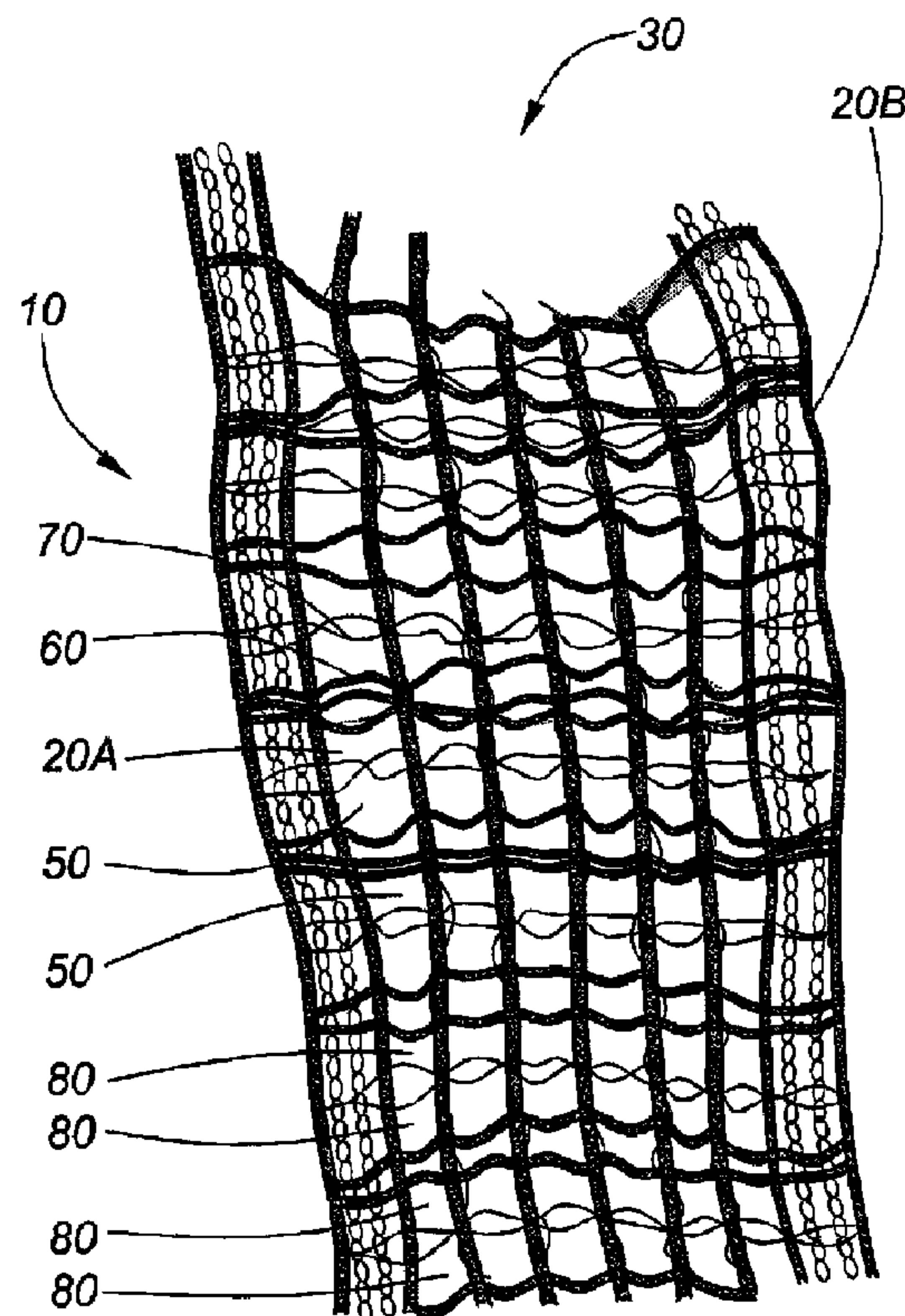




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(57) Abrégé/Abstract:

Methods and devices related to an improved mussel sock. The improved mussel sock is a mesh of cells constructed from strands of a first material such as polypropylene. Strands of a second material, with weaker mechanical properties than the first material such as cotton, are woven through the mesh so as to divide each cell into at least two sub cells. Once the mussel sock is full of mussels and after prolonged exposure to water, the second material will degrade and eventually give way to the mussel, thereby providing a mussel sock with a larger cell size. The improved mussel sock also has reinforced sides and are cut to predetermined lengths. One end of the predetermined length mussel socks are reinforcedly sewn shut to provide a ready to-use sock for the mussel farmer.



