(19) DANMARK (10) **DK 2009 00076 L**

(12) PATENTANSØGNING

Patent- og
Varemærkestyrelsen

(51) Int.Cl.[8]: ***F 03 D 1/06 (2006.01)***

(21) Patentansøgning nr: **PA 2009 00076**

(22) Indleveringsdag: **2009-01-19**

(24) Løbedag: **2009-01-19**

(41) Alm. tilgængelig: **2009-08-06**

(30) Prioritet: **2008-02-05 US 12/069.034**

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(54) Benævnelse: **Wind turbine blades and method for forming same**

(57) Sammendrag:

A wind turbine blade (112) is provided. The wind turbine blade includes a root portion (120), a tip portion (122), and an airfoil portion (121) extending radially outward from the root portion to the tip portion. The blade also includes a spar cap (150) extending radially outward from the root portion through at least a portion of the airfoil portion. At least a portion of the spar cap is oriented substantially longitudinally and extends generally linearly from a first end of the spar cap (155) to a second end of the spar cap (157). The blade further includes at least one spar cap extension (158) extending from the spar cap. At least a portion of the spar cap extension is oriented nonlinearly relative to the spar cap.

fortsættes

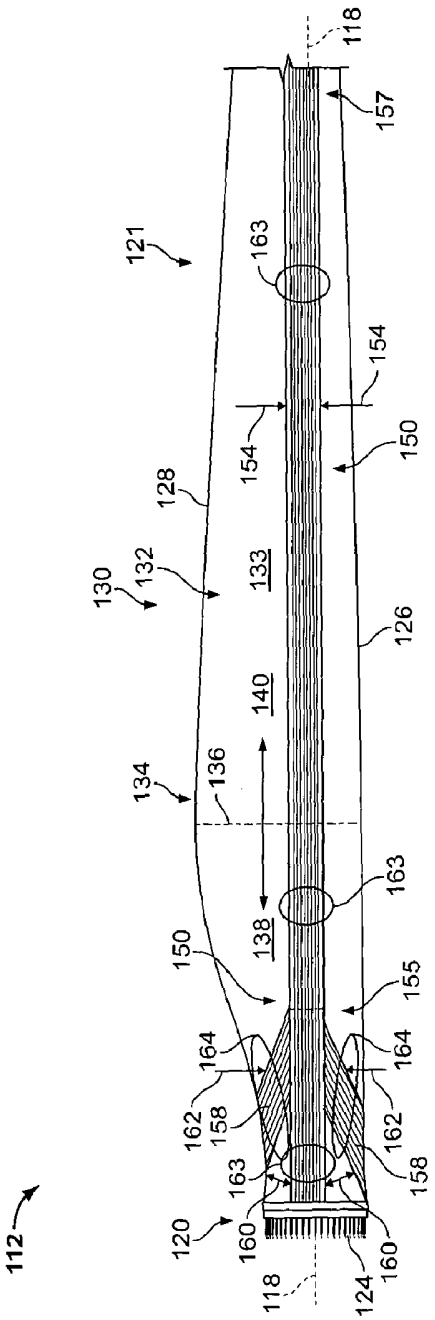
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FIG. 2

WHAT IS CLAIMED IS:

1. A wind turbine blade (112) comprising:

a root portion (120), a tip portion (122), and an airfoil portion (121) extending radially outward from said root portion to said tip portion;

a spar cap (150) extending radially outward from said root portion through at least a portion of said airfoil portion, wherein at least a portion of said spar cap is oriented substantially longitudinally and extends generally linearly from a first end of said spar cap (155) to a second end of said spar cap (157); and

at least one spar cap extension (158) extending from said spar cap, wherein at least a portion of said spar cap extension is oriented nonlinearly relative to said spar cap.

2. A wind turbine blade (112) in accordance with Claim 1 wherein said at least one spar cap extension (158) extends from said spar cap (150) at a predetermined angle (160).

