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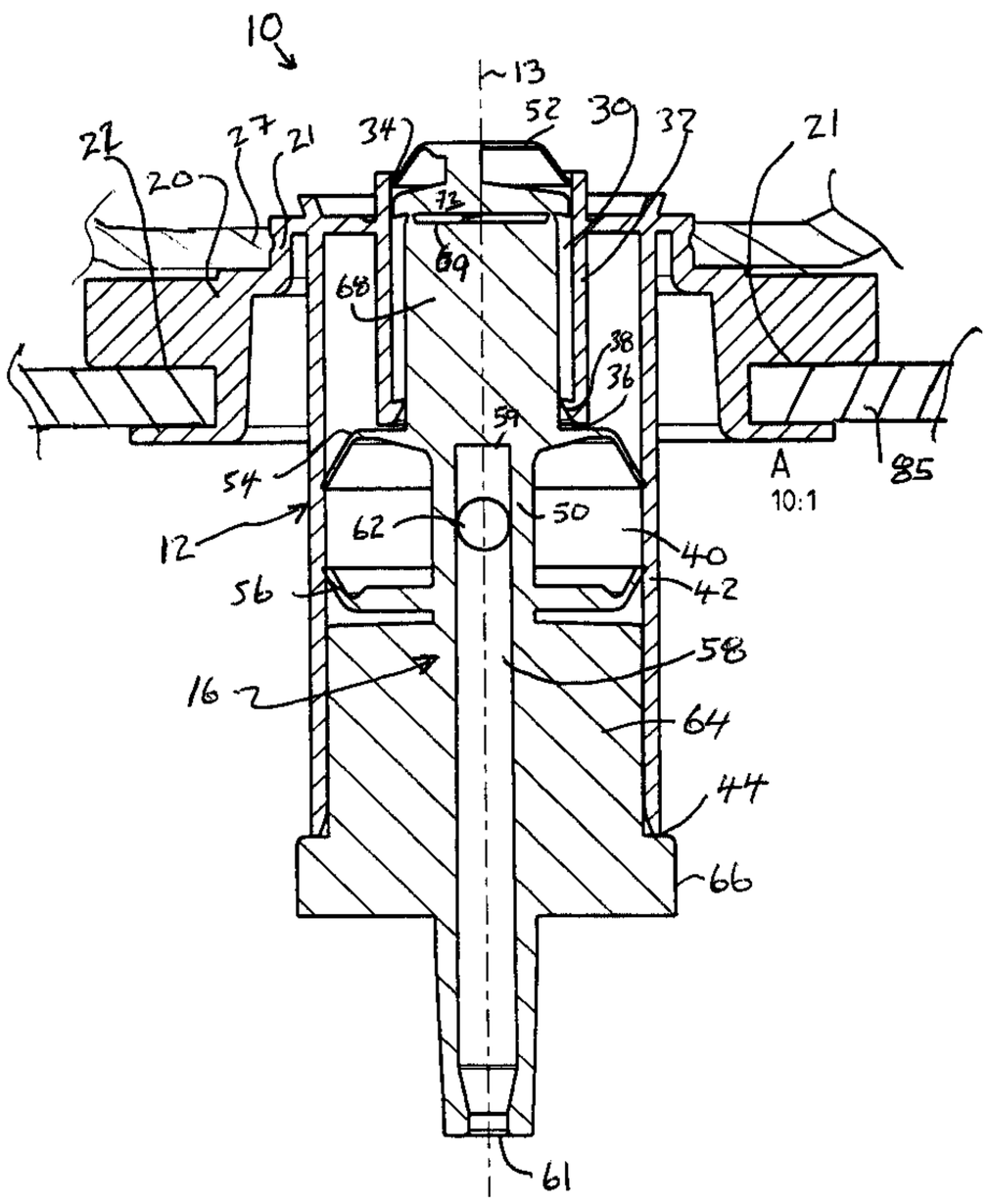
(54) Titre : POMPE A PISTON FRANGIBLE
(54) Title: FRANGIBLE PISTON PUMP



(57) Abrégé/Abstract:
A piston pump having a reciprocally movable piston with an inner portion of the piston being engaged within a piston chamber forming body such that when forces are applied to the piston attempting to withdraw it from the body an inner portion of the piston breaks off from the remainder of the piston rendering the piston pump inoperable.

ABSTRACT

A piston pump having a reciprocally movable piston with an inner portion of the piston being engaged within a piston chamber forming body such that when forces are applied to the piston attempting to withdraw it from the body an inner portion of the piston breaks off from the remainder of the piston rendering the piston pump inoperable.

Title

FRANGIBLE PISTON PUMP

Scope of the Invention

[0001] This invention relates to piston pumps for fluid dispensers and more particularly to a piston pump in which a piston is frangible so as to be broken and render the pump inoperative.

Background of the Invention

[0002] Fluid dispensers are known in which fluid in a reservoir container or bottle is to be dispensed from the bottle out of an outlet from the bottle via a pump mechanism secured in the outlet of the bottle. Such pump mechanisms are known in which a piston is coaxially slidable into a piston chamber forming member to dispense fluid from the bottle. Many known piston mechanisms provide an arrangement in which the piston can manually be removed from the piston chamber forming member and the bottle can then be refilled.

[0003] Unauthorized refilling of bottles can provide problems as to warranties and ensuring product quality and that product may be dispensed within a suitable product life.

[0004] Known pump mechanisms include those disclosed in U.S. Patent No. 5,676,277 to Ophardt issued October 14, 1997 and U.S. Patent No. 6,601,736 to Ophardt issued August 5, 2003, the disclosures of which are incorporated herein by reference.

Summary of the Invention

[0005] To at least partially overcome these disadvantages of previously known devices the present invention provides a piston pump with a reciprocally movable piston with an inner portion of the piston being engaged within a piston chamber forming body such that when forces are applied to the piston attempting to withdraw it from the body an inner portion of the piston breaks off from the remainder of the piston rendering the piston pump inoperable.

[0006] An object of the present invention is to provide an improved piston pump with a frangible piston.

[0007] Another object is to provide a dispensing apparatus including a container and piston pump which is resistant to unauthorized refilling.

[0008] The present invention provides in the context of a dispensing apparatus including a fluid containing container and a piston pump for dispensing fluid from an outlet of the container, a piston which is movable between retracted and extended positions to dispense fluids, which piston has a piston inner portion connected to a piston outer portion by a weaken strength, frangible intermediate portion which is broken to sever the piston inner portion from the piston outer portion on axially directed forces being applied to the piston second portion greater than the forces required for normal operation of the pump. In the event that the piston is attempted to be removed from a piston chamber forming member in which the piston is axially slidable, catch element on the piston inner portion engage catch elements on the piston chamber forming member such that axially outwardly applied force come to bear on the frangible intermediate portion breaking the same and severing the piston inner portion from the piston outer portion. The severed piston inner portion preferably remains in the piston chamber forming member preferably blocking fluid flow therethrough in one or both directions, preferably inwardly. Reciprocal movement of the piston forming element from which the piston inner portion has been detached is inoperative to pump fluid.

[0009] In one aspect the present invention provides a pump for dispensing fluids comprising: a piston-chamber forming member having a chamber about a chamber axis, the chamber having a chamber wall, an inner end, an open outer end, an outlet and an inlet, a piston forming element received in the piston-chamber forming member axially slidable inwardly and outwardly therein between an extended position and a retracted position in cyclical operation of the pump to draw fluid into the chamber via the inlet and dispense fluid via the outlet, the piston forming element having: an outer portion extending outwardly from the chamber through the open outer end, an inner portion in the chamber inwardly from the outer portion, an intermediate portion coupling the outer portion to the inner portion, and a piston catch member inwardly from the intermediate

portion, the intermediate portion being frangible and breaking to sever the inner portion from the outer portion when an axially outwardly directed breaking force is applied to the outer portion, the breaking force being greater than axially outwardly forces required to slide the piston forming element from the retracted position to the extended position, a chamber catch member carried by the a piston-chamber forming member engaging the piston catch member when the piston forming element is slid outwardly relative the piston-chamber forming member at least as far as the extended position and preventing outward movement of the piston catch member past the chamber catch member under axially outwardly directed forces applied to the outer portion which are equal to or greater than the breaking force, wherein when the inner portion is severed from the outer portion the pump is rendered inoperative and does not dispense fluid on axially sliding of the piston forming element inwardly and outwardly between the extended position and the retracted position.

