

### [54] TELESCOPING DIP TUBE ASSEMBLY

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[51] Int. Cl. .... B65d 35/22

[58] Field of Search .... 222/464, 523, 94, 95; 285/242, 285/255, 351; 220/85 B; 141/114

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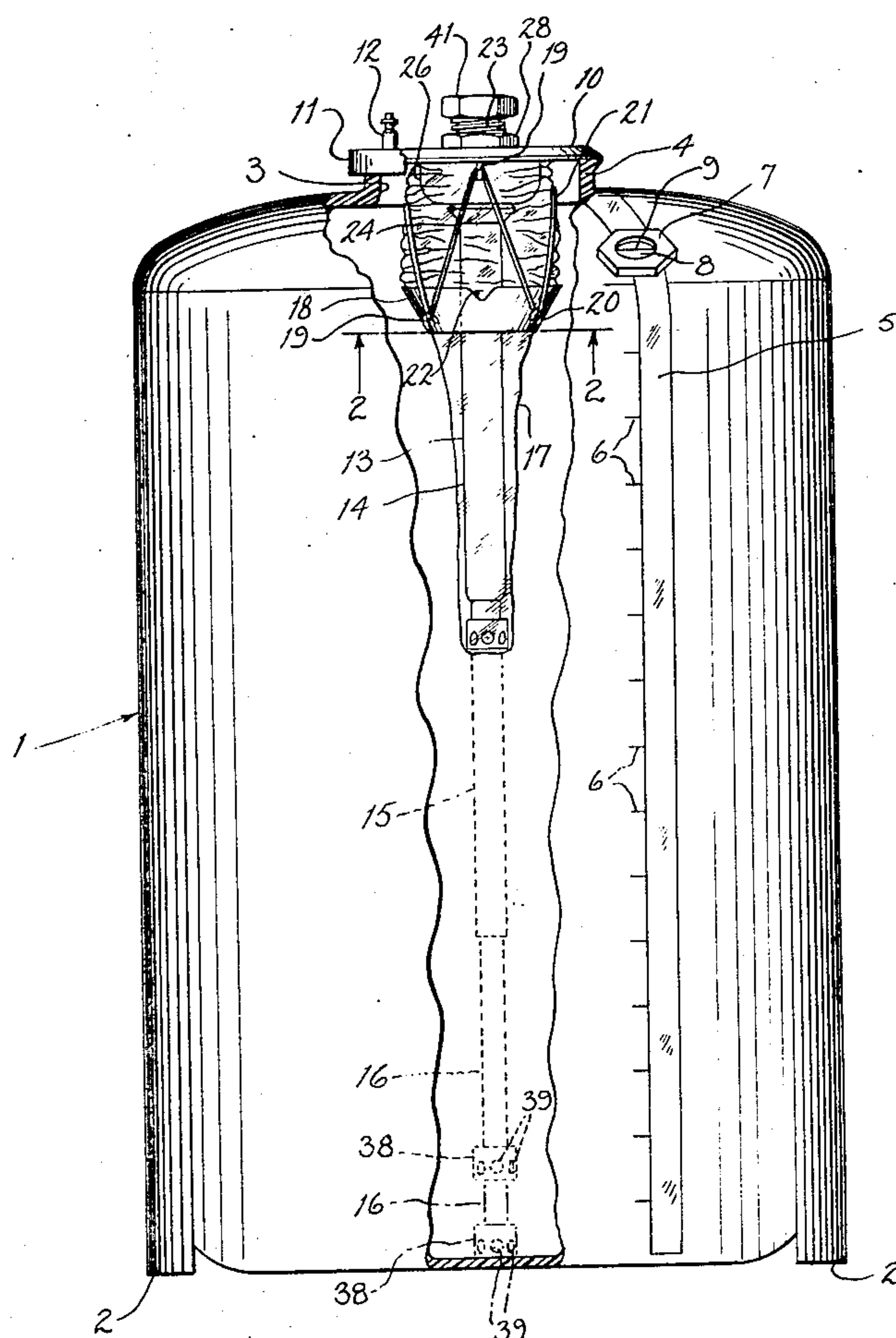
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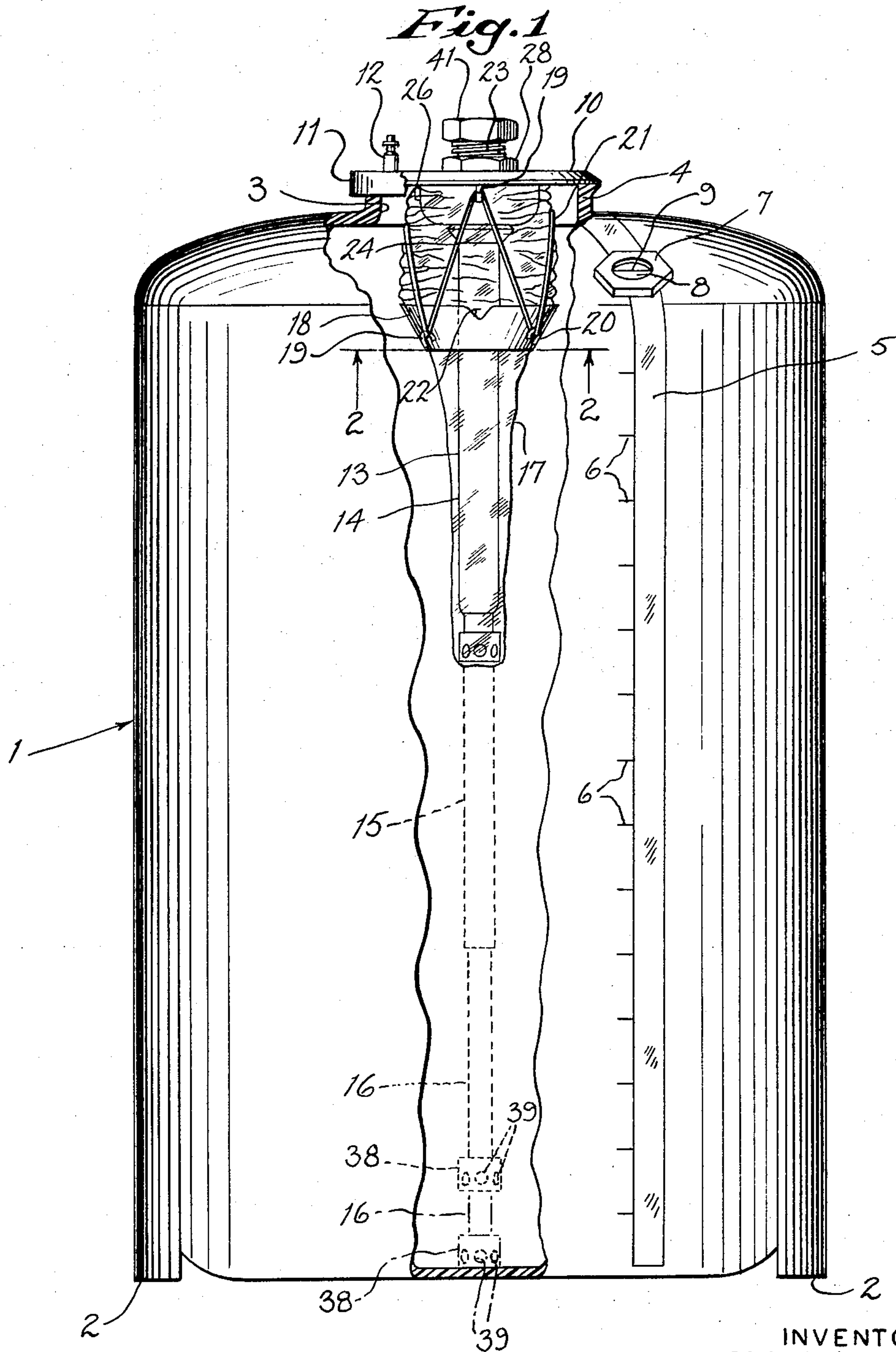
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### [57] ABSTRACT

A dip tube assembly for a liquid storage tank includes a telescoping fill pipe and a flexible discharge tube. As delivered, the pipe is telescoped and a vacuumized liner bag is collapsed about it and held in place by a resiliently suspended collar. Liquid introduced through the pipe causes the bag to feed through the collar and the pipe extends, but a stop prevents the lowest section from extending fully until it is manipulated. The tube is fed through the pipe after filling and connected to the lowest section, the tube serving as a means to manipulate the lowest section, as a discharge conduit, and as a means to retract the pipe after emptying. A seal between the tube and a fitting nipple includes spaced O-rings on the nipple and a sleeve which fits over the tube and has an inner circumferential ridge which tightly engages the tube between the O-rings.