3. A wind turbine blade (112) in accordance with Claim 2 wherein said at least one spar cap extension (158) extends from said spar cap (150) at an angle (160) within a range of approximately 0° to 40°.

4. A wind turbine blade (112) in accordance with Claim 1 wherein said at least one spar cap extension (158) that extends from said spar cap (150) comprises at least one of:

a first plurality of fiber filaments (163), wherein a first portion of said first plurality of fiber filaments is substantially co-linear with said spar cap and a second portion of said first plurality of fiber filaments (164) diverges obliquely from said first portion of said first plurality of fiber filaments; and

a second plurality of fiber filaments (164) that diverge obliquely from said first plurality of fiber elements.

5. A wind turbine blade (112) in accordance with Claim 1 wherein said at least one spar cap extension (158) comprises a plurality of laminated layers (358) comprising at least one first laminated layer (360) and at least one second laminated layer (366), wherein said at least one first laminated layer and at least one second laminated layer at least partially overlap.

6. A wind turbine blade (112) in accordance with Claim 5 wherein said first (460) and second (466) laminated layers are radially staggered.

7. A wind turbine blade (112) in accordance with Claim 1 further comprising at least one of:

a portion of a plurality of fiber filaments formed into a plurality of strands; and

at least a portion of said plurality of strands formed into a plurality of rovings.

8. A wind turbine blade (112) in accordance with Claim 7 wherein at least one of said plurality of fiber filaments, said plurality of strands, and said plurality of rovings have at least one of:

a substantially continuous longitudinal length; and

a substantially unidirectional orientation.

9. A wind turbine blade (112) in accordance with Claim 1 wherein said root portion (120) comprises at least one laminated layer that defines a variable chordal dimension (262) that increases as a function of distance from said airfoil portion (221).

10. A wind turbine system (100) comprising:

a rotatable member (108) rotatably coupled to a load (106); and

at least one wind turbine blade (112) coupled to said rotatable member (108), wherein said blade comprises:

a root portion (120), a tip portion (122), and an airfoil portion (121) extending radially outward from said root portion to said tip portion;

a spar cap (150) extending radially outward from said root portion through at least a portion of said airfoil portion, wherein at least a portion of said spar cap is oriented substantially longitudinally and extends generally linearly from a first end of said spar cap (155) to a second end of said spar cap (157); and

at least one spar cap extension (158) extending from said spar cap, wherein at least a portion of said spar cap extension is oriented nonlinearly relative to said spar cap.