Detailed Description of the Drawings

[0010] Further aspects and advantages of the present invention will become apparent from the following disclosure taken together with accompanying drawings in which:

[0011] Figure 1 is a schematic cross-sectional side view through a dispenser in accordance with a first embodiment of this invention;

[0012] Figure 2 is an enlarged cross-sectional side view of the pump mechanism shown in Figure 1 with the piston in a fully retracted position;

[0013] Figure 3 is a cross-sectional view the same as Figure 2 however with the piston in a fully extended position;

[0014] Figure 4 is a cross-sectional side view of the piston of Figure 2 showing the piston as severed;

[0015] Figure 5 is a pictorial view of the pump assembly of Figure 2;

[0016] Figure 6 is a side perspective view of the piston of Figure 2;

[0017] Figure 7 is an enlarged pictorial view of the inner end of the piston shown in Figure 6;

[0018] Figure 8 is a cross-sectional side view along Section line 8-8' in Figure 7;

[0019] Figure 9 is an enlarged cross-sectional side view of a pump mechanism similar to that shown in Figure 2 but of a second embodiment of the present invention; and

[0020] Figure 10 is a cross-sectional side view along Section 9-9' in Figure 9.

Detailed Description of the Drawings

[0021] Reference is made to Figure 1 which illustrates a dispenser generally indicated as 70 having a housing indicated as 78 to receive and support a removable bottle subassembly comprising a pump assembly 10 and a fluid container 26. Housing 78 is shown with a back plate 80 for mounting the housing to a building wall 82. A bottom support plate 84 extends forwardly from the back plate to receive and support the pump assembly 10 and container 26 as with a support shelf 85 being received in an annular groove 21 about the body 18 of the pump assembly 12. A cover member 85 is hinged to an upper forward extension 87 of the back plate 80 so as to permit replacement of the subassembly of the pump assembly 10 and the bottle 26.

[0022] The housing 78 carries at a lower, forward portion thereof an actuating lever 88 journalled for pivoting about a horizontal axis at 90. An upper end of the lever 88 carries a hook 94 to engage an engagement flange of a piston 16 of the pump assembly 12 and couples the lever 88 to the piston 16, such that movement of the lower handle end 96 of the lever from the position shown in solid lines to the position shown in dashed lines, in the direction indicated by arrow 98 slides the piston inwardly in a return, pumping stroke as indicated by arrow 100. On release of the lower handle end 96, spring 102 biases the upper portion of the lever 88 downwardly so that the lever 88 draws piston 16 outwardly to a fully withdrawn position as seen in dashed lines in Figure 1. Lever 88 and its inner hook 94 are adapted to permit manual coupling and uncoupling of the hook 94 to the piston 16 as is necessary to remove and replace the bottle subassembly comprising the pump assembly 10 and the container 26.

[0023] In use of the dispenser 70, once exhausted, the empty container 26 together with its attached pump assembly 10 are removed and a new bottle subassembly of the pump assembly 10 and the container 26 are inserted into the housing.

[0024] The pump assembly 10 is best shown in Figure 2 as comprising a piston chamber forming body 12 and a piston 16. The body 12 is generally cylindrical in cross-section and symmetrical about its central axis 13. The body 12 has an outer cylindrical hub portion 20 which provides an annular generally cylindrical plug portion 21 to which an annular rim 27 of the container 26 is to be fixedly secured against removal as for example by sonic welding, gluing or by being received in a snap-fit.

[0025] The hub portion 20 also carries the radially outwardly directed annular groove 22 to receive the support shelf 85.

[0026] The body 12 defines a stepped chamber therein as a first chamber 30 having a cylindrical sidewall 32 and being open at an open axially inner end 34 and open at an axially outer end 36. The sidewall of the inner chamber 30 provides a cylindrical interior surface other than proximate the outer end 36 where an annular catch flange 38 extends radially inwardly.

[0027] An outer chamber 40 is also provided having a sidewall 42, and an open axially outer end 44 serving as an inlet to the outer chamber 40. The outer end 36 of the inner chamber 30 opens outwardly into an inner end and inlet to the outer chamber 40.

[0028] The sidewall 42 of the outer chamber is cylindrical. The diameter of the inner chamber 30 is less than the diameter of the outer chamber 40.

[0029] The piston 16 is coaxially received within the body 12. The piston 16 is generally cylindrical in cross-section about the axis 13. The piston 16 is preferably a unitary element formed entirely of plastic preferably by injection molding. The piston 16 has a hollow stem 50 extending along the central longitudinal axis of the piston 16.

[0030] A circular resilient flexing first disc 52 is located at the innermost end of the piston 16 and extends axially therefrom. The first disc 52 is sized to circumferentially abut the cylindrical sidewall 32 of the inner chamber 30 substantially preventing fluid flow axially outwardly therebetween. The first disc 52 has an elastically deformably edge portion near the sidewall 32 which is adapted to be deformed away from the sidewall 32 so as to permit fluid to flow axially outwardly past the disc 52.

[0031] A circular resilient second flexing disc 54 is located on the stem 50 axially outwardly from the first flexing disc 52. The second disc is in the second chamber 40

and is sized to circumferentially abut the cylindrical sidewall 42 of the outer chamber 40 so as to substantially prevent fluid flow inwardly therepast. The second disc 54 has an elastically deformable edge portion which extends radially and axially outwardly.

[0032] A third disc 56 is located on the stem 50 axially outwardly of the second disc 54. The third disc 56 is also in the second chamber 40 and is sized to circumferentially abut the cylindrical sidewall 42 of the second chamber 40 substantially prevent fluid flow outwardly therepast.

[0033] The piston stem 50 has a hollow central passage 58 extending along the axis of the piston 60 from a closed inner end 59 to an open outlet 61 at the outer end of the piston 16. An inlet 62 is provided through the stem 50 providing via a short radial passageway from between the second disc 54 and third disc 50, communication to the central passageway 58.

[0034] The pump mechanism 10 is operative to dispense fluid from the interior of the container 26 out the outlet 61 in a cycle of normal operation in which the piston 16 is moved relative to the body 12 from the retracted position shown in Figure 2 to the extended position shown in Figure 3 and to then return to the retracted position shown in Figure 2. In moving in an extension stroke from the retracted position of Figure 2 to the extended position of Figure 3, fluid from the container 26 is drawn through the inner chamber 30 into the outer chamber 40 by reason of the volume in the chambers between the first disc 52 and the second disc 54 increasing, creating a vacuum to draw fluid from the container 26 outwardly past the first disc 52. In moving from the extended position of Figure 3 to the retracted position of Figure 2, fluid between the first disc 52 and second disc 54 is pressurized and urged outwardly past the deflecting second disc 54 to between the second disc 54 and the third disc 56 and hence via the outlet 62 into the passageway 58 and out of the outlet 61.

[0035] Outward of the third disc 56, the stem 50 carries a four axially extending outer webs 64 which are circumferentially spaced and serve to engage the sidewall 42 of the outer chamber 40 and assist in maintaining the piston 16 axially centred in the outer chamber 40. Axially outwardly of the web 64, the stem carries an engagement flange 66

adapted for engagement by the hook 94 of the lever 88 shown in Figure 1 to move the piston 16 between the extended and retracted positions.

[0036] Inwardly of the second disc 54, the stem 50 carries four axially extending inner webs 68 which extend radially from the stem 50 to engage the radially inner periphery of the annular catch flange 38 and assist in maintaining the piston 16 axially centred in the inner chamber 30. In the embodiment illustrated, both the outer webs 64 and the inner webs 68 are provided as four webs, pairs of which are diametrically opposed.

[0037] The inner webs 68 each end at axially inward end 69 from which a strut member 71 extends axially to connect each of the four inner webs 68 to a corresponding piston catch member 72 which extends from an inner portion of the stem 50 radially outwardly past the webs 68 and into sliding engagement with the sidewall 32 of the first chamber 30. Each of the piston catch members 72 presents an axially outwardly directed piston catch shoulder 73. The annular catch flange 38 of the first chamber 30 presents an axially inwardly directed chamber catch shoulder. On sliding of the piston 16 to the extended position illustrated in Figure 3 the piston catch shoulder 73 and the chamber catch shoulder engage to prevent movement of the piston catch shoulder 73 outwardly passed the chamber catch shoulder. The piston catch shoulder 73 has a radially innermost edge which is radially inward of a radially outermost edge of piston catch shoulder.

