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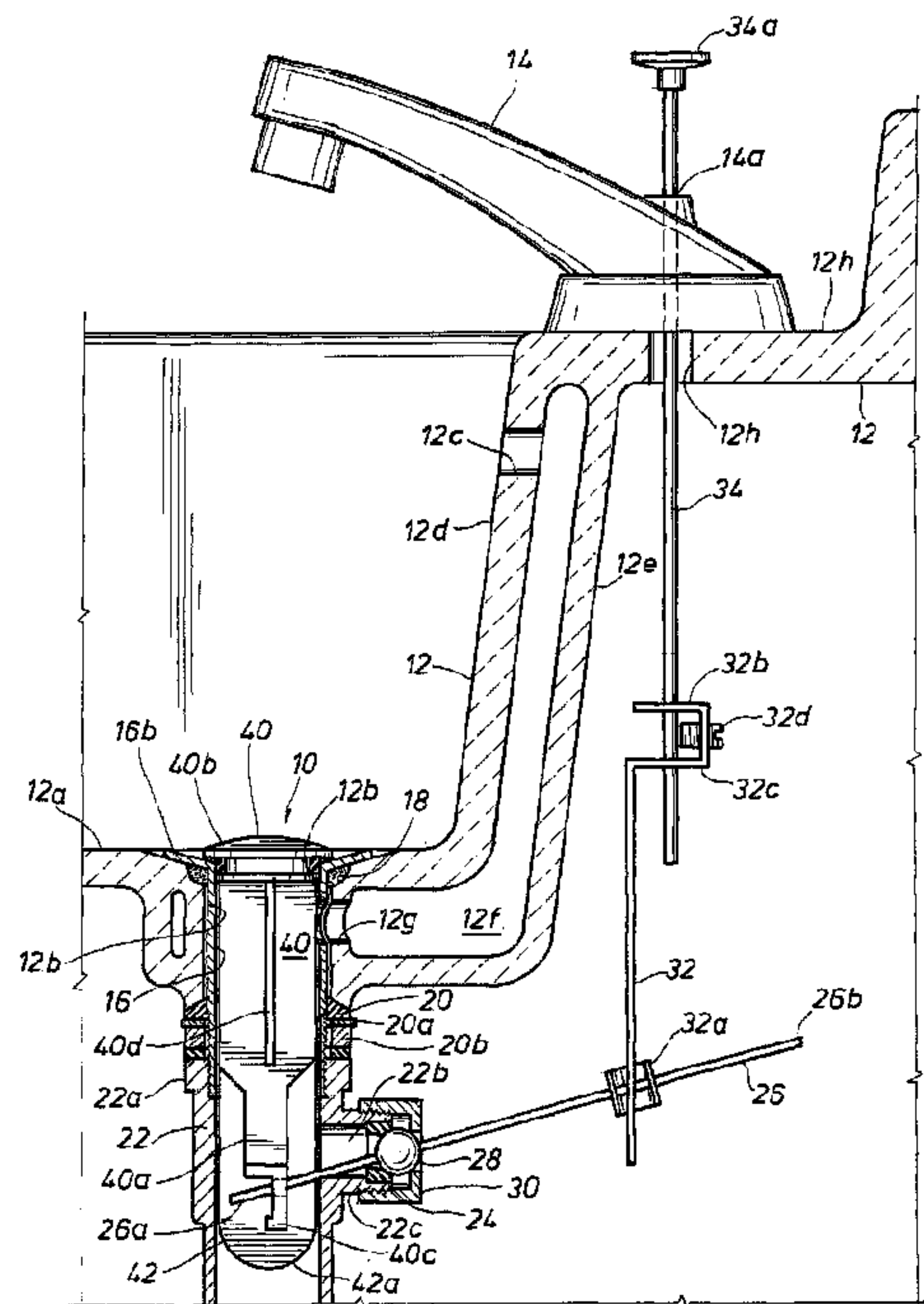
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(54) Title: POP-UP DRAIN ASSEMBLY AND DRAIN STOPPER HAVING A STRAINER



(57) **Abrégé/Abstract:**

A pop-up drain assembly for a sink has drain piping, a stopper in the drain piping, a pivot rod for opening and closing the stopper and tends not to clog because the pivot rod is not within a fluid flow path. In one embodiment the stopper has flow diverter plates that channel fluid flowing through the drain piping away from the pivot rod so that hair, waste and debris does not catch on and accumulate on the pivot rod. In another embodiment the stopper and the pivot rod are engaged through magnetic coupling, and the pivot rod does not protrude into the fluid flow path. The stopper is preferably variable in length for adjustment. In an embodiment, the drain assembly or stopper may have a strainer to remove hair and other debris from a drain fluid stream.

ABSTRACT

A pop-up drain assembly for a sink has drain piping, a stopper in the drain piping, a pivot rod for opening and closing the stopper and tends not to clog because the pivot rod is not within a fluid flow path. In one embodiment the stopper has flow diverter plates that channel fluid flowing through the drain piping away from the pivot rod so that hair, waste and debris does not catch on and accumulate on the pivot rod. In another embodiment the stopper and the pivot rod are engaged through magnetic coupling, and the pivot rod does not protrude into the fluid flow path. The stopper is preferably variable in length for adjustment. In an embodiment, the drain assembly or stopper may have a strainer to remove hair and other debris from a drain fluid stream.

POP-UP DRAIN ASSEMBLY AND DRAIN STOPPER HAVING A STRAINER

FIELD OF THE INVENTION

[0001] This present invention pertains to a pop-up drain assembly used to retain fluid in and release fluid from a sink or basin and more particularly to preventing debris such as hair from being caught in a drain pipe either by directing flow away from a pivot rod or by eliminating the pivot rod from within the drain pipe.

BACKGROUND OF THE INVENTION

[0002] In a lavatory or bathroom sink or basin equipped with a supply of running water for washing oneself, a pop-up drain assembly allows one to retain water in the sink or basin and then release the water to flow by gravity downwardly through a drain pipe. The sink or basin has an opening at a lowermost point, and a typical pop-up drain assembly comprises a drain conduit sealingly fastened to the sink or basin within the opening. A drain stopper is received in the drain conduit for sealing the opening and retaining water in the sink or basin. A pivot rod protrudes into the drain conduit and engages a bottom portion of the drain stopper. A lift rod is connected to the pivot rod. One can pull the lift rod up to pull the drain stopper down for sealing the opening in the bottom of the sink or basin for retaining water, and one can push the lift rod down to raise the drain stopper, which unseals the drain stopper and allows water to drain from the sink or basin. U.S. Patent No. 4,807,306, issued to Hayman et al., illustrates quite well the components in a typical prior art pop-up drain assembly.

[0003] As water drains from the sink, the water flows around and along the drain stopper and over the portion of the pivot rod that protrudes into the drain conduit. Debris and/or waste in the water, such as soap, dirt, oils, toothpaste and particularly hair, catches on and clings to an end of the pivot rod, where the pivot rod protrudes into the drain

conduit and engages with the bottom portion of the drain stopper. Accumulation of such debris and waste on the pivot rod and drain stopper clogs the drain conduit and causes water to not drain properly. To restore proper drainage through the drain conduit, one needs to remove and clean the pivot rod and the drain stopper. Removal of the pivot rod and drain stopper requires disassembly of a sealed connection of the pivot rod to the drain conduit, which is a messy and time-consuming task, and if a plumber is hired to provide the service, then it is also an expensive task. Improvements are needed in a pop-up drain assembly for reducing the accumulation of waste and debris in the drain assembly, and consequently, for reducing clogging in the drain assembly that slows or stops drainage through the drain conduit.

SUMMARY OF THE INVENTION

[0004] In one embodiment, the present invention provides a pop-up drain assembly for a sink or basin having a drain opening, which includes: drain piping, typically a drain flange and a drain body, which provides a fluid flow pathway from the sink or basin through the drain opening and through the piping; a stopper for retaining fluid in the sink or basin, which is received in the piping and which is moveable between an open position and a closed position; and a pivot rod for moving the stopper between the open position and the closed position, where the pivot rod is not in the fluid flow pathway. In one embodiment, fluid, typically water, draining through the drain piping is diverted around a pivot rod that extends into or protrudes inside the piping, which prevents hair, waste and debris from catching on the pivot rod. In another embodiment, the pivot rod does not protrude or extend into the piping significantly, and the pivot rod moves the stopper up and down through magnetic coupling between the stopper and the pivot rod, which also prevents hair, waste and debris from catching on the pivot rod.

[0005] In the embodiment where the pivot rod protrudes inside the drain piping, the pivot rod physically engages the stopper for moving the stopper up and down. In this embodiment, the stopper has a plug-type body with a central, longitudinal shaft. A pair of

opposing, longitudinal plates are attached at an upper end of the plates to the body of the stopper. The plates extend downwardly about the pivot rod such that the pivot rod is between the plates, and the plates extend about to or below the pivot rod. The plates are sized and designed with respect to the diameter of the drain piping so that fluid draining through the drain piping is diverted around the pivot rod, flowing along an outside surface of each plate while the pivot rod is on the inside of the plates. Hair, waste and debris flows on through the drain piping with the fluid and does not tend to get caught on or accumulate on the pivot rod or on the lower portion of the stopper that is engaged with the pivot rod. The stopper is preferably removeable from and attachable to the pivot rod, without needing to remove the pivot rod from the drain piping. The stopper is also preferably designed to provide more than one distance between the point where the pivot rod engages the stopper and a cap on an upper end of the stopper, which allows the stopper to fit drain assemblies made by different manufacturers.

[0006] In the embodiment in which magnetic coupling between the stopper and the pivot rod is used so that the pivot rod can move the stopper up and down, where the pivot rod terminates about flush with the inside wall of the drain piping, either a plug type or a tubular type stopper body can be used. A permanent magnet or magnetic material is fixed on the stopper body such that the magnet or magnetic material is adjacent to a pivot rod port in the drain piping. A distal end of a pivot rod terminates approximately flush with the inside wall of the drain piping in the pivot rod port adjacent to the magnet or magnetic material on the stopper body. The distal end of the pivot rod is made of magnetic material or a magnet that is opposite of the magnet or magnetic material on the stopper so that there is a magnetic attraction between the distal end of the pivot rod and the stopper for providing a magnetic coupling.

[0007] In another embodiment, a stopper is provided, and in one variation, the stopper preferably includes flow diverter plates for directing fluid flow away from a pivot rod holder. One preferred stopper has a pivot rod holder that has a notch, which allows the stopper to be installed and removed from a drain assembly that has a pivot rod protruding into the drain assembly, without needing to remove the pivot rod from the drain assembly,

and the pivot rod holder can preferably receive the pivot rod in more than one vertically-spaced location for providing height adjustment. One preferred embodiment of a stopper provides a magnet or magnetic material on the stopper for engagement with a pivot rod. The stopper is preferably adapted to accommodate drain assemblies from different manufacturers that have a different distance between the pivot rod and the top of the drain piping, which can be accomplished by using multiple magnets or sources of magnetic material spaced apart longitudinally and by a single longer, linear magnet or magnetic material. Another approach for adapting the stopper for different lengths is to alter the length of the stopper, such as through a connection of one portion of the stopper with another portion of the stopper, where the connection may be a threaded connection, or a friction-fit connection, a detent connection or a similar means of connection. This approach can be used with either the flow diverter guard plates or with the magnetically-coupled stopper. It is also preferable to be able to adjust the length of the pivot rod between the pivot ball and the distal end of the pivot rod that engages the stopper, such as by being able to move the pivot ball with respect to the pivot rod through a detent connection, a friction fit or by a threaded connection and/or by moving the distal end adjacent to the stopper by providing a tip that is biased outwardly by a spring or resilient material. In another embodiment, a stopper is fitted with screening means for trapping objects and debris, where the stopper is preferably removeable from and attachable to the pivot rod without removing the pivot rod, or the stopper is magnetically coupled to the pivot rod, so that the stopper can be removed, cleaned and replaced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A better understanding of the invention can be obtained when the detailed description of exemplary embodiments set forth below is considered in conjunction with the attached drawings in which:

[0009] Fig. 1 is a cross-section of a side elevation of a sink or basin and a pop-up drain assembly, according to the present invention.

[0010] Fig. 2 is a cross-section of a side elevation of a pop-up drain assembly, according to the present invention.

[0011] Fig. 2A is a plan view of the pop-up drain assembly of Fig. 2 as seen from the bottom, according to the present invention.

[0012] Fig. 3 is a perspective view of a drain stopper, according to the present invention.

[0013] Fig. 4 is a side elevation of a drain stopper, according to the present invention.

[0014] Fig. 5 is a side elevation of the drain stopper of Fig. 4 rotated 90 degrees.

[0015] Fig. 6 is a perspective view of a drain stopper adapted to have different lengths, according to the present invention.

[0016] Fig. 7 is a side elevation of a drain stopper adapted to press onto a pivot rod transversely, according to the present invention.

[0017] Fig. 8A is a side elevation of a drain stopper adapted to press onto a pivot rod transversely, according to the present invention.

[0018] Fig. 8B is a side elevation of the drain stopper of Fig. 8A during assembly or disassembly, according to the present invention.

[0019] Fig. 9 is a side elevation of a drain stopper adapted to press onto a pivot rod transversely and to lock into engagement, according to the present invention.

[0020] Fig. 10 is a cross-section of a side elevation of a drain stopper that has a magnet or magnetic material for magnetically coupling with a pivot rod, according to the present invention.

[0021] Fig. 11 is a cross-section of a side elevation of a drain stopper that has a length of magnet or magnetic material for magnetically coupling with a pivot rod, according to the present invention.

[0022] Fig. 12 is a cross-section of a side elevation of a tubular drain stopper that has several magnets or discs of magnetic material for magnetically coupling with a pivot rod, according to the present invention.

[0023] Fig. 13 is a cross-section of a side elevation of a tubular drain stopper that has a magnets or a disc of magnetic material for magnetically coupling with a pivot rod, and the length of the tubular drain stopper is adjustable, according to the present invention.

[0024] Fig. 14 is a side elevation of a drain stopper that has a magnet or magnetic material, and the length of the tubular drain stopper is adjustable, according to the present invention.

[0025] Fig. 15 is a side elevation of a pivot rod magnetically coupled to a drain stopper, wherein the pivot rod has a tip that is pressed against the drain stopper by a spring, according to the present invention.

[0026] Fig. 16 is a side view of a pivot rod and a pivot ball shown in cross-section, where the pivot ball is fixed to the pivot rod by a detent mechanism, according to the present invention.

[0027] Fig. 16A is a side view of a pivot rod and a pivot ball shown in cross-section, where the pivot ball is connected to the pivot rod by a threaded connection, according to the present invention.

[0028] Fig. 16B is a side view of a pivot rod and a pivot ball threaded onto the pivot rod, according to the present invention.

[0029] Fig. 17 is a cross-section of the tubular drain stopper shown in a side elevation with a magnet or a piece of magnetic material, according to the present invention.

[0030] Fig. 18 is a side elevation of a drain stopper having an extension and magnets or magnetic material in the extension and a basket screen attached to the extension, according to the present invention.

[0031] Fig. 19 is a cross-section of a side elevation of a sink or basin and a pop-up drain assembly, according to the present invention.

[0032] Fig. 20 is a side elevation of a drain stopper having a pair of opposing flow diverter plates, a magnet holder and a magnet or magnetic material in the magnet holder, according to the present invention.

[0033] Fig. 21 is a side elevation of the drain stopper of Fig. 20 rotated 90°.

[0034] Fig. 22 is a front elevation of a drain stopper adapted to press onto a pivot rod transversely, according to the present invention.

[0035] Fig. 23 is a side elevation of the drain stopper of Fig. 22.

[0036] Fig. 24 is the drain stopper of Fig. 23 with a cap for covering a drain flange, according to the present invention.

[0037] Fig. 25 is a front elevation of a strainer basket on a drain stopper, according to the present invention.

[0038] Fig. 26 is a side elevation of a drain stopper with a strainer basket and a cap for covering a drain flange, according to the present invention.

[0039] Fig. 27 is a partial cross-section of the drain stopper of Fig. 26.

[0040] Fig. 28 is a cross-section of the drain stopper of Fig. 26 as seen along the line 28-28 in Fig. 27.

[0041] Fig. 29 is a side elevation of a drain stopper, according to the present invention.

[0042] Fig. 30 is a front elevation of the drain stopper of Fig. 29, which is a 90-degree rotation clockwise from Fig. 29 to Fig. 30, as viewed from above.

[0043] Fig. 31 is a side elevation of the drain stopper of Fig. 29, after a 180-degree rotation clockwise from Fig. 29 to Fig. 31, as viewed from above.

[0044] Fig. 32 is a side elevation of the drain stopper of Fig. 29, after a 270-degree rotation clockwise from Fig. 29 to Fig. 32, as viewed from above.

[0045] Fig. 33 is the drain stopper of Fig. 30 holding a pivot rod.

[0046] Fig. 34 is a cross-section of the drain stopper of Fig. 33 as seen along the line 34-34 in Fig. 33.

[0047] Fig. 35 is a cross-section of the dual-prong fork of the drain stopper in Fig. 33 as seen along the line 35-35 in Fig. 34.

[0048] Fig. 36 is a perspective view of the drain stopper of Figs. 29-32.

[0049] Fig. 37 is a side elevation in partial cross-section of a drain stopper in a drain flange with a cover for a cap and for the drain flange, according to the present invention.

[0050] Fig. 38 is a side elevation of a pivot rod and an extension for making the pivot rod longer, according to the present invention.

[0051] Fig. 39 is a side elevation of a pivot rod and an extension for making the pivot rod longer, according to the present invention.

[0052] Fig. 40 is a side elevation of a pivot rod and an extension for making the pivot rod longer, according to the present invention.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0053] The present invention provides a pop-up drain assembly for a sink or basin for receiving and retaining a fluid, which is typically water, and a drain opening is provided in a lowermost portion of the sink or basin for draining the fluid. The pop-up drain assembly includes piping that can be placed through the drain opening and fastened to the sink or basin. The piping is typically connected to a drain pipe, and the piping provides a fluid flow pathway from the sink or basin through the drain opening and through the piping to the drain pipe for conveying fluid from the sink or basin to the drain pipe and away for disposal and/or treatment. After the drain assembly is installed on a sink, a drain stopper is received in the piping and is moveable between an open position and a closed position. In the closed position, the stopper provides a seal with the piping for retaining fluid in the sink or basin, and in the open position, fluid can enter the piping and drain away through the drain pipe. A pivot rod is used to move the stopper between the open position and the closed position. The pivot rod pivots about a generally horizontal position and engages the stopper, raising the stopper to the open position and lowering the stopper to the closed position.

[0054] In the drain assembly of the present invention, the pivot rod is not in the fluid flow pathway while in operation. The pivot rod either protrudes inside the piping for moving the stopper and fluid flow is diverted around the pivot rod for preventing hair and other debris from catching on the pivot rod or the pivot rod does not protrude significantly inside the piping and is magnetically coupled to the stopper for moving the stopper. In a

prior art pop-up drain assembly, the pivot rod was typically in the fluid flow pathway, and hair and debris caught on the pivot rod and stopper, which clogged the drain assembly. The present invention provides a pop-up drain assembly in which the pivot rod is not in the fluid flow pathway, so clogging in the drain assembly should be reduced.

[0055] Turning now to the drawings and with reference to Fig. 1, a pop-up drain assembly 10 is shown according to the present invention. Drain assembly 10 is received in a sink or basin 12, such as is typically used in a lavatory. Sink 12 has a lower surface 12a that drains into a drain opening 12b. Sink 12 has an overflow port 12c in a side wall 12d, which is an optional feature. An outer wall 12e and side wall 12d define an overflow channel 12f, and side wall 12d has an overflow drain port 12g for draining overflow fluid into a port in drain assembly 10. A faucet 14 is mounted on a top deck 12h of sink 12 for supplying water or other fluid to sink 12.

[0056] A number of different manufacturers make and sell pop-up drain assemblies, which can be retrofitted to provide a pop-up drain assembly according to the present invention. In the embodiment depicted in Fig. 1, pop-up drain assembly 10 comprises a drain flange 16 that fits down through drain opening 12b in sink 12. Preferably, drain flange 16 has a threaded tubular portion 16a extending essentially throughout its full length and a flange 16b extends radially outwardly on a top end. A gasket or plumber's putty 18 provides a seal between the lower surface 12a of the sink 12 and the flange 16b of drain flange 16. A flexible gasket 20 and a washer 20a are placed around a bottom portion of drain flange 16 and then pressed tightly against a bottom surface of sink 12 with a threaded nut 20b. A drain body 22 is threaded onto a lower end of drain flange 16. Drain body 22 has a wrench flange 22a for receiving a wrench for tightening and loosening drain body 22 with respect to drain flange 16. Drain body 22 has a pivot rod port 22b, and a threaded tubular stub 22c projects radially outwardly from drain body 22. A pivot rod seal 24 is received in stub 22c.

[0057] A pivot rod 26 has a stopper end 26a and an outer end 26b. A pivot ball 28 is sealingly received on pivot rod 26 closer to stopper end 26a than outer end 26b. Pivot rod 26 is received in stub 22c such that stopper end 26a is inside the drain body 22, and the

stopper ball 28 rests against pivot rod seal 24. A pivot rod cap 30 is threaded onto stub 22c sufficiently tightly to seal pivot ball 28 against pivot rod seal 24, but loose enough to allow pivot ball 28 and pivot rod 26 to pivot. An extension rod 32 having a plurality of holes, which are not shown, is received on outer end 26b of pivot rod 26 and held in place by a clip 32a. Extension rod 32 is bent so as to have two parallel portions 32b and 32c that are perpendicular to the longitudinal axis of the extension rod 32, and each of the two parallel portions has a hole through which a control rod 34 is received. Control rod 34 passes through a faucet port 14a and a sink control rod port 12h. Control rod 34 has a knob 34a at an upper end, and control rod 34 is fastened to extension rod 32 by a set screw 32d. There are various ways to connect a control rod to a pivot rod, and there are alternative means for controlling the pivot rod and the stopper, including a cable such as described in U.S. Patent No. 5,822,812, issued to Worthington et al, and U.S. Patent No. 4,596,057, issued to Ohta et al. and electronic means, which may include a solenoid, an electronic actuator and/or a motor.

[0058] A stopper 40 is received in drain flange 16 and drain body 22. Stopper 40 has an elongate shaft 40a running its length, which has a longitudinal axis through the center of stopper 40. A cap 40b is located on an upper end while the drain assembly 10 is installed and operational, and a pivot rod receiving member 40c is located on an opposing lower end. The pivot rod receiving member 40c defines an opening through which stopper end 26a of pivot rod 26 protrudes for engaging and moving stopper 40, and pivot rod receiving member 40c may be referred to as open member 40c. Four flanges or fins, referred to collectively as fins 40d, extend longitudinally along shaft 40a and project radially, and fins 40d lie in two perpendicular and intersecting planes. The fins provide structural support for the shaft and center the stopper in the drain pipe. A suitable number of fins can be used, including 2, 3, 4, 5, 6, 7, 8, 9, or 10 fins. The cap may be a separate piece that is received on the shaft, or the cap may be formed integral with the shaft. In one embodiment, the cap and shaft are formed of an integral piece of plastic, and the cap is coated with a metal such as chrome, nickel or brass. The stopper may also be made of a combination of metal and plastic.

[0059] A debris-guard flow diverter 42 is attached at an upper end to shaft 40a and fins 40d. Debris-guard flow diverter 42 has a lower free end 42a that extends below end 26a of pivot rod 26, although free end 42a may terminate above end 26a of pivot rod 26. If water is in sink 12, one can drain the water by pushing down on knob 34a of control rod 34, which pivots stopper end 26a of pivot rod 26 upward about pivot ball 28, raising stopper cap 40b. With cap 40b raised into an open position, water flows into drain flange 16. Debris-guard flow diverter 42 directs the water to flow between the debris-guard flow diverter 42 and the inside wall of drain flange 16 and drain body 22. Consequently, water does not readily flow over stopper end 26a of pivot rod 26 or over open member 40c on the lower end of stopper 40, which results in less hair, soap, toothpaste and debris being caught on and accumulating on stopper end 26a of pivot rod 26 or on pivot rod receiving member 40c. Pop-up drain assembly 10 is less likely to become clogged, particularly by accumulation of hair on pivot rod 26, than conventional prior art drain assemblies. Debris-guard flow diverter 42 may be referred to as a hair guard because it is particularly useful for preventing strands of hair from being caught and retained on the pivot rod and the lower end of the stopper.

[0060] Turning now to Fig. 2, a pop-up drain assembly 10a is shown in a cross-section of a side elevation, according to the present invention. Fig. 2A is a plan view of pop-up drain assembly 10a as seen from the bottom looking up. Drain assembly 10a is installed in sink 12 in the same manner as described with reference to Fig. 1. A stopper 44 is received in a drain flange 46. Drain flange 46 is connected to a drain body 48, which has an inside wall 48a, by a nut 48b. Stopper 44 has a body comprising longitudinal fins 44a that project radially outwardly at right angles to one another. A cap 44b is located on an upper end for sealing drain flange 46 and a notched open member 44c is located on a lower end of stopper 44. End 26a of pivot rod 26 is received in notched open member 44c, which has a notch or cut 44d. Notch or cut 44d allows stopper 44 to be pressed onto pivot rod 26 transversely, which allows stopper 44 to be installed and removed without the need to uninstall pivot rod 26 in order to engage pivot rod 26 with stopper 44. Debris-guard shields 50a and 50b are attached at an upper end to fins 44a of stopper 44 at a point 44e.

Any suitable method can be used to connect debris-guard shields 50a and 50b to fins 44a of stopper 44, including integral plastic molding, gluing and spot welding.

[0061] Debris-guard shields 50a and 50b have a lower end 50c and 50d, respectively, that is free in that it is not secured to anything. Debris-guard shields 50a and 50b have a width that is nearly as great as the diameter of drain flange 46 and drain body 48. Debris-guard shields 50a and 50b are not completely rigid, but rather are somewhat stiff, but flexible. Debris-guard shields 50a and 50b can be described in one embodiment as resilient. Debris-guard shields 50a and 50b flex outwardly from connection point 44e around the notched open member 44c, and thus around pivot rod 26. Because debris-guard shields 50a and 50b have a width essentially equal to the diameter of drain flange 46 and drain body 48 and because flow diverters 50a and 50b are sufficiently stiff, flow diverters 50a and 50b press against the inside wall of the drain body 48 at an intermediate point between the pivot rod 26 and the radius of the drain body 48 in the plane of the image of Fig. 2.

[0062] As can be seen in Fig. 2, drain body 48 has a radius r in the plane of the image shown in Fig. 2. Debris-guard flow diverter 50b presses against the inside wall 48a of drain body 48 at an intermediate point such that a gap x is defined between an outside surface of debris guard 50b and inside wall 48a at the full radius r in the plane of the image shown in Fig. 2. In the cross-sectional side elevation shown in Fig. 2, pivot rod 26 is shown as lying in a longitudinal centerline, which is a distance r from the inside wall 48a in the plane of the image. The lower free end 50d of the hair guard 50b presses against the inside wall 48a at a distance of r minus x from the centerline in the plane of the image, and consequently a flow path is defined between an outside surface of the hair guard 50b and the inside wall 48a of drain body 48. The plan view in Fig. 2A shows the flow path in the gap x is defined by the debris guard 50b and the inside wall 48a of drain body 48. The lower end 50d of debris guard 50b is bent into the shape of a circular arc because its edges are pressed against the inside wall 48a of drain body 48 while the center portion is pressed further outwardly by notched open member 44c. The inside wall 48a of drain body 48 defines a circular arc that has a greater diameter than the circular arc shape of debris guard

50b. Consequently, the flow path in gap x has a crescent shape in this embodiment. All that has been described with reference to debris guard 50b is also the same for debris guard 50a, and consequently, a flow path is provided inside drain body 48 on each side of pivot rod 26, but not over pivot rod 26 or notched open member 44c, which retards accumulation of hair and other debris on pivot rod 26 and notched open member 44c. The result is reduced frequency of clogging of pop-up drain assembly 10a.

[0063] Fig. 3 shows a side elevation of a stopper 60 in a perspective view. Stopper 60 has a central, elongate shaft from which fins 60a, 60b, 60c and 60d, which is not shown as it is hidden behind fins 60a and 60b. Stopper 60 has a cap 60e on an upper end, which has an outermost and uppermost domed flange 60f, lowermost and innermost flange 60g and a seal 60h between the flanges for sealing with a drain flange and retaining water in a sink. A pivot rod receiving element 60i is formed integral with the central shaft on a lower end opposite the cap 60e and has an opening 60j through which a pivot rod can be received so that the pivot rod can move the stopper 60 up and down between an open and a closed position, respectively. Pivot rod receiving element 60i could be notched as shown in Fig. 2 so that it could be pressed transversely onto the pivot rod. Another alternative is that the pivot rod holder could have the shape of the letter “J” such that there is a hooked end in which the pivot rod can be received. A pair of flow diverters or debris shields 60k and 60m are fastened onto the central shaft. While stopper 60 can be made of metal or plastic or a combination of metal and plastic, in this embodiment, the central shaft, the fins 60a, 60b, 60c and 60d, and the pivot rod receiving member 60i are formed by injection molding of a plastic such as polyethylene, polypropylene, polystyrene, polyvinylchloride or a copolymer of suitable monomers. Although shown as two separate pieces in other embodiments, in this embodiment, debris guards 60k and 60m are formed of a single integral piece of stiff, resilient plastic, such as polypropylene. A slot is formed or cut along a longitudinal centerline and extends about the half of the length of the debris guard, but is longitudinally centered. The width and length of the slot in the debris guard is determined by the need to fit over the fins 60a and 60c. The debris guard is folded at a longitudinal centerline and placed on the central shaft, receiving fins 60a and 60c through

the slot in the debris guard. An adhesive is preferably used to fasten the debris guard to the central shaft at an upper end near the cap 60e, but if an adhesive fails, such as due to an incompatibility of materials, other mechanical and/or chemical means can be used to fix the debris guard on the central shaft defined by fins 60a, 60b, 60c and 60d.

[0064] Continuing to reference Fig. 3, the cap's lower flange 60g and seal 60f are sized to fit snugly in a drain flange for a sealing engagement that will hold fluid in a receptacle. The width of the debris guard 60k, 60m is about the same as the diameter of cap flange 60g and cap seal 60f, probably slightly smaller, but greater than the radius of the cap flange 60g and cap seal 60f. If the radius of the cap flange 60g and cap seal 60f is R , then the width of the debris guard ranges between $1.1R$ and $1.9R$, preferably between $1.3R$ and $1.9R$, more preferably between $1.5R$ and $1.8R$. Some experimentation will likely be required, and a width of $1.75R$ may be a good starting point. The width should be such that fluid flow around stopper 60 is directed along an outside surface 60k' and 60m' of debris guards 60k and 60m, respectively. Debris guards 60k and 60m have a lower free-end portion 60k'' and 60m'', which may flex into an essentially vertical position while installed in a drain assembly, leaving a flow path along outer surfaces 60k' and 60m', while shielding pivot rod receiving element 60i from fluid and debris in the fluid, such as hair, toothpaste, oil and soap. The length and width of the debris guard relative to the diameter of the drain assembly will determine how the debris guard lies against the inside wall of the drain assembly. A longer debris guard will more likely flex into a vertical position in a lower end portion. A shorter debris guard may bend such that its lower edge is adjacent to the inside wall of the drain assembly. If a short debris guard is used, which does not flex into a vertical position in its lower end, one may wish to use a squared-off lower end rather than a rounded lower end, because if the lower end of the debris guards is squared off, this should ensure a larger semi-circular flow path as compared to a smaller crescent-shaped flow path that may result from a rounded bottom. A stopper with debris guards rounded at the bottom is easier to install in a drain, and debris guards that are long enough to flex into a vertical position around the pivot rod may be preferred.

[0065] The width of the debris guard or flow diverter is more appropriately compared to the inside diameter of the piping in which the stopper is received. A purpose for using a pair of opposing flow diverters on a stopper is to form somewhat of a seal between the flow diverters and the inside wall of the piping so that fluid flow is diverted away from the lower end of the stopper. The flow diverters provide a partial dam in the fluid flow path in the drain piping, and fluid flowing downwardly through the drain piping is directed toward the inside wall of the drain pipe and away from the lower end of the stopper. There is preferably a minimal clearance between the side edges of the flow diverters and the inside wall of the piping for providing somewhat of a seal between the flow diverters and the inside wall of the piping. The width, w , of the flow diverters could be as great as (or possibly greater than) the inside diameter of the piping, which is the drain flange and drain body in Fig. 1. It is believed that the width of the flow diverters should be at least as great as half the inside diameter of the piping, which is its radius, r . Then, the width of the flow diverters should range between about r and about $2r$ or so and is probably in the range of $1.4r$ to $1.8r$. The length, L , of the flow diverter plates will likely be related to the length of the stopper, particularly the length below the cap. If the stopper has a body length of BL , then the length of the flow diverters will likely be as least as long as about $0.25BL$ and probably not longer than about $2BL$. If a pivot rod holder, such as in Figs. 6 and 7, is included as part of the body of the stopper, then L will be likely less than or equal to about $1.25BL$ and more likely to be less than or equal to $1.75BL$, and preferably $0.5BL$ is less than or equal to L , which is less than or equal to $1.5BL$. The thickness of the flow diverters will depend on the material of which the flow diverter is made. The flow diverter should form a seal with the inside wall of the piping. A sheet of standard copier paper is believed to be less than about 0.004 inches thick, which a sheet of cardstock is believed to be about 0.0175 inches thick. If a thin, stiff, flexible and resilient metal or plastic material is used, the thickness may be about 0.01 inch or about 0.25 mm. On the other hand, a thicker plate could be used, such as another plastic with a higher content of elastomeric material, which may be as much as one-eighth of an inch thick or about 3 mm, but probably no more than about one-sixteenth of an inch or about 1.5 mm thick. The

thickness may be about 0.01 to 0.02 inches in one embodiment and may be from about 0.2 mm to about 1 mm, preferably to about 0.5 mm in another embodiment. The thickness of cardstock may be about right, depending on the material of construction. An example of a flow diverter is a rectangular plate having a length of from about 3 to 6 inches, and width of from about 0.75 to about 1.5 inches and a thickness of from about 0.01 to about 0.02 inches, where the plate is made of a material that will flex into an arc along a transverse section that has a radius of curvature equal to about the width of the plate, but is sufficiently stiff so that it will not readily flex into an arc having a radius of curvature of about half the width of the plate, and where the material is resilient so that it will return to the shape of a planar plate after a flexing force is removed.

