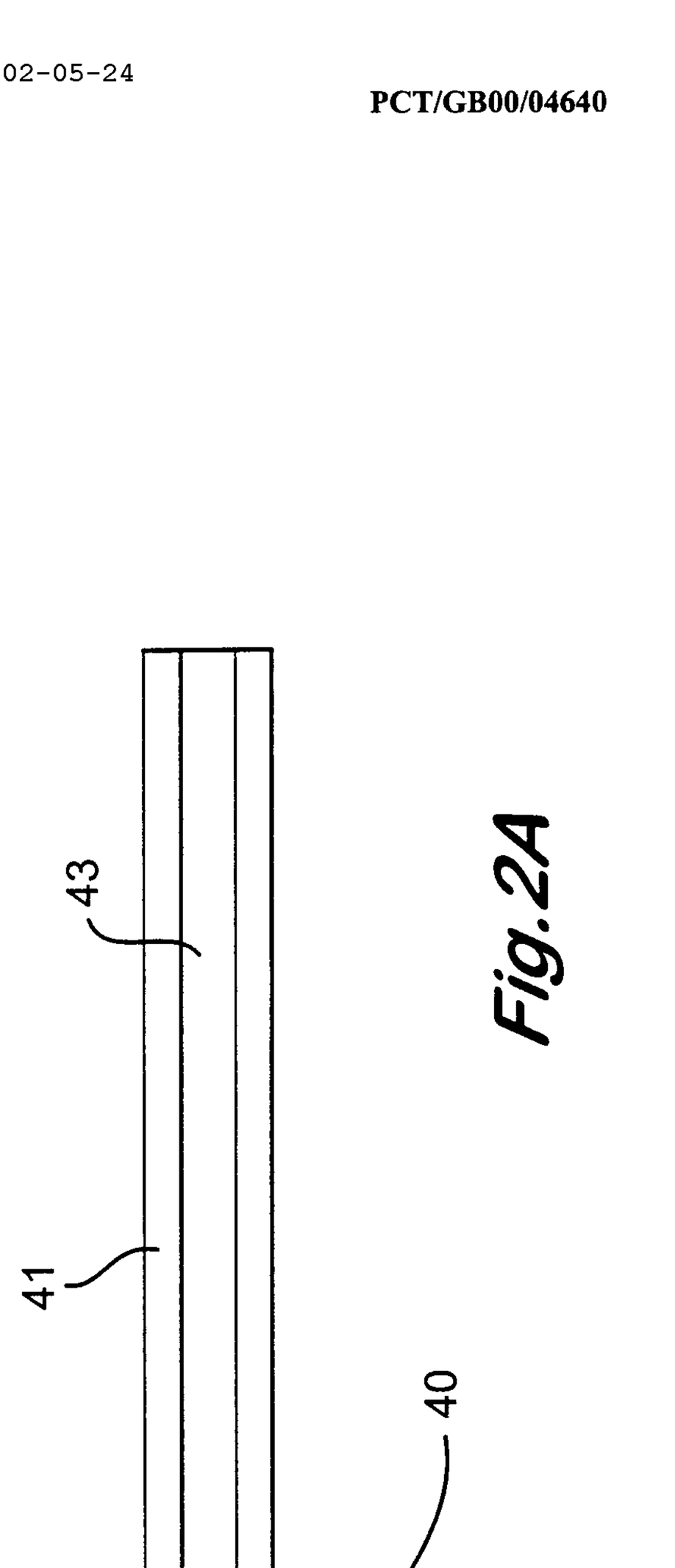
43
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Fig. 2A

