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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
11 October 2012 (11.10.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/138372 A1

(51) International Patent Classification:
B65G 53/54 (2006.01)

(21) International Application Number:
PCT/US2011/047637

(22) International Filing Date:
12 August 2011 (12.08.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/472,285 6 April 2011 (06.04.2011) US
61/472,267 6 April 2011 (06.04.2011) US

(71) Applicant *(for all designated States except US)*: **FISH TRANSPORT SYSTEMS, LLC** [US/US]; 8015 SE 28th Street, Suite 200, Mercer Island, WA 98040 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **GUEBLE, Jeff** [US/US]; c/o Picker Technologies LLC, 8015 SE 28th Street, Suite 200, Mercer Island, WA 98040 (US). **DELIGAN, Todd** [US/US]; c/o Picker Technologies LLC, 8015 SE 28th Street, Suite 200, Mercer Island, WA 98040 (US). **ALLARD, Randy** [US/US]; c/o Picker Technologies LLC, 8015 SE 28th Street, Suite 200, Mercer Island, WA 98040 (US). **KUNZLER, Alex** [US/US]; c/o Picker Technologies LLC, 8015 SE 28th Street, Suite 200, Mercer Island, WA 98040 (US). **BRYAN, Jr., Dr. Vincent, E.** [US/US]; c/o Picker Technologies LLC, 8015 SE 28th Street, Suite 200, Mercer Island, WA 98040 (US).

(74) Agent: **PARKHURST, Todd S.**; Hughes Socol Piers Resnick & Dym, Ltd., 70 West Madison Street, Suite 4000, Three First National Plaza, Chicago, IL 60602 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

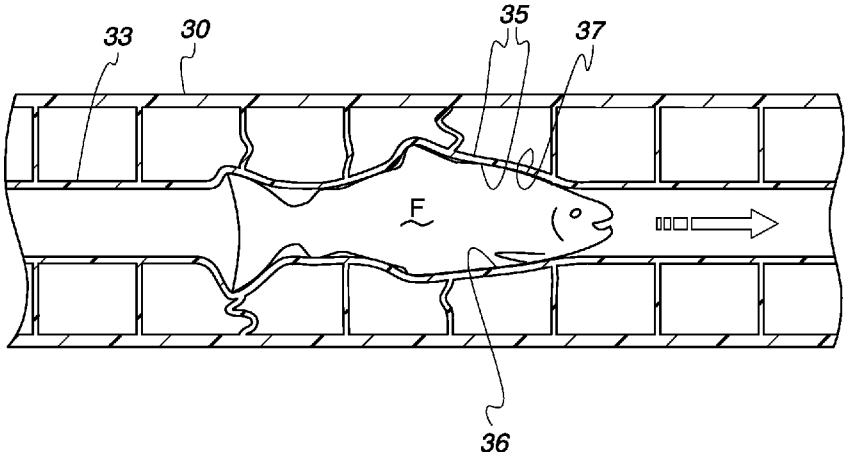
Published:

— *with international search report (Art. 21(3))*

— *with amended claims (Art. 19(1))*

(54) **Title**: OBJECT TRANSPORT TUBE

Fig. 2



(57) **Abstract**: A transport tube and system for transporting objects are disclosed. In one embodiment, the system includes an outer support and protective tube. Within the outer tube is mounted an inner tube which is adapted to radially expand and contract so as to accommodate and substantially continuously engage the surface of an object to be transported along the inner tube. The tube surface/object surface engagement provides a pressure seal across the object. When fluid pressure is reduced in front of the object and/or when pressure is increased behind the object, the pressure differential across the object urges the object along the tube. In one embodiment of the invention, the object being transported is a fish.

WO 2012/138372 A1

OBJECT TRANSPORT TUBE

Related Cases

This application is a Continuation-In-Part of co-pending U.S. Application Serial No. 12/758,653 filed April 12, 2010, which is a Continuation-In-Part of U.S. Application12/055,209 filed March 25, 2008, now U.S. Patent 7,695,220 B2 issued April 13, 2010. That U.S. Utility Application 12/055,209 claims U.S. domestic priority from U.S. Provisional Application Serial No. 60/920,069 filed March 26, 2007, and from U.S. Provisional Application Serial No. 60/949,630 filed July 13, 2007. Each of these applications and the patent are hereby incorporated by reference herein.

This application claims U.S. domestic priority from U.S. Provisional Application 61/472,267 filed April 6, 2011 and U.S. Provisional Application 61/472,285 filed April 6, 2011.

Background of the Invention

This invention relates generally to pneumatic or similar tubes and tube systems for transporting objects, and more particularly concerns a radially expandable tube adapted to receive an object to be conveyed. The tube is adapted to form a pressure-differential seal between the outer surface of the object being transported and the inner surface of the tube.

The catching and processing of fish becomes increasingly important as world population grows. Equipment for transporting and processing caught fish becomes correspondingly important. This equipment should be relatively inexpensive, reliable, and easy to maintain. The equipment should also be easy to clean and sanitize.

It is an object of the present invention to provide an inexpensive, reliable and easily cleaned, easily maintained and easily sanitized tube transport system for transporting live or dead fish and other objects from an intake position to a remote discharge position.

It is a related object to provide a system in which a seal is formed between the outer surface of the object being transported and the inner surface of the tube so that a pressure differential between the upstream portion and the downstream portion of the object being transported can be formed to thereby urge the object along the tube.

Another object is to provide such a tube designed, manufactured and arranged so that the seal between the expandable tube and the object being transported is a continuous seal; that is, the sealing action and the consequent pressure differential across the seal is continuous as the object moves along the tube.

Other objects and advantages of the invention will become upon apparent upon reading the following detailed description and upon reference to the drawings. Throughout the drawings, like reference numerals refer to like parts.

Brief Description of the Drawings

Figure 1 is a sectional view showing, in somewhat schematic fashion, a pneumatic tube having a series of disc baffles oriented perpendicularly to the tube axis and arranged to engage the outer surface of an object being transported, the object shown here being a fish such as a salmon.

Figure 2 is a sectional view similar to figure 1but showing a tube system having two coaxial tubes, the inner tube being radially expandable so as to form a continuous seal between the outer surface of the object being transported and the inner surface of the inner tube.

Figure 3 is a sectional view of a tube formed of radially expandable material and an object being transported along the tube, in which the outer surface of the object being transported continuously engages the inner surface of the tube with at least a partially pressure tight fit.

Figure 4 is a schematic sectional view similar figure 3 showing a system having two axially coincident tubes, and in which the object being transported is a fish or similar article.

Figures 5 – 14 are cross-sectional views taken substantially in the plane of line 5 – 13 in figure 3 and showing various flexible web arrangements which interconnect an outer support tube and the inner radially expandable transport tube.

Figure 15 is an isometric view in partial section showing in further detail an outer tube, a coaxial inner tube, and a web inter-connecting the outer and inner tubes.

Figures 16, 17 and 18 are isometric views of conical or windsock-shaped baffles which can be used in the tube in place of the disc baffles shown in figure 1.

Detailed Description

While the invention will be described in connection with a preferred embodiment and procedure, it will be understood that it is not intended to limit the invention to this embodiment and procedure. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning first to Figure 1, there is shown a transport tube 20 within which are a series of toroid disc baffles 22 located at spaced apart intervals along the axis A of the tube 20. Here, the object being transported is a fish F which can be either live or dead. As explained in further detail in the above-cited patent applications and patent which are incorporated herein by reference, a known vacuum source (not shown here) can generate a partial atmospheric vacuum in front of the object F being transported, and/or a known pressure device (not shown here) located behind the object F can create a positive pressure behind the object F. A pressure differential across the object is maintained by a seal formed by the consecutive engagement of the surface of the object F with one or more of the baffles 22 so as to create a pressure differential across the object F. This pressure differential draws the object along the tube 20.

As shown in figure 2, the transport system can include an outer support tube 30 and a coaxially aligned inner transport tube 33 within which the fish or other object F is transported. The outer tubes 30 can be formed of steel, aluminum, transparent or opaque plastic, or any other suitable material. The inner transport tube 33 can be formed of any suitable flexible and expandable material which will radially enlarge so as to closely conform to and contact the outer surface of the object F being transported, and so form an at least partially pressure tight seal 35 between the outer surface 36 of the object being transported and the inner surface 37 of the confirming and surrounding transport tube 33.

In either of these embodiments of the invention, the pressure differential can be continuously maintained during the entire duration of the object's travel along the tube. It is presently contemplated that the fluid providing this pressure differential will be air, and known pneumatic pressure generators and vacuum generators will be used to create the pressure differential across

the object. However, it is also contemplated that water or any other convenient and desired fluid can be used.

The material from which the inner tube 33 is formed may be an elastomer such as Bayer Desmopan 6065 A, offered by Bayer Material Science LLC of Pittsburgh Pennsylvania. Other useful elastomers are Elastosil® R plus 4305/40 or Elastosil® LR 3003/30 A/B by Wacker Chemical Corp., 3301 Sutton Road, Adrian, Michigan; and Santprene 201-55 by Exxon mobile Chemical, 13501 Katy Freeway, Houston, TX. These elastic and expandable materials may be used to form the radially expandable tube and permit the entry of the object into the tube and passage of the object along and out of the tube. The resiliency of the tube should also provide continuous engagement of the surface of the object and consequent formation of the pressure tight seal 35. Here, as suggested in Figures 2, 3 and 4, the stationary tube surface/moving object surface contact is substantially continuous along an endless closed path in an imaginary plane generally perpendicular to the axis A of the tube 33. The fluid seal 35 formed at the tube surface/object surface interface is sufficiently effective to permit development of a fluid pressure differential between upstream portions 43 and downstream portions 44 of the tube 33. If the surface of the moving object F is the interior or exterior surface of an animal or plant --i.e., if the surface of the moving object is, for example, the scaly epidermis of a fish-- the design and finish of the inner surface of the tube may be smooth but resilient so as to provide a tube surface/object surface compressive engagement of maximum sealing effect.