Abstract

Methods and devices related to an improved mussel sock. The improved mussel sock is a mesh of cells constructed from strands of a first material such as polypropylene. Strands of a second material, with weaker mechanical properties than the first material such as cotton, are woven through the mesh so as to divide each cell into at least two sub cells. Once the mussel sock is full of mussels and after prolonged exposure to water, the second material will degrade and eventually give way to the mussel, thereby providing a mussel sock with a larger cell size. The improved mussel sock also has reinforced sides and are cut to predetermined lengths. One end of the predetermined length mussel socks are reinforcedly sewn shut to provide a ready-to-use sock for the mussel farmer.

MUSSEL SOCK

Field of the Invention

The present invention relates to aquaculture and, more specifically
5 concerns but is not limited to methods and devices relating to a sock for use in mussel farming.

Background to the Invention

The field of aquaculture is growing as more and more people farm sea
10 creatures for sale on the world market. One area of aquaculture that has seen an increase in not only demand but also in the technology used in mussel farming.

Mussel farming involves growing baby mussels (referred to as mussel
"seeds") and then placing the mussel seed into a tubular/cylindrical mussel sock
15 that is immersed in water. The mussel sock keeps the mussel seeds together and, as the seeds grow, they push out of the mussel sock and attach themselves to the outside of the sock. Current mussel socks are composed of a mesh of cells through which mussels can push through. Socks also have different sizes based on the cell growing size with smaller seeds needing to be place in smaller
20 sized socks so that the seeds do not fall out of the sock.

One disadvantage that current socks suffer from is that, with fixed cell
sizes, some mussels that grow faster than expected are unable to push out of the sock. While one solution would be to place the mussel seed in socks with a
larger cell size, this will preclude the placement of smaller mussel seeds in the
25 same sock as the smaller seeds may fall out.

Another disadvantage of current mussel socks is the need for manual
labour to tie off the ends of the socks. Currently, socks are sold in rolls with the
end user cutting lengths of sock for their use and tying off one end and feeding
seeds into the socks at the other end of the cylindrical socks. Clearly, this is time
30 consuming and can lead to lost seeds if the knot tied is not secure. Current high

speed socking tables (automatic sock filling machines) would be better served if there was no requirement to manually tie off one of the ends of the sock.

A third disadvantage relates to the manufacturing method for the sock. The two walls of meshes that make up the sock are attached to each other at their longitudinal sides. This attachment can give away as the mussel seeds
5 grow, leading to lost mussels and, thereby, lost revenue for the mussel farmer.

It is therefore an object of the present invention to at least mitigate if not overcome the shortcoming of the prior art.

10 Summary of the Invention

The present invention provides methods and devices related to an improved mussel sock. The improved mussel sock is a mesh of cells constructed from strands of a first material such as polypropylene. Strands of a second material, with weaker mechanical properties than the first material such
15 as cotton, are woven through the mesh so as to divide each cell into at least two sub cells. Once the mussel sock is full of mussels and after prolonged exposure to water, the second material will degrade and eventually give way to the mussel, thereby providing a mussel sock with a larger cell size. The improved mussel sock also has reinforced sides and are cut to predetermined lengths. One end of
20 the predetermined length mussel socks are reinforcedly sewn shut to provide a ready-to-use sock for the mussel farmer.

More specifically, the first aspect of the invention provides a tubular sock for use in cultivating mussels, the mussel sock comprising two elongated walls each wall having two longitudinal sides and two latitudinal ends, said two walls
25 being joined to one another at each longitudinal side, each longitudinal side of one wall being reinforcedly attached to a longitudinal side of the other wall, one latitudinal end of one wall being reinforcedly attached to a latitudinal end of the other wall, each wall being constructed to form a mesh of cells, each cell being formed from strands of a first material, each cell being divided into at least two
30 subcells by strands of a second material interwoven with said first material, said second material being mechanically weaker than said first material.

