US010638732B2

(12) **United States Patent**
Brunner et al.

(10) **Patent No.: US 10,638,732 B2**
(45) **Date of Patent: May 5, 2020**

(54) **AQUARIUM FILTER ARRANGEMENT WITH CONTROL VALVE**

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(73) Assignee: **Spectrum Brands, Inc.**, Middleton, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/819,892**

(22) Filed: **Nov. 21, 2017**

(65) **Prior Publication Data**

US 2019/0150411 A1 May 23, 2019

(51) **Int. Cl.**

A01K 63/04	(2006.01)
B01D 35/30	(2006.01)
B01D 35/15	(2006.01)
B01D 35/26	(2006.01)
B01D 35/157	(2006.01)

(52) **U.S. Cl.**
CPC ***A01K 63/045*** (2013.01); ***B01D 35/1573*** (2013.01); ***B01D 35/26*** (2013.01); ***B01D 35/30*** (2013.01); *B01D 2201/301* (2013.01)

(58) **Field of Classification Search**
CPC A01K 63/045; B01D 35/26; B01D 35/30; B01D 35/1573; B01D 2201/301
USPC ... 210/167.21, 167.22, 167.27, 416.1, 416.2; 119/259, 260
See application file for complete search history.

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Primary Examiner — Fred Prince
(74) *Attorney, Agent, or Firm* — Merchant & Gould P.C.

(57) **ABSTRACT**

A filter arrangement for an aquarium is disclosed. The filter arrangement can include a housing assembly, a pump assembly, a transfer tube assembly, and a valve assembly for controlling water flow through the transfer tube assembly. The transfer tube assembly can include a tube structure within which a valve body of the valve assembly is rotatably disposed. The tube structure can be formed from a first tube half mated to a second tube half to permanently secure the valve body within the tube structure. A valve operator can be connected to the valve body to advantageously allow a user to manipulate the flow of water through the transfer tube assembly. Control of water flow through the filter arrangement is beneficial for obtaining a desired water flow for a certain aquarium size and application and for reducing flow during certain periods, such as during feeding.

13 Claims, 29 Drawing Sheets

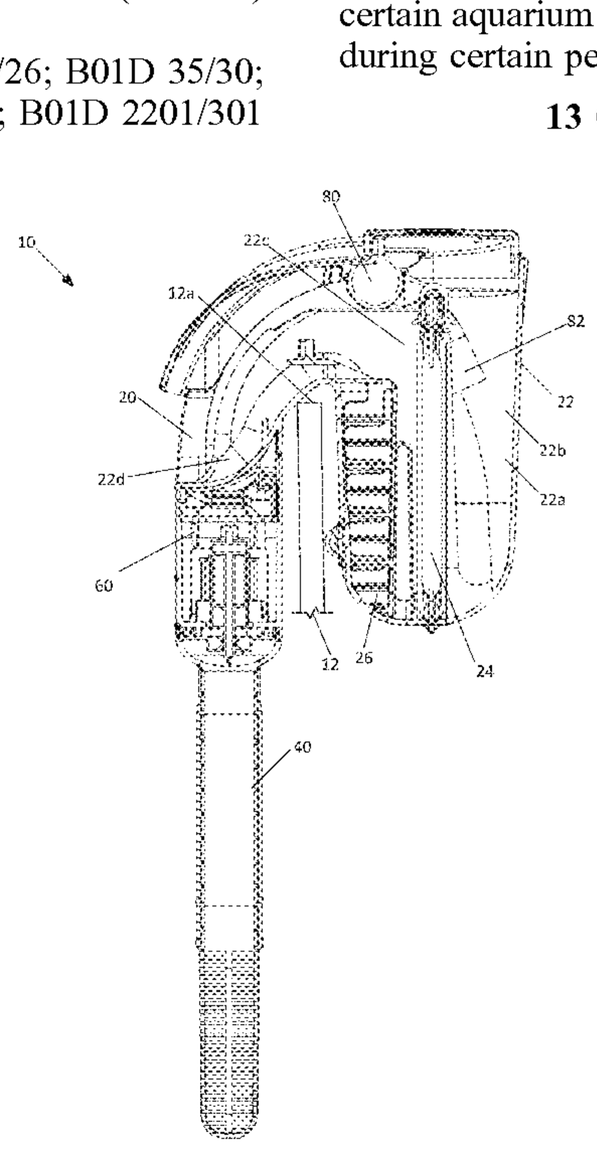


FIG. 1

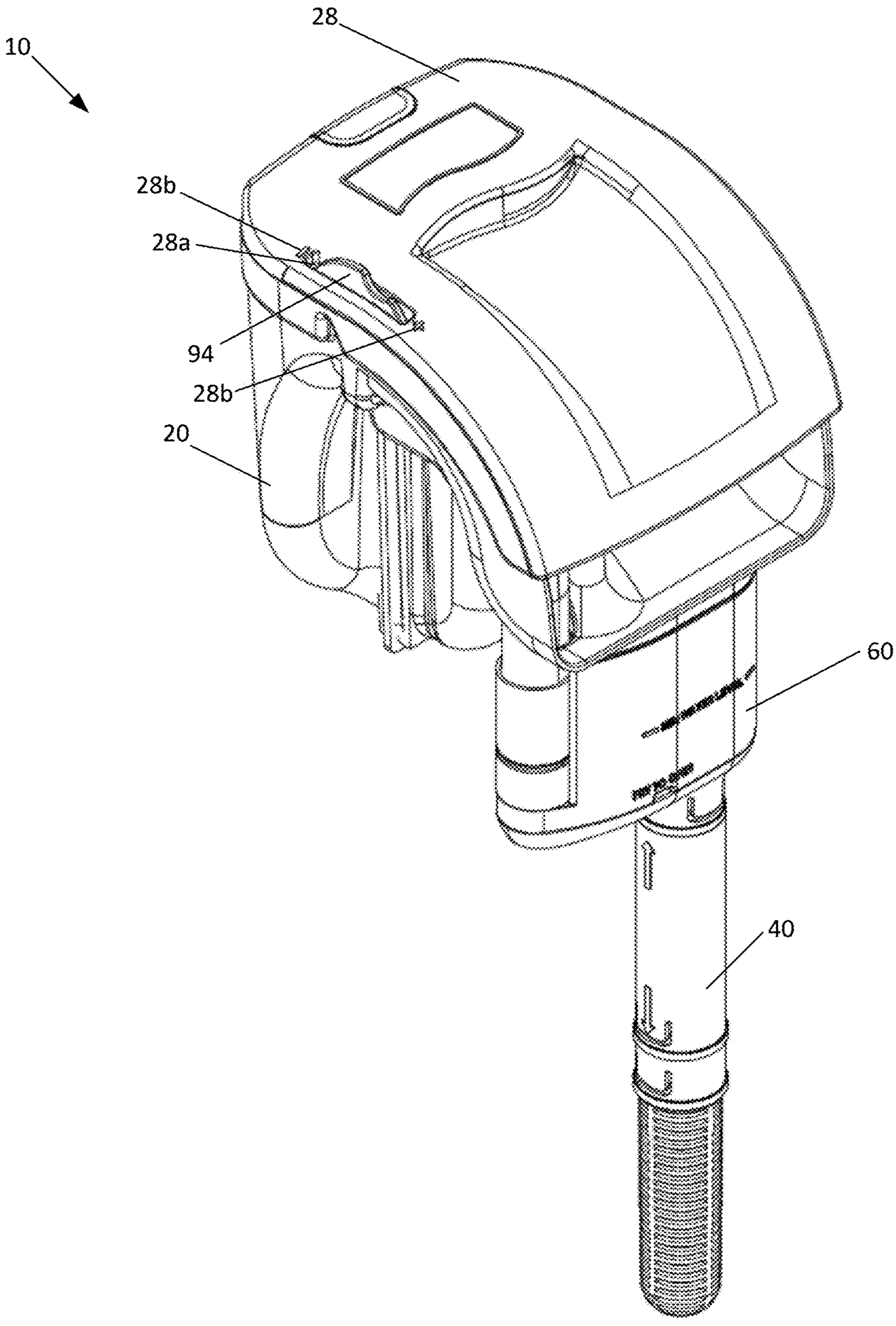


FIG. 2

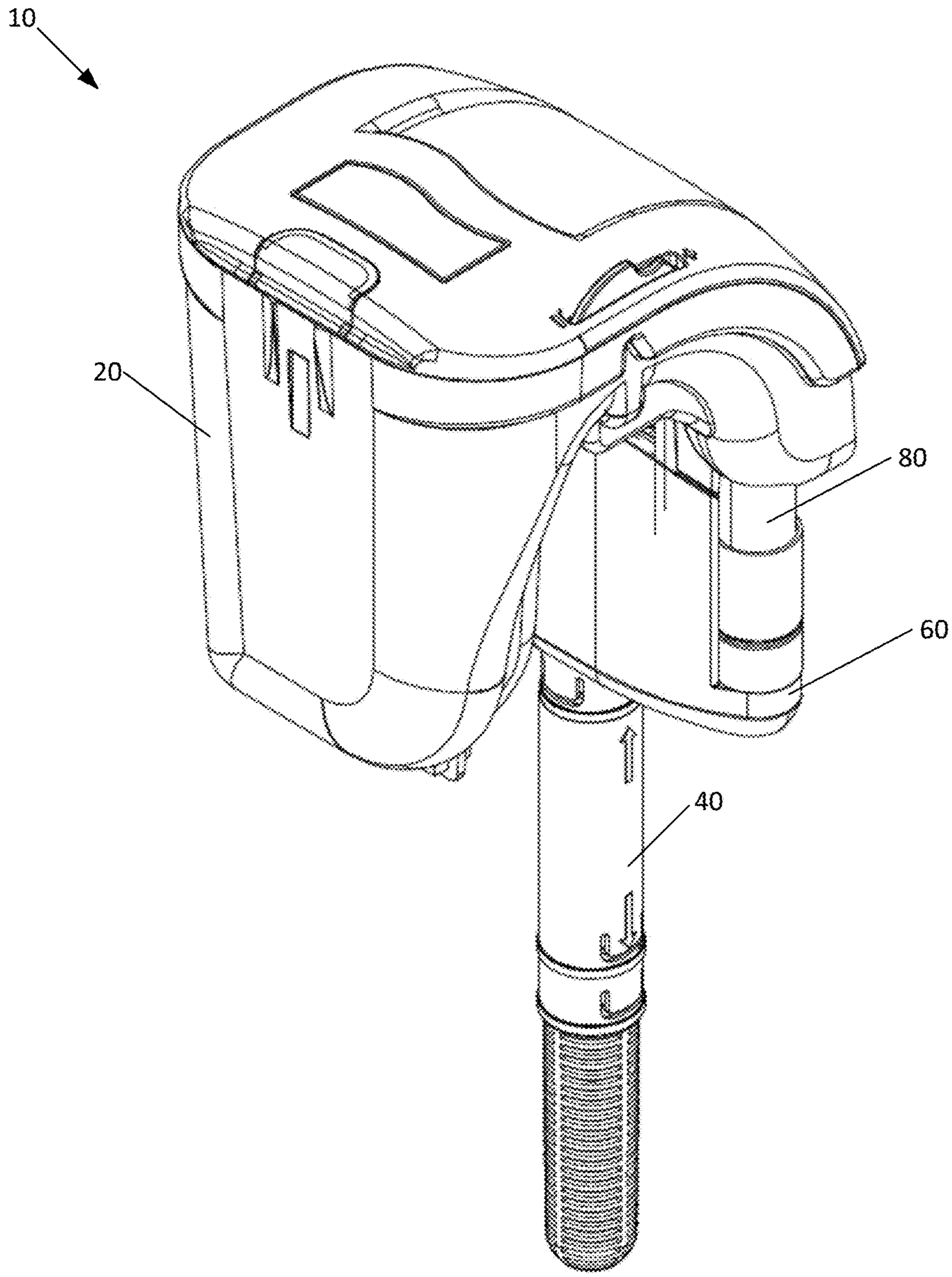


FIG. 3

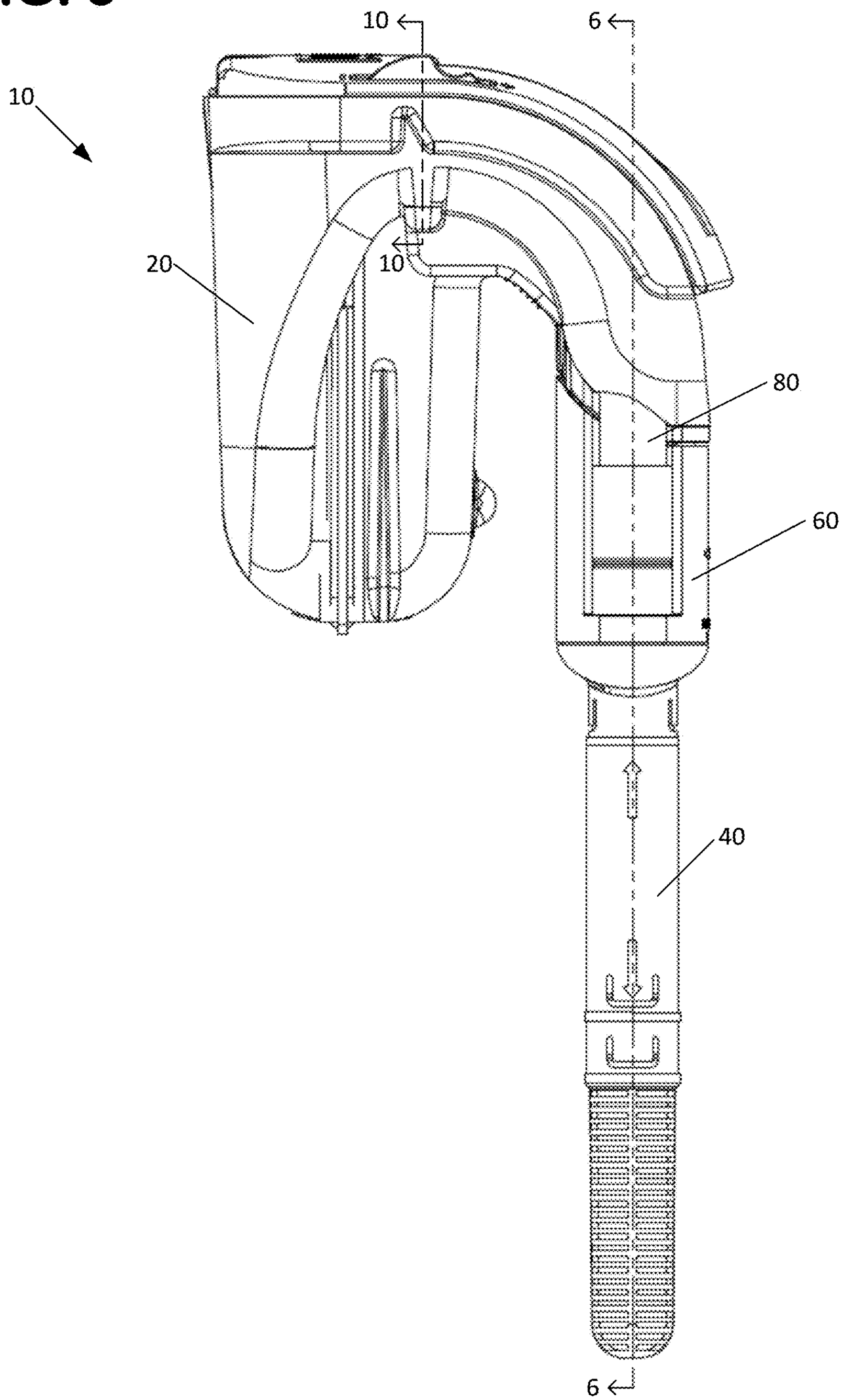


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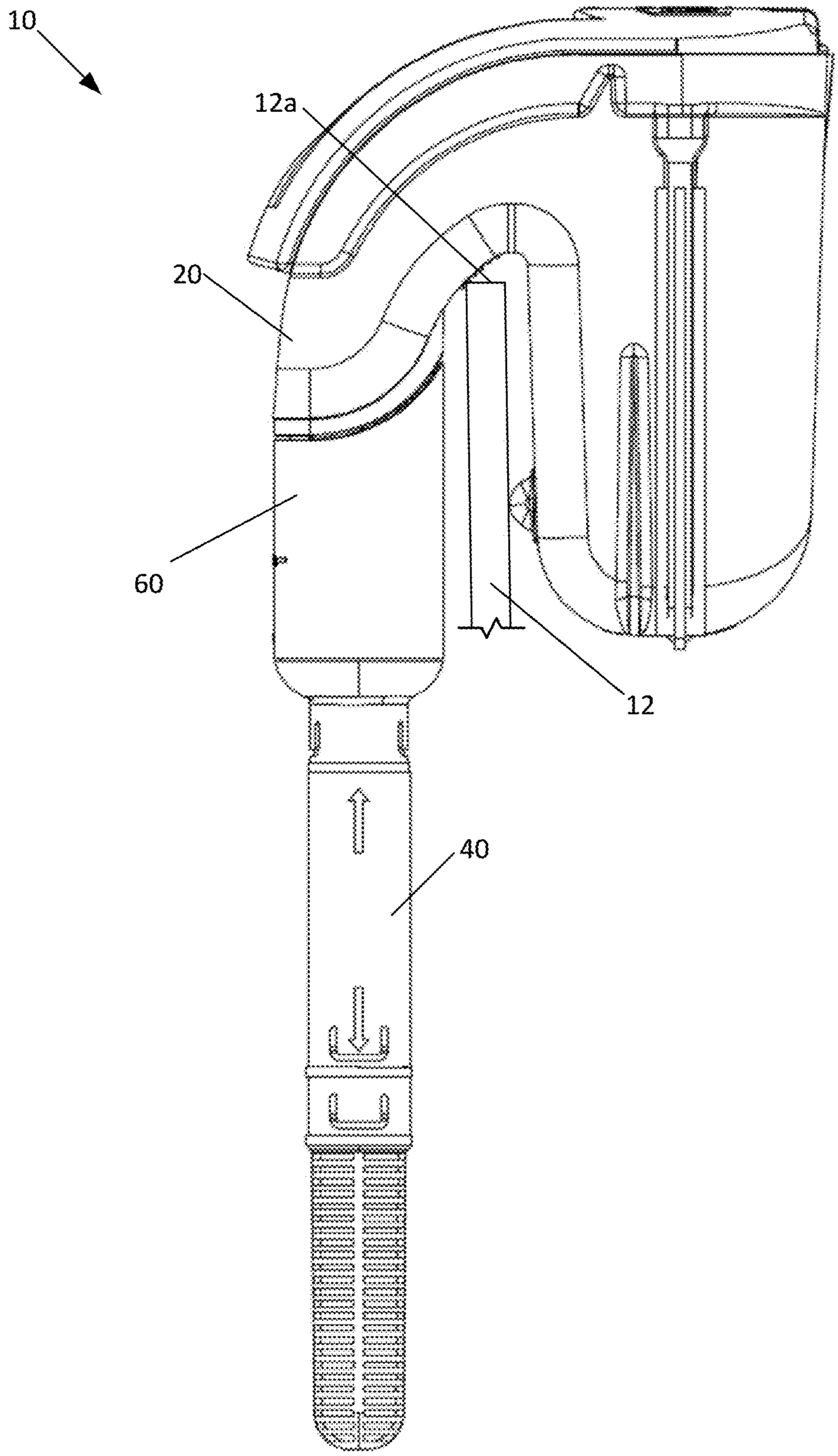


FIG. 5

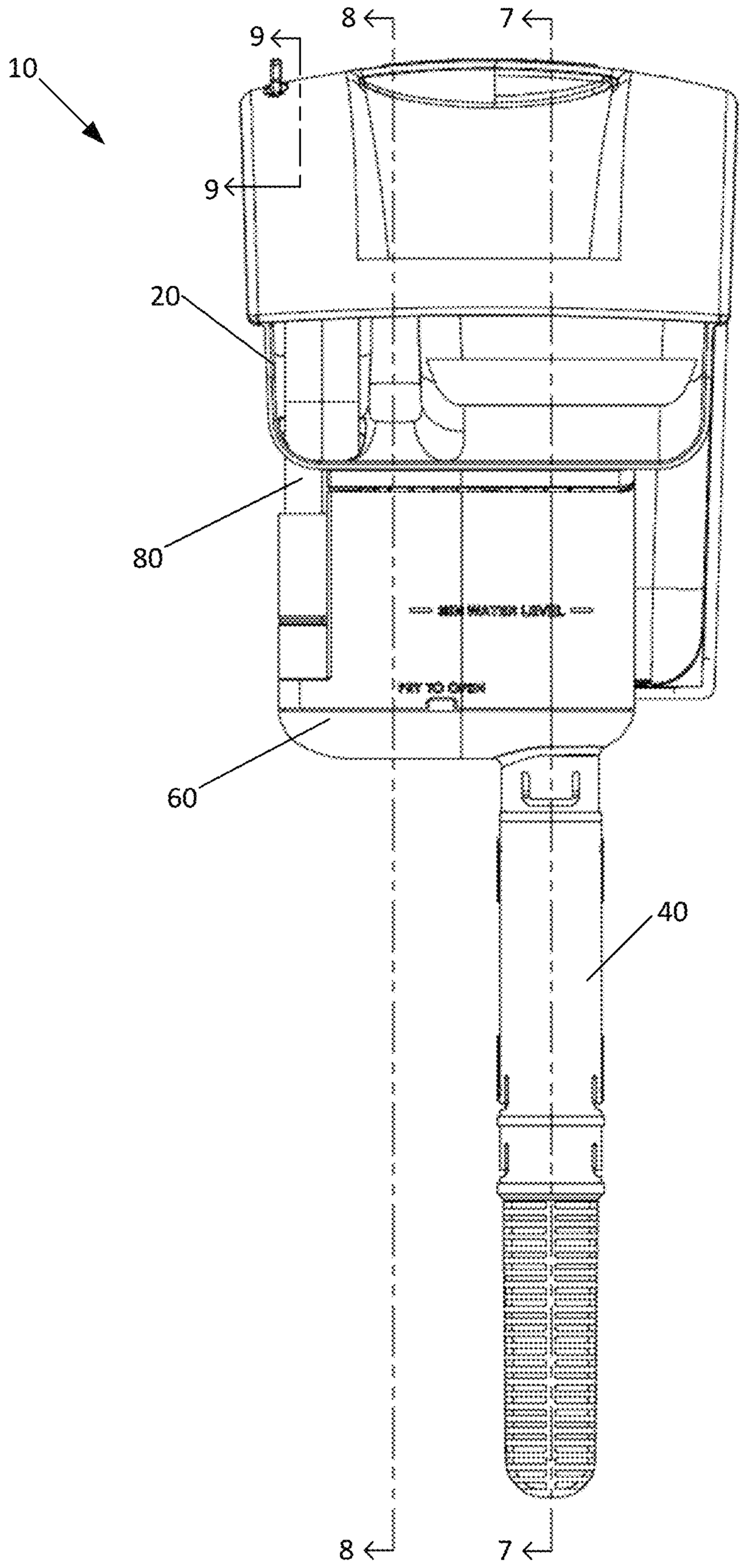


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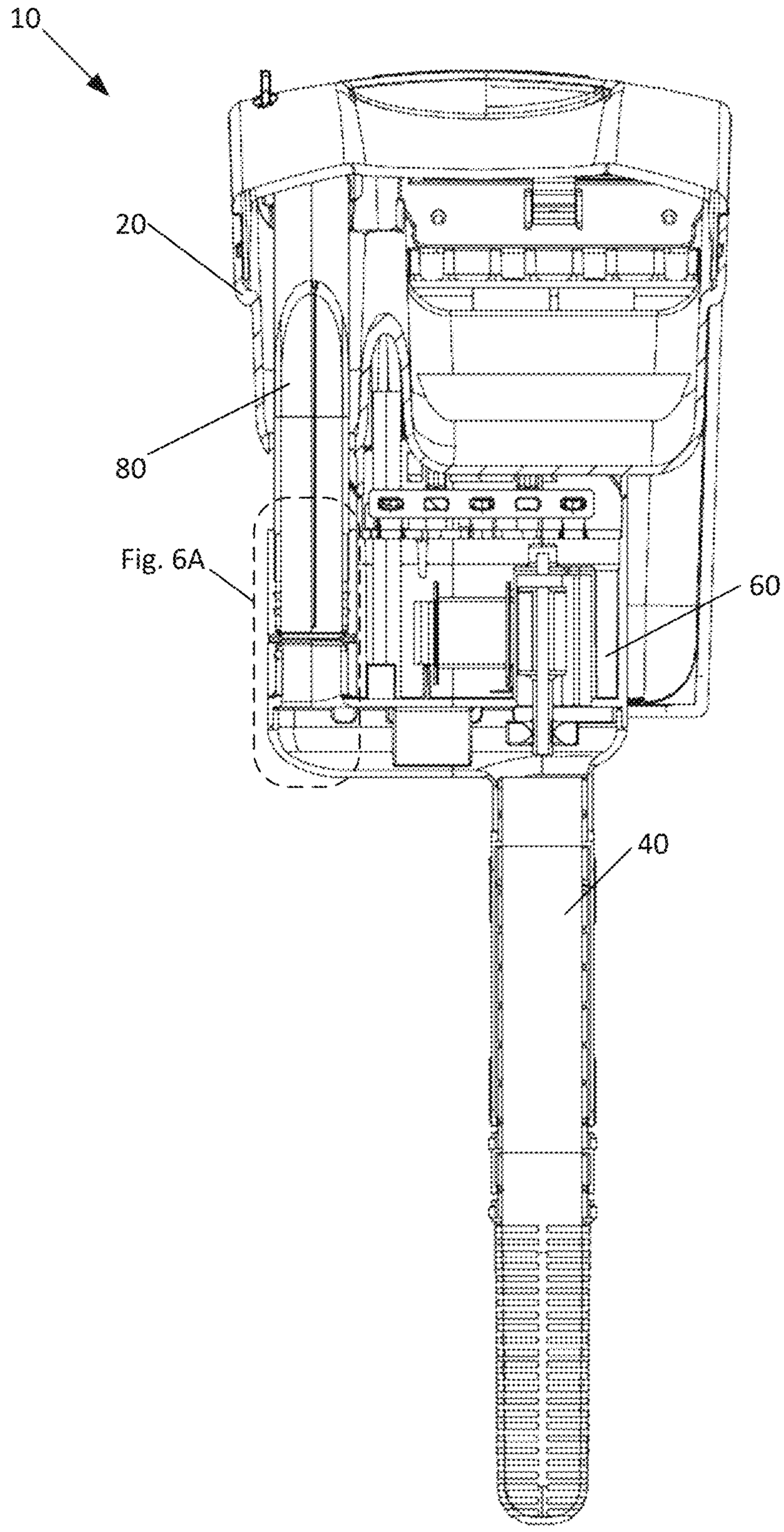