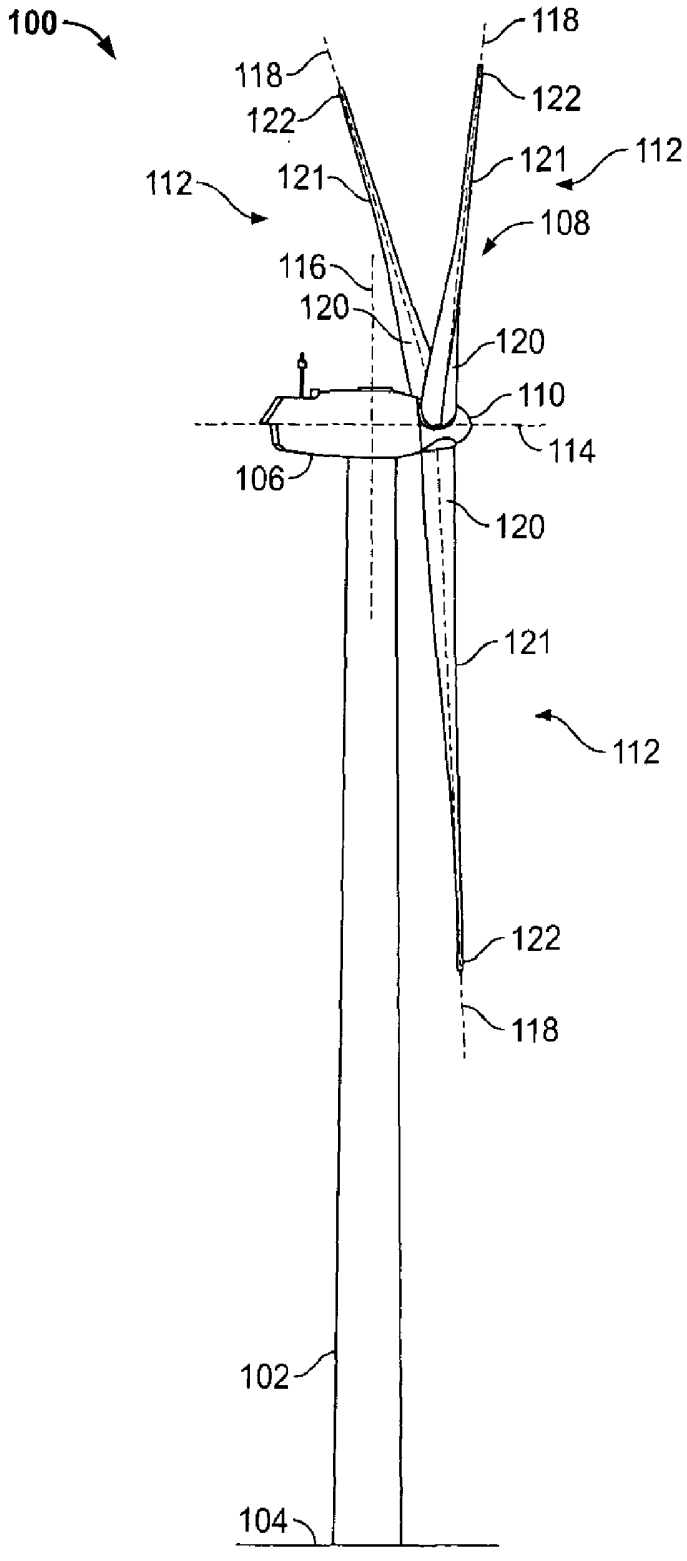
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FIG. 1

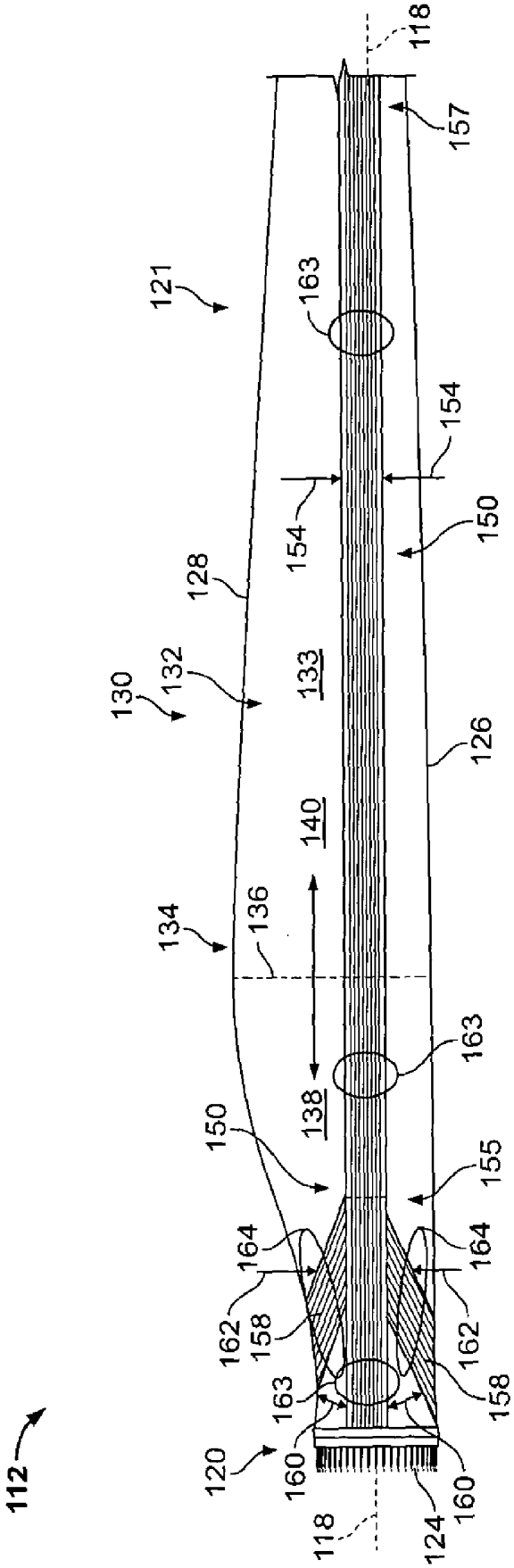
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FIG. 2