11 Claims, 11 Drawing Figures





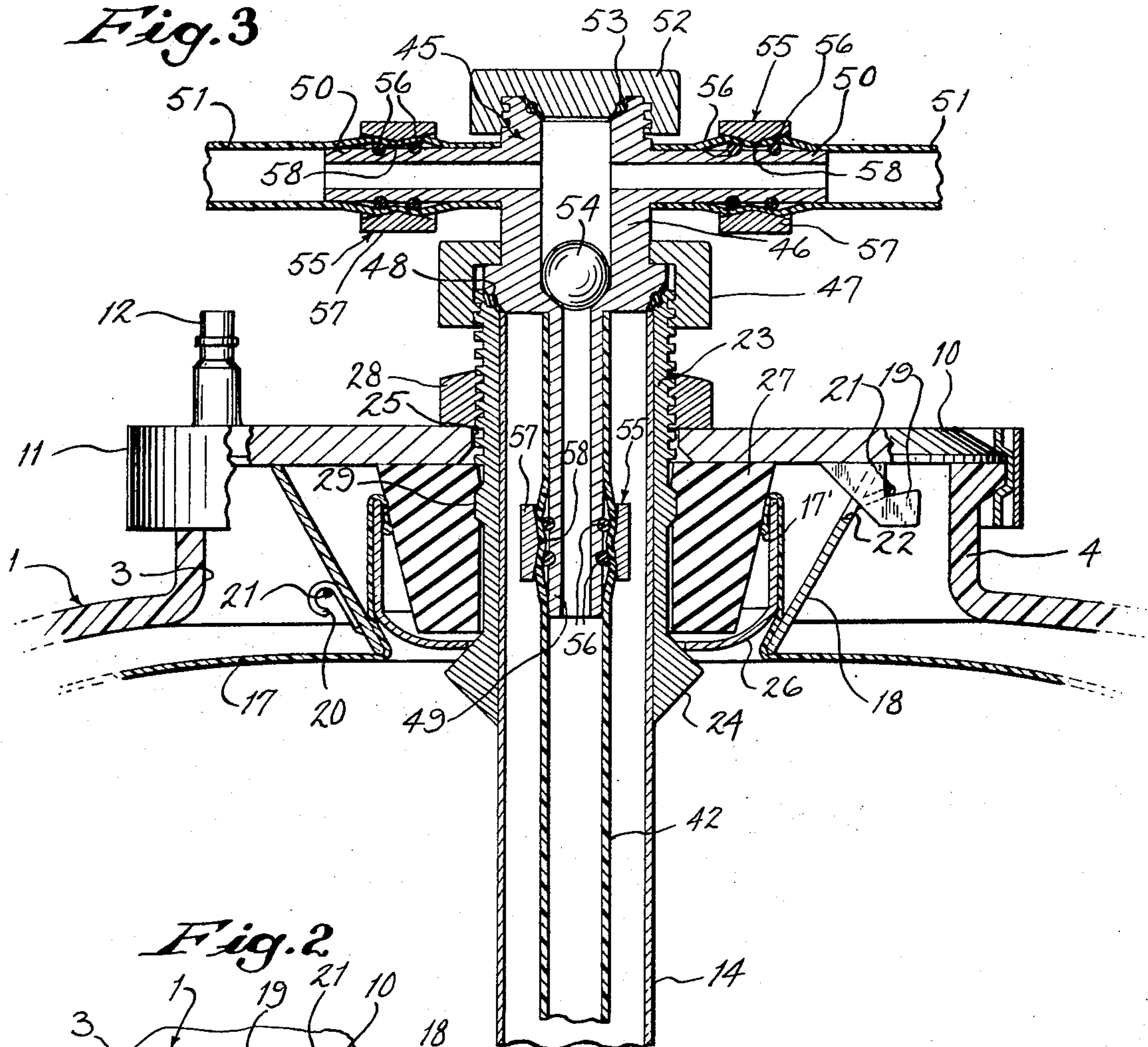
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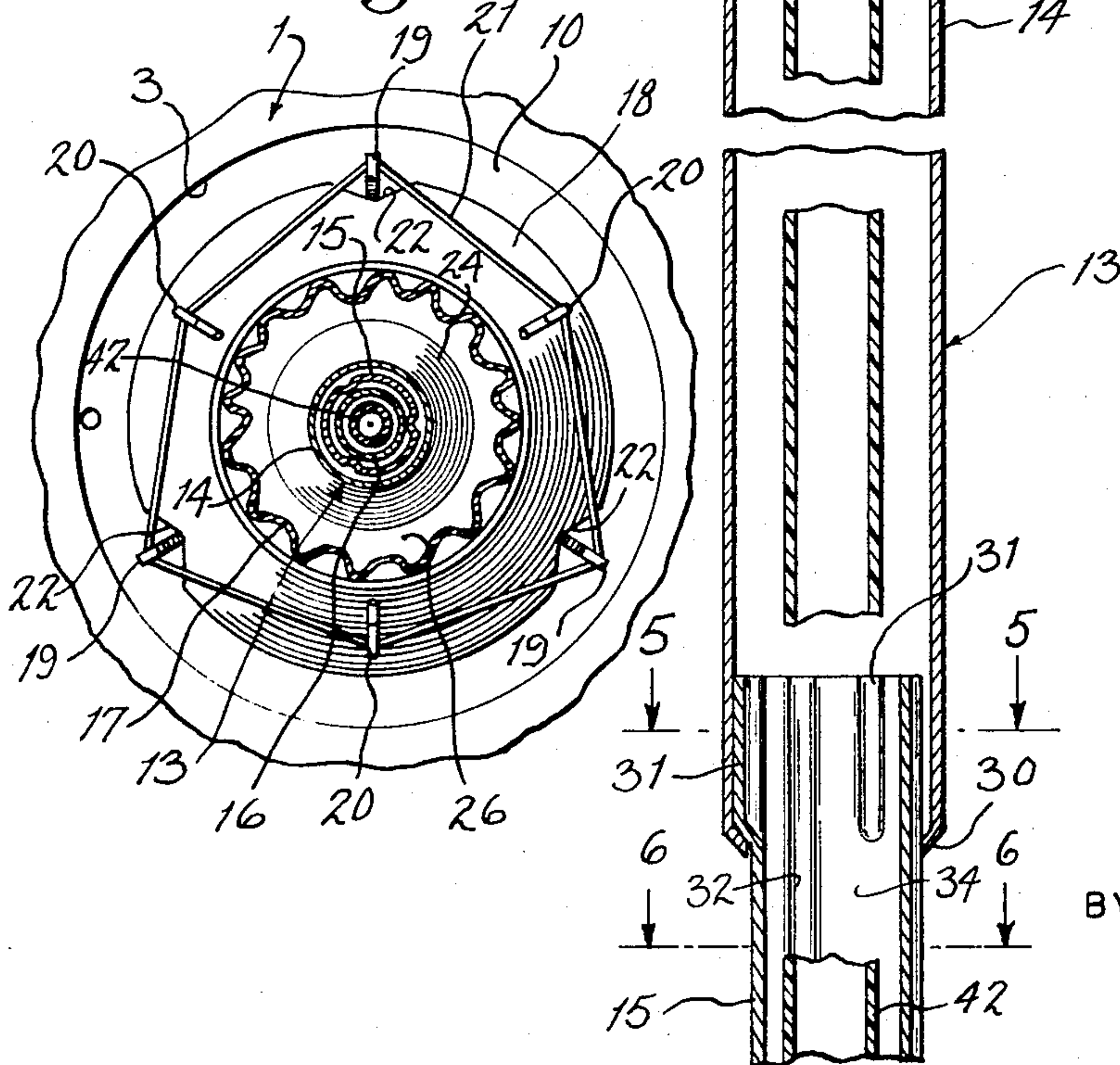
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*Fig. 3*



