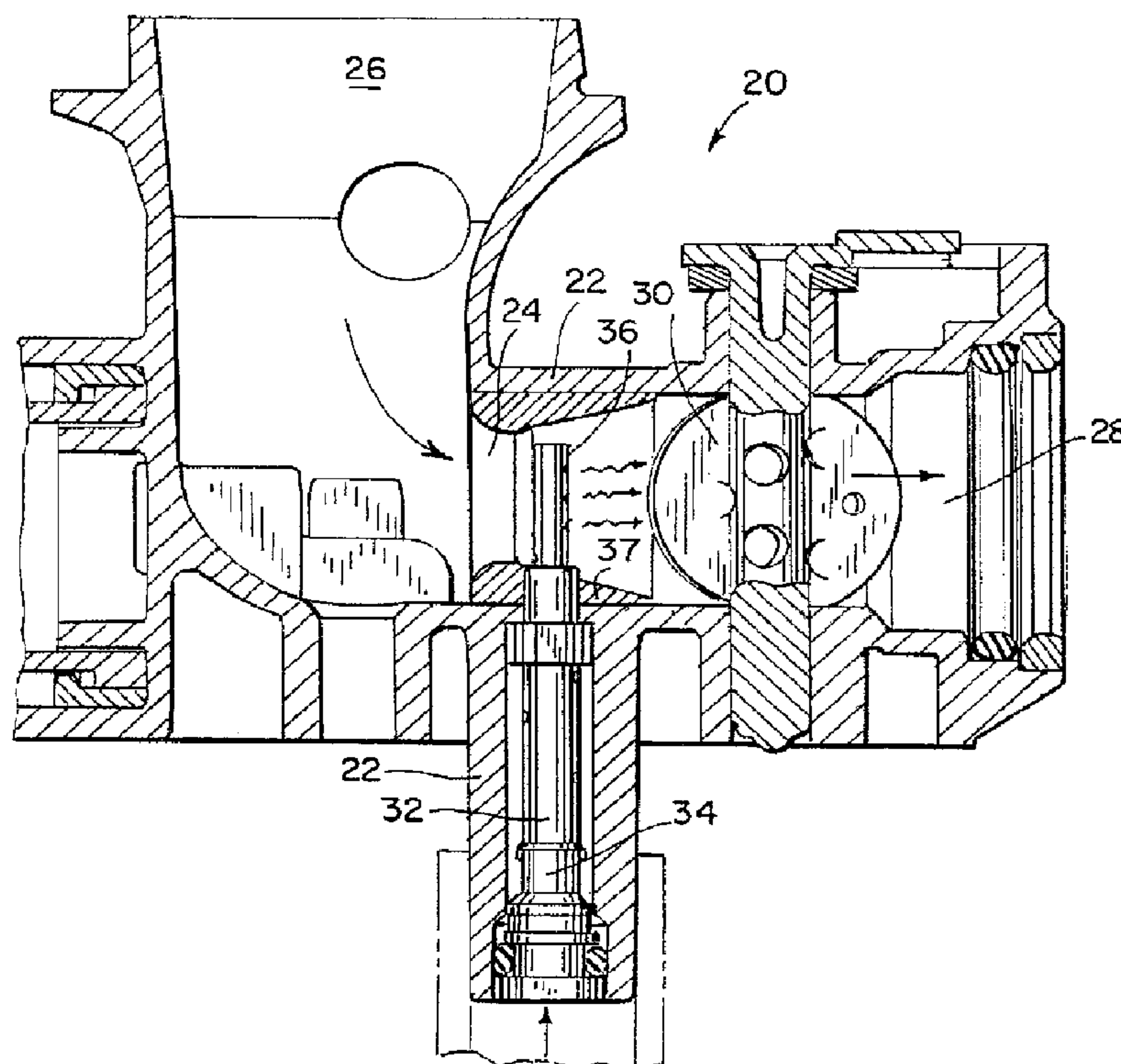




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(54) Title: CARBURETOR WITH FUEL NOZZLE



(57) Abrégé/Abstract:

A carburetor including a carburetor body (22) having a throat (24) extending from an intake (26) to a discharge (28), and a fuel nozzle (32) positioned within the throat and including an upstream orifice facing substantially upstream and a downstream orifice facing substantially downstream. A surface area of the upstream orifice is smaller than a surface area of the downstream orifice. If more than one orifice is provided on each side, a combined surface area of all upstream orifices is less than a combined surface area of all downstream orifices. The upstream orifice is positioned closer to the carburetor body than any of the downstream orifices. The downstream orifice includes a plurality of downstream orifices that have an average position that is centered with respect to the throat.