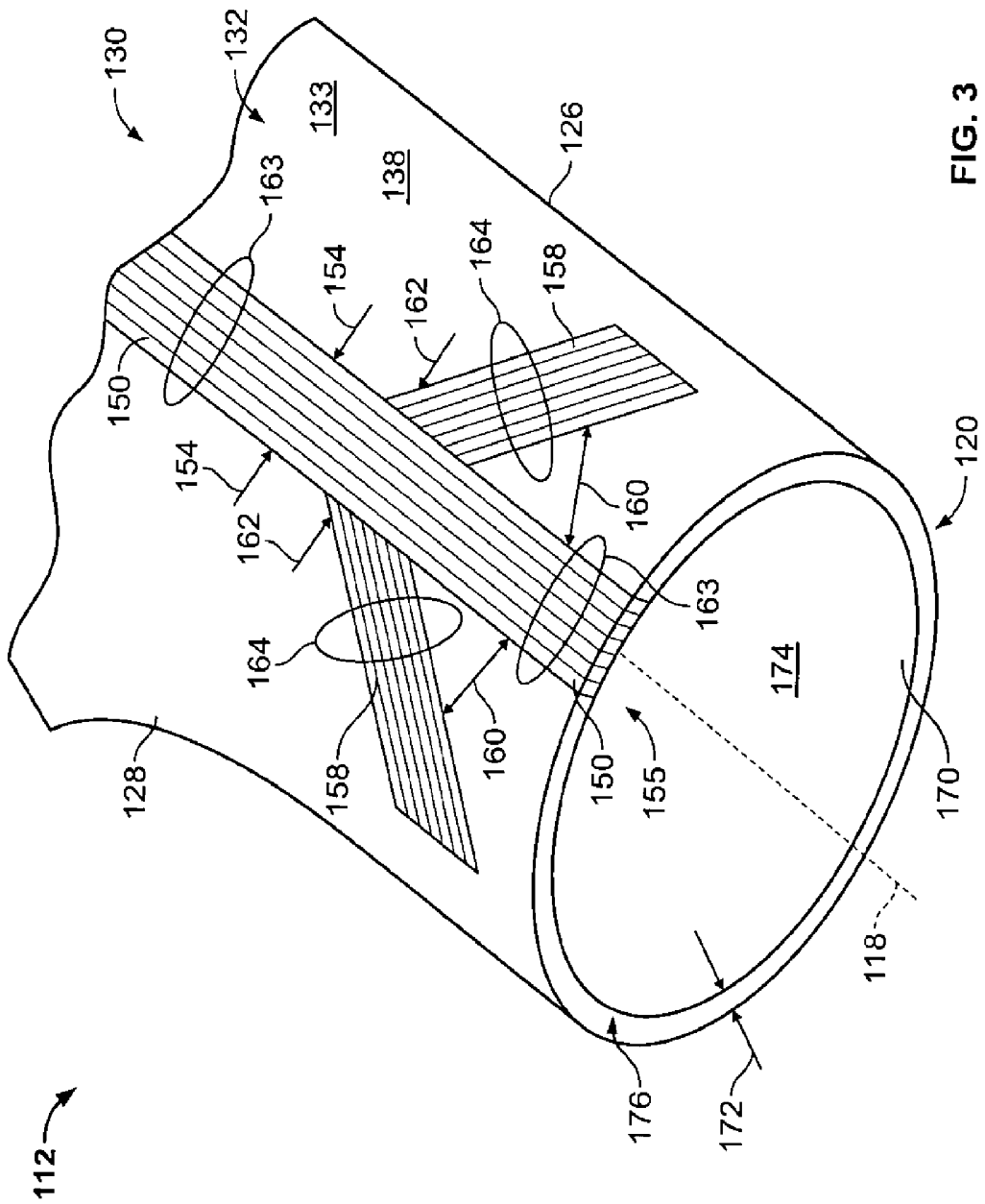
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FIG. 3