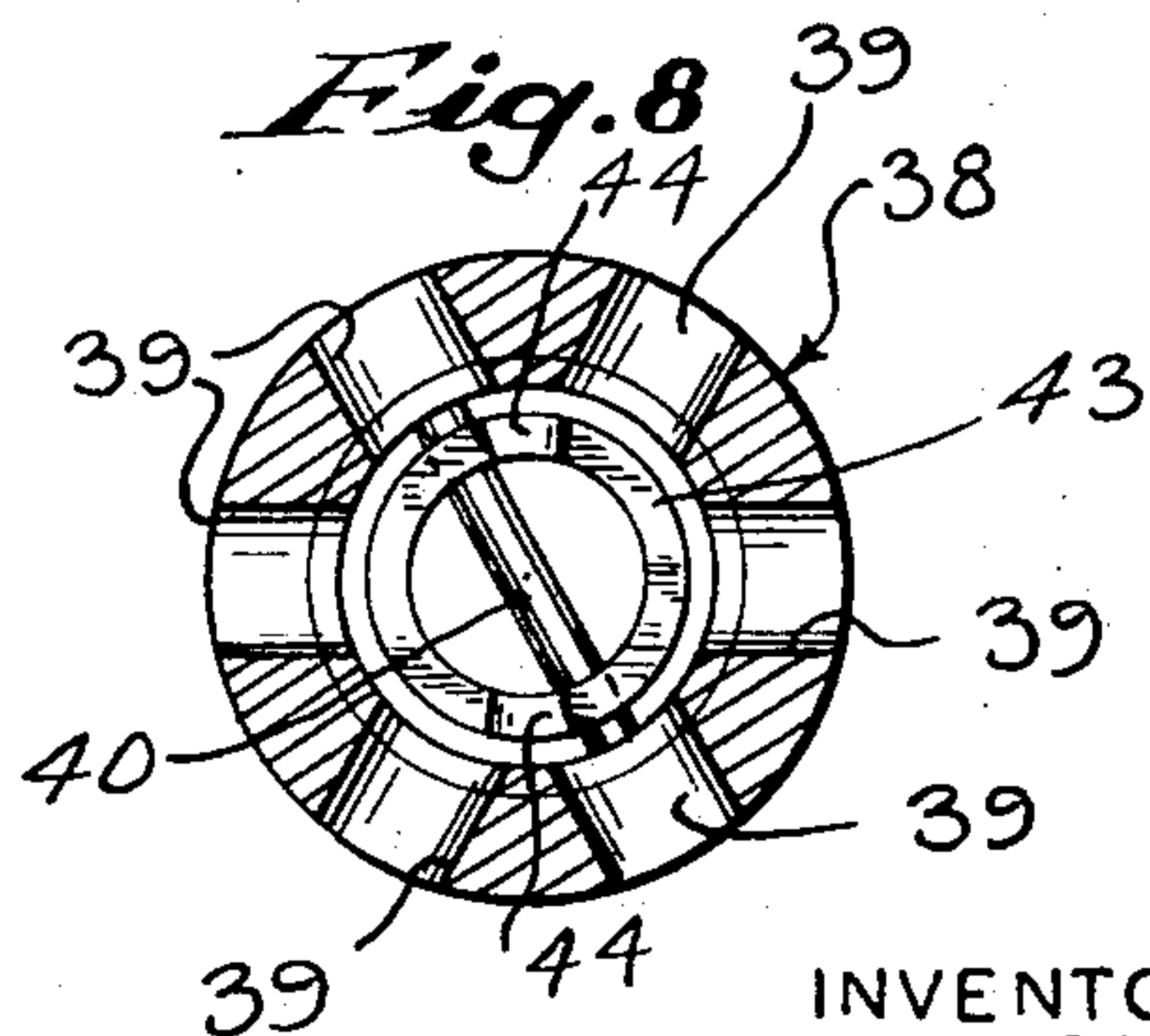
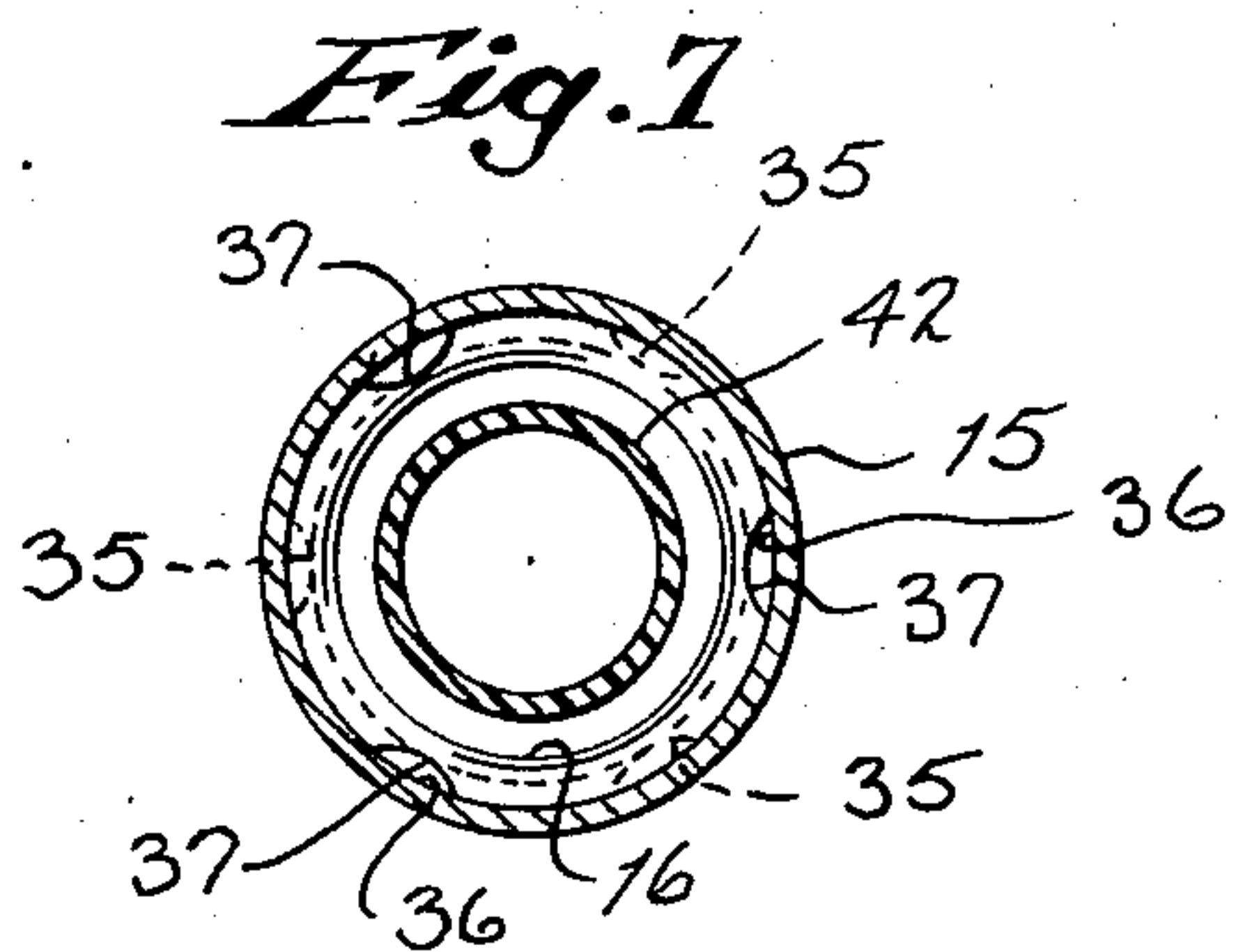
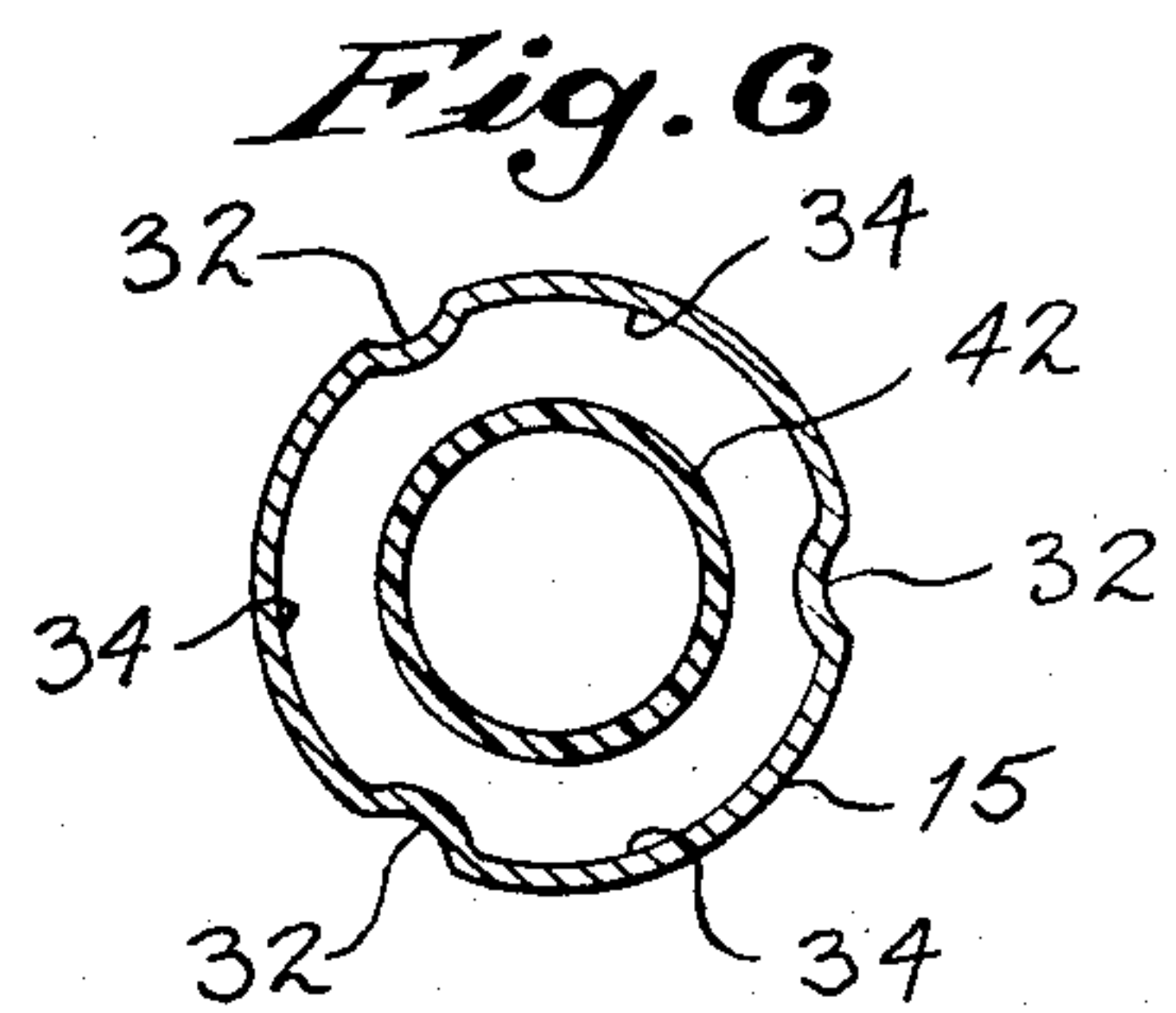
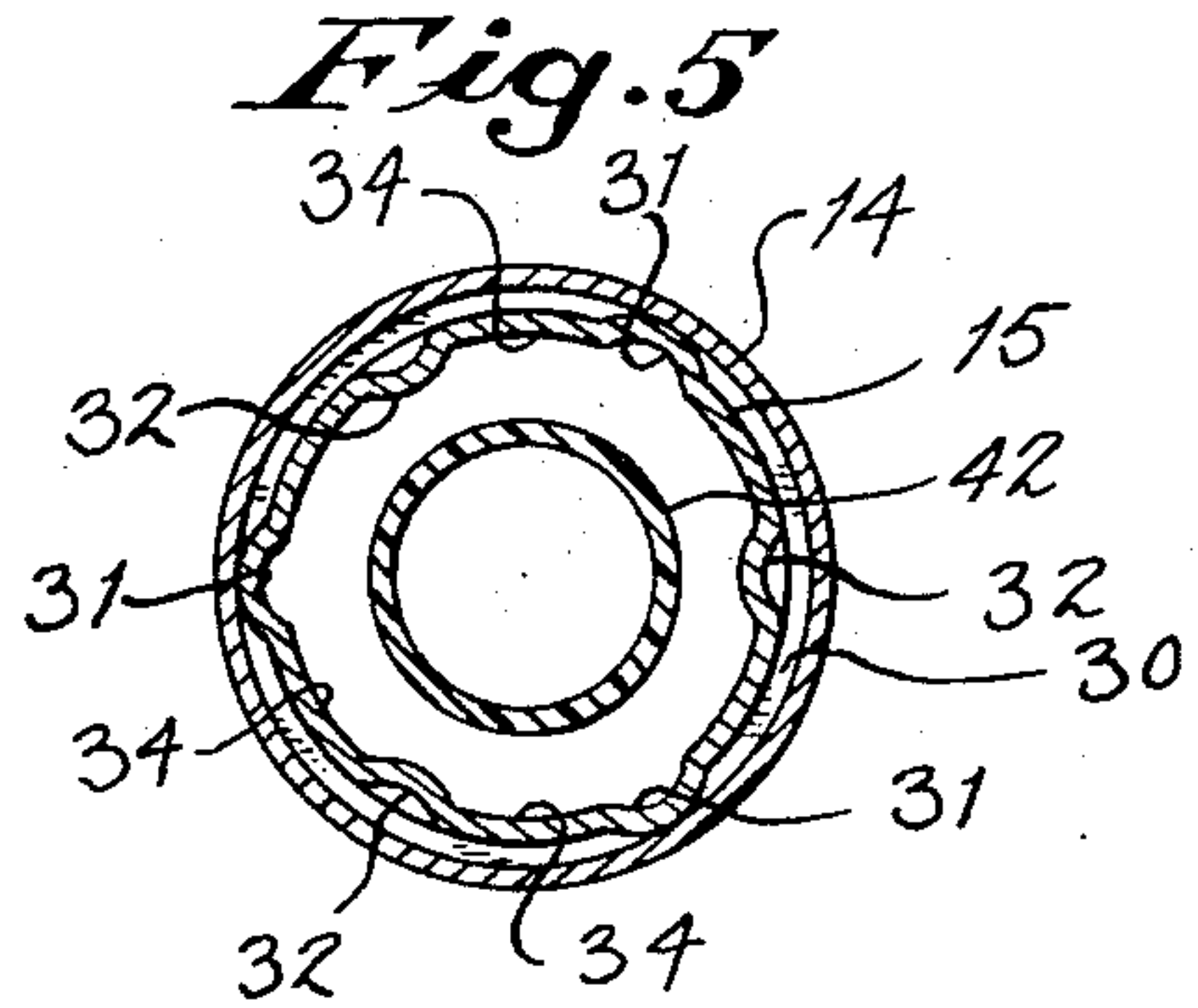
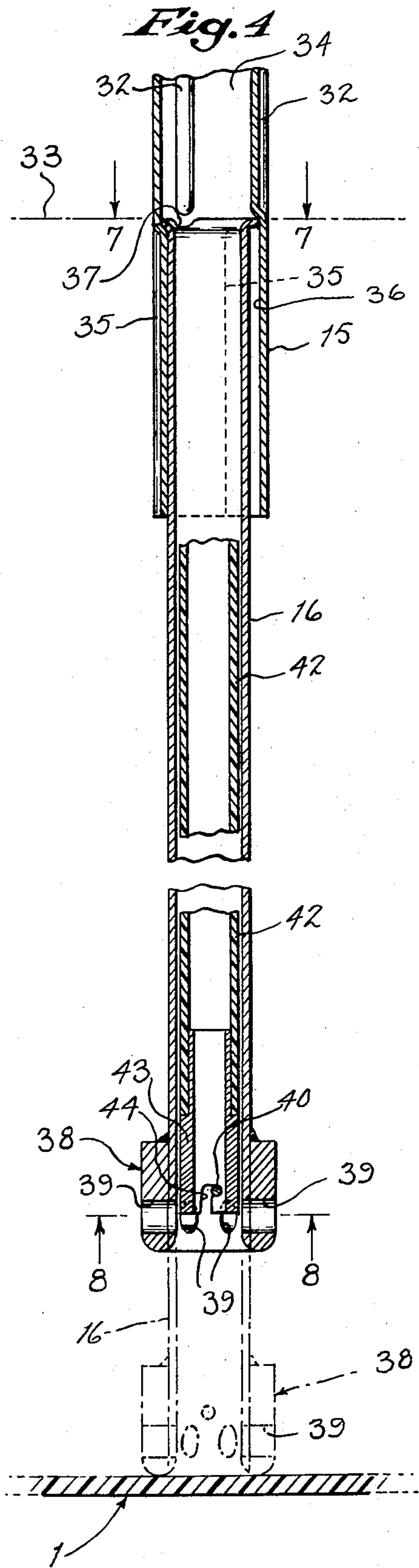
*Fig. 2*