Other embodiments of the invention are shown in figures 5 -- 14. Here, the object tube transport system 20 comprises an outside support tube 30, an inner radially expandable object transport tube 33, and a flexible web 40 interconnecting the outer tube 30 and the inner tube 33. The tube 33 here has an inner surface 37 adapted to flexibly and substantially continuously engage the surface of an object F (figure 4) to be transported along the tube 33. The inner tube surface/object surface engagement 35 (figure 4) permits development of a fluid pressure differential across the object F sufficient to urge the object F along the tube 33. It will be noted that the expanded cross-sectional shape of the inner tube 33 is in substantial conformance in shape with, but is smaller in its unexpanded size than, the cross-sectional shape and size of the object F to be transported along the tube. Here in figures 5 – 14, this cross-sectional shape of the inner tube 33 is substantially ovoid.

Inner tube 33 can have one or more pleats 42 to permit the inner surface 37 of the inner tube 33 to conform to the size and shape of a cross section of the object being transported along the tube. The pleats 42 allow the inner tube 33 to expand without inducing hoop forces, keeping the tube surface/object surface frictional forces low. A tube without pleats may have higher frictional forces. As shown in especially figure 5, the pleats 42 extend outwardly relative to the center of the inner tube 33. The outer tube 30 has confronting, conformal surfaces 45 for engaging the pleats 42 and thereby restricting unwanted displacement of the tube 33. Here, this confronting surface 45 takes shape of a squared recess having a U-shape. To provide pleat/recess engagement at the proper location, the surface 45 is located on a built-up footing 46.

As shown especially in figure 6, an alternate form of the object transport tube system has an inner tube 33 of corrugated ovoid cross-sectional shape. The inner tube 33 is connected to the outer support tube 30 by a flexible interconnector web 40 comprising walls of incomplete ovoid shape 48 and incomplete circular shape 49. These curvilinear interconnector wall formations support the tube in a central location. Importantly, they also permit the inner tube 33 to expand so as to conform to the shape of the object passing through the tube 33, and then to relax to an unexpanded state. The compressive forces acting upon the object passing through the inner tube 33 are minimal, but are sufficient to cause the inner tube surface/object surface engagement to permit development of the fluid pressure differential across the object so as to urge the object along the tube. The walls also prevent the collapse of the tube 33 when portions of the tube are subjected to negative pressure. These curvilinear shapes allow the structure to be strong and deform relatively little under negative pressure but to be relatively weak and deform more extensively under positive pressure or when an object is passing through the tube.

As shown in figure 7, the inner tube 33 can have a plurality of pleats 42 and interconnecting support walls having hollow diamond shapes 52 in their cross-sectional aspects.

As shown in figure 8, the interconnecting web walls 49 can be of substantially circular shape in their cross-sectional aspect and extend from at least some of the pleat tips 42 to the outer tube 30.

As shown in figures 9 and 10, the inner tube 33 can be mounted on interconnector curvilinear walls 51. Here, opposed walls 51 can provide ovoid formations in cross-sectional aspect.

To provide structural strength and resistance to twisting, bending and other varieties of deformation, the outer tube wall 30 can be rectilinear in shape, as shown in figure 11. Here, the outer tube 30 is rectangular. The inner ovoid tube 33 is provided with leg extensions 60 ending in feet 62 residing in slots 63. This arrangement securely mounts the inner tube 33 within the outer protective tube 30, yet permits limited expansion, contraction and other movement of the tube 33 as the transported object moves along the tube 33.

If desired, the outer tube 30 can be arranged so as to accommodate expansion, contraction and other deformation of the inner tube 33 and to permit limited accommodation of outside forces acting upon the tube system 20. As shown in figure 12, the tube 30 can be formed in opposed sections 30a and 30b and interconnector walls 51 can be provided with extensions 71 for engaging tube slots 72. In this embodiment of the invention, the pleats 42 extend to distal feet 75 residing in motion-accommodating slots 76.

In figure 13, controlled and limited motion of the inner tube 33 within the outer tube 30 is provided by mounting the curvilinear interconnector web walls 49 to footers 80 which are loosely mounted in mating slide guides 82.

Figure 14 shows a transport tube system adapted for transporting relatively heavy objects such as large fish across relatively long unsupported horizontal distances. To this end, vertical walls 90 provide box girder-like stiffness to the structure in a vertical direction. A transport tube 33 can be hung from a horizontally extending hangar foot 92 loosely mounted in mating slide guides 94, 95.

Figure 15 illustrates a tube assembly utilizing part geometry exemplified in the embodiments shown in figures 5, 9, 12 and elsewhere. These modifications and arrangements can be devised as desired or necessary to accommodate the passage of objects of specific sizes, shapes and weights over specifically extending horizontal spans and to take into account other design factors.

Figures 16, 17 and 18 illustrate several embodiments of a disc baffle which can be mounted within the inner tube 33 as suggested in figure 1. Here the baffle 22 has a generally truncated conical shape to allow easy contraction and expansion as the transported object passes through the baffle 22. The flexible, pliable baffle material can be formed to have an

object-accepting cone 97 formed of pleats or plications 98 of either curvilinear cross-section as shown in figure 16 and 17 or rectilinear cross-sectional shape 99 as suggested in figure 18. Alternatively, the baffles can have a flat, discoid shape as shown in the patents or patent applications incorporated by reference herein. In either embodiment, the resultant seal between the baffles 22 and the object being transported may not be literally endless or continuous but may be interrupted by the plication recesses. Nevertheless, the seal will be functionally complete enough and effective enough to provide the requisite pressure differential across the baffle and object being transported to permit the object being transported to move through the baffles and tube 33 in a desired manner.

These baffles can be mounted within the tube 33 by a gasket-like edge 100 (figures 16 and 18), or an o-ring like mounting edge or rim 101 can be provided as shown in figure 17.

The following is claimed as invention:

1. An object transport tube adapted to radially expand and contract so as to accommodate and substantially continuously engage the surface of an object to be transported along the tube.

2. An object transport tube according to claim 1 wherein said transport tube has an inner surface and an outer surface, the inner surface of said tube being adapted to form a substantially continuous fluid sealing contact with the transported object.

3. An object transport tube according to claim 2 wherein said transport tube surface/object surface contact is substantially continuous along an endless closed path in an imaginary plane generally perpendicular to the axis of said tube.

4. An object transport tube according to claim 1 wherein said transport tube surface/object surface engagement forms a fluid seal sufficiently effective to permit development of a fluid pressure differential between portions of the tube which are upstream and downstream of the developed fluid seal.

5. An object transport tube system including an object transport tube adapted to radially expand and contract so as to accommodate and substantially continuously engage the surface of an object to be transported along the tube, and a support tube coaxial with and surrounding but spaced apart from the object transport tube.

6. An object transport tube system according to claim 5 further including a flexible web supporting the transport tube within the support tube.

7. A system comprising, in combination, a hollow transport tube sized to accept an object to be transported, a sealing surface in the tube for creating a substantially fluid-tight seal

with the surface of the object to be transported, and means for creating a fluid pressure differential across that sealing surface and between the upstream portion of the object to be transported and the downstream portion of the of that object.

8. A system according to claim 7 wherein said tube sealing means is substantially axially stationary within said tube.

9. A system according to claim 8 wherein said sealing means comprises a series of toroidal baffles mounted at spaced apart intervals within said tube.

10. A system according to claim 8 wherein said sealing means comprises an inner surface of said tube.

11. A system according to claim 7 wherein said sealing means is positioned and arranged to substantially continuously engage the object to be transported as the object moves through the tube.

12. A system according to claim 1 wherein the object being transported has the interior or exterior surface of an animal or plant.

13. A method of transporting an object through a tube, comprising the steps of providing axially stationary sealing means within the tube, configuring the stationary sealing means with respect to the object to be transported so that the stationary sealing means will engage the surface of the object to be transported and thereby create a substantially fluid-tight seal between the stationary sealing means in the object being transported through the tube.

14. A method according to claim 13 wherein the sealing means is radially expandable to accommodate the entry of the object into the tube and passage of the object along and out of the tube.

15. A method according to claim 13 further including the step of creating a pressure differential between that portion of the object being transported which is upstream of the seal and that portion of the object being transported which is downstream of the seal.

16. A method according to claim 12 wherein the object being transported has a surface which has been created in nature and has not been substantially altered by mankind.

17. An object transport tube system comprising, in combination, a support tube, a transport tube, and at least one member web member mounting the transport tube within the support tube.

18. An object transport tube system according to claim 17 wherein said web member mounts the support tube and the transport tube coaxially.

19. An object transport tube system, comprising, in combination,
and outer support tube, an inner radially expandable object transport tube, and a flexible web interconnecting the outer tube and the inner tube.

20. An object transport tube system according to claim 19 wherein
the inner tube has an inner surface adapted to flexibly and substantially continuously engage the surface of an object to be transported along the tube,
the inner tube surface/object surface engagement permitting development of a fluid pressure differential across the object sufficient to urge the object along the tube.

21. An object transport tube system according to claim 19 wherein
the unexpanded cross-sectional shape of the inner tube is in substantial conformance in shape with, but smaller in size than, the cross-sectional shape and size of the object to be transported along the tube.

22. An object transport tube system according to claim 19 wherein
the cross-sectional shape of the inner tube is substantially ovoid.

23. An object transport tube system according to claim 19 wherein said inner tube has at least one pleat to permit the inner surface of the inner tube to conform to the size and shape of the cross section of the object being transported along the tube.