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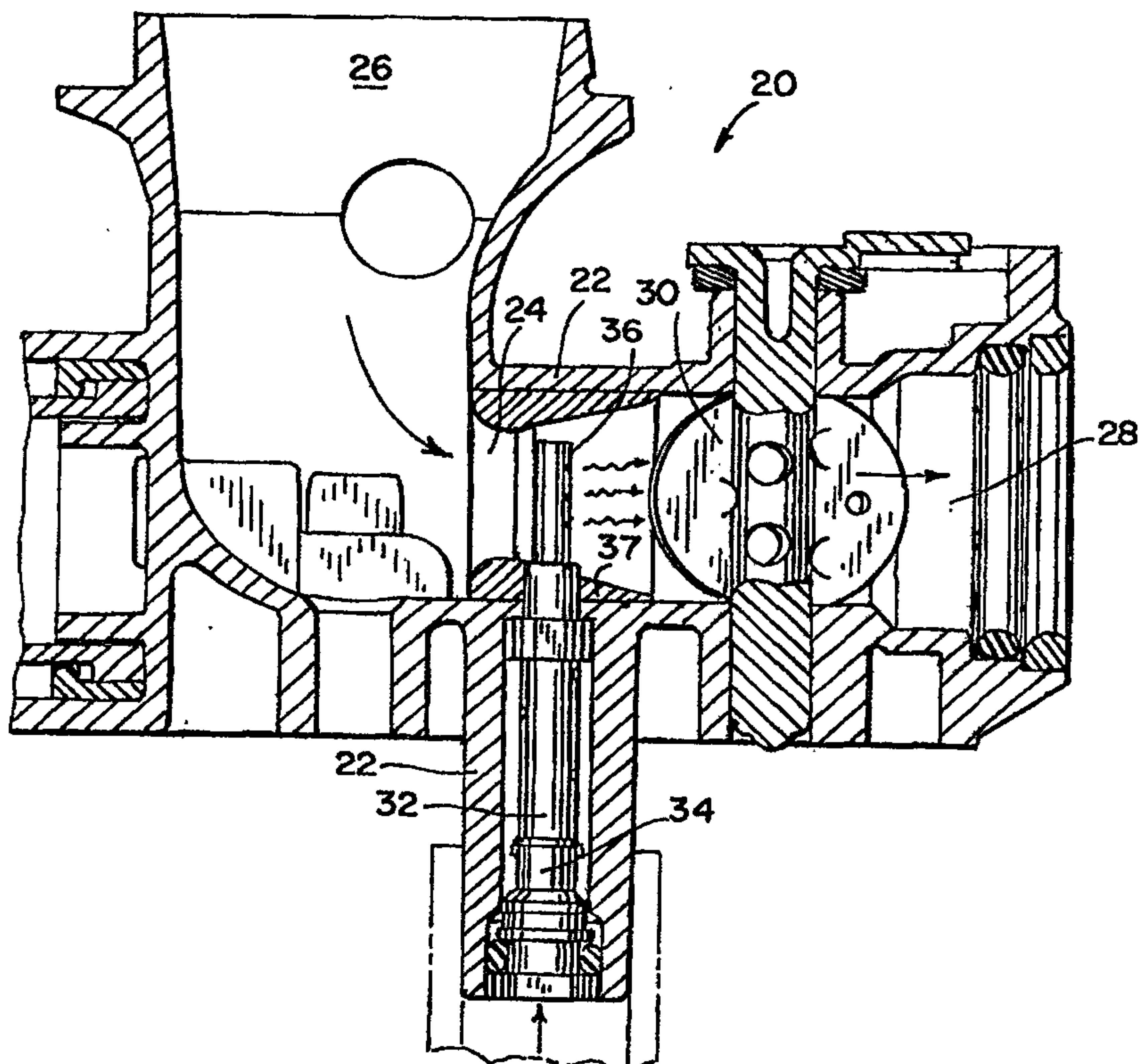
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(54) Title: CARBURETOR WITH FUEL NOZZLE