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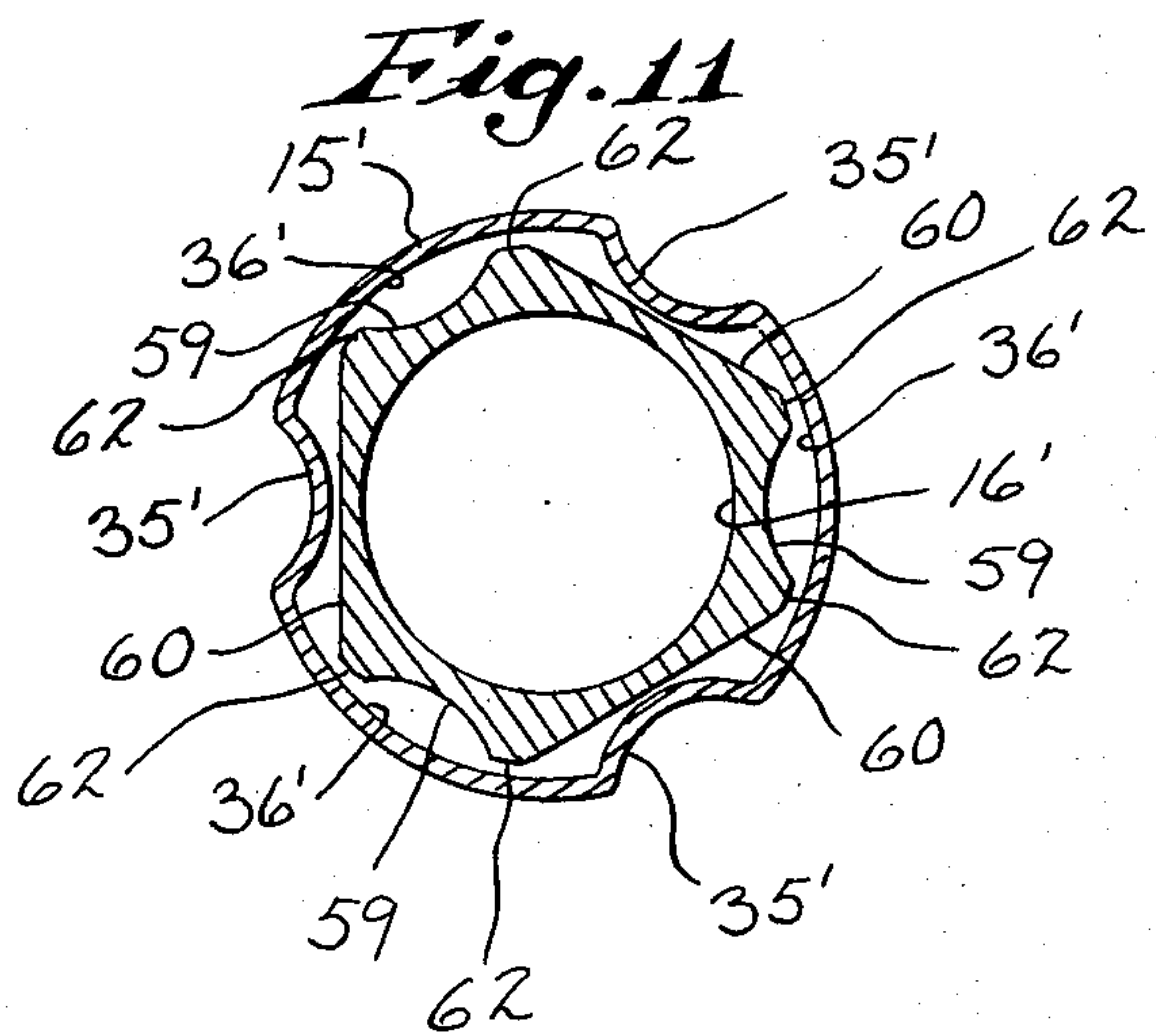
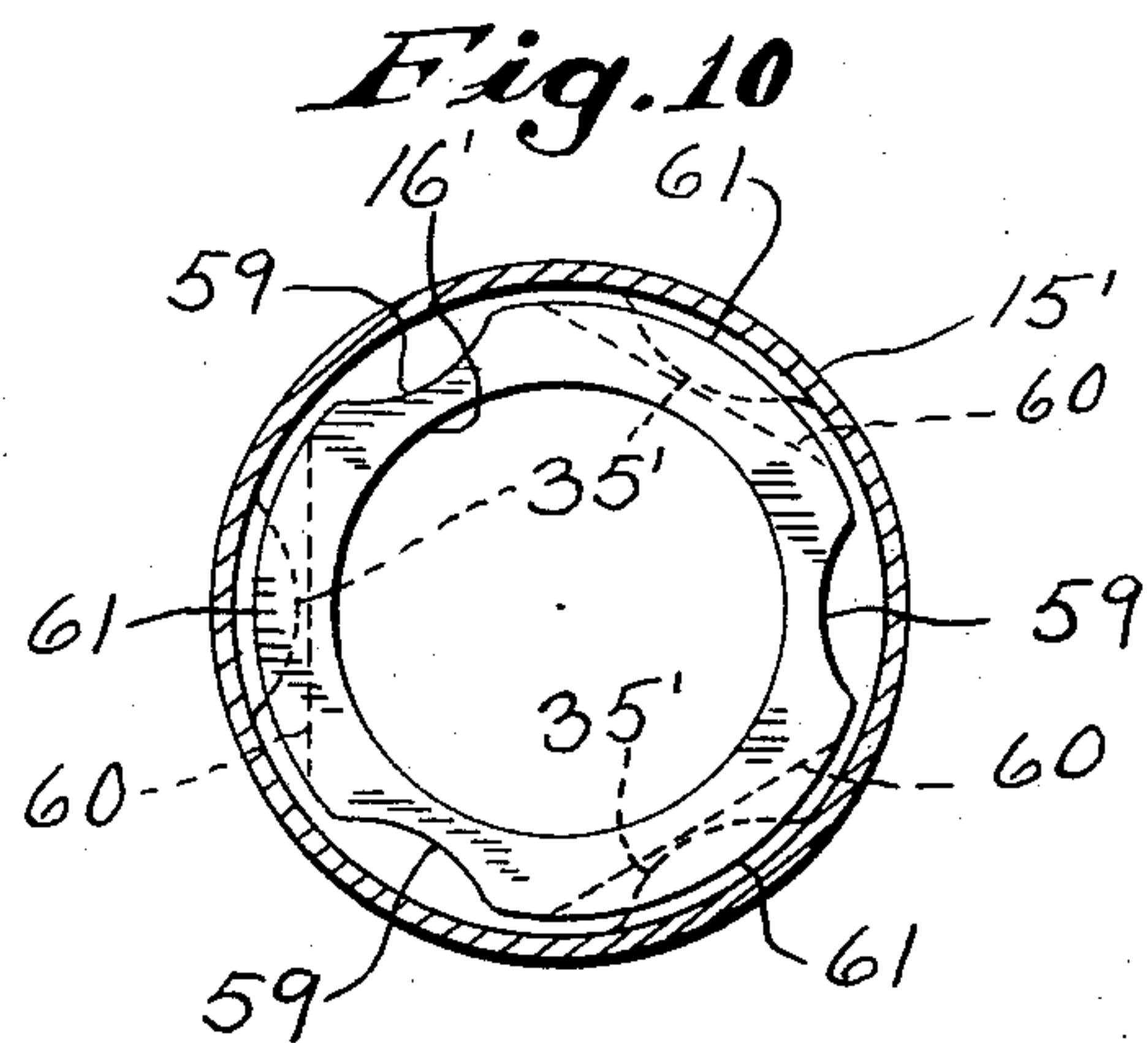
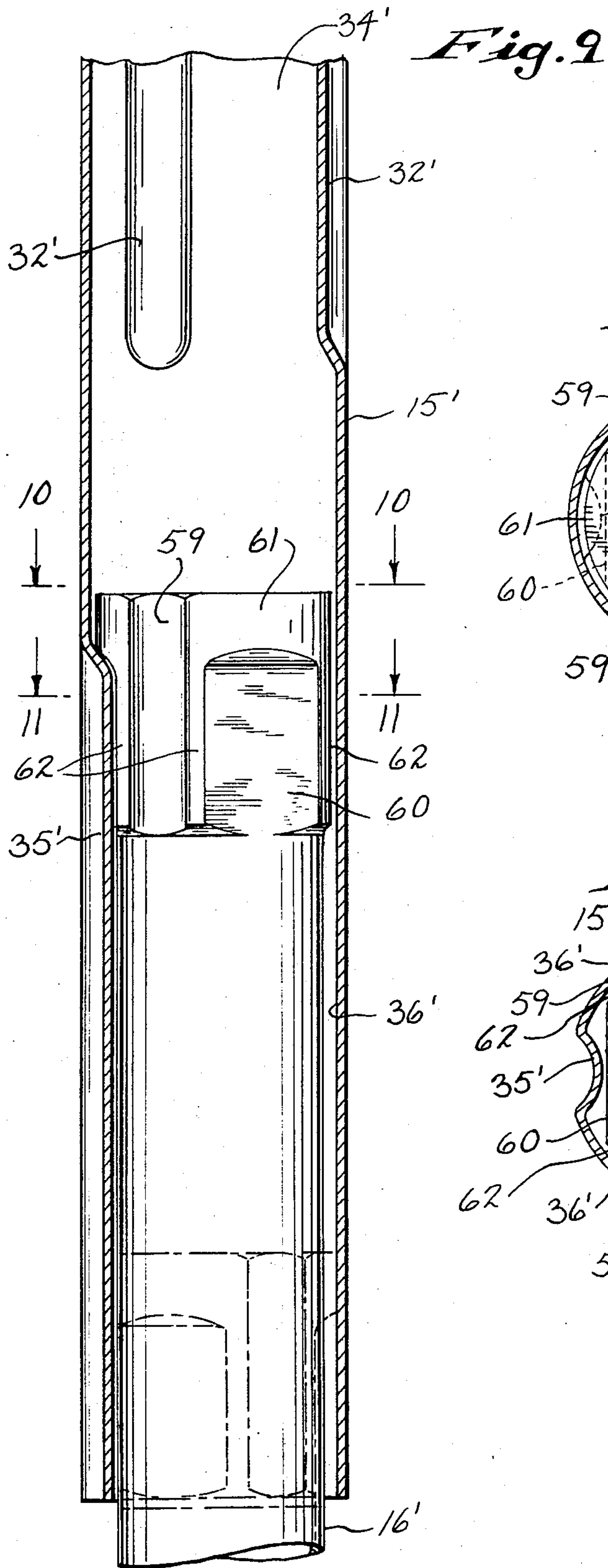
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## TELESCOPING DIP TUBE ASSEMBLY