24. An object transport tube system according to claim 23 wherein said pleat extends outwardly relative to the center of the inner tube, and wherein the outer tube has a relieved surface in conformal relationship to the pleat for engaging the pleat and thereby restricting unwanted displacement of the pleat and inner tube.

25. An object transport tube system according to claim 19 wherein said inner tube is corrugated along at least part of its cross-sectional aspect.

26. An object transport system according to claim 19 wherein said inner tube has a corrugated ovoid cross-sectional shape.

27. An object transport system according to claim 19 wherein said web includes at least one interconnecting support wall having a curvilinear shape extending between the outer tube and the inner tube.

28. An object transport system according to claim 19 wherein said web includes at least one interconnecting support wall having a hollow diamond shape in its cross-sectional aspect.

29. An object transport system according to claim 19 wherein said inner tube has a plurality of pleats and wherein said system includes a plurality of web interconnecting support walls of substantially circular shape extending from at least some of the pleat tips to the outer tube.

30. An object transport system according to claim 19 wherein said web wall is ovoid in its cross-sectional aspect.

31. An object transport system according to claim 19 wherein said outer tube is at least partly rectilinear in its cross-sectional aspect.

32. An object transport system according to claim 19 wherein said outer tube is interrupted in its cross-sectional aspect along a portion of its axial direction.

33. An object transport system according to claim 19 further including inner tube expansion motion slide guides extending between said inner tube and said outer tube.

34. A system according to claim 9 wherein said baffles have an axially extended shape.

35. A system according to claim 9 wherein said baffles are substantially flat discoids.

36. A system according to claim 9 wherein said baffles are pliated.

AMENDED CLAIMS
received by the International Bureau on 15 March 2012 (15.03.2012)

Applicant makes the following amendments to the claims in the application.

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Amended) An object transport tube according to claim 19 wherein said transport tube surface/object surface engagement forms a fluid seal sufficiently effective to permit development of a fluid pressure differential between portions of the tube which are upstream and downstream of the developed fluid seal.

5. (Canceled)

6. (Canceled)

7. (Amended) A system comprising, in combination, an outer transport tube, a hollow inner transport tube sized to accept an object to be transported, and to radially expand so as to create a sealing surface in the tube for creating a seal with the surface of the object to be transported, which is effective to permit development of a pressure differential between portions of the tube which are upstream and downstream of the developed seal and means for creating a fluid pressure differential across that sealing surface and between the upstream portion of the object to be transported and the downstream portion of that object.

8. (Original) A system according to claim 7 wherein said tube sealing means is substantially axially stationary within said tube.

9. (Original) A system according to claim 8 wherein said sealing means comprises a series of toroidal baffles mounted at spaced apart intervals within said tube.

10. (Original) A system according to claim 8 wherein said sealing means comprises an inner surface of said tube.

11. (Original) A system according to claim 7 wherein said sealing means is positioned and arranged to substantially continuously engage the object to be transported as the object moves through the tube.

12. (Canceled)

13. (Original) A method of transporting an object through a tube, comprising the steps of providing axially stationary sealing means within the tube, configuring the stationary sealing means with respect to the object to be transported so that the stationary sealing means will engage the surface of the object to be transported and thereby create a substantially fluid-tight seal between the stationary sealing means in the object being transported through the tube.

14. (Original) A method according to claim 13 wherein the sealing means is radially expandable to accommodate the entry of the object into the tube and passage of the object along and out of the tube.

15. (Original) A method according to claim 13 further including the step of creating a pressure differential between that portion of the object being transported which is upstream of the seal and that portion of the object being transported which is downstream of the seal.

16. (Original) A method according to claim 12 wherein the object being transported has a surface which has been created in nature and has not been substantially altered by mankind.

17. (Amended) An object transport tube system comprising, in combination, a support tube, a radially expansible transport tube, and at least one web member mounting the transport tube within the support tube, the transport tube having an inner surface which engages each object being transported with a substantially continuously sealing engagement oriented substantially perpendicularly to the axes of the tubes.

18. (Original) An object transport tube system according to claim 17 wherein said web member mounts the support tube and the transport tube coaxially.

19. (Amended) An object transport tube system, comprising, in combination, an outer support tube, an inner radially expandable object transport tube, and a flexible web interconnecting the outer tube and the inner tube wherein the unexpanded cross-sectional shape of the inner tube is in substantial conformance in shape with, but smaller in size than, the cross-sectional shape and size of the object to be transported along the tube.

20. (Original) An object transport tube system according to claim 19 wherein the inner tube has an inner surface adapted to flexibly and substantially continuously engage the surface of an object to be transported along the tube, the inner tube surface/object surface engagement permitting development of a fluid pressure differential across the object sufficient to urge the object along the tube.

21. (Canceled)

22. (Original) An object transport tube system according to claim 19 wherein

the cross-sectional shape of the inner tube is substantially ovoid.

23. (Original) An object transport tube system according to claim 19 wherein said inner tube has at least one pleat to permit the inner surface of the inner tube to conform to the size and shape of the cross section of the object being transported along the tube.

24. (Original) An object transport tube system according to claim 23 wherein said pleat extends outwardly relative to the center of the inner tube, and wherein the outer tube has a relieved surface in conformal relationship to the pleat for engaging the pleat and thereby restricting unwanted displacement of the pleat and inner tube.

25. (Original) An object transport tube system according to claim 19 wherein said inner tube is corrugated along at least part of its cross-sectional aspect.

26. (Original) An object transport system according to claim 19 wherein said inner tube has a corrugated ovoid cross-sectional shape.

27. (Original) An object transport system according to claim 19 wherein said web includes at least one interconnecting support wall having a curvilinear shape extending between the outer tube and the inner tube.

28. (Original) An object transport system according to claim 19 wherein said web includes at least one interconnecting support wall having a hollow diamond shape in its cross-sectional aspect.

29. (Original) An object transport system according to claim 19 wherein said inner tube has a plurality of pleats and wherein said system includes a plurality of web interconnecting support walls of substantially circular shape extending from at least some of the pleat tips to the outer tube.

30. (Original) An object transport system according to claim 19 wherein said web wall is ovoid in its cross-sectional aspect.

31. (Original) An object transport system according to claim 19 wherein said outer tube is at least partly rectilinear in its cross-sectional aspect.

32. (Original) An object transport system according to claim 19 wherein said outer tube is interrupted in its cross-sectional aspect along a portion of its axial direction.

33. (Original) An object transport system according to claim 19 further including inner tube expansion motion slide guides extending between said inner tube and said outer tube.

34. (Original) A system according to claim 9 wherein said baffles have and axially extended shape.

35. (Amended) A system according to claim 9 wherein said baffles are substantially flat discoids.

36. (Amended) A system according to claim 9 wherein said baffles are pleated.

37. (New) An object transport tube system including an object transport tube system including an object transport tube adapted to radially expand and contract so as to accommodate and substantially continuously engage the surface of an object to be transported along the tube, and support means for supporting the object transport tube from at least one position external to the object transport tube.

38. (New) An object transport tube system according to claim 37 wherein the support means is an exoskeletal means.

Fig. 1

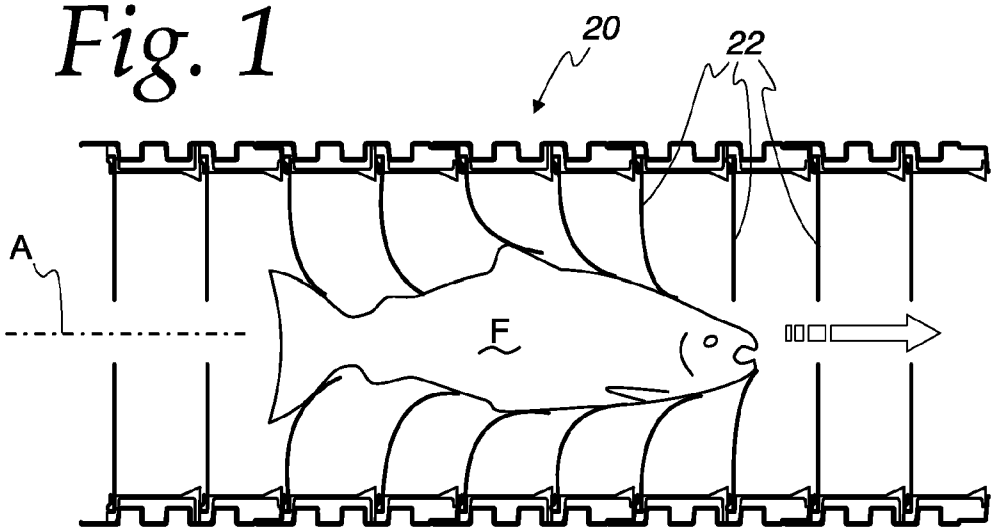
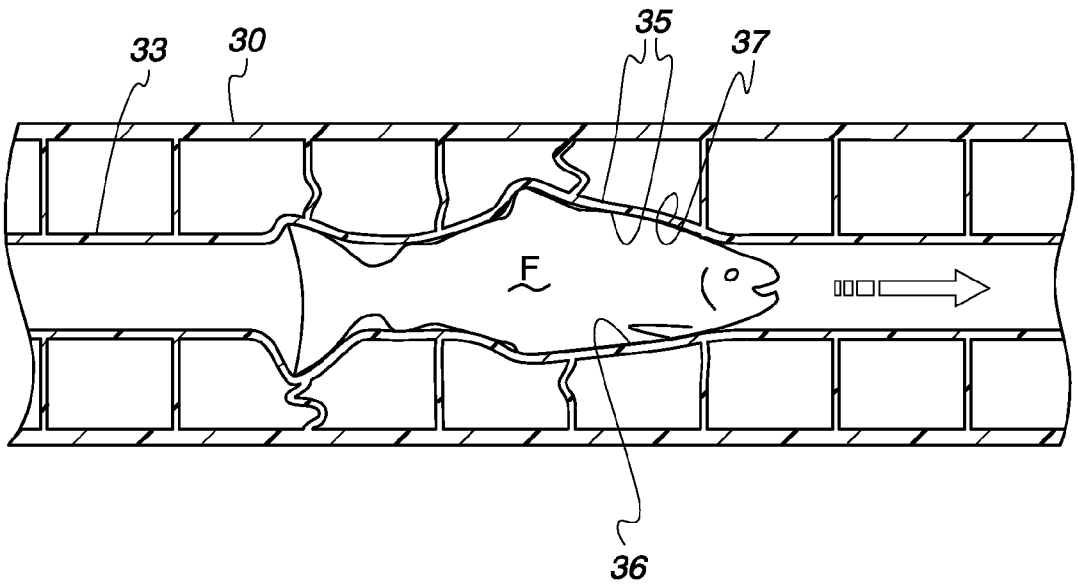