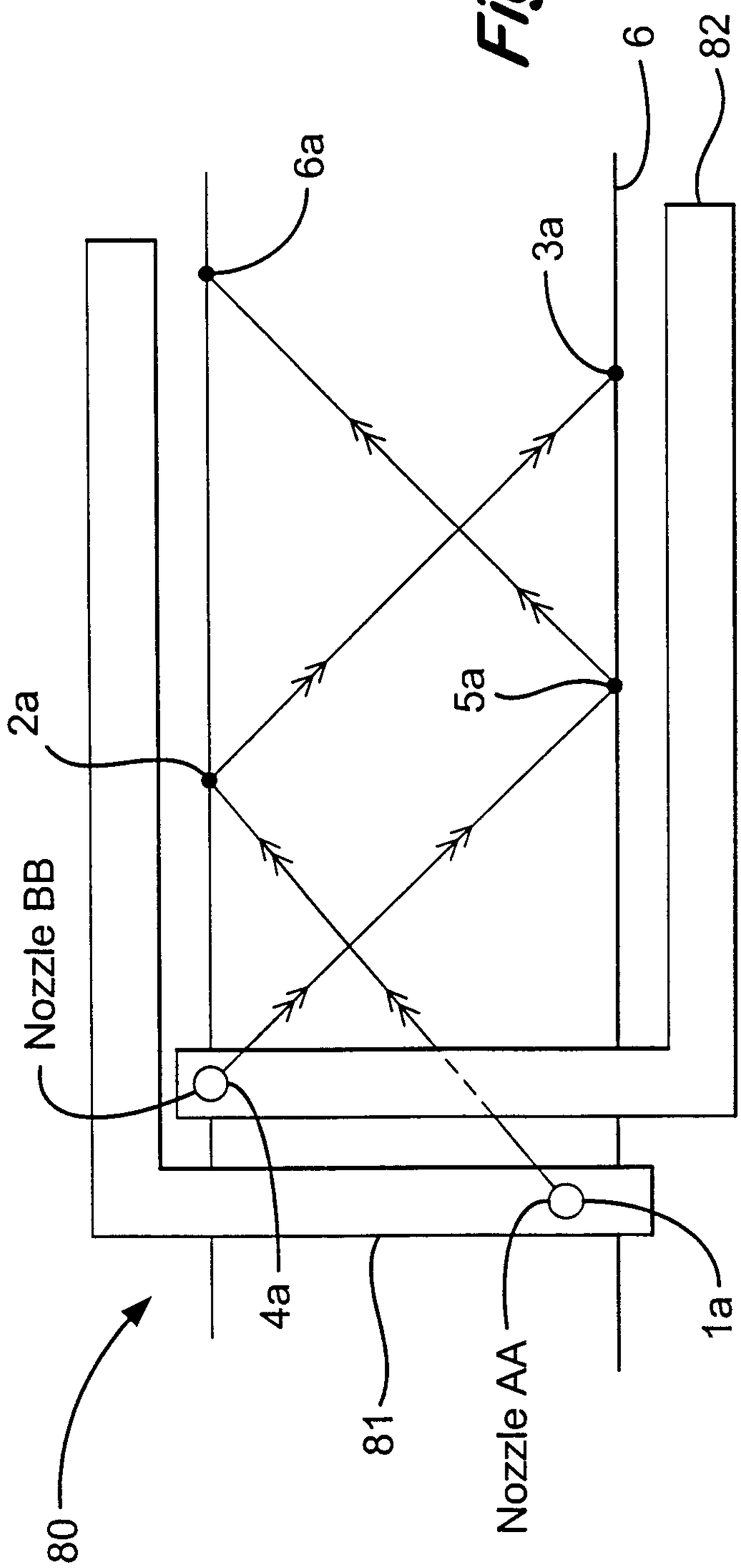
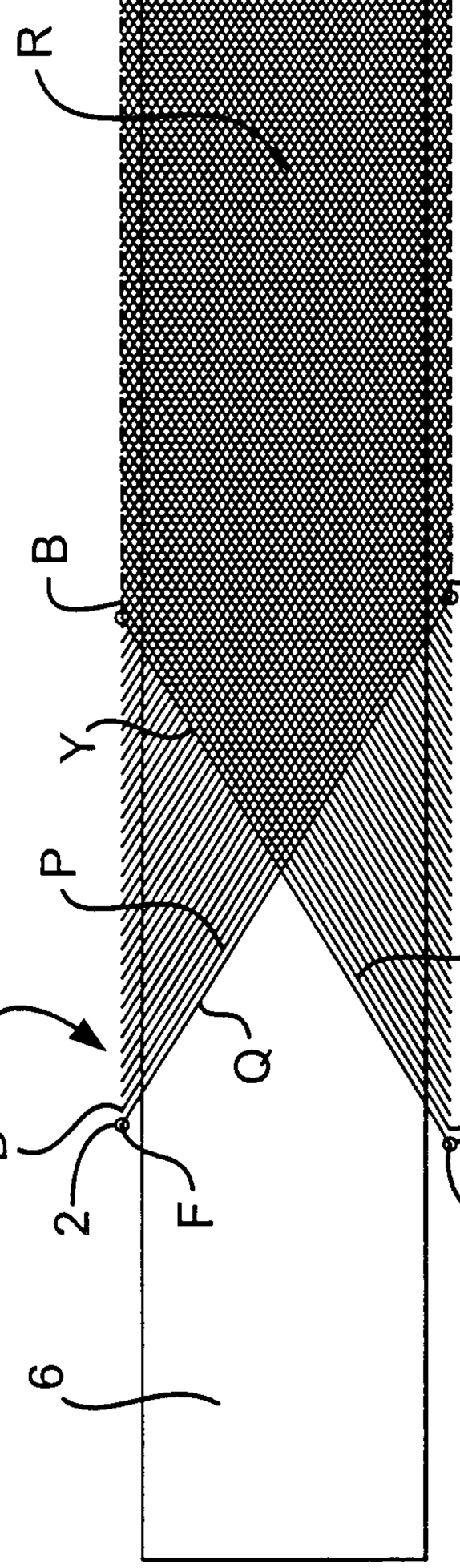