FIG. 6A

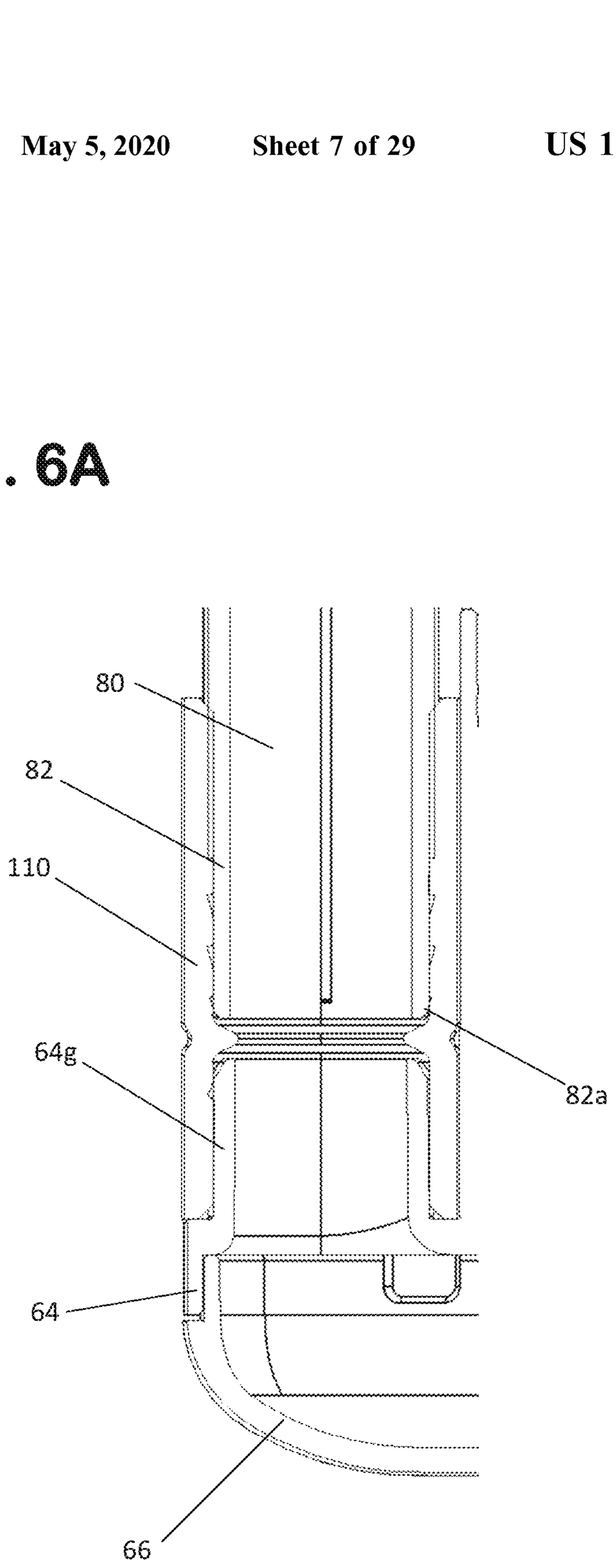


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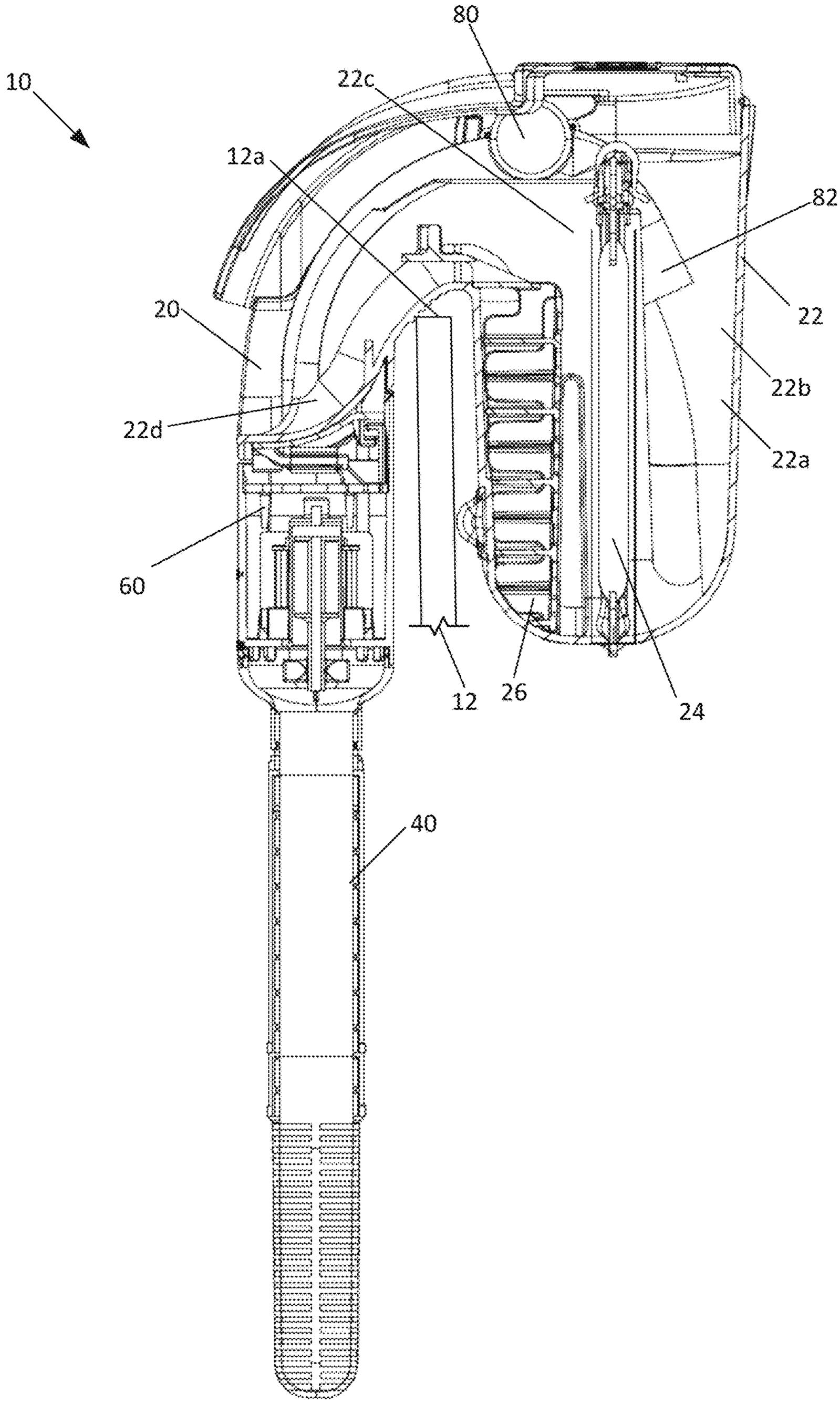


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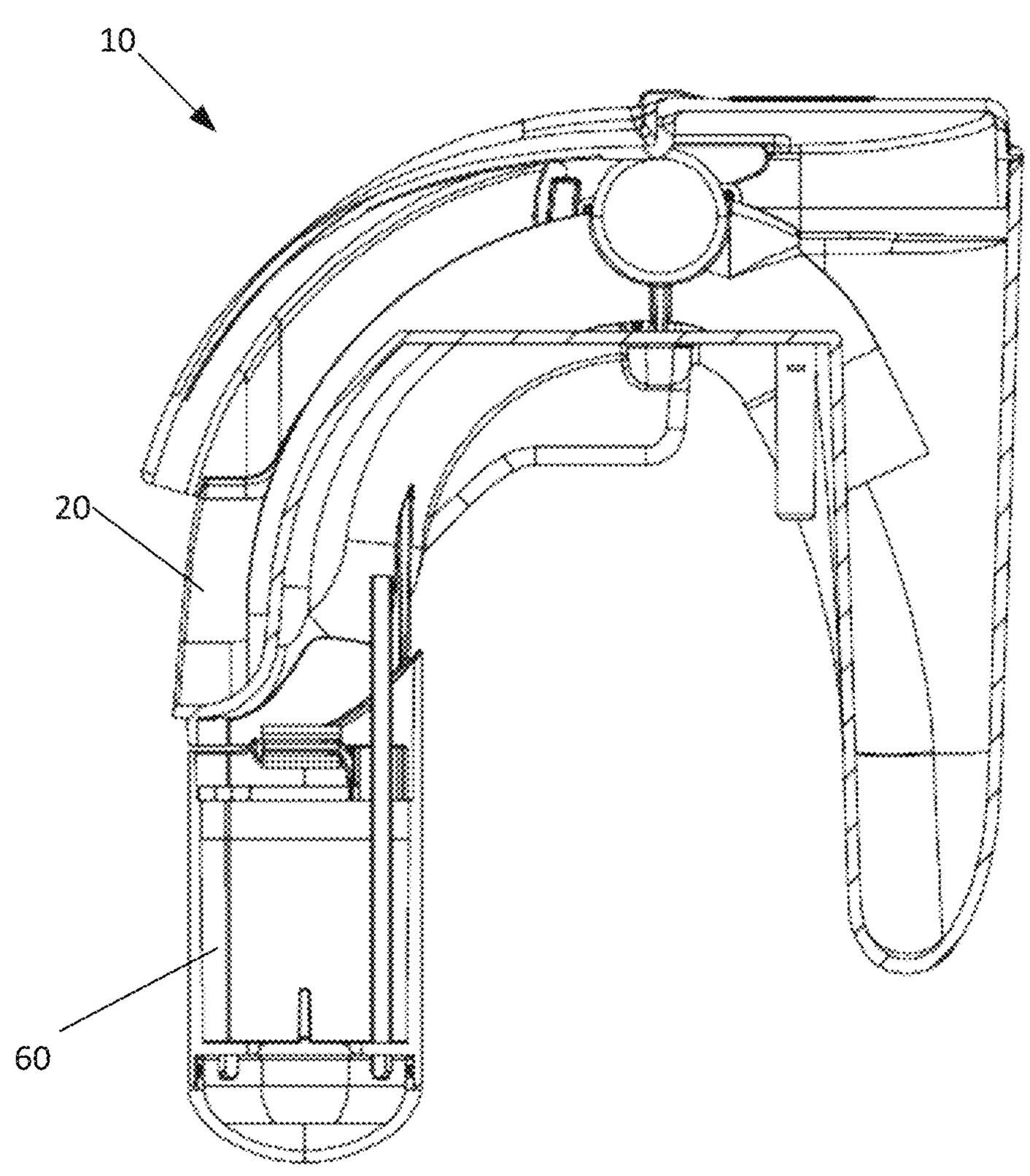


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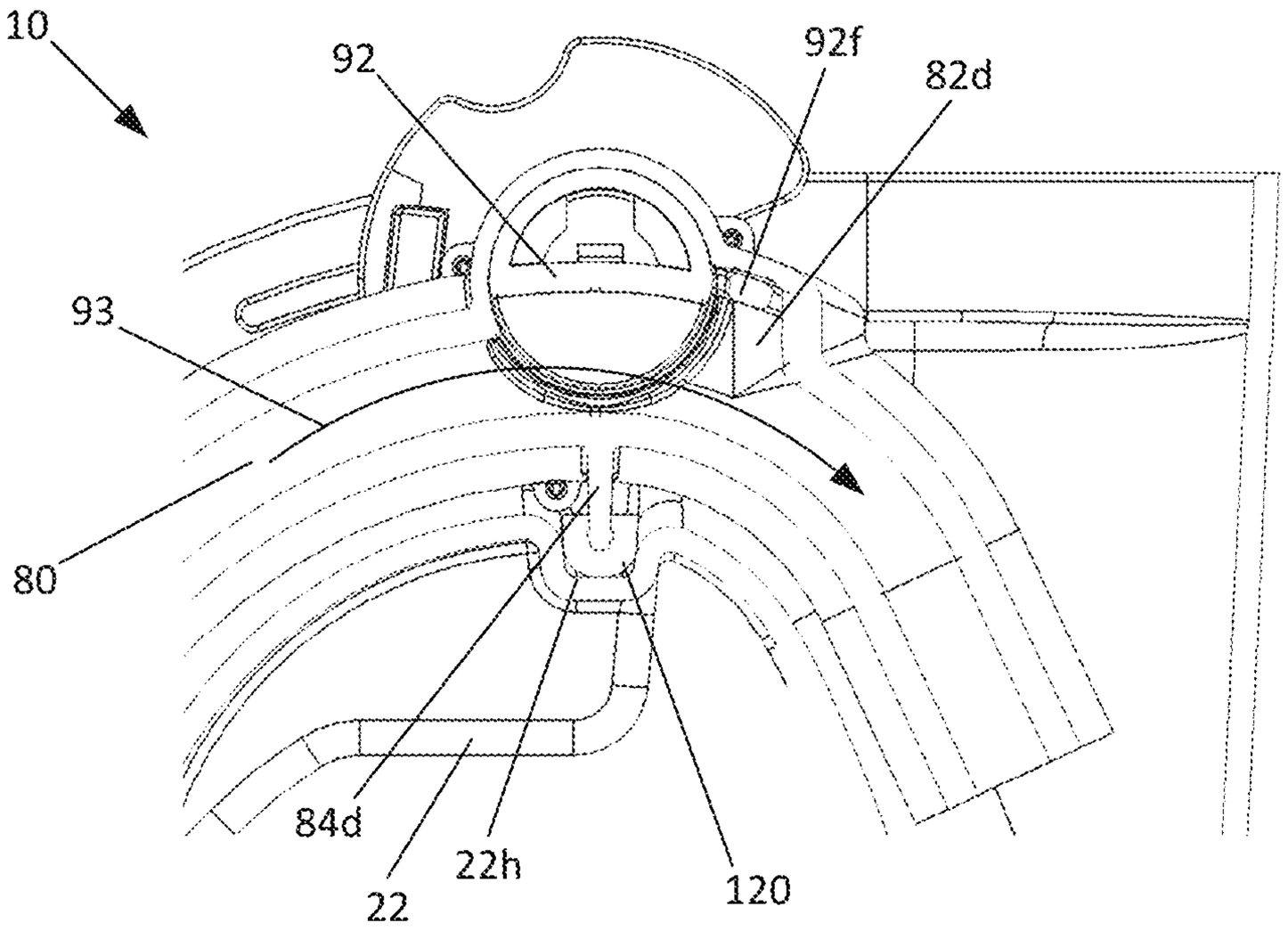


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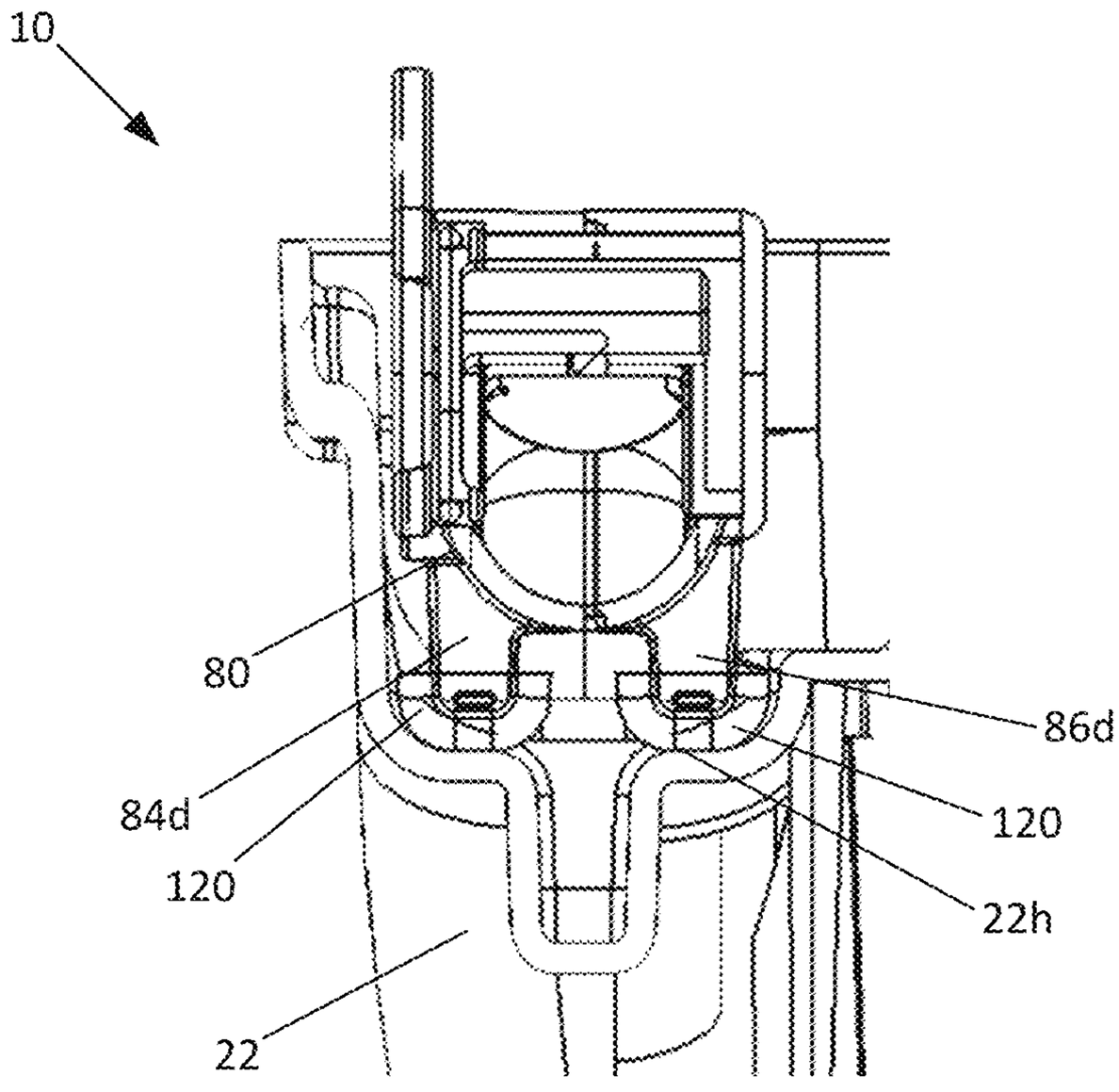


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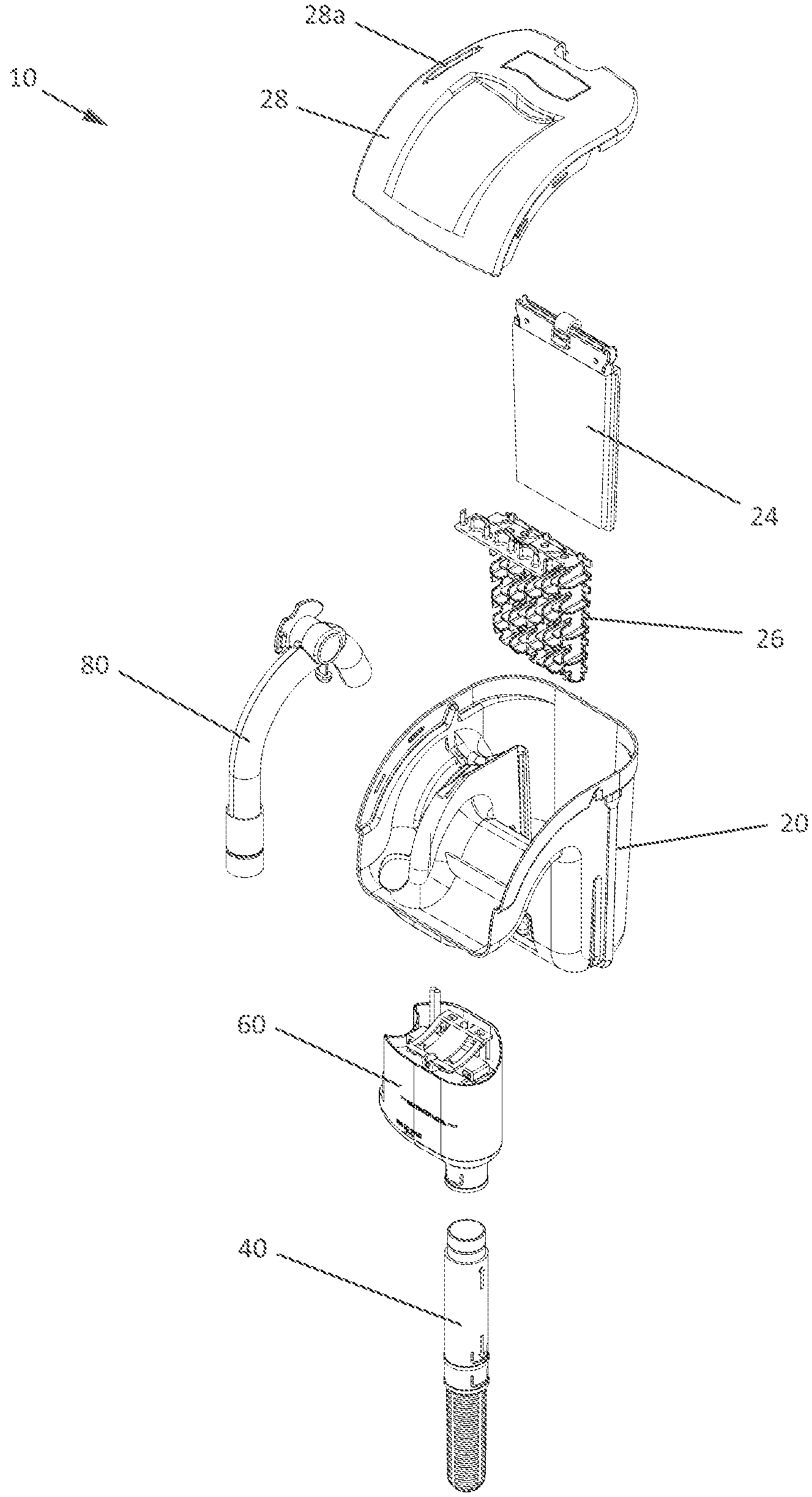


FIG. 12

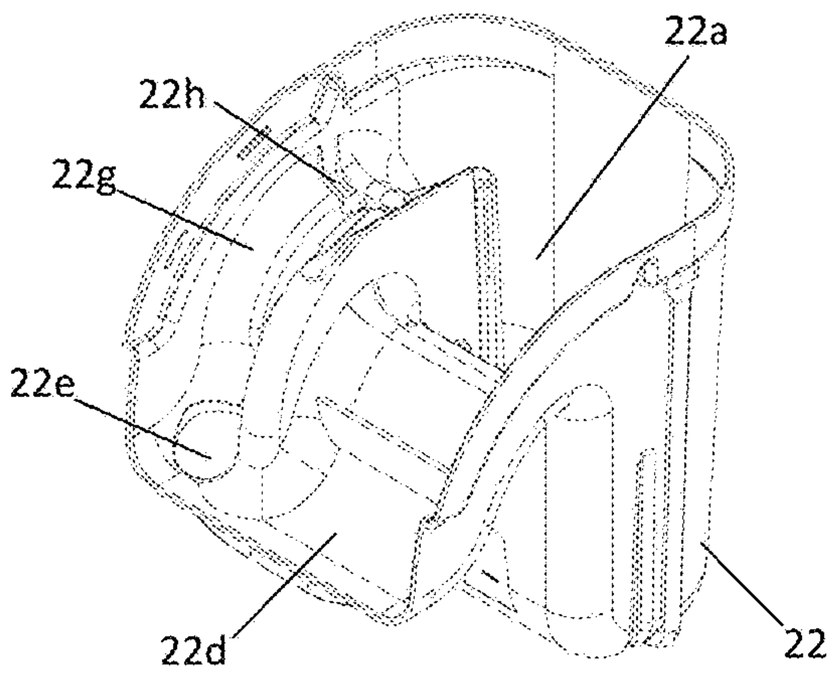


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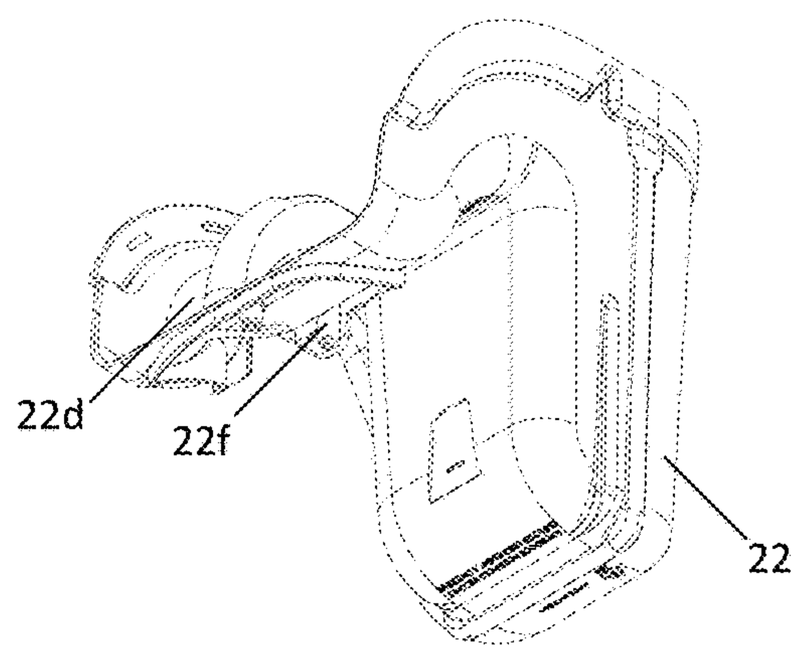


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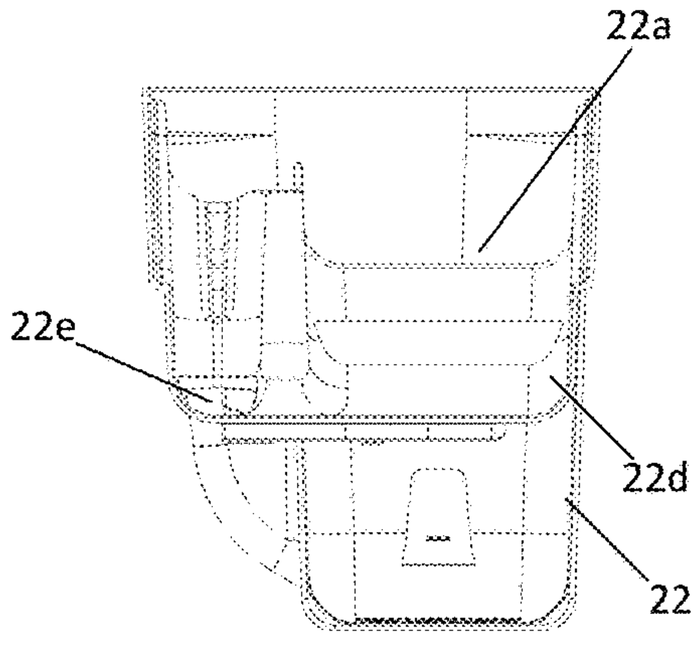


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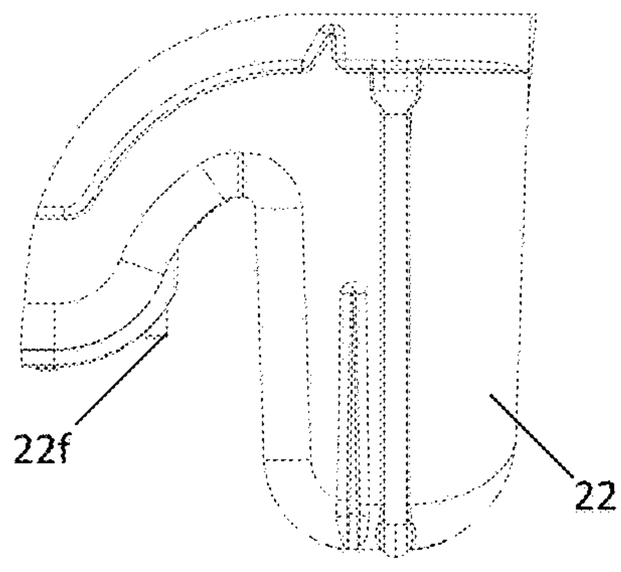