[0066] Fig. 4 is a side elevation of a drain stopper 64, and Fig. 5 is another side view of drain stopper 64 after a 90-degree rotation about its longitudinal axis. Stopper 64 comprises two plates that intersect at a right angle to provide longitudinal flanges or fins 64a, 64b, 64c and 64d, which attach to a plate 64e on a lower end. Two downwardly projecting elements 64f and 64g are attached at an upper end to a lower surface of plate 64e, and the downwardly projecting elements 64f and 64g each have a free end that curves one towards the other so that together, the downwardly projecting elements 64f and 64g form a shape that resembles a semi-circle that is cut to leave a gap 64h in the center of its arc. Downwardly projecting elements 64f and 64g are stiff and resilient so that stopper 64 can be pressed onto a pivot rod from the side, and consequently, stopper 64 can be removed from a drain assembly for cleaning without needing to remove the pivot rod. Stopper 64 can be reinstalled by pressing the stopper downwardly while the gap 64h is aligned over the side of the pivot rod. Downwardly projecting elements 64f and 64g flex outwardly to accommodate the full diameter of the pivot rod in the gap 64h and then return to their normal state to retain the pivot rod in an interior opening 64i defined by the downwardly projecting elements 64f and 64g and plate 64e. Flow diverter plates 66 and 68 have an upper end portion 66a and 68a that is adhered to fins 64a and 64c. Flow diverter plates 66 and 68 flex outwardly through a central portion 66b and 68b in order to accommodate the width of lower plate 64e. Flow diverter plates 66 and 68 have a lower portion 66c and 68c

and a lower end 66d and 68d. The flow diverter plates 66 and 68 are preferably of a stiffness, length and width such that the lower portion 66c and 68c is forced into an essentially vertical position. The flow diverter plates 66 and 68 have an outer surface 66e and 68e.

[0067] While stopper 64 is installed and in operation, two fluid flow pathways should be defined by flow diverter plates 66 and 68 and the inside wall of the drain assembly. The inside wall of the drain assembly is circular in a transverse cross-section and has a diameter of twice its radius or $2R$. If the width of flow diverter plates 66 and 68 is about $1.4R$ to about $1.8R$, then lower portions 66c and 68c will press against the inside wall of the drain assembly and orient essentially vertically, provided the flow diverter plates 66 and 68 are sufficiently long. In this case, one fluid flow path will be defined as a semi-circular shape by outside surface 66e and the inside wall of the drain assembly, and another fluid flow path will be defined between outer surface 68e of diverter plate 68 and the inside wall of the drain assembly, which flow path will also have a semi-circular shape in a transverse cross-section.

[0068] Drain stopper 64 in Figs. 4 and 5 further includes a cap portion 64j that includes a top plate 64k, which is attached to the top of the central shaft and the fins 64a, 64b, 64c and 64d, a cap shaft 64m extending upwardly from top plate 64k, and a domed flange 64n is affixed to or integral with an upper end of cap shaft 64m. A gasket or seal 64p is received around cap shaft 64m between top plate 64k and domed flange 64n. Gasket or seal 64p is typically made of an elastomeric material and provides a seal with a drain flange for retaining fluid in a receptacle. Gasket or seal 64p is shown in cross-section in Fig. 5.

[0069] Fig. 6 is a side elevation of a drain stopper 70 in a perspective view. Stopper 70 has a cap 70a and fins 70b, 70c, 70d and 70e, but fins 70d and 70e are not visible in Fig. 6. Flow diverter debris shields 70f and 70g are attached to fins 70c and 70e about midway along the length of the fins. The debris shields 66 and 68 in Figs. 4 and 5 were attached to a lower end of the fins and shaft, while in Fig. 7 the debris shields are attached to an upper end of the stopper body. Stopper 70 has a pivot rod retainer 72, which

is shown as being about as long as the fins 70b and 70c but may be longer or shorter. Pivot rod retainer 72 is attached to or formed integral with a lower end of the shaft from which the fins 70b and 70c emanate radially. Pivot rod retainer 72 has an upper end 72a, where it is attached to or formed integral with the central elongate body of the stopper, and a lower end 72b. Pivot rod retainer 72 has an open slot 72c on lower end 72b, which extends upwardly for nearly the entire length of the pivot rod retainer 72. The body of the pivot rod retainer 72 defines the slot 72c and multiple circular openings sized to have a diameter only slightly larger than the diameter of a pivot rod.. Stopper 70 and pivot rod retainer 72 can be pressed and forced onto a pivot rod transversely, and the multiple circular openings provide different distances between a pivot rod and the bottom of the cap 70a, which allows stopper 70 to fit different drain assemblies from different manufacturers. In this embodiment, pivot rod retainer 72 has openings 72d, 72e, 72f, 72g, 72h and 72i stacked one above the other along slotted opening 72c, which provides six different vertical distances between the bottom of a lavatory basin and a pivot rod in a drain assembly. The openings in the pivot rod retainer can be circular, oval, rectangular and/or triangular. Thus, stopper 70 can be used to retrofit an existing drain assembly with a stopper that reduces the likelihood of flow stoppage or clogging in the drain assembly.

[0070] Fig. 7 is another embodiment of a drain stopper according to the present invention. A side elevation of a drain stopper 76 is shown in Fig. 7, which has flow diverter debris shields 76a and 76b attached to an upper end of a radial flange 76c. An opposing radial flange can not be seen in this view. Opposing radial flanges 76d and 76e extend radially outwardly perpendicular to radial flange 76c, and the longitudinal intersection of the radial flanges define a central longitudinal shaft. Radial flange or fin 76d extends downwardly into a first prong 76f, and radial flange 76e extends downwardly into a second prong 76g. First and second prongs 76f and 76g are spaced apart and a slot 76h is defined between first and second prongs 76f and 76g. First and second prongs 76f and 76g have inside edges 76f' and 76g', respectively, and a layer of rubbery, elastomeric material 76i is bonded to the inside edges 76f' and 76g'. A gap remains within slot 76h between the elastomeric material 76i on first prong 76f and the elastomeric material 76i on the second

prong 76g, and a pivot rod can be received in this gap by forcing stopper 76 transversely over a pivot rod that is extending or protruding into a drain assembly. The width of the gap between the elastomeric material is slightly less than the width or diameter of the pivot rod, while the width of slot 76h between first and second prongs 76f and 76g is slightly greater than the width or diameter of the pivot rod, which results in a snug or tight friction fit between the stopper 76 and the pivot rod. First and second prongs 76f and 76g and slot 76h can have different lengths relative to the central longitudinal shaft such as 0.25, 0.50, 0.75, 1.0, 1.25, 1.50, 1.75 and 2.0 times the length of the central longitudinal shaft. Slot 76h and the gap between the elastomeric material 76i within slot 76h have a length equal to essentially the length of first and second prongs 76f and 76g, which is from 1 to about 10 times the diameter of a pivot rod, preferably 1 to 6 times and more preferably 1 to 3 times the diameter of a conventional pivot rod that has a circular cross-section. A conventional pivot rod may range in size of from about 6 to about 12 inches in length, more typically from about 8 to about 10 inches in length, with a diameter ranging from about 0.125 inches to about 0.375 inches, where the diameter is typically about 0.25 inches.

[0071] Figs. 8 and 9 illustrate an alternative design for a pivot rod and a pivot rod retainer on a drain stopper. Fig. 8A shows a cross-section side elevation of a drain assembly 78, and a side elevation of the lower portion of a drain plug 80. Drain plug 80 is fitted with a pair of clog preventers 80a and 80b. Drain assembly 78 has an inside wall 78a for which a horizontal cross-section would be circular, assuming drain assembly 78 is installed in a vertical position. Clog preventers 80a and 80b have a lower, vertical portion 80a' and 80b', respectively, while installed in a vertical drain assembly, due to the width and flexibility of the clog preventers, which causes the lower portions 80a' and 80b' of the clog preventers 80a and 80b to press against and rest against inside wall 78a of drain assembly 78. Clog preventers 80a and 80b have an outside surface 80a'' and 80b'', respectively, on a side opposite of where a pivot rod is received. A first flow pathway 80c is defined between the outer surface 80a'' of debris shield or clog preventer 80a, and a second flow pathway 80d is defined between the outer surface 80b'' of flow diverter or clog preventer 80b.

[0072] Fig. 8A shows a side elevation of a pivot rod holder 80e attached to a lower end of a plug body 80f. Pivot rod holder 80e has two parallel prongs 80g and 80h, which are spaced apart to provide a gap 80i. The inside walls of prongs 80g and 80h, which define gap 80i, have a series of notches 80j, and between a pair of adjacent notches 80j is a projection 80k. A pivot rod 82 having a pair of opposing longitudinal flanges 82a and 82b that project radially is received in a detent relationship in gap 80i. Fig. 8b shows the stopper and drain assembly of Fig. 8A, while stopper 80 is pushed into detent engagement with pivot rod 82. Pivot rod flanges 82a and 82b are in longitudinal alignment with the longitudinal centerline of gap 80i between prongs 80g and 80h while stopper 80 is pushed onto pivot rod 82. Projections 80k on prong 80g are opposite and facing projections 80k on prong 80h and are spaced apart a distance that is slightly less than the diameter of pivot rod 82, which requires that prongs 80g and 80h be forced apart somewhat while stopper 80 is pressed into engagement with pivot rod 82. Fig. 8A shows pivot rod 82 at rest between a pair of opposing notches 80j and between adjacent projections 80k. A pair of adjacent projections on first prong 80g opposes a pair of adjacent projections on second prong 80h and surround pivot rod 82 to hold and retain pivot rod 82 within pivot rod holder 80e in a detent relationship. A detent relationship is one in which one part is kept in a certain position relative to that of another, where one part can be released by applying force to one of the parts. Fig. 9 shows a portion of the pivot rod holder 80e of Fig. 8A and pivot rod 82. In Fig. 9 the pivot rod 82 has been rotated 90 degrees relative to the position of pivot rod 82 in Fig. 8A. Consequently, pivot rod flanges 82a and 82b are perpendicular to the longitudinal axis of slot 80i. Flanges 82a and 82b project sufficiently to force prongs 80g and 80h apart slightly, which provides a tighter engagement of pivot rod holder 80e with pivot rod 82 as compared to the arrangement in Fig. 8A. In Fig. 8A, the pivot flanges are 82a and 82b are aligned with the centerline of slot 80i, and in Fig. 9, the pivot flanges are 82a and 82b are transverse to the centerline of slot 80i, so the parallel alignment in Fig. 8A can be said to provide a soft detent hold on the pivot rod, and the transverse alignment in Fig. 9 can be said to provide pivot rod holder 80e a firm detent hold on pivot rod 82.

[0073] Turning now to Fig. 10, an embodiment of the present invention is shown in which a pivot rod and a stopper are magnetically coupled rather than physically engaged, where the pivot rod does not protrude significantly inside a drain assembly. A pop-up drain assembly 100 is shown according to the present invention, which is received in a basin, receptacle or sink 102 through a drain hole 102a. Drain assembly 100 comprises a drain flange 104 that fits down through drain opening 102a in sink 102. As described with reference to Fig. 1, drain flange 104 has a threaded tubular portion that extends essentially throughout its full length and a flange 106 extends radially outwardly on a top end. A gasket or plumber's putty provides a seal between a lower surface of flange 106 and the sink 102. A rubber gasket 108 and a washer 108a are placed around a bottom portion of drain flange 104 and then pressed tightly against a bottom surface of sink 102 with a threaded nut 110. A drain body 112 is threaded onto a lower end of drain flange 104. Drain flange 104 has an inside wall 104a, and drain body 112 each has an inside wall 112a, and these two inside walls define circular cylindrical spaces 104b and 112b, respectively. Drain body 112 has a wrench flange 112a for receiving a wrench for tightening and loosening drain body 112 with respect to drain flange 104. Drain body 112 has a pivot rod port 116, and a threaded tubular stub 118 projects radially outwardly from drain body 112. A pivot ball seal 120 is received in stub 118.

[0074] A pivot rod 122 has a stopper end 122a and an outer end 122b, which is not shown. A pivot ball 124 is sealingly received on pivot rod 26 closer to stopper end 122a than outer end 122b. Pivot rod 122 is received in stub 116 such that stopper end 122a does not protrude into the interior space 112b defined by the inside wall 112a of the drain body 112 or only protrudes slightly inside of inside wall 112a. The pivot rod ball 124 rests against pivot rod seal 120. A pivot rod cap 126 is threaded onto stub 118 sufficiently tightly to seal pivot ball 124 against pivot rod seal 120, but loose enough to allow pivot ball 124 and pivot rod 122 to pivot. The positioning of pivot ball 124 on pivot rod 122 may be made adjustable so that the end of pivot rod tip 122a is located flush with the inside wall 112a of drain body 112.

[0075] A drain stopper 130 is received in drain flange 104 and drain body 112. Stopper 130 has a cap 132 with a gasket 134 (shown in cross-section) for sealing with flange 106 of drain flange 104 to retain fluid in sink 102. Stopper 130 has a plug-type body as described above with radial flanges 130a, 130b, 130c and 130d extending the length of the body. A bottom horizontal plate 136 is adhered to or formed integral with the lower end of the body of stopper 136. A holder 138 (shown in partial cross-section) is bonded to or formed integral with the bottom horizontal plate 136 and extends downwardly along the inside wall 112a of drain body 112 in alignment with pivot rod port 116. Holder 138 has a recess 138a, and a magnet or magnetic material 140 is received in recess 138a. Pivot rod end 122a is made of a magnetic material or is a magnet also, and pivot rod end 122a is magnetically coupled or linked to or engaged with magnet or magnetic material 140, such that there is a magnetic attraction between pivot rod end 122a and magnet or magnetic material 140. Only one of magnet or magnetic material 140 and pivot rod end 122a needs to be a magnet, while the other may be magnetic material, but a stronger magnetic coupling will be achieved if both are magnets. Stopper 130 is shown in the open position in Fig. 10, and pivoting of pivot rod 122 such that pivot rod end 122a is lowered will move stopper 130 into a closed position. Pivoting of pivot rod 122 about pivot ball 124 such that pivot rod end 122a is raised (into the position shown in Fig. 10) will move stopper 130 into an open position. Consequently, drain assembly 100 is less likely to become clogged than a conventional pop-up drain assembly because the pivot rod is not in the fluid flow path, which coincides with much of the space 104b and 112b inside drain flange 104 and drain body 112, respectively. Hair and other debris cannot readily catch on and/or adhere to pivot rod end 122a because pivot rod end 122a does not protrude inside of inside wall 112a of drain body 112. In a preferred embodiment, a permanent magnet is received in recess 138a in holder 138, while end 122a of the pivot rod 122 is made of magnetic material that is attracted to the permanent magnet, but the reverse arrangement can be used. The stopper 130 is open and closed by pivoting pivot rod 122 up and down, while the end 122a of the pivot rod 122 is not physically engaged with stopper 130, but is instead magnetically engaged with stopper 130.

[0076] Fig. 11 shows a pop-up drain assembly 150 much like the drain assembly 100 in Fig. 10. The sink, drain flange, drain body and pivot rod are the same as described for Fig. 10 and have been given the same element numbers as described above with reference to Fig. 10. A stopper 152 is received in the drain flange and drain body shown in Fig. 11. The stopper 152 in Fig. 11 is not the same as the stopper 130 in Fig. 10. Stopper 152 has an elongate central shaft from which four fins 154, 156, 158 and 160 project radially outwardly. Stopper 152 could be made, such as by plastic injection molding, with 3, 4, 5, 6, 7, 8, 9 or 10 fins or flanges. Fin 154 tapers inwardly through a lower section 154a in a manner similar to the stoppers shown in Figs. 2-7. Fin 158 does not taper inwardly and inside has an outside edge that remains adjacent to the inside wall 104a and 112 a throughout its length. A lower plate 162 is bonded to or formed integral with the bottom edges of fins 154, 156, 158 and 160, as well as to a central shaft at the intersection of the fins. A holder 164 is bonded to or formed integral with lower plate 162 and possibly to fin 158. Holder 164 has a recess 164a, and holder 164 and recess 162a are preferably from about 2 to about 10 times as long as the diameter of pivot rod 122, preferably 3 to 8 times as long and more preferably 4 to 7 times as long. Stopper 152 in Fig. 11 differs from stopper 130 in Fig. 10 primarily in that holder 164 and recess 164a are longer than holder 138 and recess 138a in Fig. 10. This allows stopper 152 to fit drain assemblies of different lengths. The distance between the flange 106 at the surface of the sink 102 and the pivot rod 122 is different in drain assemblies from different manufacturers and between different models from the same manufacturer. The stopper 152 should be designed to fit many, if not all, of these different configurations. Either a permanent magnet or magnetic material 166 can be placed in recess 164a, and end 122a of pivot rod 122 can be either magnetic material or a permanent magnet, respectively, such that there should be a magnetic attraction between end 122a of pivot rod 122 and the magnet or magnetic material in recess 164a in holder 164 on stopper 152. A stronger magnetic coupling will be obtained if both are magnets and neither is merely a magnetic material. Pivoting of pivot rod 122 such that pivot rod end 122a moves up and down should correspondingly move stopper 152 up and down between an open position and a closed

position, respectively. For further information, see U.S. Patent Application Pub. Nos. 2010/0154114 published June 24, 2010, for inventors Van Zeeland and Sims entitled “Magnetic Drain Assembly” and 2009/0255041 published October 15, 2009, for inventor Duncan entitled “Magnetically Actuated Drain Stopper Apparatus”.

[0077] Fig. 12 is a cross-section of a side elevation of a pop-up drain assembly 180, according to the present invention. A basin 182 has a drain opening 182a. A drain flange 184 is received in drain opening 182a and held in place by a threaded nut 186, which presses against a gasket 188. A drain body 190 extends below drain flange 184 and has an inside wall 190a. Drain flange 184 and drain body 190 together form a piping that defines a circular cylindrical flow path for draining water or another fluid from basin 182. Drain body 190 has a pivot rod port and a stub 192 projects radially outwardly from drain body 190. A pivot ball seal 194 is received in stub 192. A pivot rod 196 and a pivot ball 198, which is in a sealing engagement with pivot rod 196, is received within stub 192 such that pivot ball 198 sealingly and moveably rests against pivot ball seal 194. A pivot assembly cap 200 holds pivot ball 198 against pivot ball seal 194. Pivot rod 196 has a tip 202 that is inside stub 192. A distal end 202a (with respect to pivot ball 198) extends inside stub 192 and terminates essentially flush with drain body inside wall 190a. Drain body inside wall 190a defines a circular cylindrical volume or space 190b. Distal end 202a may extend into drain body space 190b by as much as 10 mm, preferably no more than 50 mm, and more preferably no more than 3 mm, but is preferably flush plus or minus about 1 or 2 mm, although a large drain body may require tip 202a to extend further within space 190b.

[0078] A stopper 204 is received in drain assembly 184 and drain body 190. Stopper 204 has a stopper body 204a that is tubular in shape such that the wall of the body defines a circular, cylindrical, empty space 204b within the body 204a. A cap 204c having a gasket 204d is received on an upper end of tubular body 204a. An upper body tube 204e has two, three or four or more ports or openings 204f (which could be slots or a screen) located at an upper end just below cap 204c through which fluid in basin 182 can drain. Upper body tube 204e has an opposing lower end, which is threaded, and a lower body tube 204g has an upper end that is threadedly engaged with the lower end of upper body

tube 204e such that the upper and lower body tubes thread together to form a unified piece of pipe or tubing. Lower body tube 204g is open at its lower end 204h. Lower body tube 204g has several recesses 204i, 204j, 204k and 204m spaced apart radially and longitudinally such that a line passing through the recess traces a spiral shape on an outer surface of lower body tube 204g.

[0079] A permanent magnet or magnetic material 206 is received in recess 204i on lower body tube 204g. The permanent magnet or magnetic material 206 is located in close proximity to distal end 202a of tip 202 on pivot rod 196. Tip 202 on pivot rod 196 is made of magnetic material or is a permanent magnet so as to be opposite of permanent magnet or magnetic material 206 such that there is a magnetic attraction between tip 202 and permanent magnet or magnetic material 206, which provides a magnetic coupling or engagement between pivot rod 196 and stopper 204. Through this magnetic coupling, one can pivot pivot-rod 196 down and up to move stopper 204 up and down to open and close the seal between gasket 204d and drain flange 184. Additional permanent magnets or magnetic material 206a, 206b and 206c is received in recesses 204j, 204k and 204m, respectively. Several magnets or magnetic material at different longitudinal locations allows stopper 204 to fit different manufacturer's drain assemblies, where there may be a difference in the distance between the center of pivot rod port and stub 192 (and hence the pivot rod 196) and the upper end of drain flange 184, which is flush with a drain surface of basin 182. The threaded engagement of upper body tube 204e and lower body tube 204g provides further adjustability to fit different manufacturer's drain assemblies, but the threaded engagement is optional, and a single piece of pipe or tubing could be used instead.

[0080] Fig. 13 is a side elevation of a pop-up drain assembly 210, according to the present invention. The sink, drain flange, drain body, pivot rod assembly and pivot rod are the same as for pop-up drain assembly 180 in Fig. 12, and like elements bear like numbers. Pop-up drain assembly 210 has a drain stopper 212 that is different from stopper 204 in Fig. 12, although it is similar. Stopper 212 has an upper tubular body 212a, which is threaded at a lower end 212b and which has one or more ports or openings 212c at an upper end through which water or fluid can pass into the inside of stopper 212. A cap 212d

having a gasket 212e, which is shown in cross-section, is fixed to an upper end of upper tubular body 212a. A lower tubular body 212f having a threaded upper end 212g (shown partially without cross-section) is threaded onto the lower end upper tubular body 212f, although a single unified body could be used. Lower tubular body 212f is open at a lower end 212h so that fluid retained in basin 182 can flow into openings 212c, through the interior of upper tubular body 212a, lower tubular body 212f and out the open end 212h. Lower tubular body 212f has a circumferential recess or groove 212i, which is proximate to the pivot rod port in the drain body 190 while the stopper 212 is installed and operational. Either a ring of magnetic material or permanent magnet 212j or a plurality of discrete portions of magnetic material or permanent magnet 212j is received in groove 212i. The ring of magnetic material or permanent magnet 212j or a plurality of discrete portions of magnetic material or permanent magnet 212j is magnetically coupled to or engaged with tip 202 of pivot rod 196 so that pivot rod 196 can lift stopper 212 up and pull it down. The ring 212j allows stopper 212 to rotate about a longitudinal axis, while remaining magnetically engaged with or coupled to distal end 202a of tip 202 of pivot rod 196.

[0081] Fig. 14 is a side elevation in partial cross-section of a stopper 220, according to the present invention. Stopper 220 has a central longitudinal shaft 222 and four longitudinal fins 224, 226, 228 and 230 (hidden in back) radiate outwardly from shaft 222 forming two intersecting, perpendicular planes in a transverse cross-section. The longitudinal fins have a top portion and a bottom portion, which is not as wide as the top portion because each fin tapers inwardly through a curved arc in the bottom portion. A bottom plate 232 is bonded to or formed integral with a bottom edge of shaft 222 and fins 224, 226, 228 and 230. A holder 234 is bonded to or formed integral with plate 232 at an outer edge of plate 232. Holder 234 has a longitudinal axis that is parallel to the longitudinal axis of the shaft 222. A recess 236 is provided in holder 234, and a magnet or magnetic material 238 is received in recess 236 for magnetic engagement with a pivot rod as described above. The central longitudinal shaft 222 has a bore 240, and an inside wall 242 that defines bore hole 240 is threaded. A fully threaded rod or stud 244 has male threads threaded into the female threads in the wall 242. A cap 246, which would have a

gasket that is not shown, is secured to the upper end of threaded rod 244, such as by threading, integral formation, welding or gluing. Rod 244 can be screwed to a desired depth to give stopper 220 a desired length so that stopper 220 will fit different manufacturer's drain assembly. Alternatively or additionally, bottom plate 232 (and holder 234) can be attached to the bottom edge of shaft 222 and fins 224, 226, 228 and 230 by a similar threaded rod and threaded borehole arrangement for providing a variable length for stopper 220. The means for adjusting the length of a stopper body described in reference to Figs. 12-14 can also be incorporated in the stoppers described in reference to Figs. 1-9, including having a two-piece, threaded shaft in which the length of the shaft can be adjusted.

[0082] Fig. 15 shows a side elevation in partial cross-section of a magnetic coupling assembly 250, according to the present invention. A cross-section of a small portion of a stopper 252 has a recess 254 in which is received a magnet or magnetic material 256. A drain body with a pivot rod port, pivot rod stub and pivot ball holder assembly is not shown for simplification. A side elevation in partial cross-section of a pivot rod 258 is shown, and a pivot ball 260 having a central bore is received on pivot rod 258. A seal is formed between pivot ball 260 and pivot rod 258. Pivot rod 258 has an end portion 262, which is a hollow, tubular portion. The remainder of pivot rod 258 may be a hollow tube or may be solid. A tip 264 has a bulbous head 266 formed integral with a shaft 268. A distal end 270 of end portion 262 has a shoulder 272 that projects inwardly about the circumference of the end 270 of pivot rod 258. Shaft 268 has a longitudinal slot 274 on an end 276 distal to head 266 and a radially outwardly projecting shoulder 278 about the circumference. Tip 264 can be pressed into engagement with end portion 262 of pivot rod 258. End 276 of shaft 268 of tip 264 is pushed inside distal end 270 of end portion 262 of pivot rod 258. Slot 274 allows shaft 268 of tip 264 to compress sufficiently so that outwardly projecting shoulder 278 passes through inwardly projecting shoulder 272, after which shaft 268 expands back to its normal diameter. After shoulder 278 of shaft 268 has passed to the interior of shoulder 272 of end portion 262 of pivot rod 258, tip 264 is locked into engagement with end portion 262 of pivot rod 258 because shoulder 272 on end portion

262 blocks the exit of shoulder 278 on tip 264. A spring (or resilient material) 280 is retained inside end portion 262. Spring 280 pushes against a solid portion within pivot rod 258 to push tip 264 outwardly so that head 266 remains adjacent to and/or is in contact with magnet or magnetic material 256 on stopper 252. Moving pivot rod 258 up and down moves stopper 252 down and up through magnetic coupling between tip 264 and stopper 252. Tip 264 is made of either magnetic material or a permanent magnet, opposite of the magnet or magnetic material 256 so that there is a magnetic attraction between tip 264 and stopper 252.

[0083] Fig. 16 is a side elevation of a pivot ball 290 (in cross-section) received on a pivot rod 292. Pivot ball 290 has a bore 294 through it and a hollow cylindrical extension 296. Pivot ball 290 has a shoulder 298 that projects inwardly into bore 294 and extends around the interior circumference of the wall that defines bore 294. Pivot rod 292 has circumferential grooves 300, 302 and 304 that can matingly receive shoulder 298 in a detent relationship. Pivot rod 292 has a distal end 306 for magnet coupling with a stopper. The detent fastening of pivot ball 290 onto pivot rod 292, where the pivot rod has multiple grooves spaced longitudinally apart for receiving the shoulder 298, allows the distance between the pivot ball 290 and distal end 306 of pivot rod 292 to be adjusted to fit different spacings that different manufacturers may have between a pivot ball and the inside wall of a drain body. The hollow cylindrical extension 296 on pivot ball 290 is optional. Alternative means for adjusting the distance between a pivot ball and the adjacent distal end of a pivot rod is a threaded connection, a friction fit and an easy slip-on ball with a set screw connection.

[0084] Fig. 16A is very similar to Fig. 16, but instead depicts a threaded connection between pivot rod 292 and pivot ball 290. Pivot rod 292 has a spiral groove 292a on at least a portion of its surface, which provides threads, and pivot ball 290 has internal threads 290a for engagement with the threads on the pivot rod. Distal end 306 has a smaller diameter than the threaded portion of the pivot rod 292 for passing through the pivot ball 290. The extension 296 is optional, but useful for providing an O-ring seal between the pivot rod and the pivot ball, in which case the pivot rod has a circumferential

groove 292b in which is received an O-ring 293, which forms a seal with an unthreaded, smooth-walled extension 306. An alternative to threading pivot ball 290 and extension 206 is to use a material and to have an inside diameter in the pivot ball and extension that will allow threads to be created while the threaded rod is threaded into the pivot ball 290. Fig. 16B is a side elevation of a pivot ball 290d (in cross-section) received on a pivot rod 292d. Pivot ball 290d has a bore 294d through it. Pivot rod 292d has a stopper end 292e and an outer end 292f. Pivot rod 292d has external threads 292g that extend from the stopper end 292e toward the outer end 292f. The pivot ball 290d has mating internal threads that define the bore 294d. The pivot rod 292d can be threaded through the pivot ball 290d a desired amount to provide a desired distance between the pivot ball 290d and the stopper end 292e of the pivot rod 292d.

[0085] Fig. 17 is a side elevation of a stopper 310 in partial cross-section. Stopper 310 has a hollow, cylindrical tubular body 312, which has an upper end 314 and a lower end 316. A cap 318 is fixed to upper end 314, and tubular body 312 has a hole, recess or indentation 320 for receiving a magnet or magnetic material 322. The upper end 314 of the tubular body 312 has a plurality of slotted openings 324 spaced together closely through which fluid, typically water, may pass, but which screens out debris, waster and objects that are too large to pass through the slotted openings 324. Slotted openings 324 are located around the entire circumference of the upper end 314 of tubular body 312. If a person's ring is dropped in a sink in which stopper 310 is installed, the upper end 314 serves as a screen to block entry of the ring into the interior of the tubular body 312. Long hair that falls into the sink may be caught in slotted upper end 314 as water flows into tubular body 312. Alternatively, a mesh screen can be used instead of the slotted openings 324. Alternative means for screening includes installing a horizontal mesh screen in a transverse cross-section of the lower end 316 of tubular body 312 or along the open end of lower end 316, in which case tubular body 312 becomes a basket for catching things such as hair that enter stopper 310, and in which case large ports would be provided in upper end 314 rather than slots 324.

[0086] Fig. 18 is a side elevation of a drain stopper 330, according to the present invention, which is similar to stopper 152 shown in Fig. 11 and described above. Stopper 152 in Fig. 11 was described as having a single linear magnet or magnetic material, but a plurality of magnets or magnetic material can be used. Stopper 330 has a plug-type body 332 comprised of a central shaft from which longitudinal flanges 334, 336, 338 and 340 (hidden) project radially. A top plate 342 is attached to the upper end of the central shaft and the longitudinal flanges 334, 336, 338 and 340. A cap 344 is received on the top plate 342. A bottom plate 346 is attached to the lower end of the central shaft and the longitudinal flanges 334, 336, 338 and 340. A receptacle member 348 extends downwardly from bottom plate 346 for a distance of about 0.25 to about 20, preferably about 0.5 to about 12 and more preferably from about 0.75 to about 5 times the diameter of the body 332. Receptacle member 348 has a plurality of recesses 350, and each recess 350 contains a permanent magnet or magnetic material 352. Alternatively, a single linear magnet or magnet material having approximately the length of the receptacle member 348 can be used. A cylindrical ring 354 is attached to or formed integral with the lower end of the receptacle member 348. A mesh basket 356 is attached to a lower end of ring 354. Mesh basket 356 provides a screen for catching objects, debris, hair and waste. Since stopper 330 will be magnetically coupled to a pivot rod, stopper 330 can be easily removed from a drain, cleaned and reinstalled. Alternatively, a screening mechanism can be used on an upper end of stopper body 332.