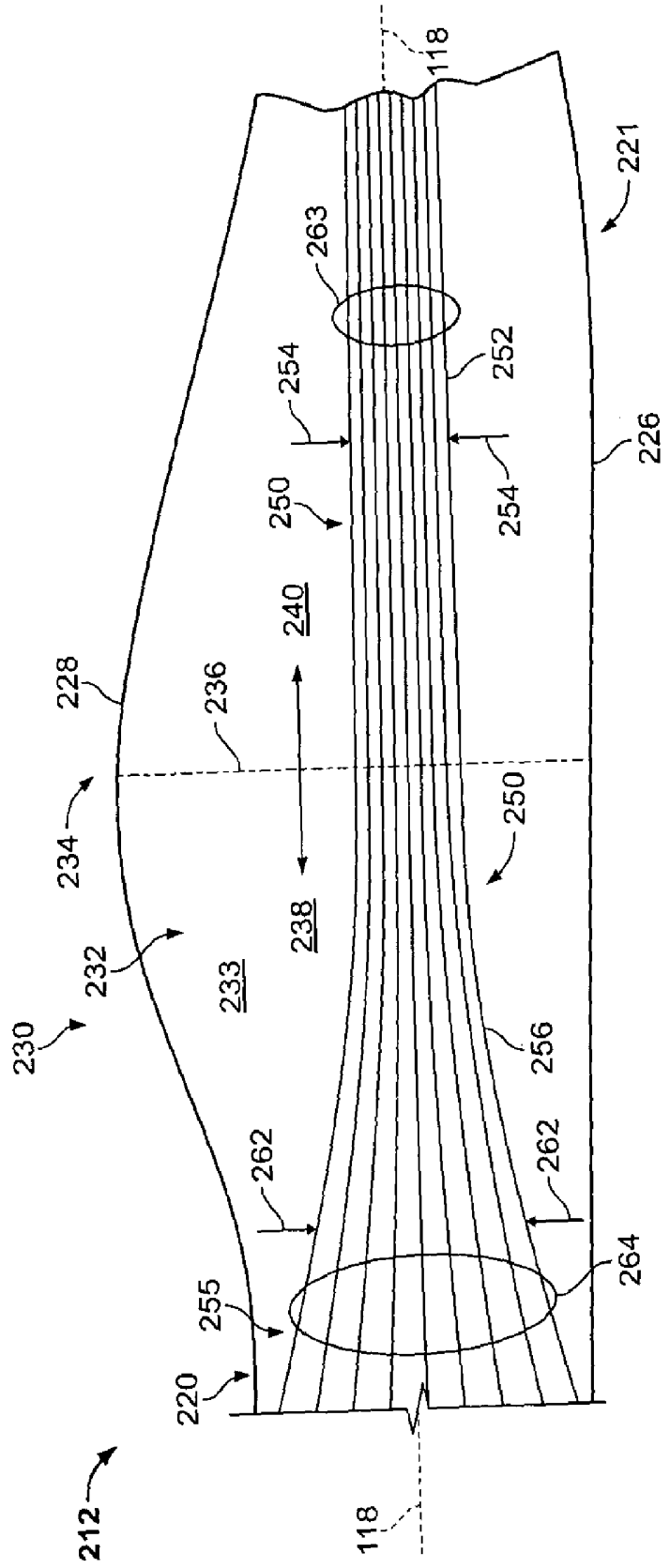
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FIG. 4

