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CA 2364873 C 2005/11/01

(11)(21) 2 364 873

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 2001/08/29
(41) Mise à la disp. pub./Open to Public Insp.: 2002/01/02
(45) Date de délivrance/Issue Date: 2005/11/01
(62) Demande originale/Original Application: 2 356 086
(30) Priorité/Priority: 2001/08/29 (2,356,086) CA

(51) Cl.Int.^{7}/Int.Cl.^{7} F04C 2/107
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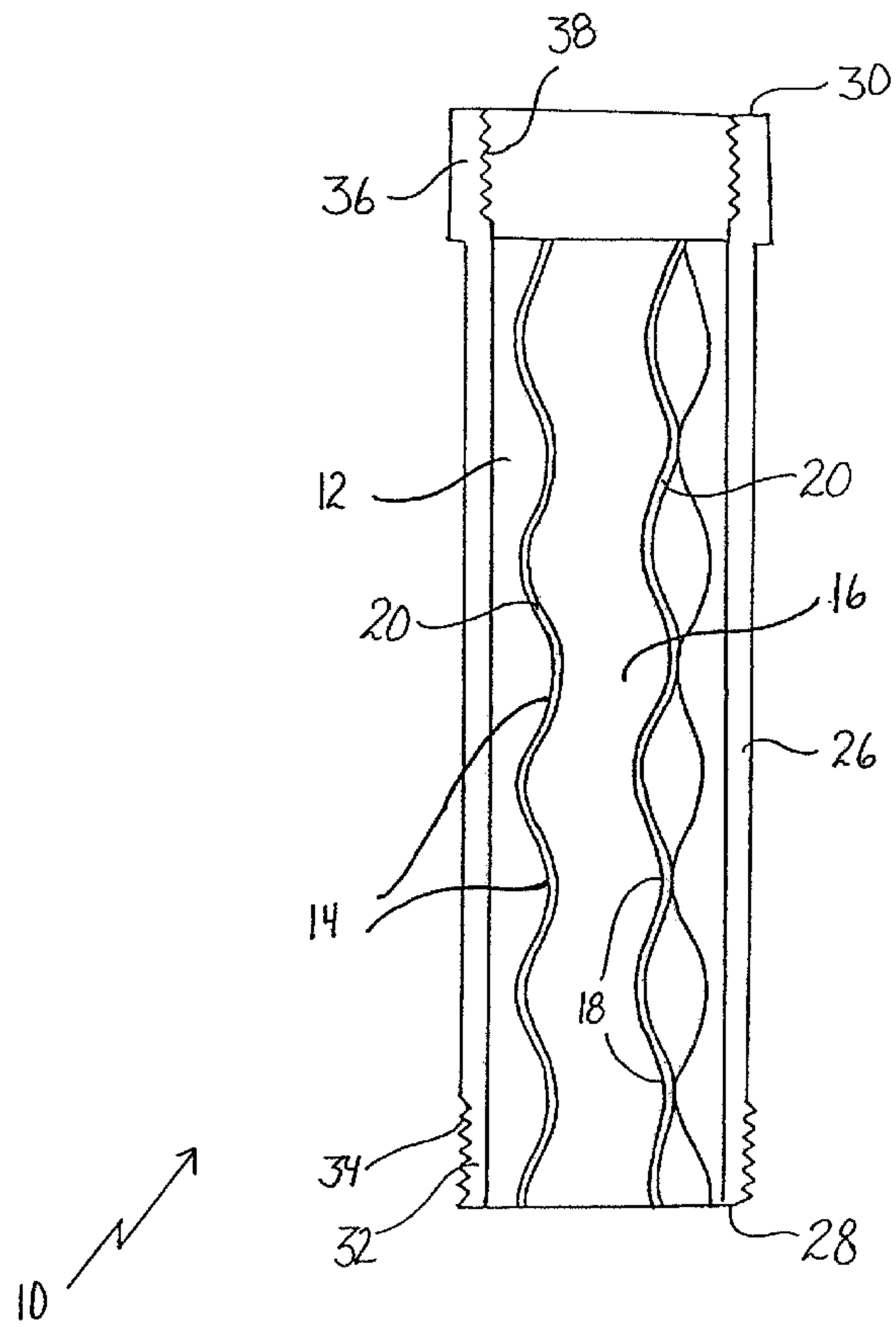
(54) Titre : LIGNE DE POMPAGE RESISTANT AU BOUCHON DE GAZ
(54) Title: GAS-LOCK RESISTANT PUMP STRING