[0087] Fig. 19 shows an alternative means for opening and closing a stopper. The present invention has been described with reference to a pop-up drain in which a pivot rod is used to open and close the stopper. However, one skilled in this art would know a number of alternative means for opening and closing the stopper. Fig. 19 is a side elevation in partial cross-section showing a drain assembly 370, according to the present invention. Fig. 19 shows a prior art drain assembly disclosed in U.S. Patent No. 3,002,196, issued to Mackey, Jr., as modified according to the present invention. In Fig. 19, a lavatory bowl 372 has a drain opening 374 and piping 376 is received in bowl 372 through opening 374. A stopper 378 has an elongate body from which a plurality of elongate fins 380 extend

radially. A lower end of a flow diverter 382 is visible in the drawing. Debris-guard, debris shield, or flow diverter 382 is made, attached to stopper 378 and used as described above with reference to Figs. 1-9. However, stopper 378 is not opened and closed by a pivot rod. Each of the fins 380 of stopper 378 have a split end 384, and a wedge-shaped cam 386 is received in one of the split ends 384. Cam 386 slides within a neck 388, and a cable 390 connects a control knob 392 to cam 386. As cam 386 is pushed inwardly by pressing downwardly on control knob 392, cam 386 slides into split end 384 of stopper 378 and lifts stopper 378 into an open position. As cam 386 is pulled outwardly by pulling upwardly on control knob 392, cam 386 slides out of split end 384 of stopper 378, and stopper 378 falls by gravity into a closed position. A pair of opposing guard shield flow diverters 382 divert water from bowl 372 around cam 386 and the lower split ends 384 to prevent debris, particularly hair, from accumulating on cam 386 and lower ends 384. Other means for opening and closing a stopper include electromechanical means, electric and magnetic means, and a spring-loaded detent mechanism. The following patents and patent applications describe various drain and stopper arrangements, different means for opening and closing stoppers and different means for controlling a pivot rods: U.S. Patent Nos. 773,408, issued to Moore; 1,980,250, issued to Baxter; 6,219,861, issued to Chen; and 6,308,351, issued to Franke; and U.S. Patent Application Publication Nos. 2003/0041374, listing Franke as inventor; and 2006/0179564, listing Jacobs as inventor. Means for moving a stopper in a drain include a pivot rod, a cam system, an electromechanical system, an electric-magnetic system, a human-manual system, a detent mechanism or a spring-loaded detent mechanism. The human-manual system is one in which a person holds the stopper and moves it between an open position and a closed position.

[0088] Additionally, the debris guard flow diverters described with reference to Figs. 1 to 9 can be used in conjunction with the magnetic coupling described with reference to Figs. 10, 11, 14 and 18 for stoppers having plug-type bodies. Fig. 20 is a side elevation of a drain stopper 400, which has four longitudinal fins or flanges 400a, 400b, 400c and 400d that extend radially from a central, longitudinal shaft 400e at the intersection of the fins. The fins extend radially outwardly and define an outermost circumference of

the stopper 400. A magnet holder 400f extends downwardly from fin 400b. A magnet or magnetic material 400g is received in a recess in the holder 400f. Magnet holder 400f and/or the magnet or magnetic material 400g has an outer, longitudinal surface 400h, which is aligned with the outermost circumference of the stopper 400. Magnet holder 400f has a lower end 400i. A pair of opposing flow diverter plates 400j and 400k are bonded to longitudinal fins 400b and 400d. Magnet holder 400f and the magnet or magnetic material 400g are located between the flow diverter plates 400j and 400k, which extend downwardly to the lower end 400i of the magnet holder 400f and shield the magnet holder 400f and the magnet or magnetic material 400g from water and debris flowing downwardly around the stopper 400. A cap 400m and a sealing gasket 400n are received at and adjacent to an upper end of the shaft 400e. Fig. 21 is a side elevation of drain stopper 400 in Fig. 20 rotated ninety degrees clockwise as viewed from looking down on the cap 400m. The various embodiments of the present invention are believed to effectively address a problem of clogging in sink and basin pop-up drain assemblies, particularly in that the pivot rod is not in the fluid flow pathway in the drain assembly. Fluid flow is diverted around the pivot rod that protrudes into the fluid flow path using debris shield flow diverter plates, or the pivot rod does not protrude significantly into the fluid flow path and is magnetically coupled to the stopper. An electromagnet could be used instead of a permanent magnet, along with a suitable control mechanism.

[0089] Fig. 22 is a front elevation of a drain stopper 410, and Fig. 23 is a side elevation. Fig. 24 is a side elevation with a cap. This is the same type of drain stopper as shown in Fig. 7. Four radial flanges 412a, 412b, 412c and 412d intersect and form a central, longitudinal shaft 412e. Shaft 412e has a longitudinal axis, and the radial flanges extend along the longitudinal axis and have a length. Radial flanges 412a, 412b, 412c and 412d centralize drain stopper 410 in a drain pipe and project radially to define a circular cylindrical space. A circular disc 414 is fixed to an upper end of the shaft and the radial flanges. A threaded stud 416 projects upwardly, outwardly and along the longitudinal axis of the shaft. Fig. 24 shows a cap 418 that has a central threaded bore 418a screwed onto the stud 416. The cap 418 has a second threaded bore 418b surrounding the central bore

418a for use in a different application. A conical, washer-shaped seal 418c is received in a recess or groove around the stopper.

[0090] A two-prong fork 420 depends from the radial flanges 412a and 412c. First and second prongs 420a and 420b have inside edges 420c and 420d, respectively, and a layer of rubbery, elastomeric or foam material 420e is bonded to the inside edges 420c and 420d. The prongs 420a and 420b may have a T-shaped cross-section. The layer of material 420e may be a single integral piece having a mating cross-section bonded to the prongs. A gap or slot 420f is defined between the elastomeric material 420e on first prong 420a and the elastomeric material 420e on the second prong 420b, and a pivot rod can be received in this gap by forcing stopper 410 transversely over a pivot rod that is extending or protruding into a drain assembly. The width of the gap between the elastomeric material 420e is slightly less than the width or diameter of the pivot rod, while the width of the gap between first and second prongs 420a and 420b is slightly greater than the width or diameter of the pivot rod, which results in a snug or tight friction fit between the two-prong fork 420 on the stopper 410 and the pivot rod. First and second prongs 420a and 420b and slot 420f can have different lengths relative to the central longitudinal shaft such as 0.25, 0.50, 0.75, 1.0, 1.25, 1.50, 1.75 and 2.0 times the length of the central longitudinal shaft.

[0091] Stopper 410 has a body that comprises the central shaft 412e and the radial flanges 412a-d. The two-prong fork 420 is a pivot rod holder that depends from the body. The flanges 412a-d circumscribe a circle or a circular cylindrical shape. A cross-section of the two-prong fork 420 has a rectangular shape. Stopper 410 has a transition portion 422 where the circular body changes to the rectangular pivot rod holder 420. Radial flanges 412a and 412c gradually narrow towards the longitudinal axis along a curve and then thicken into the prongs 420a and 420b, respectively. A shoulder 422a is formed where the radial flanges abruptly thicken and become the prongs. A lower end 420g of each of the prongs is angled inwardly to provide a V-shape 420h that points into the gap 420f. The prongs 420a and 420b are slightly angled such that the gap 420f becomes nonexistent at the point of the V-shape 420h. Stopper 410 can be made of a stiff resilient polymeric material or a different material. The stopper 410 is pushed down transversely onto a pivot

rod, and the mouth of the V-shape 420h is about as wide as the diameter of the pivot rod. The V-shape 420h helps to feed the pivot rod into the gap 420f. The prongs 420a and 420b are forced apart slightly and squeeze the pivot rod. The flexible or elastomeric material 420e grips the pivot rod by friction.

[0092] The cap 418 in Fig. 24 is much larger than normal. With reference to Fig. 1, the cap 40b has a diameter that is only slightly larger than the circle circumscribed by the radial flanges 40d, possibly 120% larger. The cap 40b or its seal rests on the drain flange 16b, and a substantial portion of the drain flange 16b is visible from above. A casual observer may see the drain flange 16b. If the drain flange 16b becomes worn or unsightly for any reason or if an owner wishes to change the color of the finish, it was necessary in the past to change out the drain flange 16b. The stopper 410 and the larger-than-normal cap 418 can replace the drain stopper 40 in Fig. 1, without the need to change out the drain flange 16b. The drain flange 16b will be hidden from sight by the larger-than-normal cap 418. The cap 418 can have a different finish color than the drain flange 16b, which allows the owner to update the appearance of a sink. The cap 418 may have a diameter that is 1.5, 2.0, 2.5, 3.0 or 3.5 times the diameter of the circle circumscribed by the radial flanges 412a-d. A standard cap may have a diameter of about 1.25 to 1.5 inches (3 cm to 4 cm). The over-sized or larger-than-normal size cap 418 of Fig. 24 has a diameter at its widest point of at least 1.75 inches (4.4 cm), preferably at least 2.0 inches (5.0 cm) and more preferably between 2.0 and 3.0 inches (5.0 to 7.6 cm). A cap with a diameter of 2.5 inches (6.35 cm) may be suitable for most applications. Cap 418 has a flange 418d at a base or bottom end, which has a hexagonal shape. In one embodiment the base has a diameter of about 1.125 inches, and the diameter at the widest point of the cap 418 is 2.5 inches. The diameter of the base is preferably in the range of 0.75 to 1.5 and more preferably in the range of 1.0 to 1.25 inches. The base seats against the disc 414, which in one embodiment has a diameter of 1.0 inch. The disc may have a diameter in the same range as the base 418d or may be in the range of 0.75 to 1.25 inches. The seal has an inside diameter that is slightly smaller than the base and an outside diameter of about 1.75 inches and is preferably in the range of 1.5 to 2.0 inches. Cap 418 has a decorative dome shape along its upper and outer surface.

Cap 418 is also quite thick. For the embodiment in which the base is 1.125 inches and the widest point is 2.5 inches, the thickness from the bottom of the base to the top of the dome is about 0.75 inch. The thickness of the cap 418 is preferably in the range of 0.5 to 1.0 inch. The seal 418c has a thickness of about 0.25 inch in the embodiment where the thickness of the cap 418 is 0.75 inch.

[0093] Fig. 25 is a front elevation of the drain stopper 410 fitted with a strainer basket 430. Fig. 26 is a side elevation of the drain stopper of Fig. 24 fitted with the strainer basket 430. Fig. 27 is the drain stopper of Fig. 26 with the strainer basket 430 shown in cross-section. Fig. 28 is a cross-section as seen along the line 28-28 in Fig. 27. The drain stopper of Fig. 25 has a cap 424, which has a seal 424a. The strainer basket 430 is for removing hair and other debris from a drain fluid stream. The strainer 430 has a generally cylindrical shape, an open upper end 430a, a plurality of longitudinal slots defined by edges 430b and a partially closed lower end or base 430c. The radial flanges 412a-d are in the longitudinal slots defined by edges 430b. The strainer has a plurality of openings 430d such as holes and slots through which water can pass and a plurality of obstructions 430e on which hair and other debris tends to be caught and retained. The upper end 430a of the strainer flares outwardly and has an outermost circumference proximate to an uppermost edge, which is sized to fit snugly in a drain pipe from a sink. The longitudinal slots extend nearly the entire length of the strainer. A fin of the drain stopper is received in a longitudinal slot, and there is a slot for each fin. A section of wall between two longitudinal slots has a V-shaped notch defined by edges 430f, which provides a wide opening along the upper edge, which narrows to a point at a lower end of the notch. The notches and the longitudinal slots allow the strainer basket to flare outwardly against an inside wall of a drain pipe and to be compressed inwardly to accommodate an inside diameter of a drain pipe that is smaller than the diameter of the strainer. The four longitudinal slots 430b extend roughly 75% of the length of the strainer basket 430 from the upper end 430a toward the base 430c. The four V-shaped notches 430f extend roughly 15-20% of the length from the upper end 430a to the base 430c.

[0094] Fig. 28 is a cross-section of the drain stopper 410 and strainer 430 as seen along the line 28-28 in Fig. 27. The base 430c of the strainer has a transverse, rectangular slot defined 430g defined by edges 430h. The slot 430g is an open rectangular shape along the diameter of the base with a small transverse open rectangular shape at each end, which resembles a T-shape on each end. The base has two semicircular plates 430i and 430j spaced apart with edges 430h that define the slot 430g. The plates 430i and 430j have openings 430k through which water can pass. The transverse slots at the opposing ends of the slot 430g allow the plates 430i and 430g to flex. The lower end 420g of the pivot rod holder 420 is placed in the slot 430g, and the two-prong fork 420 is pushed through the strainer 430 until the upper end 430a of the strainer is near the upper disc 414 on the stopper. The normal shape of the slot is smaller than the cross-section of the pivot rod holder 420, and the plates 430i and 430j flex downwardly and outwardly from the body of the strainer to accommodate the size of the pivot rod holder. The strainer is preferably pushed onto the stopper 410 until the plates 430i and 430j are above the shoulder 422a and resting against the transition portion 422. The base 430c of the strainer 430 preferably fits tightly around the transition portion 422 of the stopper body where it transitions into the two-prong fork 420. The transition portion 422 has a rectangular shape, which is shown in cross-section in Fig. 28. The projections 430i and 430j that define the slot 430g in the base 430c of the strainer 430 fit snugly about the transition portion 422 just above the shoulder 422a, thereby providing a friction fit and a detent mechanism for securing the strainer to the body of the stopper. The strainer can be removed from the stopper body with a little force. The strainer may be made of a polymeric material or a metal, which is preferably noncorrosive. The strainer can be used with any stopper design. The strainer 430 can be used with the stopper 40 in Fig. 1, but would not be needed since stopper 40 has debris shields 42a. The same is true for the other stopper designs that have debris shields such as 76a and 76b in Fig. 7. The strainer 430 can be used with the stopper 100 in Fig. 10, but would not be needed since the pivot rod 122 is not in the fluid flow path. It may be desirable to have an opening in the base portion of the strainer that accommodates the shape of the body of the stopper. A kit may be made and sold that includes a drain stopper with a

strainer and several extra strainers. The strainers can be used, removed, discarded and replaced. The stopper can be fitted with the small cap 424 or with the large cap 418, which can be used to cover a drain flange in a sink.

[0095] Fig. 29 is a side elevation of a drain stopper 440, which can be received in the drain flange 16 of Fig. 1. Stopper 440 has an upper end 440a, and a cap 440b is located on the upper end 440a. Four flanges or fins 440c, 440d, 440e and 440f, referred to collectively as flanges or fins 440c, extend longitudinally and project radially. Fins 440c lie in two perpendicular and intersecting planes. Stopper 440 has an elongate, longitudinal shaft 440g along its longitudinal axis, and the flanges or fins 440c, 440d, 440e and 440f extend longitudinally along the shaft 440g and project radially outwardly from the longitudinal axis of the stopper 440. The flanges or fins 440c-440f center the stopper 440 within a drain flange such that the stopper 440 fits somewhat snugly within the drain flange while also being easily movable up and down. A suitable number of fins can be used, including 2, 3, 4, 5, 6, 7, 8, 9, or 10 fins. The cap may be a separate piece that is received on the shaft, or the cap may be formed integral with the shaft. In one embodiment, the cap 440b and shaft 440g are formed of an integral piece of plastic, and the cap is coated with a metal such as chrome, nickel or brass. The stopper may also be made of a combination of metal and plastic. In another embodiment, the upper end 440a has an upwardly and outwardly extending stud with male threads, and the cap 440b has female threads for threaded engagement with the stopper body.

[0096] Stopper 440 has a two-prong or a dual-prong fork 440h on its lower end. Dual-prong fork 440h comprises two generally parallel, downwardly-extending prongs 440i and 440j of which only prong 440i is visible in Fig. 29. The body of stopper 440, which includes the fins 440 and the prongs 440i and 440j, is preferably made of a polymeric material that is somewhat rigid, but flexible and resilient. Prongs 440i and 440j have inside faces, and a liner 440k is fixed to the inside faces, possibly by an adhesive bond. The liner 440k on each of the prongs 440i and 440j has an inside surface, and these inside surfaces define a gap 440m, which cannot be seen in Fig. 29. Fig. 30 is a front elevation, which shows the gap 440m. The liner 440k is preferably made of a polymeric material that is less

rigid, more flexible and more resilient than the material used to make the body of the stopper 440. The stopper end of a pivot rod is received in the gap 440m and held there by a friction fit, which is a combination of a spring force applied by the prongs 440i and 440j of the dual prong fork 440h and by friction between the liner 440k and the stopper end of the pivot rod. The pivot rod tends to sink into the liner 440k to some extent, which provides more surface area that is in contact between the liner 440k and the pivot rod, thereby providing more friction than a more rigid material would provide.

[0097] A stop plate 440n extends downwardly from the shaft 440g and upper body of the stopper 440, which is illustrated in this embodiment as being along the longitudinal axis of the stopper 440. Stop plate 440n restricts how far the stopper end of the pivot rod can protrude inside of a drain body. A support plate 440p extends downwardly from the shaft 440g and upper body of the stopper 440 and connects to and extends between an edge of the stop plate 440n and an edge of prong 440j. Support plate 440p provides structural support for stop plate 440n. Stop plate 440n and support plate 440p tend to divert water and debris, such as hair, that flows downwardly inside the drain body away from the stopper end of the pivot rod, thereby reducing the tendency of hair and other debris to accumulate on the stopper end of the pivot rod, which tends to clog the drain body.

[0098] Figs. 30-36 provide various side elevation views and cross-sections of the drain stopper 440. Fig. 29 shows drain stopper 440 in the same orientation as the stopper 40 in Fig. 1. Fig. 30 shows drain stopper 440 as it would present to the pivot rod, which is a 90 degree rotation clockwise from Fig. 29 to Fig. 30 as viewed from above. Fig. 31 shows the stopper after an additional 90 degree rotation clockwise. Fig. 32 shows the stopper after another 90 degree rotation clockwise. Fig. 33 is a view in the same orientation as Fig. 30 and shows a pivot rod held by the two prong 440i and 440j. Fig. 34 is a cross-section as seen along the line 34-34 in Fig. 33. Fig. 36 is a perspective view of the stopper 440. Prongs 440i and 440j have lower ends 440q and 440r, respectively, which are angled inwardly, thereby making it easier to press the dual-prong fork 440h onto the stopper end of the pivot rod so that the pivot rod is received in the gap 440m. As can be seen in Fig.

33, the prongs 440i and 440j have insets 440t and 440u, respectively, which provide a support base for receiving the liner 440k. The liner 440k in this embodiment is a single piece of material that has an inverted U-shape as viewed in Fig. 30. Fig. 31 shows drain stopper 440 rotated 90 degrees clockwise from the view in Fig. 30, as seen from above, which is a 180 degree rotation from the orientation in Fig. 29. Support plate 440p is shown more visibly in Fig. 31. Fig. 32 shows drain stopper 440 rotated 90 degrees clockwise from the view in Fig. 31, as seen from above, which is a rotation of 90 degrees counterclockwise from the view in Fig. 29. Stop plate 440n is shown more visibly in Fig. 32. Stop plate 440n has an angled lower end 440v, which has the same slope as the lower end 440r of prong 440j. The inwardly sloping ends 440q, 440r and 440v tend to feed the pivot rod into the gap 440m between the prongs 440i and 440j of the dual-prong fork 440h as an installer or user presses stopper 440 onto the stopper end 26a of the pivot rod 26. Drain stopper 440 is shown in Figs. 29-32 prior to engagement with the pivot rod 26. Fig. 30 shows that the prongs 440i and 440j are closer together at the lower ends 440q and 440r, respectively, than at an upper end 440w, indicating that the prongs 440i and 440j are not quite parallel although nearly parallel.

[0099] Figs. 33-35 show drain stopper 440 engaged with the stopper end 26a of the pivot rod 26. Fig. 33 shows a side elevation of the drain stopper 440 in the same orientation as in Fig. 30, which is as seen looking from the outer end 26b of the pivot rod 26 toward the drain stopper 440. The prongs 440i and 440j of the dual-prong fork 440h are essentially and substantially parallel while engaged with the stopper end 26a of the pivot rod 26 because the pivot rod 26 forces the prongs apart slightly. The prongs 440i and 440j provide some spring force against the pivot rod 26, and the liner 440k provides a somewhat high-friction surface, so that the combination of the spring force and the high-friction surface provides a friction fit, whereby the stopper end 26a of the pivot rod 26 is held in a fixed engagement with the dual-prong fork 440h of the drain stopper 440.

[00100] Fig. 34 is a cross-section of the dual-prong fork 440h of drain stopper 440 as seen along the line 34-34 in Fig. 33. The prongs 440i and 440j have a T-shape, where the leg portion of the T points inwardly toward the stopper end 26a of the pivot rod

26, and the cap portion of the T provides an outermost, external surface. The cross-section of the liner 440k has a U-shape that wraps around the leg portion of the T-shape of the prongs 440i and 440j. The support plate 440p can be made integral with the cap portion of the prong 440j and extend in the same plane as the cap portion toward the center of a drain pipe and away from the outer end 26b of the pivot rod 26. The stop plate 440n can be made integral with the support plate 440p along an edge of each to form an L-shape. The stop plate 440n provides a stop to limit how far the stopper end 26a of the pivot rod 26 can protrude into the flow path of water draining from the sink 12 in Fig. 1.

[00101] Fig. 35 is a cross-section of the dual-prong fork 440h of Fig. 33 as seen along the line 35-35 in Fig. 34. The prongs 440i and 440j have a plurality of indentations 440x, and liner 440k has a matching and mating plurality of protuberances 440y, which tend to improve the bond between the liner 440k and the prongs 440i and 440j for maintaining the position of the liner in the prongs while the dual-prong fork 40h is forced transversely over the stopper end 26a of the pivot rod 26.

[00102] Fig. 36 shows a perspective view of the drain stopper 440, which is in an orientation similar to that in Fig. 29. The flanges or fins 440c, 440d and 440e are visible and extend longitudinally along the central, longitudinal shaft 40g through which the longitudinal axis of the stopper 440 runs. The flanges or fins 440c-440f extend radially and define an outermost circumference of the drain stopper 440. This outermost circumference defines a circular cylindrical space that the drain stopper 440 occupies. The flange or fin 440e expands and projects downwardly and splits into the dual prong fork 440h and its two prongs 440i and 440j. The dual-prong fork 440h is offset radially from the longitudinal axis of the drain stopper 440. The dual prong fork 440h and its two prongs 440i and 440j have a radially outermost surface 40z, which lies approximately, but substantially, on the outermost circumference of the drain stopper. The outermost surface 40z of the dual-prong fork 440h lies preferably within a tolerance of about 2 millimeters of the outermost circumference drain stopper 440 as defined by the guide fins 440c-440f. The outermost surface 440z of the dual-prong fork 440h lies proximate to, indeed immediately adjacent to, the pivot rod port 22b, preferably within 2 or 3 mm. The

outermost surface 440z comprises the radially outermost surfaces of the prongs 440i and 440j and/or the radially outermost surfaces of the liner 440k. There may be some irregularities in the outermost surface 440z, but it is a longitudinal surface that has a substantial length so that the dual-prong fork 440h can accommodate different vertical distances between the pivot rod port 22b and the lower surface 12a of the sink 12. Said another way, the fins 440c-440f have a radius from the longitudinal axis to an outer edge. The radial distance from the longitudinal axis to the outermost surface 440z of the dual-prong fork is substantially the same as the radius of the guide and centering fins 440c-440f. While most prior art drain stoppers have an engagement point with a pivot rod along or very close to the longitudinal axis of the drain stopper, the engagement point of drain stopper 40 with pivot rod 26 is adjacent to, immediately adjacent to or in close proximity with the inside wall of the drain body 22 at the pivot rod port 22b. However, a drain stopper with a centrally-located dual-prong fork connector for easy engagement with a pivot rod is also useful with a pop-up drain assembly, particularly one such as pop-up drain assembly 10 in Fig. 1.

[00103] Other aspects of drain stopper 440 include that the stop plate 440n is aligned and in the same plane as the guide fins 440d and 440f, which places the stop plate 440n on a centerline of the drain stopper 440. The longitudinal axis of the drain stopper 440 runs longitudinally through this centerline. The support plate 440p is neither on a centerline nor necessarily on an outside surface of the drain stopper 440, as its location depends on the width of the dual-prong fork 440h. In this embodiment, the stop plate 440n is spaced substantially away from the dual-prong fork 440h, but it could be located immediately adjacent to the dual-prong fork 440h. Also, the stop plate 440n could be eliminated, and the drain stopper 440 would function satisfactorily. The support plate 440p is also an optional feature. The strainer 430 of Fig. 25 can be used with the stopper 440 of Figs. 29-36. The drain stopper 440 is shown with a standard size cap, but the large cap 418 of Fig. 24 can be used instead. The large cap 418 of Fig. 24 can be used instead of the following caps: 40b in Fig. 1; 44b in Fig. 2; 60e in Fig. 3; 64n in Fig. 4; 70a in Fig. 6; the

cap in Fig. 7; 132 in Fig. 10; 152 in Fig. 11; 204c in Fig. 12; 212d in Fig. 13; 246 in Fig. 14; 318 in Fig. 17; 344 in Fig. 18; and cap 400m in Figs. 20 and 21.

[00104] Fig. 37 is a side elevation in partial cross-section of a drain stopper 450 received in a drain flange 452, which is sealed in a sink 454. Stopper 450 includes a body 450a and a cap 450b having a seal 450c. The finish on the drain flange 452 and on the cap 450b can become worn or damaged and unsightly or out of date. An owner may wish to change the appearance of the drain flange and the cap. It has been necessary in the past to change out the drain flange and the cap in order to change the appearance of a plumbing fixture. A cap cover 456 is attached with a layer of adhesive 458 to cap 450b. Cap cover 456 covers the entire surface of the cap 450b that is visible to a user after installation of the stopper 450 in the sink 454. A washer-shaped flange cover 460 is attached with a layer of adhesive 462 to an upper surface of the drain flange 452. Flange cover 460 covers the entire surface of the drain flange 452 that is visible to a user after installation of the stopper 450 in the sink 454. Cap cover 456 and drain flange cover 460 have a decorative finish, which is typically a common finish for a faucet such as chrome, polished brass, brushed nickel, stainless steel or a dark finish, although the finish could be different such as a nontraditional color like red, white or blue. Cap cover 456 and flange cover 460 allow an owner to change the appearance of the drain stopper 450 and the drain flange 452. The owner may wish to change the finish cover from polished brass to brushed nickel. The owner can simply adhere the cap cover 456 to the cap 450b and the flange cover 460 to the flange 452, where the cap cover and the flange cover have a finish color of brushed nickel, and the appearance of the drain stopper and the drain flange is changed without having to remove the old and install a new drain flange and stopper. The cap and flange covers can be sold with a layer of adhesive covered by a sheet that can be peeled off. The cap and flange covers can be sold without an adhesive layer, and an adhesive can be applied during installation. The cap and flange covers can be magnetic for an application in which the cap and the drain flange are made of a magnetic material that will be attracted by a magnet. It is also possible to rely on suction to fasten the covers to the cap and drain flange.

[00105] Fig. 38 is a side elevation of a pivot rod 470 with a pivot ball 472. Pivot rod 470 is shorter than the typical pivot rod 26 shown in Fig. 1, possibly about one half or one third as long. Such pivot rods may use a different linkage for opening and closing a drain stopper than the control rod 34 and connecting rod 32 shown in Fig. 1. There are times, particularly when there is a retrofit, when it is desirable to increase the length of a pivot rod, particularly the length of a short pivot rod. A slip-on coupling 474 is pressed onto an outer end 470a. An end of an extension rod 476 is pressed into the coupling 474. The pivot rod 470, the coupling 474 and the extension rod 476 can be threaded to provide a threaded engagement. The short rod 470 plus the coupling 474 plus the extension rod 476 gives a combined pivot rod that is sufficient in length. Fig. 40 shows the pivot rod 470 and pivot ball 472 with an extension rod 478 that has a fixed connector 480 for connecting the extension rod 478 to the pivot rod 470. The fixed connector can be attached with a tight press fit that relies on friction or the pivot rod and the fixed connector can be threaded for a threaded engagement. Fig. 40 is a side elevation of the pivot rod 470, a coupling 482 and the extension rod 476. Fastening means 484a and 484b connect the coupling 482 to the rods 470 and 476. Each of the fastening means 484a and 484b may be an O-ring, a garter spring, an adhesive, a snap ring, a detent mechanism, or some similar means for engaging a male part with a female part.

EMBODIMENTS OF THE INVENTION

[00106] The appended claims are directed to some embodiments of the invention. The following are additional embodiments of the invention.

[00107] A pop-up drain assembly with a stopper that has flow diverters.

[00108] A1. A pop-up drain assembly for a sink or basin having a drain opening, comprising: piping for providing a fluid flow pathway from the sink or basin through the drain opening and through the piping, wherein the piping has an inside wall that defines the fluid flow pathway, and wherein the piping has a pivot rod port; a stopper for retaining fluid in the sink or basin, wherein the stopper is received in the piping while in operation and is moveable between an open position and a closed position, wherein the stopper has a central, longitudinal shaft, a longitudinal axis, a length, an upper end and an opposing lower end, wherein the stopper has two or more longitudinal fins that have a length extending along the longitudinal axis and that project radially from the longitudinal axis for centralizing the stopper in the piping; and a pivot rod for moving the stopper between the open position and the closed position, wherein the pivot rod is attached to the piping at the pivot rod port, wherein the pivot rod is pivotable between upward and downward positions, and while in operation, wherein the pivot rod is engaged directly or indirectly with the stopper for moving the stopper between its open and closed positions, wherein the stopper has opposing first and second plates that have a length, a width and opposing upper and lower ends for diverting flow away from the pivot rod, wherein the upper end of each plate is fixed directly or indirectly to or formed integral with the shaft, and wherein the lower end of the plate is free, wherein the first and second plates have edges and opposing interior and exterior sides, wherein the sides are defined by the length and width of the first and second plates, wherein the edges are along the perimeter of the plates, and wherein the interior side of each plate faces toward the longitudinal axis of the stopper, and wherein the pivot rod is between the interior sides of the plates.

[00109] A2. The pop-up drain assembly of embodiment A1, wherein the upper end of each of the first and second plates is adjacent to the longitudinal axis of the

stopper, and wherein the lower end of each of the first and second plates is spaced outwardly from the longitudinal axis of the stopper.

[00110] A3. The pop-up drain assembly of embodiment A1, further comprising a pivot rod holder located on the lower end of the shaft, the pivot rod holder comprising two prongs that extend downwardly, wherein a slot is defined between the two prongs, and wherein the two prongs comprise an elastomeric and/or flexible material for receiving the pivot rod in a friction fit within the slot.

[00111] A4. The pop-up drain assembly of embodiment A1, wherein at least a portion of the edges of each of the plates touches the inside wall of the piping, and wherein the first and second plates create two fluid flow paths while in operation, one path being between one plate and an inside wall of the piping and another path being between the other plate and an inside wall of the piping.

[00112] A5. The pop-up drain assembly of embodiment A1, wherein the radial projection of the longitudinal fins defines a diameter of the stopper inside the piping, wherein the stopper has a cap on its upper end, and wherein the cap has a diameter that is at least two times the diameter of the stopper inside the piping, wherein two times the diameter means that if the diameter of the stopper inside the piping is one unit then the diameter of the cap is at least two units.

[00113] A6. The pop-up drain assembly of embodiment A1, wherein a transverse cross-section of the shaft of the stopper has the general shape of a circular central portion with at least two opposing fins extending radially outwardly, and wherein each plate has a notch through which one of the fins extends.

[00114] A7. The pop-up drain assembly of embodiment A1, wherein the stopper has an open member attached to or integral with the lower end of the shaft for receiving the pivot rod, wherein the open member has a slot in its longitudinal axis for receiving the pivot rod, and wherein the slot is long enough to accommodate more than one distance between the pivot rod and the drain opening in the sink or basin.

[00115] A8. The pop-up drain assembly of embodiment A7, wherein the open member has a longitudinal slot that provides an opening for receiving the pivot rod

in an orientation transverse to the longitudinal axis of the open member, and wherein the slot is defined to appear as a circle attached to another circle by a line.

[00116] A9. The pop-up drain assembly of embodiment A8, wherein the pivot rod has a pair of opposing longitudinal fins, wherein the pivot rod may be received in the open member such that the fins on the pivot rod are received within a circle in the slot in the open member.

[00117] A10. The pop-up drain assembly of embodiment A1, wherein the stopper comprises at least four longitudinal fins that extend radially for centering the stopper in the piping, wherein the upper end of each of the first and second plates is attached to or formed integral with two of the fins.

[00118] A11. The pop-up drain assembly of embodiment A8, wherein the stopper can be engaged with and disengaged from the pivot rod while the pivot rod is sealingly connected to the piping.

[00119] A drain stopper that has flow diverters

[00120] B1. A drain stopper for a sink or basin, comprising: a central, longitudinal shaft having a longitudinal axis, an upper end and an opposing lower end; a cap received on the upper end for providing a seal to retain fluid in the sink or basin; two or more longitudinal fins that have a length extending along the longitudinal axis and that project radially from the longitudinal axis for centralizing the drain stopper in a drain pipe; first and second opposing plates, wherein each plate has a length, a width and opposing top and bottom ends, wherein the top end of each plate is fixed directly or indirectly to or formed integral with the shaft or the longitudinal fins, and wherein the bottom end of each plate is free and spaced farther from the longitudinal axis than the top end; wherein the first and second plates have sides and edges, wherein the sides are defined by the length and width of the first and second plates, wherein each plate has an inside side and an opposing outside side, wherein the edges are along the perimeter of the first and second plates and between the inside side and the outside side; and a pivot rod holder depending directly or indirectly from the shaft or the longitudinal fins, wherein the pivot rod holder is between the inside sides of the first and second plates.

[00121] B2. The drain stopper of embodiment B1, wherein the pivot rod holder has an open slot so that the drain stopper can be pressed onto a pivot rod transverse to the longitudinal axis of the pivot rod.

[00122] B3. The drain stopper of embodiment B1, wherein the pivot rod holder is located on the lower end of the shaft, wherein the pivot rod holder comprises two prongs that extend downwardly, wherein a slot is defined between the two prongs, and wherein the two prongs comprise an elastomeric and/or flexible material for receiving a pivot rod in a friction fit within the slot.

[00123] B4. The drain stopper of embodiment B1, wherein the central, longitudinal shaft is an integral unit that comprises at least two planar sheets of material that intersect at a longitudinal axis of the shaft, and wherein the first and second plates are fixed to one of the sheets of material.