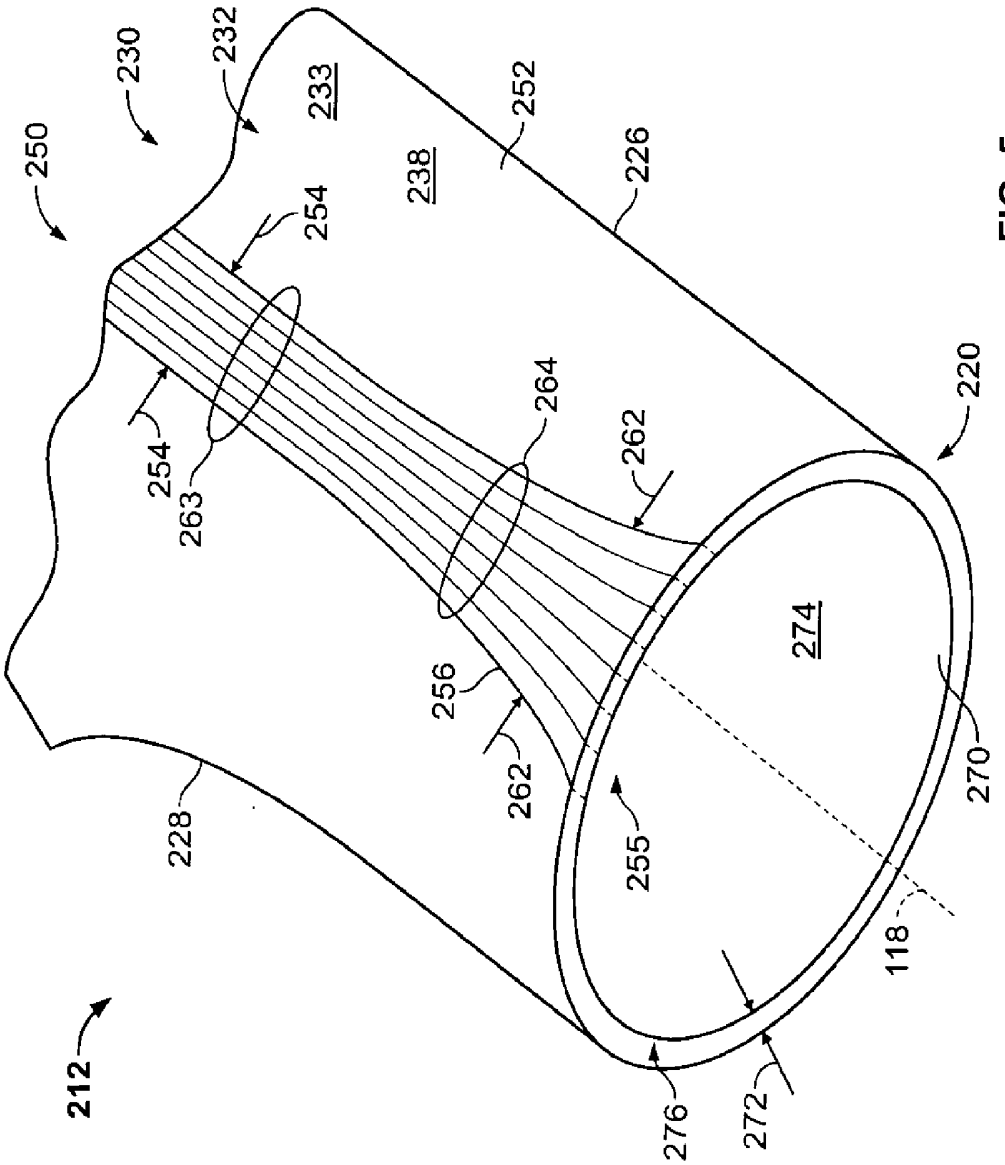
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FIG. 5