According to a second aspect of this invention, there is provided a method

of manufacturing a mussel sock for use in aquaculture, the method comprising: providing two walls for use in said sock, each wall being a mesh of cells, each cell being formed from strands of a first material, each wall having two longitudinal sides and two latitudinal ends; weaving at least one strand of a second material through each cell thereby subdividing each cell into at least two subcells; attaching each longitudinal side of one wall to a corresponding longitudinal side of the other wall to form a tube; reinforcing each attachment of corresponding longitudinal sides; measuring a predetermined length of said tube and latitudinally cutting said tube to result in a predetermined length of tube with openings at two latitudinal ends wherein said second material is mechanically weaker than said first material; attaching one latitudinal end of one wall to a corresponding latitudinal end of the other wall.

Yet a further aspect of the invention provides, a tubular mussel sock for use in cultivating mussels, the mussel sock comprising two elongated walls each wall having two longitudinal sides, said two walls being joined to one another at each longitudinal side, each longitudinal side of one wall being reinforcedly attached to a longitudinal side of the other wall, each wall being constructed to form a mesh of cells, each cell being formed from strands of a first material, each cell being divided into at least two subcells by strands of a second material interwoven with said first material, said second material being mechanically weaker than said first material, wherein each longitudinal side has a reinforcing band for reinforcedly attaching said two walls.

A further aspect provides, a method of manufacturing a mussel sock for use in aquaculture, the method comprising: providing two walls for use in said sock, each wall being a mesh of cells, each cell being formed from strands of a first material, each wall having two longitudinal sides and two latitudinal ends; weaving at least one strand of a second material through each cell to thereby subdivide each cell into at least two subcells; attaching each longitudinal side of one wall to a corresponding longitudinal side of the other wall to form a tube; and reinforcing each attachment of corresponding longitudinal sides by using a reinforcing band at each longitudinal side, wherein said second material is mechanically weaker than said first material.

Brief Description of the Drawings

A better understanding of the invention will be obtained by considering the detailed description below, with reference to the following drawings in which:

Figure 1 illustrates a portion of an improved mussel sock according to the invention;

Figure 2 illustrates a flattened side view of the sock of Figure 1;

Figure 3 illustrates the sealed latitudinal ends of the sock of Figure 1.

Detailed Description

Referring to Figure 1, a portion of an improved mussel sock (10) is illustrated. The mussel sock (10) has two longitudinal sides (20A), (20B) and two latitudinal ends (30) of which only one is illustrated in Figure 1. Two walls (40A), (40B) are seen in Figure 2, a flattened side view of the mussel sock (10). These two walls (40A), (40B), of the sock (10) are each a mesh of cells (50) formed from strands (60) of a first material. Strands (70) of a second material (70) are woven through each cell (50) to divide each cell (50) into subcells (80). As can be seen in Figures 1 and 2, cells may be separated by more than one strand of the first material and subcells may be determined by more than one strand of the second material. The two walls, between them, provide a tubular sock such that

mussel seeds may be inserted in the sock in a conventional manner.

As can be seen from the figures, the cells are all of the same shape. In the figures, the cells are approximately of a rectangular shape. Depending on the size of the mussels being grown and the needs of the end user, the cell shape may be different. Square shaped cells may also be use as well as hexagonal shaped cells. However, square or rectangular shaped cells have provided the best results.

The design of the mussel sock allows the cells to stay a fixed shape even after the mussels have migrated to the outside of the sock. Each cell is formed by weaving strands of the first material widthwise (latitudinal direction) across the sock and, at each intersection between the strands of the first material and the lengthwise supporting strands, also constructed of the first material, the two are woven and/or sewn together. This has the effect of preventing the cell shape from overly deforming when laden with mussel seeds and/or mussels. The cell sizes (and cell shape) are therefore fixed and, with a fixed number of cells per sock area, the quantity of mussels per meter of sock is controllably fixed. The increased number of strands of the first material and the lengthwise supporting strands also provides an increased surface area to which the migrating mussels can latch on.