80
4a
81
Nozzle AA
1a
Nozzle BB
2a
5a
3a
6a
6
82

Fig.2B


R
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E
Y
P
X
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50
A
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C
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6

Fig.3

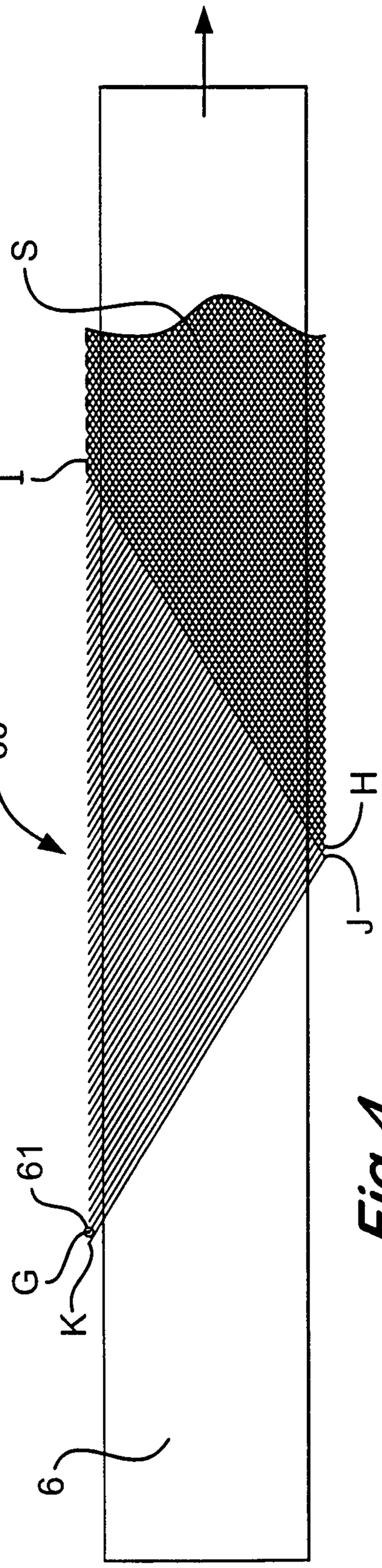


Fig.4

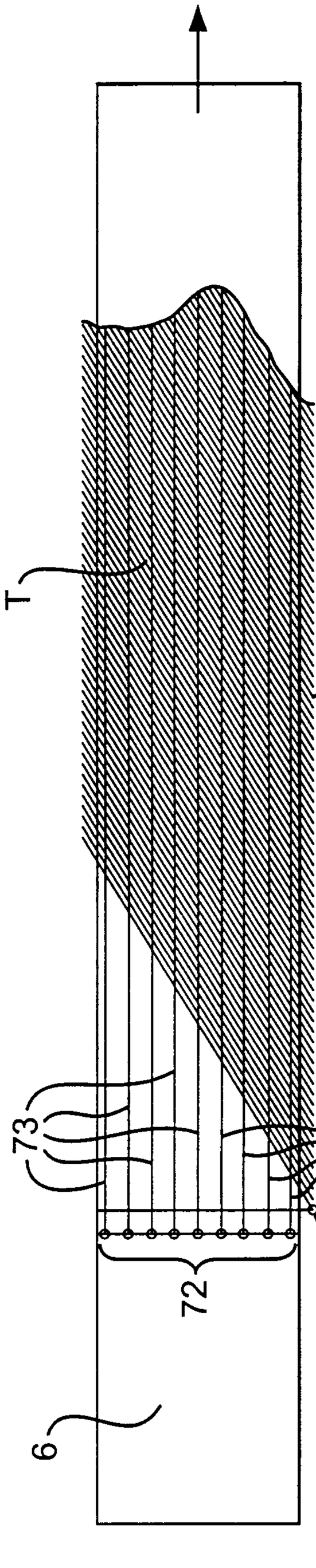


Fig.5

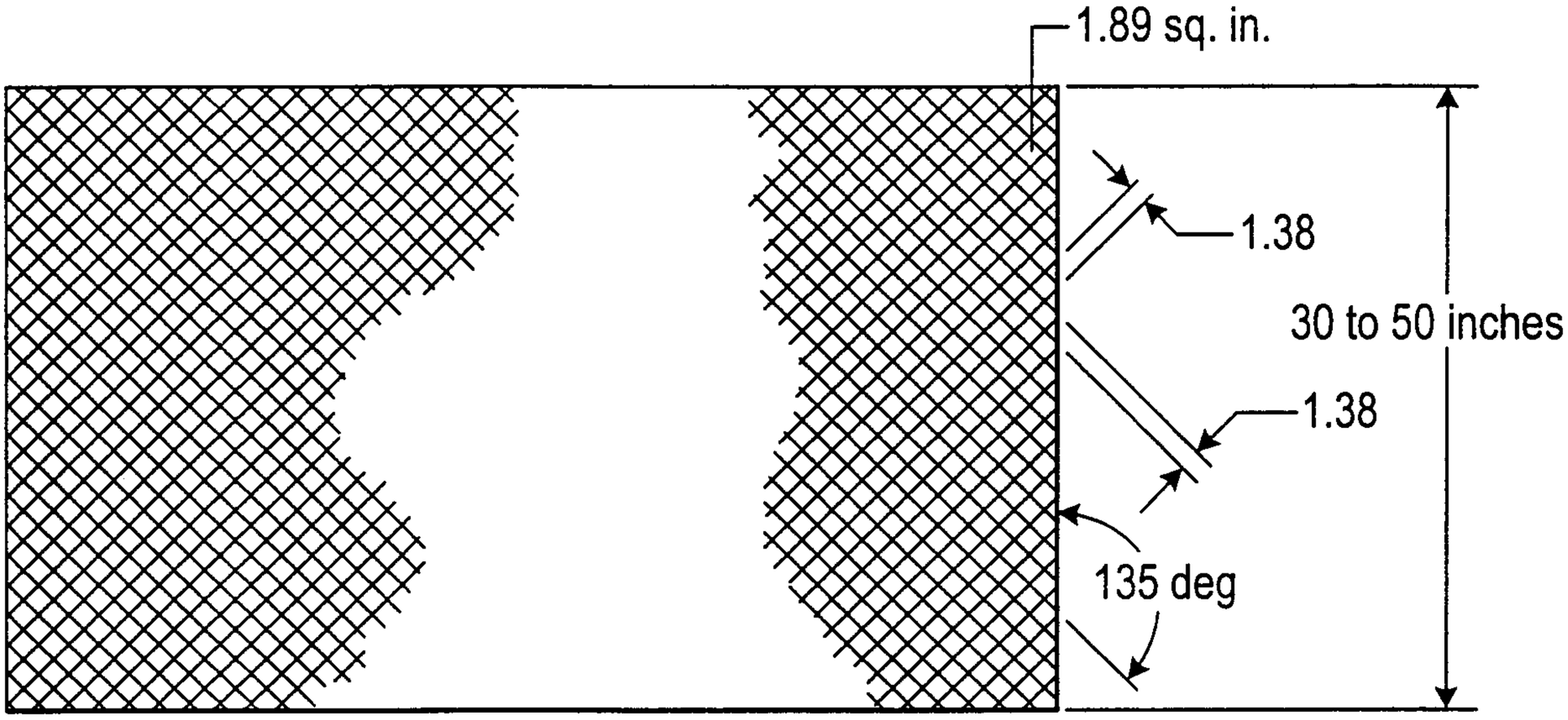

1.89 sq. in.
1.38
30 to 50 inches