[00124] B5. The drain stopper of embodiment B1, wherein the pivot rod holder comprises a magnet or magnetic material for magnetic coupling with a pivot rod.

[00125] B6. The drain stopper of embodiment B5, wherein there are four longitudinal fins, wherein the longitudinal fins define an outermost circumference of the drain stopper, wherein the cap has a maximum diameter that is more than 1.5 times greater than the diameter of the outermost circumference and less than 4.5 times greater than the diameter of the outermost circumference.

[00126] A magnetic drain stopper

[00127] C1. A drain stopper, comprising: an elongate body comprising at least three longitudinal fins for centering the body in a drain pipe, wherein the fins project radially and define an outermost circumference of the body, a cap on one end of the body for providing a seal and a magnet holder extending longitudinally from one of the fins away from the cap end, wherein the body has a longitudinal axis, wherein the body has a longitudinal side edge at the outermost circumference that is parallel to the longitudinal axis, wherein the magnet holder has an outer surface approximately and substantially aligned with the longitudinal side edge, wherein a magnet or a magnetic material is received in the magnet holder, and wherein the magnet or magnetic material has an

elongated-rod shape and a longitudinal axis that is approximately parallel to the longitudinal axis of the body.

[00128] C2. A drain stopper operable with a pop-up drain assembly having a drain pipe that has a pivot rod port, comprising: a body having a length, a longitudinal axis, an upper end, a lower end and more than two fins that project radially and extend longitudinally; a magnet holder and a magnet or a magnetic material received in or on the magnet holder; and a cap received on the upper end of the body, wherein the fins define an outermost circumference and a longitudinal side edge of the body, wherein the magnet holder depends from one of the fins and extends toward or to the lower end of the body, wherein the magnet holder or the magnet or magnetic material has a surface along the longitudinal side edge, wherein the magnet or magnetic material has an elongate-bar shape that has a longitudinal axis that is offset from and approximately parallel to the longitudinal axis of the body.

[00129] C3. The drain stopper of embodiment C2, wherein there are four fins, wherein the fins define an outermost circumference of the drain stopper around the longitudinal axis of the body, wherein the cap has a maximum diameter that is more than 1.5 times greater than the diameter of the outermost circumference and less than 4.5 times greater than the diameter of the outermost circumference.

[00130] C4. A drain stopper, comprising: a body having a length, an upper end and an opposing lower end; fins projecting radially from the body and extending longitudinally along the body, wherein the fins define a circular cylindrical space that has a longitudinal axis and an outermost cylindrical surface; a cap having a seal or a gasket, wherein the cap is received on the upper end of the body; a magnet holder attached directly or indirectly to the body or to one or more of the fins, wherein the magnet holder has an outer side surface that lies on the outermost cylindrical surface; and a magnet or a magnetic material received in the magnet holder, wherein the magnet or magnetic material has the shape of an elongated bar, wherein the magnet or magnetic material has a longitudinal axis that is offset from and approximately parallel to the longitudinal axis of the body.

[00131] C5. The drain stopper of embodiment C4, wherein the magnet holder has a lower end surface that defines the lower end of the drain stopper, and wherein the outer side surface of the magnet holder extends upwardly toward the cap from the lower end surface and along the outermost cylindrical surface, wherein the cap has a maximum diameter that is more than 1.5 times greater than the diameter of the circular cylindrical space and less than 4.5 times greater than the diameter of the circular cylindrical space, further comprising a strainer basket surrounding the body above the magnet holder.

[00132] A Drain Stopper with a Two-Prong Fork along a Perimeter

[00133] D1. A pop-up drain assembly for a sink or basin having a drain opening, comprising: piping for providing a fluid flow pathway from the sink or basin through the drain opening and through the piping; a stopper for retaining fluid in the sink or basin, wherein the stopper is received in the piping while in operation and is moveable between an open position and a closed position; and a pivot rod engaged with the stopper for moving the stopper between the open position and the closed position, wherein the pivot rod has a stopper end and an outer end, wherein the piping has a pivot rod port, wherein the pivot rod is received in the pivot rod port, wherein the stopper comprises a body that has a length, a longitudinal axis, an upper end, a cap on the upper end, a lower end, and a dual-prong fork on the lower end, wherein the dual-prong fork has a longitudinal axis that is offset from the longitudinal axis of the body, wherein the dual prong fork is adjacent to the pivot rod port, and wherein the pivot rod is received between the prongs in the dual-prong fork in a friction fit.

[00134] D2. The pop-up drain assembly of embodiment D1, wherein the body of the stopper comprises a plurality of fins that project radially from the longitudinal axis of the body and extend longitudinally, wherein the fins have longitudinal outer edges that define an outermost perimeter of the body, wherein the outermost perimeter has a circular cylindrical shape, wherein the dual-prong fork depends from one of the fins, and wherein the dual-prong fork has a surface that lies on the outermost perimeter of the body.

[00135] D3. The pop-up drain assembly of embodiment D2, wherein the dual-prong fork comprises two parallel prongs, wherein each of the two parallel prongs has

an inside face, wherein the body and the dual-prong fork are made of a first polymeric material, wherein a second polymeric material is fastened to each of the inside faces, wherein the second polymeric material is less rigid and more resilient than the first polymeric material, wherein a gap is defined between the second polymeric material on one prong and the second polymeric material on the other prong, and wherein the pivot rod is received in the gap and held there by friction and by a spring force applied on the pivot rod by the prongs.

[00136] D4. The pop-up drain assembly of embodiment D1, wherein the dual-prong fork comprises two parallel prongs, wherein each of the two parallel prongs has an inside face and an opposing outside face, wherein the inside faces define a gap between the two parallel prongs, wherein the stopper has a support plate attached to or made integral with the outside face of one of the prongs that extends toward a central portion of the stopper, and wherein the stopper has a stop plate connected at a right angle to an edge of the support plate such that the stop plate is parallel to and spaced away from the prongs.

[00137] D5. A drain stopper, comprising: a body having a length, an upper end and an opposing lower end, wherein the body defines a circular cylindrical space that has a longitudinal axis and an outer surface; a cap having a seal or a gasket, wherein the cap is received on the upper end of the body; and a two-prong fork attached directly or indirectly to the body, wherein the two-prong fork has an outer surface, wherein the outer surface of the two-prong fork has a length that extends longitudinally along the outer surface of the circular cylindrical space, and wherein the two-prong fork has a longitudinal axis that is offset radially from the longitudinal axis of the circular cylindrical space.

[00138] D6. The drain stopper of embodiment D5, wherein the body includes a plurality of fins that project radially to the outer surface of the circular cylindrical space and extend longitudinally, and wherein the cap has a maximum diameter that is more than 1.5 times greater than the diameter of the outermost circumference and less than 4.5 times greater than the diameter of the outermost circumference.

[00139] D7. The drain stopper of embodiment D6, further comprising a stop plate extending longitudinally from the lower end of the body along the longitudinal axis.

[00140] D8. The drain stopper of embodiment D7, wherein the two-prong fork has an inner surface opposing the outer surface, and wherein a space is defined between inner surface and the stop plate.

[00141] D9. The drain stopper of embodiment D8, further comprising a support extending between one of the prongs and the stop plate.

[00142] D10. A drain stopper having an upper end and a lower end, a cap on the upper end, and a dual-prong fork on the lower end, wherein the dual-prong fork comprises two parallel prongs, wherein each of the two parallel prongs has an inside face and an opposing outside face, wherein the inside faces define a gap between the two parallel prongs, wherein the stopper has a support plate attached to or made integral with the outside face of one of the prongs that extends toward a central portion of the stopper, and wherein the stopper has a stop plate connected at a right angle to an edge of the support plate such that the stop plate is parallel to and spaced away from the prongs.

[00143] D11. The drain stopper of embodiment D10, wherein the stopper has a body that defines a circular cylindrical space that has a longitudinal axis and a perimeter, wherein the dual-prong fork has an outer surface that has a length that extends longitudinally along the perimeter of the circular cylindrical space.

[00144] Changing Finish on Stopper and Drain Flange

[00145] E1. A kit for changing the appearance of a pop-up drain assembly in a sink having a drain opening, wherein the pop-up drain assembly has a drain flange received in the drain opening and a stopper received in the drain flange, wherein the drain flange has an uppermost ring-shaped surface that surrounds the drain opening, and wherein the stopper has a cap that seals against the drain flange, the kit comprising: articles of manufacture, including: a washer-shaped ring of material that is sized and designed to fit on and cover the ring-shaped surface of the drain flange; a cap-shaped cover that is sized and designed to fit on and cover the cap; means for attaching the ring of material to the

drain flange; and means for attaching the cap-shaped cover to the cap, wherein each of the ring of material and the cap-shaped cover has a decorative finish.

[00146] E2. The kit of embodiment E1, wherein the means for attaching is selected from the group consisting of adhesive, magnet and suction.

[00147] Pivot rod and ball

[00148] F1. A rod and ball assembly for a pop-up drain assembly, comprising: a rod having a first end, a second end and external threads that extend from the first end toward the second end; and a ball having a bore extending through the ball and internal threads that define the bore, wherein the ball has an entrance opening to the bore and an exit opening from the bore, wherein the internal threads in the ball matingly engage the external threads on the rod, wherein the first end of the rod can be placed in the entrance opening of the bore, wherein the ball can be threaded onto the rod until the first end of the rod passes through the exit opening and protrudes a desired distance outside the ball, wherein the ball is received on the rod, and wherein the distance between the ball on the rod and the first end of the rod is adjustable.

[00149] Pivot Rod Extension

[00150] G1. A pivot rod assembly for a pop-up drain assembly, comprising: a pivot rod having a ball end and an opposing outer end; a ball received on the pivot rod; an extension rod; a coupling for connecting the extension rod to the pivot rod; and means for fastening the coupling to the pivot rod and to the extension rod.

[00151] G2. The pivot rod assembly of embodiment G1, wherein the means for fastening the coupling to the pivot rod and to the extension rod is selected from the group consisting of threaded engagement, O-ring, garter spring, adhesive, snap ring and making the coupling integral with the extension rod and using one of the other fastening means for connecting the integral coupling to the pivot rod.

[00152] A drain stopper with a two-prong-fork pivot rod holder

[00153] H1. 12. A pop-up drain stopper for a sink or basin, comprising: a body, wherein the body has a length and upper and lower ends; a cap on the upper end of the body; and a pivot rod retainer on the lower end of the body, wherein the

pivot rod retainer comprises a pair of opposing prongs and an elastomeric and/or flexible material on the prongs, wherein the opposing prongs define a slot, wherein the slot has an upper end and a lower end, and wherein the lower end of the slot is open so that the pivot rod retainer can be pressed transversely over a pivot rod.

[00154] H2. The pop-up drain stopper of embodiment H1, wherein the body has at least two flanges along its length, wherein the flanges project radially from the body, wherein each prong has an inside edge, wherein the inside edges of the prongs oppose each other and define the slot, wherein each inside edge of the opposing prongs comprises multiple notches or indentations, and wherein adjacent notches or indentations are separated by a projection.

[00155] H3. The pop-up drain stopper of embodiment H1, further comprising first and second flow diverter debris shields for diverting flow away from the pivot rod retainer, wherein each of the flow diverter debris shields has a length and opposing upper and lower ends, wherein the upper end of each of the flow diverter debris shields is fixed directly or indirectly to or formed integral with the body, wherein the lower end of each of the flow diverter debris shields is free.

[00156] H4. The pop-up drain stopper of embodiment H1, wherein the cap is threadedly connected to the body, wherein the body has at least two flanges along its length, wherein the flanges project radially from the body and define an outermost circumference of the body, wherein the cap has a diameter that is at least 1.75 times greater than the diameter of the outermost circumference of the body.

[00157] A drain stopper with a large cap for covering a drain flange

[00158] J1. A drain stopper for use with a pop-up drain assembly in a sink that has a drain opening, the pop-up drain assembly having a drain pipe in the drain opening and a drain flange sealed against the sink and surrounding the drain opening, the drain stopper comprising: a shaft having a length, a longitudinal axis through the length of the shaft, an upper end and an opposing lower end; a cap received on the upper end of the shaft, wherein the cap includes an uppermost portion and a gasket for providing a seal against the drain flange for retaining fluid in the sink, and wherein the uppermost portion

has a diameter; at least two radial flanges that extend along the length of the shaft and project radially with respect to the longitudinal axis of the shaft, wherein the radial flanges either intersect to define the shaft or are attached to the shaft or are formed integral with the shaft, wherein the radial flanges define a circumference that has a diameter, wherein the diameter of the uppermost portion of the cap is at least 1.5 times the diameter of the circumference defined by the radial flanges, wherein the diameter of the uppermost portion of the cap is no more than 5 times the diameter of the circumference defined by the radial flanges; and a pivot rod holder that depends downwardly from the lower end of the shaft or that depends downwardly from the radial flanges. The diameter of the uppermost portion of the cap is preferably between 2 and 4 times the diameter of the circumference defined by the radial flanges, and more preferably between 2.25 and 3.5 times the diameter of the circumference defined by the radial flanges.

[00159] J2. The drain stopper of embodiment J1, wherein the diameter of the uppermost portion of the cap is greater than the diameter of the drain flange.

[00160] J3. The drain stopper of embodiment J1, wherein the cap is made of a polymeric material, and wherein the uppermost portion of the cap has an upper surface, further comprising a metal sheet covering the upper surface of the cap.

[00161] A strainer for a drain stopper

[00162] K. A strainer for a drain stopper, comprising a generally cylindrical basket having a base, a side wall and an upper end, wherein the side wall and upper end is flared outwardly with respect to the base, wherein the side wall has one or more longitudinal slots for accommodating one or more longitudinal fins on a drain stopper, wherein the base has an opening sized and designed to allow the strainer to be slipped onto the drain stopper, wherein the opening is defined by a portion of the strainer that provides a friction fit with the stopper, and wherein the strainer has a plurality of holes through which water can flow.

[00163] A pop-up drain assembly with a strainer

[00164] L1. A pop-up drain assembly for a sink or basin having a drain opening, comprising: piping for providing a fluid flow pathway from the sink or basin

through the drain opening and through the piping, wherein the piping has an inside wall that defines the fluid flow pathway, and wherein the piping has a pivot rod port; a stopper for retaining fluid in the sink or basin, wherein the stopper is received in the piping while in operation and is moveable between an open position and a closed position; a pivot rod for moving the stopper between the open position and the closed position, wherein the pivot rod is attached to the piping at the pivot rod port, wherein the pivot rod is pivotable between upward and downward positions; and a strainer, wherein the stopper comprises: a shaft having a length, a longitudinal axis through the length of the shaft, an upper end and an opposing lower end; a cap received on the upper end for providing a seal to retain fluid in the sink or basin; at least two radial flanges, wherein the radial flanges extend along the length of the shaft, wherein the radial flanges either intersect to define the shaft or are attached to the shaft or are formed integral with the shaft, and wherein the radial flanges project radially with respect to the longitudinal axis of the shaft for centering the drain stopper in a drain pipe; and a pivot rod holder that depends downwardly from the lower end of the shaft or that depends downwardly from the radial flanges, wherein the pivot rod holder comprises a pair of opposing prongs, wherein each of the prongs has an inside edge, wherein a gap is defined between the inside edges of the opposing prongs; and wherein the pivot rod is received in the gap and held between the prongs in a friction fit, wherein the strainer is received on an upper portion of the pivot rod holder, and wherein the strainer surrounds the shaft.

[00165] L2. The pop-up drain assembly of embodiment L1, wherein the strainer has a lowermost base, wherein the base of the strainer has a slot extending along its diameter, and wherein the slot is sized and designed for the pivot rod holder to pass through the slot.

[00166] L3. The pop-up drain assembly of embodiment L2, wherein opposing projections define the slot, and wherein the projections press against the pivot rod holder for providing friction for securing the strainer to the pivot rod holder.

[00167] L4. The pop-up drain assembly of embodiment L3, wherein the stopper has a transition portion above the upper portion of the pivot rod holder, wherein

the transition portion has a rectangular cross-section, wherein the upper portion of the pivot rod retainer has a rectangular cross-section that is larger than the rectangular cross-section of the transition portion, wherein a shoulder is defined between the transition portion and the upper portion of the pivot rod holder, wherein the projections that define the slot in the base of the strainer are adjacent to the transition portion and above the shoulder so that the shoulder tends to keep the strainer from sliding down past the pivot rod holder while in use.

[00168] Having described the invention above, various modifications of the techniques, procedures, materials, and equipment will be apparent to those skilled in the art. It is intended that all such variations within the scope and spirit of the invention be included within the scope of the appended claims.

CLAIMS

1. A pop-up drain assembly for a sink or basin having a drain opening, comprising:
 - piping for providing a fluid flow pathway from the sink or basin through the drain opening and through the piping, wherein the piping has an inside wall that defines the fluid flow pathway, and wherein the piping has a pivot rod port;
 - a stopper for retaining fluid in the sink or basin, wherein the stopper is received in the piping while in operation and is moveable between an open position and a closed position; and
 - a pivot rod for moving the stopper between the open position and the closed position, wherein the pivot rod is attached to the piping at the pivot rod port, wherein the pivot rod is pivotable between upward and downward positions, wherein the stopper comprises:
 - a shaft having a length, a longitudinal axis through the length of the shaft, an upper end and an opposing lower end;
 - a cap received on the upper end for providing a seal to retain fluid in the sink or basin;
 - at least two radial flanges, wherein the radial flanges extend along the length of the shaft, wherein the radial flanges either intersect to define the shaft or are attached to the shaft or are formed integral with the shaft, and wherein the radial flanges project radially with respect to the longitudinal axis of the shaft for centering the drain stopper in a drain pipe;
 - a pivot rod holder that depends downwardly from the lower end of the shaft or that depends downwardly from the radial flanges, wherein the pivot rod holder comprises a pair of opposing prongs, wherein each of the prongs has an inside edge, and wherein a gap is defined between the inside edges of the opposing prongs; and
 - a flexible material bonded to or formed integral with at least one of the inside edges,

wherein the pivot rod is received in the gap and held between the prongs in a friction fit, and

wherein the pop-up drain assembly further comprising a strainer around the shaft.

2. The pop-up drain assembly of claim 1, wherein there are four radial flanges that extend along the length of the shaft and project radially with respect to the longitudinal axis of the shaft, further comprising a disc at the upper end of the shaft that projects radially with respect to the longitudinal axis of the shaft and a threaded stud that projects from the disc along the longitudinal axis of the shaft, wherein the cap is threadedly connected to the threaded stud.

3. The pop-up drain assembly of claim 1, wherein the radial flanges define an outermost circumference of the stopper around the shaft, and wherein the maximum diameter of the cap is at least twice and no more than 4.5 times the diameter of the outermost circumference defined by the radial flanges around the shaft.

4. The pop-up drain assembly of claim 1, wherein the cap has a maximum diameter that is between two and three inches.

5. The pop-up drain assembly of claim 1, wherein the cap has a dome-shaped upper portion, a cylindrical-shaped lower portion and a seal around the cylindrical-shaped lower portion, wherein the dome-shaped upper portion has a diameter between 2.25 and 2.75 inches.

6. The pop-up drain assembly of claim 1, further comprising first and second flow diverter debris shields for diverting flow away from the lower end of the shaft, wherein each of the flow diverter debris shields has a length and opposing upper and lower ends, wherein the upper end of each of the flow diverter debris shields is fixed to or formed integral with the shaft or one of the radial flanges, wherein the lower end of each of the

flow diverter debris shields is free, and wherein the lower end of each of the flow diverter debris shields is spaced radially outwardly from the longitudinal axis of the shaft.

7. The pop-up drain assembly of claim 1, wherein the strainer comprises a generally cylindrical basket having a base, a side wall and an upper end, wherein the side wall and upper end is flared outwardly with respect to the base, wherein the side wall has a slot for accommodating each of the radial flanges on the stopper, wherein the base has an opening sized and designed to allow the strainer to be slipped onto the stopper, wherein the opening is defined by a portion of the strainer that provides a friction fit with the stopper, and wherein the strainer has a plurality of holes through which water can flow.

8. The pop-up drain assembly of claim 1, wherein the strainer has a lowermost base, wherein the base of the strainer has a slot extending along its diameter, wherein the slot is sized and designed for the pivot rod holder to pass through the slot, wherein opposing projections define the slot, wherein the projections press against the pivot rod holder for providing friction for securing the strainer to the pivot rod holder, wherein the stopper has a transition portion above an upper portion of the pivot rod holder, wherein the transition portion has a rectangular cross-section, wherein the upper portion of the pivot rod retainer has a rectangular cross-section that is larger than the rectangular cross-section of the transition portion, wherein a shoulder is defined between the transition portion and the upper portion of the pivot rod holder, wherein the projections that define the slot in the base of the strainer are adjacent to the transition portion and above the shoulder so that the shoulder tends to keep the strainer from sliding down past the pivot rod holder while in use.

9. A drain stopper for a sink or basin, comprising:
a shaft having a length, a longitudinal axis through the length of the shaft,
an upper end and an opposing lower end;

a cap received on the upper end for providing a seal to retain fluid in the sink or basin;

at least two radial flanges, wherein the radial flanges extend along the length of the shaft, wherein the radial flanges either intersect to define the shaft or are attached to the shaft or are formed integral with the shaft, and wherein the radial flanges project radially with respect to the longitudinal axis of the shaft for centering the drain stopper in a drain pipe;

a pivot rod holder that depends downwardly from the lower end of the shaft or that depends downwardly from the radial flanges, wherein the pivot rod holder comprises a pair of opposing prongs, wherein each of the prongs has an inside edge, and wherein a gap is defined between the inside edges of the opposing prongs;

a flexible material bonded to or formed integral with at least one of the inside edges; and

a strainer around the shaft.

10. The drain stopper of claim 9, wherein the flexible material is bonded to or formed integral with each of the inside edges, and wherein the opposing prongs are spaced apart from each other so that a pivot rod can be received in the gap and can be held within the gap due to friction between the pivot rod and the flexible material.

11. The drain stopper of claim 10, wherein each inside edge of the opposing prongs lies on an essentially straight line.

12. The drain stopper of claim 9, wherein the prongs have a length that is approximately equal to the length of the shaft.

13. The drain stopper of claim 9, further comprising first and second flow diverter debris shields for diverting flow away from the lower end of the shaft, wherein each of the flow diverter debris shields has a length and opposing upper and lower ends, wherein the

upper end of each of the flow diverter debris shields is fixed to or formed integral with the shaft or one of the radial flanges, and wherein the lower end of each of the flow diverter debris shields is free and spaced radially outwardly from the longitudinal axis of the shaft.

14. The drain stopper of claim 13, wherein each inside edge of the opposing prongs comprises multiple notches or indentations, and wherein adjacent notches or indentations are separated by a projection.

15. The drain stopper of claim 9, wherein the flexible material is an elastomeric material, wherein the elastomeric material is bonded to each of the inside edges, and wherein the opposing prongs are spaced apart a distance that will provide a snug friction fit for a pivot rod.

16. The drain stopper of claim 9, wherein the cap is threadedly connected to the shaft, and wherein the distance between the cap and the lower end of the shaft can be changed by rotating the cap with respect to the shaft.

17. The drain stopper of claim 9, wherein the diameter of the uppermost portion of the cap is at least twice and no more than 4.5 times the diameter of the circumference defined by the radial flanges.

18. The drain stopper of claim 9, wherein the cap has a maximum diameter that is between two and three inches.

19. The drain stopper of claim 9, wherein the strainer has a lowermost base, wherein the base of the strainer has a slot extending along its diameter, wherein the slot is sized and designed for the pivot rod holder to pass through the slot, wherein opposing projections define the slot, wherein the projections press against the pivot rod holder for providing friction for securing the strainer to the pivot rod holder, wherein the stopper has a transition

portion above an upper portion of the pivot rod holder, wherein the transition portion has a rectangular cross-section, wherein the upper portion of the pivot rod retainer has a rectangular cross-section that is larger than the rectangular cross-section of the transition portion, wherein a shoulder is defined between the transition portion and the upper portion of the pivot rod holder, wherein the projections that define the slot in the base of the strainer are adjacent to the transition portion and above the shoulder so that the shoulder tends to keep the strainer from sliding down past the pivot rod holder while in use.

20. A drain stopper for use with a pop-up drain assembly in a sink that has a drain opening, the pop-up drain assembly having a drain pipe in the drain opening and a drain flange sealed against the sink and surrounding the drain opening, the drain stopper comprising:

- a shaft having a length, a longitudinal axis through the length of the shaft, an upper end and an opposing lower end;

- a cap received on the upper end of the shaft, wherein the cap includes an uppermost portion and a gasket for providing a seal against the drain flange for retaining fluid in the sink, and wherein the uppermost portion has a diameter;

- at least two radial flanges that extend along the length of the shaft and project radially with respect to the longitudinal axis of the shaft, wherein the radial flanges either intersect to define the shaft or are attached to the shaft or are formed integral with the shaft, wherein the radial flanges define a circumference that has a diameter, and wherein the maximum diameter of the cap is between 1.5 and 4.0 times the diameter of the circumference defined by the radial flanges;

- a pivot rod holder that depends downwardly from the lower end of the shaft or that depends downwardly from the radial flanges, wherein the pivot rod holder comprises a pair of opposing prongs, wherein each of the prongs has an inside edge, wherein a gap is defined between the inside edges of the opposing prongs, wherein a flexible, resilient or elastomeric material is bonded to or formed integral with at least one of the inside edges, and wherein the pivot rod holder is sized and designed

to be pressed onto a pivot rod and to hold the pivot rod in a friction grip in the gap between the prongs; and

a strainer around the shaft.

21. The drain stopper of claim 20, wherein the lower end of the pivot rod holder has a “V” shape, and wherein the “V” shape points inwardly toward the gap for feeding the pivot rod into the gap.

22. The drain stopper of claim 20, wherein there are four radial flanges that extend along the length of the shaft and project radially with respect to the longitudinal axis of the shaft, further comprising a disc at the upper end of the shaft that projects radially with respect to the longitudinal axis of the shaft and a threaded stud that projects from the disc along the longitudinal axis of the shaft, wherein the cap is threadedly connected to the threaded stud.

23. The drain stopper of claim 20, wherein the maximum diameter of the cap is between 2.0 and 3.0 times the diameter of the circumference defined by the radial flanges.

24. The drain stopper of claim 20, wherein the drain flange has a diameter, and wherein the diameter of the uppermost portion of the cap is greater than the diameter of the drain flange.

25. The drain stopper of claim 20, further comprising a disc at the upper end of the shaft that projects radially with respect to the longitudinal axis of the shaft and a threaded stud that projects from the disc along the longitudinal axis of the shaft, wherein the cap has a lower portion that comprises a bore defined by threads, wherein the threaded stud is received in the bore, and wherein the cap has a maximum diameter that is at least 1.75 times the diameter of the disc.

26. The drain stopper of claim 20, wherein the strainer has a lowermost base, wherein the base of the strainer has a slot extending along its diameter, wherein the slot is sized and designed for the pivot rod holder to pass through the slot, wherein opposing projections define the slot, wherein the projections press against the pivot rod holder for providing friction for securing the strainer to the pivot rod holder, wherein the stopper has a transition portion above an upper portion of the pivot rod holder, wherein the transition portion has a rectangular cross-section, wherein the upper portion of the pivot rod retainer has a rectangular cross-section that is larger than the rectangular cross-section of the transition portion, wherein a shoulder is defined between the transition portion and the upper portion of the pivot rod holder, wherein the projections that define the slot in the base of the strainer are adjacent to the transition portion and above the shoulder so that the shoulder tends to keep the strainer from sliding down past the pivot rod holder while in use.

27. A pop-up drain stopper for a sink or basin, comprising:
a body, wherein the body has a length and upper and lower ends;
a cap on the upper end of the body;
a pivot rod retainer on the lower end of the body, wherein the pivot rod retainer comprises a pair of opposing prongs, wherein the opposing prongs define a slot, wherein the slot has an upper end and a lower end, and wherein the lower end of the slot is open so that the pivot rod retainer can be pressed transversely over a pivot rod; and
a strainer received on the body between the upper end and the pivot rod retainer.

28. The pop-up drain stopper of claim 27, wherein the strainer surrounds the body and engages the body in a friction fit.

29. The pop-up drain stopper of claim 28, wherein the body has at least two fins that extend along the length of the body and project radially for centering the body in a drain pipe, wherein the strainer has a longitudinal slot for each fin, and wherein each fin is received in a corresponding slot in the strainer.

30. The pop-up drain stopper of claim 29, wherein the strainer has a lowermost base adjacent to the pivot rod retainer and an opposing open end that is closer to the cap than to the pivot rod retainer, wherein the base has a plurality of openings through which water can drain and a plurality of obstructions on which hair or other solid material may catch and be retained, and wherein the open end is open so that water will flow into the strainer.

31. The pop-up drain stopper of claim 30, wherein each of the open end and the base of the strainer has a diameter, and wherein the diameter of the open end of the strainer is greater than the diameter of the base.

32. The pop-up drain stopper of claim 27, wherein the strainer has a lowermost base adjacent to the pivot rod retainer, wherein the base of the strainer has a slot extending along its diameter, and wherein the slot is sized and designed for the pivot rod retainer to pass through the slot.

33. The pop-up drain stopper of claim 32, wherein opposing projections define the slot, and wherein the projections press against the pivot rod retainer or the body for providing friction for securing the strainer to the body or to the pivot rod retainer.

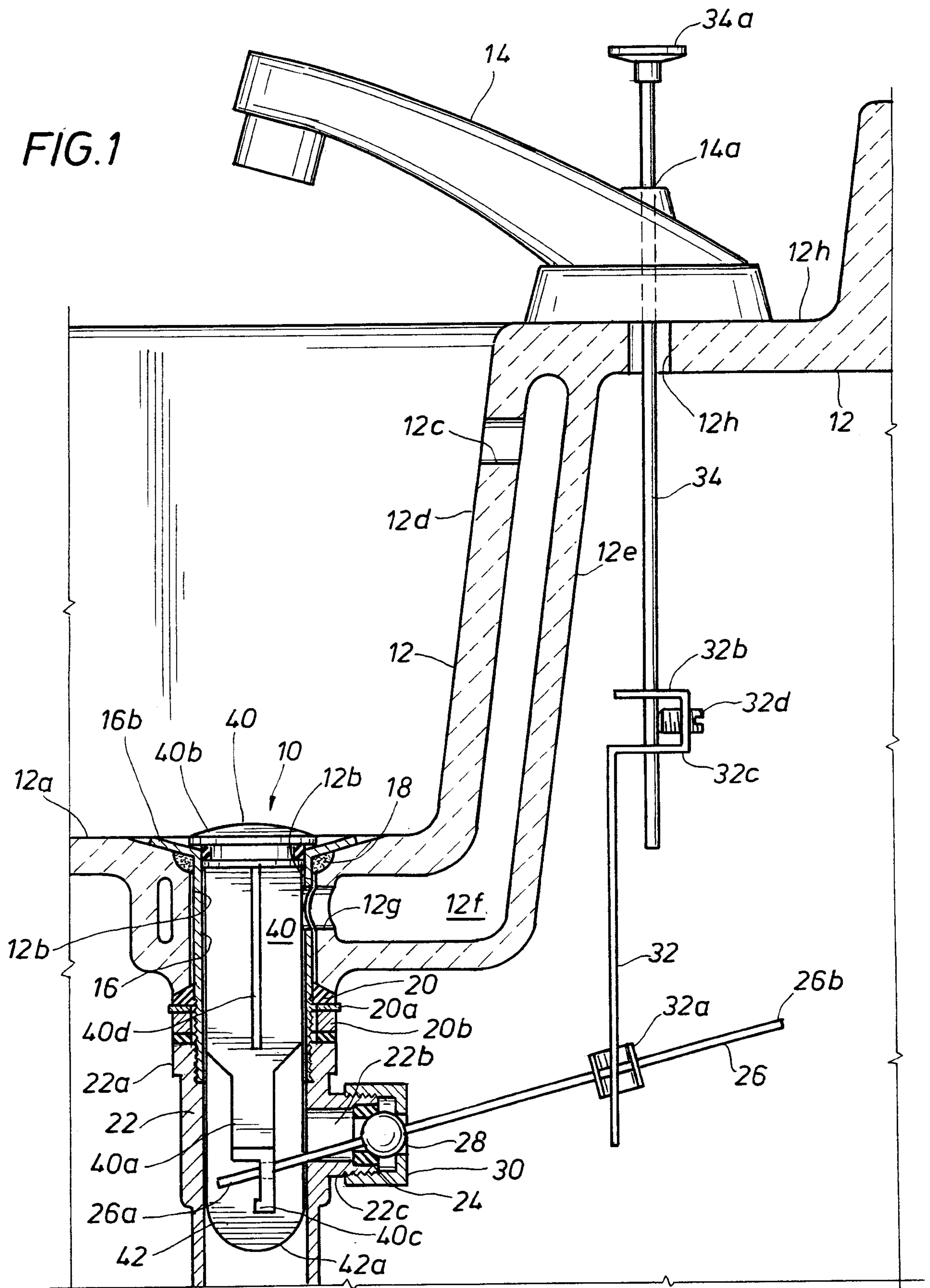
34. The pop-up drain stopper of claim 33, wherein the stopper has a transition portion between the body and the pivot rod retainer, wherein the transition portion has a rectangular cross-section, wherein the pivot rod retainer has an upper end, wherein the upper end of the pivot rod retainer has a rectangular cross-section that is larger than the rectangular cross-section of the transition portion, wherein a shoulder is defined between the transition portion and the upper end of the pivot rod retainer, wherein the projections that define the slot in the base of the strainer are adjacent to the transition portion and above the shoulder so that the shoulder tends to keep the strainer from sliding down past the pivot rod retainer while in use.