The two materials used to construct the mesh of cells and subcells are to be selected for differing characteristics. The first material should be selected for durability and mechanical strength even after prolonged exposure and immersion in salt or fresh water. It should also be chosen for lightness and, preferably, for an ability to be easily woven or sewn. The reasoning behind these characteristics is that the first material will form the basis for the sock that will hold the mussels together as they grow underwater. Since the sock will be submerged underwater for as long as a year if not two years, mechanical strength to hold the growing mussels is required for the first material. Since most mussel socks are currently constructed using automatic mechanical weaving techniques, it would be advantageous if the first material, as strands, could be easily woven or sewn. Much success has been achieved using the plastic polypropylene as the first material. As an alternative, polyethylene may also be

used as the first material.

For the second material, mechanical strength is not as important as for the first material. Since the subcells formed by the second material need only hold in the mussel seeds and not the larger or nearly full grown mussels, the mechanical strength of the second material need not be that high. In fact, less mechanical strength than the first material is advantageous as the strands of second material forming the subcells are meant to break and/or dissolve to provide a larger cell size for the sock. However, the strands of second material should only break and/or dissolve after prolonged exposure of immersion in salt or fresh water. This is because these strands of second material should dissolve only after the mussel seeds have had a chance to attach themselves to the first material of the sock's construction. Typically, the mussel seeds attach to the first material within the first few days after the mussel seed laden sock is placed in the water. Once the strands of second material have fallen away, the now mussels, now attached to the first material of the cells through the mussel's byssal threads, can slip, push, and pull through the resultant larger cell size and thereby migrate itself to the outside of the sock. As with the first material, it is preferred that the second material be easily weavable or sewable with the first material. Experimentation has shown that cotton is suitable for use as the second material. Strands of cotton, in the form of cotton thread has been found to have the necessary characteristics for use in the improved mussel sock.

As an alternative to cotton for the second material, a polyester/cotton blend of material may be used. While such a second material may not dissolve after prolonged exposure to water, due to the presence of the polyester, the polyester/cotton strands of material should be sufficiently weakened by the exposure to water that the mussels can break the strands as they migrate to the outside of the sock.

As a further improvement to the mussel sock, the two walls are reinforcedly attached to one another by reinforcedly attaching their longitudinal (or lengthwise) sides together. The longitudinal sides of the two walls can be attached by being woven or sewn together (as shown in Figure 1) or by any other convenient means. However, to reinforce the attachment between the two

longitudinal sides of the walls, sewing or weaving them multiple times has been formed to be advantageous. If polypropylene or some other plastic material (such as polyethylene) is used as the first material, heat sealing or heat attachment by melting the polypropylene strands will also provide the required reinforcement at the sides. From Figure 1, it should be clear that the reinforcement can be done to both longitudinal sides of the sock but, if the user desires, it is also possible to reinforce only one longitudinal side.

As can be seen from Figures 1 and 3, the longitudinal sides have reinforcing bands with reinforcing strips within the bands. The reinforcing strips have a chain-like structure. There may be differing numbers of reinforcing strips in each reinforcing band. In Figure 1, there are two reinforcing strips per band but in Figure 3 there are either three or four reinforcing strips per reinforcing band.

As can also be seen from Figure 1, reinforcing strands of material may be incorporated in the longitudinal strands of the first material. These reinforcing strands of material may be wound helically around the longitudinal strands of the first material.

To save the mussel farmer time and effort when using the improved mussel sock, the sock may be cut to predetermined lengths and the bottom end or one of the latitudinal ends (widthwise ends) may be sealed. Referring to Figure 3, an illustration of the sealed latitudinal ends is provided. This sealing is accomplished by folding over a portion of the latitudinal ends of the two walls and then sewing or weaving the folded over ends. As with the reinforced longitudinal sides, if polypropylene or some other suitable plastic is employed as the first material heat sealing may also be used to attach the two latitudinal ends. While folding over the ends and sewing them together has been the preferred method of sealing the latitudinal ends, the folding over step is not necessary. Other means of sealing the latitudinal ends are also possible. The predetermined length of the mussel sock may vary and may depend on the specific end user's requirements.