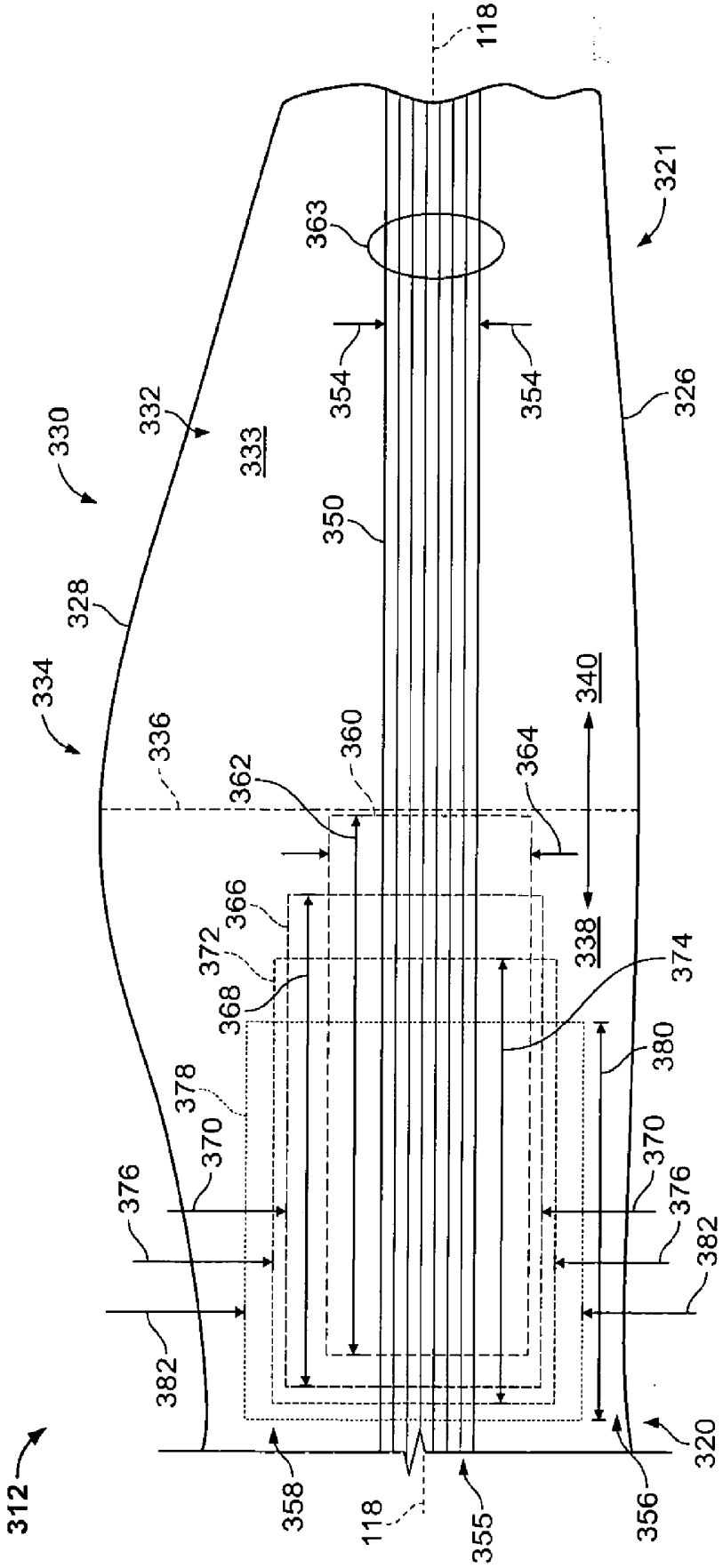
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FIG. 6