35. The pop-up drain stopper of claim 34, wherein the cap comprises a decorative uppermost portion and a resilient flange, wherein the resilient flange provides a sealing surface, and wherein the resilient flange is between the decorative uppermost portion and the body of the stopper.

36. The pop-up drain stopper of claim 35, wherein the body of the stopper has an outermost circumference, wherein the outermost circumference of the body has a body diameter, wherein the decorative flange has an outermost circumference, wherein the outermost circumference of the decorative flange has a decorative flange diameter, and wherein the decorative flange diameter is at least 1.5 times the body diameter.

37. The pop-up drain stopper of claim 36, wherein the decorative flange diameter is about twice to about 2.5 times the diameter of the outermost circumference of body.

FIG. 1



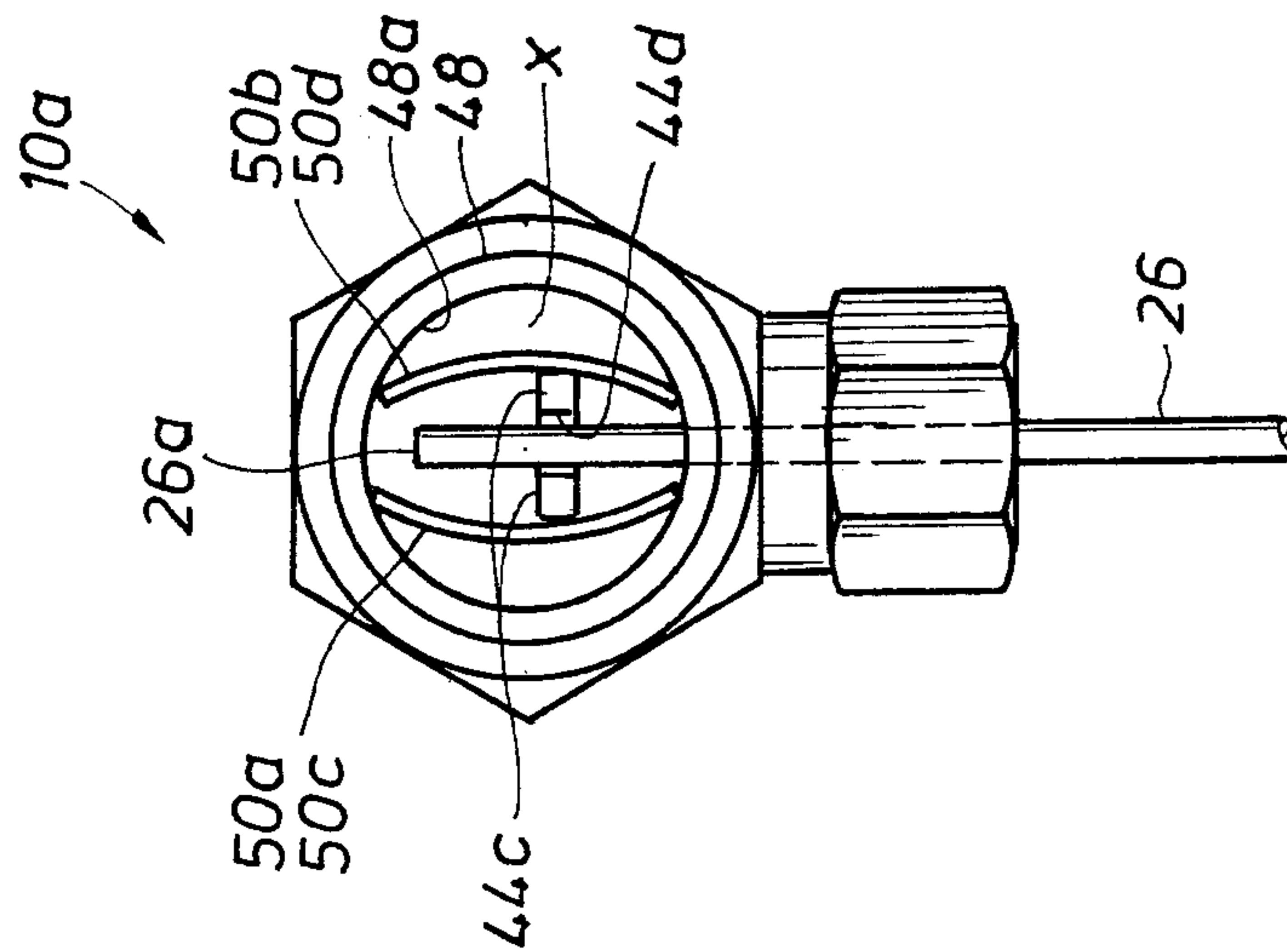
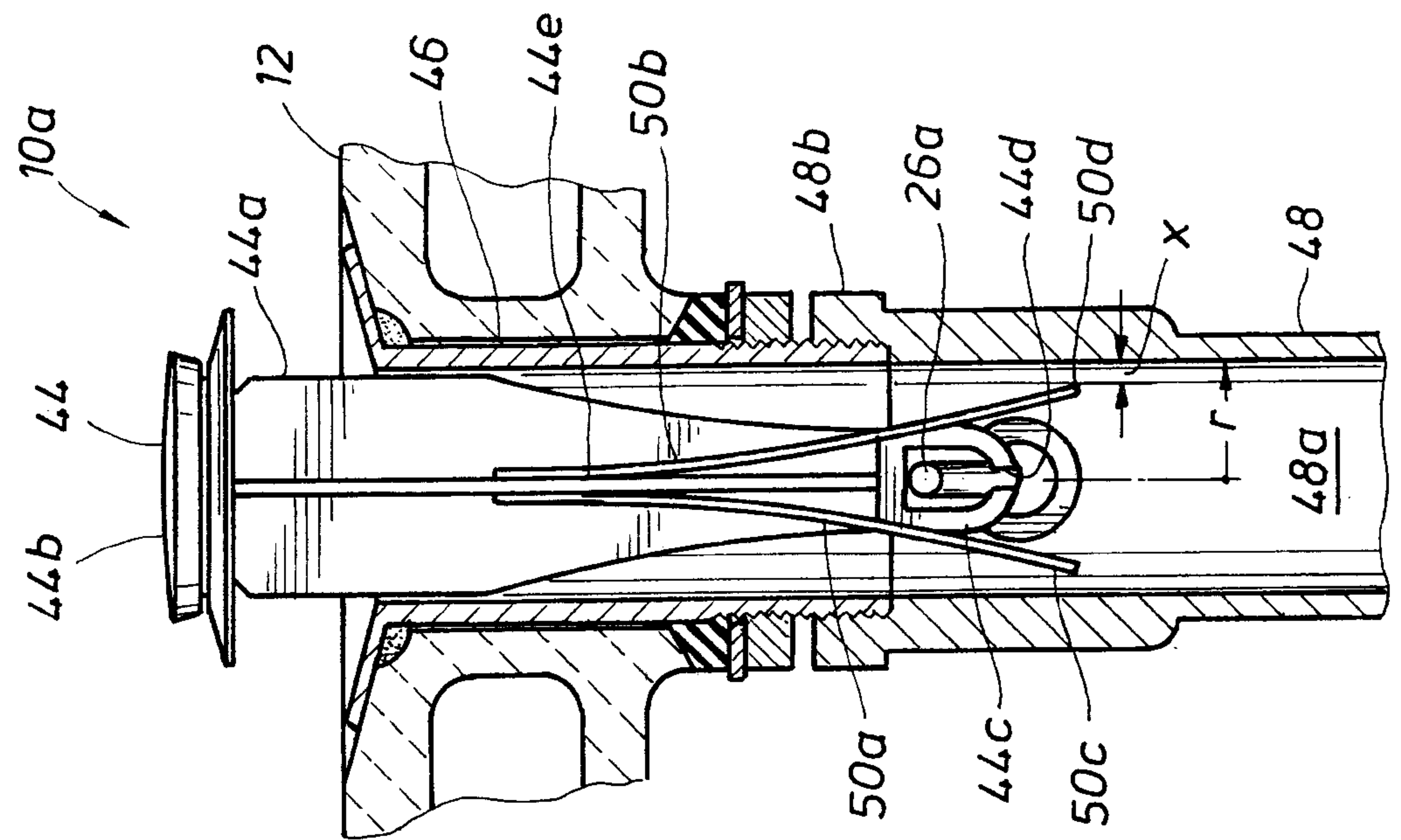


FIG. 2A

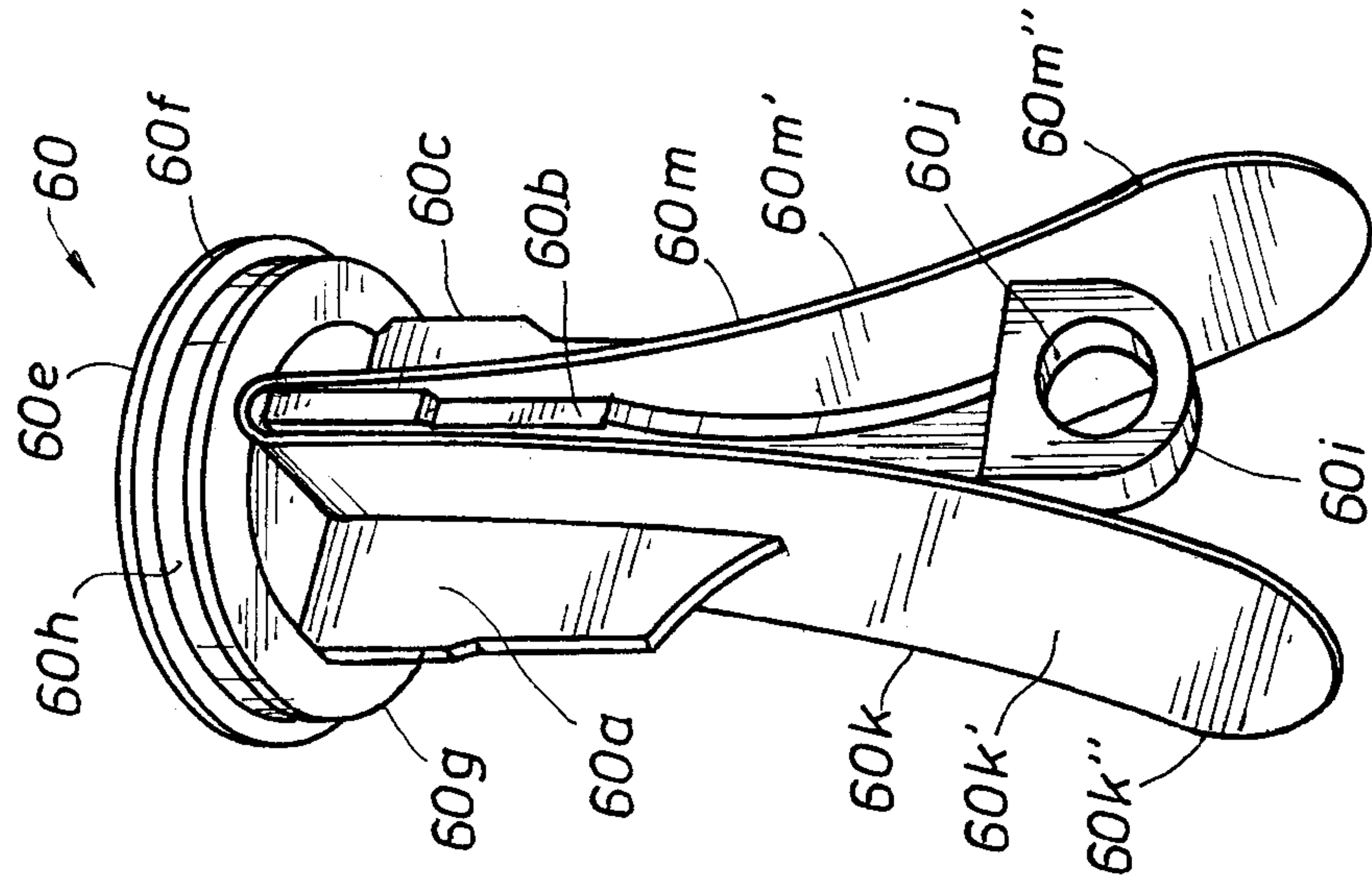


FIG. 3

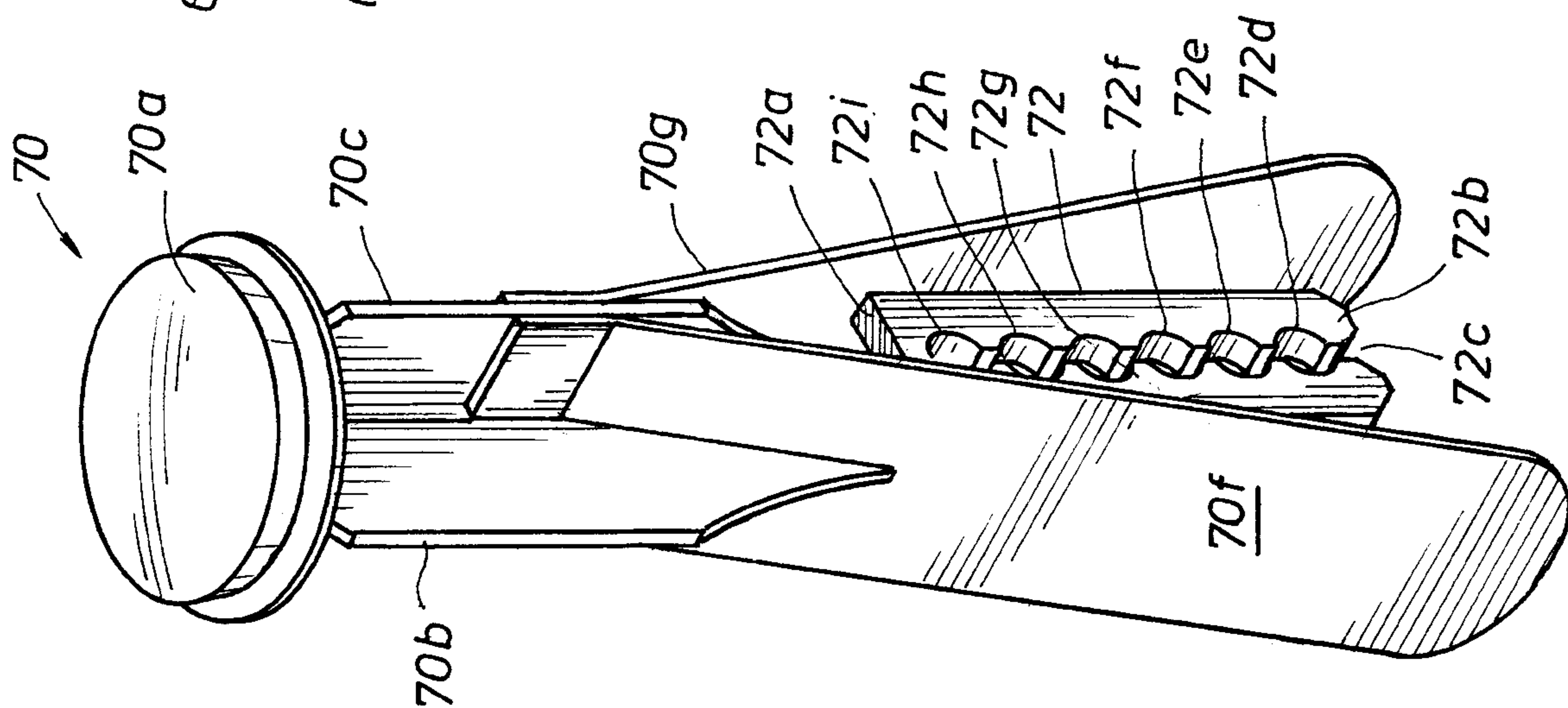
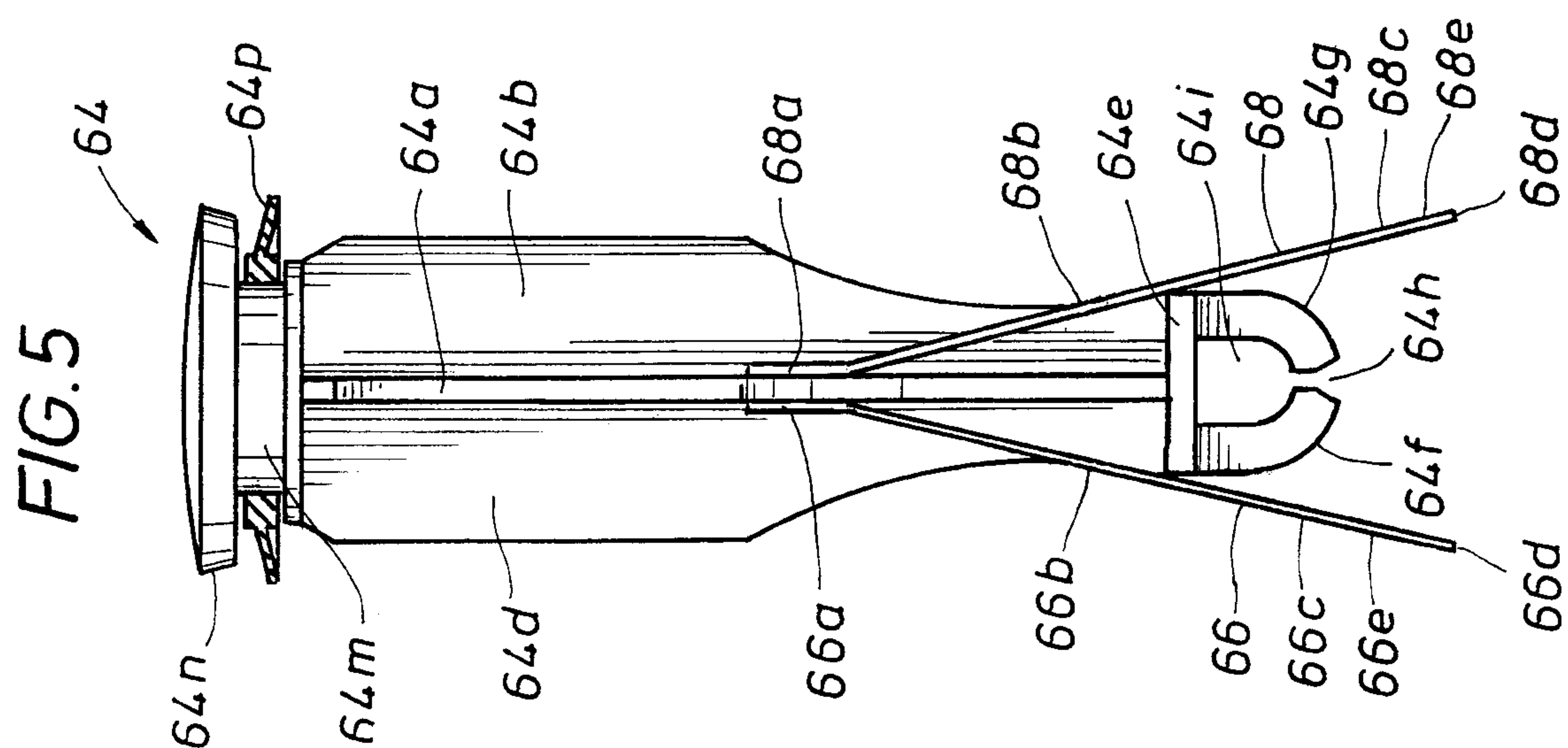
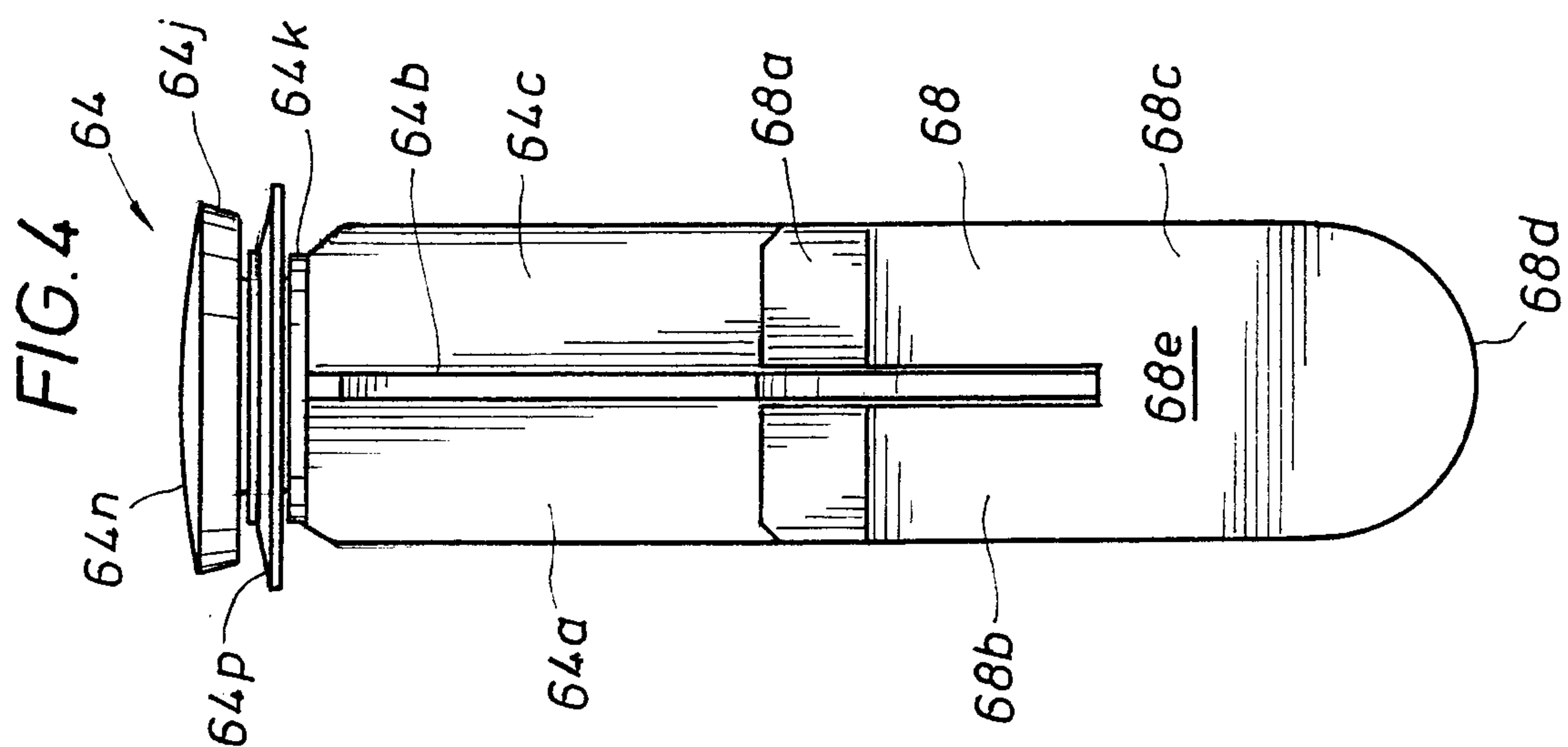


FIG. 6

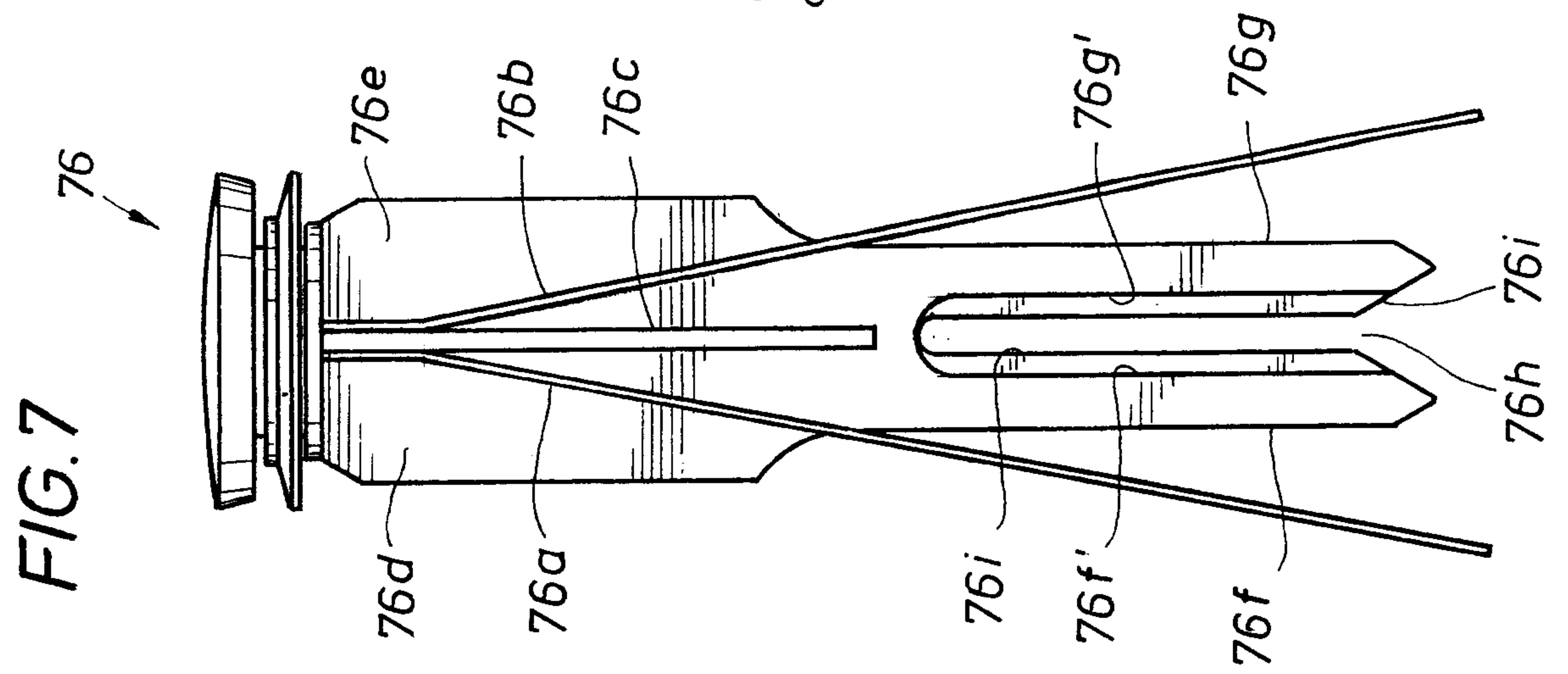


FIG. 7

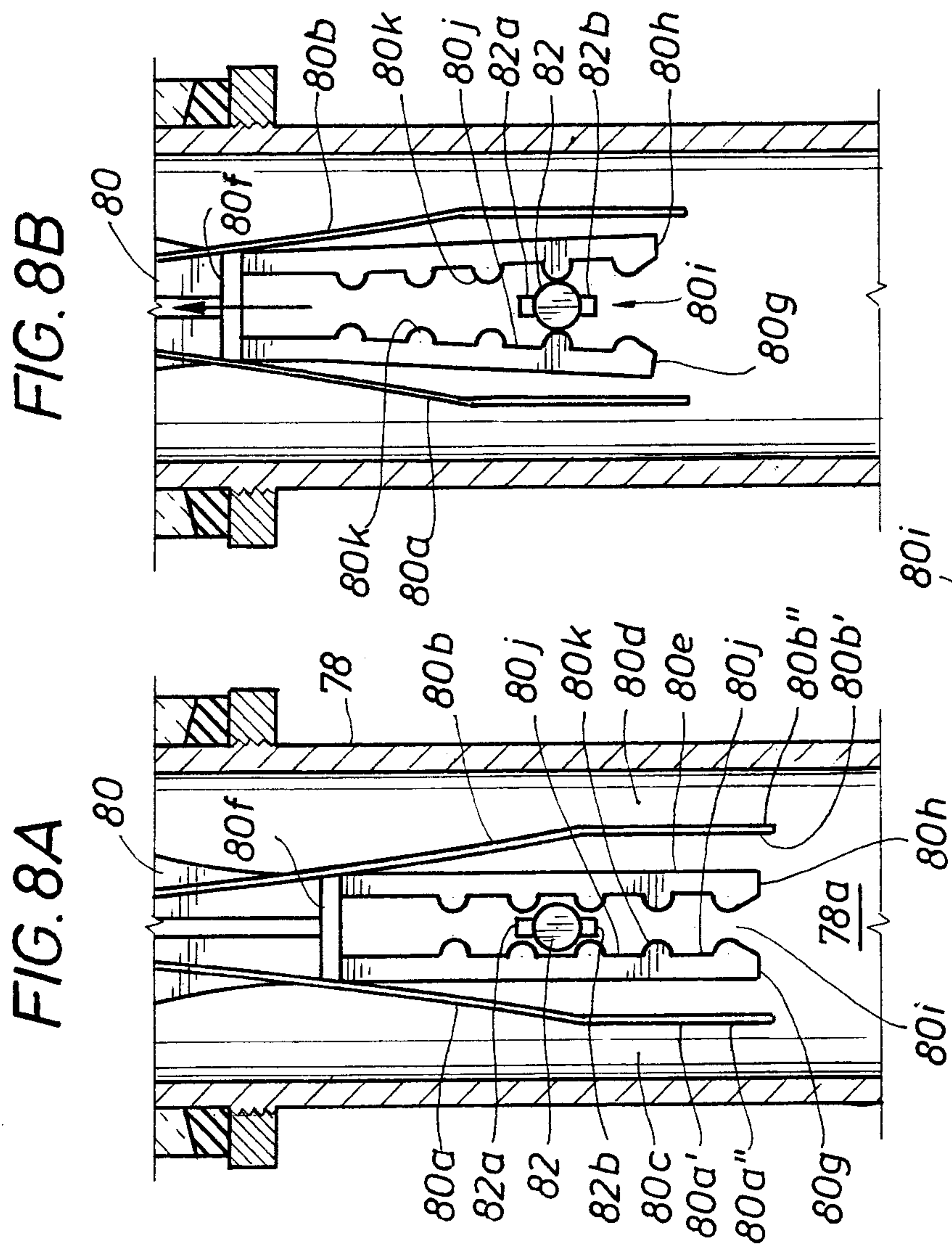


FIG. 8A

FIG. 8B

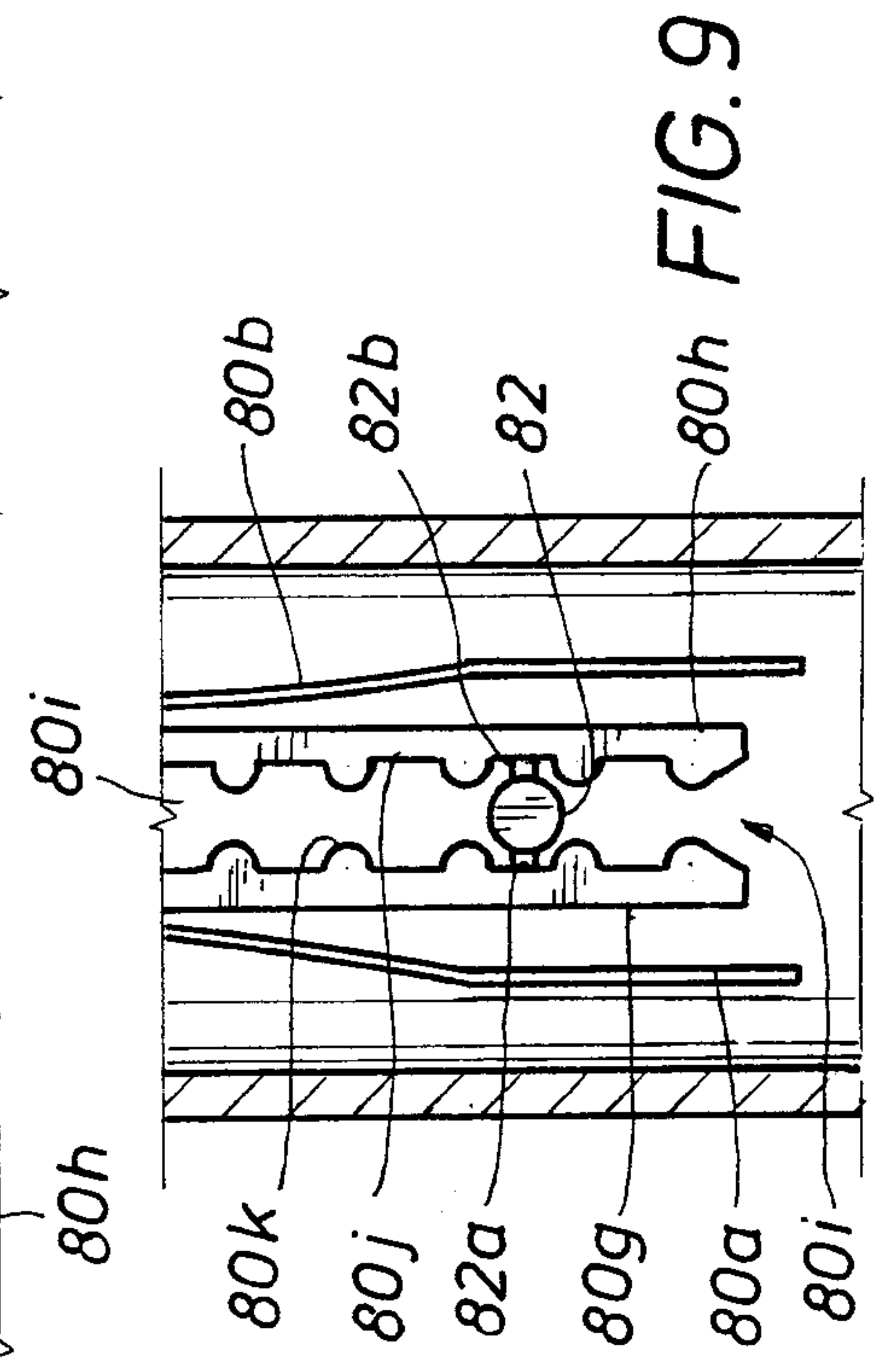
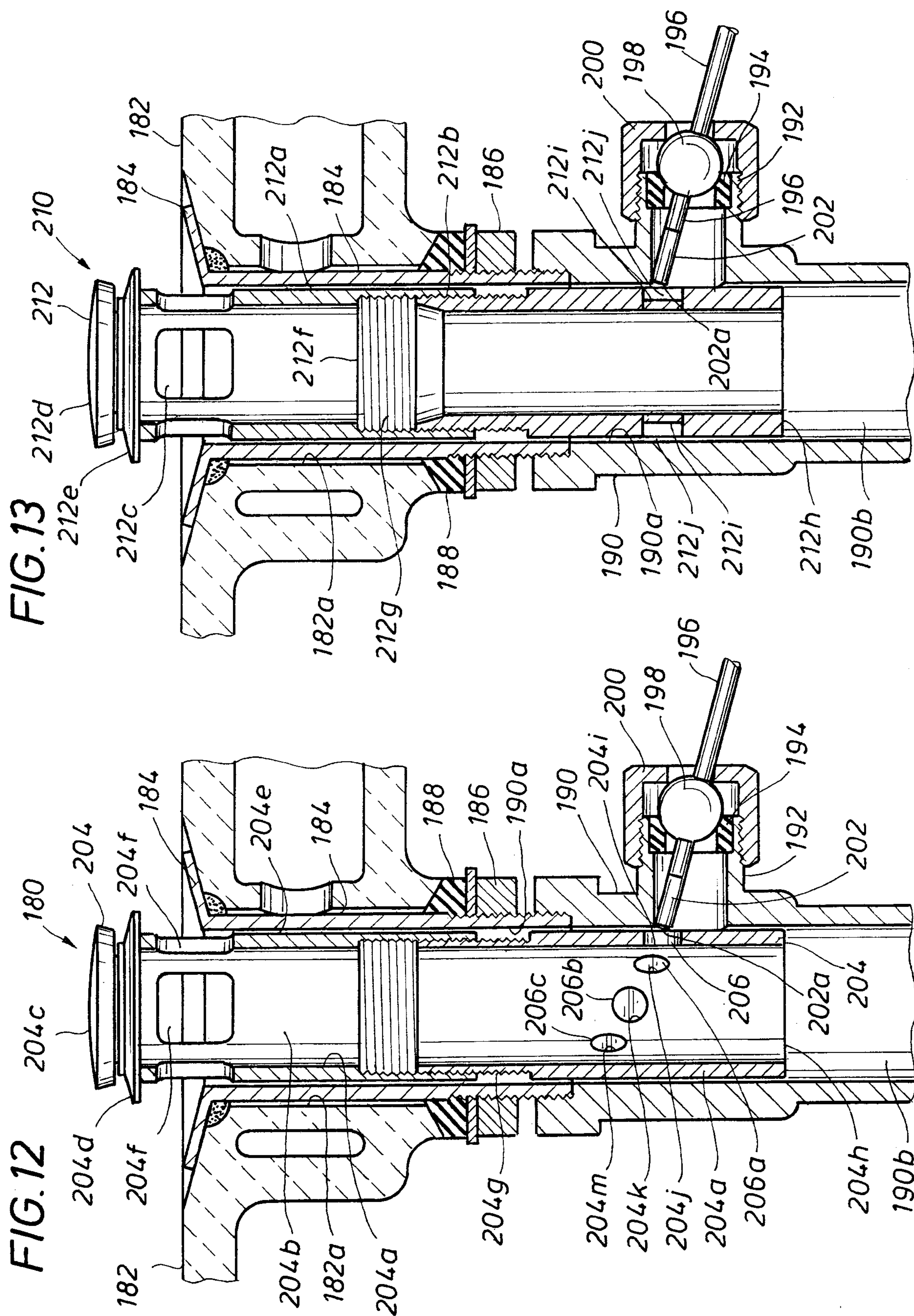