FIG. 16

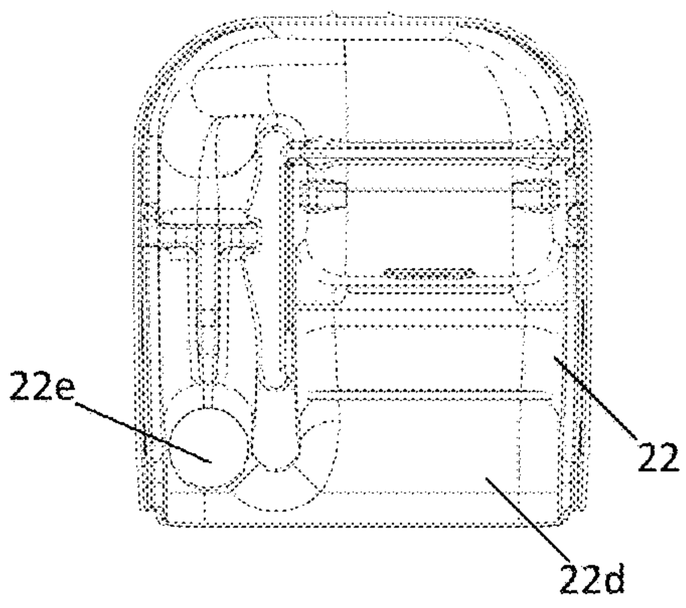


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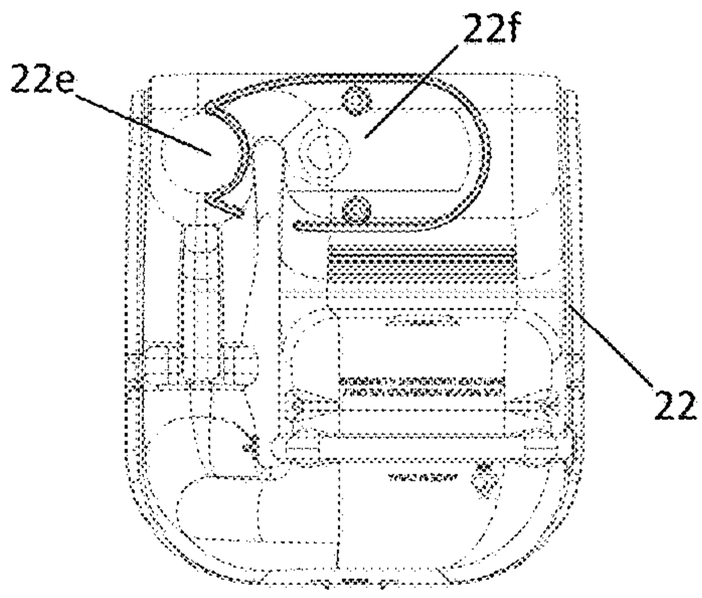


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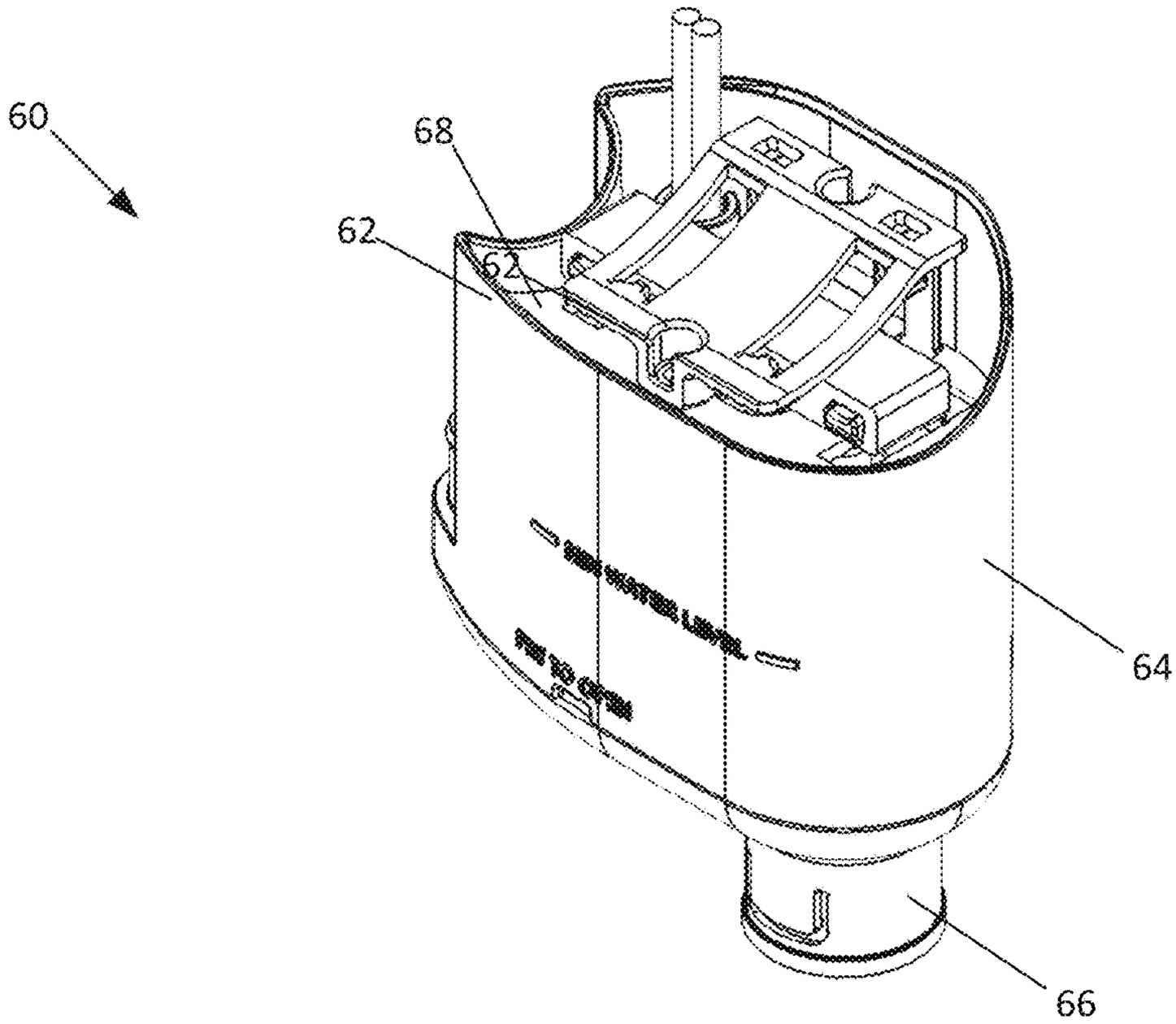


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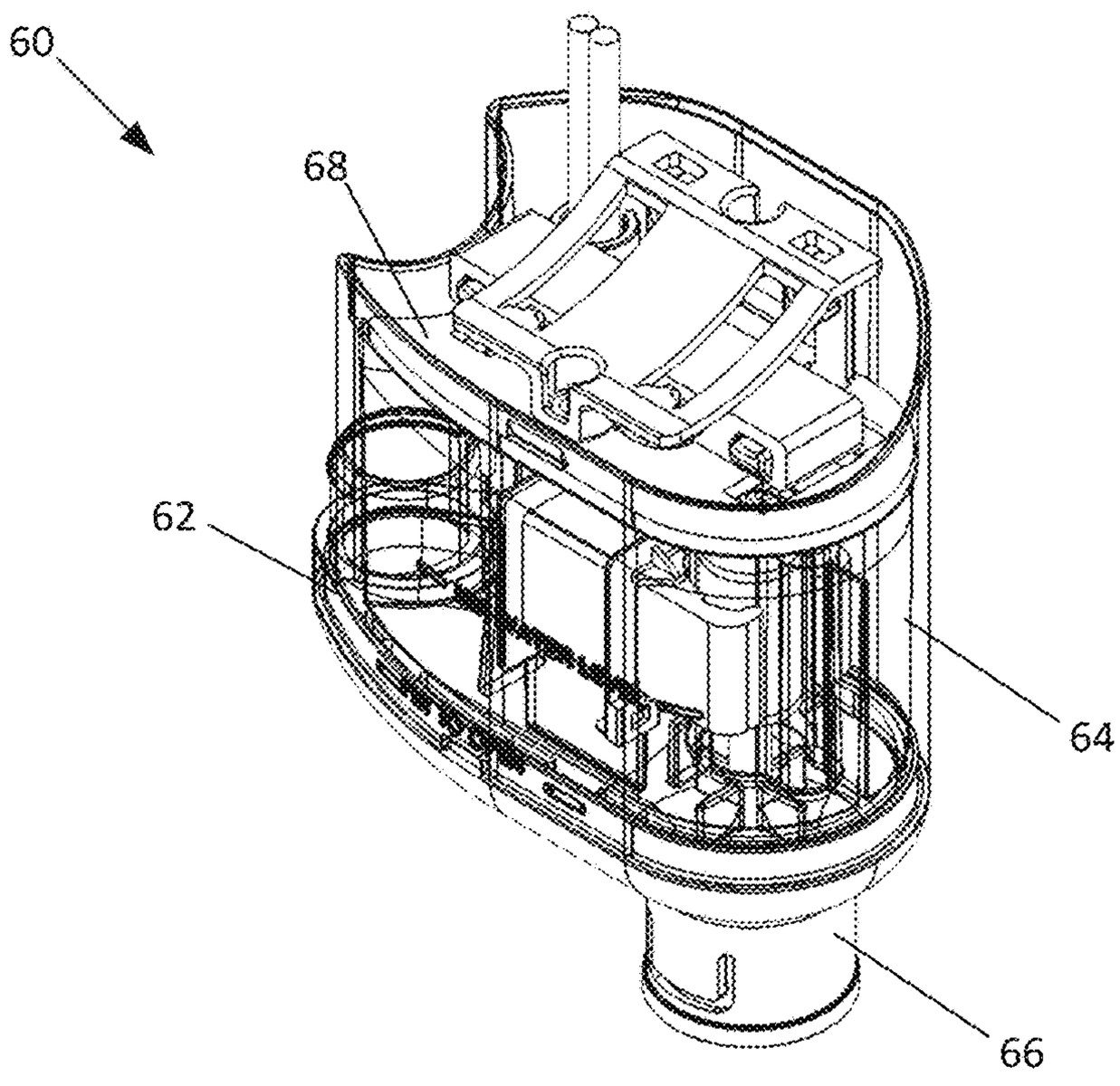


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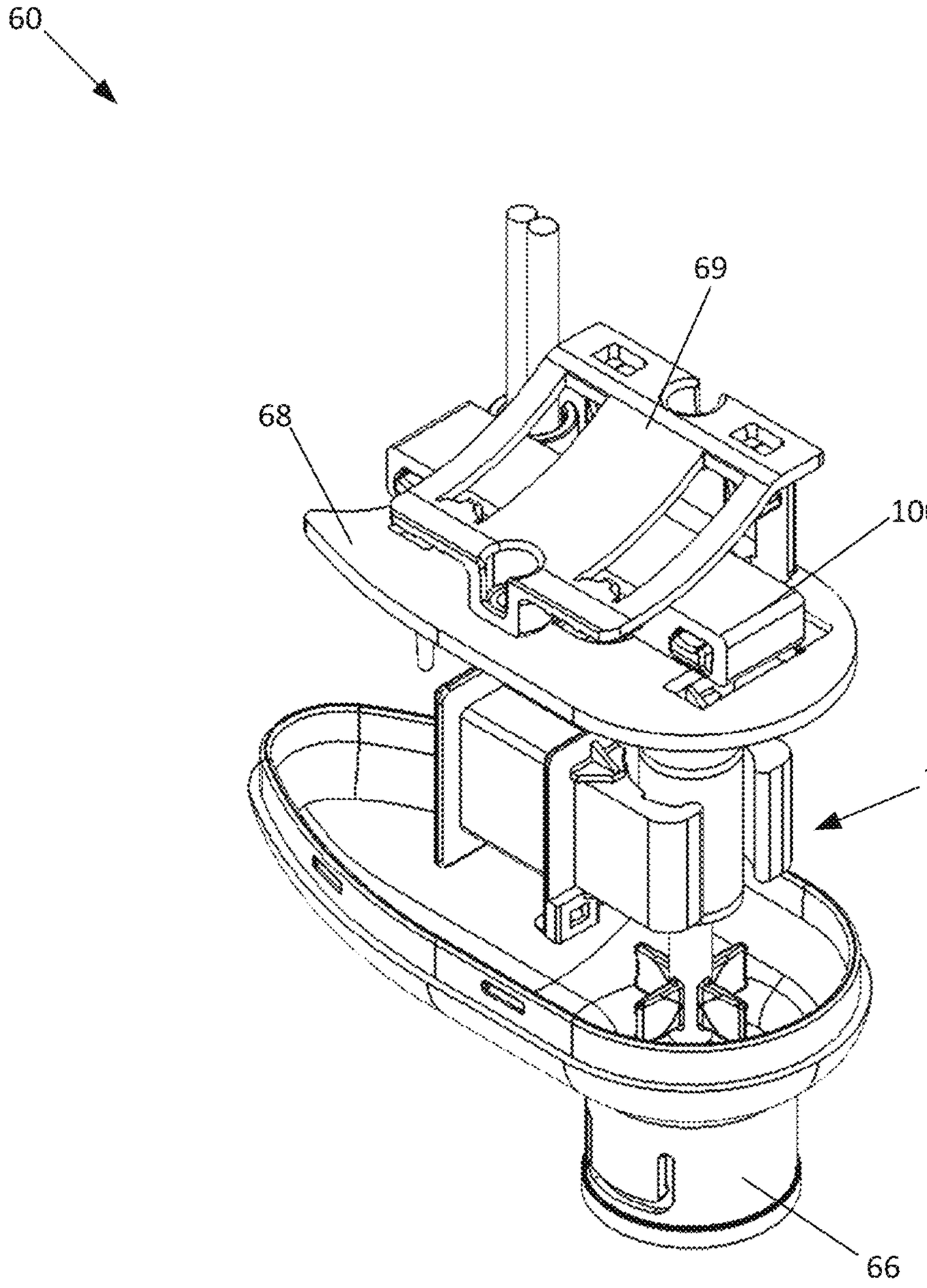


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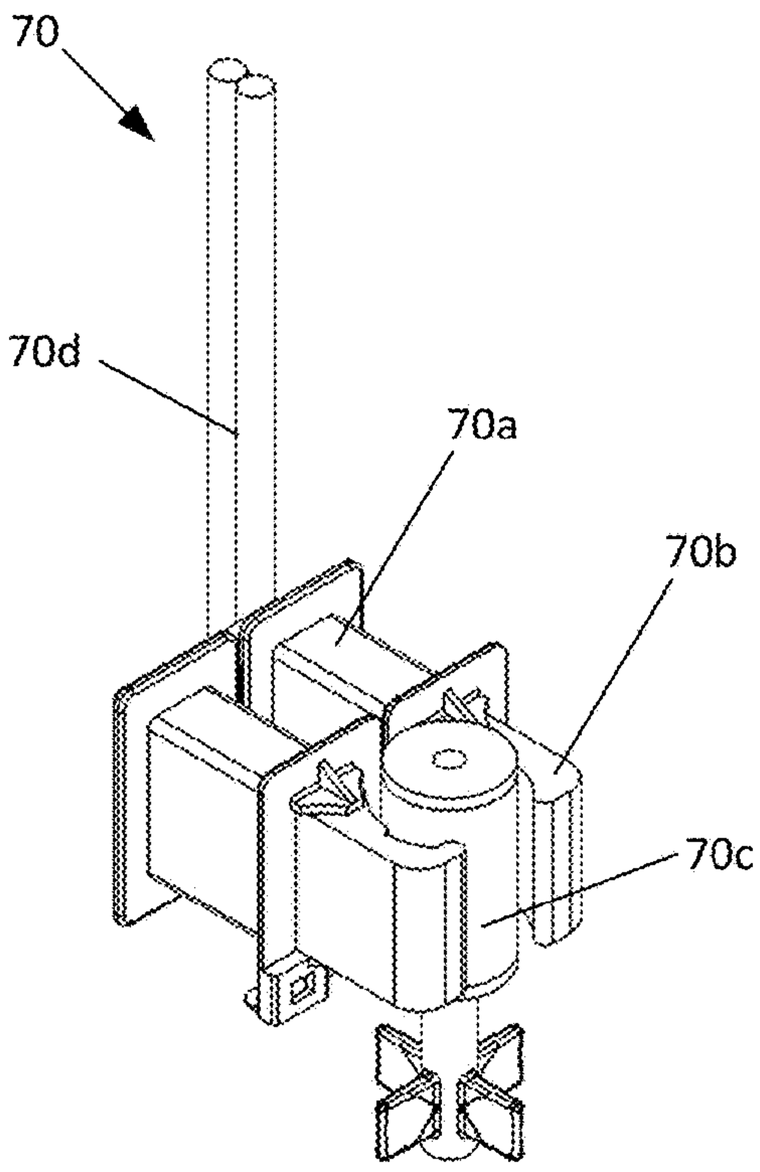


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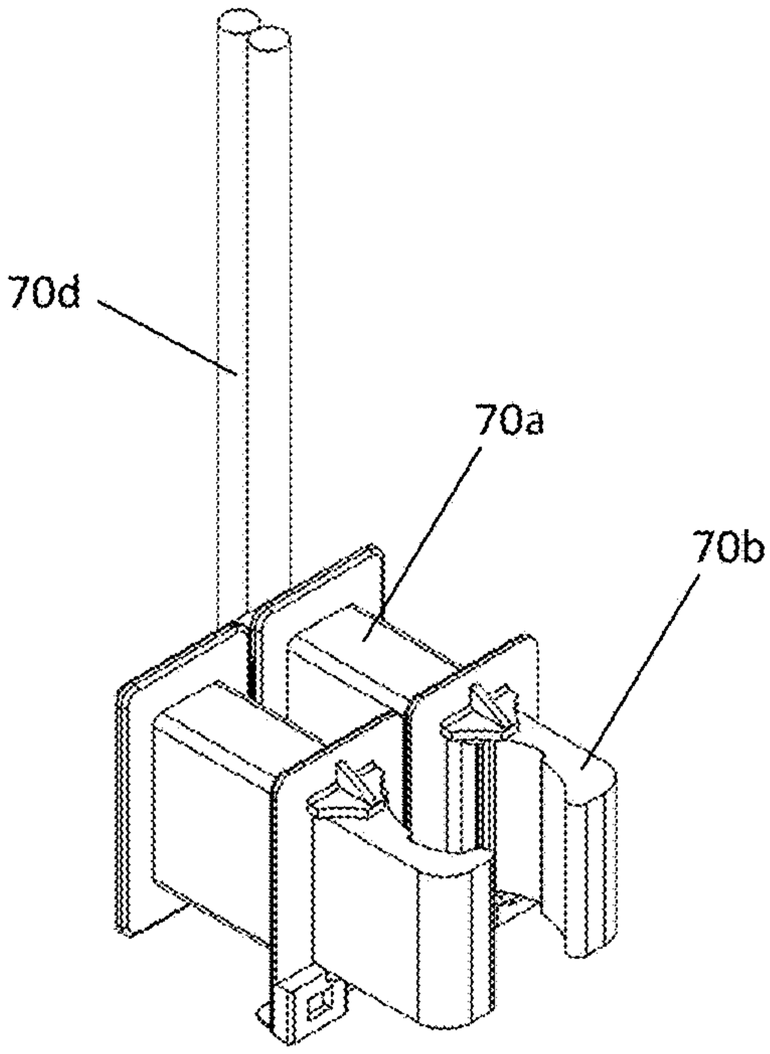


FIG. 23

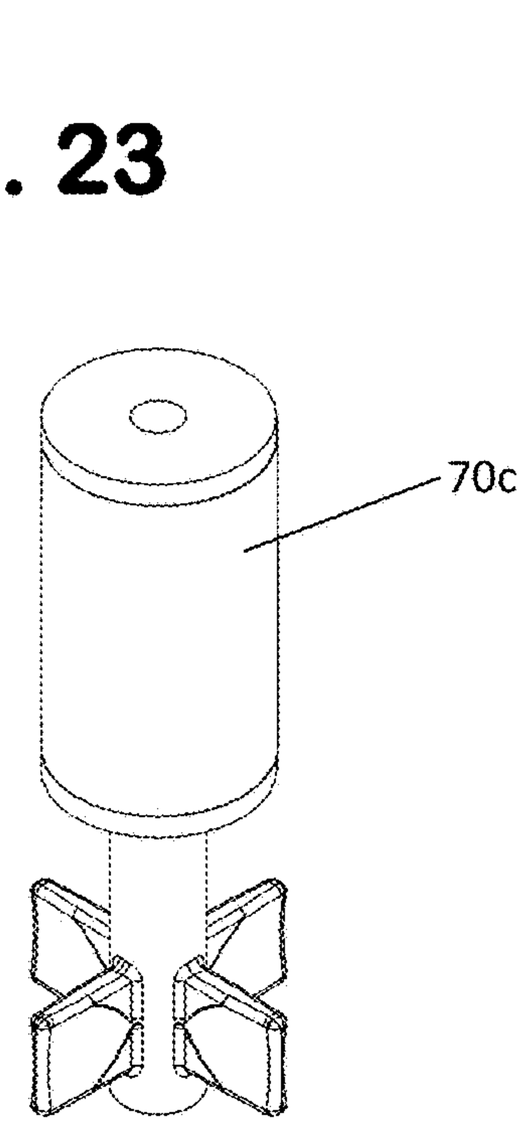


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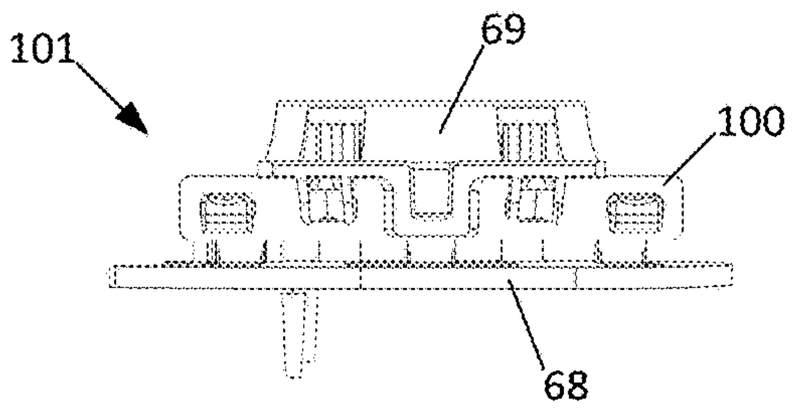


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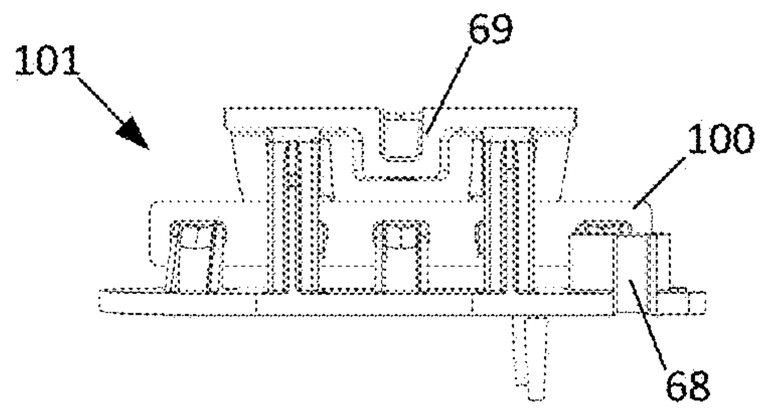


FIG. 26

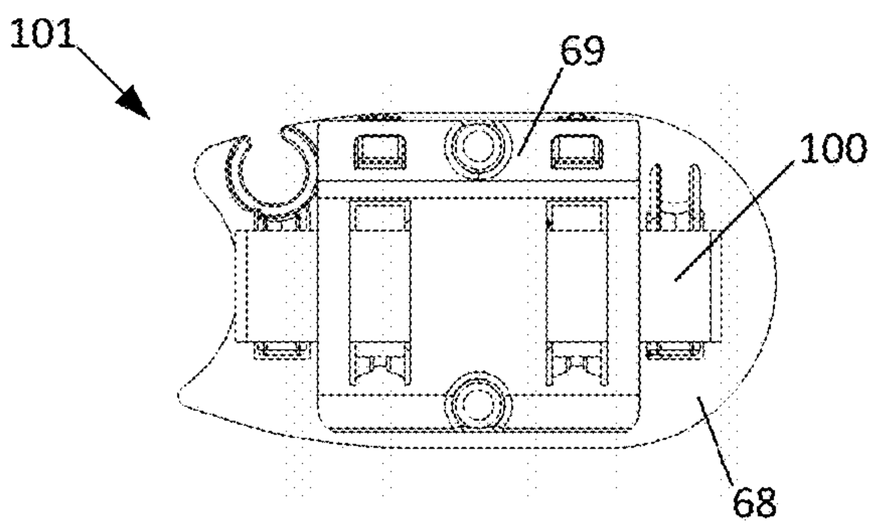


FIG. 27

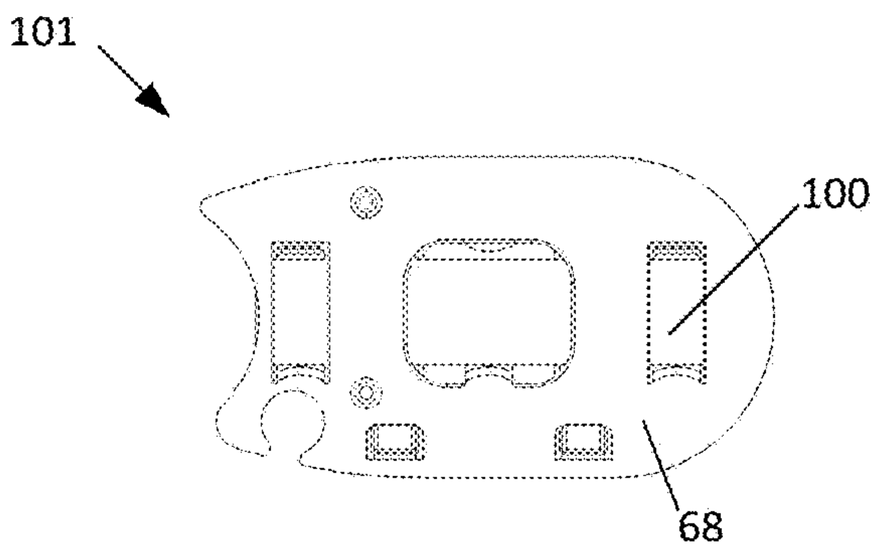


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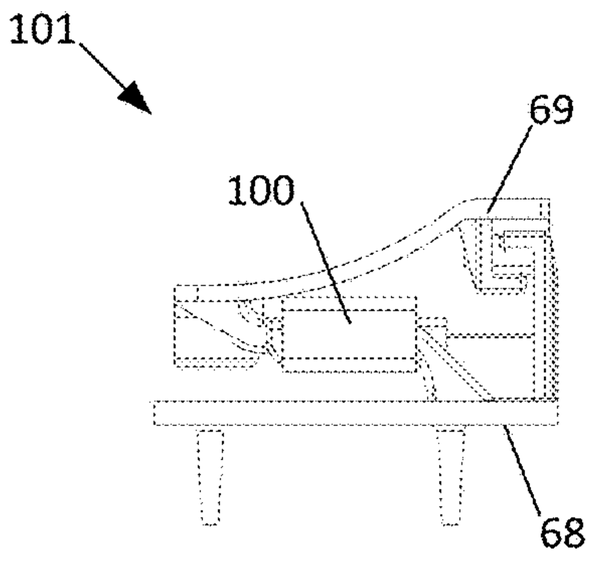