(57) Abstract

A carburetor including a carburetor body (22) having a throat (24) extending from an intake (26) to a discharge (28), and a fuel nozzle (32) positioned within the throat and including an upstream orifice facing substantially upstream and a downstream orifice facing substantially downstream. A surface area of the upstream orifice is smaller than a surface area of the downstream orifice. If more than one orifice is provided on each side, a combined surface area of all upstream orifices is less than a combined surface area of all downstream orifices. The upstream orifice is positioned closer to the carburetor body than any of the downstream orifices. The downstream orifice includes a plurality of downstream orifices that have an average position that is centered with respect to the throat.



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CARBURETOR WITH FUEL NOZZLEFIELD OF THE INVENTION

5 The present invention generally relates to the field of carburetors that mix air and fuel for internal combustion engines and, more particularly, to the field of fuel nozzles that provide fuel to the throat of such carburetors.

10 BACKGROUND OF THE INVENTION

Background art includes French reference FR-E-26,901, which discloses a fuel nozzle (1) having a pair of upstream orifices (2) and which is interconnected to a fuel conduit (5). French reference FR-A-555,986
15 discloses a fuel nozzle (1) disposed in a carburetor and in fluid communication with a fuel line (6). Another background art reference is British reference GB-A-649,920, which discloses a fuel nozzle (13) having an upstream orifice (24) and a downstream orifice (23)
20 disposed within a carburetor. The fuel nozzle is angled with respect to the flow of air through the carburetor, and fuel within the fuel nozzle blocks the upstream orifice (24) during high suction and low engine speeds. Another background art reference is British reference GB-
25 A-148,507, which discloses a fuel nozzle or choke tube (g) having an air inlet orifice (k) and a orifice for the outflow of fuel (k1). Fuel is drawn through the choke tube (g) from a chamber (d) containing a constant level (indicated by line 1-1) of fuel.

30 In conventional carburetors, air enters through an intake of a carburetor throat and travels through a venturi where the air is mixed with fuel and subsequently provided to a combustion chamber of the engine. Fuel is typically provided to the air by a fuel nozzle that is
35 operatively interconnected with a fuel supply (e.g., a fuel bowl). The fuel nozzle extends transversely into the carburetor throat, and includes an outlet port in a tip thereof. The outlet port commonly faces transverse

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to the air flow such that air passing over the port will create a negative pressure, thereby resulting in fuel being drawn from fuel nozzle.

5 In some engines, air can also flow in the reverse direction (i.e., from the combustion chamber toward the carburetor intake), sometimes called "reverse flow." Reverse flow is typically caused by intake valve leakage, which can result from valve lash, inconsistent cam profiles or poor valve seals. Due to the presence of an
10 air velocity, reverse flow creates a negative pressure at the outlet port, resulting in fuel being drawn from the fuel nozzle. When forward flow resumes, fuel is again drawn from the fuel nozzle, resulting in a "double charge" of fuel. This double charge creates an air/fuel
15 ratio that is richer than the optimum air/fuel ratio of the carburetor, resulting in excess emissions and lower fuel economy.

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SUMMARY OF THE INVENTION

The present invention provides a carburetor with a fuel nozzle that alleviates the problem of double charging by positioning orifices in the fuel nozzle such that more
5 fuel is dispensed during downstream gas flow than during upstream gas flow. In one aspect, the present invention provides a carburetor comprising: a carburetor body having a throat extending from an intake to a discharge, wherein a downstream direction is defined as extending from said
10 intake toward said discharge, and wherein an upstream direction is defined as extending from said discharge toward said intake; and a fuel nozzle having body, said body having a longitudinal axis positioned within said throat such that said longitudinal axis is substantially normal to said
15 upstream and downstream directions, said nozzle including at least one upstream orifice facing substantially upstream and at least one downstream orifice facing substantially downstream, wherein a surface area of said at least one upstream orifice is less than about 50 percent of a surface
20 area of said at least one downstream orifice, wherein said upstream orifice is sized and positioned to allow air to enter said fuel nozzle at a right angle to a flow of fuel in said nozzle during downstream flow of air in said carburetor throat to cause improved fuel atomization in said fuel
25 nozzle before said fuel and air exit said downstream orifice during normal operation of the engine.