FIG. 9



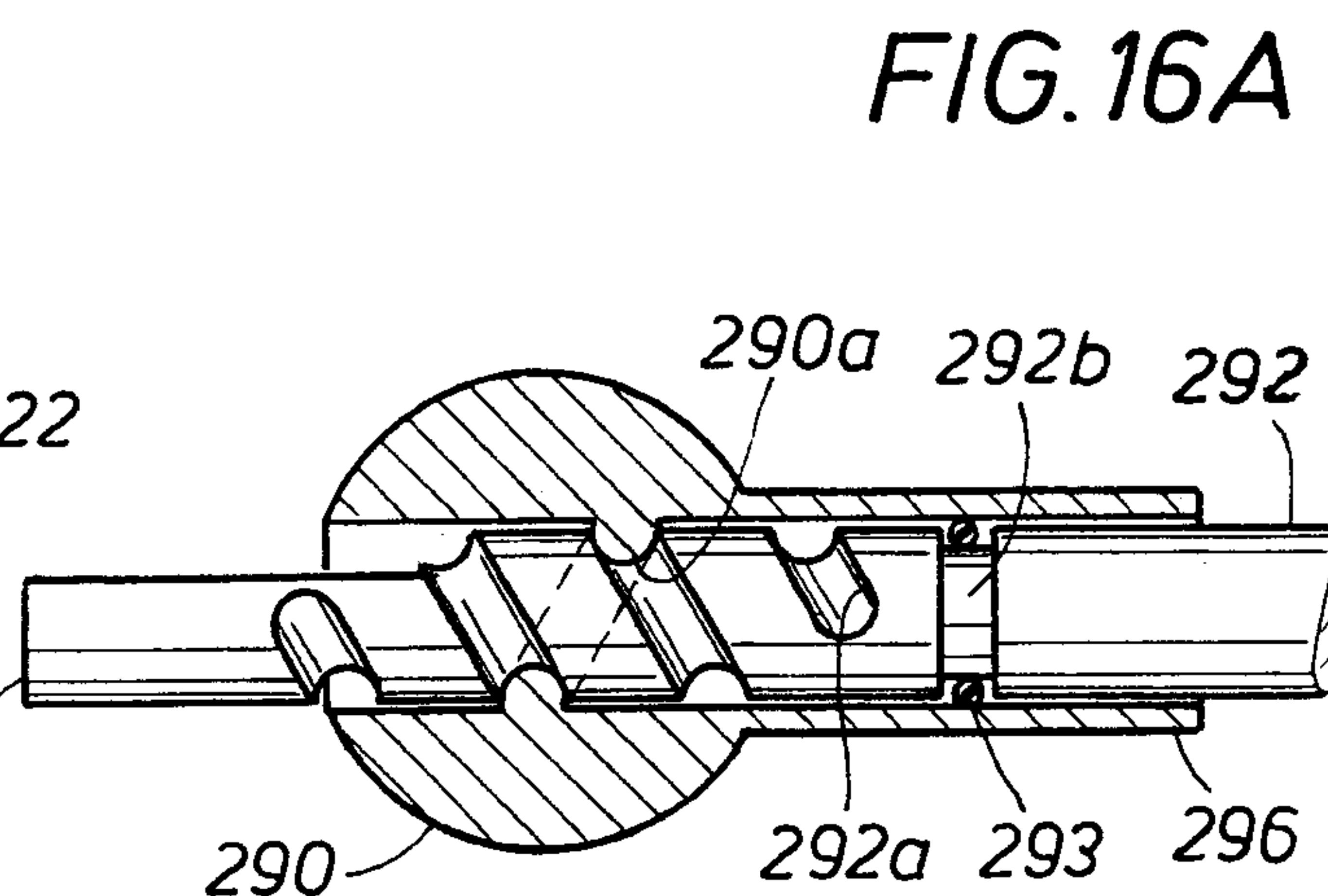
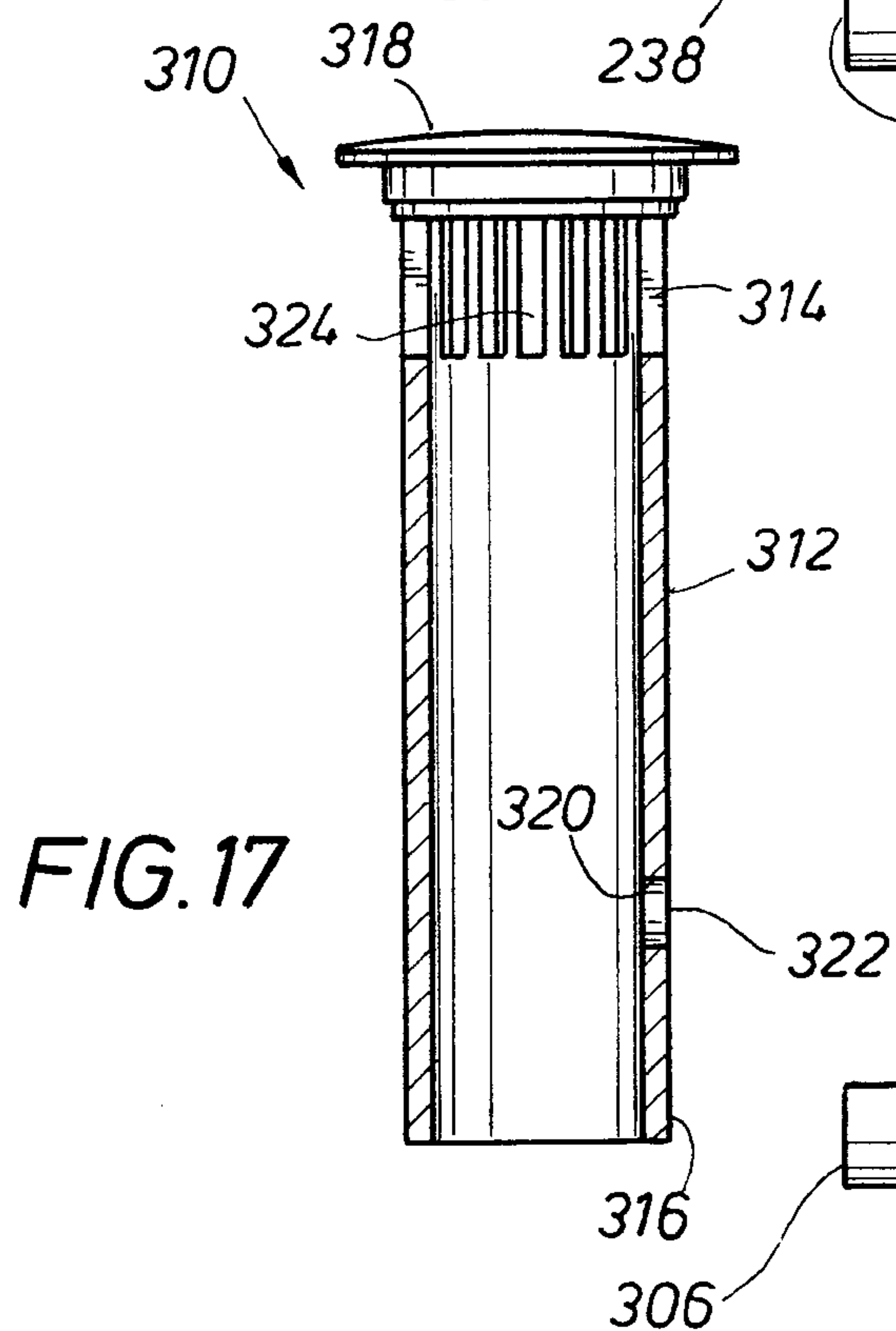
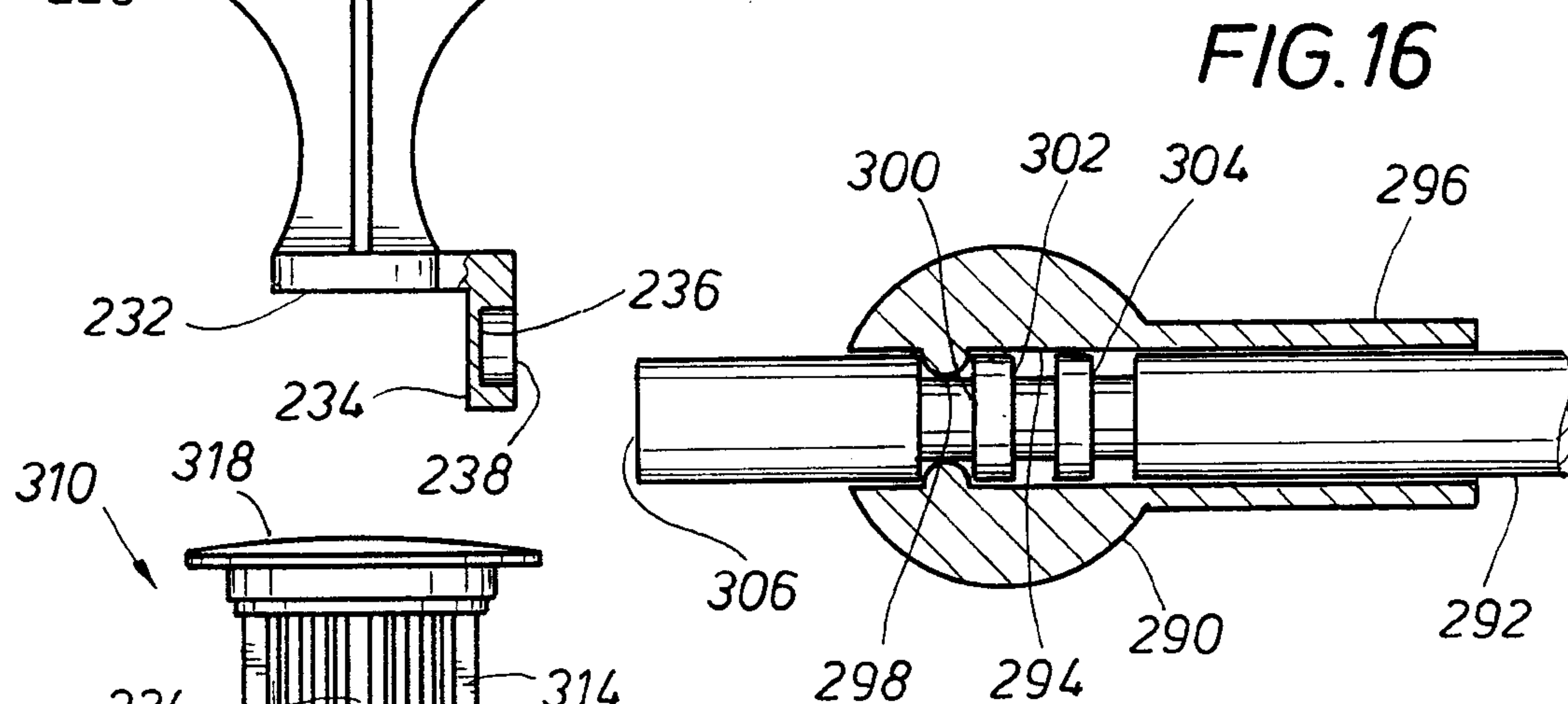
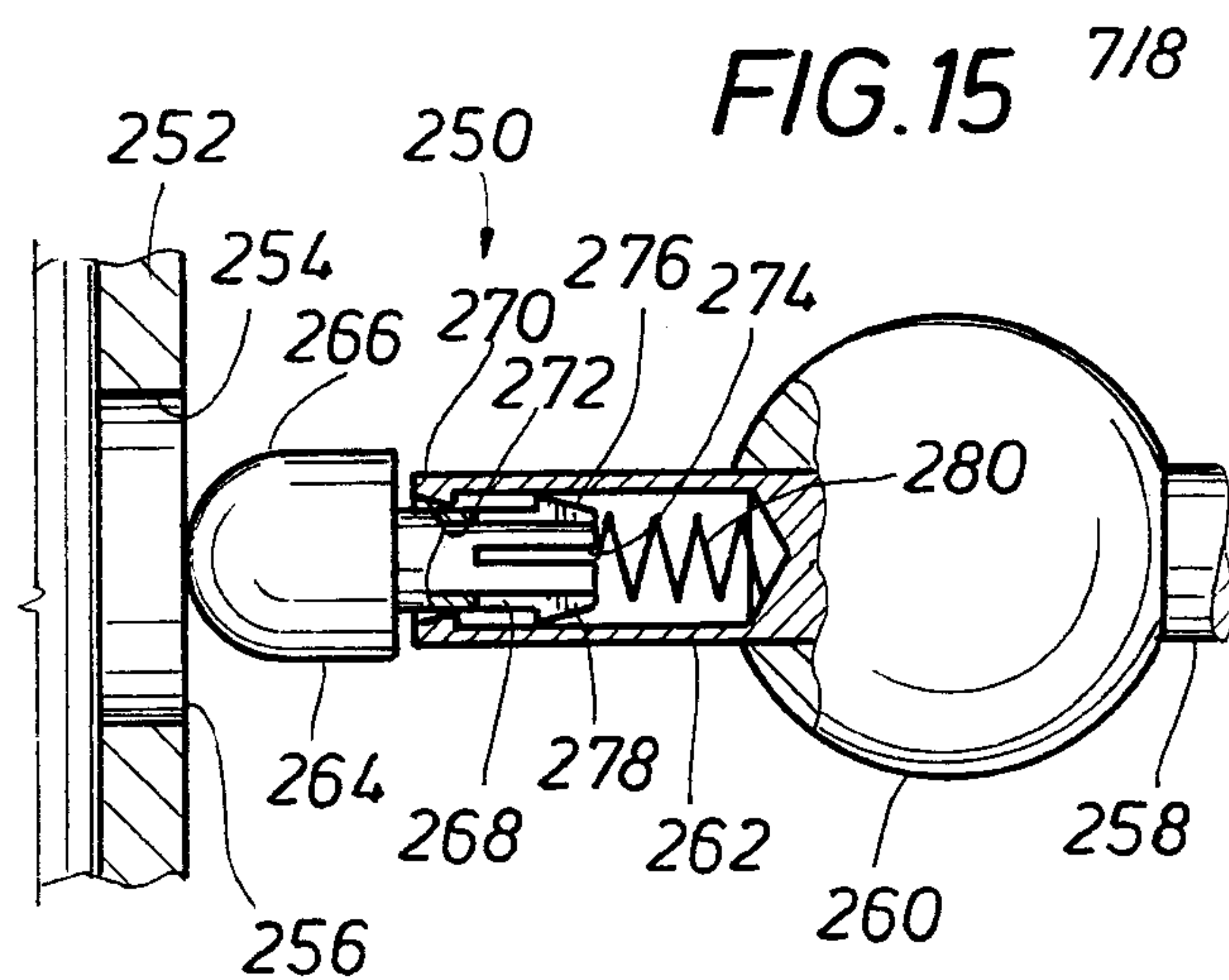
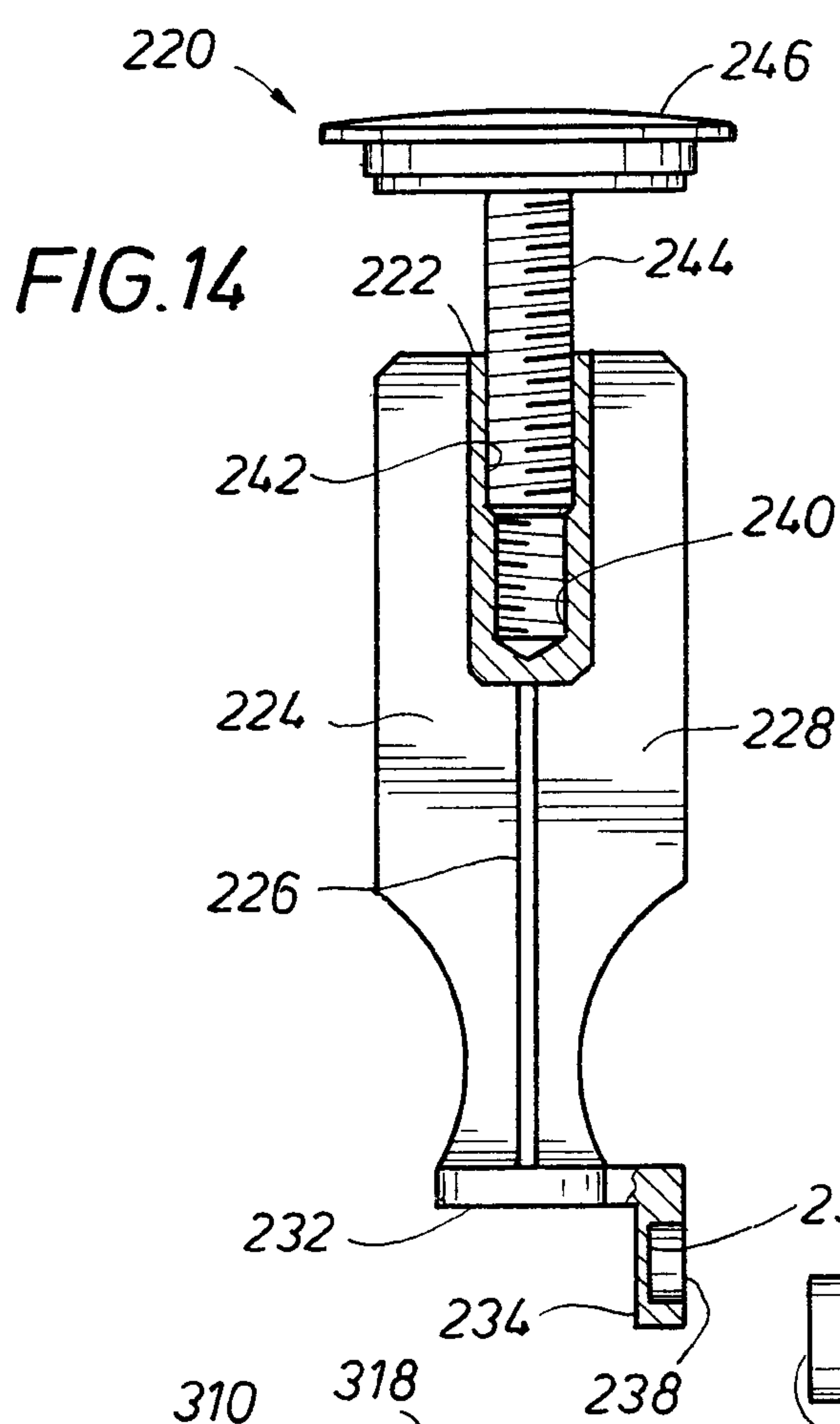


FIG. 19

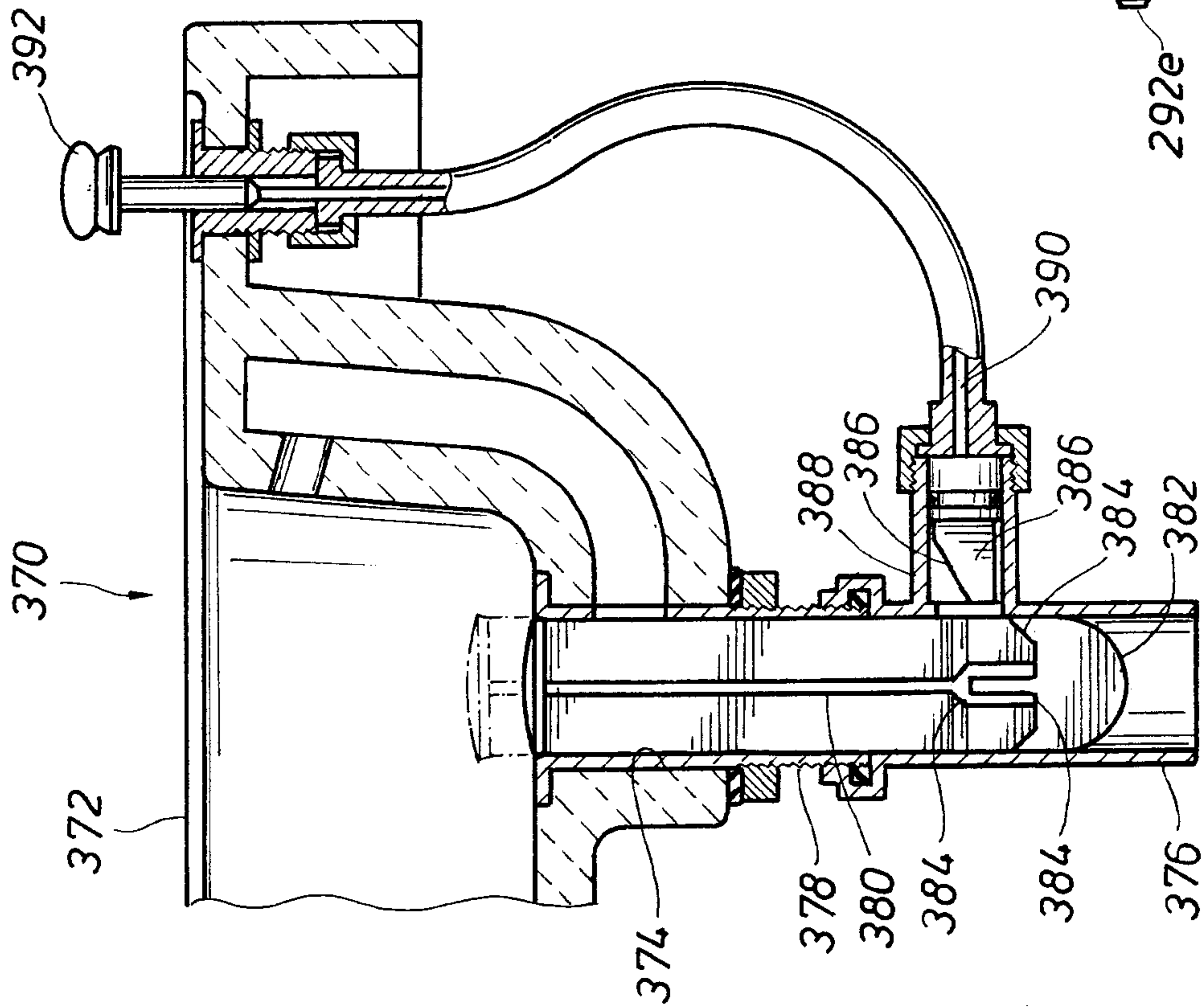


FIG. 18

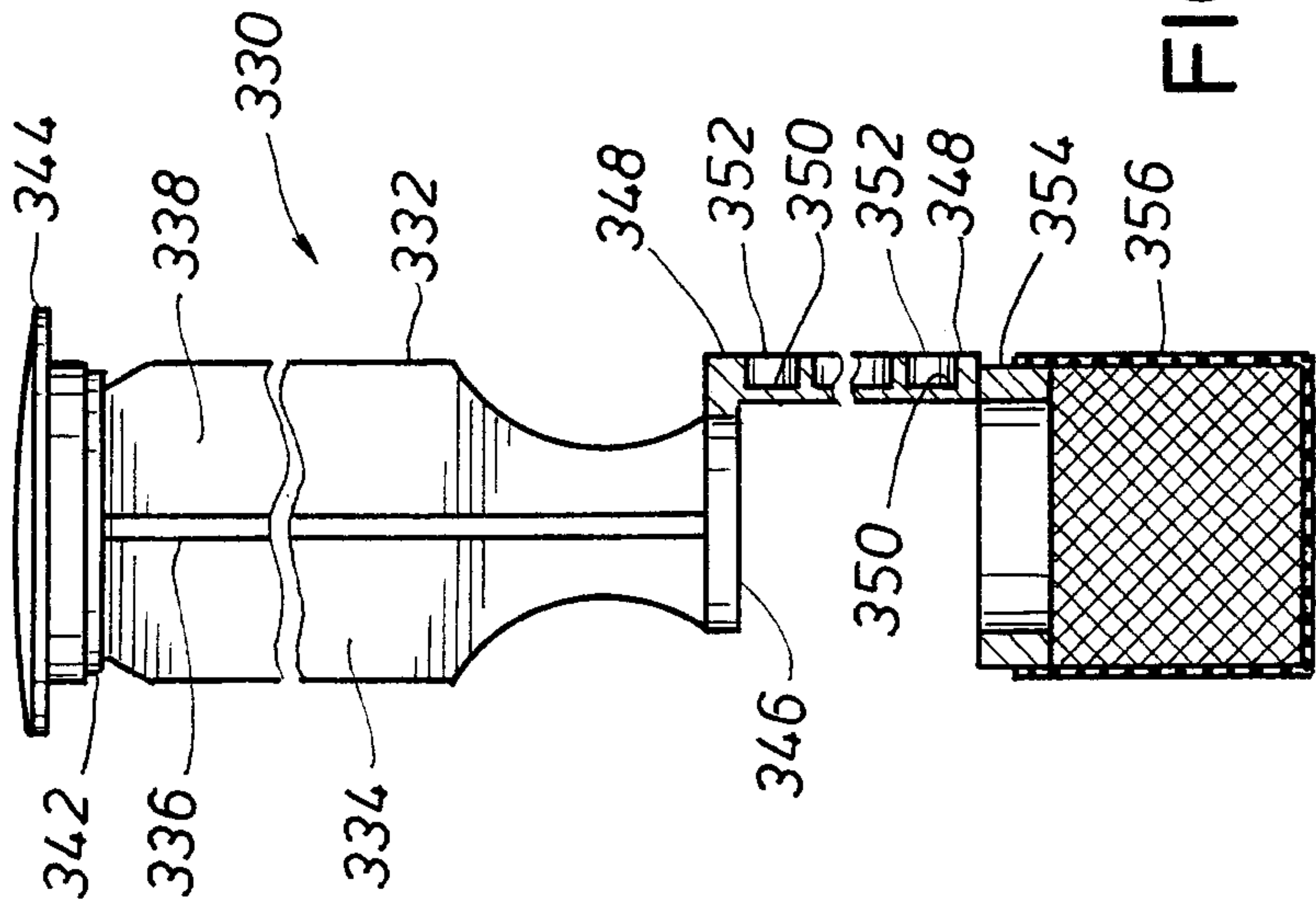
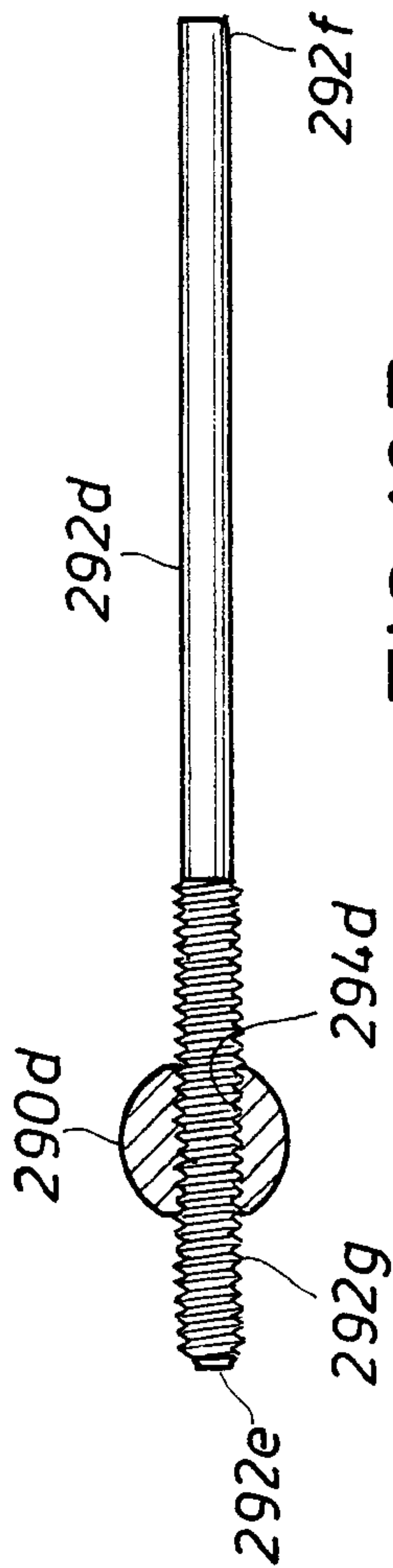
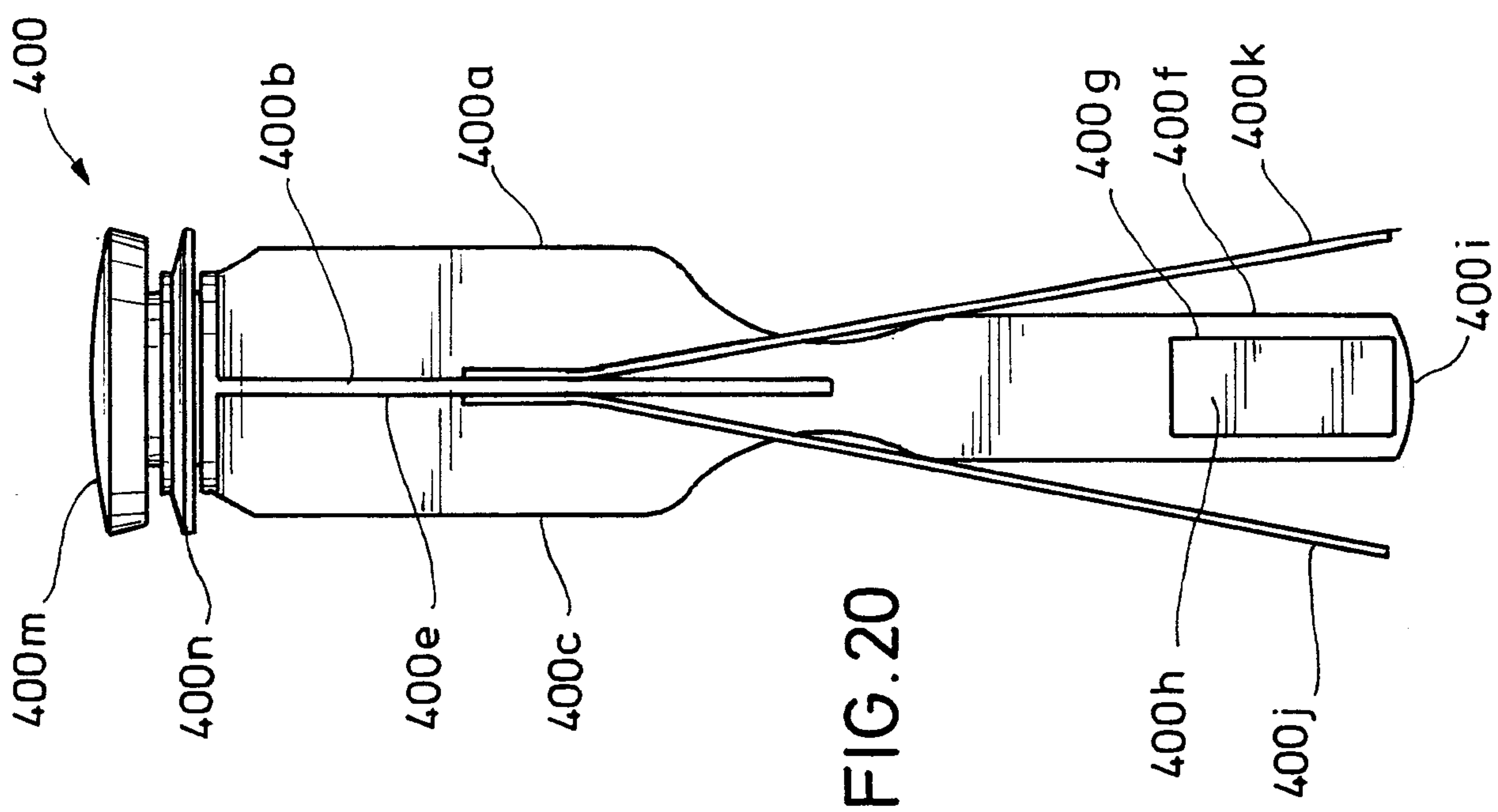
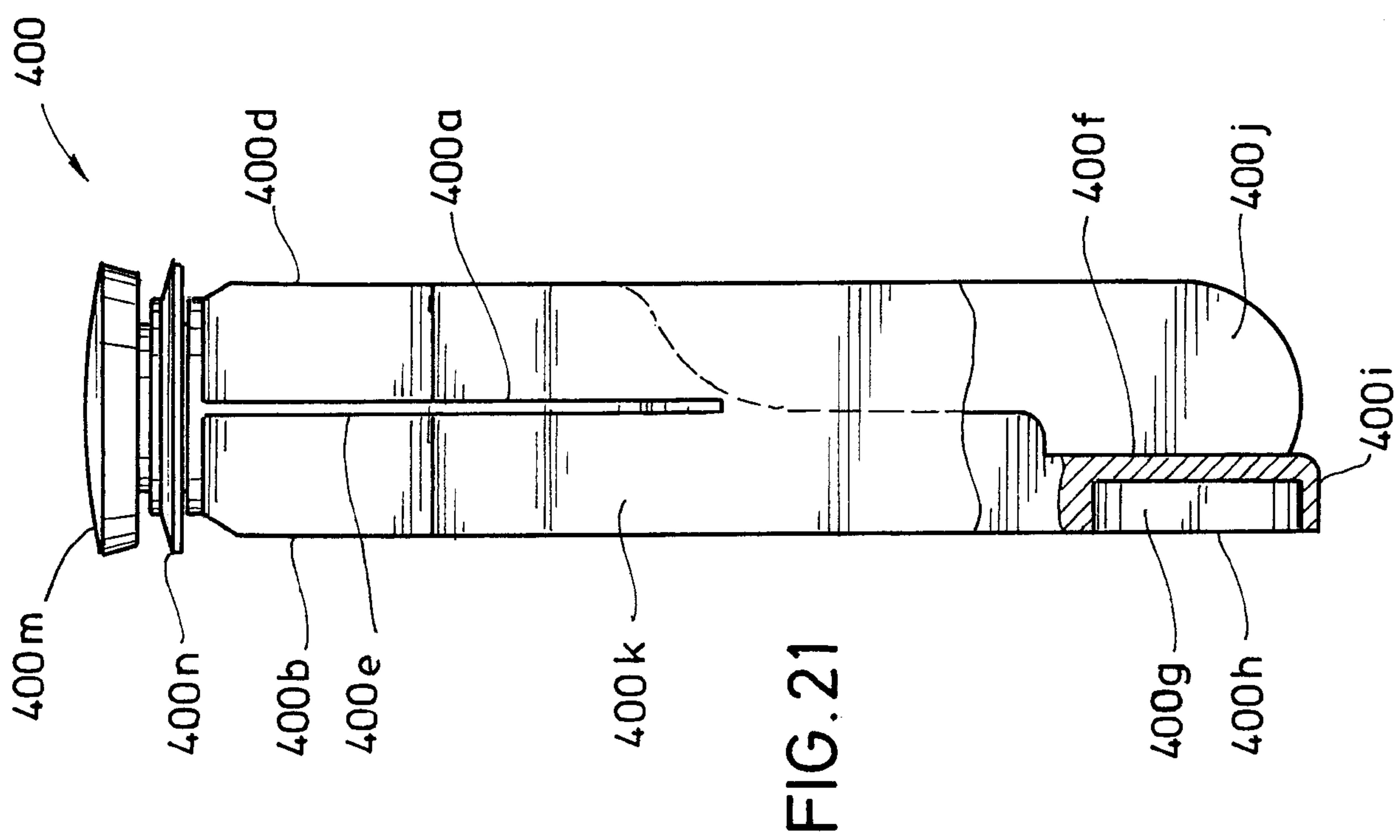