FIG. 29

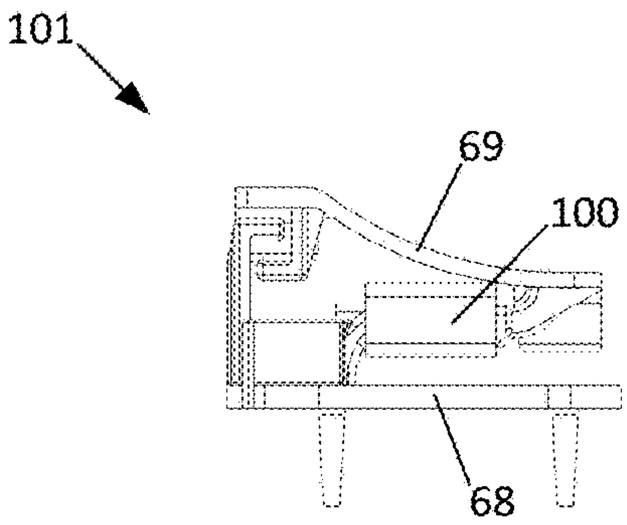


FIG. 30

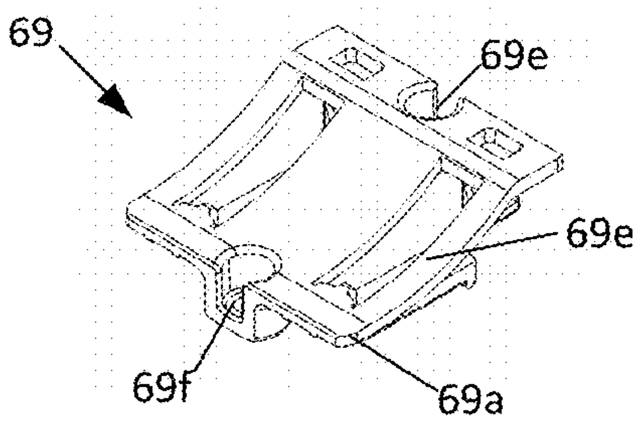


FIG. 31

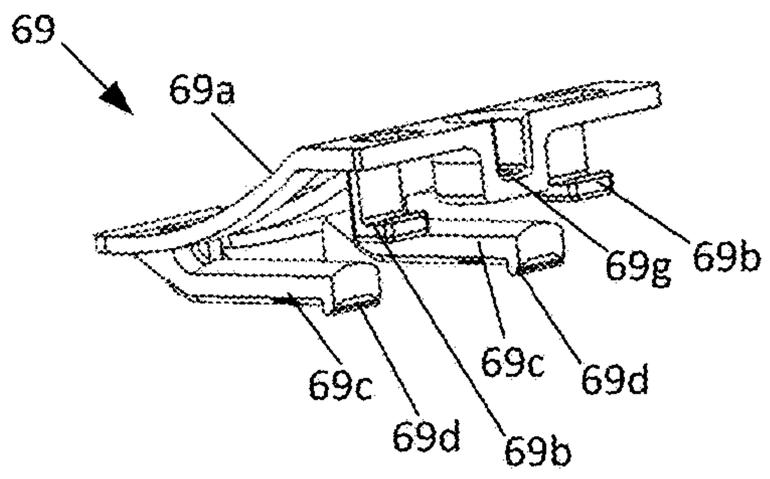


FIG. 32

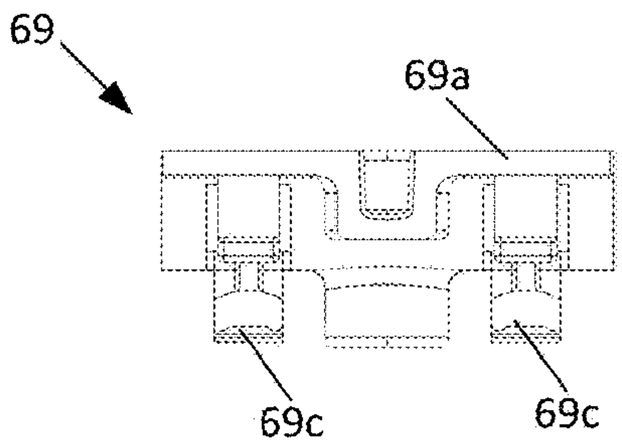


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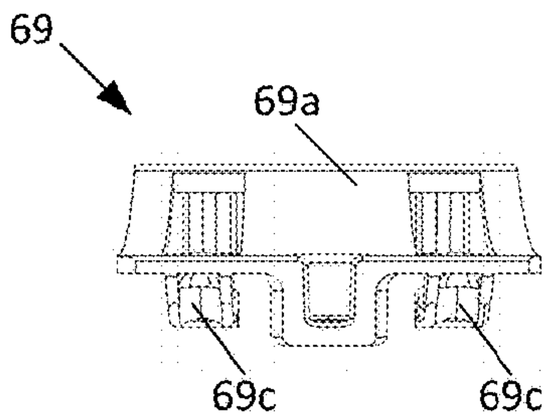


FIG. 34

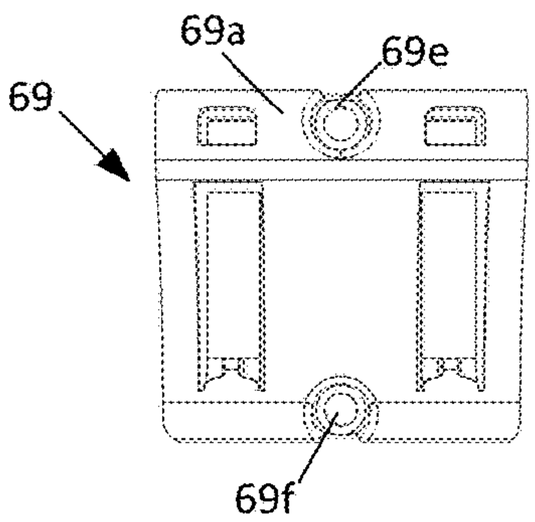


FIG. 35

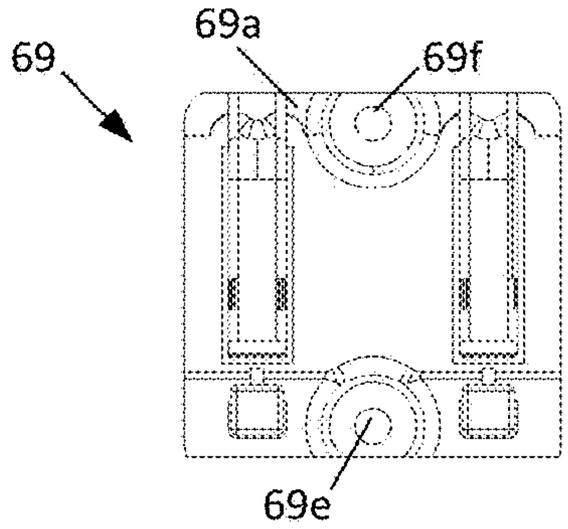


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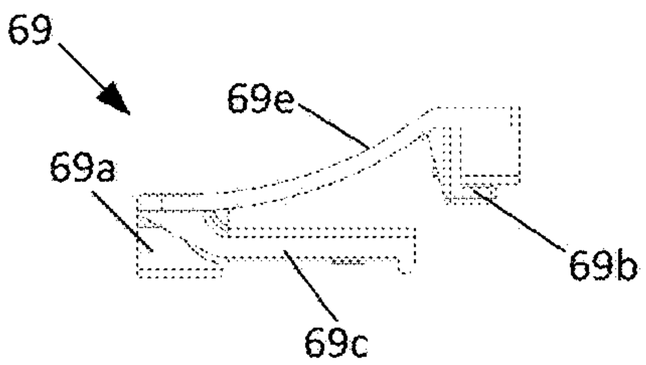


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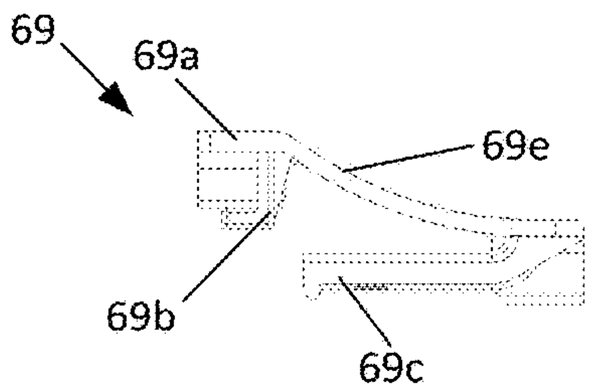


FIG. 38

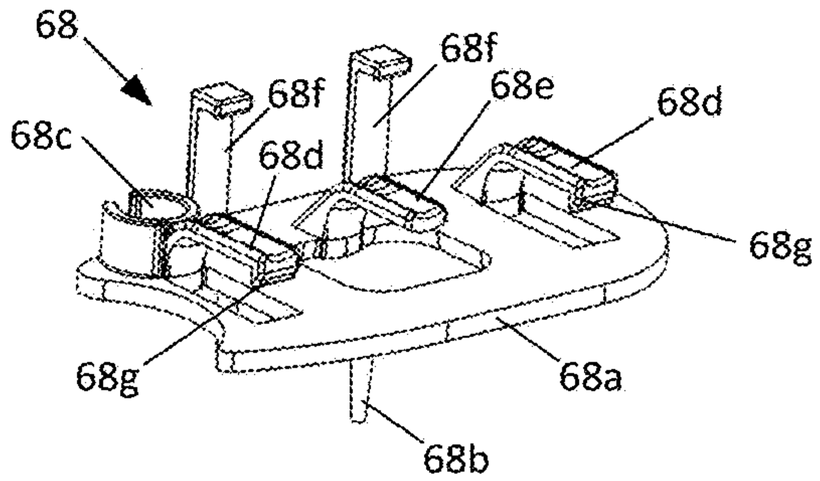


FIG. 39

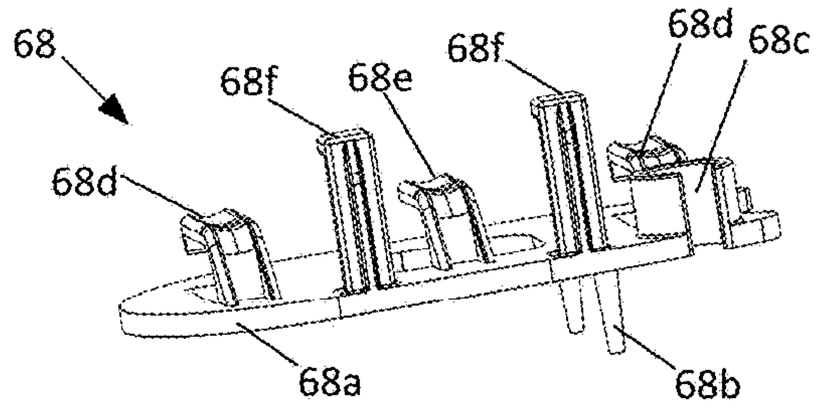


FIG. 40

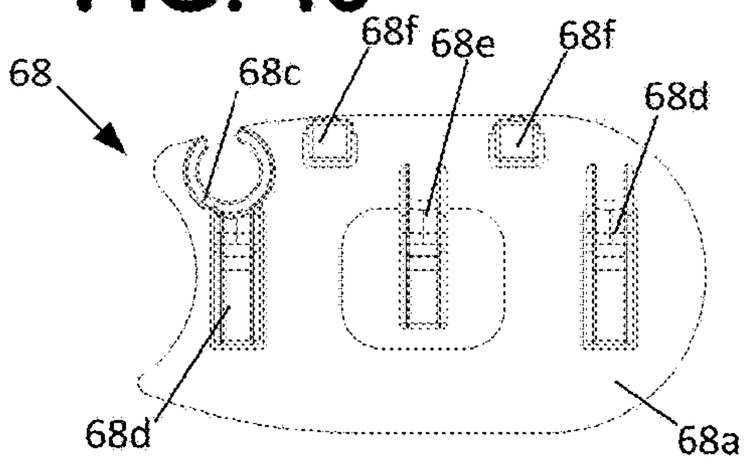


FIG. 41

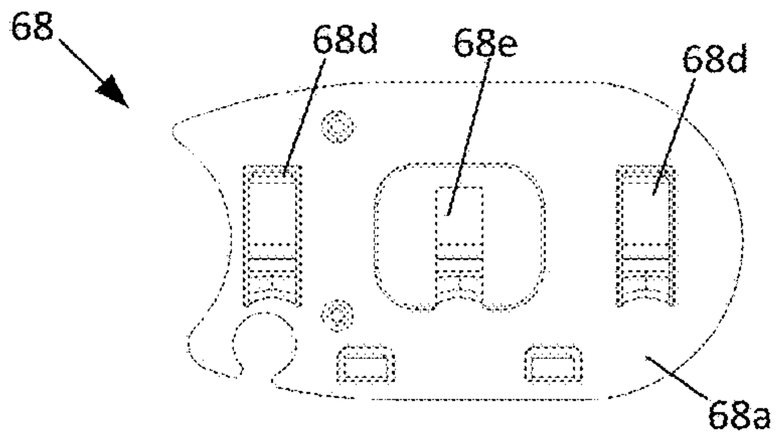


FIG. 42

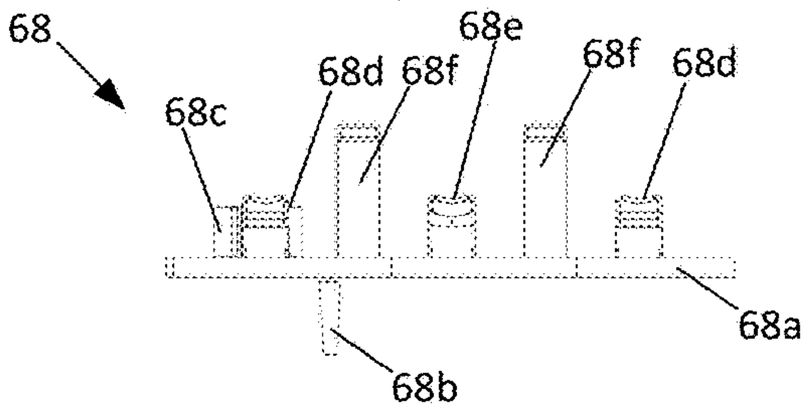


FIG. 43

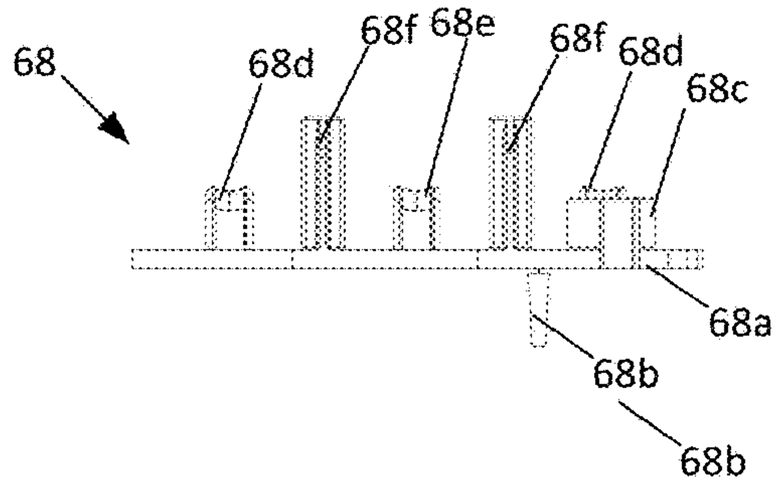


FIG. 44

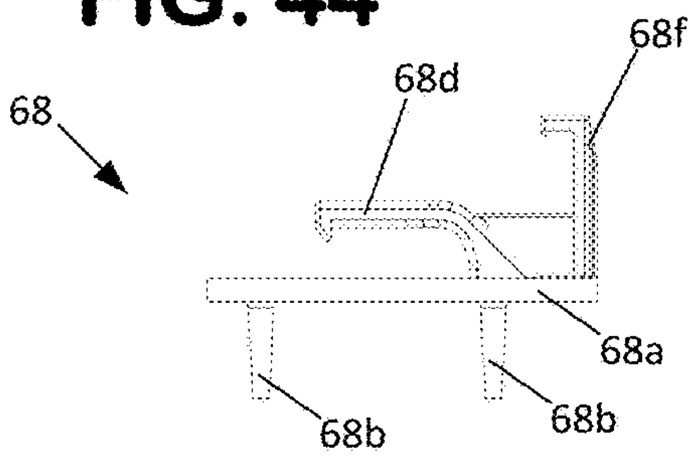


FIG. 45

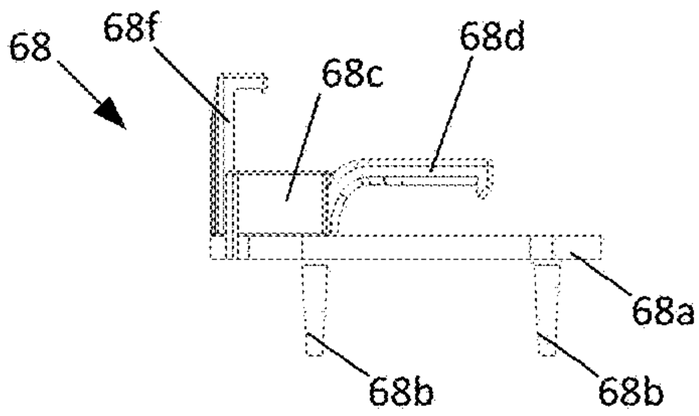


FIG. 46

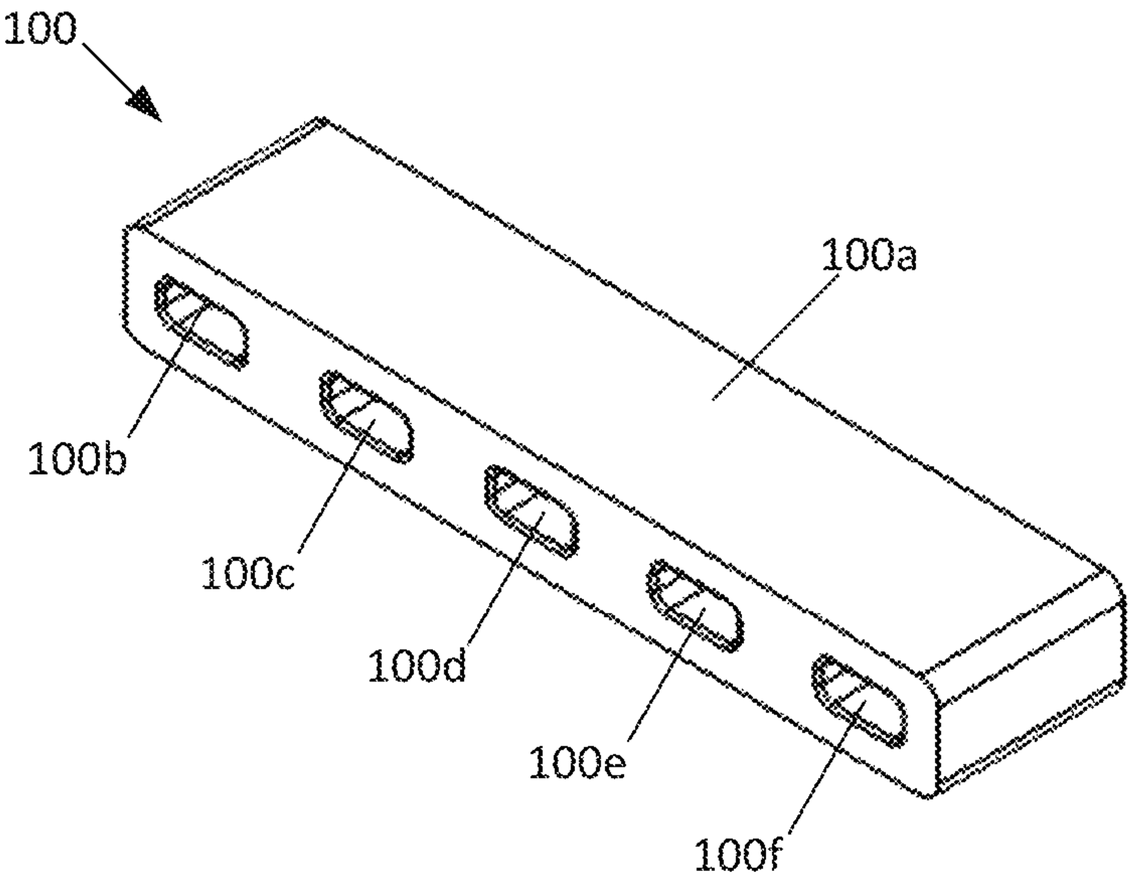

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FIG. 47

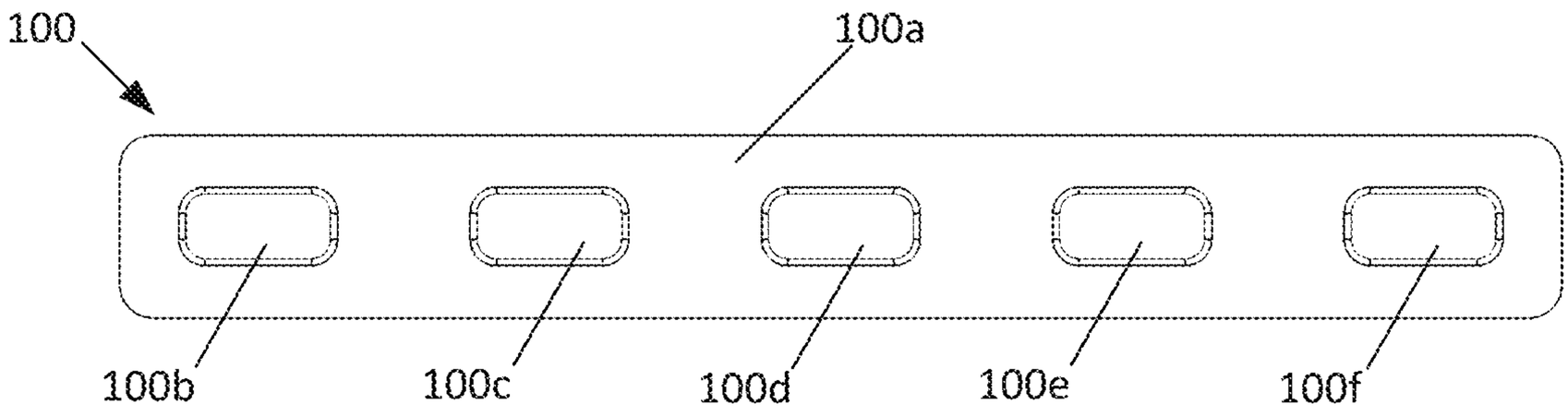

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FIG. 48

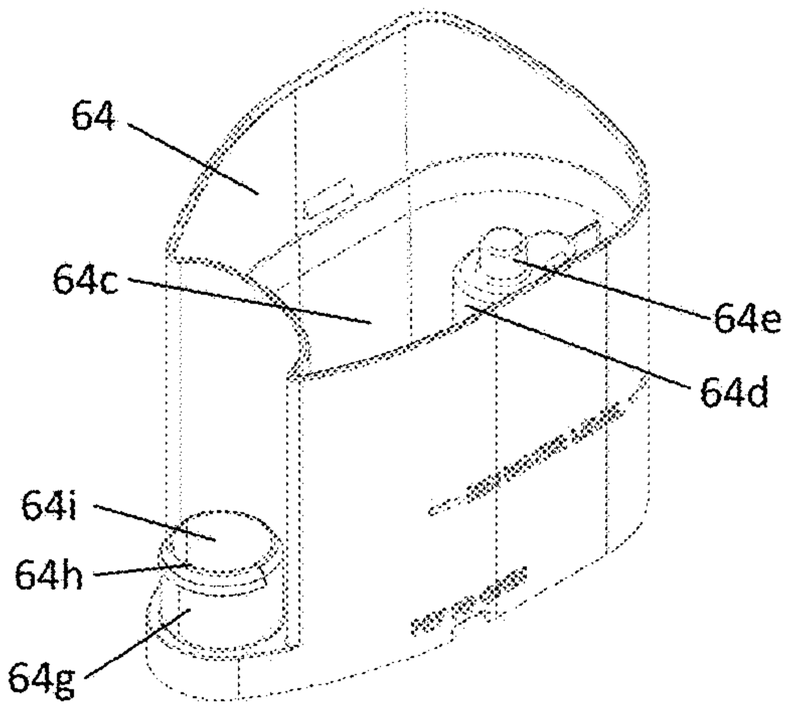


FIG. 49

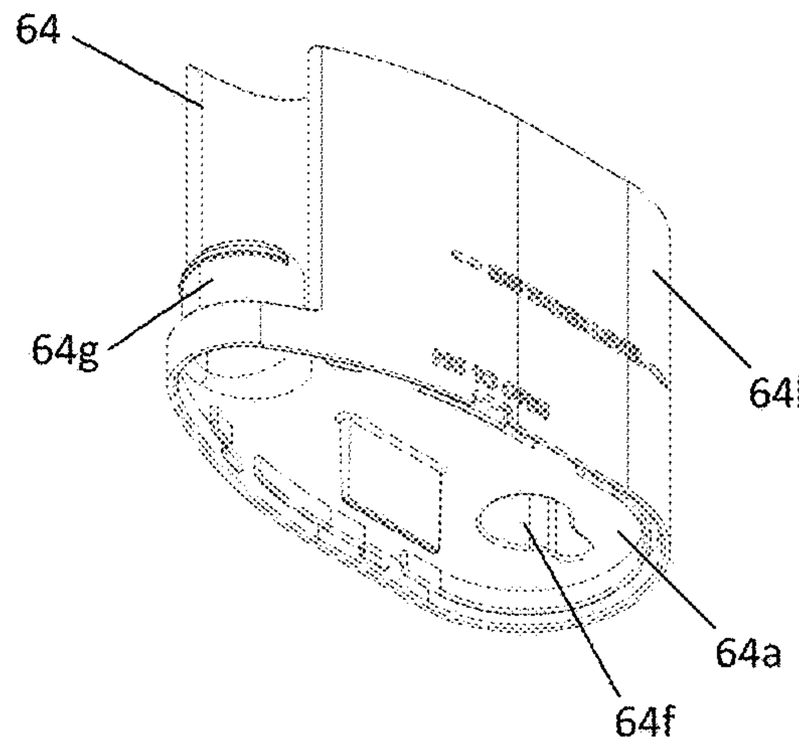


FIG. 50

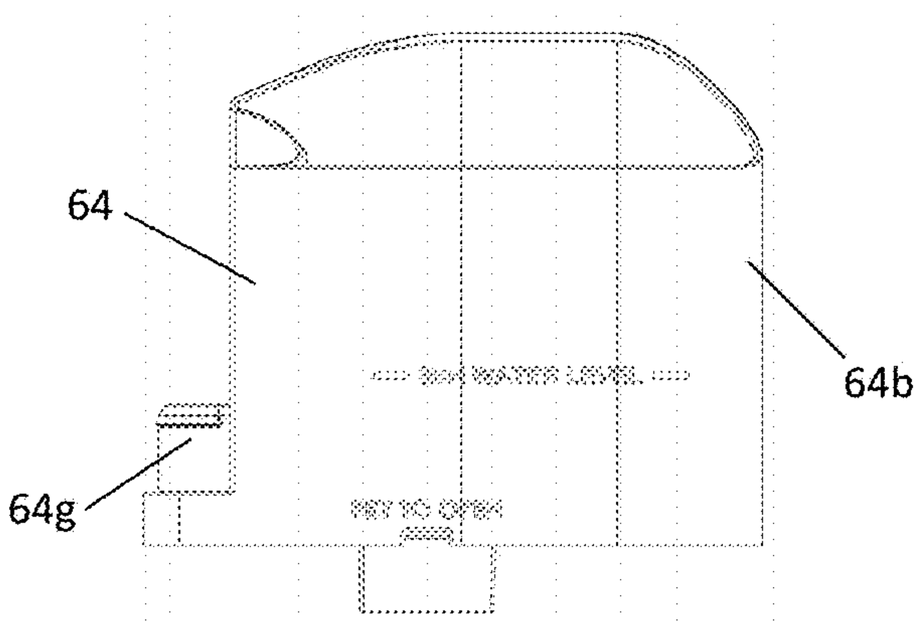


FIG. 51

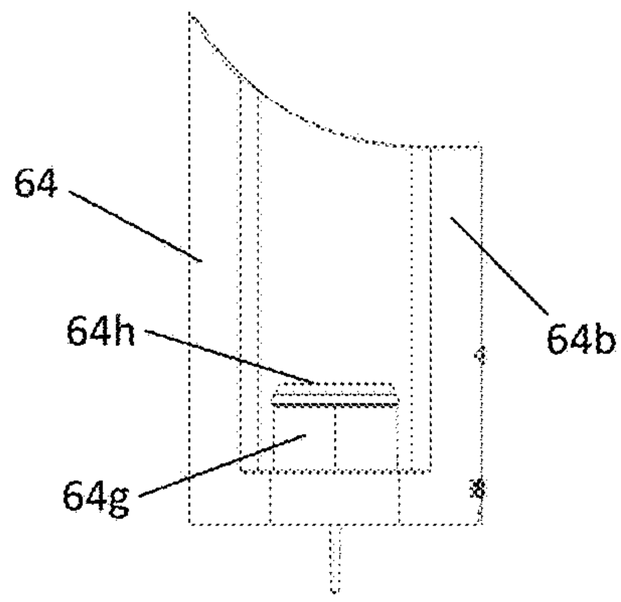


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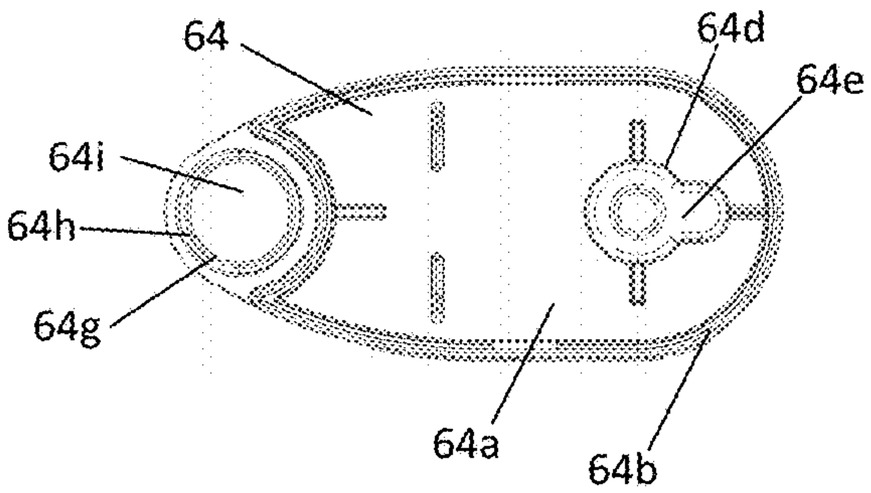