1.38
135 deg

Fig. 6A

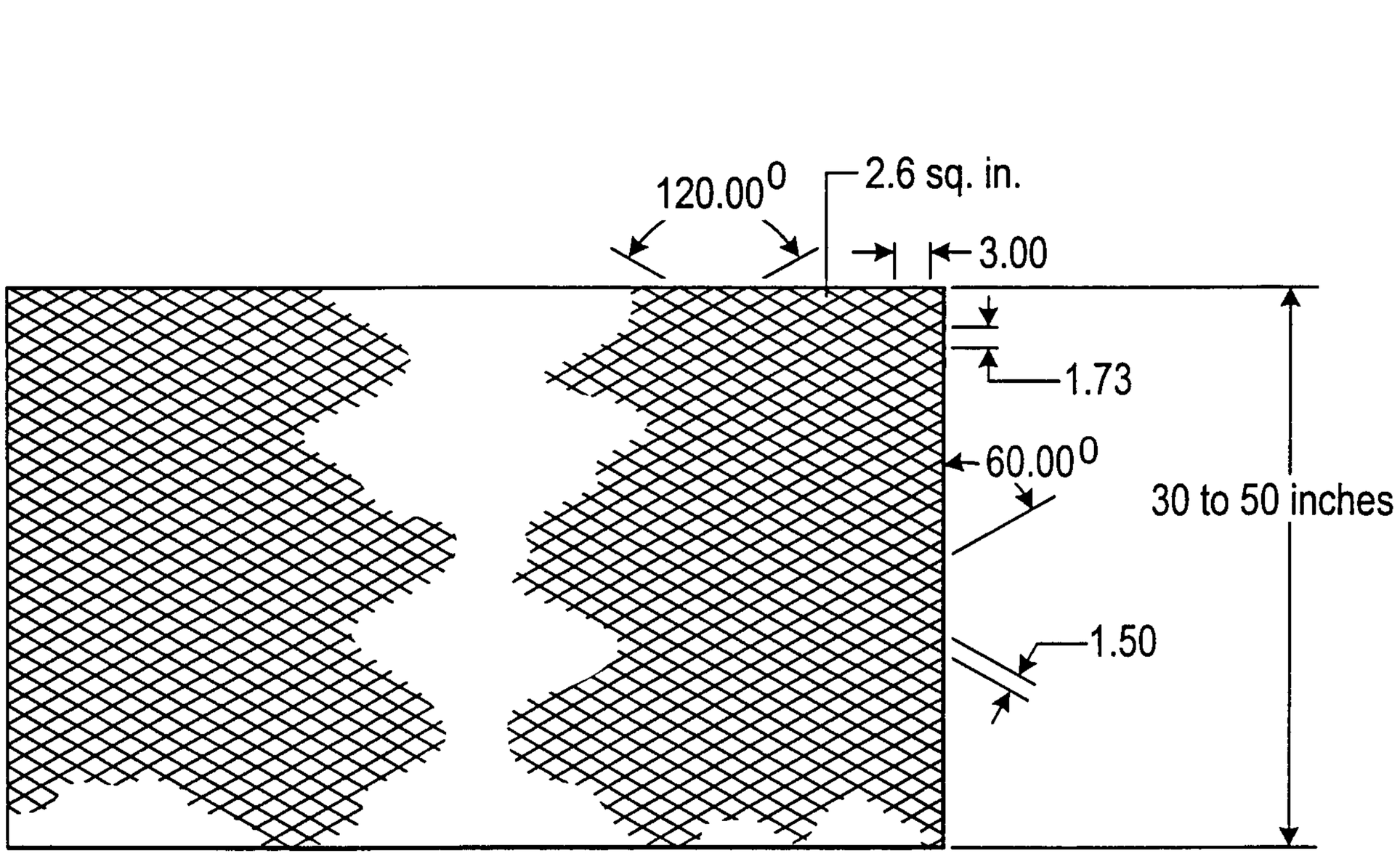

120.00°
2.6 sq. in.
3.00
1.73
60.00°
30 to 50 inches
1.50

Fig. 6B