FIG. 16B





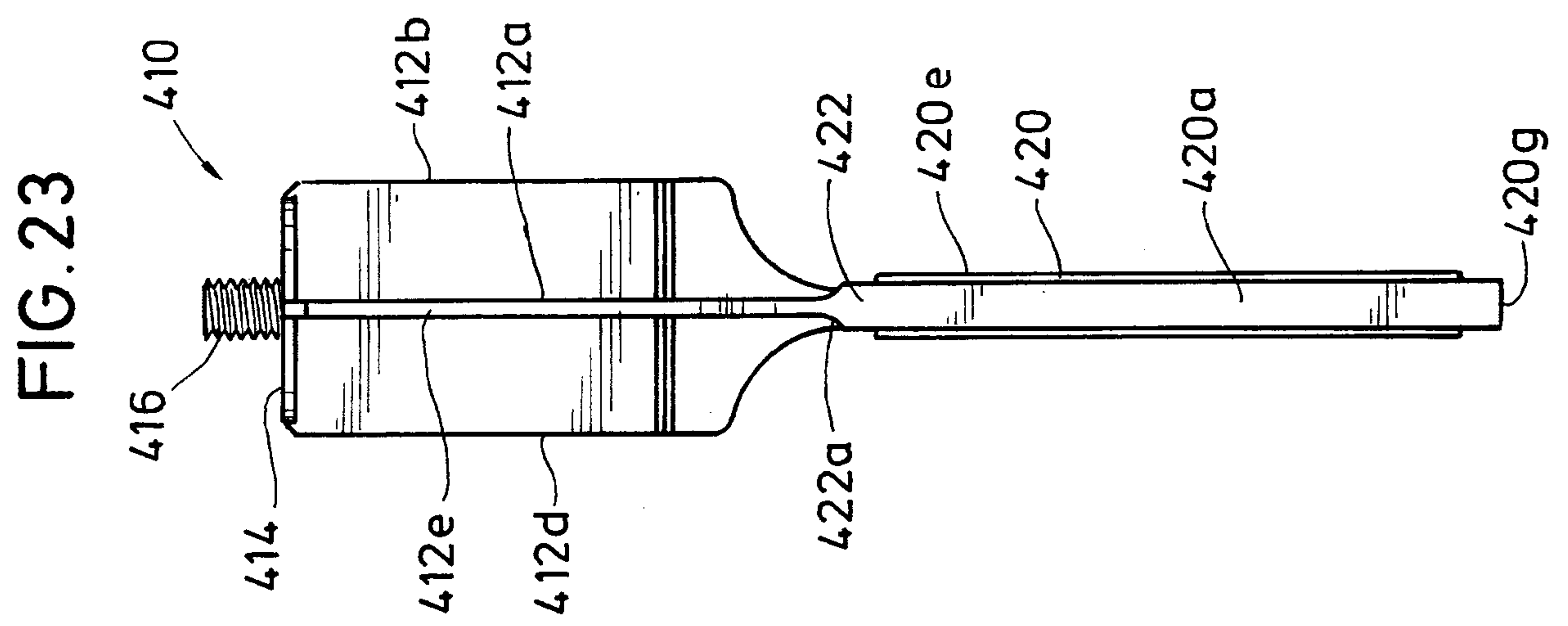
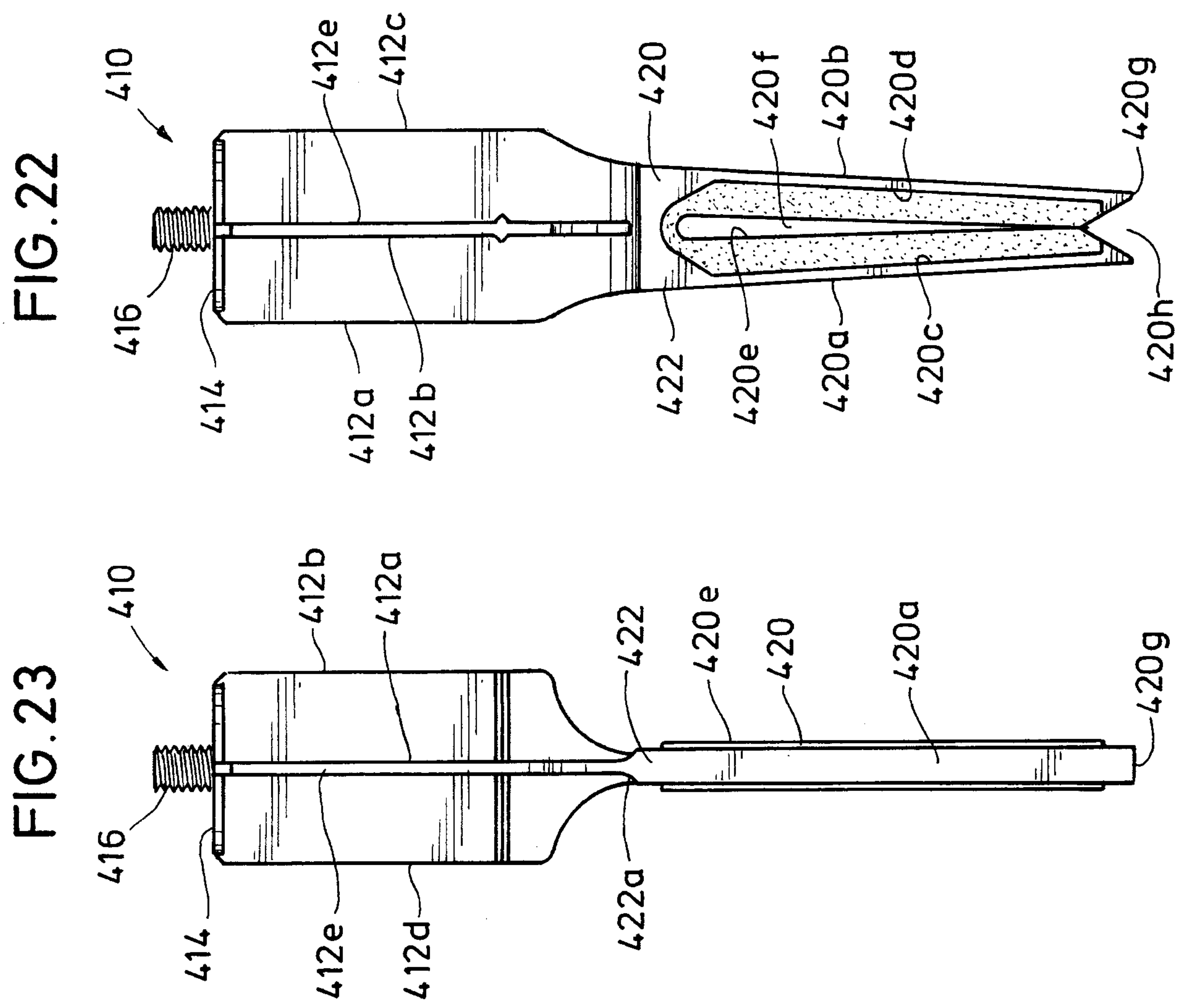
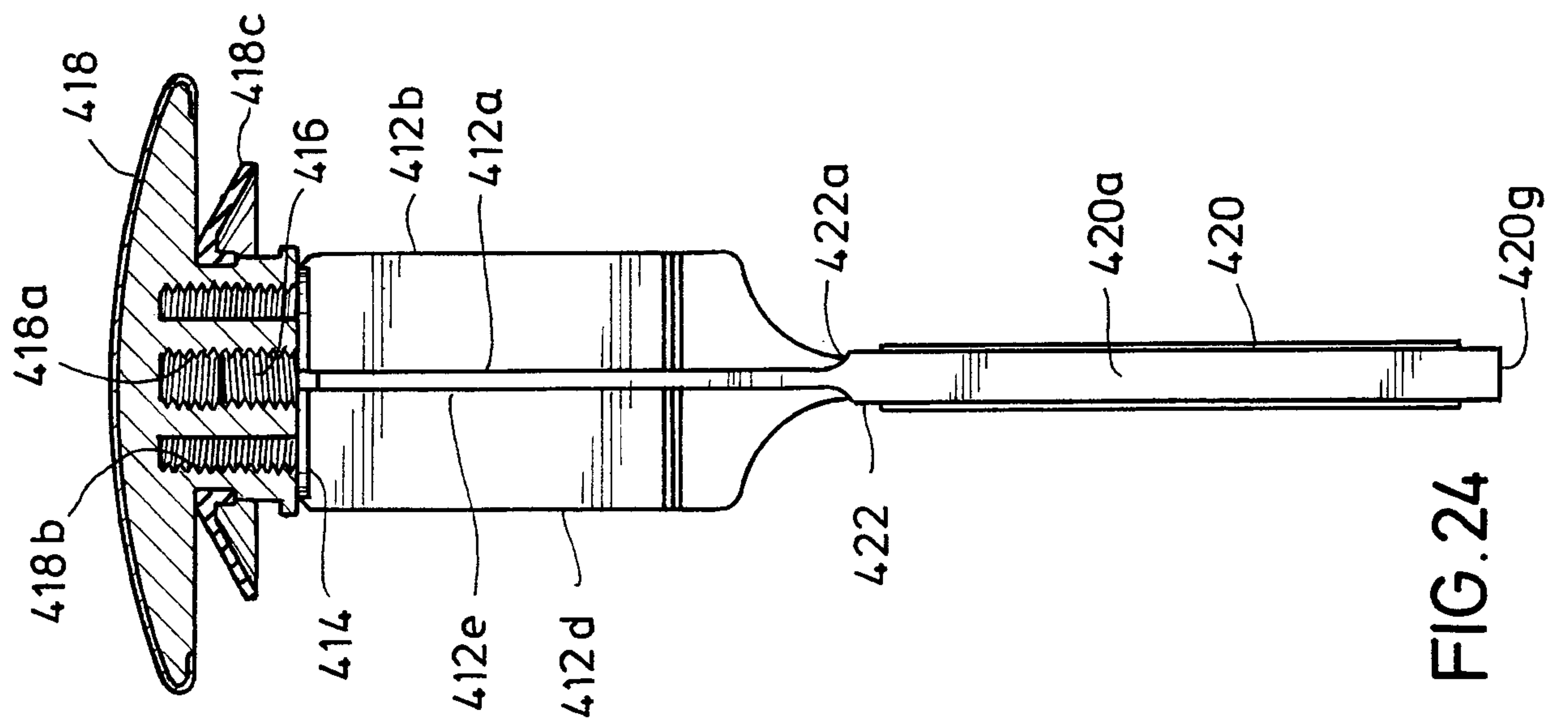


FIG. 25

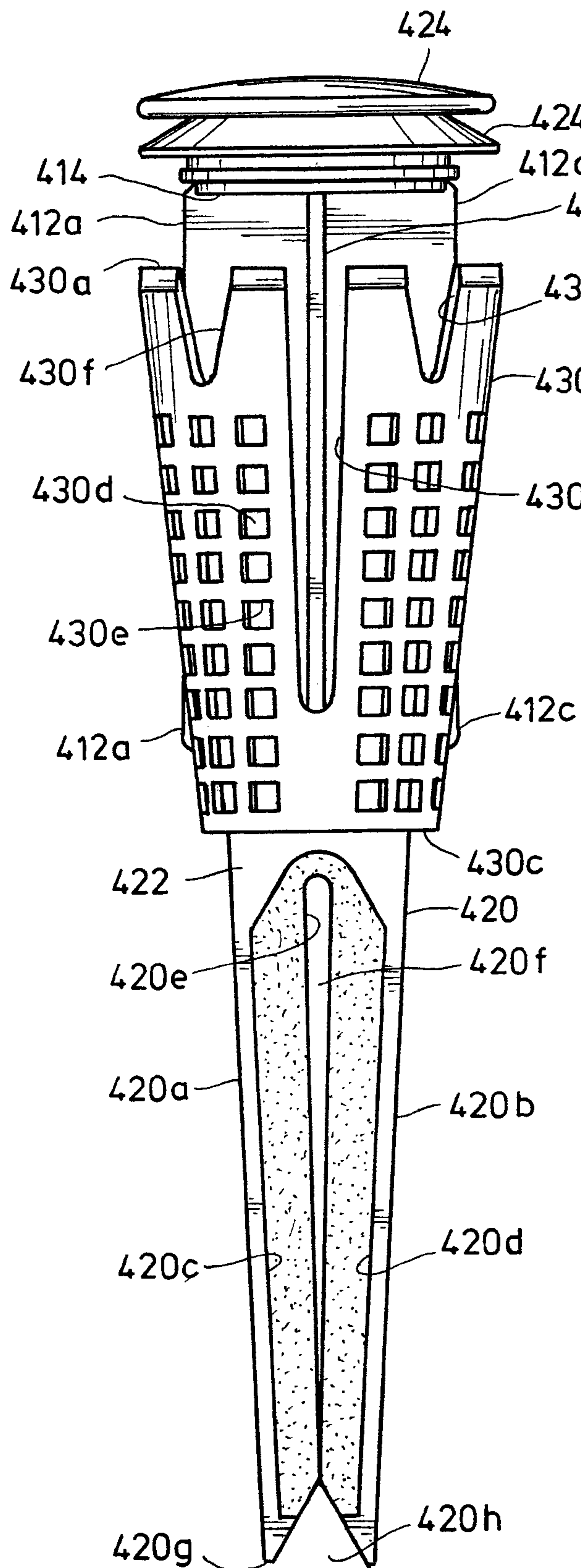
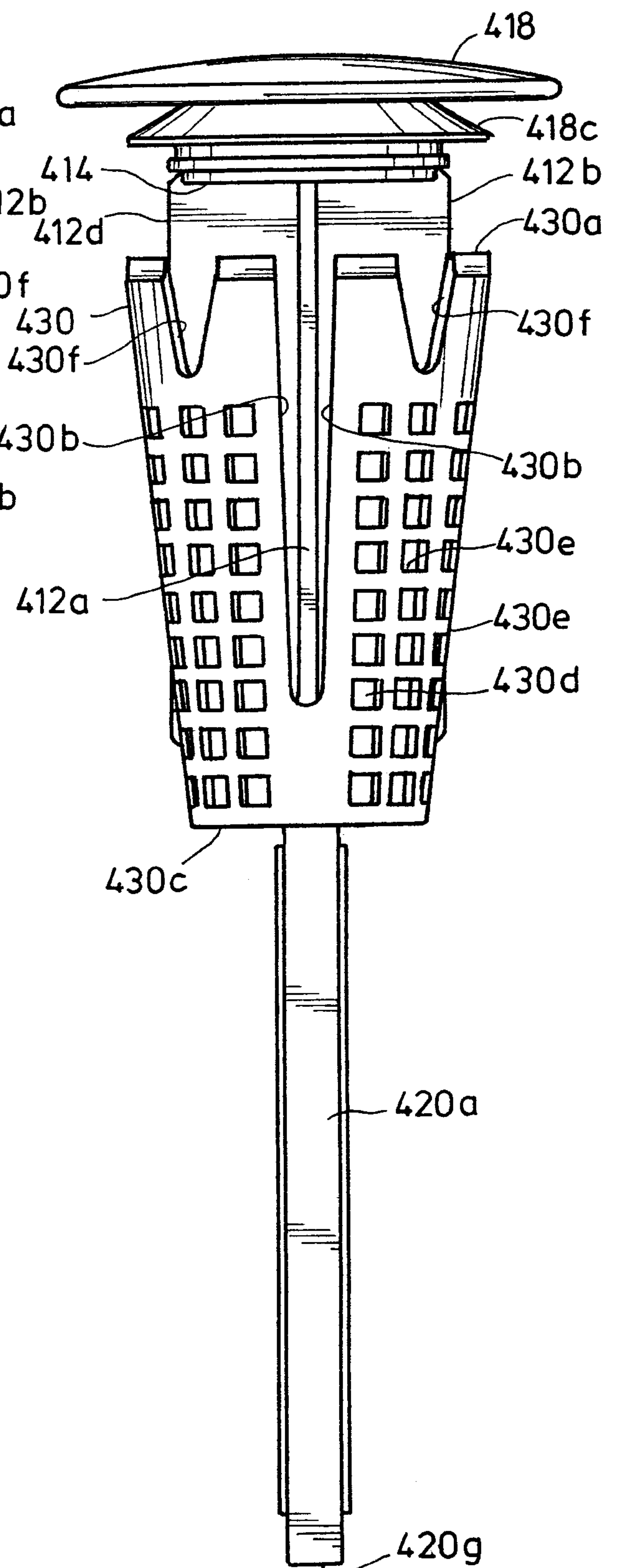