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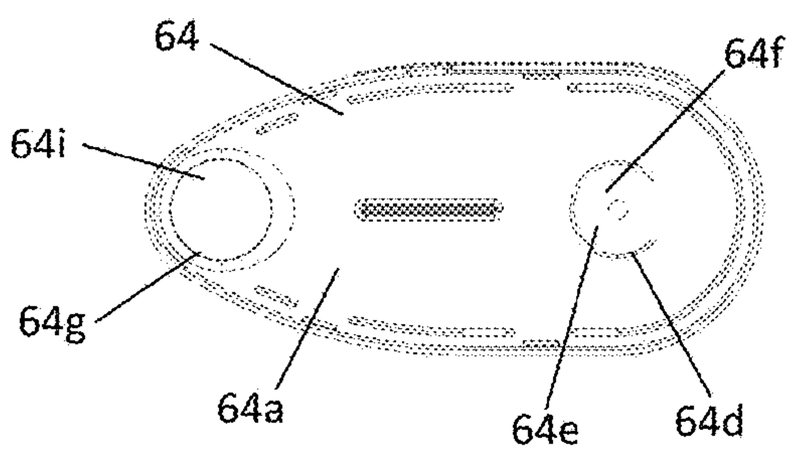


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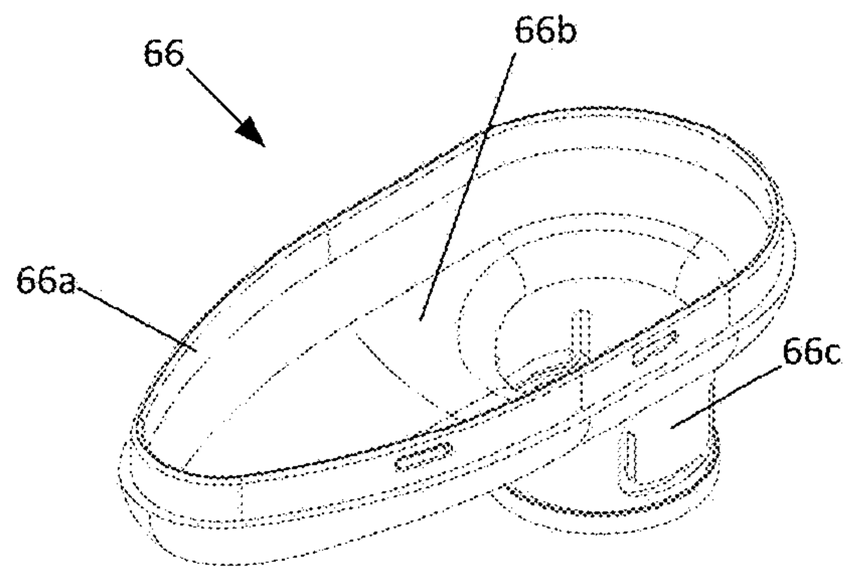


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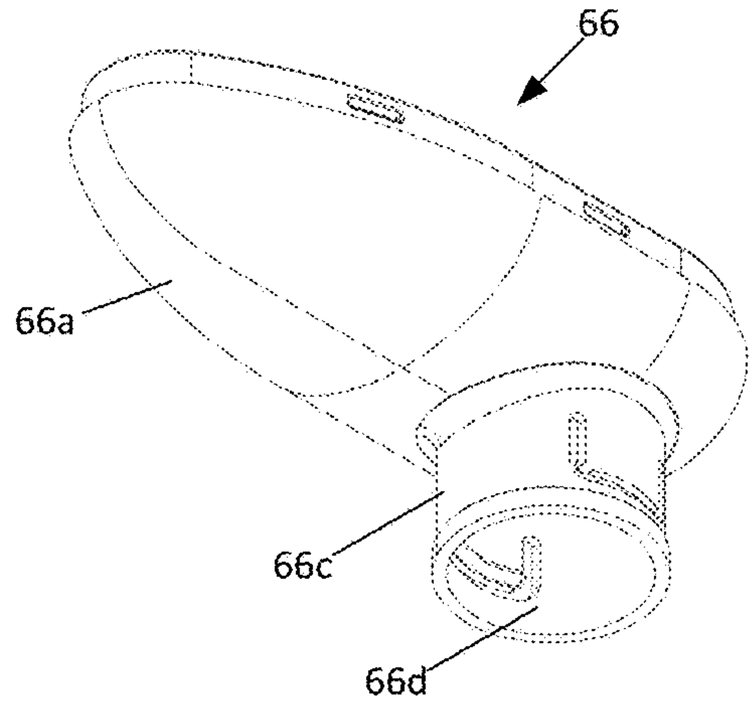


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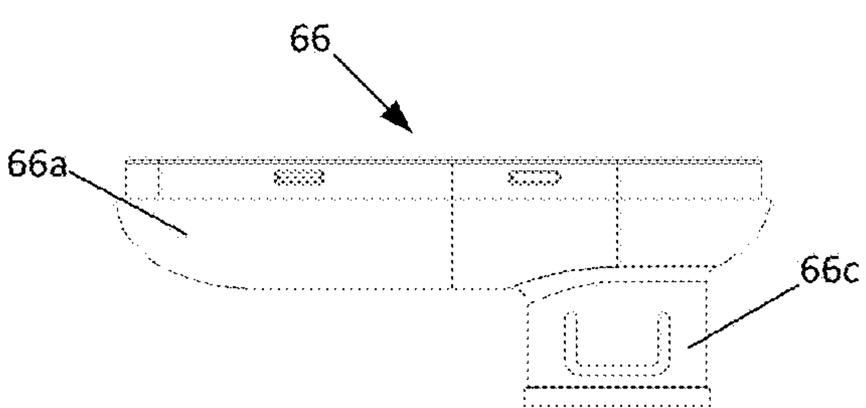


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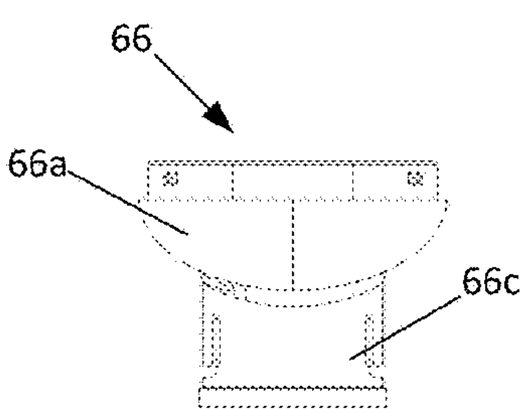


FIG. 58

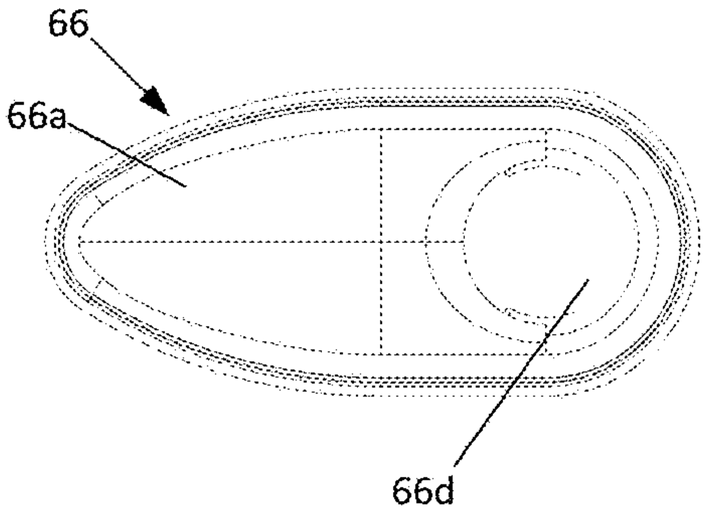


FIG. 59

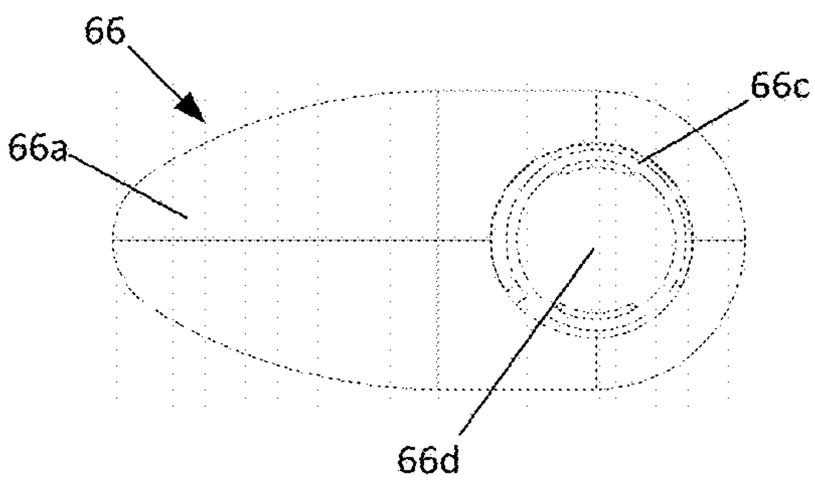


FIG. 60

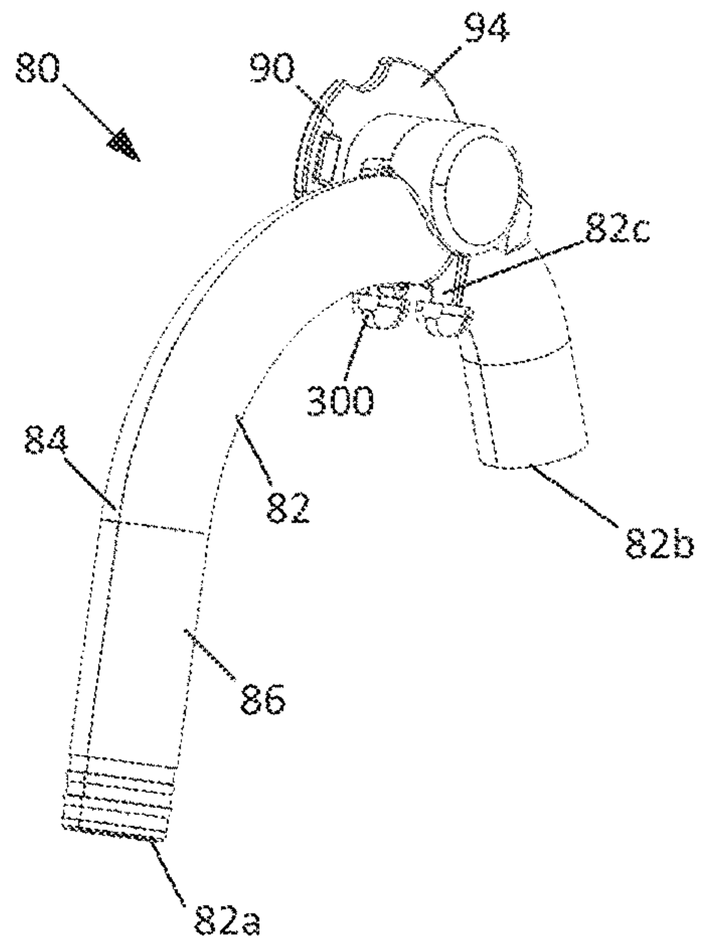


FIG. 60A

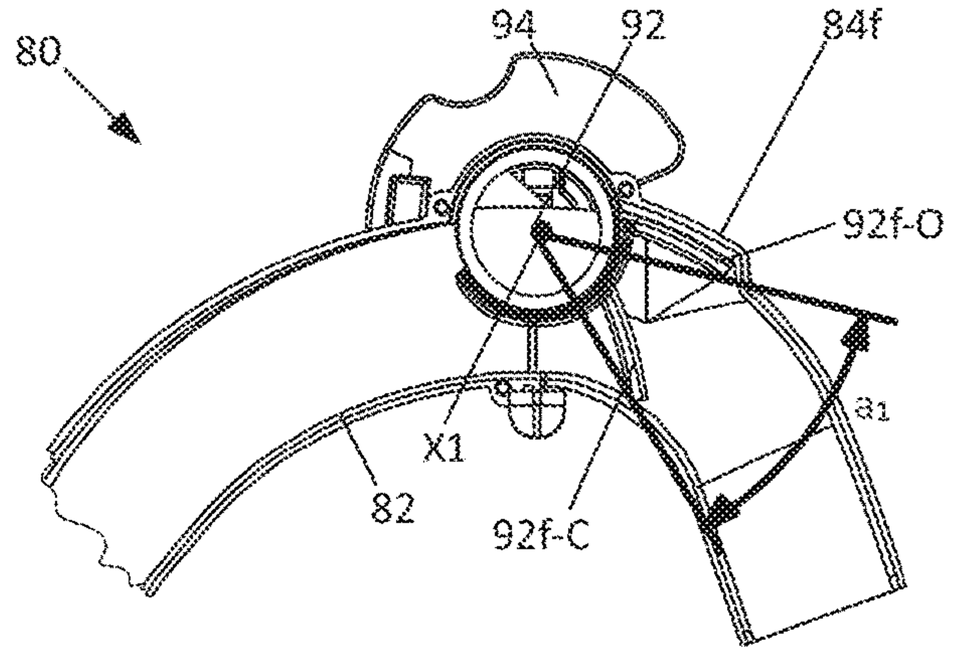


FIG. 61

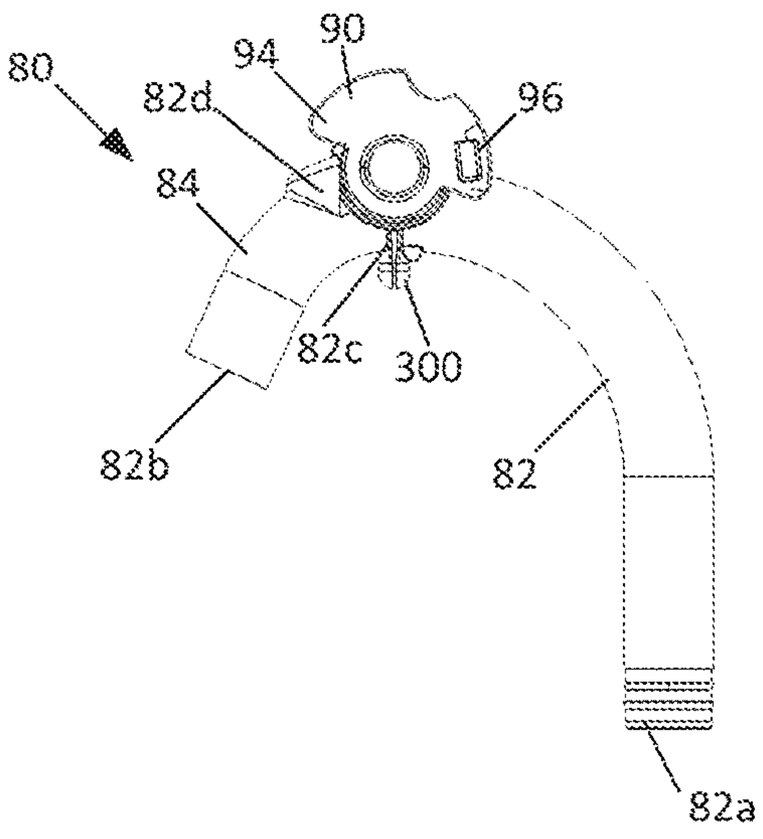


FIG. 62

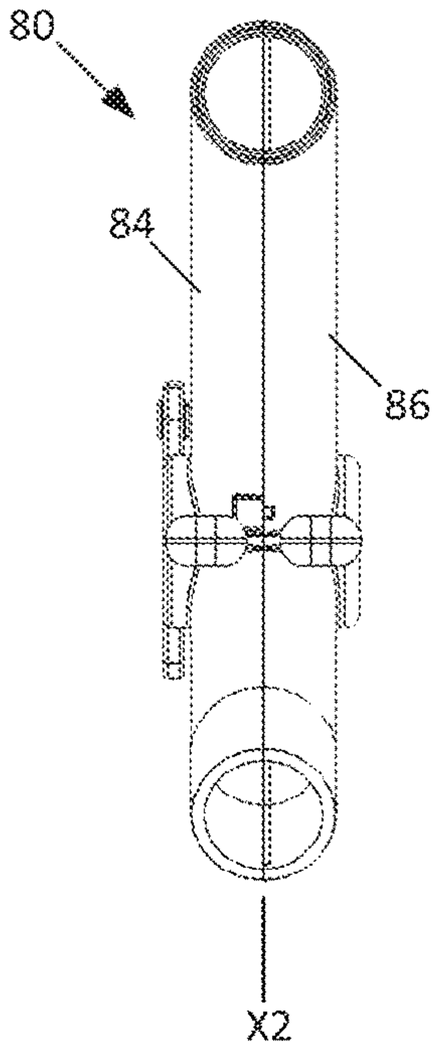
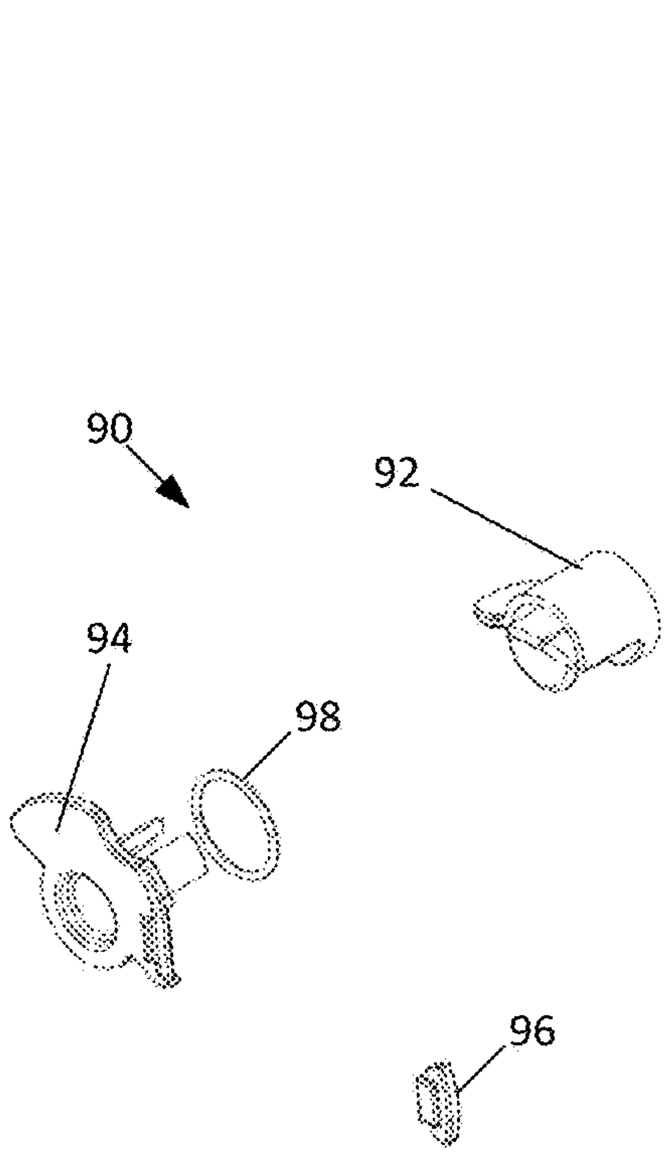