## BACKGROUND OF THE INVENTION

This invention relates generally to bulk delivery, storage and dispensing systems for liquid ice cream mixes or the like, such as that shown in U.S. Pat. No. 3,371,822, issued Mar. 5, 1968, which is incorporated herein by reference; and it relates more particularly to a new telescoping dip tube assembly for use in such a system. While the invention is especially suited for this particular application, it is adapted for any liquid storage and dispensing system.

While the system shown in the aforesaid U.S. Pat. No. 3,371,822 is generally satisfactory, practical problems have been encountered in its use, primarily because of the length of the dip tube assembly which can be 4½ or 5 feet long for usual commercial installations. Not only is the long tube unwieldy from the handling standpoint, but it can be very difficult to insert and remove from the tank where, as often happens, the tank is placed under storage shelves or in other cramped locations. It is possible to solve this problem by providing a telescoping dip tube, but it is difficult to provide a telescoping dip tube assembly that meets all of the requirements for commercial use. It is, for example, difficult to provide seals between the several tube sections which are sufficiently tight to allow liquid to move through the entire length of the tube during emptying without loss or air entrainment while still allowing for rapid extension during filling and compliance with sanitation requirements. Also, where a liner bag is used it is difficult to hold the bag in place when the tube is telescoped and still allow it to expand fully during filling. These problems are even more serious in delivery systems for highly perishable items such as liquid ice cream mix which must be handled in accordance with the highest degree of sanitation.

## SUMMARY OF THE INVENTION

It is the general object of this invention to provide a telescoping dip tube assembly which can be retracted for insertion, removal and handling, but which can readily be extended to reach the bottom of a storage tank.

It is one particular object of the invention to provide a telescoping dip tube assembly which includes a liner bag and is provided with a resiliently supported collar which holds the bag in place while the assembly is telescoped but which allows the bag to feed through for filling.

Another object of the invention is to provide a telescoping dip tube assembly including a continuous, flexible discharge tube which is inserted after filling. This expedient allows the use of a fill pipe with freely telescoping sections, and the tube also serves as a means to retract the pipe.

A further object is to provide an assembly including stop means to prevent the lowermost pipe section from extending fully during filling with possible damage to the liner bag, but wherein the lowermost section can easily be fully extended after filling by simple manipulation using the discharge tube.

Still another object is to provide a novel seal for connecting the discharge tube to a fitting nipple, which seal also has general application wherever it is desired to attach a flexible tube to a nipple.

A further object is to provide a dip tube assembly which can be easily and effectively vacuumized for sanitation purposes.