[0038] With the piston 16 in the extended position as illustrated in Figure 3, if axially directed forces are applied to the piston, the engagement between the piston catch member 72 and the chamber catch flange 38 resists further outward movement of the piston 16 with the axially directed forces being transferred from the engagement flange 66 through the piston 16 to the piston catch member 72 via the four strut members 71.

[0039] With the piston member 16 formed as an integral member formed from plastic as by injection moulding, the strut members 71, when subjected to axially outwardly directed forces greater than a breaking force will break such that each of the four inner webs 68 will become severed from its corresponding piston catch member 72. In this regard, the strut members 71 form a frangible intermediate portion of the piston which is

intermediate an inner portion 100 including the piston catch member 72 and the first disc 52 and an outer piston portion 102 including, amongst other things, the inner webs 68, second disc 54, third disc 56, outer webs 54 and engagement flange 66.

[0040] Reference is made to Figure 8 which illustrates a cross-sectional side view along section line 8-8' in Figure 7, showing the cross-section through each of the four strut members 71 as cross thatched circles since each of the strut-like members are conical. Figure 8 shows the cross-sectional area represented by the webs 68, which is many times greater than the sum of the cross-sectional areas of the strut members 71.

[0041] In the preferred embodiment illustrated, the sum of the cross-sectional areas of the strut members 71 are substantially less than the sum of the cross-sectional area through any other portion of the stem 50 axially outwardly of the strut members 71. Accordingly, on the application of the axially outwardly directed forces to the piston 16 as on the engagement flange 66 axially outwardly from the strut members 71, such forces are applied across the strut members 71. When the piston catch members 72 are prevented from outward movement, applying to the engagement flange 66 a force sufficient will break the frangible strut members 71 and result in severing of the outer portion 102 of the piston from its inner portion 100.

[0042] Reference is made to Figure 4 which illustrates a condition of the pump assembly 10 when the outer portion 102 of the piston 16 has been severed from the inner portion 100. The inner portion 100 is shown as including the piston catch member 72 and the first disc 52 which remain received within the inner chamber 30 and effective serve to restrict fluid flow inwardly therepast.

[0043] The outer portion 102 of the piston 16 is free to be removed outwardly out the open outer end 44 of the outer chamber 40. Reciprocal movement of the outer portion 102 of the piston 16 within the body 12 will not result in pumping of fluid from the container 26.

[0044] In operation of the preferred embodiment, in the normal stroke of operation, the piston 16 may be moved between a retracted position and an extended position. The extended position need not be a position as illustrated in Figure 3 in which the piston catch member 72 engages the chamber catch flange 38. Preferably, in a full stroke of the

piston 16 as controlled by the lever 88, the piston 16 will reach an extended position which is axially inwardly from the fully extended position and thus ensuring that in normal operation of the piston pump, by movement of the lever 88, the piston catch member 72 will not come to engage the annular catch flange 38.

[0045] In normal operation of the pump with movement of the piston 16 between a retracted position and an extended position, axially forces are applied to the outer portion 102 of the piston pump. In normal operation such forces include normal axially outwardly directed forces to move the piston from a retracted to an extended position in normal pumping which are less than an axially outwardly directed breaking force which, when applied to the piston 16, will rupture the strut members 71. To state this another way, the breaking force which is applied to the frangible strut members 71 is greater than the axially outwardly directed forces required to slide the piston 16 from the retracted to the extended position and movement of the pump 16 to normally operate the pump assembly 10.

[0046] The strut members 71 may have different forms. Preferably as shown, the strut members 71 extend normal to the axis 13 and each strut member is of a similar cross-sectional area and shape.

[0047] In the preferred embodiment, for assembly of the pump assembly 10, the piston catch members 72 are adapted to be moved inwardly into the inner chamber 30 past the annular catch flange 38. In this regard, the annular catch flange 38 of the first chamber 30 carries an outwardly directed surface which is tapered to extend axially inwardly and radially inwardly so as to provide a bevelled cam surface adapted to engage an upper camming surface on the inner side of the piston catch members 72. Engagement of the cam surfaces with the camming surfaces assists in deflecting the piston catch members 72 inwardly and/or the annular catch flange 38 outwardly such that the piston catch members 72 may pass upwardly into the inner chamber 30 in assembly. Similarly, the first disc 52 on the piston inner portion 100 are adapted to pass inwardly past the chamber catch flange 38.

[0048] Reference is made to Figure 9 which illustrates a second embodiment of a pump mechanism in accordance with the present invention. In Figure 10, similar

reference numerals are used to the reference numerals in the first embodiment to illustrate similar elements.

[0049] In Figure 9 the body 12 is shown to be modified to eliminate the second chamber 30 and to provide an equivalent radially inwardly extending annular flange 38 on the wall 42 of the chamber 40. The piston 16, however, has been modified to eliminate the inner disc 52 of the first embodiment and, as well, portions of the stem 50 inward of the piston catch member 72. In replacement of the inner disc 52, a one-way valve 104 is provided across the inner end of the inner chamber 30. The piston catch members 72 are formed as a top portion of the webs 68 without frangible members therebetween. Rather, as best seen in cross-section in Figure 10, the sidewall of the stem 50 intermediate the second disc 54 and the third disc 56 has been reduced so as to provide enlarged openings 62 bridged by a plurality of strut members 63 of reduced cross-section and therefore reduced strength such that they are frangible. In the embodiment of Figure 9, the inner portion of the pump which is to remain after severing within the body 12 comprises that portion inward from the frangible strut members 63 and therefore includes the second disc 54 and the inner web 68 carrying the piston catch member 72. The outer portion which becomes severed includes the third disc 56, the web 64 and the engagement flange 66.

[0050] Figure 1 illustrates the first embodiment of the invention used with a collapsible container 26, however, the first embodiment may be used with rigid containers as with various venting mechanisms whether through the container wall or through the pump mechanism. The frangible piston of the preferred embodiments may be used in a wide range of pumps having chambers in which the piston is slidable.

[0051] Many modifications and variations of the invention will now occur to persons skilled in the art. For a definition of the invention reference is made to the following claims.

WE CLAIM:

1. A pump for dispensing fluids comprising:

a piston-chamber forming member having a chamber about a chamber axis, the chamber having a chamber wall, an inner end, an open outer end, an outlet and an inlet,

a piston forming element received in the piston-chamber forming member axially slidable inwardly and outwardly therein between an extended position and a retracted position in cyclical operation of the pump to draw fluid into the chamber via the inlet and dispense fluid via the outlet,

the piston forming element having:

an outer portion extending outwardly from the chamber through the open outer end,

an inner portion in the chamber inwardly from the outer portion,

an intermediate portion coupling the outer portion to the inner portion, and

a piston catch member inwardly from the intermediate portion,

the intermediate portion being frangible and breaking to sever the inner portion from the outer portion when an axially outwardly directed breaking force is applied to the outer portion,

the breaking force being greater than axially outwardly forces required to slide the piston forming element from the retracted position to the extended position,

a chamber catch member carried by the a piston-chamber forming member engaging the piston catch member when the piston forming element is slid outwardly relative the piston-chamber forming member at least as far as the extended position and preventing outward movement of the piston catch member past the chamber catch member under axially outwardly directed forces applied to the outer portion which are equal to or greater than the breaking force,

wherein when the inner portion is severed from the outer portion the pump is rendered inoperative and does not dispense fluid on axially sliding of the piston forming element inwardly and outwardly between the extended position and the retracted position.

2. A pump as claimed in claim 1 wherein

the chamber catch member extends radially inwardly into the chamber relative to the chamber wall presenting an axially inwardly directed chamber catch shoulder,

the piston catch member extending radially outwardly in the chamber from the piston forming element presenting an axially outwardly directed piston catch shoulder axially inwardly of the chamber catch shoulder to engage the chamber catch shoulder.

3. A pump as claimed in claim 2 wherein chamber catch shoulder has a radially innermost edge,

the piston catch member has a radially outermost edge which is radially outward of the innermost edge and axially opposed thereto.

4. A pump as claimed in claim 3 wherein the chamber catch member comprises a radially inwardly extending annular flange extending inwardly from the chamber wall proximate the inner end of the chamber.

5. A pump as claimed in claim 4 wherein the piston intermediate portion comprises a plurality of frangible strut-like members joining the piston outer portion to the piston inner portion at circumferentially spaced locations.