FIG. 63



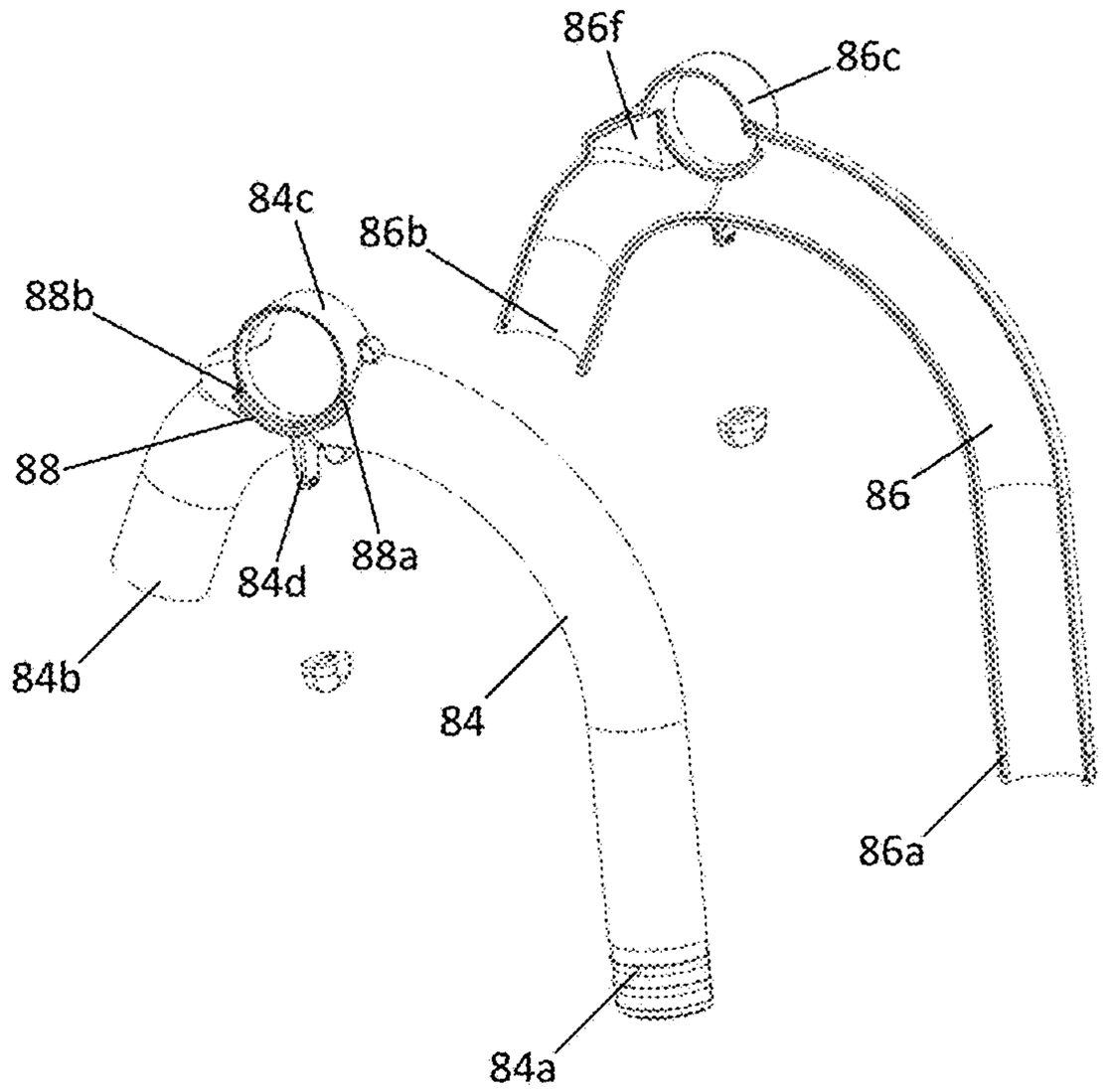


FIG. 64

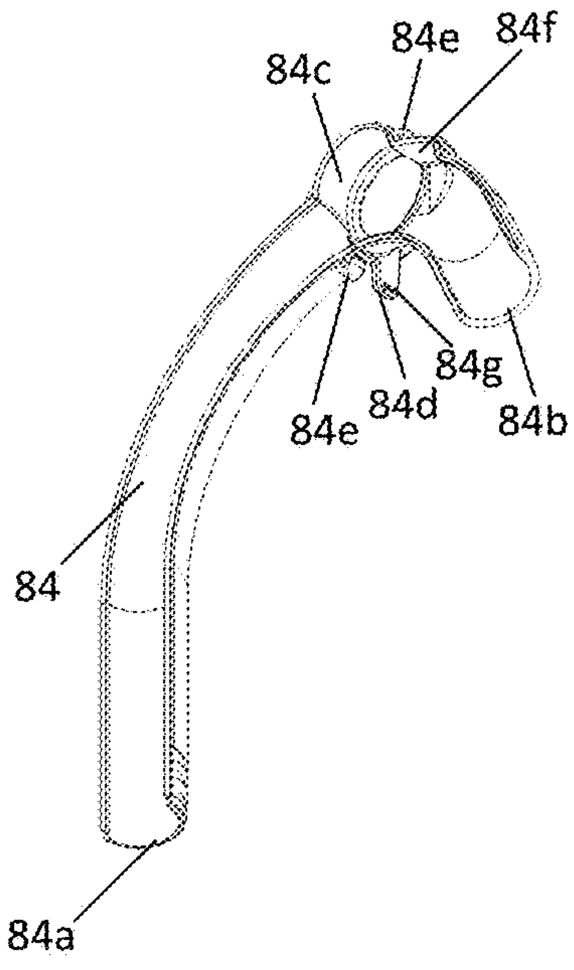


FIG. 65

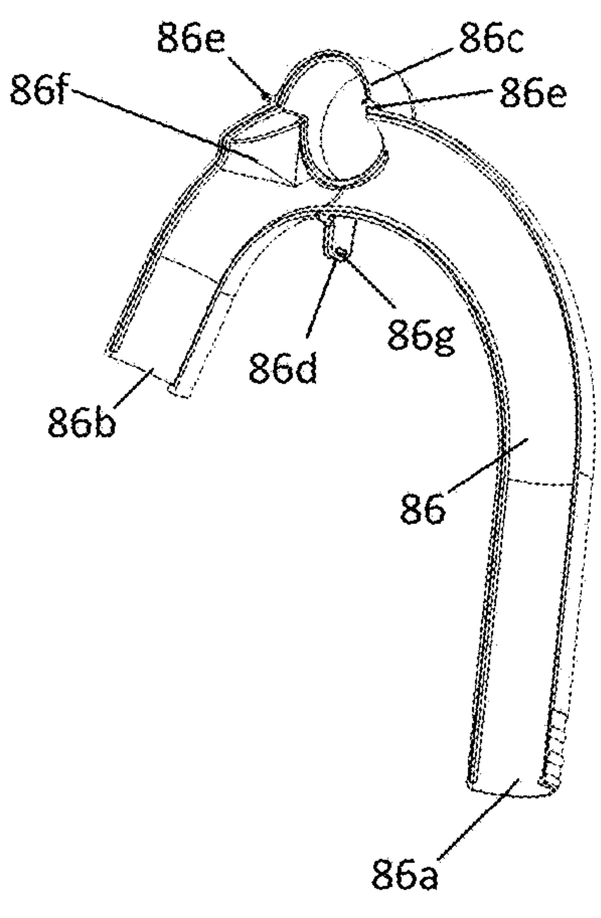


FIG. 66

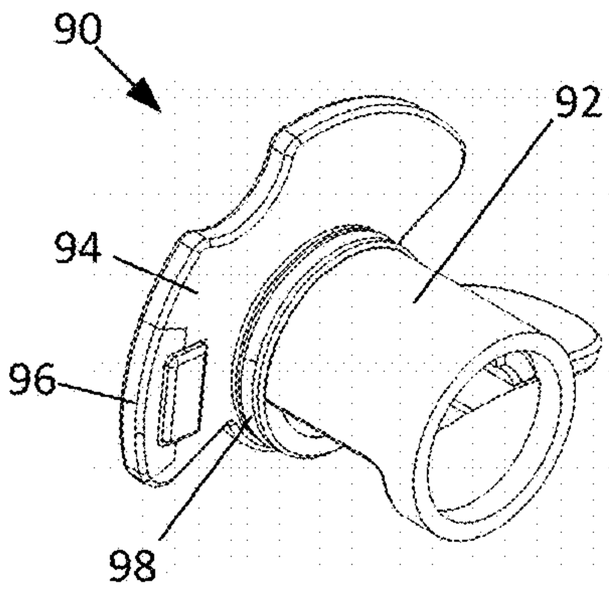


FIG. 67

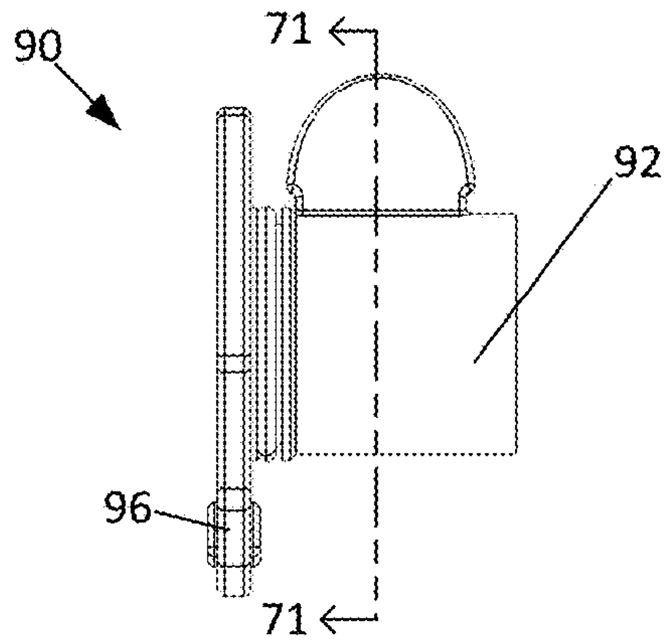


FIG. 68

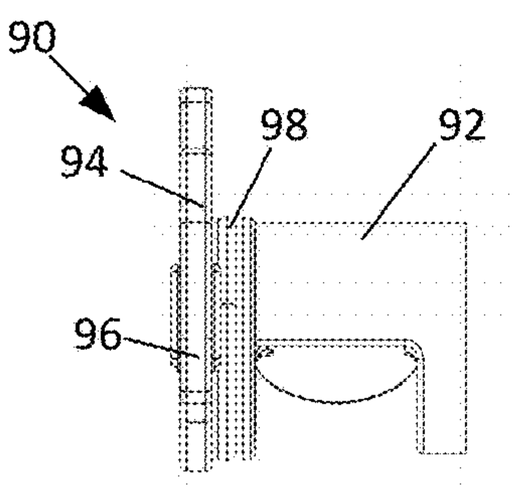


FIG. 69

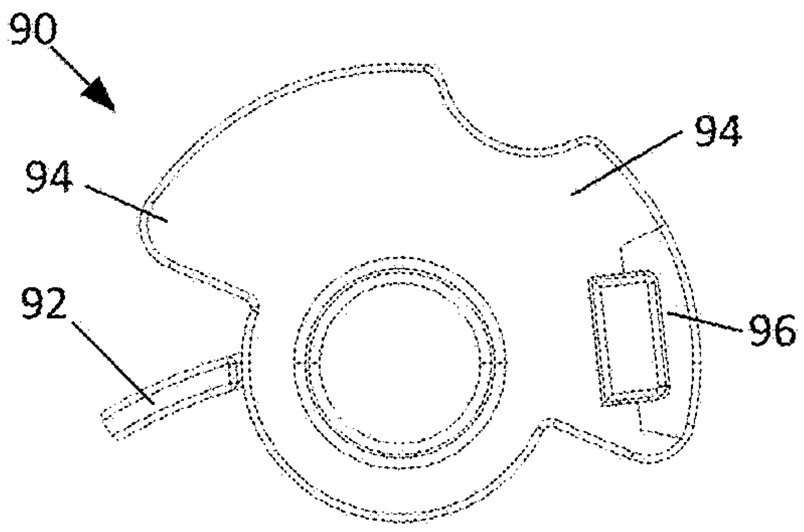


FIG. 70

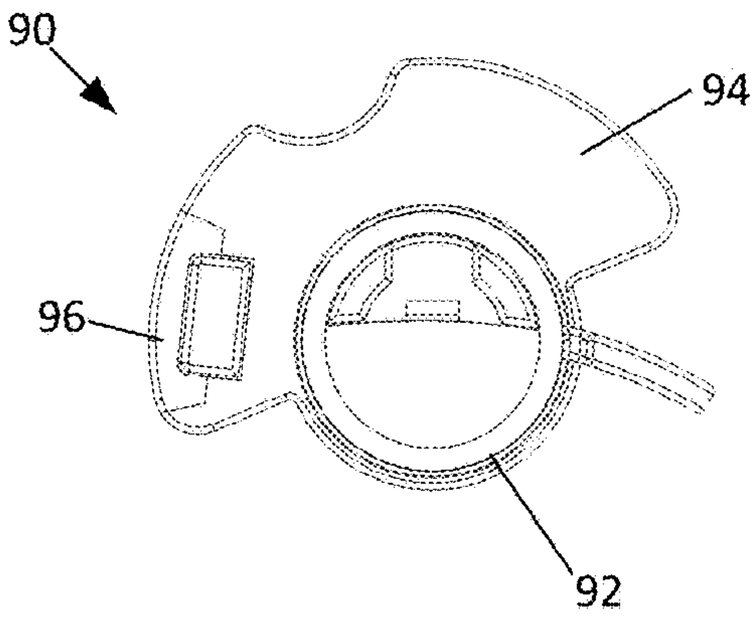


FIG. 71

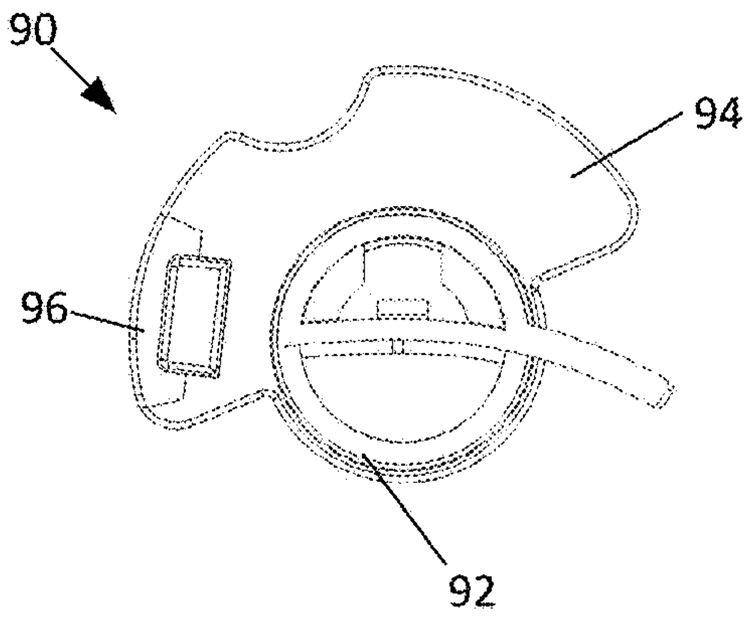


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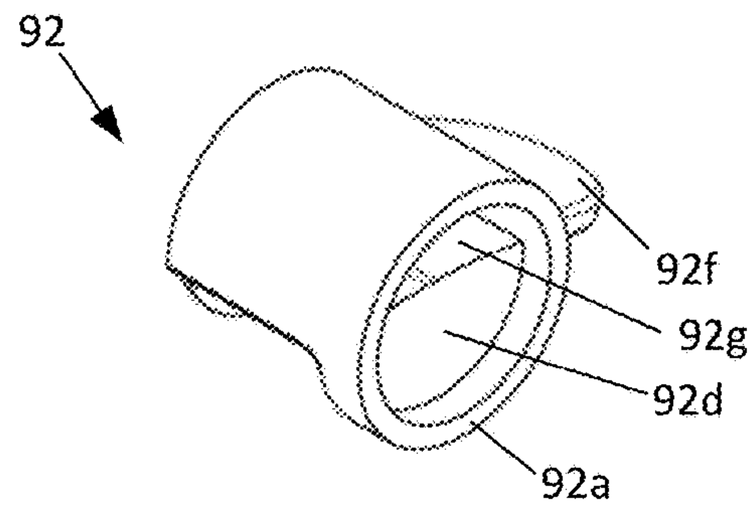