The mussel sock can be assembled using conventional techniques well-known to those skilled in the art. The sock can be woven using conventional

weaving and/or sewing machines known to those skilled in the art. It should be noted that the sealing of the bottom of the sock or the attachment of the two latitudinal ends of the sock may be accomplished after the sock is constructed but prior to delivery to the end consumer. The fully constructed sock, without the attached or sealed off latitudinal ends, may be marketed as a continuous roll. End users may then use such a sock in a conventional manner by cutting the desired lengths and tying off the ends as has previously been done.

It should further be noted that the fixed cell size and fixed cell shape of the improved mussel sock generally subsists for the useful life of the sock. The use of the second material that is mechanically weaker than the first material to divide

the cells into smaller subcells provides ease of manufacture. Previously, different cell sizes were required for different mussel seed sizes. With the use of the second material to subdivide the cells, the subcells are sized smaller than the mussel seed placed in the sock. This eliminates the need for many socks sized
5 differently for seed size. Once the strands of second material have dissolved or disintegrated, the mussel seeds have had time to attach themselves to the cells and can therefore migrate out of the sock. The advantage of this is that the cell size is fixed to one that will allow all mussel seed sizes to migrate out of the sock. As such, the cell size need not be adjusted during the manufacture of the sock
10 but merely the size of the subcells formed by the strands of the second material as outlined above.

A person understanding the invention may now conceive of alternative structures and embodiments or varieties of the above all of which are intended to fall within the scope of the invention as defined in the claims that follow.

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What is claimed is:

1. A tubular mussel sock for use in cultivating mussels, the mussel sock comprising two elongated walls each wall having two longitudinal sides, said two walls being joined to one another at each longitudinal side, each longitudinal side of one wall being reinforcedly attached to a longitudinal side of the other wall, each wall being constructed to form a mesh of cells, each cell being formed from strands of a first material, each cell being divided into at least two subcells by strands of a second material interwoven with said first material, said second material being mechanically weaker than said first material,

wherein each longitudinal side has a reinforcing band for reinforcedly attaching said two walls.

2. A mussel sock according to claim 1 wherein said first material is polypropylene.

3. A mussel sock according to claim 1 wherein said second material is cotton.

4. A mussel sock according to claim 1 wherein said longitudinal end of one wall is sewn to the longitudinal end of the other wall.

5. A mussel sock according to claim 1 wherein said latitudinal end of one wall is sewn to the latitudinal end of the other wall.

6. A mussel sock according to claim 1 wherein said second material is mechanically degraded after prolonged immersion in water.

7. A mussel sock according to claim 1 wherein said sock has a predetermined length.

8. A mussel sock according to claim 1 wherein each cell has an approximate shape selected from a group comprising:

- rectangle
- square
- hexagon.

9. A method of manufacturing a mussel sock for use in aquaculture, the method comprising:

a) providing two walls for use in said sock, each wall being a mesh of cells, each cell being formed from strands of a first material, each wall having two longitudinal sides and two latitudinal ends;

b) weaving at least one strand of a second material through each cell to thereby subdivide each cell into at least two subcells;

c) attaching each longitudinal side of one wall to a corresponding longitudinal side of the other wall to form a tube; and

d) reinforcing each attachment of corresponding longitudinal sides by using a reinforcing band at each longitudinal side,

wherein said second material is mechanically weaker than said first material.

10. A method according to claim 9 wherein each cell has an approximate shape selected from a group comprising:

- rectangle
- square
- hexagon.

11. A method according to claim 9 wherein said longitudinal sides are attached to each other by sewing.

12. A method according to claim 9 wherein each reinforcing band has at least one reinforcing strip.

13. A method according to claim 9 wherein said first material is polypropylene.

14. A method according to claim 9 wherein said second material is cotton.

5 15. A mussel sock according to claim 1 wherein the first material is polyethylene.

16. A mussel sock according to claim 1 wherein the second material is a polyester/cotton blend.

10 17. A method according to claim 9 wherein said first material is polyethylene.

18. A method according to claim 9 wherein said second material is a polyester/cotton blend.

15 19. A mussel sock according to claim 1 wherein each reinforcing band has at least one reinforcing strip.