(57) Abrégé/Abstract:
A rotor and stator pumping apparatus includes a rotor and a stator. A plurality of stator sections are joined in end to end relation to form a pumping assembly. One of the stator sections is provided with radial gas breakout ports positioned in recesses between some of the internal lobes. This makes provision for gas breakout as liquids enter the pumping assembly and, thereby, prevents gas lock as liquids progress along the pumping assembly.

ABSTRACT OF THE DISCLOSURE

A rotor and stator pumping apparatus includes a rotor and a stator. A plurality of stator sections are joined in end to end relation to form a pumping assembly. One of the stator sections is provided with radial gas breakout ports positioned in recesses between some of the internal lobes. This makes provision for gas breakout as liquids enter the pumping assembly and, thereby, prevents gas lock as liquids progress along the pumping assembly.

GAS-LOCK RESISTANT PUMP STRING

FIELD OF THE INVENTION

The present invention relates to a rotor and stator pumping apparatus.

BACKGROUND OF THE INVENTION

A rotor and stator pumping apparatus, also known as the Moineau pump, was developed by the French aviator Moineau. The stator portion is a cylindrical housing with an elastomer lining having a series of deformable elastomer internal lobes. The rotor is a metal rod that has a series of non-deformable external lobes. As the rotor rotates, the elastomer internal lobes on the stator deform to maintain a sealing engagement between the external lobes on the rotor and the internal lobes on the stator which moves liquid through the stator. The Moineau pump, however, is rendered ineffective when a gas lock occurs due to gas breakout. It is known in the oil and gas industry that gas locks can occur in pumping and processing equipment, in both downhole and surface contexts, due to the introduction of free gas released during drilling or recovery processes.

SUMMARY OF THE INVENTION

What is required is a rotor and stator pumping apparatus which is less susceptible to gas lock.

According to the present invention there is provided a plurality of stator sections joined in end-to-end relation to form a pumping assembly. One of the stator sections is provided with radial gas breakout ports positioned in recesses between some of the internal lobes. This makes provision for gas breakout as liquids enter the pumping assembly and, thereby prevents gas lock as liquids progress along the pumping assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more apparent from the following description in which reference is made to the appended drawings, the drawings for the purpose of illustration only and not intended to in any way limit the scope of the invention to the particular embodiment or embodiments shown, wherein:

Figure 1 is a side elevation view, in section, of a rotor and stator pumping apparatus constructed in accordance with the teachings of the present invention.

Figure 2 is a side elevation view, in section, of a pumping assembly constructed in accordance with the teachings of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment, a rotor and stator pumping apparatus generally identified by reference numeral 10, will now be described with reference to **Figures 1** and **2**.

Structure and Relationship of Parts:

Referring to **Figure 1**, a rotor and stator pumping apparatus 10 includes a stator 12 with non-deformable internal lobes 14. Non-deformable internal lobes 14 are made from steel or ceramic materials, although other materials with suitable strength and abrasion resistance can be used. Ceramic materials are preferred for reasons that will hereinafter be further described. A rotor 16 is provided that has external lobes 18. External lobes 18 of rotor 16 have a deformable covering 20. Deformable covering 20 on external lobes 18 of rotor 16 deforms to maintain a sealing engagement with internal lobes 14 of stator 12 as rotor 16 rotates. This is an interference fit which efficiently moves liquids. Although various materials can be used for deformable covering 20, elastomeric materials are preferred. The type of elastomer used will depend upon the environment in which the rotor is to be used.

Referring to **Figure 2**, there is provided a plurality of stator sections 22 joined in end to end relation to form a pumping assembly 24. Each stator section 22 has a housing 26 with a first end 28 and a second end 30. A male connector 32 with external threads 34 is provided at first end 28 of housing 26. A female connector 36 with internal threads 38 is provided at second end 30 of housing 26 that is adapted to receive male connector 32 of adjoining stator section 22. An upstream one 40 of stator sections 22 has radial gas breakout ports 42 positioned in recesses 44 between some of internal lobes 16.