FIG. 73

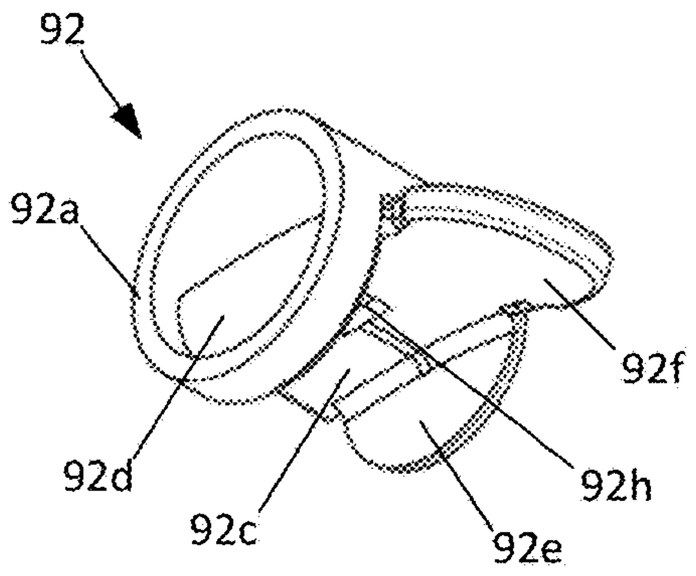


FIG. 74

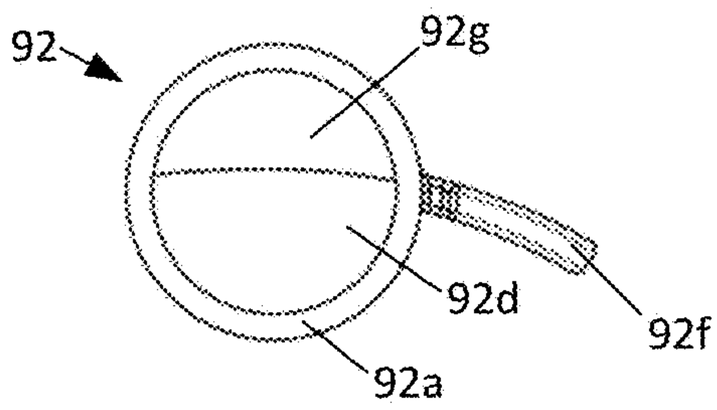


FIG. 75

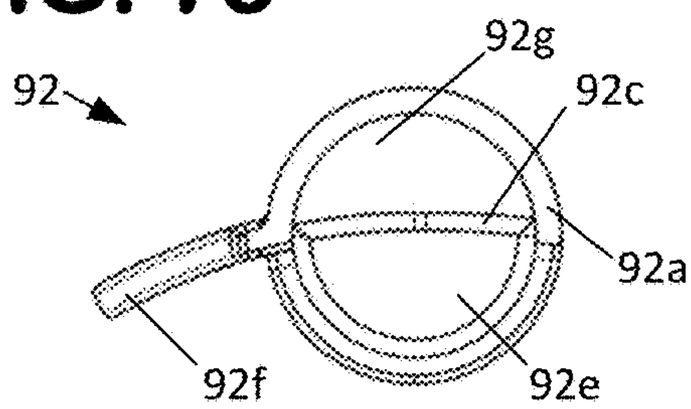


FIG. 76

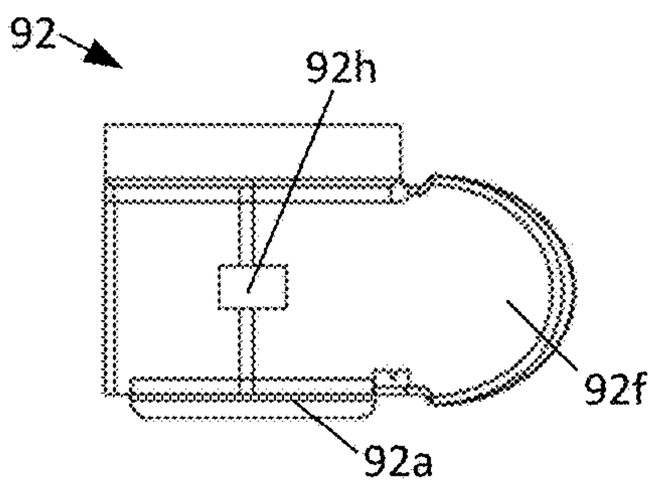


FIG. 77

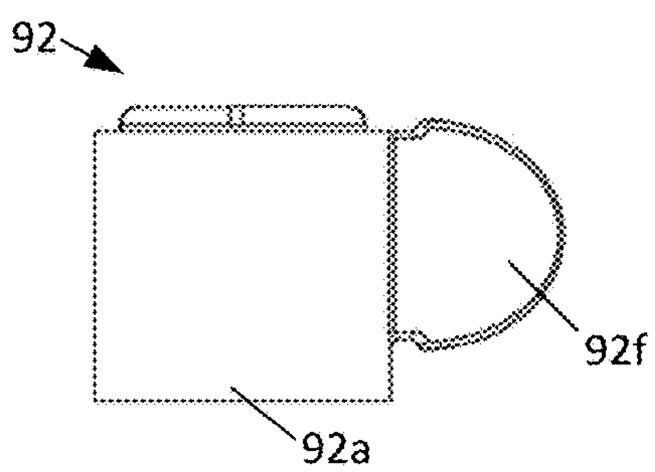


FIG. 78

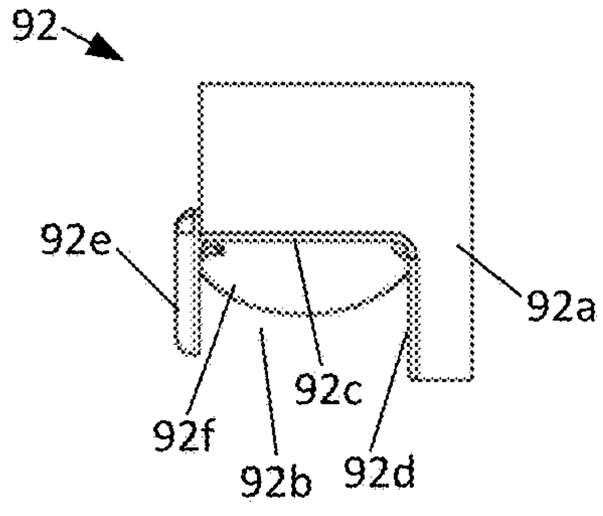


FIG. 79

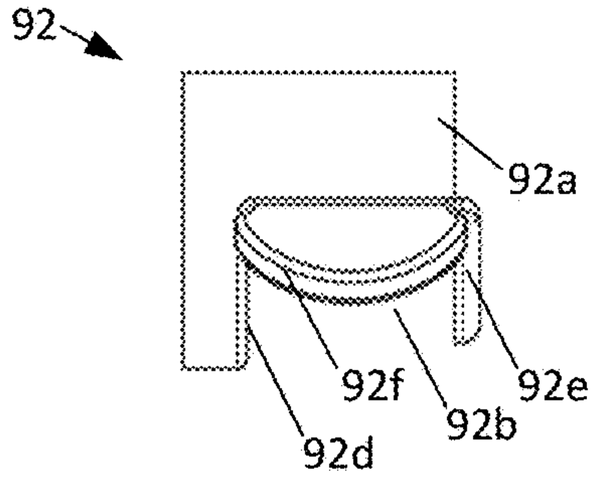


FIG. 80

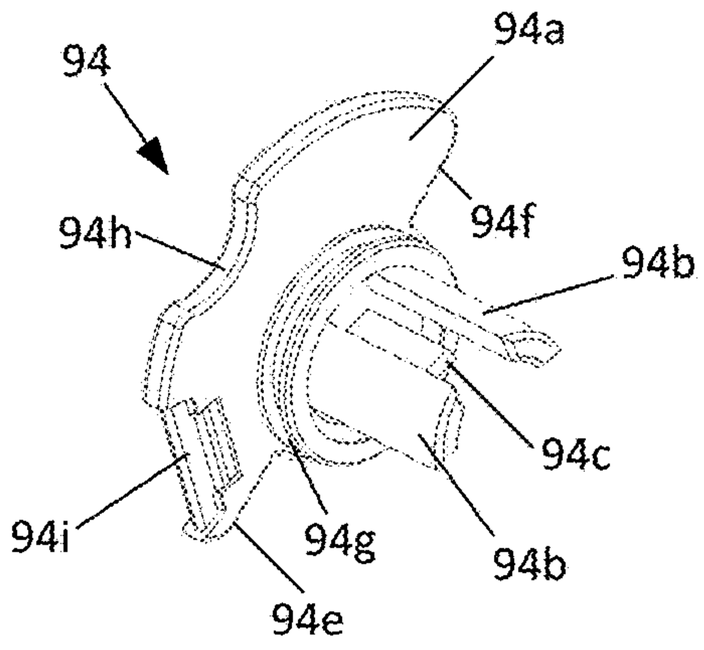


FIG. 81

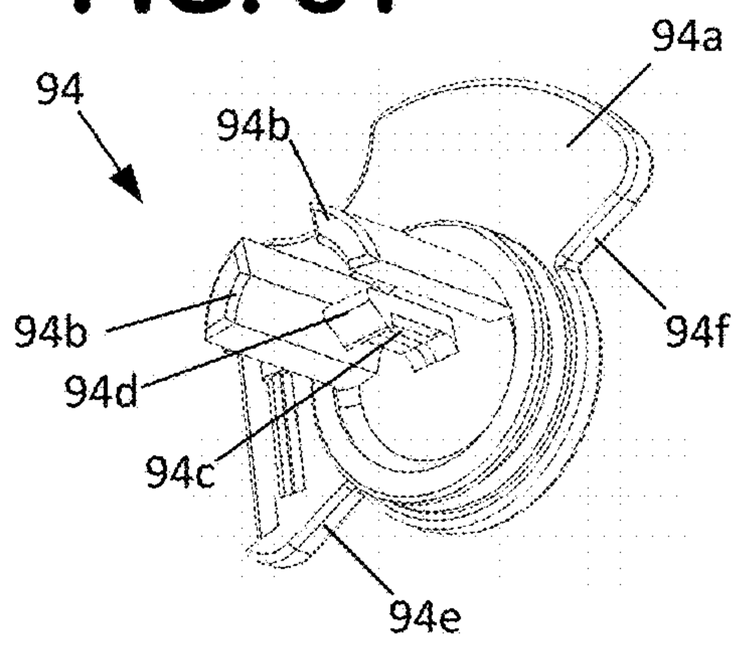


FIG. 82

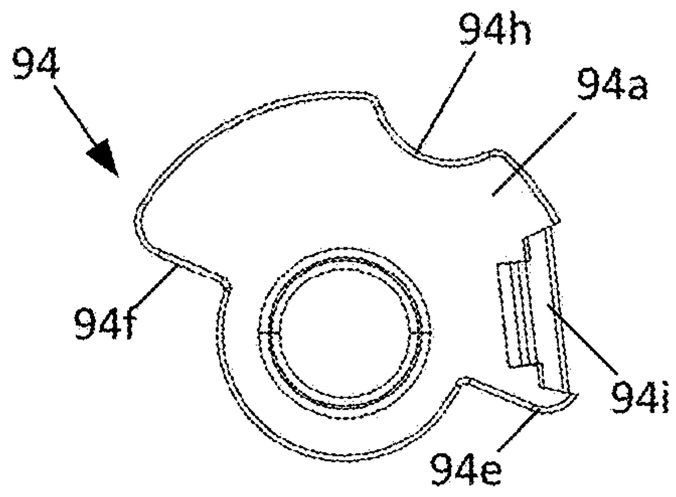


FIG. 83

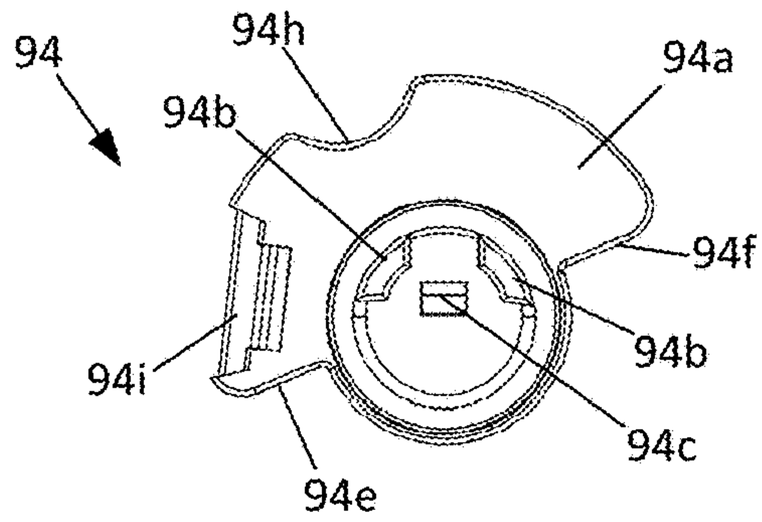


FIG. 84

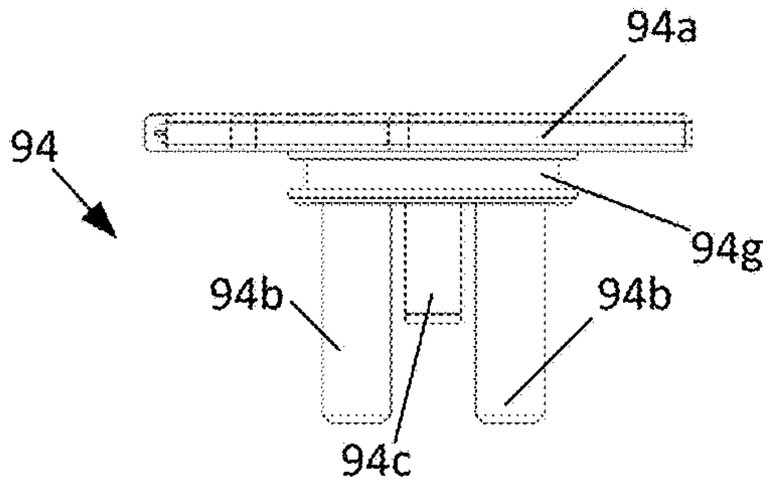


FIG. 85

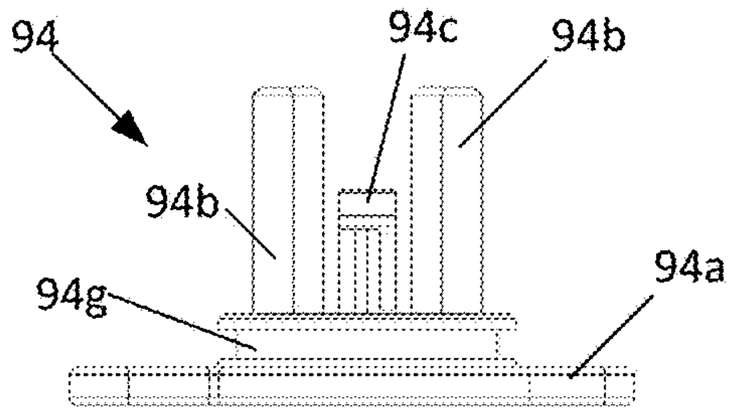


FIG. 86

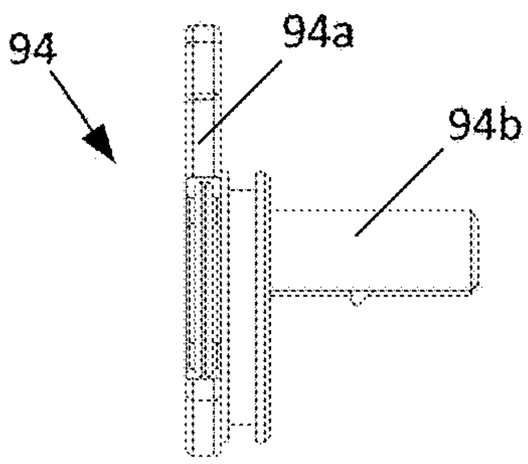


FIG. 87

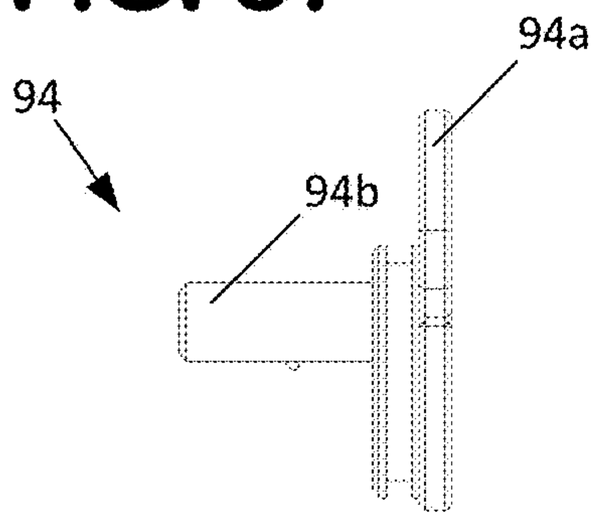


FIG. 88

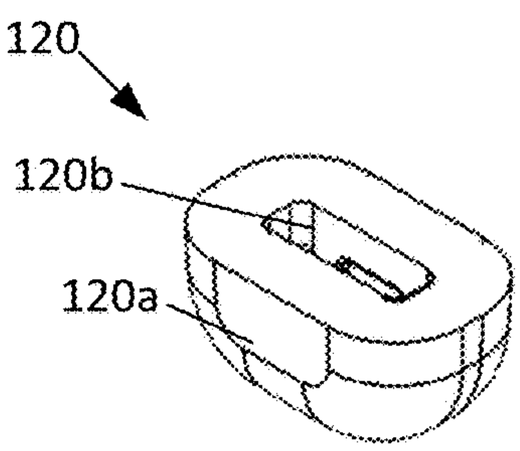


FIG. 89

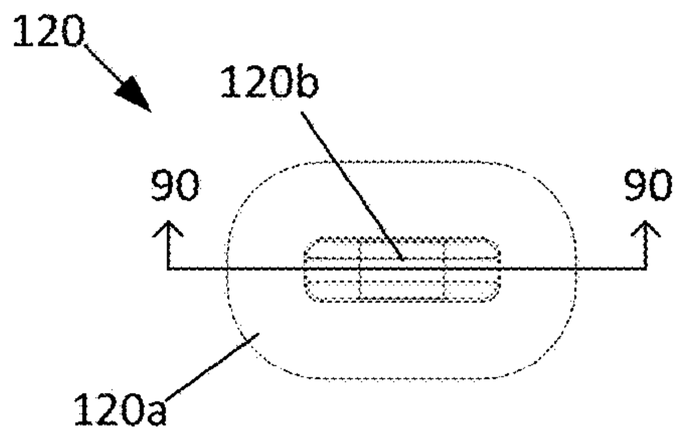


FIG. 90

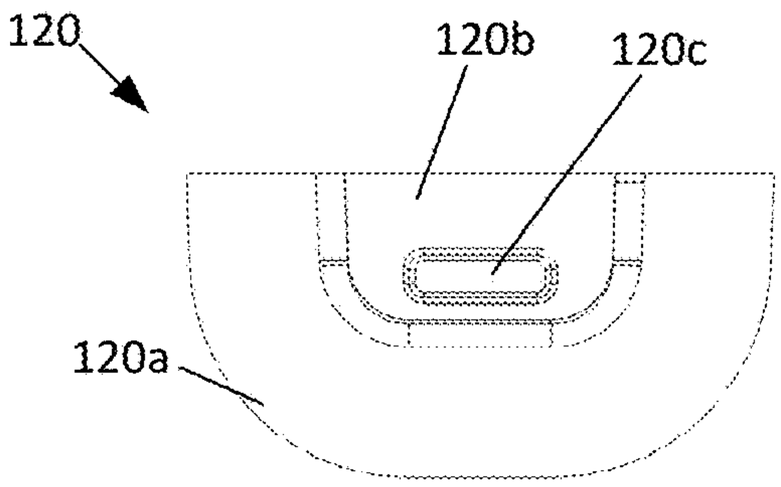


FIG. 91

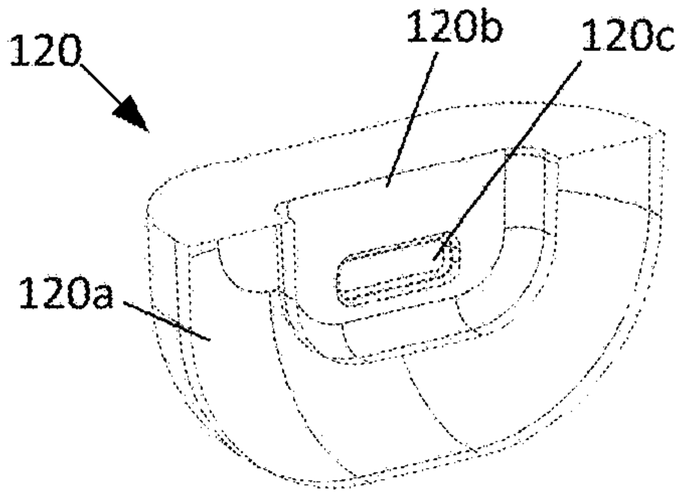


FIG. 92

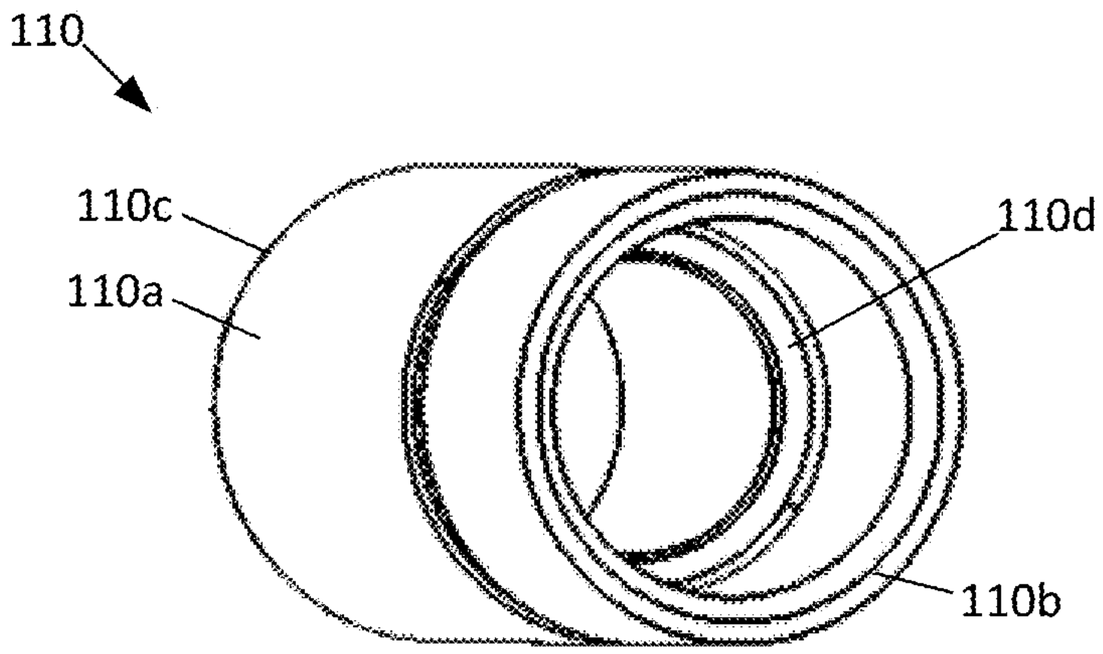


FIG. 93

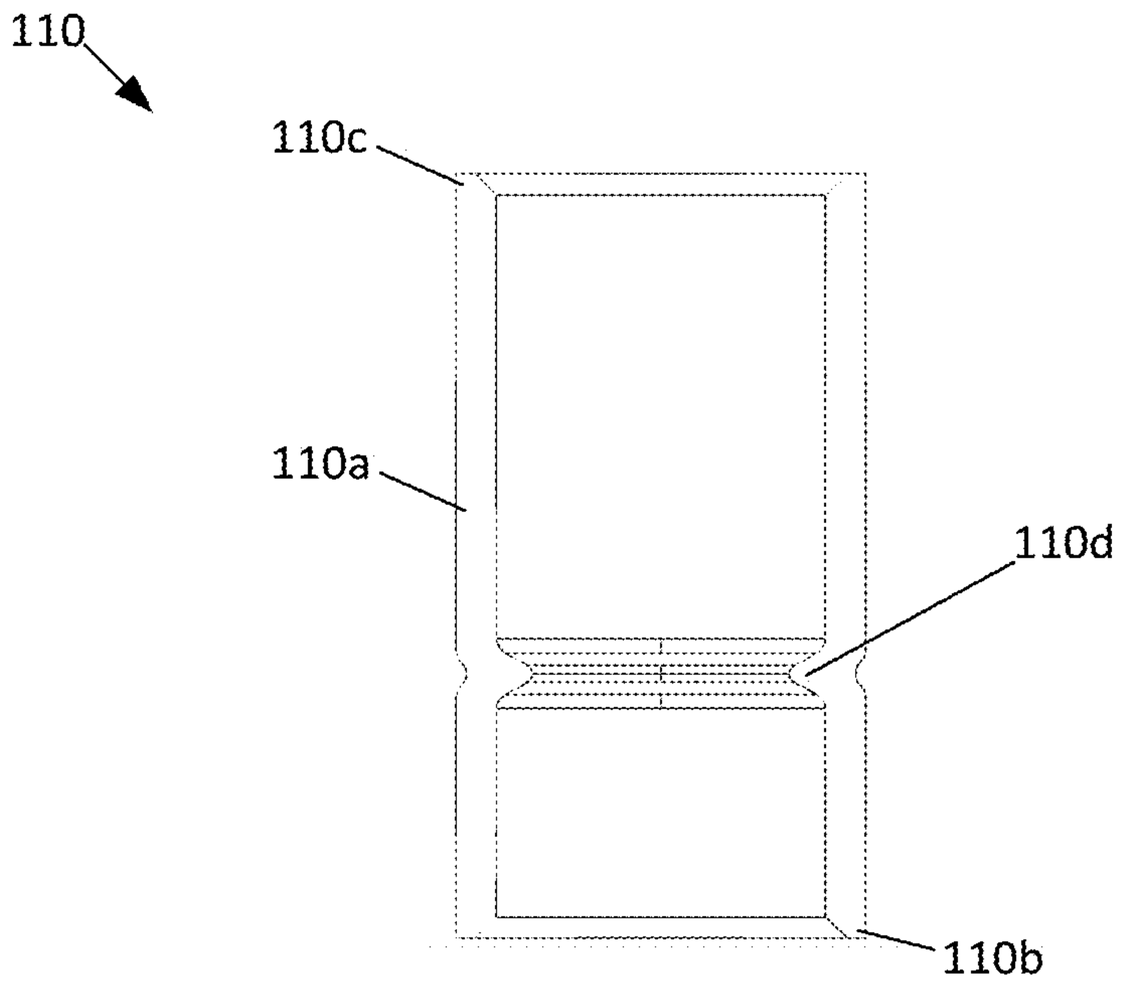


FIG. 94

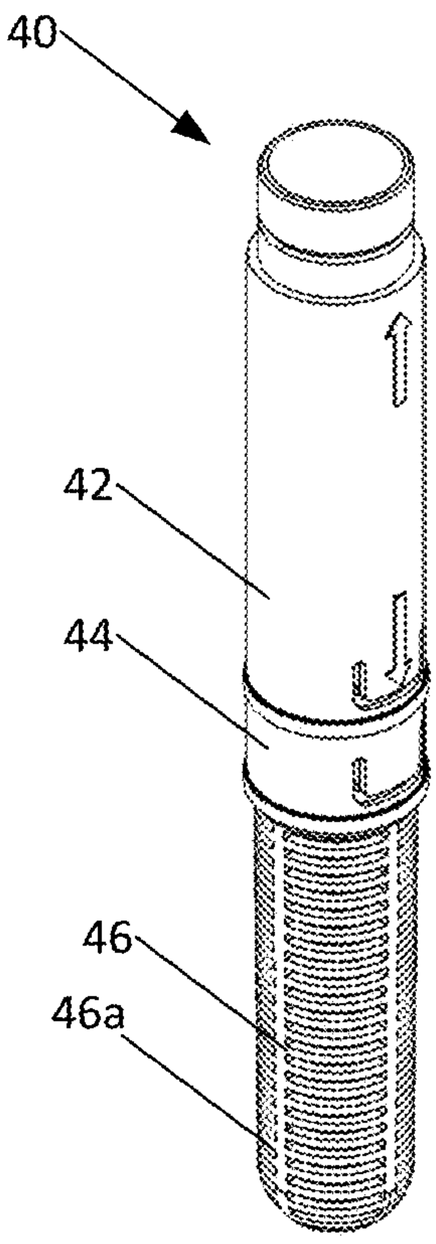
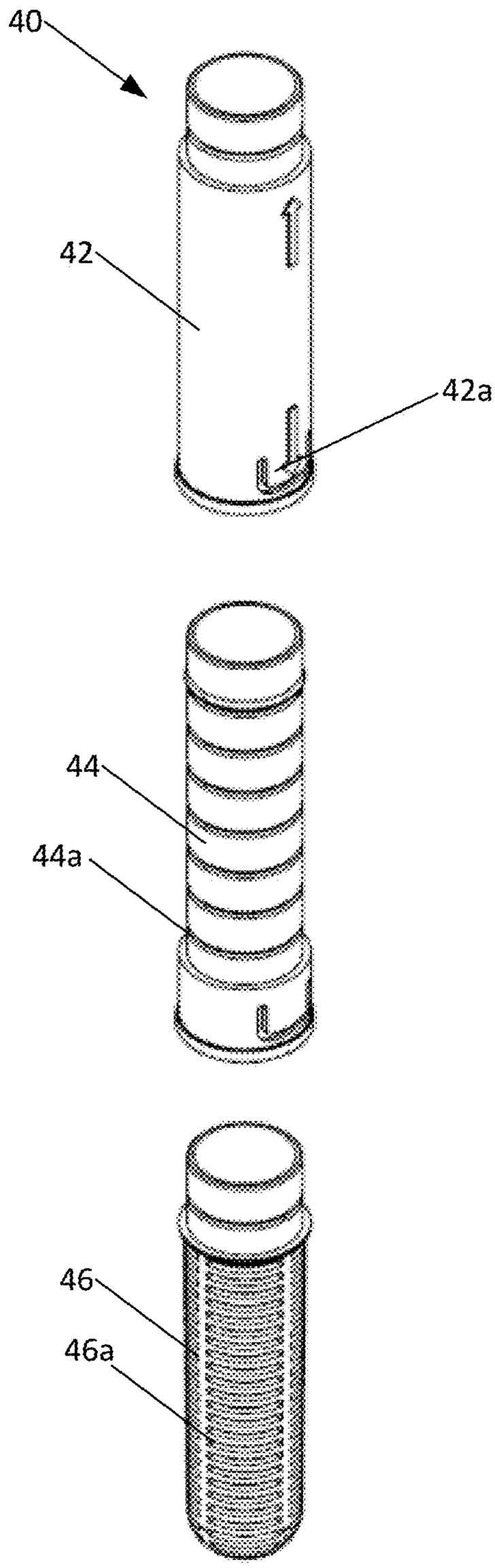


FIG. 95



AQUARIUM FILTER ARRANGEMENT WITH CONTROL VALVE

TECHNICAL FIELD

This disclosure relates generally to methods and devices for filtering aquarium water. More particularly, this disclosure relates to a filter housing arrangement and methods related to use of the filter housing arrangement.

BACKGROUND

To maintain an ecological balance within an aquarium, it is necessary to keep the water in the aquarium clean. Cleaning is often accomplished by pumping water from the aquarium to a filter device, filtering the water through a filter medium, and returning the filtered water to the aquarium. Such filtering devices generally include an internal pump driven by an electric motor for pumping the water through the filter medium. During operation of the pump and motor assembly, it is sometimes desired to control the flow provided by the pump. Devices exist in the prior art for this purpose. However, some are difficult to operate and/or are not provided integrally with the remainder of the filter device.

In general improvements in filtering devices are sought.

SUMMARY

A filter arrangement for an aquarium is disclosed. In some examples, the filter arrangement includes a housing assembly, a pump assembly, a transfer tube assembly, and a valve assembly for controlling water flow through the transfer tube assembly.

In some examples, the housing assembly includes a housing and a removable cover, wherein the housing and cover defining an interior volume within which a filter cartridge is disposed.

In some examples, the transfer tube assembly has an inlet and an outlet and is operably connected to the pump outlet and the transfer tube outlet is in fluid communication with the interior volume upstream of the filter cartridge.

In some examples, the transfer tube assembly includes a tube structure within which a valve body of the valve assembly is rotatably disposed.

In some examples, the tube structure is formed from a first tube half and a second tube half mated to the first tube half.

In some examples, the first and second tube halves are bonded to each other.

In some examples, the valve body is non-removable from the tube structure after the first and second tube halves are bonded to each other.

In some examples, the valve assembly includes a rotatable valve body and a valve operator connected to the valve body.

In some examples, a portion of the valve operator extends through an aperture of the removable cover of the housing assembly.

In some examples, the valve operator includes an indicator for providing a visual indication of the position of the valve operator.

In some examples, the transfer tube assembly includes a first stop surface against which the valve operator abuts when the valve operator is rotated to a position corresponding to the valve body being in a fully open position. The first stop surface can be located on a tube structure of the transfer tube assembly.

In some examples, the transfer tube assembly includes a second stop surface against which the valve operator abuts when the valve operator is rotated to a position corresponding to the valve body being in a relatively closed position. The second stop surface can be located on a tube structure of the transfer tube assembly.

In some examples, the valve assembly further includes a seal member mounted to the valve operator, wherein the seal member forms a seal between the valve operator and a tube structure of the transfer tube assembly.

In one aspect of the disclosure the transfer tube assembly can include a tube structure including a first tube half and a second tube half mated to the first tube half, wherein the tube structure defines a valve cavity between an inlet end of the tube structure and an outlet end of the tube structure. In such an example, a valve body can be rotatably disposed within the valve cavity of the tube structure, wherein the valve body is rotatable to limit water flow through the tube structure. In one aspect, a valve operator can be connected to the valve body, wherein the valve operator is for manipulating the rotational position of the valve body. A seal member can also be provided for forming a seal between the valve operator and the tube structure.

In some examples, the tube structure includes a first stop surface against which the valve operator abuts when the valve operator is rotated to a position corresponding to the valve body being in a fully open position.

In some examples, the tube structure includes a second stop surface against which the valve operator abuts when the valve operator is rotated to a position corresponding to the valve body being in a relatively closed position.

In some examples, the tube structure defines a recessed portion within which a valve member of the valve body resides when the valve body is in a fully open position.

In one aspect of the disclosure, a method for constructing a transfer tube assembly for of an aquarium filter arrangement for an aquarium is presented. In one example, the method can include the steps of inserting a valve body into a first cavity portion of a first tube half, joining a second tube half to the first tube half such that the valve body is received into a second cavity portion of the second tube half, and bonding the first tube half to the second tube half to secure the valve body between the first and second tube halves.

In some examples, the method includes mounting a valve operator to the valve body.

In some examples, the bonding step includes sonic welding.

In some examples, the step of mounting the valve operator includes mounting the valve operator such that a seal member forms a seal between the valve operator and the first tube half.

A variety of additional aspects will be set forth in the description that follows. The aspects can relate to individual features and to combinations of features. It is to be understood that both the forgoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the broad inventive concepts upon which the examples disclosed herein are based.

One aspect of the present disclosure relates to a filter arrangement for use with an aquarium.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front perspective view of a filter arrangement in accord with the principles of the present disclosure.

FIG. **2** is a rear perspective view of the filter arrangement shown in FIG. **1**.

FIG. **3** is a first side view of the filter arrangement shown in FIG. **1**.

FIG. **4** is a second side view of the filter arrangement shown in FIG. **1**.

FIG. **5** is a front view of the filter arrangement shown in FIG. **1**.

FIG. **6** is a cross-sectional view of the filter arrangement shown in FIG. **1**, taken along the line **6-6** in FIG. **3**.

FIG. **6**A is an enlarged portion of the view shown in FIG. **6**, as indicated at FIG. **6**.

FIG. **7** is a cross-sectional view of the filter arrangement shown in FIG. **1**, taken along the line **7-7** in FIG. **5**.

FIG. **8** is a cross-sectional view of the filter arrangement shown in FIG. **1**, taken along the line **8-8** in FIG. **5**.

FIG. **9** is a cross-sectional view of a portion of the transfer tube assembly of the filter arrangement shown in FIG. **1**, taken along the line **9-9** in FIG. **5**.

FIG. **10** is a cross-sectional view of a portion of the transfer tube assembly of the filter arrangement shown in FIG. **1**, taken along the line **10-10** in FIG. **3**.

FIG. **11** is an exploded perspective view of the filter arrangement shown in FIG. **1**.

FIG. **12** is a front top perspective view of a filter housing of the filter arrangement shown in FIG. **1**.

FIG. **13** is a bottom rear perspective view of the filter housing shown in FIG. **12**.

FIG. **14** is a front view of the filter housing shown in FIG. **12**.

FIG. **15** is a side view of the filter housing shown in FIG. **12**.

FIG. **16** is a top view of the filter housing shown in FIG. **12**.

FIG. **17** is a bottom view of the filter housing shown in FIG. **12**.

FIG. **18** is a front top perspective view of a pump assembly of the filter arrangement shown in FIG. **1**.

FIG. **19** is a front top perspective view of the pump assembly shown in FIG. **18**, with a first housing part of the pump assembly shown as being transparent.

FIG. **20** is a front top perspective view of the pump assembly shown in FIG. **18**, with a first housing part of the pump assembly shown as being removed.

FIG. **21** is a top front perspective view of a pump impeller assembly of the pump assembly shown in FIG. **18**.

FIG. **22** is a top perspective view of the pump impeller assembly shown in FIG. **21**, with the impeller portion removed.

FIG. **23** is a top perspective view of the impeller portion of the pump impeller assembly shown in FIG. **21**.

FIG. **24** is a front view of a dampening structure of the pump assembly shown in FIG. **21**.

FIG. **25** is a rear view of the dampening structure shown in FIG. **24**.

FIG. **26** is a top view of the dampening structure shown in FIG. **24**.

FIG. **27** is a bottom view of the dampening structure shown in FIG. **24**.

FIG. **28** is a first side view of the dampening structure shown in FIG. **24**.

FIG. **29** is a second side view of the dampening structure shown in FIG. **24**.

FIG. **30** is a first perspective view of an cover member of the dampening structure shown in FIG. **24**.

FIG. **31** is a second perspective view of the cover member shown in FIG. **30**.

FIG. **32** is a front view of the cover member shown in FIG. **30**.

FIG. **33** is a rear view of the cover member shown in FIG. **30**.

FIG. **34** is a top view of the cover member shown in FIG. **30**.

FIG. **35** is a bottom view of the cover member shown in FIG. **30**.

FIG. **36** is a first side view of the cover member shown in FIG. **30**.

FIG. **37** is a second side view of the cover member shown in FIG. **30**.

FIG. **38** is a first perspective view of a motor cover of the dampening structure shown in FIG. **24**.

FIG. **39** is a second perspective view of the motor cover shown in FIG. **38**.

FIG. **40** is a front view of the motor cover shown in FIG. **38**.

FIG. **41** is a rear view of the motor cover shown in FIG. **38**.

FIG. **42** is a top view of the motor cover shown in FIG. **38**.

FIG. **43** is a bottom view of the motor cover shown in FIG. **38**.

FIG. **44** is a first side view of the motor cover shown in FIG. **38**.

FIG. **45** is a second side view of the motor cover shown in FIG. **38**.

FIG. **46** is a perspective view of a first dampening member of the dampening structure shown in FIG. **24**.

FIG. **47** is a front view of the first dampening member shown in FIG. **46**.

FIG. **48** is a first perspective view of a first housing part of the pump assembly shown in FIG. **18**.

FIG. **49** is a second perspective view of the first housing part shown in FIG. **48**.

FIG. **50** is a front view of the first housing part shown in FIG. **48**.

FIG. **51** is a side view of the first housing part shown in FIG. **48**.

FIG. **52** is a top view of the first housing part shown in FIG. **48**.

FIG. **53** is a bottom view of the first housing part shown in FIG. **48**.

FIG. **54** is a first perspective view of a second housing part of the pump assembly shown in FIG. **18**.

FIG. **55** is a second perspective view of the second housing part shown in FIG. **54**.

FIG. **56** is a front view of the second housing part shown in FIG. **54**.

FIG. **57** is a side view of the second housing part shown in FIG. **54**.

FIG. **58** is a top view of the second housing part shown in FIG. **54**.

FIG. **59** is a bottom view of the second housing part shown in FIG. **54**.

FIG. **60** is a perspective view of a transfer tube assembly of the filter arrangement shown in FIG. **1**.

FIG. **60**A is a cross-sectional side view of a portion of the transfer tube assembly shown in FIG. **60**.

FIG. **61** is a side view of the transfer tube assembly shown in FIG. **60**.

FIG. **62** is a bottom view of the transfer tube assembly shown in FIG. **60**.

FIG. **63** is an exploded perspective view of the transfer tube assembly shown in FIG. **60**.

FIG. **64** is a perspective view of a first tube half of the transfer tube assembly shown in FIG. **60**.

FIG. **65** is a perspective view of a second tube half of the transfer tube assembly shown in FIG. **60**.

FIG. **66** is a first perspective view of a valve assembly of the transfer tube assembly shown in FIG. **60**.

FIG. **67** is a top view of the valve assembly shown in FIG. **66**.

FIG. **68** is a front view of the valve assembly shown in FIG. **66**.

FIG. **69** is a first side view of the valve assembly shown in FIG. **66**.

FIG. **70** is a second view of the valve assembly shown in FIG. **66**.

FIG. **71** is a cross-sectional view of the valve assembly shown in FIG. **66**, taken along the line **71-71** in FIG. **67**.

FIG. **72** is a first perspective view of a first valve part of the valve assembly shown in FIG. **66**.

FIG. **73** is a second perspective view of the first valve part shown in FIG. **72**.

FIG. **74** is a first side view of the first valve part shown in FIG. **72**.

FIG. **75** is a second side view of the first valve part shown in FIG. **72**.

FIG. **76** is a bottom view of the first valve part shown in FIG. **72**.

FIG. **77** is a top view of the first valve part shown in FIG. **72**.

FIG. **78** is a front view of the first valve part shown in FIG. **72**.

FIG. **79** is a rear view of the first valve part shown in FIG. **72**.

FIG. **80** is a first perspective view of a second valve part of the valve assembly shown in FIG. **66**.

FIG. **81** is a second perspective view of the second valve part shown in FIG. **80**.

FIG. **82** is a first side view of the second valve part shown in FIG. **80**.

FIG. **83** is a second side view of the second valve part shown in FIG. **80**.

FIG. **84** is a top view of the second valve part shown in FIG. **80**.

FIG. **85** is a bottom view of the second valve part shown in FIG. **80**.

FIG. **86** is a front view of the second valve part shown in FIG. **80**.

FIG. **87** is a rear view of the second valve part shown in FIG. **80**.

FIG. **88** is a perspective view of a dampening member of the transfer tube assembly shown in FIG. **60**.

FIG. **89** is a top view of the dampening member shown in FIG. **88**.

FIG. **90** is a cross-sectional view of the dampening member shown in FIG. **88**, taken along the line **90-90** in FIG. **89**.

FIG. **91** is a perspective cross-sectional view of the dampening member shown in FIG. **88**, taken along the line **90-90** in FIG. **89**.

FIG. **92** is a perspective view of a dampening member connecting the transfer tube assembly to the pump assembly first housing part of the filter arrangement shown in FIG. **1**.

FIG. **93** is a cross-sectional view of the dampening member shown in FIG. **92**.

FIG. **94** is a perspective view of an intake tube assembly of the filter arrangement shown in FIG. **1**.

FIG. **95** is an exploded perspective view of the intake tube assembly shown in FIG. **94**.

DETAILED DESCRIPTION

Various examples will be described in detail with reference to the drawings, wherein like reference numerals represent like parts and assemblies throughout the several views. Reference to various examples does not limit the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible examples for the appended claims. Referring to the drawings wherein like reference numbers correspond to like or similar components throughout the several figures.

General Construction

FIGS. **1-9** illustrate a filter arrangement **10** having features that are examples of how inventive aspects in accordance with the principles of the present disclosure may be practiced. Preferred features are adapted for reducing the generation of vibration and noise emanating from the filter arrangement **10**.

As shown in FIG. **1**, the filter arrangement **10** generally includes a filter housing assembly **20**, an intake tube assembly **40**, a pump assembly **60**, and a transfer tube assembly **80**. When the pump assembly **60** is activated, water is drawn by the pump assembly **60** from the aquarium **12** (partially, schematically illustrated at FIG. **4**) through the intake tube assembly **40** and is delivered to the transfer tube assembly **80**. From the transfer tube assembly **80**, the pumped water passes through a filter cartridge **24** disposed within a housing **22** of the filter housing assembly **20**, and is then returned to the aquarium via a spillway **22***d* formed in the housing **22**. As is discussed in detail later, dampening structures are provided at the connection point between the pump assembly **60** and the housing assembly **20**, at the connection point between the transfer tube assembly **80** and the housing assembly **20**, and at the connection point between the transfer tube assembly **80** and the pump assembly **60**. Theses dampening structures greatly reduce the transmission of vibration and sound generated by the pump assembly **60** to the housing assembly **20** directly from the pump assembly **60** and via the transfer tube assembly **80**.

Filter Housing Assembly **20**

As most easily seen at FIG. **9**, the filter housing assembly **20** includes a housing **22**, a filter cartridge **24**, a bio-plate structure **26**, and a removable cover **28** for accessing the interior of the housing **22**. The housing **22** defines a filter chamber **22***a* within the filter cartridge **24** and bio-plate structure **26** are disposed. Once installed, the filter cartridge **24** divides the filter chamber **22***a* of the housing **22** into an intake chamber **22***b* and a discharge chamber **22***c*, as can be most easily viewed at FIG. **7**. Water flow from the pump assembly **60** is directed into the intake chamber **22***b* via a transfer tube **82** the transfer tube assembly **80**. The water then passes through the filter cartridge **24** and into the discharge chamber **22***c*. Once the water level in the discharge chamber **22***c* reaches a sufficient height, the filtered water spills over a spillway **22***d*. The spillway **22***d* of the filter arrangement **10** is constructed to mount over an edge **12***a* of the aquarium **12** so that the filtered water is directed back into the aquarium. As can be seen at FIGS. **12-17**, the housing **22** also includes an aperture **22***e* for receiving the transfer tube **82**. The housing **22** additionally includes a

receiving arrangement **22***f* for enabling connection between the housing **22** and the pump assembly **60**, discussed later.