6. A pump as claimed in claim 5 wherein

each of the strut-like members extend generally axially.

7. A pump as claimed in claim 6 wherein each of the strut-like members are of a similar cross-sectional area normal the chamber axis.

8. A pump as claimed in claim 7 wherein the sum of the cross-sectional areas through all the strut-like members being less than any the cross-sectional area through the piston outer portion normal the chamber axis in any cross-section.

9. A pump as claimed in claim 1 wherein the piston forming element is formed from plastic.

10. A pump as claimed in claim 1 wherein the piston inner portion comprises an element selected from the group consisting of one or more of:

an element of a one way valve mechanism which resists fluid flow in the chamber in an axial direction, and

a disc member which extends radially outwardly to engage the chamber wall and prevent fluid flow therepast in at least one axial direction.

11. A pump as claimed in claim 10 wherein the piston forming element being generally cylindrical in cross-section with a central axially extending hollow stem having a central passageway open at an outer end of the piston outer portion forming a fluid outlet and closed at an inner end;

an inlet to the passageway on the stem axially inwardly of the fluid outlet via a short channel extending radially inwardly through the stem from the inlet to the passageway to receive fluid from the chamber.

12. A pump as claimed in claim 11 wherein the piston outer portion including an engagement member outward of the piston chamber forming member for engagement to apply axially directed forces to the piston forming element to axially slide the piston forming element relative the piston-chamber forming member.

13. A pump as claimed in claim 10 wherein the open outer end of the chamber is the outlet of the chamber.

14. A pump as claimed in claim 11 wherein the open outer end of the chamber is the outlet of the chamber, and the inner end of the chamber is open and forms the inlet of the chamber.

15. A pump as claimed in claim 11 wherein the outlet of the chamber extends radially outwardly through the chamber wall.

16. A pump as claimed in claim 10 wherein the piston outer portion including a plurality of axially extending locating webs extending radially outwardly to engage said chamber wall and guide the piston forming element in sliding axially centered and aligned within the chamber, each web having an axial inner end,

one of the strut-like members provided on the axial inner end each of the webs.

17. A pump as claimed in claim 16 wherein the piston catch member comprising a plurality of web catch members with one of the web catch member provided on each of the webs.

18. A pump as claimed in claim 17 including

a first disc extending radially outwardly from the stem, the first disc engaging the chamber wall circumferentially thereabout,

a second disc extending radially outwardly from the stem spaced axially outwardly from the first disc, the second disc engaging the chamber wall circumferentially thereabout,

the inlet located on the stem between the first disc and the second disc.

19. A pump as claimed in claim 18 wherein the chamber wall is stepped having a first portion of a first diameter and a second portion of a second diameter different than the first diameter.

20. A pump as claimed in claim 19 wherein the first disc is carried on the piston inner portion in the first portion of the chamber and the second disc is carried on the piston outer portion in the second portion of the chamber.

21. A pump as claimed in claim 20 including

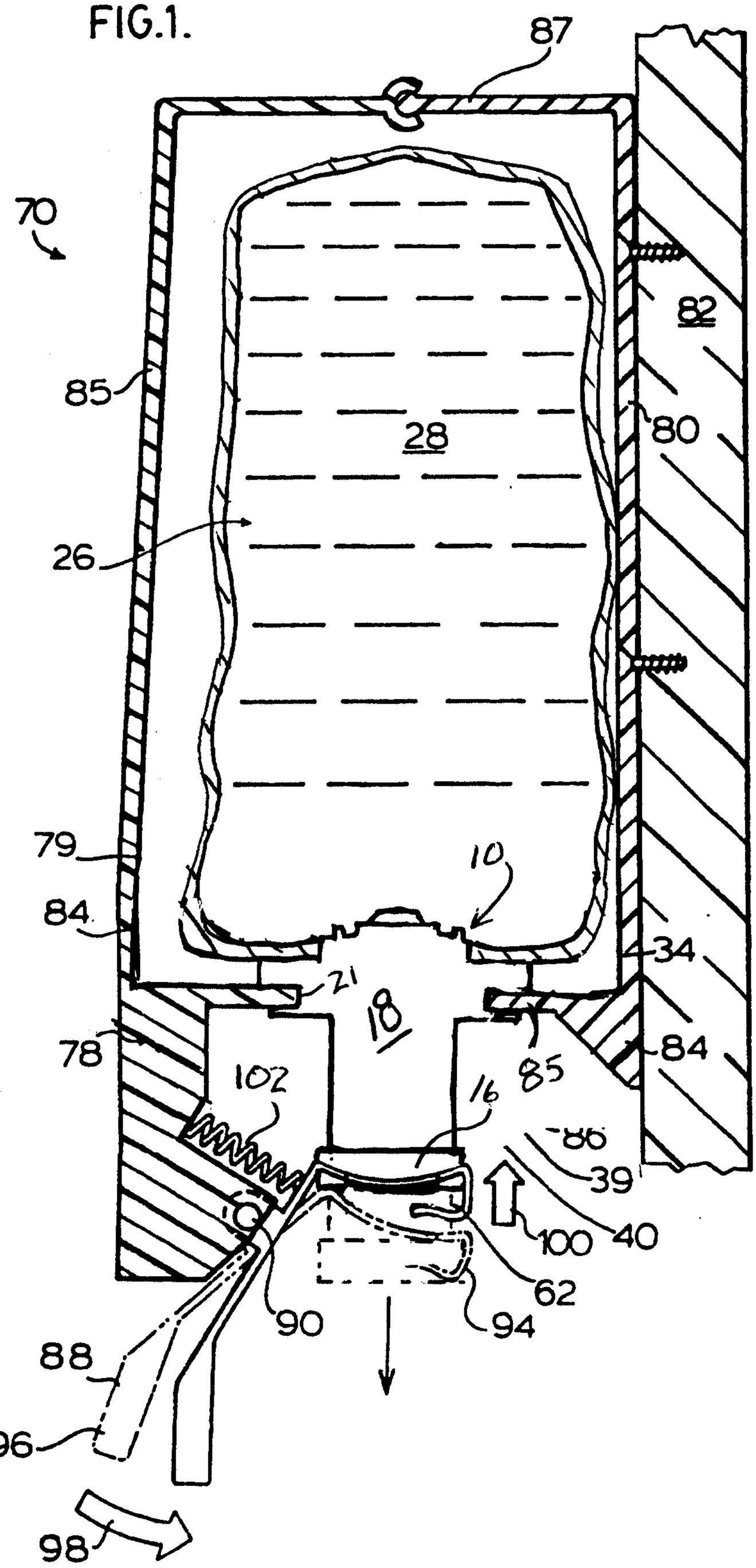
a third disc extending radially outwardly from the stem in between the first disc and the second disc, the third disc engaging the chamber wall circumferentially thereabout.

22. A pump as claimed in claim 1 wherein

the chamber catch member engaging the piston catch member when the piston forming element is slid outwardly relative the piston-chamber forming member past the extended position so that the piston catch member does not engage the chamber catch member during sliding of the piston forming element between the extended position and the retracted position.

22. A pump as claimed in claim 1 wherein the piston inner portion when severed from the outer portion remains in the chamber and prevents fluid flow inwardly through the chamber.