In one embodiment, the surface area of the upstream orifice can be less than about 50 percent, preferably less than about 25 percent, and more preferably
30 between about 5 percent and about 20 percent of the surface area of the downstream orifice. In another embodiment, the fuel nozzle supplies fuel through a carburetor wall, and the

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upstream orifice is positioned closer to the carburetor wall than any of the downstream orifices. For example, the upstream orifice can be positioned adjacent the carburetor body that forms the throat. In yet another embodiment, the
5 downstream orifice includes a plurality of downstream orifices. Preferably, the plurality of downstream orifices have an average position that is centered with respect to the throat. For example, the downstream orifice can include three

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5 downstream orifices, wherein one of the three downstream orifices is centered with respect to the throat, and wherein the other two downstream orifices are evenly spaced on opposing sides of the centered downstream orifice.

10 In another aspect, the invention is embodied in a carburetor comprising a carburetor body having a throat extending from an intake to a discharge, and a fuel nozzle positioned within the throat and supplying fuel through a carburetor wall. The fuel nozzle includes at least one upstream orifice facing substantially upstream and at least one downstream orifice facing substantially downstream, and at least one of the upstream orifices is positioned closer to the carburetor wall than all of the downstream orifices. Preferably, the upstream orifice includes only one upstream orifice, and the downstream orifice includes a plurality of downstream orifices that have an average position that is centered with respect to the throat.

20 In yet another aspect, the present invention includes a carburetor including a carburetor body having a throat extending from an intake to a discharge, and a fuel nozzle positioned within the throat and including at least one upstream orifice facing substantially upstream and at least one downstream orifice facing substantially downstream, wherein a combined surface area of all upstream orifices is less than a combined surface area of all downstream orifices. In one embodiment, the surface area of the upstream orifice can be less than about 50 percent, preferably less than about 25 percent, and more preferably between about 5 percent and about 20 percent of the surface area of the downstream orifice.

BRIEF DESCRIPTION OF THE DRAWINGS

35 Fig. 1 is a side section view of a carburetor embodying the present invention and including a fuel nozzle.

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Fig. 2 is a longitudinal section view of the fuel nozzle illustrated in Fig. 1.

Fig. 3 is a section view of the fuel nozzle taken along line 3-3 in Fig. 2.

5 Fig. 4 is an end view of the fuel nozzle taken along line 4-4 in Fig. 2.

Fig. 5 is a side section view of a different carburetor embodying the present invention and including a fuel nozzle.

10 Fig. 6 is a longitudinal section view of the fuel nozzle illustrated in Fig. 5.

Fig. 7 is an end view of the fuel nozzle taken along line 7-7 in Fig. 6.

15 Figs. 8-12 illustrate various fuel nozzles embodying the present invention.

DETAILED DESCRIPTION

20 Fig. 1 illustrates a carburetor 20 having a carburetor body 22 with a carburetor throat 24 extending therethrough from an intake region 26 to a discharge region 28. The carburetor 20 further includes a throttle 30 that regulates the amount of air and fuel passing through the throat 24. A fuel nozzle 32 is positioned to provide fuel to the throat 24. The fuel nozzle 32
25 generally includes a base 34 mounted to the carburetor body 22, and a tip 36 extending from the base 34, through a carburetor wall 37, and at least partially positioned within the carburetor throat.