Intake Tube Assembly **40**

Referring to FIGS. **1-6**, **11**, and **94-95**, the intake tube assembly **40** is shown in greater detail. In one aspect, the intake tube assembly **40** connects to a sidewall **66***c* of the pump assembly second housing part **66** (discussed later) in a snap-fit manner such that water at a selected height range within the aquarium **12** can be drawn into the pump assembly **60**. As shown, the intake tube assembly **40** includes a main tube **42**, an extension tube **44**, and a strainer tube **46**. The strainer tube **46** is connected to the extension tube in a snap-fit manner and includes a plurality of openings **46***a* through which water can pass into the interior of the tube **46**. The extension tube **44** is slidably connected to the main tube **42** via respective cooperating features **42***a*, **44***a* on the main tube **42** and extension tube **44**. In the example shown, feature **42***a* includes a deflectable rib or protrusion and features **44***a* are circumferential grooves which can receive the rib or protrusion **42***a* such that the height of the strainer tube **46** can be positively indexed at a desired height within the aquarium **12**.

Pump Assembly **60**

Referring to FIGS. **10-36** details of the pump assembly **60** and first dampening structure **100** are shown. In the examples presented, the filter housing assembly **20** and the pump assembly **60** are separate assemblies that are connected to each other via the dampening structure **100**. This arrangement allows for vibration and sounds generated by the pump assembly **60** to be isolated from the filter housing assembly **20**. As the filter housing assembly **20** is directly mounted to the aquarium **12**, the dampening structure **100** thus isolates vibration and sound generated by the pump assembly **60** from being transmitted to the filter housing assembly **20** and aquarium walls **12**.

In one aspect, the pump assembly **60** includes a housing **62** formed by interconnected first and second housing parts **64**, **66**. The first and second housing parts **64**, **66** can be connected together via a snap-fit type connection, or by other means such as by an adhesive or mechanical fasteners.

The first housing part **64** includes a bottom wall **64***a* from which a sidewall **64***b* extends to define a first interior cavity **64***c*. The first housing part **64** further includes an interior sidewall **64***d* and interior end wall **64***e* that defines a second interior cavity **64***f* within the interior cavity **64***c*. The first housing part **64** additionally includes an exterior sidewall **64***g* which extends through the bottom wall **64***a* to an open end **64***h* to form an exit passageway **64***i*. In one aspect, the interior cavity **64***c* of the first housing part **64** can be filled with an epoxy material to secure the magnetic drive components and related electrical components of the pump **70**, discussed later.

The second housing part **66** is defined by a first sidewall **66***a* defining an interior cavity **66***b* and a second sidewall **66***c* defining an inlet passageway **66***d* into the interior cavity **66***b*. The second sidewall **66***c* is configured to connect with the intake tube assembly **40**. When the first and second housing parts **64**, **66** are connected together, the second interior cavity **64***f* of the first housing part **64** opens into interior cavity **66***b* of the second housing part **66**. Additionally, the passageway **64***h* defined by the sidewall **64***f* is also open to the interior cavity **66***b* of the second housing part such that a passageway is defined from the intake tube assembly **40**, through the interior cavity **66***b*, through the exit passageway **64***i*, and into the transfer tube assembly **80** where water from the aquarium **80** can be delivered to the housing intake chamber **22***b*.

The pump assembly **60** includes a pump **70** including a bracket **70***a* supporting a magnetic drive part **70***b*, a coil (not shown), and an impeller magnet part **70***c*. The impeller magnet part **70***c* is coupled to an impeller **70***e* such that when the impeller magnetic part **70***c* rotates, the impeller **70***e* rotates as well. Electrical leads **70***d* extend to the control part **70***a* such that the magnetic drive part **70***b* can be powered to drive the impeller via the impeller magnet part **70***c*.

As shown, the electrical leads **70***d*, the bracket **70***a*, and the magnetic drive part **70***b* are housed within the first interior cavity **64***c* while the impeller magnet part **70***c* is housed within the second interior cavity **64***e*, with the impeller extending into the interior cavity **66***b* of the second housing part. Thus, when the magnet drive part **70***b* is powered, the impeller **70***e* rotates to draw fluid from the aquarium **80** and into the intake tube assembly **40**, through the interior cavity **66***b*, through the exit passageway **64***i*, and into the transfer tube assembly **40**.

In one aspect, a cover member **68** can be provided to enclose the interior cavity **64***c* of the first housing part **64** within which the pump assembly **60** is disposed. The cover member **68** is shown in isolation at FIGS. **38-45**. In the example shown, the cover member **68** is connected to the first housing part **64** via the epoxy filled into the interior cavity **64***c*. The cover member **68** can be connected to the first housing part **64** by other types of connections, for example a snap-fit type connection. As shown, the cover member **68** includes a base member **68***a* that has a perimeter profile that generally matches the perimeter profile of the first housing part **64** such that the cover part generally encloses the top of the interior cavity **64***c*. The cover member **68** can be provided with one or more projections or extensions **68***b* that extend into the interior cavity to allow the epoxy to more securely engage with and retain the cover member **68**. The cover member **68** can also be provided with a collar or aperture **68***c* for allowing electrical leads **70***d* of the pump assembly **60** to extend out of the interior cavity **64***c*.

The cover member **68** is also shown as being provided with a plurality of support arms **68***d*, **68***e*, **68***f* that enable connection to a mounting member **69** via a dampening member **100**. The mounting member **69** is directly coupled to the filter housing assembly **20** while the dampening member **100** reduces and/or eliminates vibrations and sounds generated by the pump assembly **60** from being transmitted to the filter housing assembly **20**. Collectively, the cover member **68**, the mounting member **69**, and the dampening member **100** function as a dampening structure/assembly and connection mechanism for coupling the pump assembly **60** to the filter housing assembly **20**. Thus, these components may be referred to as an independent dampening assembly **101** or as a dampening subassembly of the pump assembly. This assembly or subassembly **101** is shown in isolation at FIGS. **24-29**. The vibration and sound dampening functionality of the dampening assembly or subassembly is an improvement over prior art designs in which the pump assembly and filter housing assembly are constructed as a single assembly which leaves little or no opportunity for incorporating vibration isolation measures.

As shown, a pair of support arms **68***d* is provided which extend up from the base member **68***a* and then extend in a direction parallel to the base member **68***a*. As such, the support arms **68***d* can be characterized as having an L-shape

or a bent shape. The support arms **68***d* further include hook or retaining portions **68***g* that extend down towards the base member **68***a* and function to retain the dampening member **100** on the support arms **68***d* once the dampening member **100** is installed onto the arms **68***d*. A third support arm **68***e* is provided between the support arms **68***d* and similarly extends up from the base member **68***a* and then parallel to the base member **68***a*, but without having a hook or retaining portion **68***g*.

The support arms **68***f* of the cover member **68** similarly extend up from the base **68***a*, but to a larger extent with a relatively shorter portion extending in a direction parallel to the base **68***a*. The support arms **68***f* are also provided with a hook or retaining portion **68***h*. Unlike the support arms **68***d* and **68***e*, the support arms **68***f* are configured to engage with corresponding L-shaped or bent support arms **69***b* of the mounting member **69** if necessary, but are normally spaced from the support arms **69***b* such that sound and vibration transmission directly from the cover member **68** to the mounting member **69** does not occur.

Referring to FIGS. **30-37**, the mounting member **69** is shown in isolation. As shown, the mounting member **69** is unitarily formed with a base member **69***a*, the aforementioned support arms **69***b*, and with an additional pair of support arms **69***c*. The support arms **69***c* extend down from the base member **69***a* and then extend in a direction parallel to the base member **68***a* of the cover member **68** such that the support arms **69***c* are parallel to the support arms **68***d*, **68***e*. As such, the support arms **69***c* can be characterized as having an L-shape or a bent shape. The support arms **69***c* further include hook or retaining portions **69***d* that extend down and away from the base member **69***a* and function to retain the dampening member **100** on the support arms **69***c* once the dampening member **100** is installed onto the arms **69***c*. In one aspect, the base member **69***a* defines a mounting surface **69***e* which is formed with a curved shape that is complementary to the shape of the bottom of the housing **22** of the filter housing assembly **20** such that the mounting member **69** can be joined in a flush relationship to the housing **22**, as can be most easily seen at FIGS. **7** and **8**. The profile of this curve can also be observed at the top edge of the first housing part **64** of the pump assembly **60** (e.g. see FIG. **51**) which allows the first housing part **64** to be flush mounted to the housing **22** of filter housing assembly. To facilitate attachment of the mounting member **69** to the housing **22**, the mounting member **69** is provided with mounting holes **69***f*, **69***g* through which fasteners can extend into the receiving arrangement **22***f* Through this connection, the pump assembly **60** is mounted to the filter housing assembly **20**, but with vibration from the pump assembly **60** being dampened by the interconnected dampening member **100**.

The dampening member **100** is shown in isolation at FIGS. **46-47**. As presented, the dampening member **100** is formed with a unitary construction from an elastomeric or viscoelastic polymeric material, such as plastics, rubbers, silicones, and polyurethanes. In one aspect, the dampening member **100** is provided with a main body **100***a* having a plurality of openings for receiving the support arms from the cover member **68** and the mounting member **69**. For example, the main body **100***a* is provided with openings **100***b* and **100***f* for receiving the support arms **68***d* and an opening **100***d* for receiving the support arm **68***e*. The main body **100***a* is also provided with openings **100***c* and **100***e* for receiving the pair of mounting arms **69***b* of the mounting member **69**. Accordingly, any vibration or sound transmitted to the support arms **68***d*, **68***e* from the pump **70** is dampened by the dampening member **100** and is transmitted to a much lesser degree, if at all, to the support arms **69***b* of the mounting member **69**. In the embodiment shown, the opening **100***b*-**100***f* are generally rectangular in shape (with rounded corners) and extend all the way through the main body **100***a*. However, different shapes may be utilized, such as circular, triangular, and other polygonal shapes with or without rounded corners. Also, although five total openings are shown, more or fewer openings can be provided depending upon the desired number of support arms extending from the mounting member **69** and cover member **68**.

The pump assembly **60** can also be provided with a dampening member **110** to facilitate the connection between the pump assembly **60** and the transfer tube assembly **80**. As presented, the dampening member **110** is formed with a unitary construction from an elastomeric or viscoelastic polymeric material, such as plastics, rubbers, silicones, and polyurethanes. As described earlier, the first housing part **64** of the pump assembly **60** includes an exterior sidewall **64***g* which extends through the bottom wall **64***a* to an open end **64***h* to form an exit passageway **64***i*. This structure essentially forms a pumped fluid outlet opening to which the inlet end **82***a* of a tube structure **82** (discussed later) of the transfer tube assembly **80** can be connected via the dampening member **110**, as can most easily be seen at FIG. **6**A. The dampening member **110** is shown in isolation at FIGS. **92-93** where it can be seen that the dampening member **110** is a tubular structure with a sidewall **110***a* extending from a first open end **110***b* to a second open end **110***c*. The sidewall **110***a* frictionally engages the sidewall **64***g* at the first open end **110***b* and the tubular structure inlet end **82***a* at the second open end **110***c*. The seals formed between the sidewall **110***a* and the sidewall **64***g* and tubular structure **82** may be further formed with a sealant, such as silicone or may be further effectuated mechanically, such as with a band.

In one aspect, the dampening member **110** includes an internal circumferential flange **110***d* which extends radially inwardly from the sidewall **110***a*. The circumferential flange **110***d* extends sufficiently inwardly such that the end of the sidewall **64***g* and the inlet end **82***a* of the tube structure are prevented from abutting each other, and thus transmitting sound and vibration from the pump assembly **60** to the transfer tube assembly **80**. Instead, the end of the sidewall **64***g* and the inlet end **82***a* of the tube structure **82** each abuts the internal circumferential flange **110***d* where these components are inserted into the dampening member **110** to such a degree.

Taken together, the dampening members **100** and **110** operate to reduce or prevent the transmission of sound and vibration from the pump assembly **60** to the downstream related components (e.g. housing assembly **20**, transfer tube assembly **80**) of the filtration arrangement **10** and thus ultimately reduce or prevent sound and vibration from being transmitted to the aquarium **12** where the sound and vibration can be further amplified.

Transfer Tube Assembly **80**

Referring to FIGS. **6-11** and **60-91**, features of the transfer tube assembly **80** are shown in greater detail. In one aspect, the transfer tube assembly **80** includes an arc-shaped tube structure **82** extending between an inlet end **82***a* and an outlet end **82***b*. The tube structure **82** is primarily situated within the housing **22** and rests within a concave-shaped support channel **22***g* defined within the housing **22**. The inlet end **82***a* of the tube structure **82** extends through the aperture

22*e* of the housing **22** and is connected to the pump assembly exterior sidewall **64***g* via a dampening structure **100** (discussed later). The tube structure **82** is oriented within the housing **22** such that the second end **82***b* extends into the intake chamber **22***b* of the housing **22**, as most easily viewed at FIG. **7**. Thus, the tube structure **82** allows for water pumped by the pump assembly **60** to be delivered to the intake chamber **22**. The tube structure **82** additionally defines a valve cavity **82***d* for housing a valve assembly **90** (discussed later) and a support structure **82***c* to which dampening structures **300** (discussed later) are attached.

In one aspect, the tube structure **82** is formed by a first tube half **84** and a second tube half **86** mated to the first tube half **84**. The tube halves **84**, **86** can be bonded to each other by a variety of means, such as by sonic welding. Each tube half **84**, **86** extends between a first end **84***a*, **86***a* and a second end **84***b*, **86***b*. Additionally, the tube half **84** includes a cylindrical sidewall portion **84***c* and the tube half includes a cavity portion **86***c* that cooperatively define the valve cavity **82***d*. The valve cavity **82***d* retains the valve body **92** of a valve assembly **90**, discussed later. The tube halves **84**, **86** are also provided with a recessed area **84***f*, **86***f* that together form a recessed portion **82***d* within which a valve member **92***f* of the valve body **92** resides when the valve assembly **90** is in an open position.

In one aspect, the tube half **84** is shown as including a pair of alignment apertures **84***e* while the tube half **86** is shown as including a pair of alignment protrusions **86***e* that are received into the apertures **86***e*. These features ensure that the tube halves **84**, **86** are properly aligned to each other prior to being bonded together and also aid in initial alignment during assembly. As shown, the apertures **84***e* and protrusions **86***e* are located proximate the valve cavity **82***c* where proper alignment is generally more important. The apertures and protrusions **84***e*, **86***e* can also impart additional structural integrity to the tube structure **82**. Other numbers, locations, and combinations of apertures and protrusions may be provided on the tube halves **84**, **86** to ensure alignment. Also, other alignment features may be utilized such as elongated slots or grooves that receive cooperatively shaped protrusions.

In one aspect, the tube half **84** is additionally provided with a stop structure **88**, as can be seen most easily at FIG. **65**. The stop structure **88** provides for a limiting function for the positioning of the valve assembly **90** such that the valve assembly **90** can only be rotated between two end stop points. To achieve this function, the stop structure **88** is provided with a first stop surface **88***a* and a second stop surface **88***b* which interact with a portion of the valve assembly **90**, such as an operator portion or valve body.

By providing the tube structure **82** in two halves **84**, **86**, the valve body **92** (discussed later) of the valve assembly **90** can be installed within the sidewall portion **84***c* and cavity portion **86***c* prior to the tube halves **84**, **86** being joined together. Once the tube halves **84**, **86** are joined together, the valve body **92** is securely retained within the valve cavity **82***c* and can rotate within the valve cavity **82***c* to control the volumetric flow rate of the water flowing through the filter arrangement **10**. Each tube half **84**, **86** also defines a support leg **84***d*, **86***d* which together form the support structure **82***c* of the tube structure **82**.

As most easily seen at FIGS. **63** and **66** to **71**, the valve assembly **90** is shown in further detail. The valve assembly **90** allows for the volumetric flow rate through the transfer tube assembly **80** to be controlled manually by selectively providing resistance to the water pumped by the pump assembly **60** and passing through the tube structure **82**. In some instances, it is undesirable for the filter arrangement **10** to operate at full flow capacity. For example, when food is added to the aquarium **12** it is desirable to have little or no flow through the filter arrangement to avoid the food being unintentionally drawn into the filter arrangement before it can be consumed. Also, where the filter arrangement **10** has a larger capacity than what is required for the aquarium **12** in which it is installed, the valve assembly **90** can be adjusted and set such that a desired flow rate through the filter arrangement **10** is achieved. As presented, the valve assembly **90** includes the aforementioned valve body **92**, a valve operator **94**, an indicator **96** attached to the valve operator **96**, and a seal member **98**. The valve assembly **90** is shown in isolation from the tube structure **92** at FIGS. **66-71**.

Referring to FIGS. **72** to **79**, the valve body **92** is shown in isolation. As presented, the valve body **92** is a unitarily formed component with a cylindrical body **92***a* within which a channel or passageway **92***b* is formed by sidewalls **92***c*, **92***d*, and **92***e*. A cavity **92***g* is also formed between the cylindrical body **92***a* and the sidewall **92***c*. The sidewall **92***c* extends between the sidewalls **92***d*, **92***e* and extends beyond the cylindrical body **92***a* to a distal end **92***f* In one aspect, the sidewall **92***c* is provided with an aperture **92***h* for receiving a latch member of the valve operator **96**. The distal end **92***f* has a radius and/or shape that generally matches the interior radius and/or shape of the tube structure **82**. As constructed, the distal end **92***f* of the sidewall **92***c* functions as a stop or regulating member of the valve assembly **90**. As such, the distal end **92***f* of the valve body **92** may be referred to more broadly as a valve member, stop member, or regulating member **92***f*. As can be most easily seen at FIG. **9**, when the valve body **92** is rotated fully into an open flow position, the valve member **92***f* resides in a recessed area **82***d* of the tube structure **82**. This allows water flowing through the valve assembly **90** to pass through the channel or passageway **92***b* of the valve body **92** relatively unobstructed along a flow path **93**. When the valve body **92** is rotated within the tube structure **82**, which is about an axis that is parallel to the top of the aquarium **12**, the valve member **92***f* enters into the flow path **93** and provides resistance to the water flowing through the flow path **93**. Thus, a desired flow rate through the tube structure **82** can be achieved by appropriately rotating the valve body **92**. Although the axis of rotation of the valve body **92** is shown as being parallel to the top of the aquarium, other angles are possible.

In one aspect, the valve body **92** can be connected to and rotated via the valve operator **94**. The valve operator **94** is shown in isolation at FIGS. **80** to **87**. As shown, the valve operator **94** is unitarily formed with an operator portion **94***a*, a pair of engagement members **94***b* extending from the operator, and a connecting member **94***c* also extending from the operator portion **94***a*. The operator portion **94***a* provides a mechanism by which an operator can manipulate the rotational position of the valve body **92** by likewise rotating the operator portion **94***a*. In the example shown, the operator portion **94***a* is provided with a concave shaped recess **94***h* to allow a user's finger to more easily grip or engage the operator portion **94***a*. Other features such as knurls and ribs may be provided for tactile purposes as well.

The extension members **94***b* extend into the cavity **92***g* of the valve body **92** and engage with the valve body **92** such that a rotational force applied to the operator portion **94***a* is translated to the valve body **92**. In one aspect, the extension members **92***b* and the cavity **92***g* have complimentary shapes for a relatively low tolerance engagement. The connecting member **94***c* is provided with a latch member **94***d* that is

received by the aperture **92***h* in the valve body sidewall **92***c* to form a secure, snap-fit type connection.

In one aspect, the operator portion **94***a* includes a first stop surface **94***e* and a second stop surface **94***f* that respectively interact with the stop surfaces **88***a*, **88***b* of the stop structure **88** on the tube half **84**. These surfaces cooperate to limit the rotation of the operator portion **94***a*, and by extension, the valve body **92**. As such, the valve assembly **90** can be rotated to a fully open position when the operator stop surface **94***e* is engaged with the stop structure end stop surface **88***a* and can be rotated to a fully closed position when the operator stop surface **94***f* is engaged with the stop structure end stop surface **88***b*. It is noted that the fully closed position can be a position in which virtually all flow through the tube structure **82** is blocked or in which flow is restricted but still exists at some reduced rate. Additionally, it is noted that the stop surfaces **94***e*, **94***f* could also be provided on the valve body **92** rather than the operator **94**.

The valve operator **94** can also be provided with a flanged recess **94***g* for retaining the seal member **98**. The seal member **98** is most easily viewed as being retained in the flanged recess **94***g* at FIGS. **66** to **68**. As stated, earlier, the valve body **92** is initially installed between the tube halves **84**, **86** and the valve operator **94** is connected to the valve body **92** after the tube halves **84**, **86** have been joined together. As such, a potential leak path exists at the location where the valve operator **94** is connected to the valve body **92**. The seal member **98**, configured as an O-ring, prevents such leakage by engaging with the cylindrical sidewall portion **84***c* of the tube half **84** once the valve operator **94** is joined to the valve body **92**.

In one aspect, the valve operator **94** is provided with an indicator **96** that enables an operator to visually observe the relative position of the valve assembly **90**. In the example shown, the operator portion is provided with a recessed area **94***i* for receiving the indicator **96** in a snap-fit type arrangement. The indicator **96** is most easily viewable at FIGS. **66** to **71**, where it can be seen that the indicator **96** saddles each side of the operator portion **94***a* and generally follows the perimeter profile of the operator portion **94***a*. By providing the indicator **96** as a separate component, the indicator **96** can be more easily provided with a color that is different than the color of the operator portion **94***a*. For example, the indicator **96** can be molded from a red plastic material to differentiate it from a darker color from which the valve operator **94** is molded. However, it is entirely possible to provide an indicator **96** directly on the operator portion without requiring a separate component, such as by painting. As can be seen at FIGS. **1** to **6**, the operator portion **94***a* of the valve operator **94** extends through an aperture **28***a* of the cover **28**. Thus, the position of the valve assembly **90** can be manipulated by a user without requiring removal of the cover **28**. The cover **28** can also include indicia **28***b*, such as "+" and "−" symbols to provide an indication to an operator as to which direction the operator portion **94***a* should be moved in order to provide more or less flow. When the operation portion **94***a* has been rotated to a sufficiently closed position, the indicator **96** will pass through the opening **28***a* and be viewable to a user. Thus, the indicator **96** can provide a visual alert to an operator that the filter arrangement **10** is not operating at full capacity.

With reference to FIG. **60**A, the operation of the valve body **92** within the transfer tube halves **84** can be most easily viewed. In FIG. **60**A, the valve member **92***f* is shown in an open position, as referenced at **92***f*-O, and is shown in the closed position, as referenced at **92***f*-C. The valve body **92** rotates between the open and closed positions about a rotational axis X**1** through an angle a**1**. With the disclosed design, the valve body **92** and the valve operator **94** can be beneficially rotated between the fully open and closed positions with 90 degrees or less of total rotation. In the example shown, angle a**1** is about 46 degrees. This relatively low value is advantageous in that an operator need not turn the operator **94** multiple times in order to move the valve body **92** between the open and closed positions. In one aspect, the rotational axis X**1** is orthogonal or perpendicular to a longitudinal axis X**2** (see FIG. **62**) of the transfer tube assembly **80** and the constituent tube halves **84**. By orienting the rotational axis X**1** in such a manner, the operator **94** can be located on one side of the tube halves **84**, thereby enabling the operator **94** to be placed in an ideal use for an operator.

In the example embodiments presented, the transfer tube assembly **80** can be constructed with isolation features that minimize or eliminate the transfer of vibration and sound to the housing **22** of the filter housing assembly **20**. As described previously, each tube half **84**, **86** of the tube structure defines a support leg **84***d*, **86***d* which together form the support structure **82***c* of the tube structure **82**. As most easily viewed at FIGS. **60-62**, a dampening member **120** is inserted onto each of the support legs **84***d*, **86***d*. The dampening members **120**, shown in isolation at FIGS. **88-91**, can be formed from the same types of elastomeric materials as already described for dampening members **100**, **100**. Each dampening member **120** is provided with a main body **120***a* defining a generally hemi-spherical or oblong rounded shape defining a recess **120***b* for receiving the support leg **84***d* or **86***d*. In one aspect, the recess **120***b* can include a further pair of recesses **120***c* for receiving protrusions **84***g*, **86***g* extending from the opposite surfaces of the support legs **84***d*, **86***d*. The interaction of the protrusions **84***g*, **86***g* and the recesses **120***c* aid in locking the dampening members **120** to the support legs **84***d*, **86***d*. As most easily viewed at FIGS. **9** and **10**, the dampening members **120** are received within a recessed area **22***h* defined in the housing **22**. This configuration allows for the entire transfer tube assembly **80** to be supported by the dampening member **120** and by the dampening member **100** such that hard plastic-to-plastic contact between the transfer tube assembly **80** and the housing **22** can be avoided. Thus, any vibration or sound that is transferred to the transfer tube assembly **80** from the pump **70** is further isolated from being transmitted to the housing **22** by the dampening member **120**. Furthermore, any vibration or sound generated within the transfer tube assembly **80**, which is not generally expected but could potentially occur at the valve assembly **90**, is also isolated from the housing.

From the forgoing detailed description, it will be evident that modifications and variations can be made in the aspects of the disclosure without departing from the spirit or scope of the aspects. While the best modes for carrying out the many aspects of the present teachings have been described in detail, those familiar with the art to which these teachings relate will recognize various alternative aspects for practicing the present teachings that are within the scope of the appended claims.

The invention claimed is:

1. A filter arrangement for an aquarium, the filter arrangement comprising:

a) a housing assembly including a housing and a removable cover, the housing and cover defining an interior volume within which a filter cartridge is disposed;

b) a pump assembly including a pump having an inlet and an outlet;

c) a transfer tube assembly having an inlet and an outlet, wherein the transfer tube assembly inlet is operably connected to the pump outlet and the transfer tube outlet is in fluid communication with the interior volume upstream of the filter cartridge; and

d) a valve assembly for controlling flow through the transfer tube assembly, wherein the transfer tube assembly includes a tube structure within which a valve body of the valve assembly is rotatably disposed and wherein a rotational axis of the valve assembly is perpendicular to a longitudinal axis of the tube structure.

2. The filter arrangement of claim **1**, wherein the valve assembly can be rotated between a closed position and an open position in 90 degrees or less of rotation.

3. The filter arrangement of claim **2**, wherein the tube structure is formed from a first tube half and a second tube half mated to the first tube half.

4. The filter arrangement of claim **3**, wherein the first and second tube halves are bonded to each other.

5. The filter arrangement of claim **4**, wherein the valve body is non-removable from the tube structure after the first and second tube halves are bonded to each other.

6. The filter arrangement of claim **1**, wherein the valve assembly includes a rotatable valve body and a valve operator connected to the valve body.

7. The filter arrangement of claim **6**, wherein a portion of the valve operator extends through an aperture of the removable cover of the housing assembly.

8. The filter arrangement of claim **6**, wherein the valve operator includes an indicator for providing a visual indication of the position of the valve operator.

9. The filter arrangement of claim **6**, wherein the transfer tube assembly includes a first stop surface against which the valve operator abuts when the valve operator is rotated to a position corresponding to the valve body being in a fully open position.

10. The filter arrangement of claim **9**, wherein the first stop surface is located on a tube structure of the transfer tube assembly.

11. The filter arrangement of claim **9**, wherein the transfer tube assembly includes a second stop surface against which the valve operator abuts when the valve operator is rotated to a position corresponding to the valve body being in a relatively closed position.

12. The filter arrangement of claim **10**, wherein the second stop surface is located on a tube structure of the transfer tube assembly.

13. The filter arrangement of claim **6**, wherein the valve assembly further includes a seal member mounted to the valve operator, wherein the seal member forms a seal between the valve operator and a tube structure of the transfer tube assembly.

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