FIG.1.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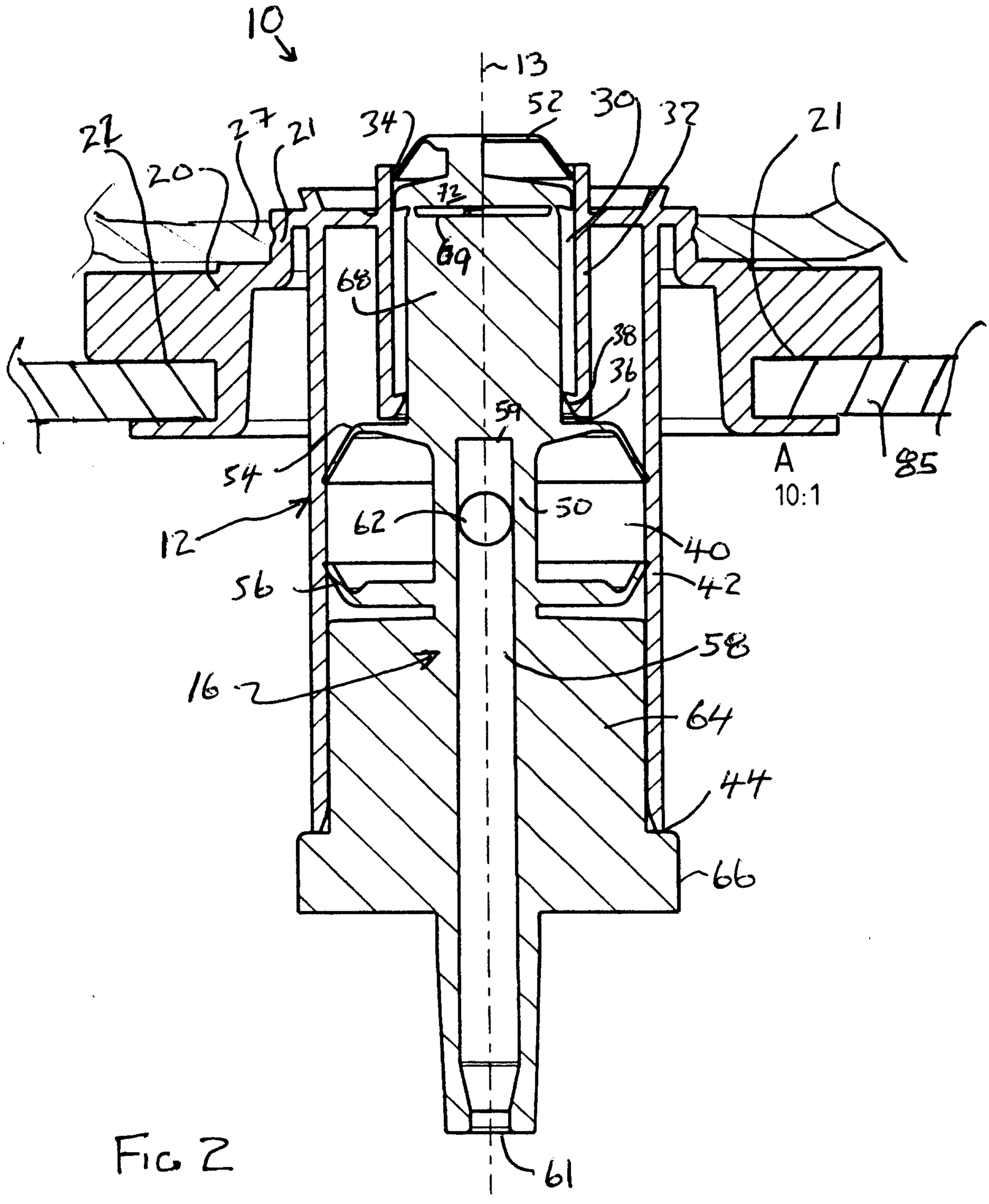
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Fig 2