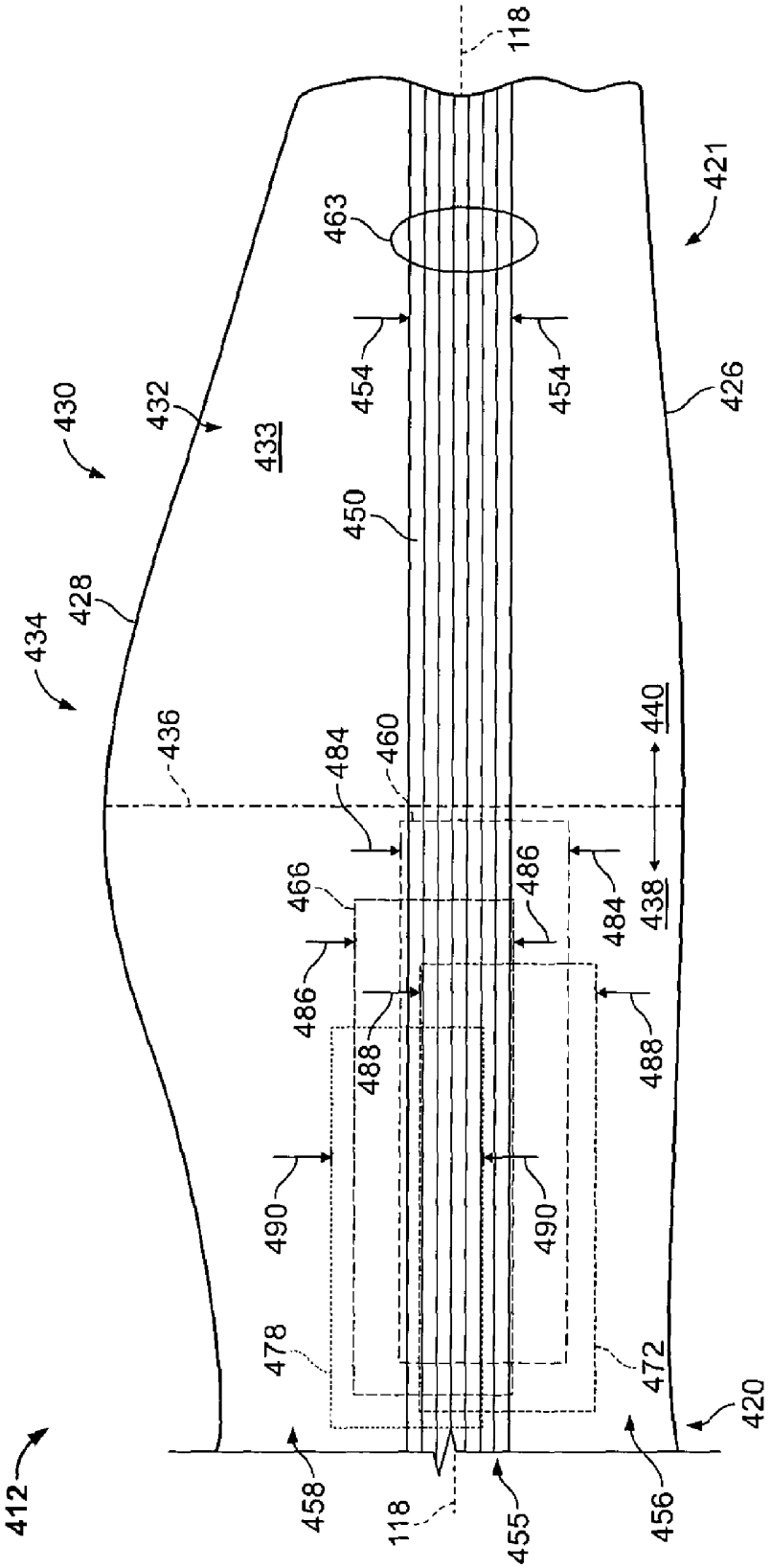
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FIG. 7