Fig. 2



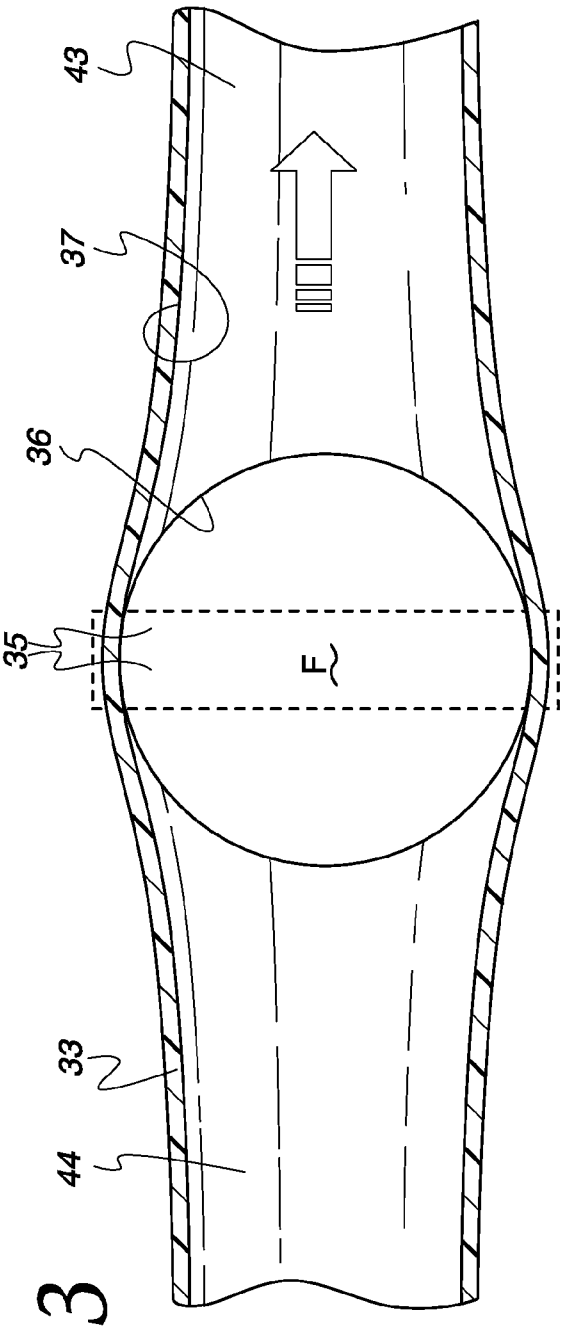


Fig. 3

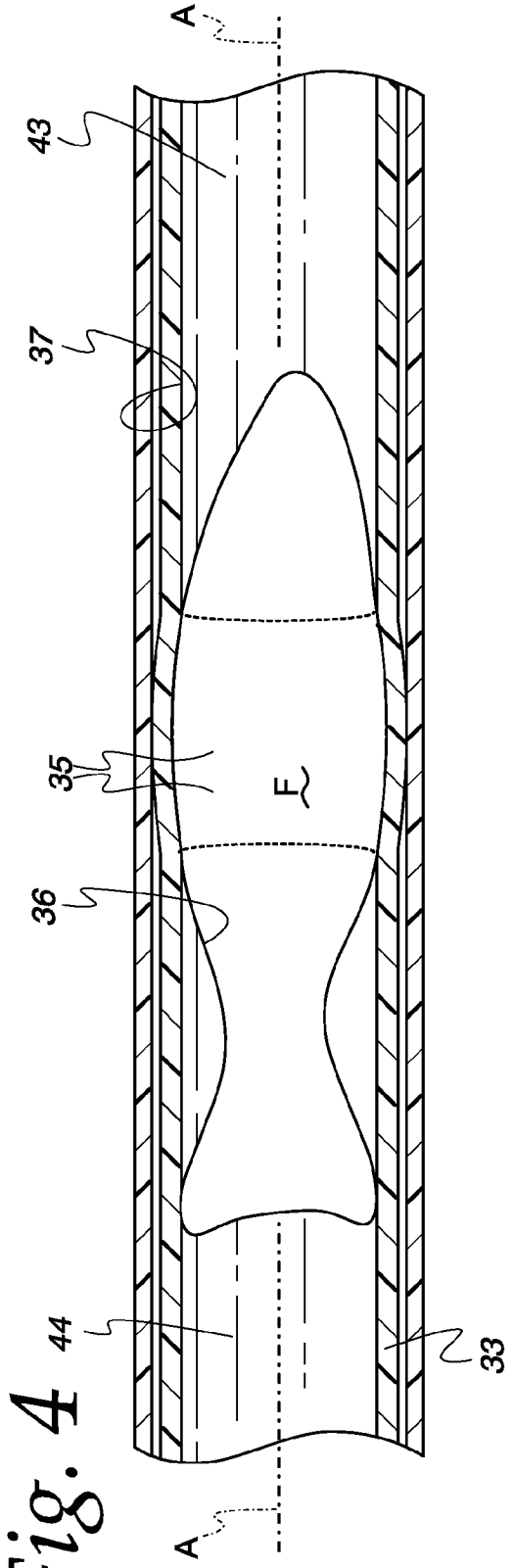


Fig. 4

Fig. 5

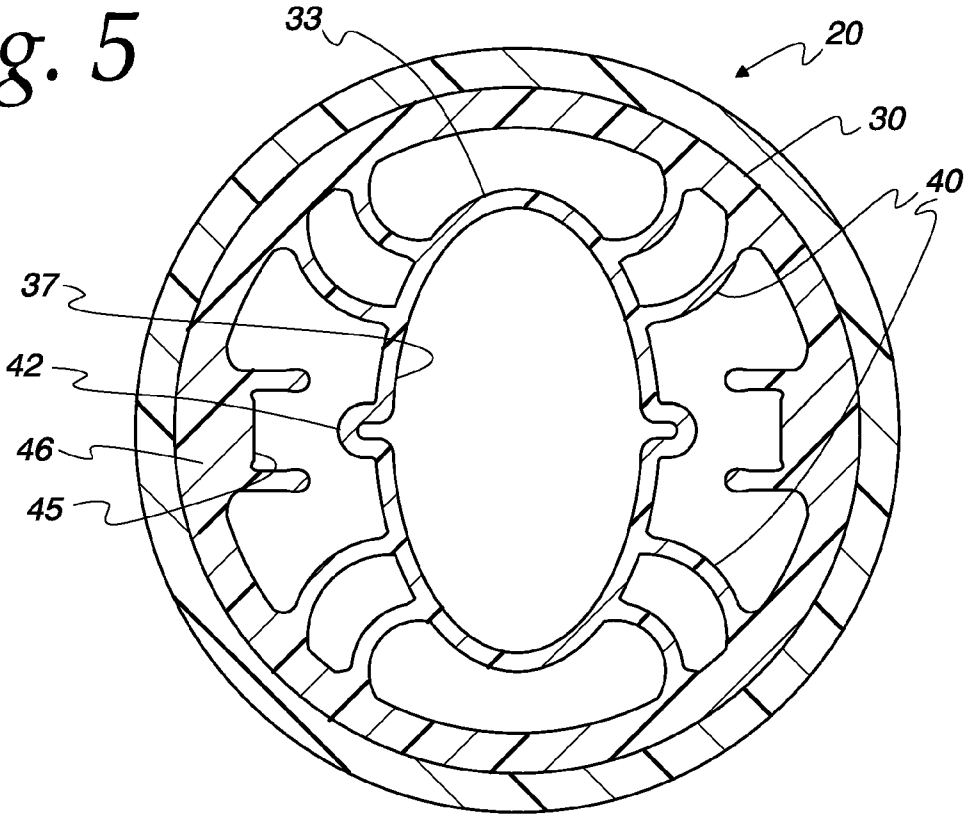


Fig. 6