20 20. A mussel sock according to claim 19 wherein each reinforcing strip has a chain-like structure.

21. A method according to claim 12 wherein each reinforcing strip has a chain-like structure.

25 22. A mussel sock according to claim 1 wherein at least one longitudinal strand of said first material incorporates reinforcing strands.

23. A mussel sock according to claim 22 wherein said reinforcing strands are helically wrapped around said longitudinal strands.

30 24. A method according to claim 9 wherein at least one longitudinal strand of said first material incorporates reinforcing strands.

25. A method according to claim 24 wherein said reinforcing strands are helically wrapped around said longitudinal strands.

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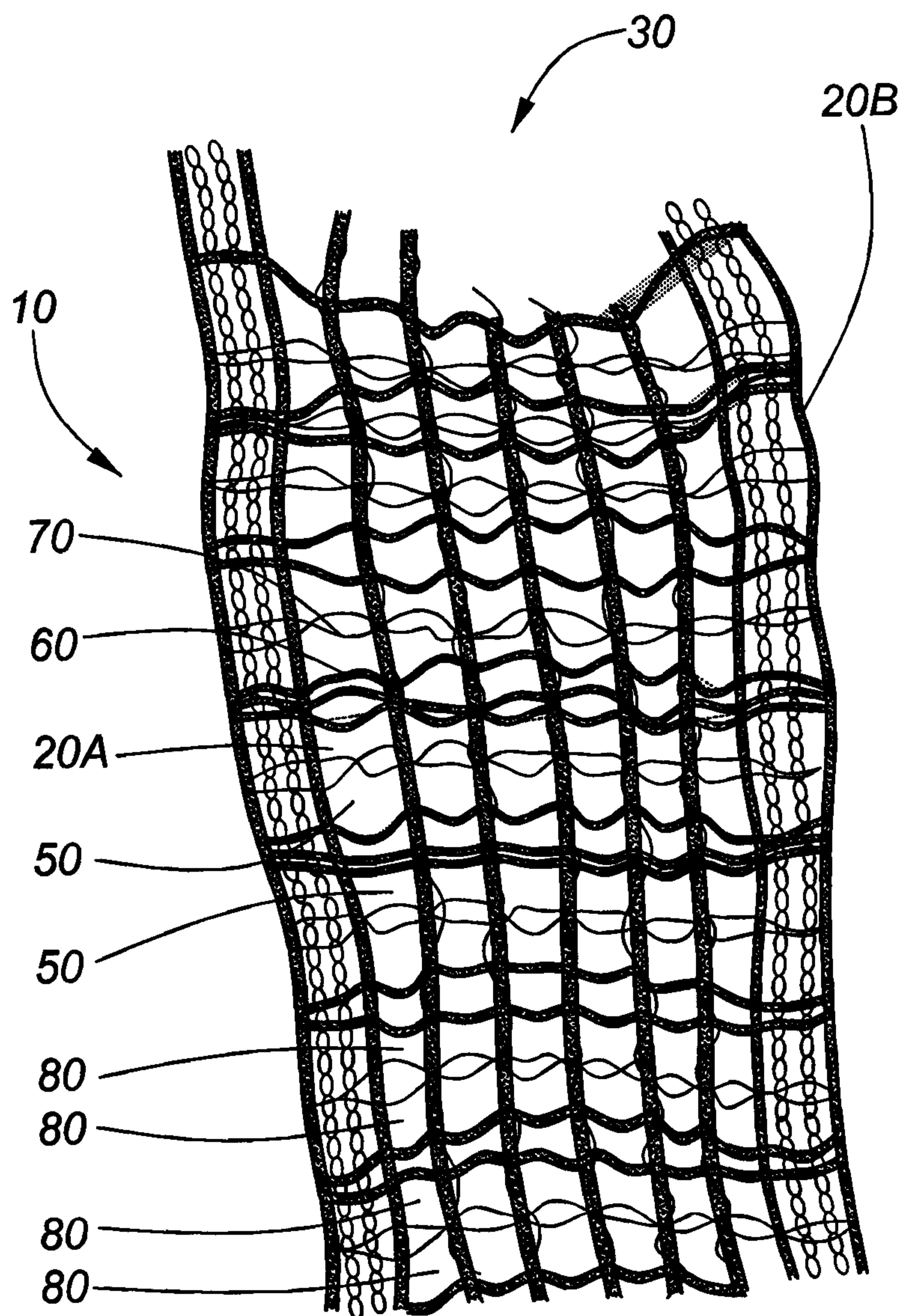