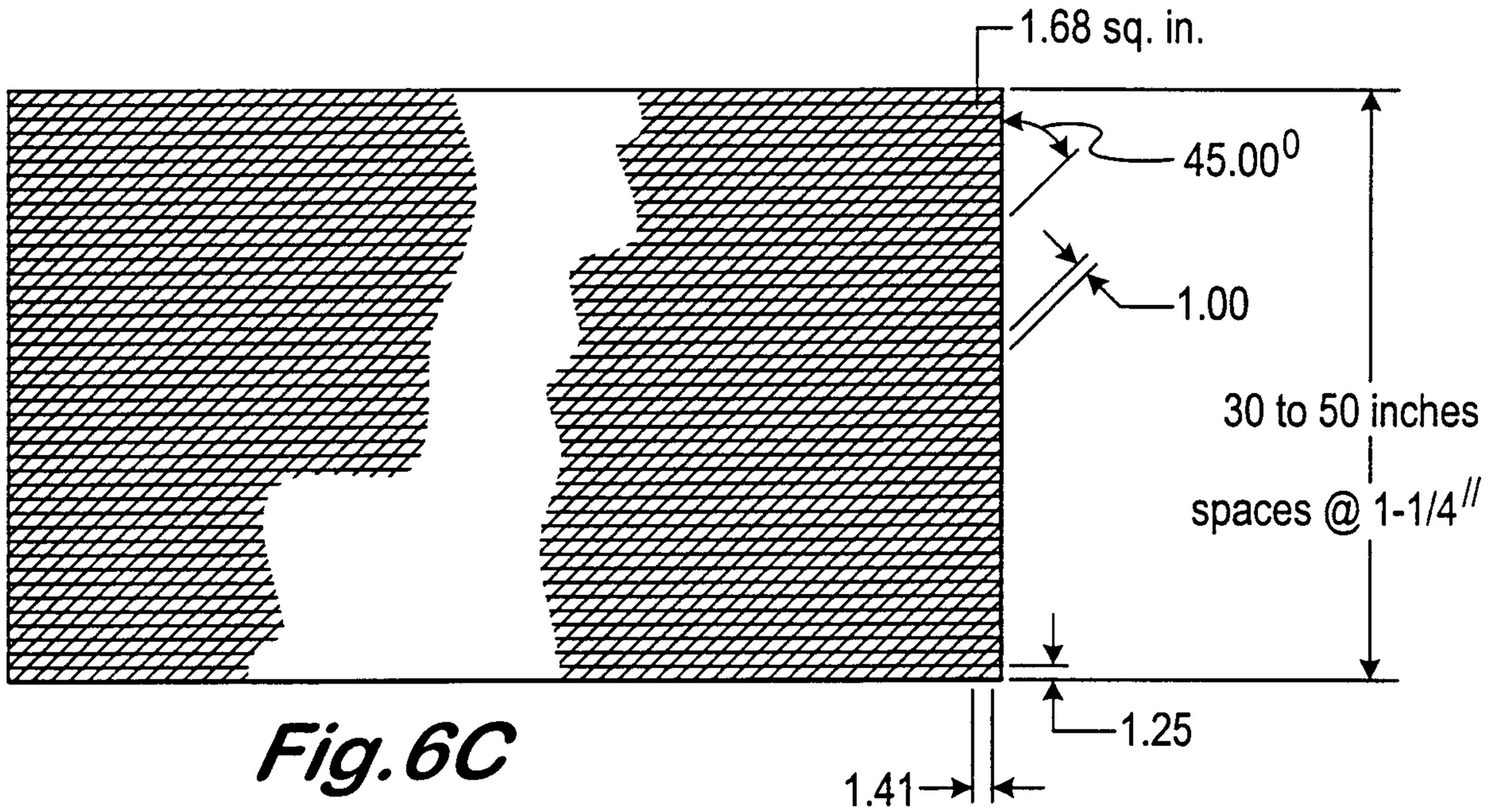

1.68 sq. in.
45.00°
1.00
30 to 50 inches
spaces @ 1-1/4"
1.25
1.41

Fig.6C

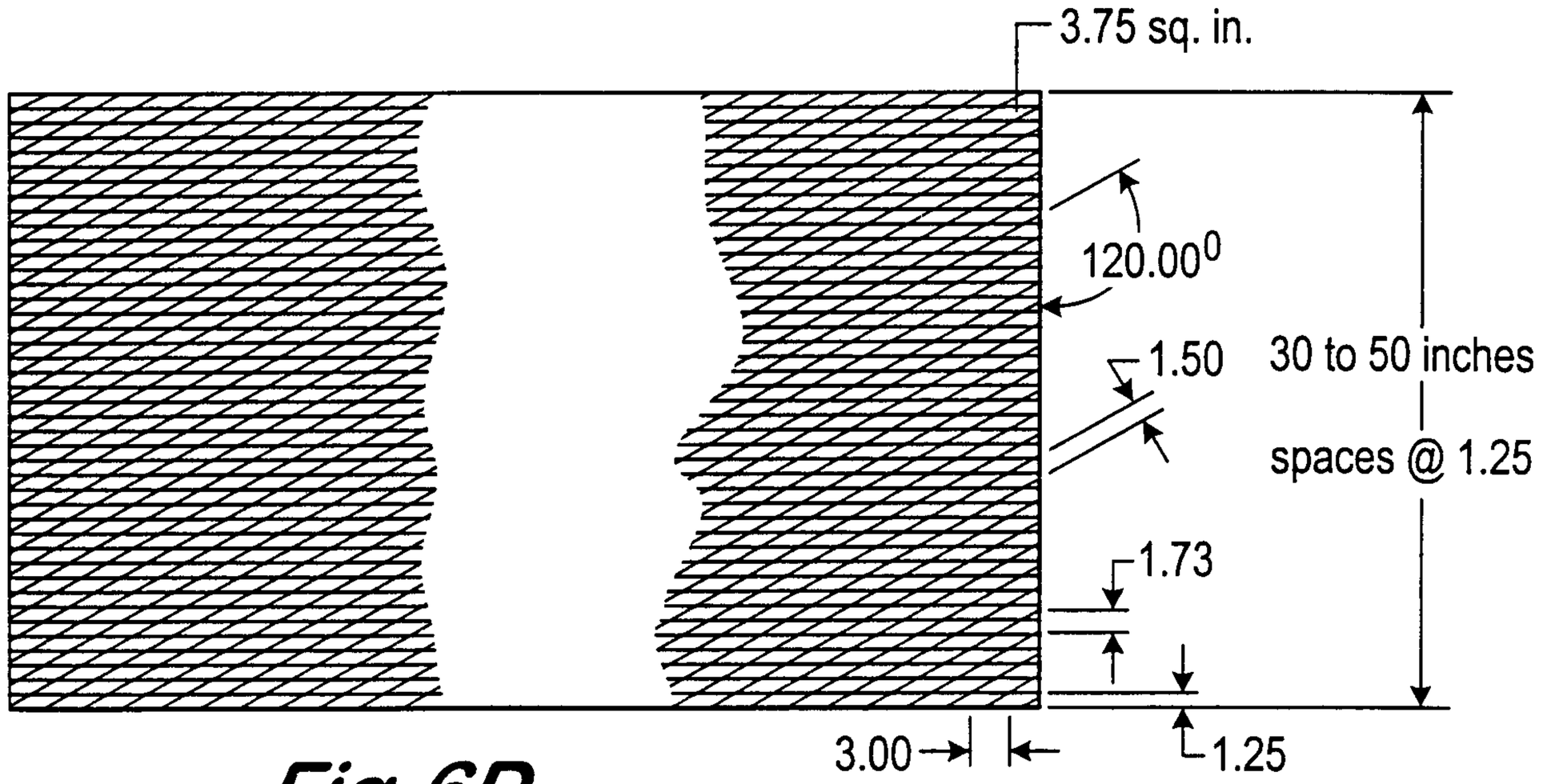