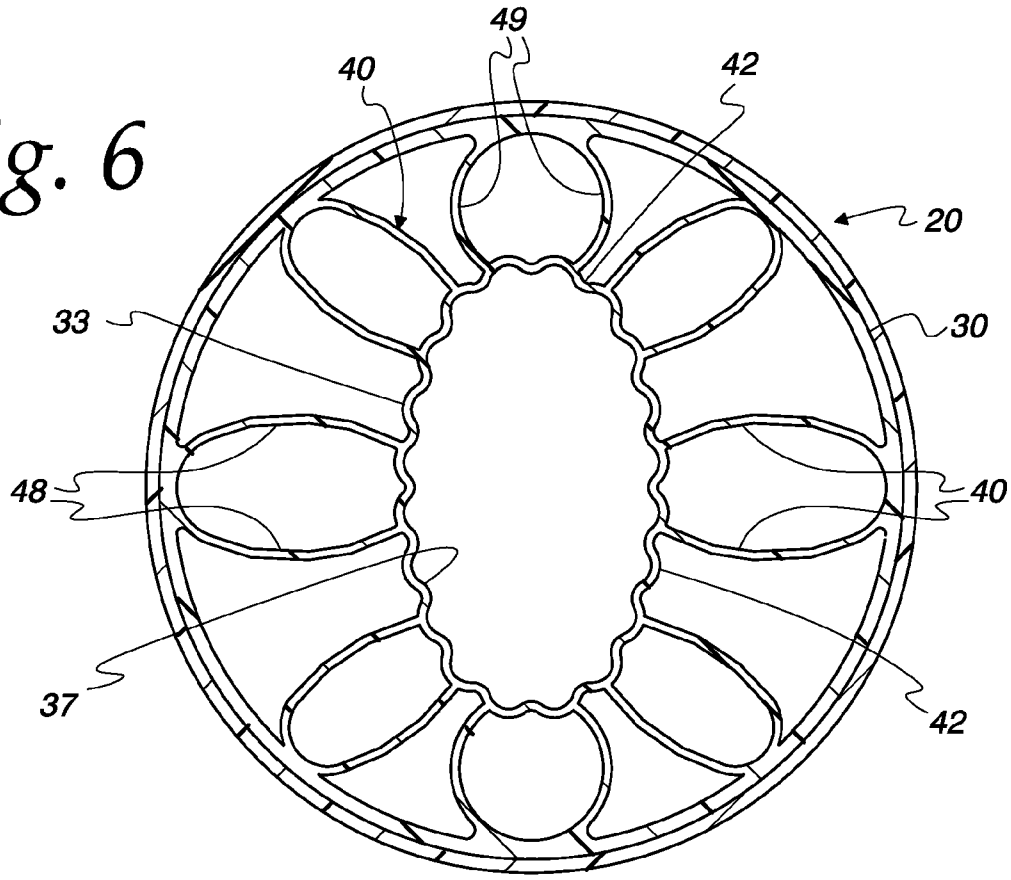


Fig. 7

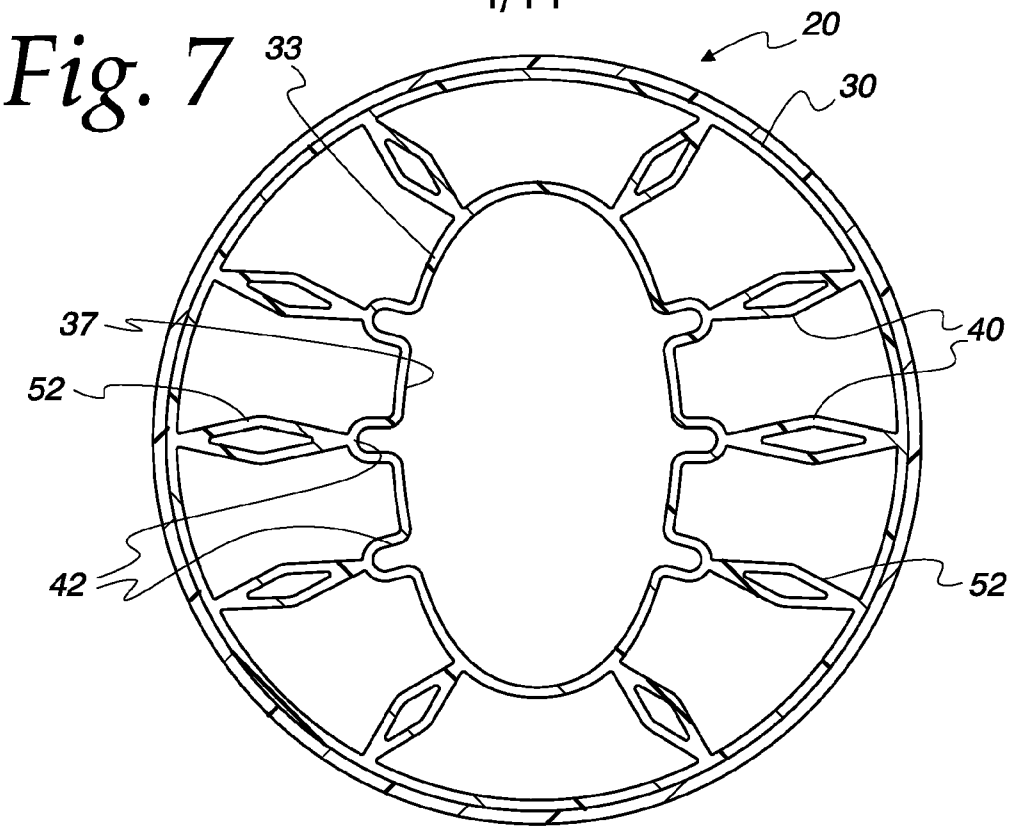


Fig. 8

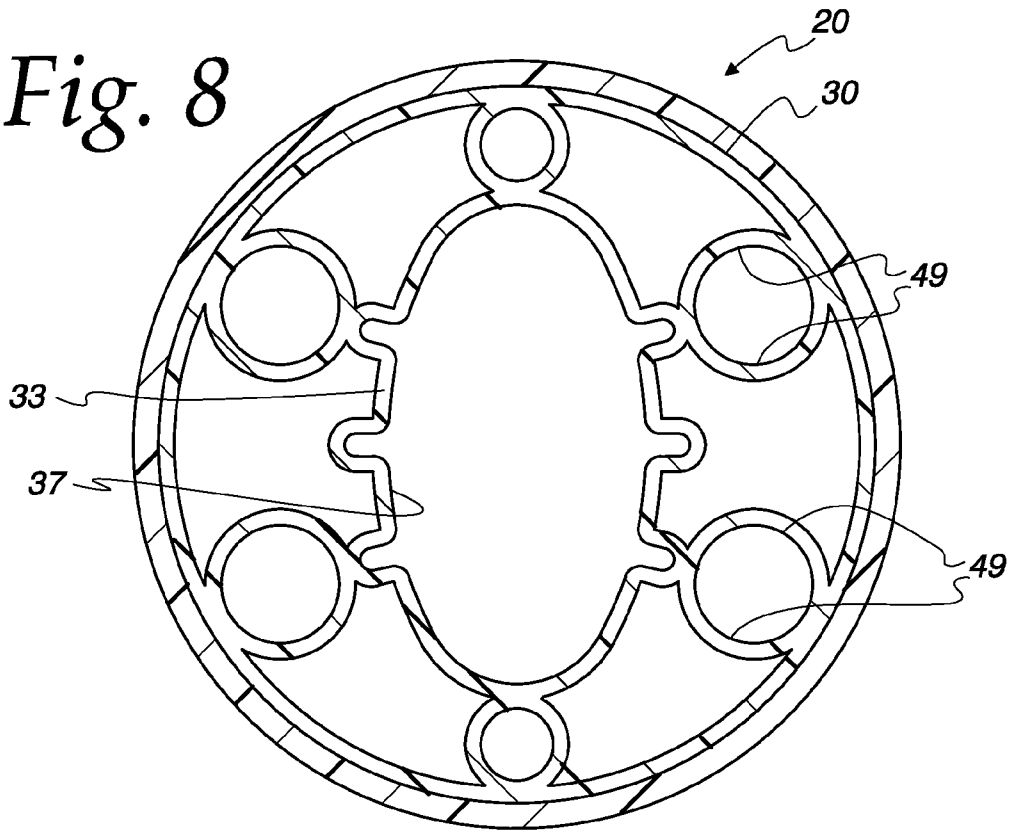


Fig. 9

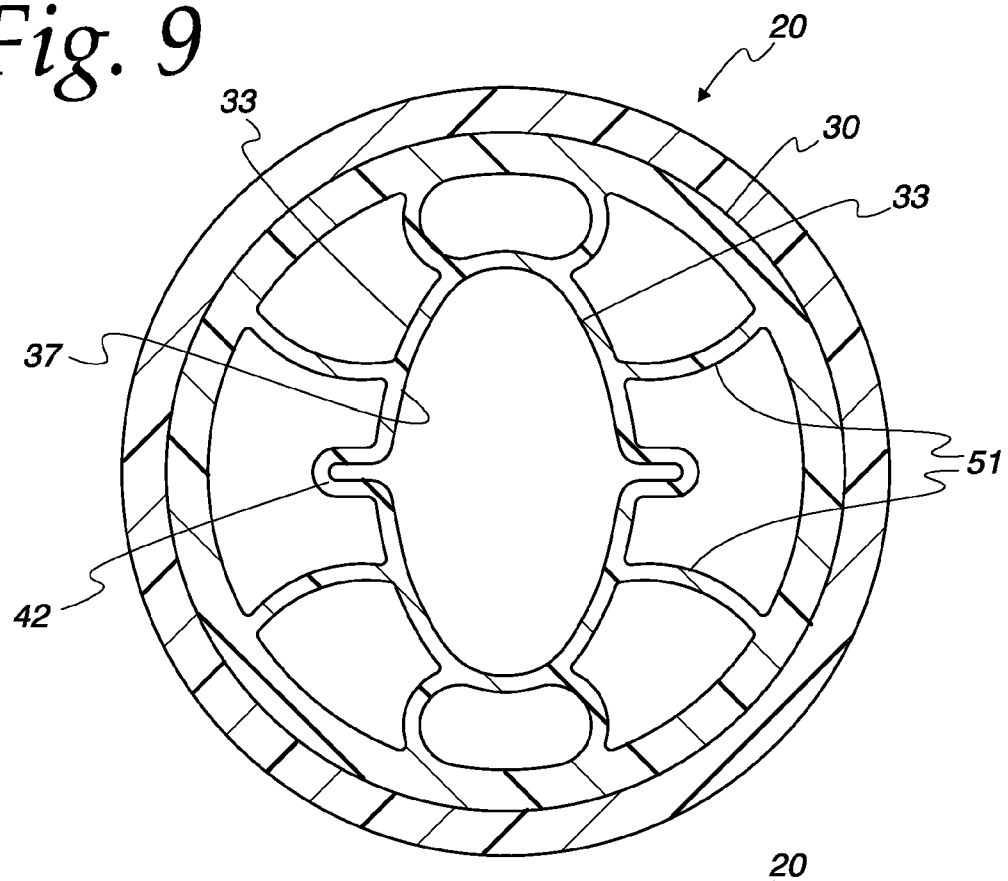