FIG. 26



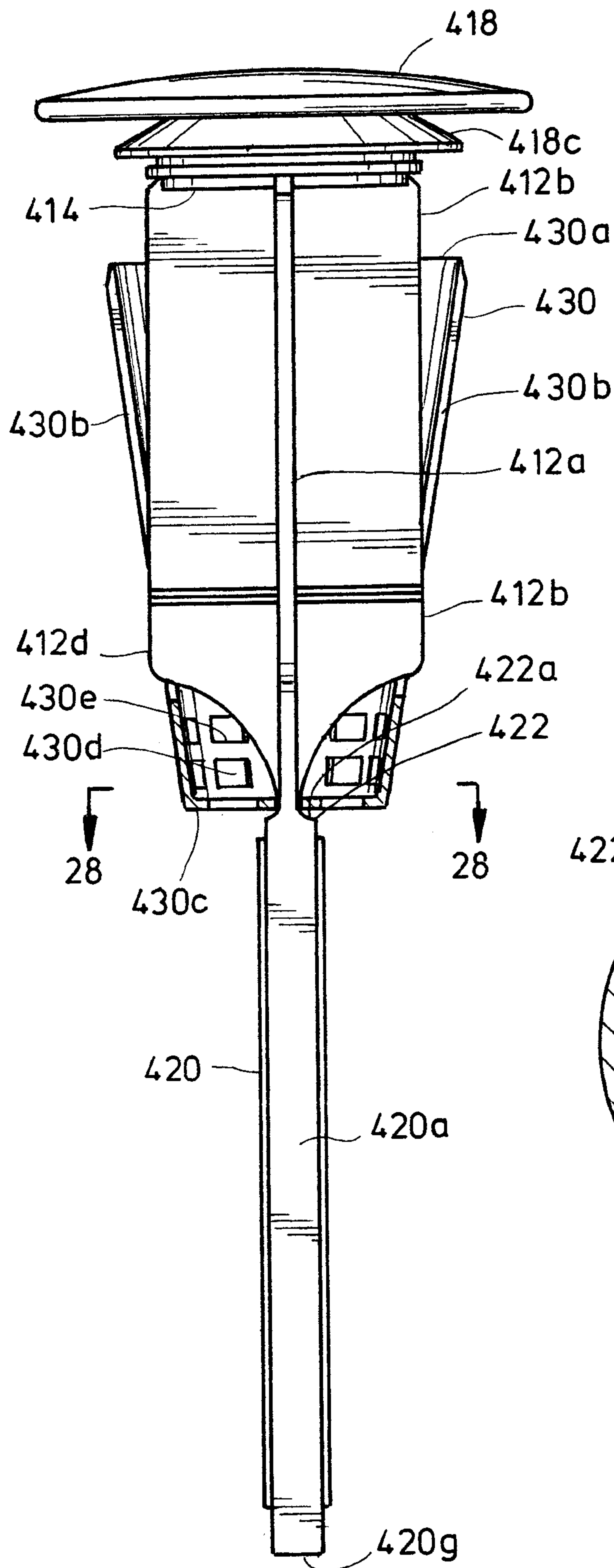


FIG. 27

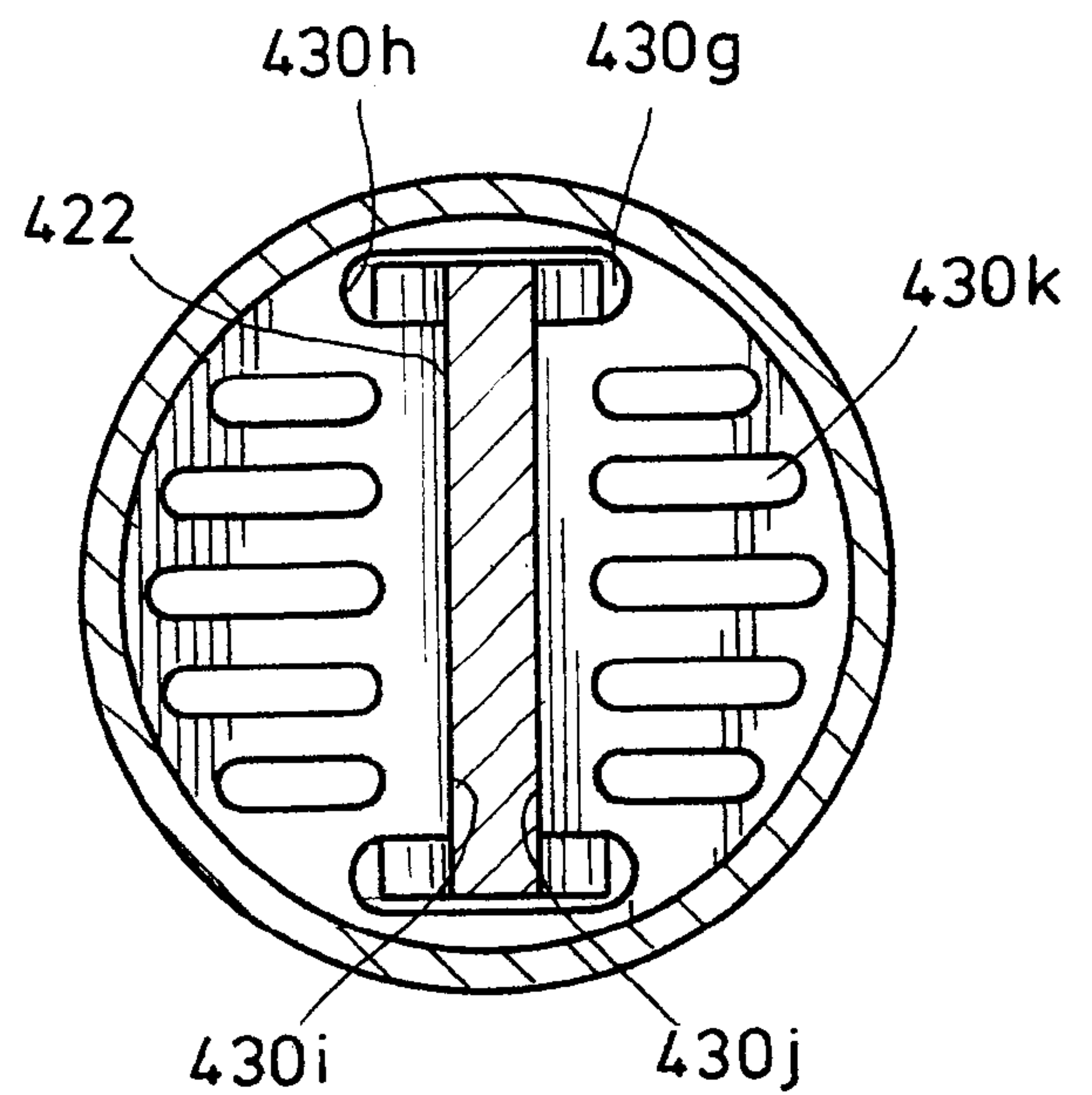


FIG. 28

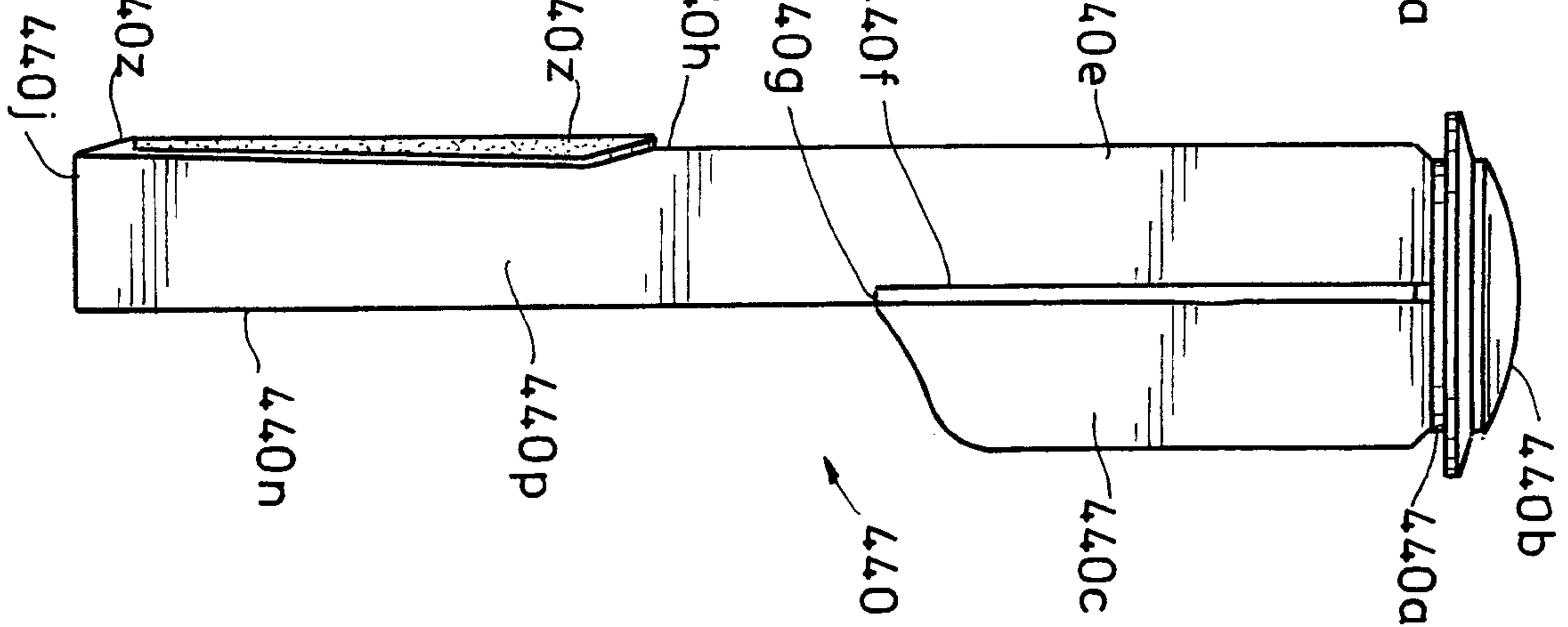
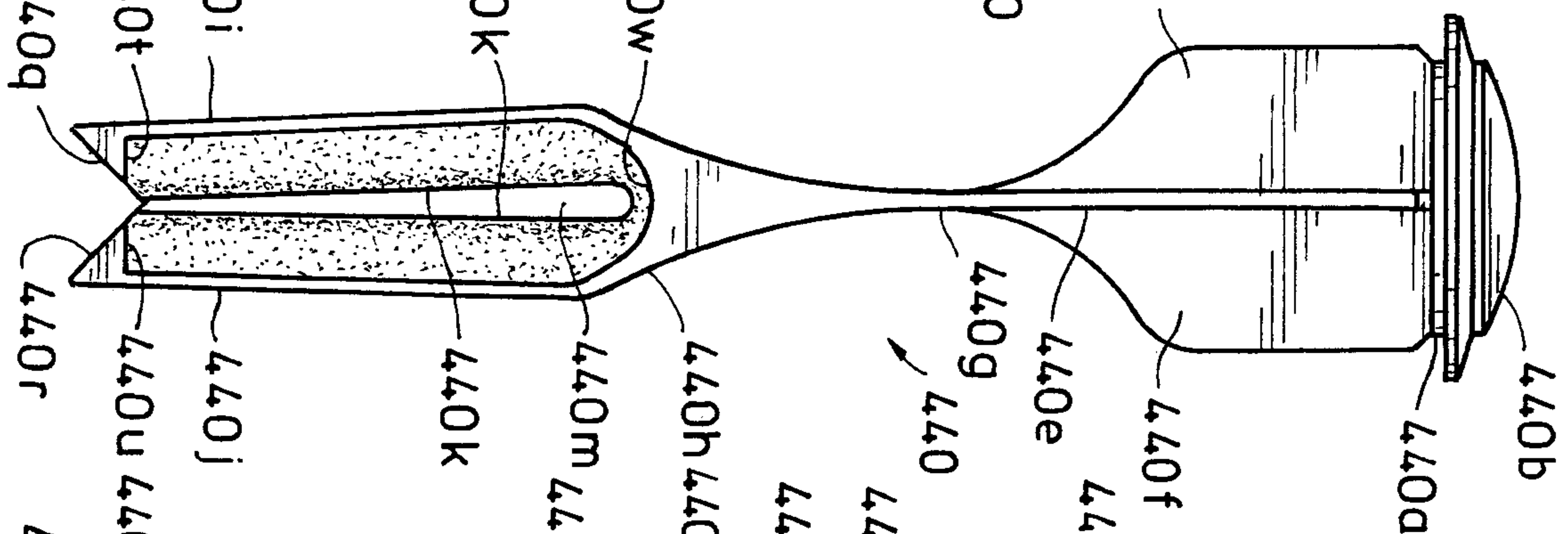
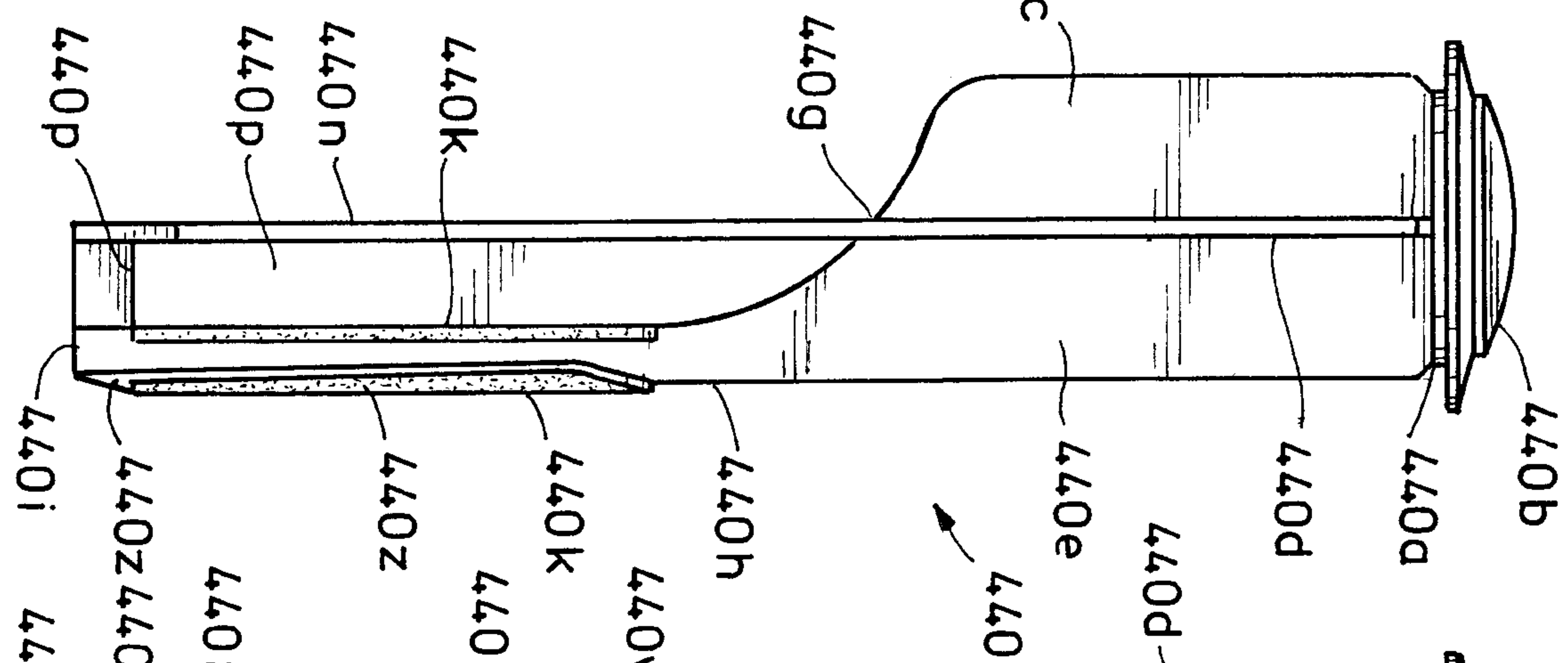
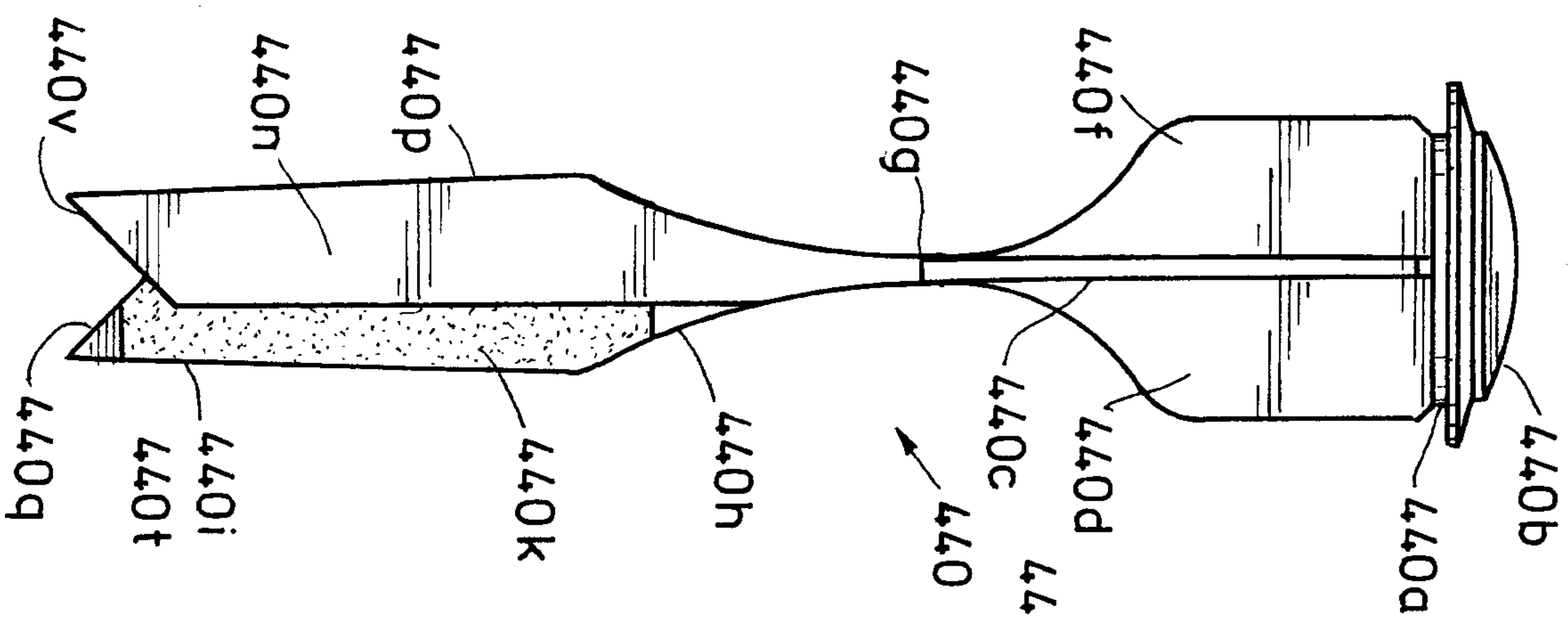
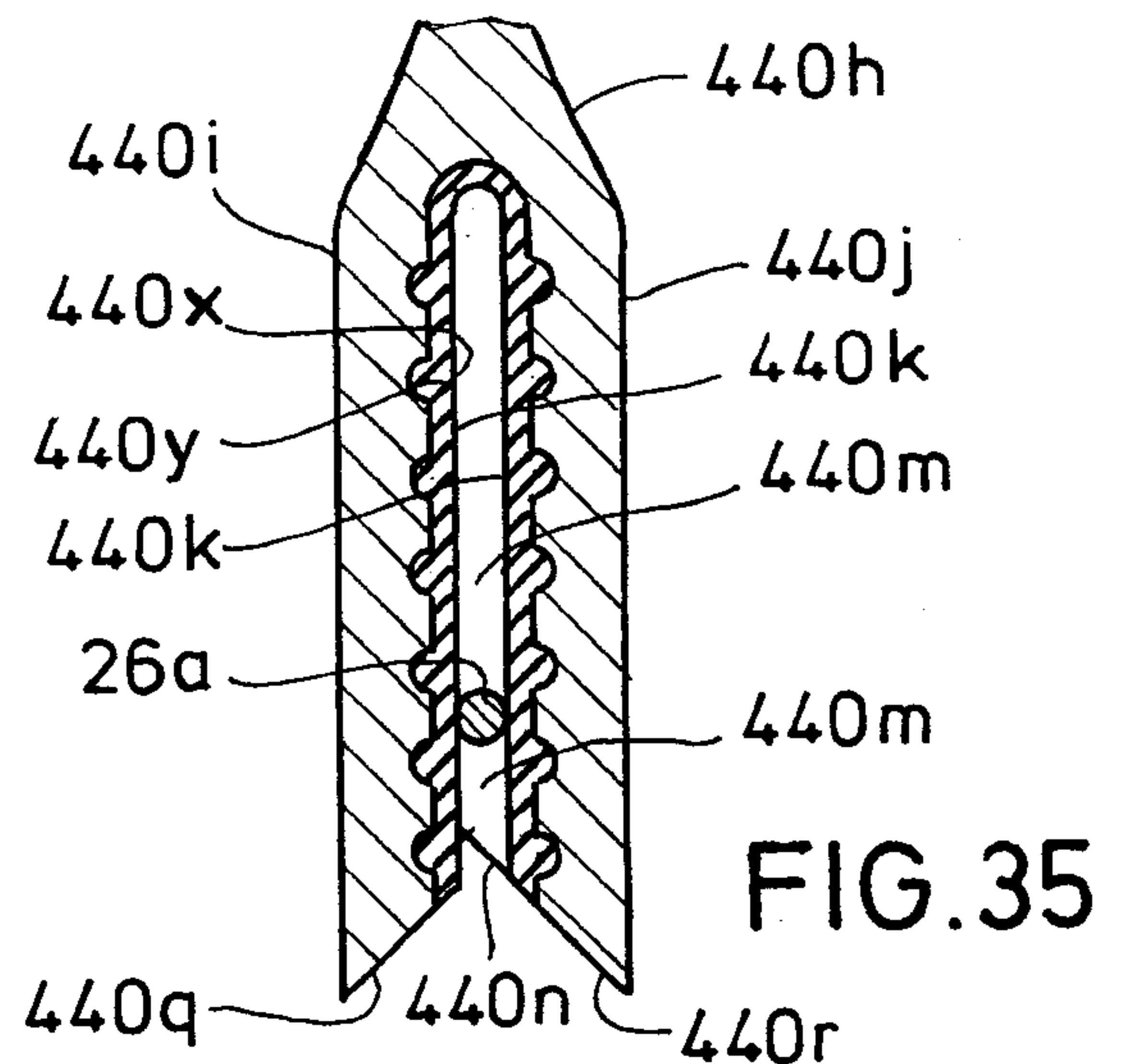
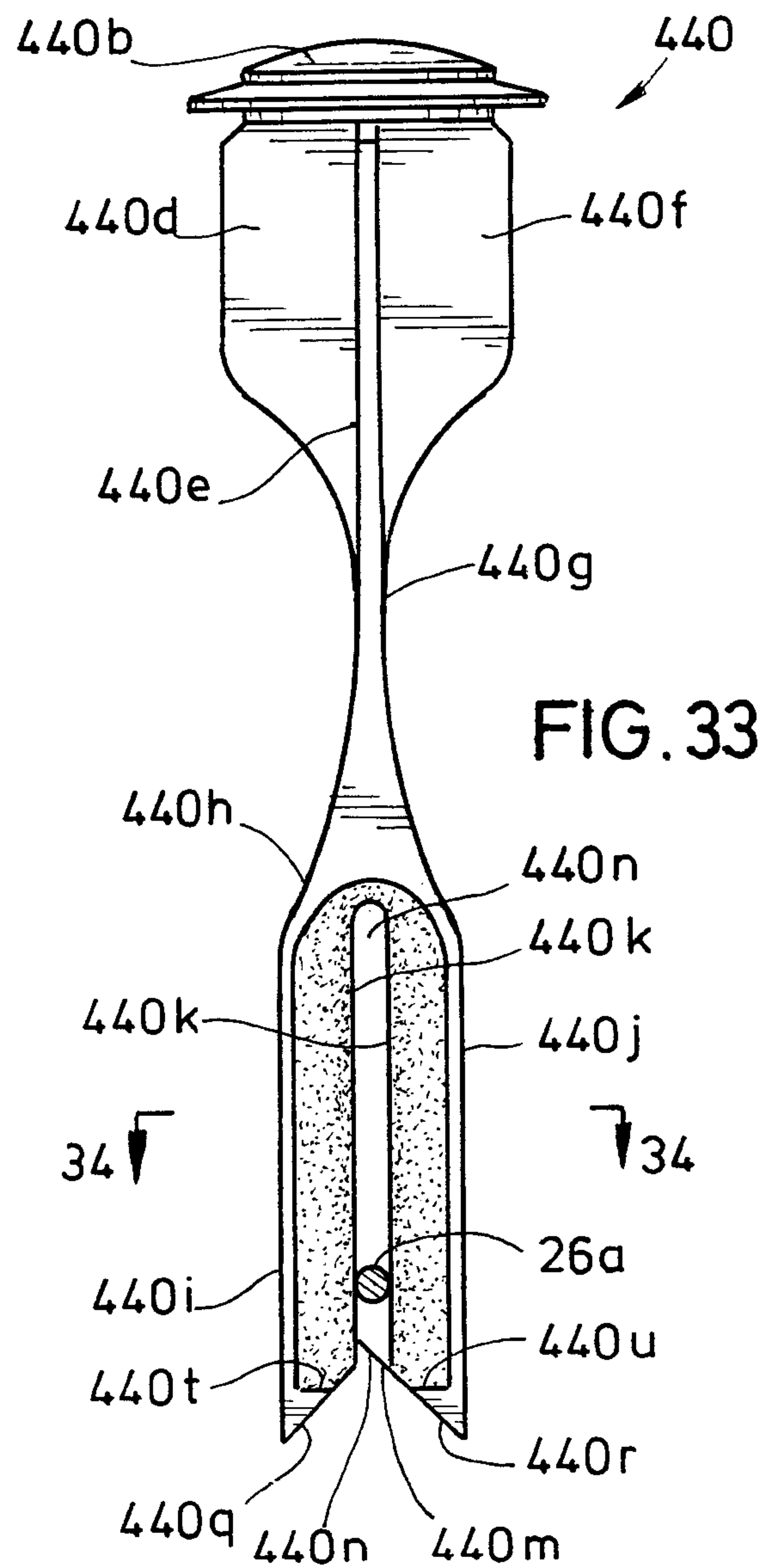
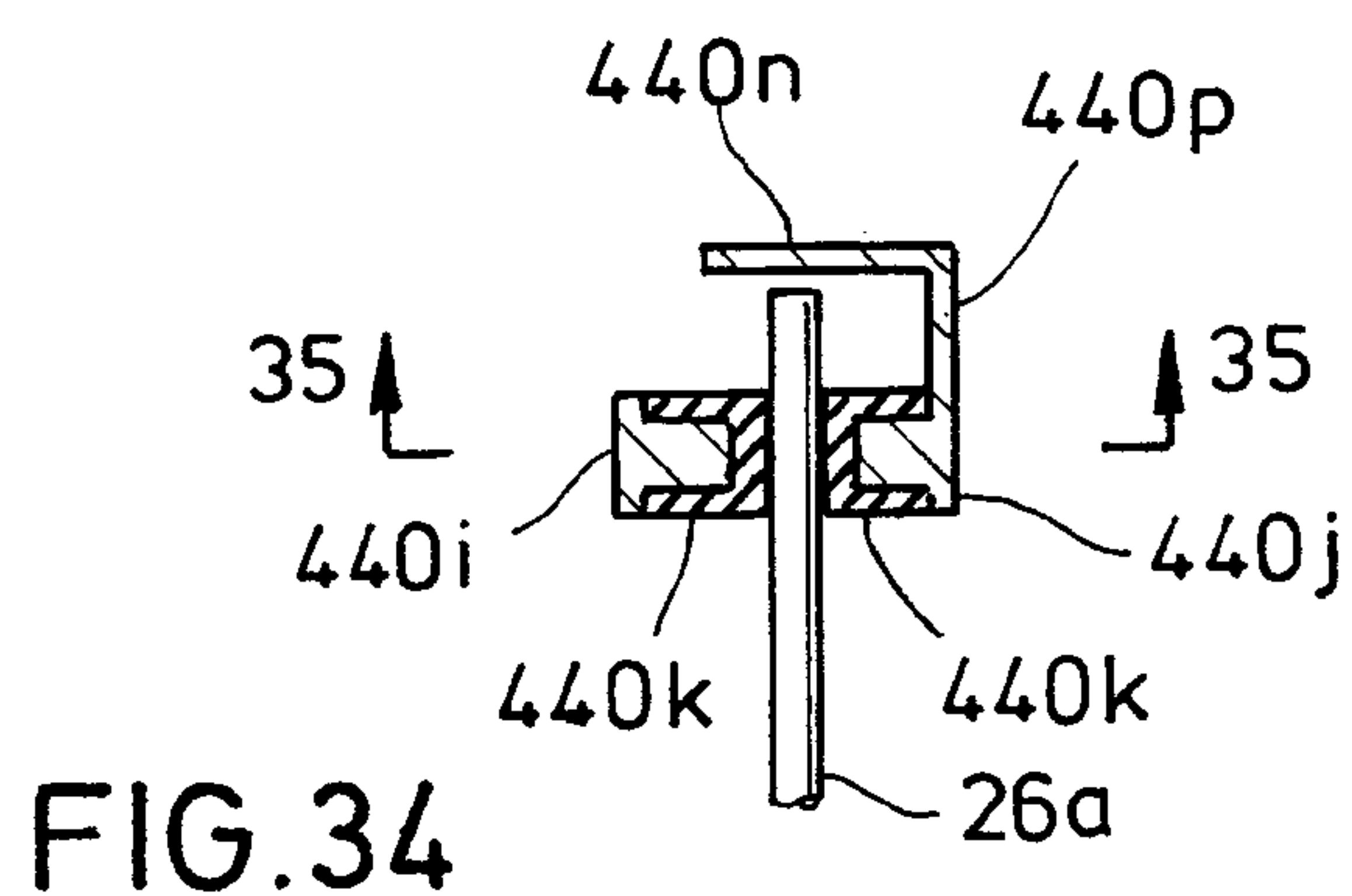
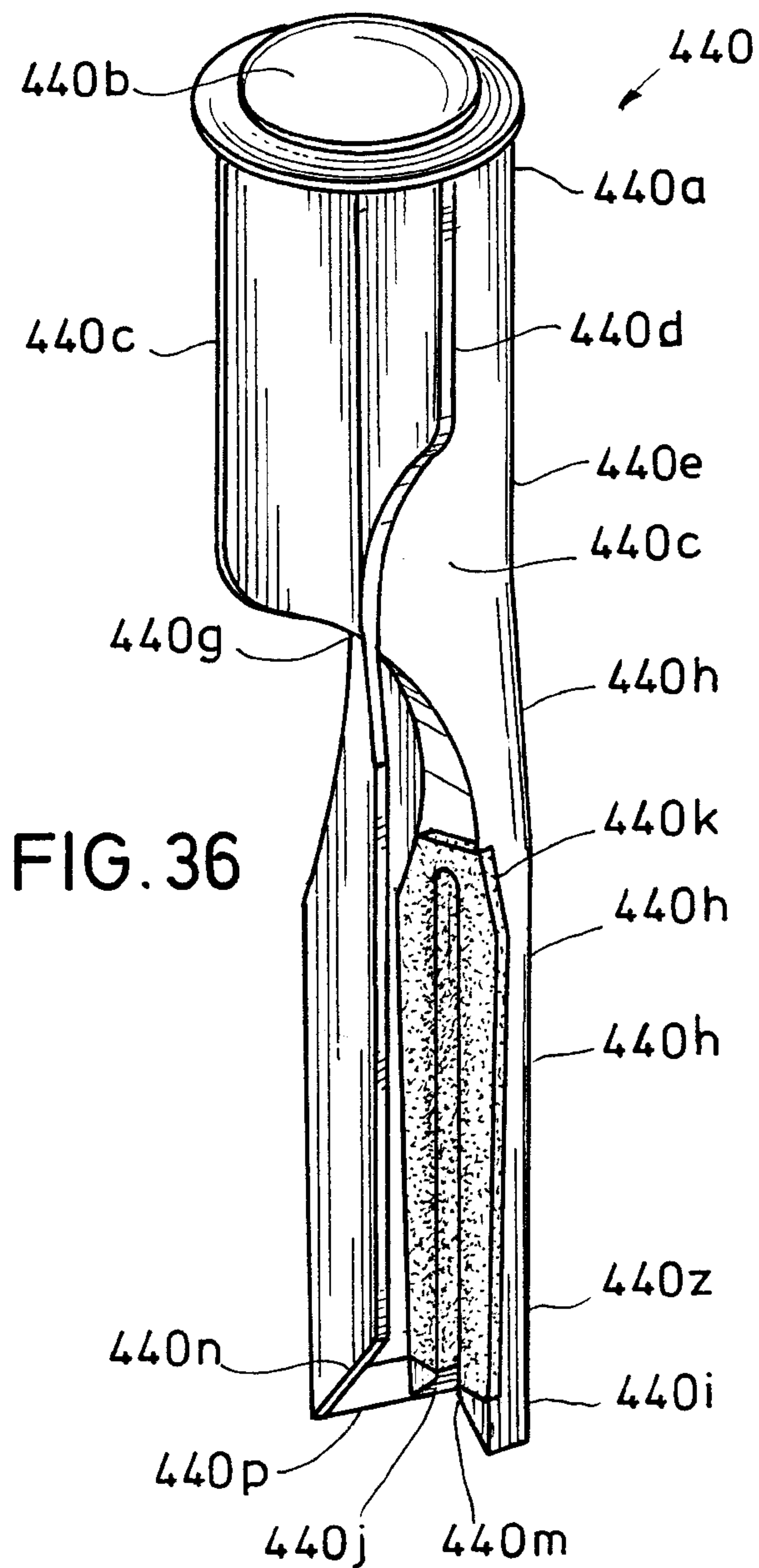


FIG. 32

FIG. 29

FIG. 30

FIG. 31



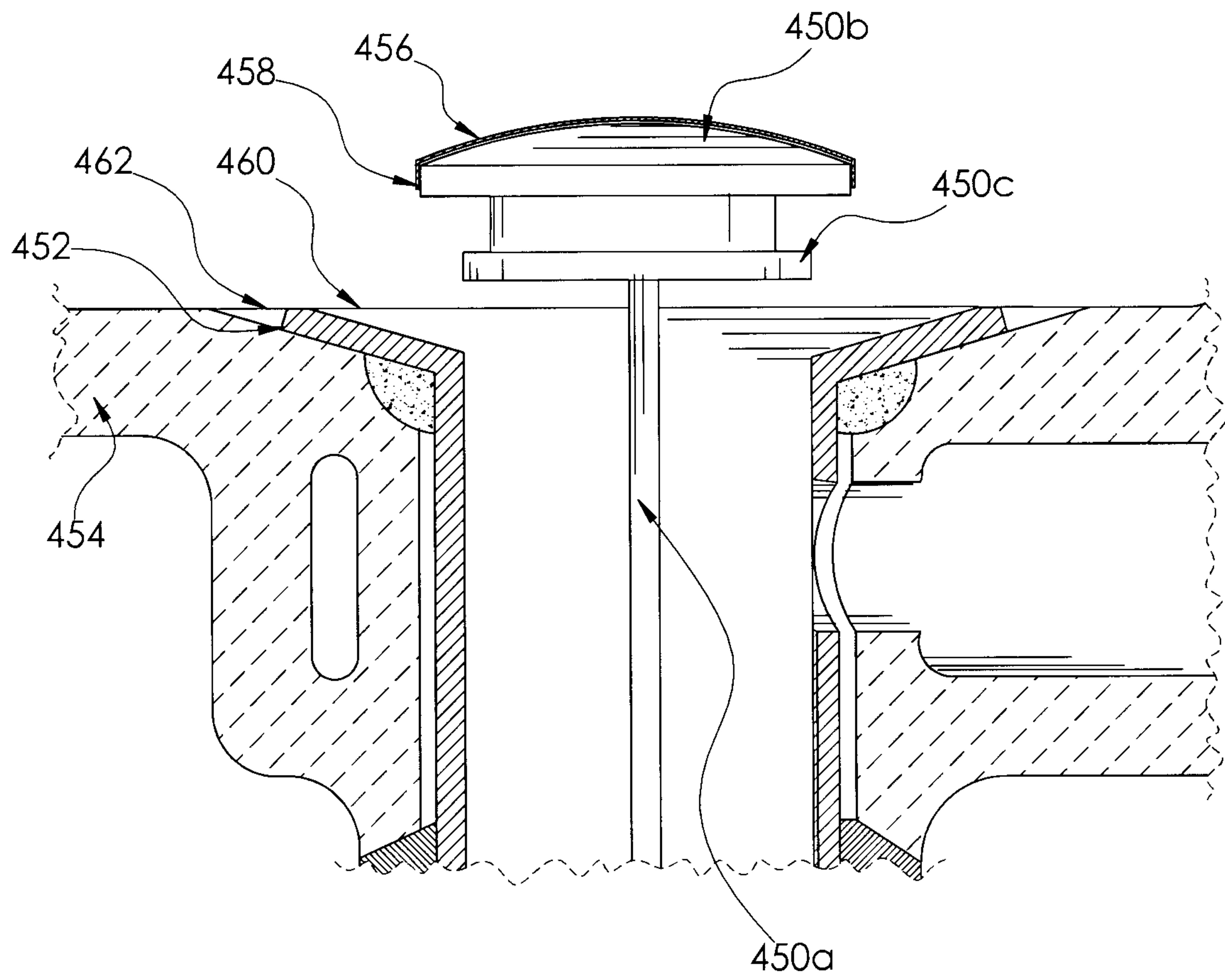


FIG. 37

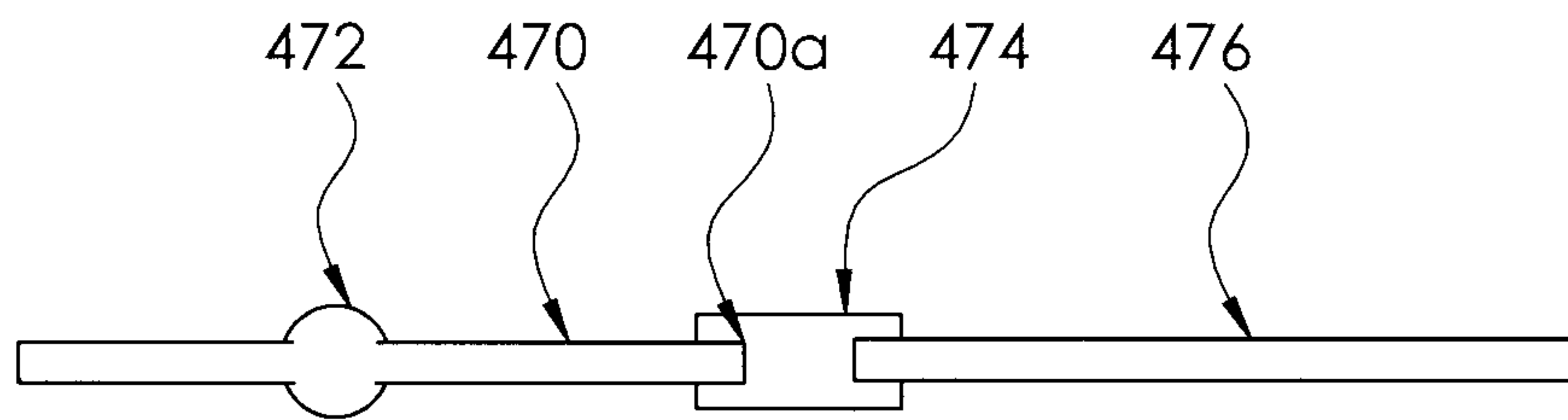


FIG. 38

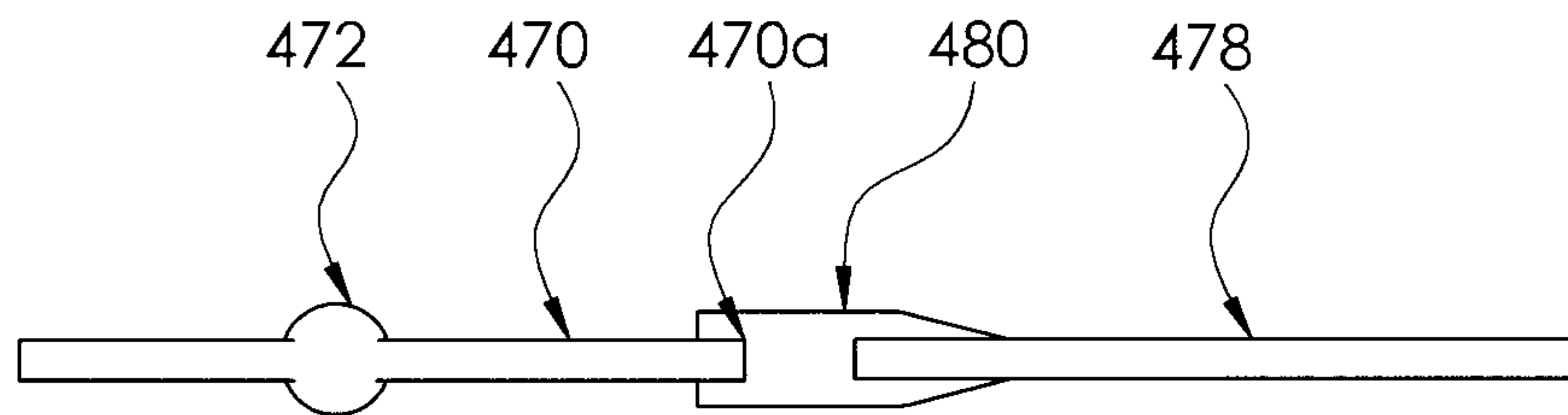


FIG. 39

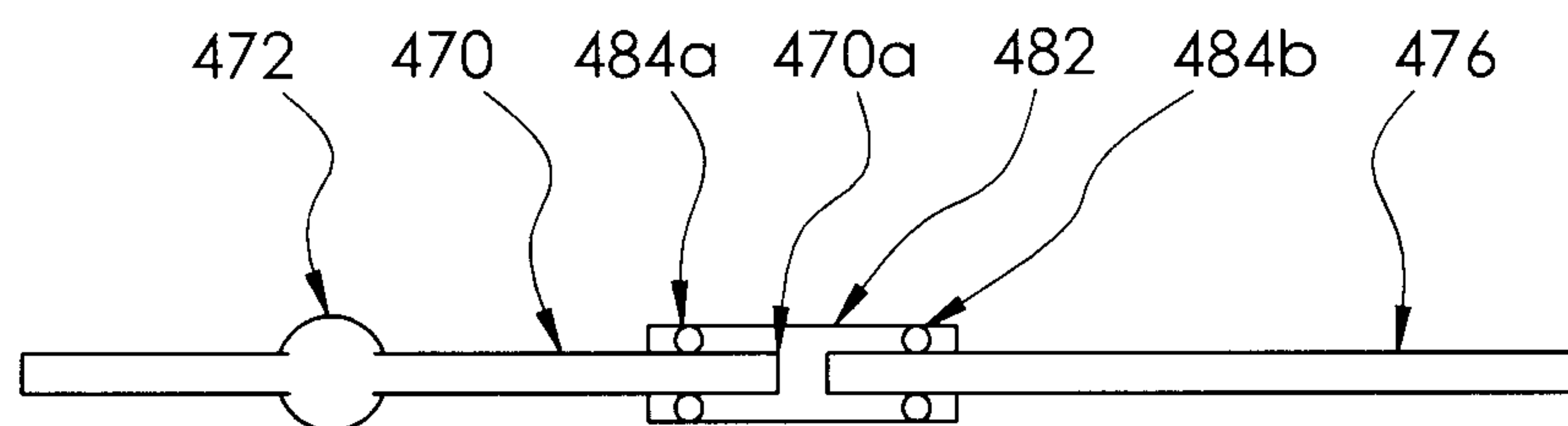


FIG. 40