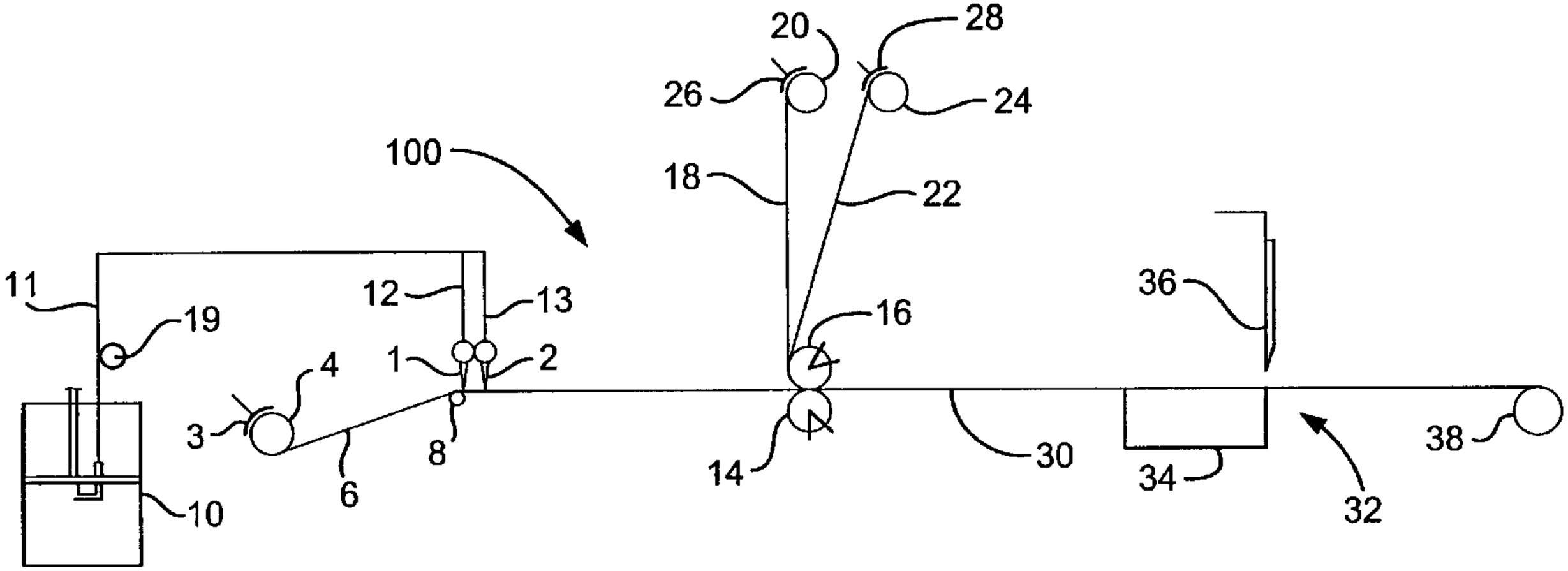

3.75 sq. in.
120.00°
1.50
30 to 50 inches
spaces @ 1.25
1.73
3.00
1.25

Fig.6D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