30 In accordance with the present invention, the tip 36 is provided with an upstream orifice and at least one downstream orifice having a surface area larger than a surface area of the upstream orifice. As used herein, the term "surface area" is used to describe the orifice's propensity to discharge fuel. That is, the larger the
35 surface area of the orifice, the more fuel it is likely to discharge given a particular pressure. The surface area values used herein refer to the area of the orifice at the outer surface of the fuel nozzle. It should be

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appreciated, of course, that other techniques could be used to achieve the present invention. For example, by using narrow slot-shaped or pinhole openings, surface tension could also play a role in an orifice's propensity to dispense fuel. Further, orifices that change in area from the surface inward could also affect the orifice's performance.

In the embodiment illustrated in Figs. 1 and 2, the tip includes one upstream orifice 38 that is circular and has a diameter of about .021 inches, corresponding with a cross-sectional surface area of about .00035 square inches. The illustrated embodiment includes three downstream orifices 40,42,44 that are each circular and have a diameter of about .037 inches, corresponding with a total cross-sectional surface area of about .00323 square inches. It should be appreciated that the orifices do not need to be round in cross-section, and could instead be configured in other appropriate shapes.

As best shown in Fig. 2, the middle downstream orifice 42 is approximately centered with respect to the throat 24, and the other two downstream orifices 40,44 are equally spaced on either side of the middle downstream orifice 42. Accordingly, the downstream orifices 40,42,44 are positioned in a pattern that is evenly distributed across the throat 24. In contrast, the upstream orifice 38 is positioned off-center with respect to the throat 24. More specifically, the upstream orifice 38 is positioned closer to the carburetor wall 37 than any of the downstream orifices 40,42,44, as shown in Figs. 1 and 2.

By virtue of the positioning of the downstream side of the nozzle tip, double charging is significantly reduced. More specifically, forward flow will create a low pressure at the downstream orifices, resulting in fuel being dispensed through the downstream orifices. During reverse flow, a high pressure is formed at the downstream orifices, resulting in little or no fuel being

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dispenses through the downstream orifices. Accordingly, double charging is significantly reduced.

5 The positioning of the upstream orifice allows air to enter the fuel nozzle at a right angle to the flow of fuel in the nozzle during forward flow. The right angle motion of the air relative to the fuel causes shearing of the fuel in the fuel nozzle, resulting in better fuel atomization as the fuel and air exit the downstream orifices. Because of the small surface area of the upstream orifice relative to the downstream orifices, reverse flow will not result in significant dispersal of fuel through the upstream orifice.

10 As noted above, the fuel nozzle 32 includes a tip 36 and a base 34. The tip 36 and the base 34 can be made from a wide variety of materials, including metals and plastics. In the embodiment illustrated in Figs. 1-4, the tip 36 and the base 34 are machined from metallic material, such as SAE CA 332 Brass, and the base 34 is press fit into the tip 36. The utilization of a two-piece fuel nozzle facilitates production of a fuel nozzle 15 32 having a tip 36 with a thinner wall than the base 34. The thinner wall allows the tip to occupy less space within the throat, thereby improving engine performance. To insure proper alignment of the base 34 with the tip 20 36, the base 34 includes a flat surface 46 that corresponds with a flat segment 48 on the tip 36, as shown in Fig. 3. Further, to insure that the assembled fuel nozzle 32 is properly inserted into the carburetor body 22, the base 34 includes a flat portion 50 that matches the shape of the carburetor body 22, as shown in Fig. 4.

25 The carburetor 60 illustrated in Fig. 5 includes an integral fuel bowl 62 and associated float 64 for providing fuel to the carburetor throat 66 via a metering orifice 68 and a fuel nozzle 70. Referring to Fig. 6, 35 the fuel nozzle 70 is a one-piece design made from plastic, such as acetal resin. The lower portion of the fuel nozzle includes a D-shaped base portion 72, as shown

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in Fig. 7, to insure proper alignment of the fuel nozzle 70 with the carburetor body 74.

Fig. 8 illustrates another fuel nozzle 80 embodying the present invention. The fuel nozzle 80 is a two-piece design, including a tip 82 and a base 84. The tip 82 and the base 84 are both made of plastic material, such as Delrin, a trademark of E.I. Du Pont De Nemours of Wilmington, Delaware. The tip 82 and the base 84 are interconnected by a snap fit, wherein a ridge 86 on the tip 82 fits into a groove 88 on the base 84. In the illustrated embodiment, the tip 82 has a wall thickness that is about the same as the wall thickness of the base 84.