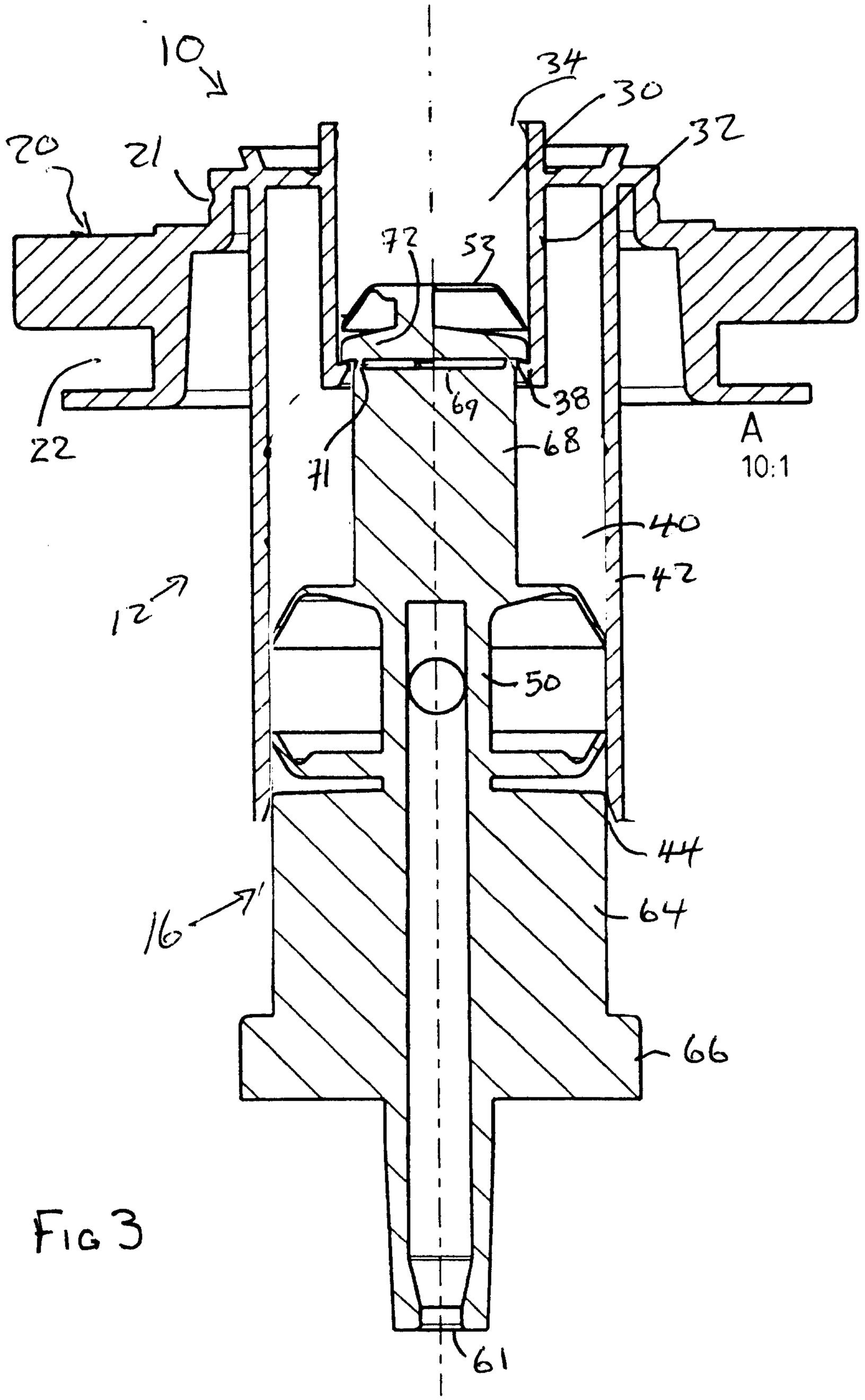

Fig 3

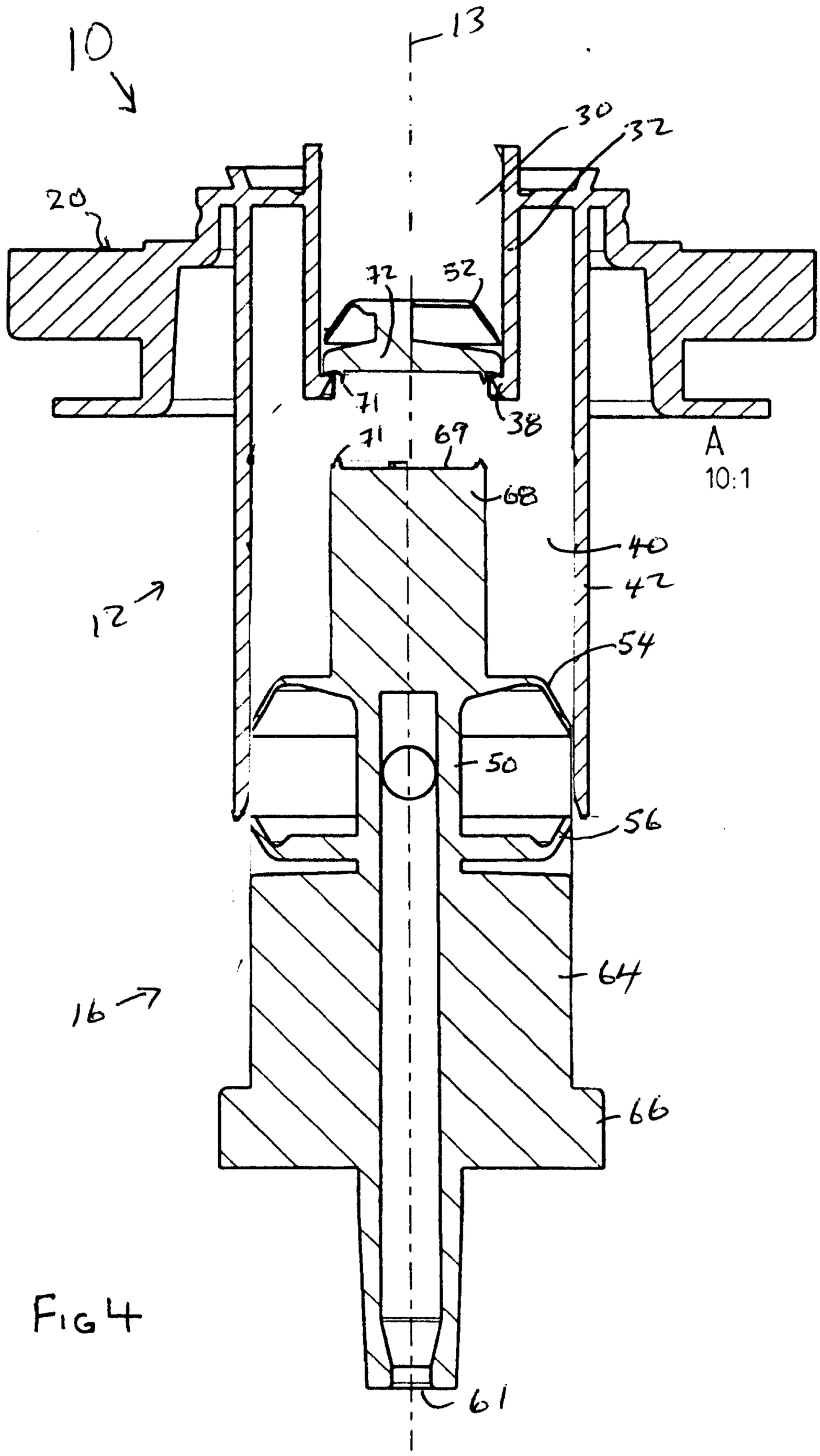

FIG 4

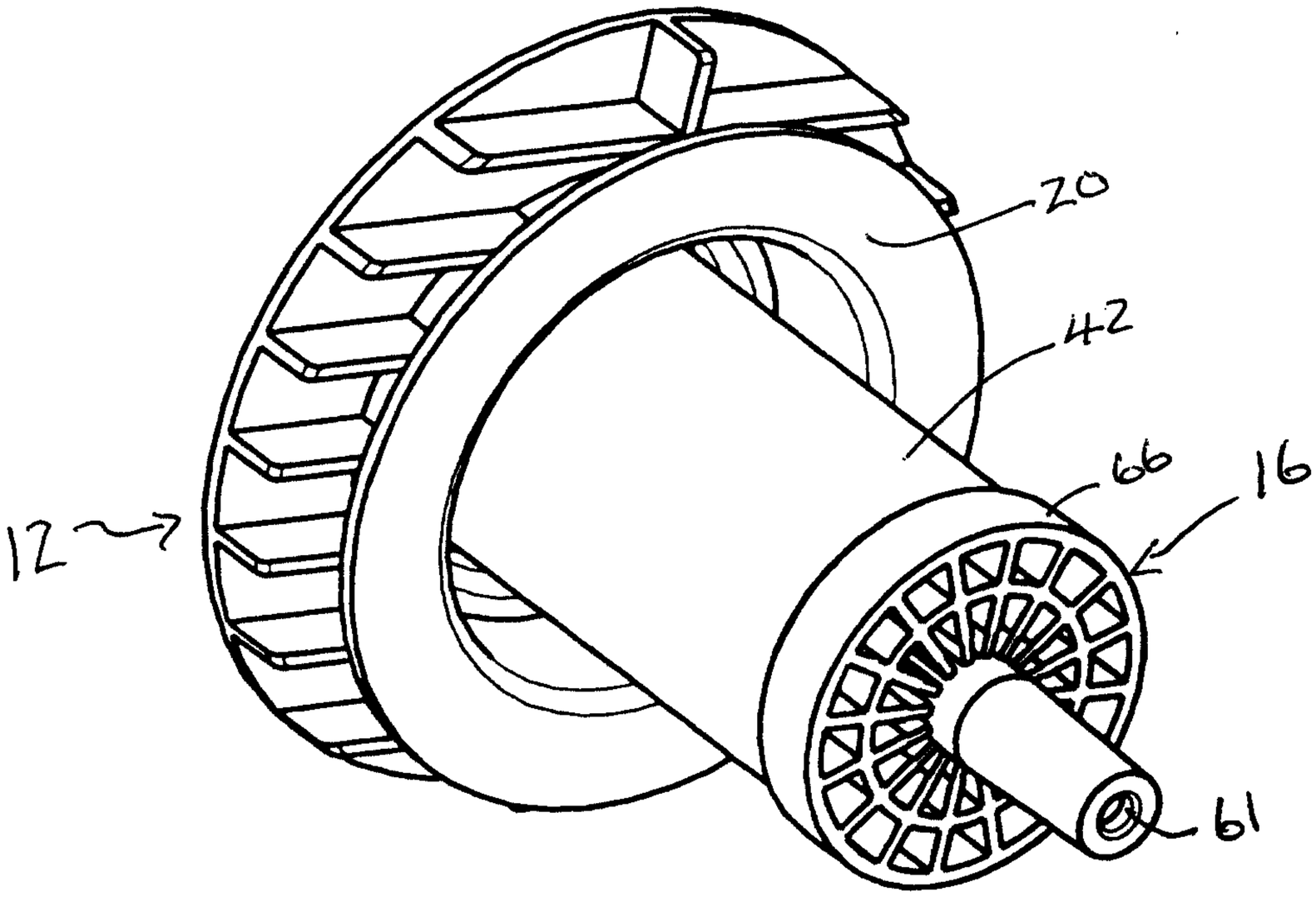

Fig 5

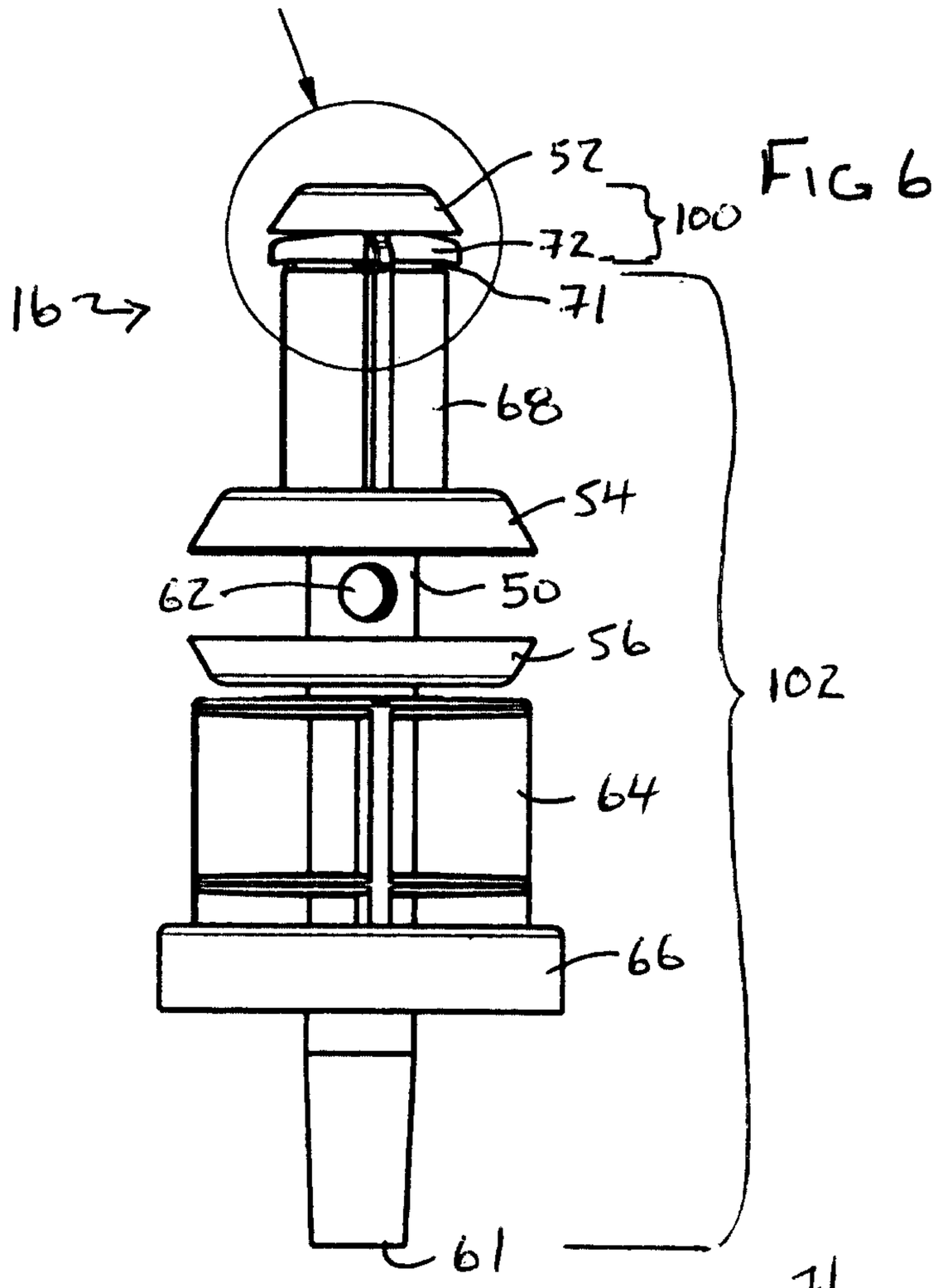