Fig. 10

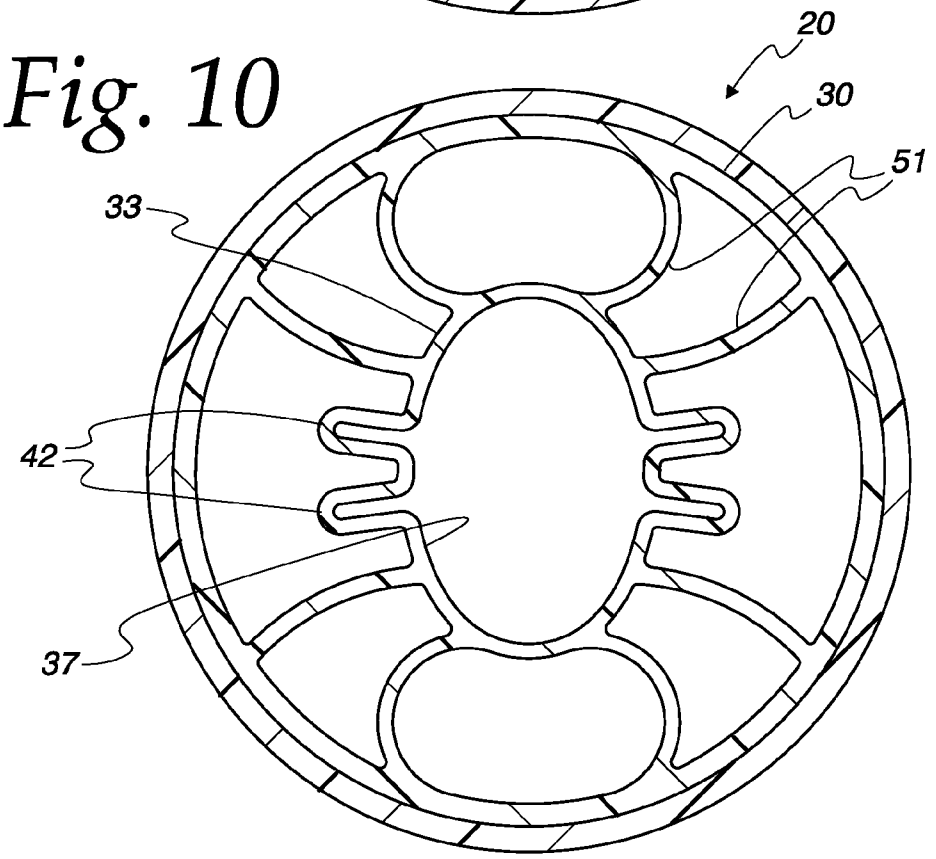


Fig. 11

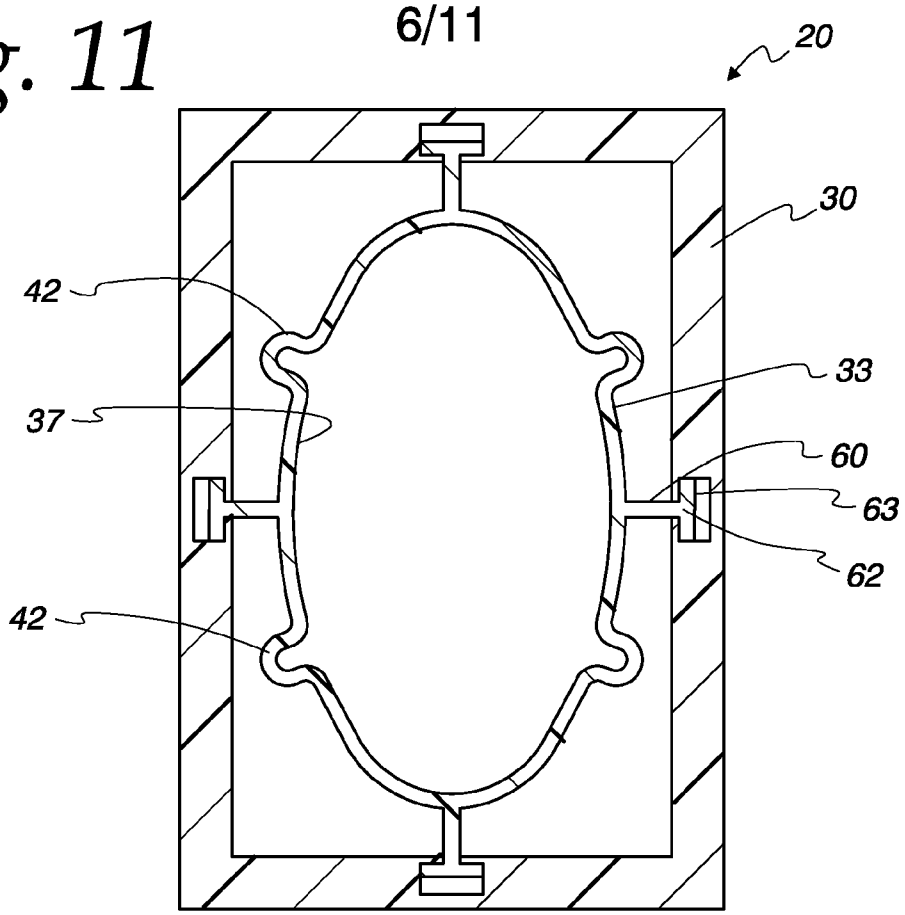

20
30
42
33
37
60
63
62
42

Fig. 12

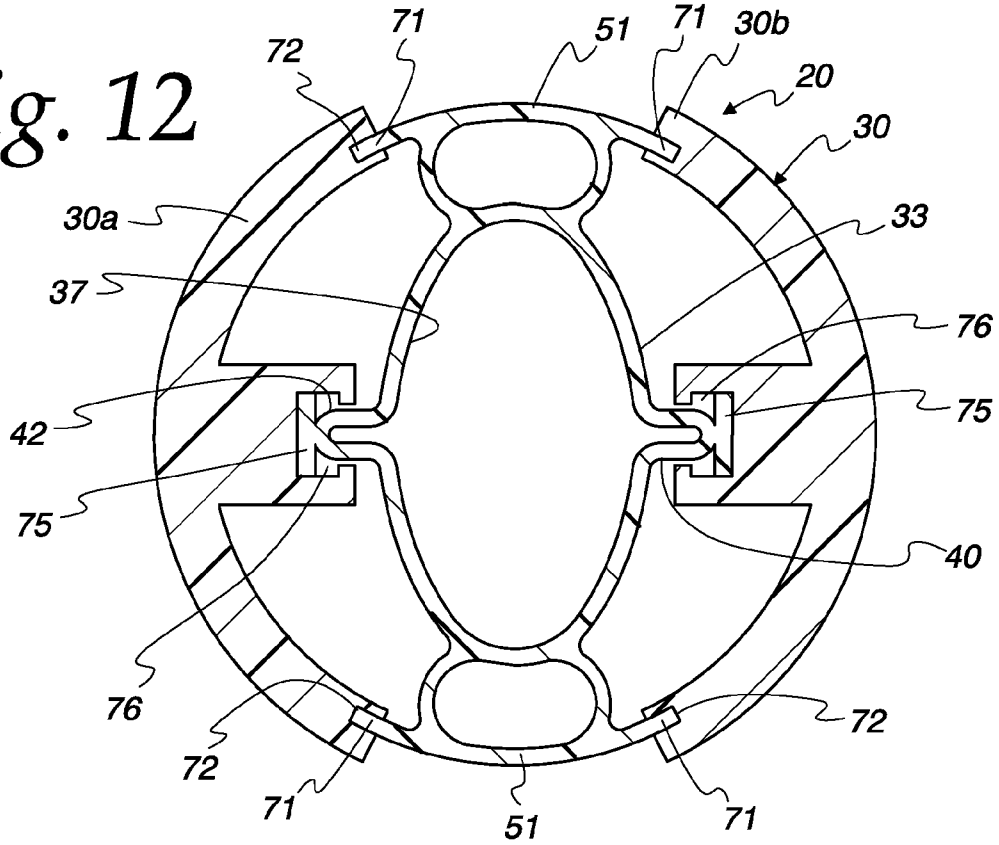