Other objects are to provide a dip tube assembly that is highly sanitary, durable, and easy to use and maintain while still being relatively simple and inexpensive. Further objects and advantages will appear from the description to follow.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view in elevation, partially broken away, showing a dip tube assembly formed according to the invention in place in a storage tank, the dip tube assembly being shown in a telescoped position prior to filling, with partially and fully extended positions indicated in broken lines,

FIG. 2 is a fragmentary view in cross section through the plane 2—2 shown in FIG. 1, but with the liner bag removed for the sake of clarity,

FIG. 3 is an enlarged fragmentary view in cross section showing the upper part of the dip tube assembly of FIG. 1, but with the assembly in an extended position with a flexible discharge tube in place,

FIG. 4 is an enlarged fragmentary view in cross section showing the lower part of the dip tube assembly as seen in FIG. 2,

FIG. 5 is a view in cross section through the plane 5—5 shown in FIG. 3,

FIG. 6 is a view in cross section through the plane 6—6 shown in FIG. 3,

FIG. 7 is a view in cross section through the plane 7—7 shown in FIG. 4,

FIG. 8 is a view in cross section through the plane 8—8 shown in FIG. 4,

FIG. 9 is a fragmentary view generally similar to FIG. 4 but showing a preferred modified form of stop means for the lowest pipe section, a fully extended position being shown in broken lines,

FIG. 10 is a view in cross section through the plane 10—10 shown in FIG. 9, and

FIG. 11 is a view in cross section through the plane 11—11 shown in FIG. 9.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, the reference numeral 1 designates a rigid storage tank with which the dip tube assembly of the invention is used. In the embodiment shown, the tank 1 is formed of fiberglass, and has integral supporting legs 2. It has an opening 3 surrounded by an upstanding neck 4. The fiberglass of the tank 1 is pigmented except for a narrow strip 5 which extends vertically to the bottom of the tank 1, this being unpigmented and translucent to allow the operator to determine the level of liquid in the tank 1, suitable markings 6 being provided along the strip 5. A plug 7 fitted to the tank 1 near the top of the strip 5 is provided with a transparent window 8 which enables the operator to see into the tank and which is provided with a "full" line 9 to let the operator determine when the tank 1 is completely full, the fact that the line 9 is located on the relatively horizontal upper surface of the tank 1 serving to provide a very accurate indication. In the embodiment shown, the total capacity of the tank 1 is approximately 145 gallons. Other tank materials and configurations are possible; one particularly suitable material is a polycarbonate resin which is basically clear so that the panel 5 and plug 7 are unnecessary.

The dip tube assembly includes a flat metal cover plate 10 which completely covers the tank opening 3 and is removably connected to the neck 4 by means of a conventional split ring connector 11. The plate 10 is provided near its outer edge with an air fitting 12 which allows for the introduction of compressed air into the tank 1 for emptying and which also serves as a vent during filling.

The dip tube assembly includes a rigid metal fill pipe designated generally by the reference numeral 13, which is made up of three concentric, telescoping sections of generally circular cross section — an upper or outer section 14, an intermediate section 15, and an inner or lower section 16. As seen in full lines in FIG. 1, the sections 14, 15 and 16 are fully telescoped or retracted so that the fill pipe 13 is relatively short, this being the condition in which the assembly is delivered to a customer. The sections 15 and 16 can, however, extend to the positions shown in dotted lines in FIG. 1 where the pipe 13 reaches the bottom of the tank 1. As delivered, a flexible, disposable liner bag 17 with an upper opening 17' is disposed about and encloses the pipe 13, with a lower portion of the bag 17 being about the lowermost end of the lowest pipe section 16 to hold the sections in retracted position. The bag is of sufficient size to substantially fill the inside of the tank 1, and may be of any suitable construction; a single-ply plastic bag is shown in the preferred embodiment for simplicity, but a multi-ply bag could be used.



As delivered, the bulk of the material of the bag 17 is folded around the upper part of the fill pipe 13 and is held in place against the underside of the cover plate 10 by means of a generally conical, upwardly opening metal or plastic collar 18. As can be seen in FIGS. 1 and 2, three upwardly opening, 5 equally circumferentially spaced hooks 19 are fixed on the underside of the plate 10, and three equally circumferentially spaced, downwardly facing hooks 20 are provided on the outer surface of the collar 18. A long rubber strip 21 is strung 10 between and above and below the hooks 19 and 20 as shown so that the collar 18 is resiliently suspended from the plate 10. If desired, multiple strips 21 can be used for failure protection. As shown in FIG. 1, the strip 21 is stretched, and as the bag 17 feeds through the collar 18 as will be described, the collar 18 15 will move upwardly to come to rest against the underside of the plate 10 as seen in FIG. 3, the upper edge of the collar 18 being provided with cut-outs 22 which receive the hooks 19 to allow the collar 18 to come against the underside of the plate 10. Although this is a preferred method of resiliently suspending the collar 18, other systems such as coil springs could be used.

Referring now to FIG. 3, the upper pipe section 14 is permanently fitted at its upper end with a metal sleeve 23 that is threaded at its upper end and that is provided at its lower end with an annular enlargement 24. The threaded upper end of the sleeve 23 passes relatively freely through an opening 25 provided in the cover plate 10, so that the pipe section 14 opens upwardly through the plate 10 to define an inlet. An upwardly opening annular metal cup 26 is relatively loosely 20 disposed about the section 14 between the underside of the plate 10 and the enlargement 24, and a large, generally toroidal resilient seal member 27 of natural or synthetic rubber or other suitable material is disposed within and extends above the cup 26. The top surface of the seal 27 bears against the underside of the plate 10 and its inner and outer side surfaces bear, respectively, against the pipe section 14 and at least the upper edge of the cup 26. The edge of the bag 17 around the opening 17' is sealingly clamped between the outer surface of the seal 27 and the inner upper edge surface of the cup 26 as seen in FIG. 3, and this edge is preferably suitably beaded for strength. A nut 28 is threaded on the sleeve 23 above the cover plate 10 and bears against the plate 10, and the nut 28 and enlargement 24 together serve to removably hold the section 14 on the plate 10 and to compress the seal 27 to prevent air or fluid from passing in either direction outside the section 14 and to seal and hold the bag 17 in place. The sleeve 23 is preferably provided with an intermediate annular enlargement 29 which engages the inner side surface of the seal 27 to hold it against axial movement when the section 14 is disconnected from the plate 10. While the particular arrangement shown is particularly satisfactory from the standpoint of allowing rapid assembly and disassembly and providing a highly effective seal, other arrangements could be used for removably connecting the upper pipe section 14 to the plate 10 and providing an effective seal.

The bottom edge of the outer pipe section 14 is turned inwardly to define an annular, inwardly extending ledge 30. The body of the intermediate pipe section 15 is relatively freely 60 slidable through the restricted opening defined by the ledge 30, but the section 15 is provided at its upper end with three short, equally circumferentially spaced, axially extending enlargements 31. The ends of enlargements 31 are engageable with the ledge 30 to limit extension of the section 15, and the enlargements are of sufficient axial length to provide bearing surfaces which minimize lateral movement. While the enlargements 31 limit extension of section 15, it is freely removable and insertable through the upper end of section 14 for disassembly and re-assembly.

The section 15 is also provided with three equally circumferentially spaced, axially extending indentations 32 which extend from the top of the section 15 approximately to a plane 33, corresponding to the section line 7—7 in FIG. 4, which is near but spaced from the bottom of the section 15, the

distance between the plane 33 and the lower end of the section 15 being approximately three inches in the embodiment shown. The indentations 32 define between them a set of three 5 equally circumferentially spaced grooves 34 which correspondingly extend from the top of the section 15 to the plane 33. Below the plane 33, the section 15 is provided with a second set of three equally circumferentially spaced, axially extending indentations 35 which extend to the bottom of the section 15. The indentations 35 are, however, circumferentially offset from the indentations 32 so that the upper 10 end of each indentation is aligned with and in essence defines the lower end of a respective groove 34. The indentations 35 define between them a second set of three grooves 36 which also extend to the bottom of the section 15 and which are circumferentially offset from the grooves 34. While the indentations 32 and 35 both extend approximately to the plane 33, there is a small axial spacing between the lower ends of the indentations 32 and the upper ends of the indentations 35 to 15 define an area where the section 15 has a continuous circular internal surface of full diameter, this allowing rotation of the section 16 as will be described. In the embodiment shown, the axial spacing has been kept to a minimum, but more space could be provided.

The inner or lower pipe section 16 is turned outwardly and cut away at its upper end to define three, equally circumferentially spaced detents 37 which mate with and are relatively 20 freely slidable in tracks defined by the grooves 34 or 36. When the fill pipe 13 is fully telescoped as shown in FIG. 1, the detents 37 are in the upper grooves 34, and the section 16 is free to slide downwardly until the detents 37 reach the plane 33, the engagement of the detents 37 and grooves 34 preventing rotation of the section 16 during such movement. When the section 16 extends far enough so that the detents reach the plane 33, however, they will come into engagement with the upper ends of the indentations 35, which serve as stops limiting further extension of the section 16. Upon slight rotation of the section 16, however, the detents 37 will move past the indentations 35 and come into alignment with the lower grooves 36, 25 whereupon the section 16 can be further extended. The section 16 is insertable into and removable from the bottom of the section 15 for assembly and disassembly.

The lower end of the section 16 is permanently fitted with an enlarged annular collar 38. A set of six ports 39 extend 30 through the collar 38 and serve, with the open end of the section 16, to afford communication between the interior and exterior of the section 16 and thus define a filling outlet and discharge inlet. A pin 40 is fixed to and extends across the interior of the section 16 near its lower end.

As previously indicated, FIG. 1 shows the dip tube assembly as supplied to the customer prior to filling. In this condition, the upper end of the section 14 is sealed off by suitable means such as a threaded cap 41. The section 15 is fully telescoped 35 within the section 14, and the section 16 is fully telescoped within the section 15. A lower portion of the bag 17 extends around the bottom of the section 16 and serves to hold the sections telescoped against their own weight because of the resiliently suspended collar 18. The bag 17 is preferably vacuumized, both for sanitation purposes and to eliminate air which might otherwise be trapped when the bag 17 is filled, and it is a particular advantage of the invention that a vacuum process can be used.