FIG 6

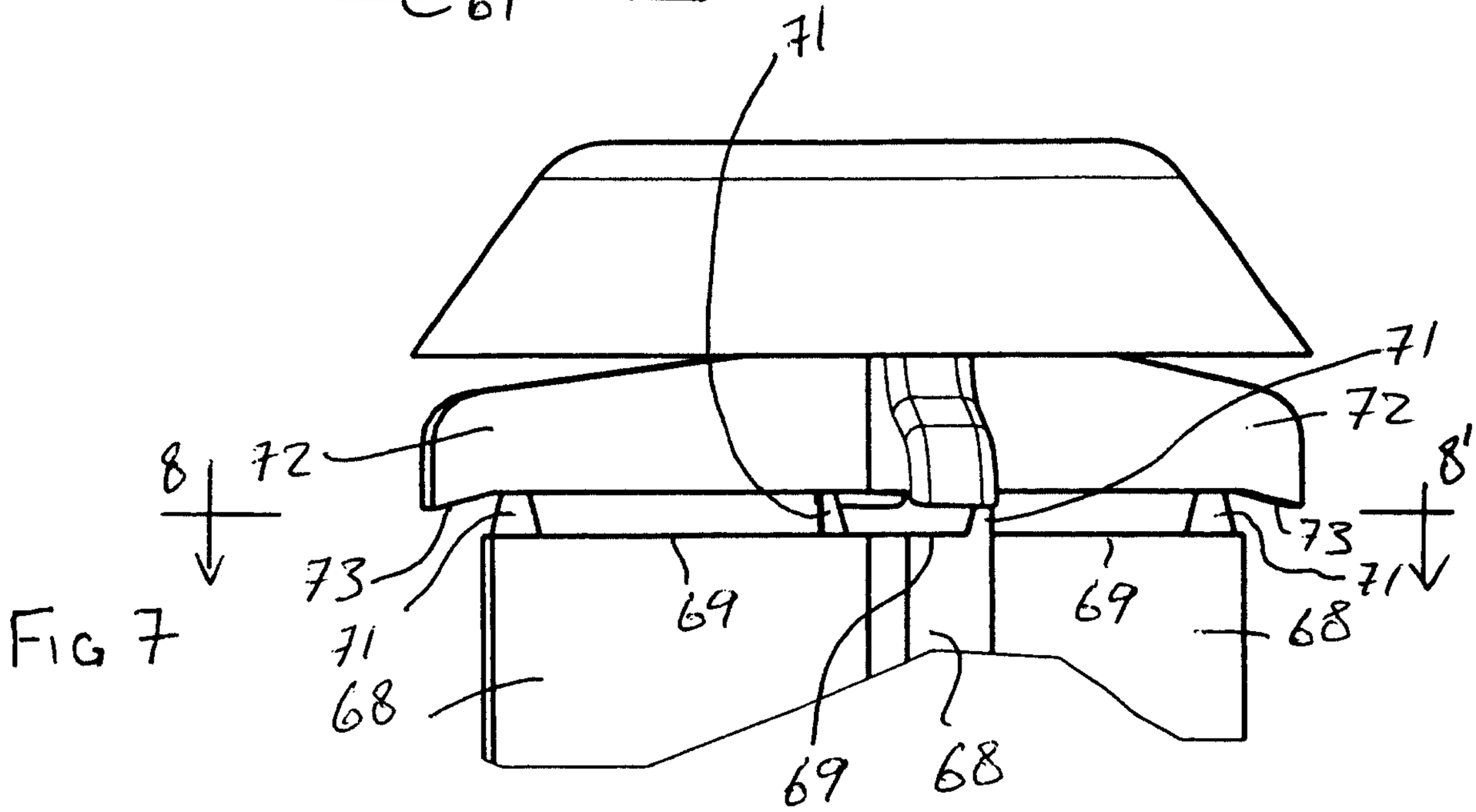

FIG 7

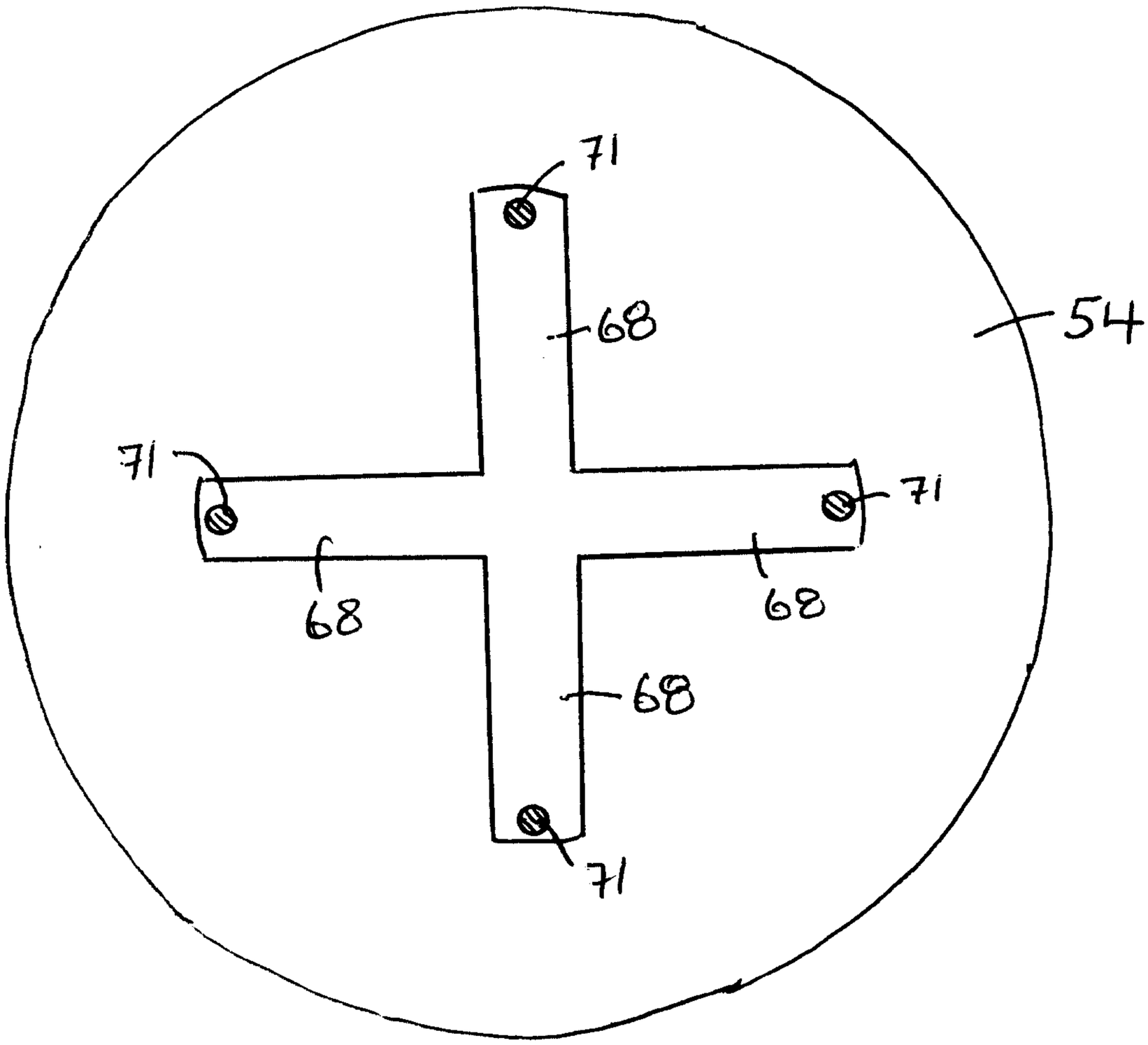

FIG 8

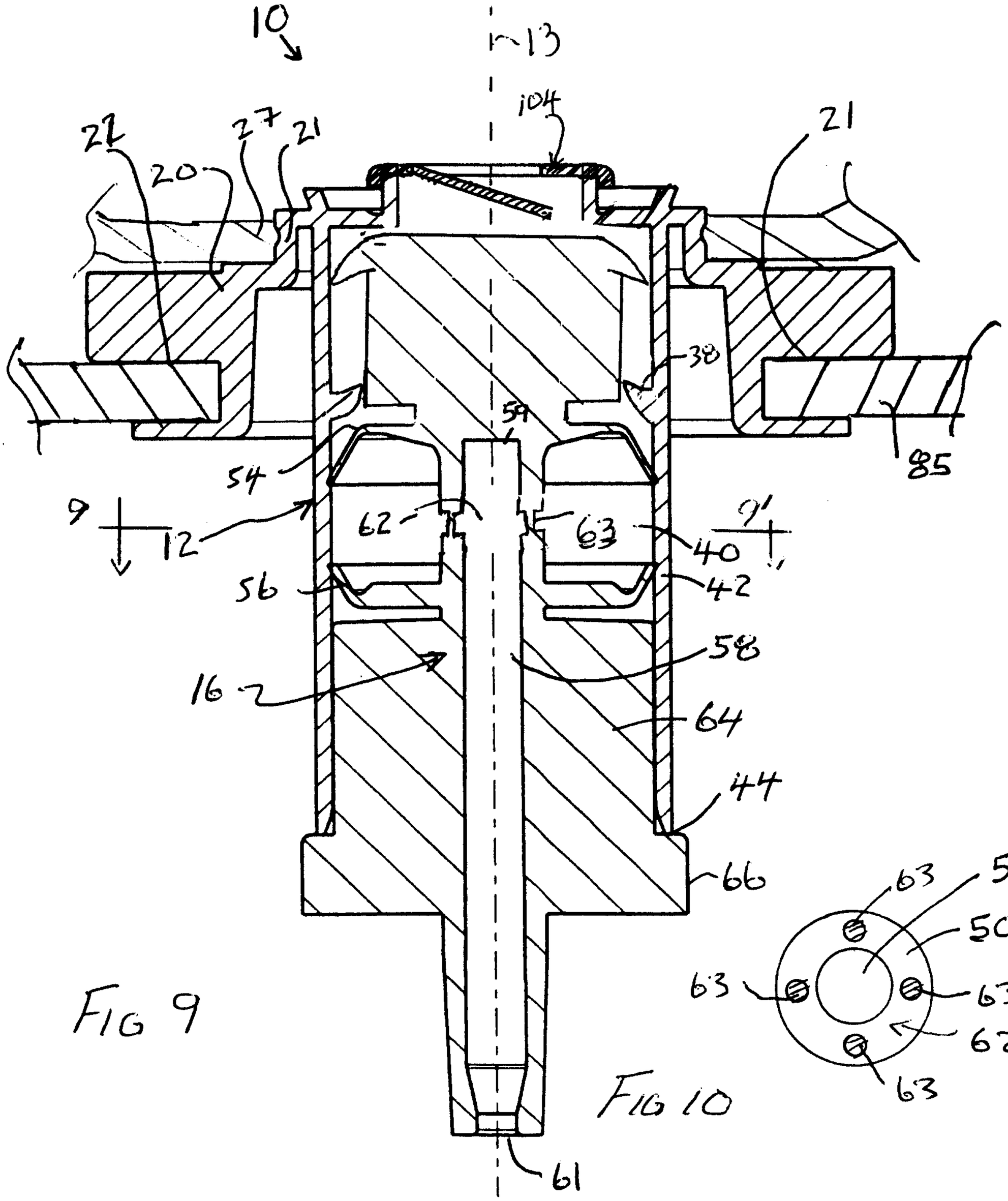
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FIG 