71
72
51
71
30b
20
30
30a
33
37
76
42
75
75
40
76
72
72
71
51
71

Fig. 13

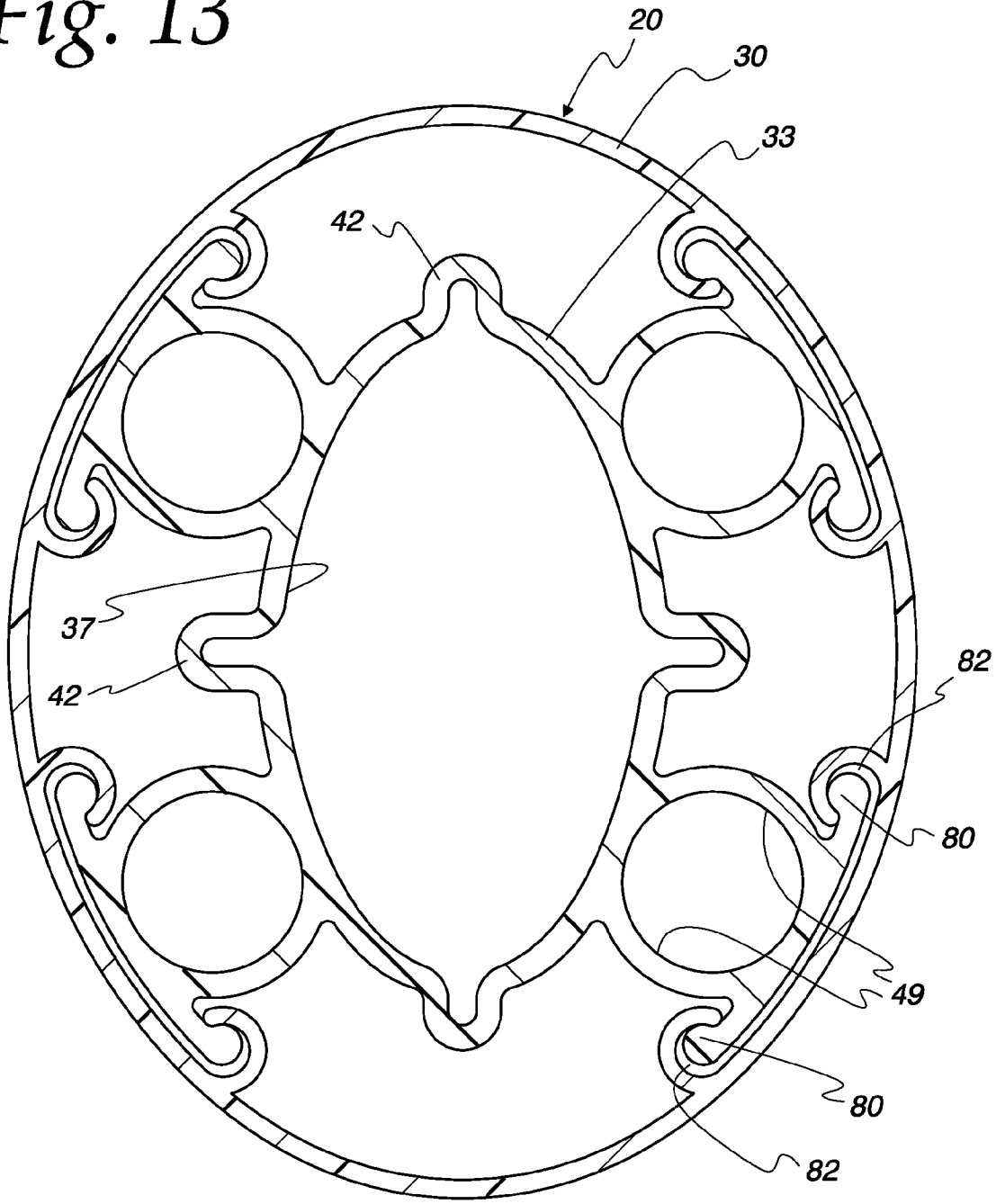
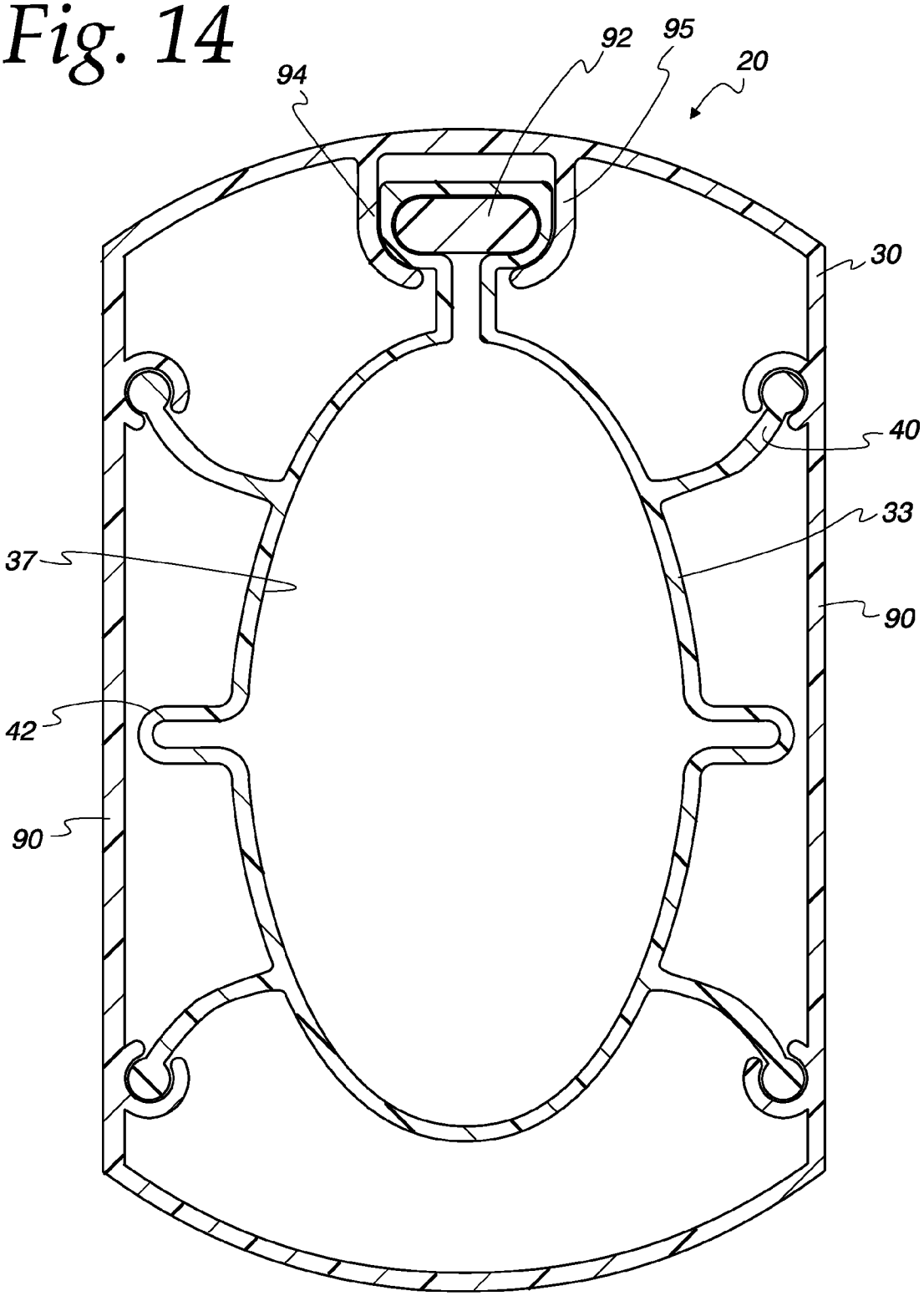