As thus supplied, the assembly is fitted to the tank 1 by means of the connector 11, the short telescoped length of the fill pipe 13 allowing this to be done even in relatively cramped locations. The cap 41 is then removed and the sleeve 23 is connected to a tank or reservoir of ice cream mix or other liquid (not shown), which liquid can be fed into the upper end 40 of the fill pipe 13 by gravity or under pressure. As liquid is introduced through the fill pipe 13, the weight of liquid collecting at the bottom of the bag 17 causes the latter to be pulled or fed through the collar 18, allowing the sections 15 and 16 to extend of their own weight. The air fitting 12 is open during filling to allow air trapped in the tank 1 to be vented as the bag



17 expands. The filling process continues until the bag 17 has been completely filled and substantially fills the tank 1.

It has been found that if the section 16 is free to extend fully during filling, it is liable to come against the bottom of the tank 1 with considerable force which is likely to cause damage to the liner bag 17. Because of the detents 37 and the stops defined by the upper ends of the indentations 35, however, the section 16 will not extend fully during filling but will come to a stop at the upper position shown in broken lines in FIG. 1, where it is spaced several inches above the bottom of the tank 1.

The dip tube assembly as thus far described could be use without further elements. As previously indicated, however, it is difficult to make the pipe sections 14, 15 and 16 freely telescopic while still providing seals which allow fluid to move upwardly through the fill pipe 13 without loss or air entrainment at the junctures of the several sections. Accordingly, the invention contemplates the additional provision of a continuous, flexible discharge tube 42, preferably plastic, which can be fed downwardly through the fill pipe 13 to the bottom of the tank 1, the tube 42 being shown in place in FIGS. 3-8. The tube 42 is provided at its lower or distal end with a metal fitting 43 which is held in place by friction. The fitting 43 is provided at its bottom edge with two opposite, downwardly opening, L-shaped slots 44 which are engageable with the pin 40 to define a releasable, bayonet-type connection between the tube 42 and the lower end of the section 16. As the tube 42 is fed toward the bottom of the tank 1, the pin 40 will enter the vertical portions of the slots 44, and slight rotation of the tube 42 will then effect a connection which holds the tube 42 and section 16 against relative axial movement. Further rotation of the tube 42, in a counterclockwise direction as seen in FIG. 4, will cause rotation of the section 16 and, when the section 16 is in the position shown in FIG. 4 will move the detents 37 to bring them in line with the lower grooves 36, thus allowing full extension of the section 16 by gravity. In the embodiment shown, the length of the elements is such that the section 16 cannot come completely out of the section 15 because it will first engage the bottom of the tank 1, but another stop could be provided at the bottom of section 15 to accomplish the same purpose.

A discharge fitting designated generally by the reference numeral 45 is provided at the upper end of the tube 42. It includes a body 46 which mates with the upper end of the sleeve 23 and is removably connected thereto by means of a slip nut 47, an annular seal 48 being interposed between these elements. A nipple 49 extends downwardly from the body 46 and is received within the tube 42, and opposite discharge nipples 50 extend laterally from the body 46 and are connected to discharge conduits 51 which lead to ice cream machines or other equipment to which the liquid in the tank 1 is to be discharged (not shown). In the preferred embodiment shown, the tank 1 is designed to serve two pieces of equipment, but it could be made to serve one, or three or more.

The body 46 is generally tubular, and its upper end is closed off by means of a threaded cap 52, an annular seal 53 being interposed between the cap 52 and body 46. The hollow interior of the body 46 defines a valve chamber within which there is a ball check valve 54 that is freely vertically movable. The valve 54 of course allows liquid to flow upwardly through the nipple 49 and out through the nipples 50, but prevents reverse flow.

The tube 42 and conduits 51 are connected to their respective fitting nipples by novel seals which are substantially identical so that the same reference numerals have been used for each. The seals, which are designated generally by the reference numeral 55, each include a pair of resilient, axially spaced O-rings 56 which are seated in substantially semicircular grooves formed in the respective nipples so that they project radially outwardly from the nipple surfaces. The tube 42 and conduits 51 fit relatively tightly over their associated nipples and O-rings 56, and the seals are completed by sleeves 57, which are preferably formed of a relatively rigid plastic material such as nylon. The sleeves 57 are generally cylindri-

cal, but their inner surfaces are V-shaped to define inner circumferential ridges 58 which are axially between the O-rings 56 when the sleeves 57 are in place. The inner diameters of the sleeves 57 at the apexes of the ridges 58 are substantially less than the outer diameters of the O-rings 56 so that the ridges 58 bear against the short section of flexible material between the respective O-rings 56 to deflect it inwardly along a circumferential line parallel to and between the O-rings. This in effect causes the flexible material to assume a V-shape as the result of which it bears tightly against the opposite O-rings 56 along converging tangential lines generally parallel to the V-surfaces on the interior of the sleeve 57. The deformation resulting from the tight engagement between the flexible tube material and resilient O-rings develops substantial sealing contact areas so that the resulting seal is extremely effective, particularly for vacuum applications. It is also very secure in that the V-deflection tends to resist axial movement of the tube or conduit in either direction. The dimensions and spacing of the elements can be varied, but since the effectiveness depends primarily on deflecting the flexible material against the O-rings the inner diameter of the sleeve 57 at the apex of the ridge 58 need not be small enough to tightly compress the flexible material against the nipple surface; it must, however, be substantially less than the outer diameters of the O-rings 56 to accomplish the required deflection. The O-rings 56 should project outwardly far enough, and/or the two O-rings should be axially close enough, so that the tangential bearing lines are at significant angles to the longitudinal axis of the nipple to resist axial movement. The sleeves 57 can of course easily be slid over the conduits 51 or tube 42 before attachment to the nipples and then slid back over the nipples to the positions shown in FIG. 3. While the seals 55 are particularly suitable for systems like that shown herein, it will be obvious that they may have application wherever it is desired to fit a relatively flexible tube to a nipple.

As previously indicated, when the filling process has been completed the liner 17 is substantially full and substantially fills the tank 1. The fill pipe 13 is substantially fully extended, except that the section 16 is at the intermediate dotted line position shown. At this point, the fill tube 42 is inserted downwardly through the pipe 13. The bayonet connection between the fitting 43 and pin 40 is then effected, and the tube 42 is rotated to rotate the section 16 and allow it to extend fully. The fitting 45 is then connected to the sleeve 23 and the conduits 51 are attached and connected to the ice cream making machines or other equipment to be served. Emptying is accomplished by introducing compressed air through the fitting 12 which causes the bag 17 to collapse to force liquid up through the tube 42 past the check valve 54 and out through the conduits 51. When the bag 17 has been completely emptied, the conduits 51 are disconnected from their equipment and the fitting 45 is disconnected from the sleeve 23 whereupon the tube 42 can be withdrawn. Since it is still connected to the section 16, however, withdrawal of the tube 42 will cause the sections 16 and 15 to telescope, the enlarged collar 38 engaging the lower end of the section 15 to accomplish this, thus returning the pipe 13 to the length shown in full lines in FIG. 1 which makes it easy to remove the entire assembly from the tank 1.

The embodiment of FIGS. 1-8 is fully satisfactory as shown, but FIGS. 9-11 illustrate a modified stop arrangement for the lowest section which is preferred for at least some applications. That is, in the first embodiment the detents 37 are made by bending out the material of the section 16, and in some cases repeated engagements with the indentations 35 will cause them to be deformed and bent up to the point where they slide past the indentations. Also, there is a tendency for the section 16 to bounce back off the indentations 35, and it may then rotate to the point where the detents 37 are in line with the grooves 36, whereupon it can extend fully before it is supposed to. This can be minimized by keeping the axial space between the facing ends of the indentations 32 and 35 as small as possible so that the detents 37 will reenter the grooves 34 if there is a bounce, but there still may be a problem.



The stop arrangement illustrated by FIGS. 9-11 avoids the foregoing problems completely by providing a stronger detent and primarily by providing fingers which extend between the lower indentations to hold the lower section against rotation even if it raises slightly as the result of bouncing. In FIGS. 9-11, the middle pipe section is identified by the reference numeral 15', and it includes upper indentations 32' which define between them upper grooves 34' and circumferentially offset lower indentations 35' which define between them lower grooves 36'. In these and all other respects the section 15' is the same as the section 15, except only that the axial space between the ends of the indentations 32' and 35' is substantially greater than that between the indentations 32 and 35, the actual spacing in the embodiment shown in FIGS. 9-11 being about one and one-half inches.

The lower section in FIGS. 9-11 is identified by the reference numeral 16', and it is the same as the section 16 except for its upper end configuration. The section 16' is provided at its upper end with an enlarged portion of substantial axial extent, about an inch in the form shown. This is cut away along its entire axial extent to define three equally circumferentially spaced concave channels 59 which extend inwardly to about the outer diameter of the body of the section 16 and are of sufficient circumferential size to receive the indentations 32' or 35'. These define enlarged areas between them, and each such enlarged area is cut away to define a flat surface 60 which is approximately tangential to the outer surface of the lower part of the section 16' and terminates short of the upper end of the section to define a radially extending detent 61. The flat surfaces 60 and channels 59 do not meet and as a result they define between them a series of radially projecting, axially extending fingers 62, there being in effect two fingers 62 extending downwardly from the opposite ends of each detent 61.