Operation:

The use and operation of rotor and stator pumping apparatus 10 will now be described with reference to **Figures 1** and **2**. Referring to **Figure 1**, with rotor and stator pumping apparatus 10, as described above, as rotor rotates, deformable covering 20 on external lobes 18 of rotor 16 deform to maintain an interference fit sealing engagement between external lobes 18 of rotor 16 and internal lobes 14 on stator 12. By maintaining a sealing engagement, liquid is moved through stator 12 by rotation of rotor 16. Because rotor 16 carries deformable covering 20, as opposed to stator 12 carrying it, servicing is simplified as rotor 16 can be pulled out and replaced on site in a matter of minutes. Internal lobes 14 of stator 12 are made from a non—deformable material and, as such, stator 12 will become the component that fails the least. Rotor 16, which is comparatively easy to retrieve, becomes the component that must periodically be replaced as deformable covering 20 becomes worn.

This configuration provides superior fluid washing characteristics. Ceramic material is preferred for stator 12, as ceramic is harder than steel. Ceramic material react better to abrasion that does steel. Whereas most materials rapidly deteriorate in an abrasive environment, constant exposure to abrasion tends to polish the ceramic material without much adverse effect on its operative life.

Referring to **Figure 2**, stator sections 22 can be joined in end to end relation to form pumping assemble 24 by threading male connector 32 at first end 28 of housing 26 of stator section 22 with female connector 36 at second end 30 of housing 26 adjoining stator section 22. Although the illustrated embodiment shows three stator sections 22 joined together, there can be any number of stator sections 22 joined together to form pumping assemble 24. Radial gas breakout ports 42 positioned on upstream 40 of stator sections 22.

It is preferred that gas breakout ports 42 are positioned at the point of pressure differential across the stator in order to ensure proper amounts of circulation are being maintained. The size of gas breakout ports 42 is determined by the amount of flow required to maintain circulation. Gas breakout port positioning is in the minor cavity of the pump (usually the upstream section) where the gas and fluid is trapped before moving to the next cavity. This allows for effective breakout and circulation of gas. A progressive cavity pump will not move gas under high pressure. Placement of gas breakout ports 42 allows free gas to move through the upstream portions of the rotor and stator assembly as long as there is no significant pressure differential. When a pressure differential is encountered which potentially could disrupt pumping, gas can exit through the gas breakout ports 42 to relieve the pressure build up.

There are a number of advantages gained through the configuration described. Gas lock is avoided, so the rotor and stator will not burn out due to lack of flow. The invention allows a rotor and stator pump configuration to be run with higher aromatic wells than would otherwise be the case. It can also be run with wells with high Hydrogen Sulfide gas content. It can be run with hotter wells or deeper wells. The configuration has superior washing characteristics. Exotic deformable coatings can be applied to the rotor which were difficult, costly or impossible to apply to the stator.

In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

It will be apparent to one skilled in the art that modifications may be made to the illustrated embodiment without departing from the spirit and scope of the invention as hereinafter defined in the Claims.

THE EMODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A rotor and stator pumping apparatus, comprising:

a stator section having internal lobes with a recess between adjacent internal lobes;

a rotor having external lobes, such that a sealing engagement is maintained between the internal lobes of the stator section and the external lobes of the rotor as the rotor rotates; and

the stator section having at least one gas breakout port positioned in the recess, thereby permitting gas to escape to relieve pressure caused by gas breakout.

2. A rotor and stator pumping apparatus, comprising:

a plurality of stator sections joined in end to end relation to form a pumping assembly, each of the plurality of stator sections having internal lobes with a recess between adjacent internal lobes;

a rotor having external lobes, such that a sealing engagement is maintained between the internal lobes of the plurality of stator sections and the external lobes of the rotor as the rotor rotates; and

at least one of the plurality of stator sections having at least one gas breakout port positioned in the recess, thereby permitting gas to escape to relieve pressure caused by gas breakout.

3. The rotor and stator pumping apparatus of Claim 2 wherein the at least one gas breakout port is located in an upstream one of the plurality of stator sections, such that

gas escapes prior to passage of liquids through the balance of the plurality of stator sections.