Fig. 14



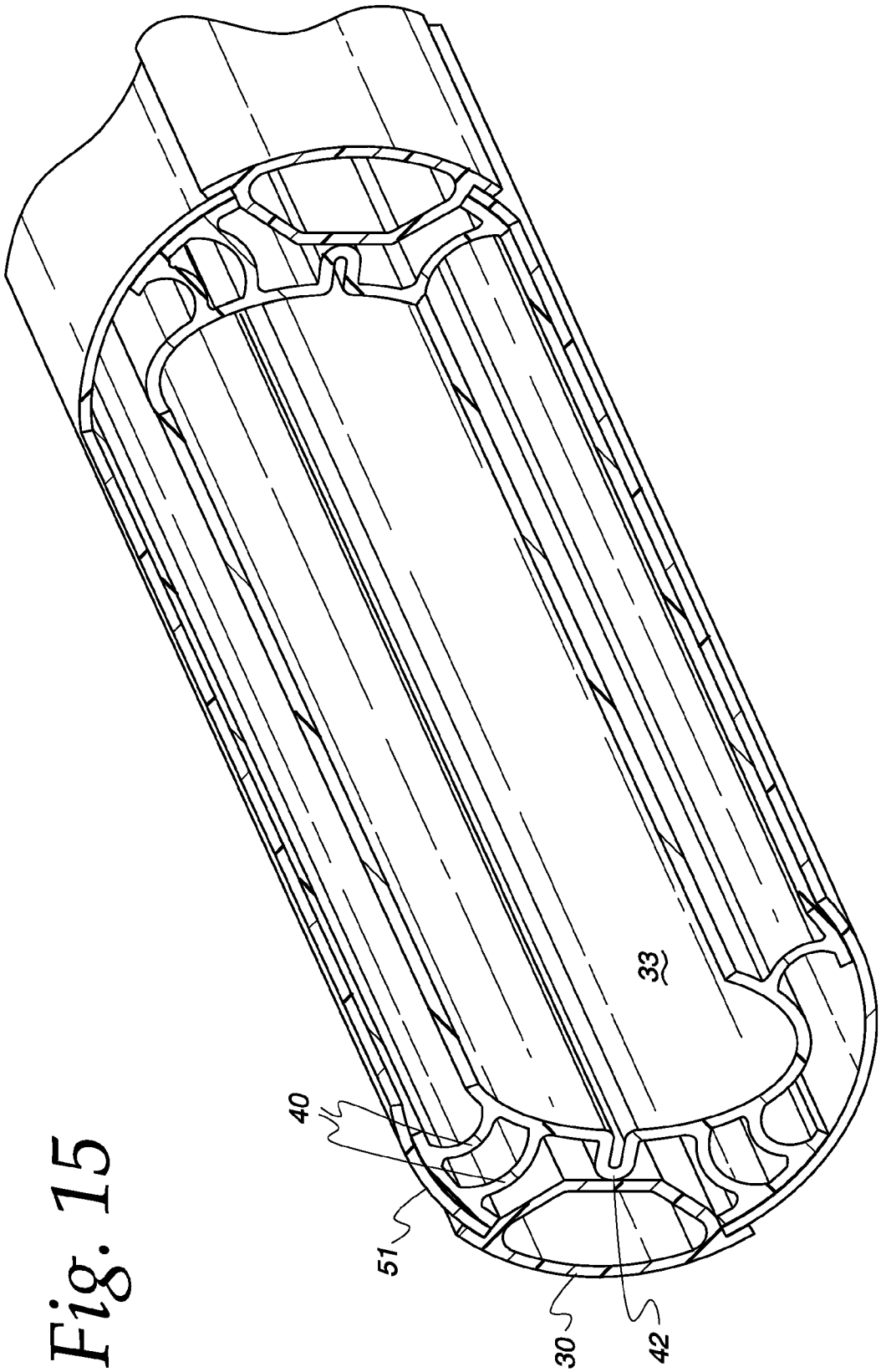


Fig. 15

Fig. 16

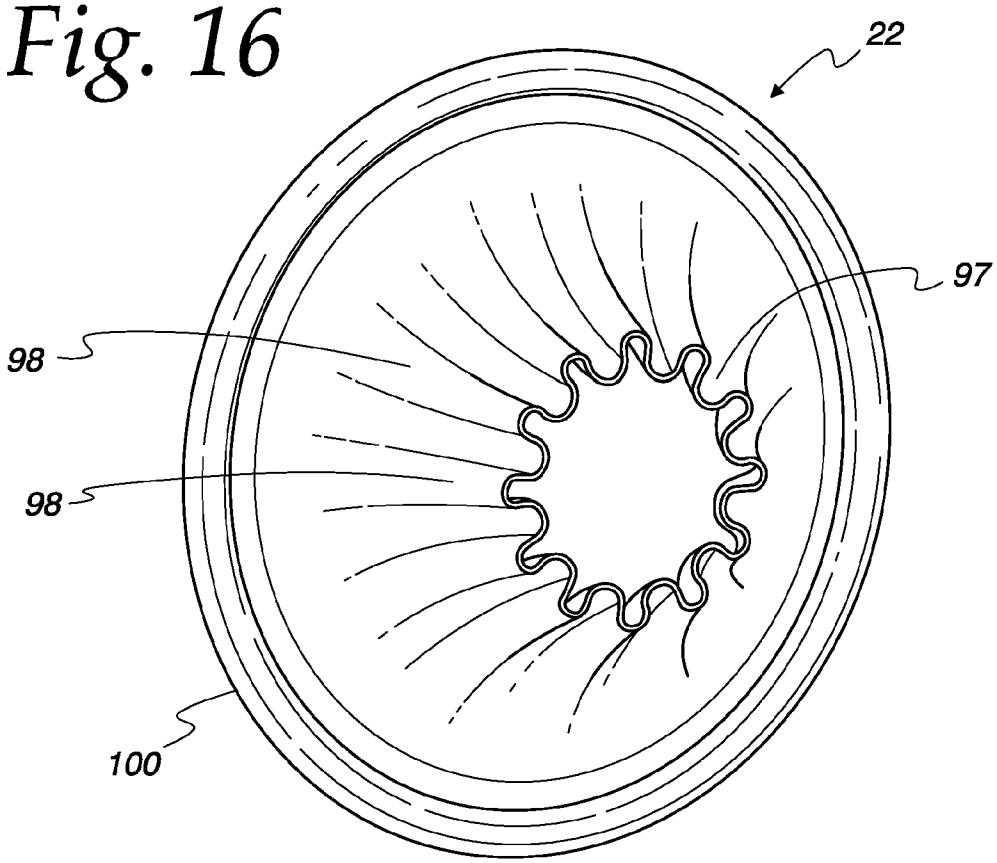


Fig. 17

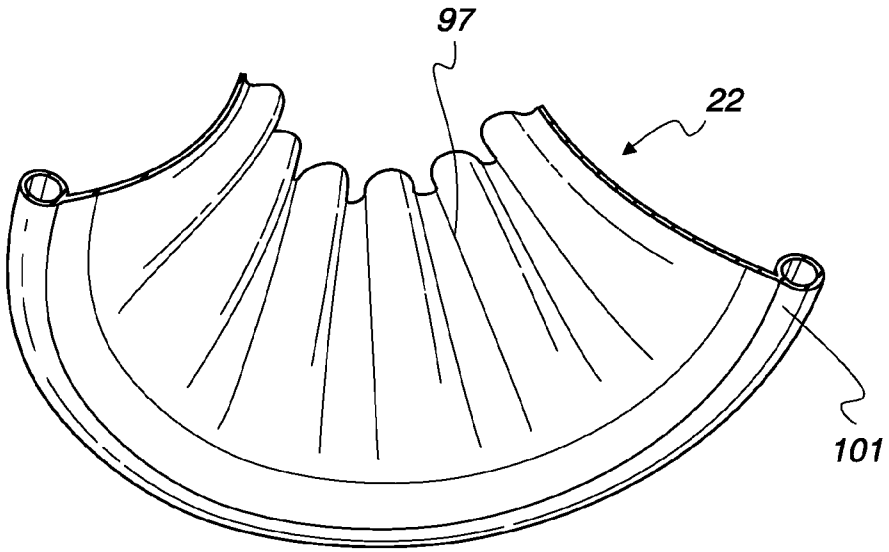
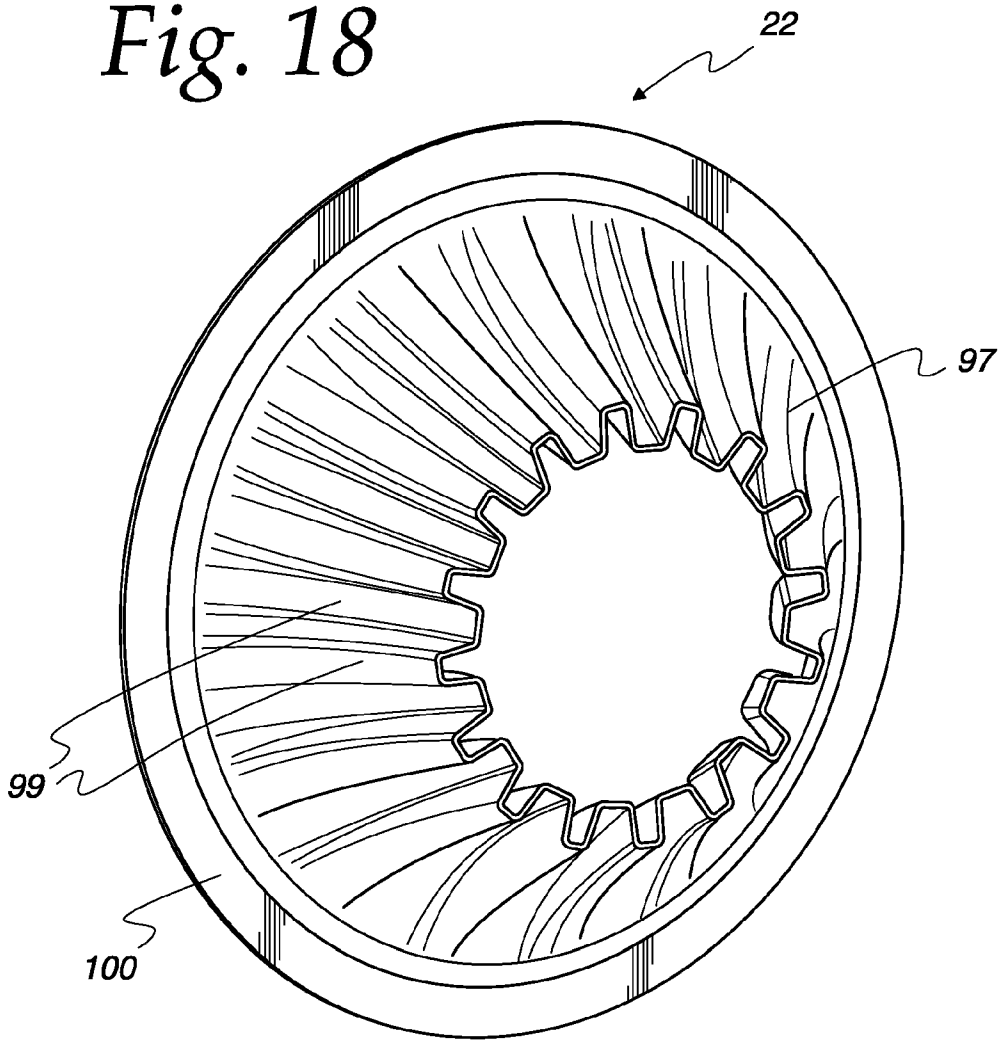


Fig. 18



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/047637

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B65G 53/54 (2012.01)
USPC - 406/196
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - B65G 11/10, 51/04, 53/24, 53/52, 53/54 (2012.01)
USPC - 56/327.1, 328.1; 193/25R, 25S; 406/83, 147, 191, 192, 195, 196, 197

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Orbit

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2000062594 A1 (LUCAS) 26 October 2000 (26.10.2000) entire document	1-4, 7-8, 10-12
X	US 2,478,326 A (SCARTH) 09 August 1949 (09.08.1949) entire document	5, 6, 17-20, 22, 27, 28, 30, 31
X	US 2011/0091292 A1 (BRYAN, JR. et al) 21 April 2011 (21.04.2011) entire document	7-9, 13-16, 34-36
A	US 4,715,749 A (HOPPE et al) 29 December 1987 (29.12.1987) entire document	1-36
A	US 3,265,445 A (CRONIN) 09 August 1966 (09.08.1966) entire document	1-36
A	US 3,913,307 A (CARINAL, JR.) 21 October 1975 (21.10.1975) entire document	1-36

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 January 2012	12 JAN 2012

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)