When the section 16' is retracted, the detents 61 are in the upper grooves 34' and it is free to extend of its own weight until it reaches the intermediate stop position shown in full lines in FIGS. 9-11. This occurs when the detents 61 come into engagement with the upper ends of the indentations 35', just as the detents 37 engage the indentations 35 in the first embodiment. When the section 16' has reached the position shown, however, the fingers 62 have moved between the indentations 35' and, as seen most clearly in FIG. 11, are laterally engageable therewith to prevent rotation of the section 16'; and they are effective for this purpose even if the section 16' bounces up a substantial distance. To free the section 16' for full extension, the tube 42 is connected to its lower end and is used to raise the section 16' until the fingers 62 clear the indentations 35' and then rotate it to bring the detents 61 into line with the lower grooves 36', the increased axial space between the indentations 32' and 35' allowing this to be done without bringing the detents back into the grooves 34'. The section 16' is then free to move to the fully extended position shown in broken lines in FIG. 9. It is preferable to make the section 16' of such length that the fingers 62 remain substantially entirely within the section 15' when it is fully extended and against the bottom of the tank 1, the fingers 62 then serving the additional purpose of providing increased bearing surfaces which minimize lateral movement between the sections 15' and 16'.

As indicated, the construction of FIGS. 9-11 is preferred, particularly for heavy duty applications, and it is particularly convenient to form the upper end of the section 16' by providing an enlarged portion and then using simple machining operations to develop the channels 59 and flats 60. Variations are, however, possible; and to have the advantage of preventing rotation during a bounce it is necessary only that there be at least one radially projecting finger extending axially below a detent to be laterally engageable with a lower indentation.

The assembly shown is highly effective and easy to use. All of the parts shown are relatively simple and inexpensive, and may easily be disassembled for cleaning purposes and re-assembled. The lower section 16 or 16' is removed through the bottom of section 15 or 15', and the section 15 or 15' is

removed through the top of the section 14. The section 14 can be disconnected from the plate 10 by removing the nut 28. The seal 27 can easily be removed to remove the liner bag 17 which is discarded. The cap 52 allows easy access to the interior of the fitting body 46 for cleaning purposes. The seals 55 are easily disconnectable as previously described. The entire assembly is thus particularly suited for applications wherein an extremely high degree of sanitation is required.

While a preferred embodiment of the invention has been shown and described, it will be obvious that modifications in both structure and application are possible without departure from the spirit of the invention. The invention is not, therefore, intended to be limited by the showing herein, or in any other manner, except insofar as may specifically be required.

I claim:

1. A dip tube assembly adapted to be fitted to a top opening of a liquid storage tank or the like, said assembly comprising: a cover plate adapted to be removably fitted over the tank opening; a fill pipe leading from the underside of the cover plate, the pipe comprising a plurality of concentric, slidably telescopic sections including an upper section the upper end of which is connected to and opens upwardly through the cover plate to define an inlet, the pipe being axially telescopic between a fully retracted position of relatively short length and an extended position wherein the lowest section extends to a point near the bottom of the tank to define an outlet; a closed, flexible liner bag which encloses the pipe and has an opening effectively sealed around the pipe near the underside of the cover plate; and a collar below the cover plate which surrounds the pipe and bag, the collar being adapted when the bag is empty to hold a bottom portion of the bag against the lower end of the pipe to maintain the pipe in retracted position and also to hold the remainder of the material of the bag against the underside of the cover plate, the weight of material introduced through the inlet and entering the bag through the outlet causing the bag to feed through the collar, the pipe then being free to extend.

2. An assembly according to claim 1 wherein the collar is resiliently suspended from the underside of the cover plate to be movable toward and away from the cover plate.

3. An assembly according to claim 1 wherein the upper end of the upper section passes freely through an opening in the cover plate and is threaded at its upper end and is provided with an annular enlargement spaced below the cover plate; and there is an annular cup that is disposed freely about the upper section between the enlargement and the cover plate and that opens upwardly toward the cover plate; and there is a generally toroidal resilient seal member seated in and extending above the cup around the upper section, the seal having an upper surface above the cup that bears against the underside of the cover plate, an inner side surface that surrounds and bears against the upper section, and an outer side surface that bears against the cup wall, the edge of the liner bag around the bag opening being interposed between the cup and the outer side surface; and there is a nut on the threaded portion above the cover plate which bears against the cover plate and is adapted with the enlargement to draw the cup toward the cover plate and compress the seal.

4. An assembly according to claim 1 wherein there is a continuous flexible discharge tube that is adapted to be inserted into and withdrawn from the pipe through the inlet and that is of sufficient length to reach the outlet when the pipe is fully extended; and there is means to releasably connect the distal end of the tube to the lowermost section of the pipe, the connection being such that withdrawal of the tube causes axial retraction of the lowermost section.

5. An assembly according to claim 4 wherein there is a stop means operatively interposed between the lowermost pipe section and the next succeeding pipe section which is operable to stop axial movement of the lowermost section short of its full extension but which allows full extension upon manipulation of the lowermost section; and the means connecting the discharge tube and lowermost section is such that the tube can



be used to effect the necessary manipulation of the lowermost section.

6. An assembly according to claim 5 wherein the lowermost section is provided with at least one radially extending detent near its upper end; and the said next succeeding section is provided with at least one first axial groove which serves as a track for the detent, said groove beginning near the upper end of said next succeeding section and terminating short of the lower end thereof; and the stop comprises an inwardly extending projection in the said next succeeding section which is below and aligned with the bottom of the first groove and is engageable with the detent to limit extension of the lowermost section; and the said next succeeding section has at least one second axially extending groove which is also adapted to serve as a track for the detent and which is circumferentially offset from the first groove and which begins below the point where the first groove terminates and thence continues downwardly, the lowermost section being adapted to be rotated to cause the detent to be moved past the stop into line with the second groove to allow further extension of the lower section; and the connection between the tube and lowermost section comprises a pin extending across the interior of the lowermost section and a rigid fitting at the lower end of the tube which has opposite, downwardly opening, L-shaped slots, the slots and pin together defining a releasable bayonet connection between the tube and lowermost pipe section whereby the tube may be used to rotate the lowermost pipe section.

7. An assembly according to claim 6 wherein the stop is an axially extending indentation formed in the lower end of the next succeeding section, the upper end of which is engageable with the detent; and the lowermost section is provided with radially projecting finger means extending axially below the detent and laterally engageable with the indentation when the detent is against the upper end of the indentation to prevent rotation of the lowermost section until it is raised to a point where the finger means can clear the indentation, there being sufficient axial space between the lower end of the upper groove and the upper end of the indentation to allow the lowermost section to be raised to said point without moving the detent back into the upper groove; and the tube can be used to raise and rotate the lowermost section.

8. An assembly according to claim 6 wherein there are a plurality of circumferentially spaced detents; and the said next succeeding section is provided with an equal plurality of first axial indentations which define between them an equal plurality of first grooves, the first grooves and indentations terminating approximately at a common transverse plane spaced from the lower end of said next succeeding section; and the said next succeeding section is provided with an equal plurality of second axial indentations which are circumferentially offset from the first indentations and define second grooves between them, the second indentations and second grooves

leading from below said plane to the lower end of said next succeeding section, the upper ends of the second indentations being aligned with the bottoms of respective first grooves to serve as stops engageable with respective detents, the upper ends of the second indentations being at least slightly axially spaced from the lower ends of the first indentations to define an area where the said next succeeding section is of full internal area to allow rotation of the lowermost section.

9. An assembly according to claim 8 wherein the lowermost section is provided with radially projecting, axially extending fingers, there being a set of two such fingers extending axially downwardly from the circumferentially opposite ends of each detent, the fingers being alongside and laterally engageable with respective second indentations when the detents are in engagement with the stops to prevent rotation of the lowermost section until it is raised to a point where the fingers can clear the second indentations; and the axial space between the first and second indentations is sufficient to allow the lowermost section to be raised to said point without moving the detents into the first grooves; and the tube can be used to raise and rotate the lowermost section.

10. The assembly of claim 4 wherein the discharge tube is provided at its upper end with a fitting that is releasably connectible to the inlet and that includes a nipple projecting downwardly into the pipe, the nipple being provided with two resilient, axially spaced O-rings seated in grooves therein and projecting radially outwardly from the nipple surface; and the tube fits over the nipple and O-rings with a relatively close fit; and there is a cylindrical sleeve that is slidable over the tube at the O-rings, the inner surface of the sleeve being shaped to define a generally central, inwardly extending circumferential ridge, the inner diameter of the sleeve at the apex of the ridge being substantially less than the outer diameters of the O-rings so that the ridge is adapted to bear against the section of tube between the O-rings when the sleeve is in place to deflect the same inwardly into a V-configuration to hold the tube material tightly against the opposite O-rings.

11. A seal for connecting a flexible tube to a cylindrical fitting nipple, said seal comprising: a pair of axially spaced circumferential grooves in the outer surface of the nipple; a pair of resilient O-rings seated in the grooves and projecting above the surface of the nipple, the tube fitting over the nipple and O-rings with a relatively close fit; and a cylindrical sleeve adapted to be slid over the tube with a relatively close fit, the inner surface of the sleeve being shaped to define a generally central, inwardly extending circumferential ridge, the inner diameter of the sleeve at the apex of the ridge being substantially less than the outer diameters of the O-rings so that the ridge is adapted to bear against the section of tube between the O-rings when the sleeve is in place to deflect the same inwardly into a V-configuration to hold the tube material tightly against the opposite O-rings.

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