FIG. 1

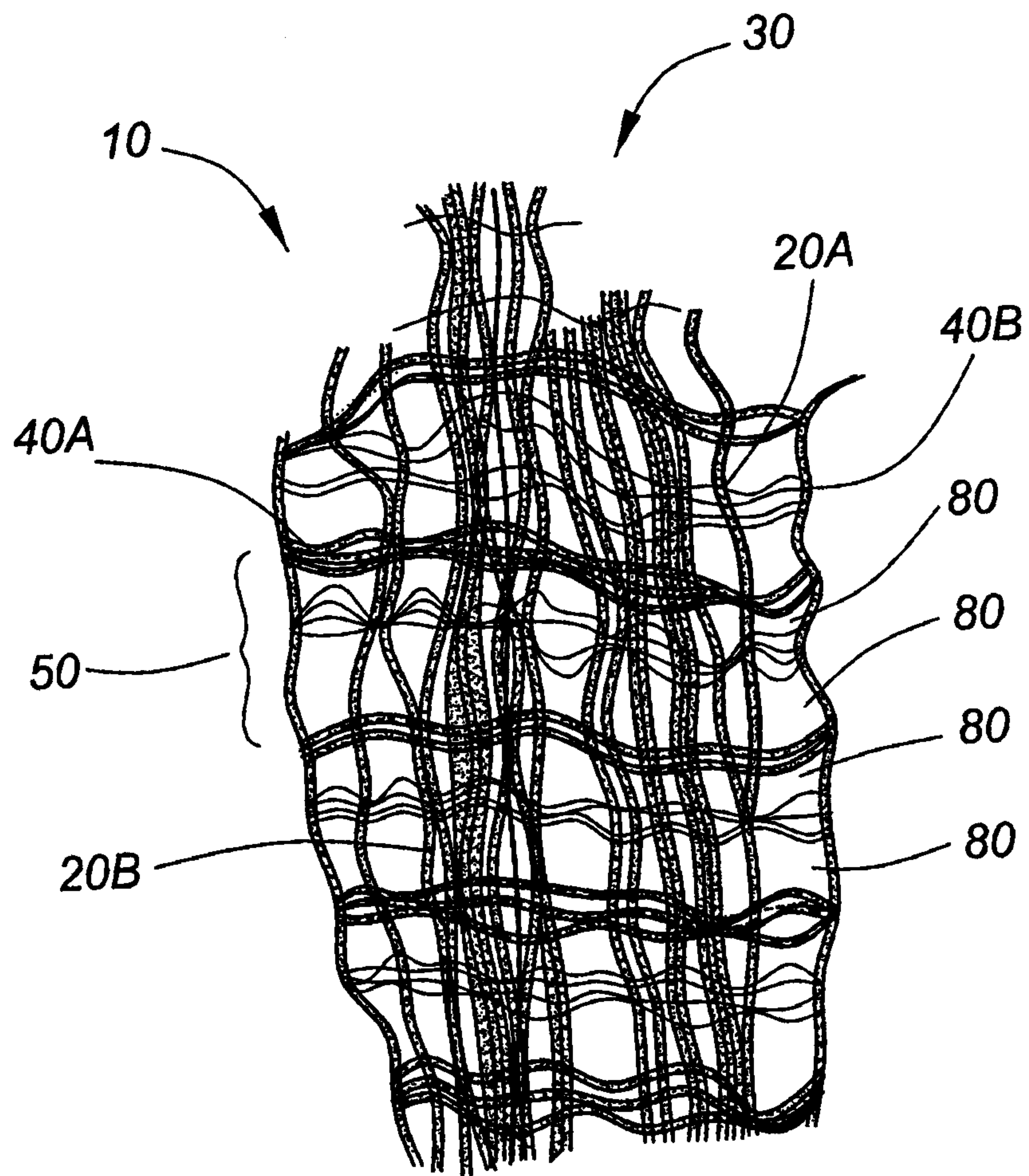