9

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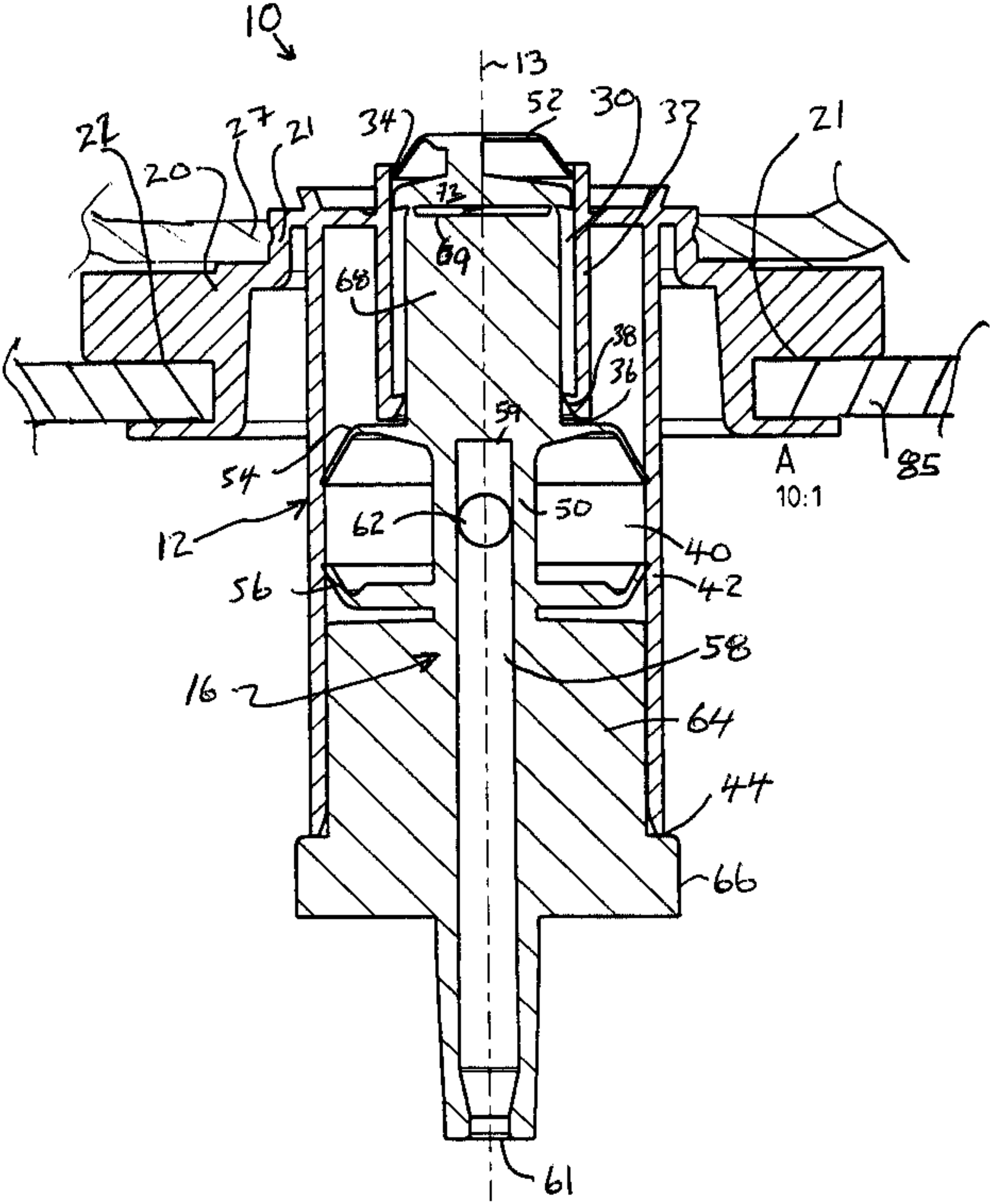
FIG 10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