4. The rotor and stator pumping apparatus of Claim 2 wherein the at least one gas breakout port is located in an upstream one of the plurality of stator sections at a point of pressure differential across the upstream one of the plurality of stator sections, such that gas escapes prior to passage of liquids through the balance of the plurality of stator sections.

5. The rotor and stator pumping apparatus of Claim 1 wherein the sealing engagement is maintained by a deformable covering on the external lobes of the rotor.

6. The rotor and stator pumping apparatus of Claim 5 wherein the deformable covering is composed of an elastomeric material.

7. The rotor and stator pumping apparatus of Claim 2 wherein the plurality of stator sections are joined in end to end relation to form a pumping assembly by means of male and female connectors respectively on adjacent ends of adjacent ones of the plurality of stator sections.

8. The rotor and stator pumping apparatus of Claim 1 wherein the internal lobes of the stator section are composed of ceramic material.

9. The rotor and stator pumping apparatus of Claim 1 wherein the size of the at least one gas breakout port is determined by the amount of flow required to maintain circulation.

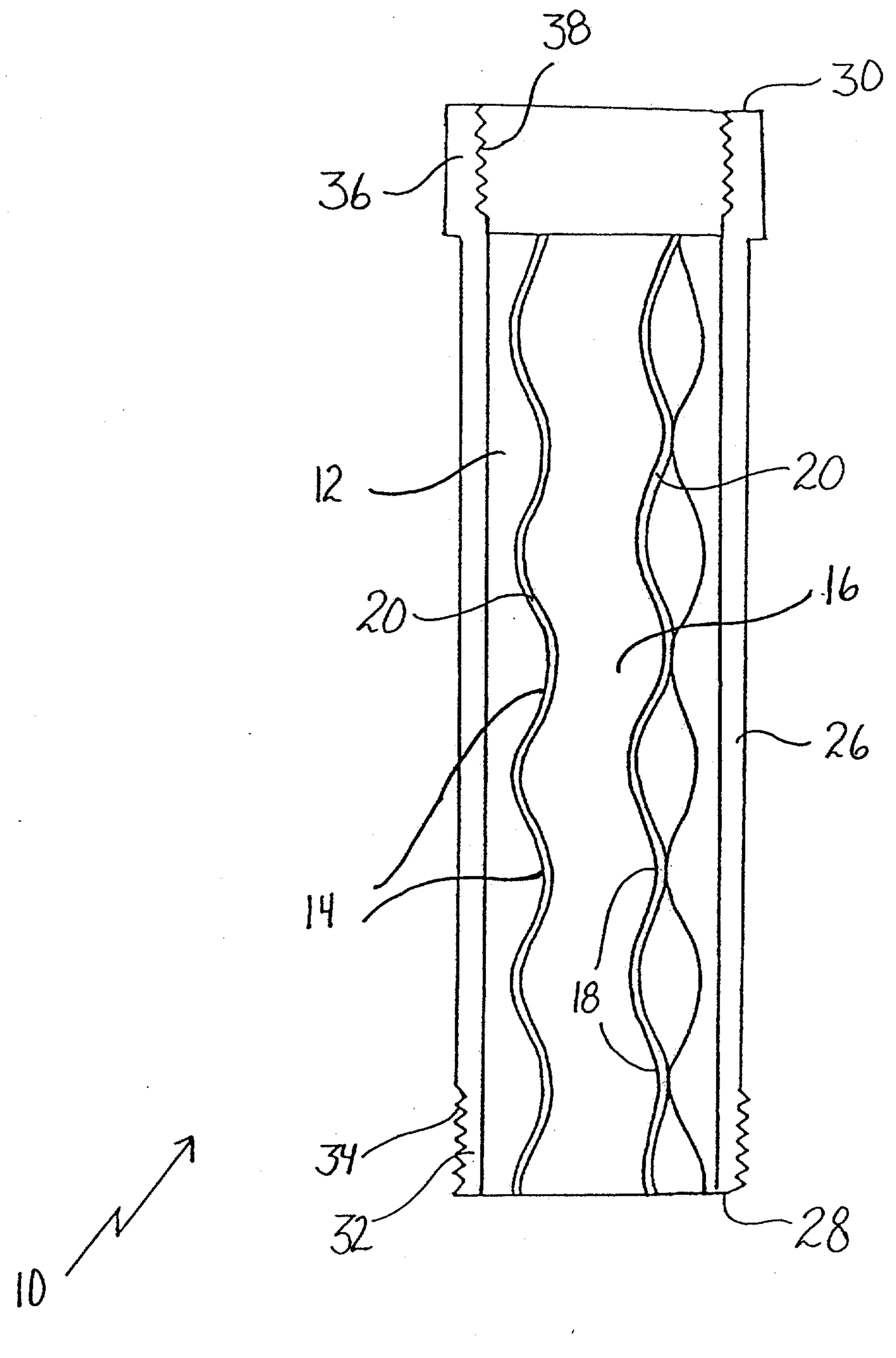


FIGURE 1

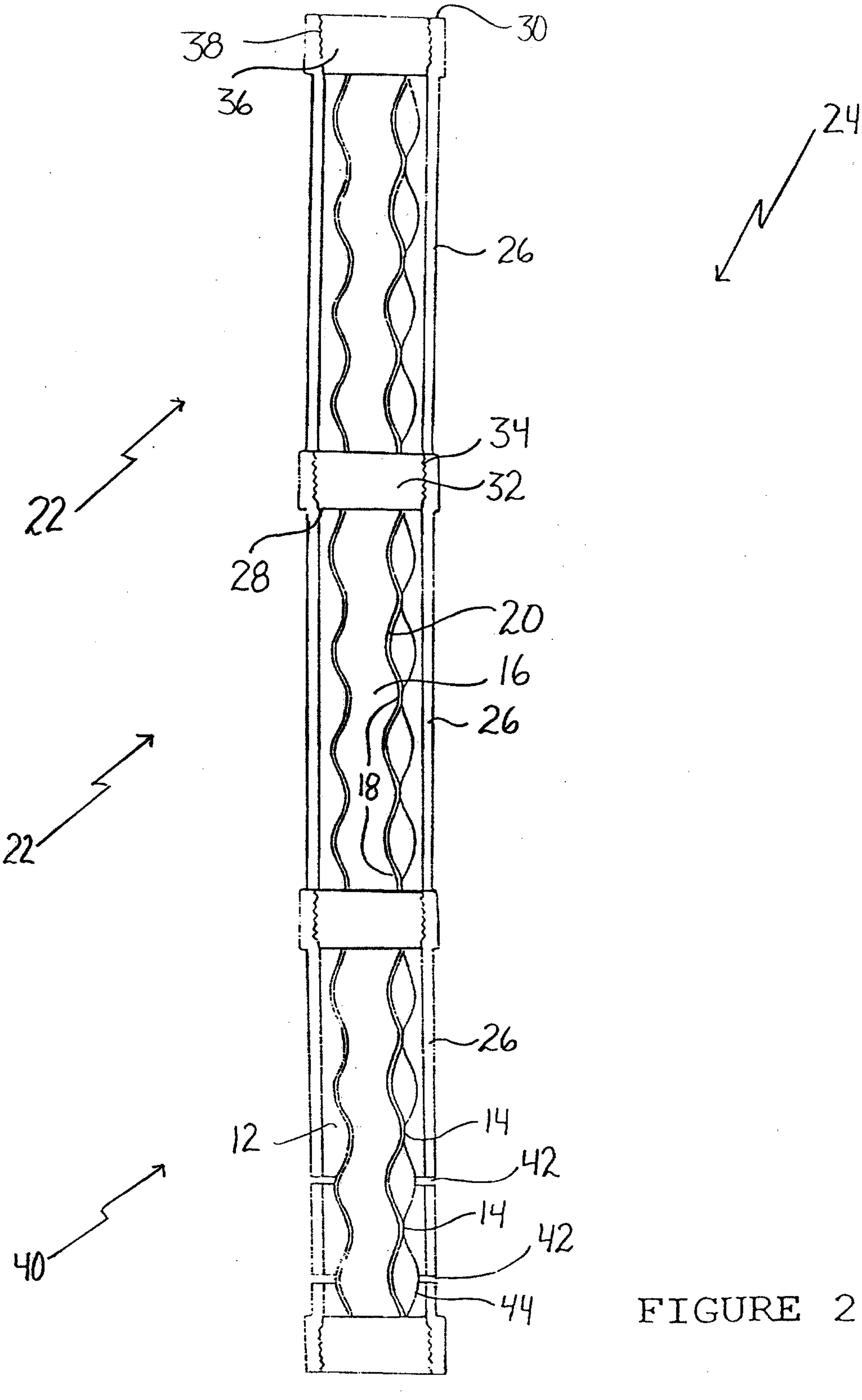
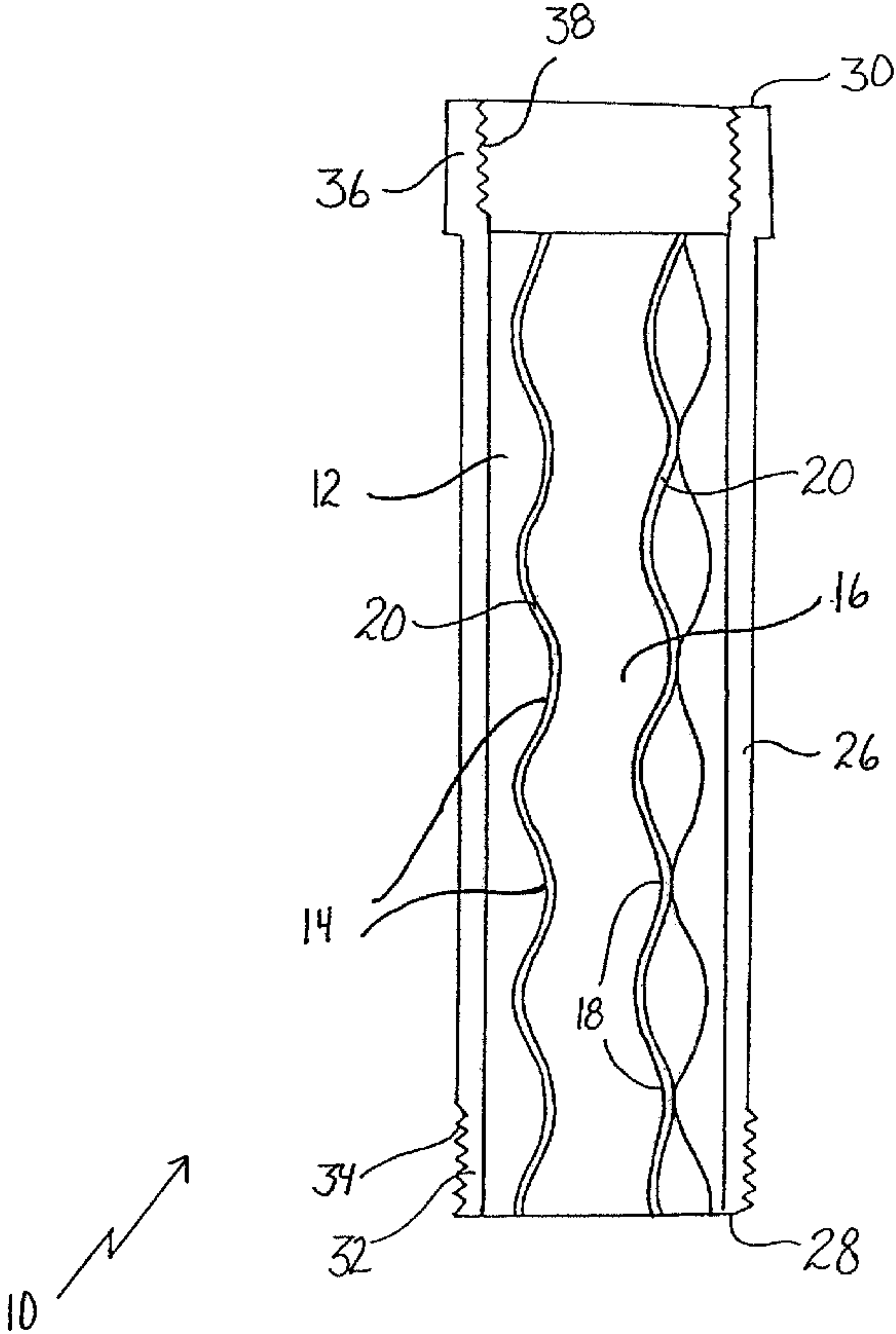


FIGURE 2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