FIG. 2

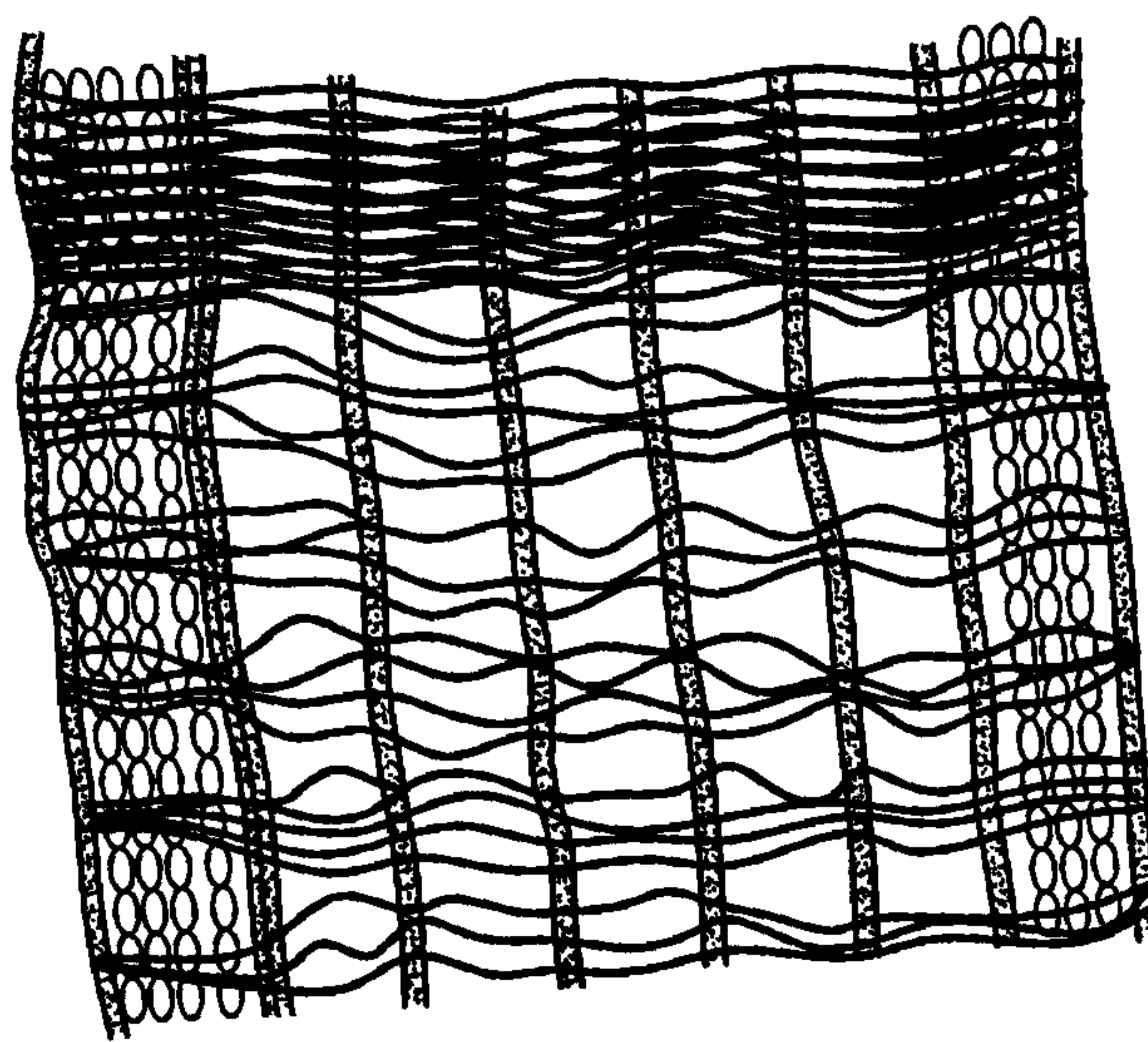


FIG. 3