Fig. 9 illustrates another fuel nozzle 90 embodying the present invention. The illustrated fuel nozzle 90 is a one-piece design that is machined from a metallic material, such as brass. A tip portion 92 of the fuel nozzle 90 is blocked by a ball plug 94.

Fig. 10 illustrates a fuel nozzle 100 embodying the present invention. Similar to the fuel nozzle illustrated in Fig. 8, the fuel nozzle 100 of Fig. 10 is a two-piece Delrin design wherein a tip 102 is snap fit with a base 104. The end of the tip 102 includes a ball plug 106 integrally formed therewith via a flexible interconnecting member 108. The open end of the tip 102 can be selectively closed by inserting the ball plug 106 into the open end.

Fig. 11 illustrates another fuel nozzle 110 embodying the present invention. The fuel nozzle 110 is identical to that illustrated in Fig. 8, except the tip 112 has a wall thickness that is significantly thinner than the wall thickness of the base 114.

Fig. 12 illustrates a two-piece brass fuel nozzle 120 having a tip 122 and a base 124 press fit into the tip 122. In contrast to the previously-described fuel nozzles, the tip 122 illustrated in Fig. 12 extends only partially (e.g., less than halfway) into the carburetor throat 126. Further, the tip 122 illustrated in Fig. 12

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includes only one downstream orifice 128, rather than the three downstream orifices illustrated in the other fuel nozzles. As shown, the downstream orifice 128 has a cross-sectional surface area that is significantly larger than the surface area of the upstream orifice 130.

The foregoing description of the present invention has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and the skill or knowledge of the relevant art, are within the scope of the present invention. The embodiments described herein are further intended to explain best modes known for practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments and with various modifications required by the particular applications or uses of the present invention. It is intended that the appended claims be construed to include alternative embodiments to the extent permitted by the prior art.

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CLAIMS:

1. A carburetor comprising:

a carburetor body having a throat extending from an intake to a discharge, wherein a downstream direction is defined as extending from said intake toward said discharge, and wherein an upstream direction is defined as extending from said discharge toward said intake; and

a fuel nozzle having body, said body having a longitudinal axis positioned within said throat such that said longitudinal axis is substantially normal to said upstream and downstream directions, said nozzle including at least one upstream orifice facing substantially upstream and at least one downstream orifice facing substantially downstream, wherein a surface area of said at least one upstream orifice is less than about 50 percent of a surface area of said at least one downstream orifice,

wherein said upstream orifice is sized and positioned to allow air to enter said fuel nozzle at a right angle to a flow of fuel in said nozzle during downstream flow of air in said carburetor throat to cause improved fuel atomization in said fuel nozzle before said fuel and air exit said downstream orifice during normal operation of the engine.

2. A carburetor as claimed in claim 1, wherein said surface area of said at least one upstream orifice is less than about 25 percent of said surface area of said at least one downstream orifice.

3. A carburetor as claimed in claim 1, wherein said surface area of said at least one upstream orifice is

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between about 5 percent and about 20 percent of said surface area of said at least one downstream orifice.

4. A carburetor as claimed in claim 1, wherein said at least one upstream orifice is positioned closer to the carburetor body than said at least one downstream orifice.

5. A carburetor as claimed in claim 4, wherein said at least one upstream orifice is positioned adjacent the carburetor body that forms the throat.

6. A carburetor as claimed in claim 1, wherein said at least one downstream orifice includes a second downstream orifice.

7. A carburetor as claimed in claim 6, wherein said first and second downstream orifices have an average position that is centered with respect to said throat.

8. A carburetor as claimed in claim 6, wherein said at least one downstream orifice includes a third downstream orifice.

9. A carburetor as claimed in claim 8, wherein said first downstream orifice is centered with respect to said throat, and wherein said second and third downstream orifices are evenly spaced on opposing sides of said first downstream orifice.

10. The carburetor as claimed in claim 7, wherein said at least one upstream orifice further comprises a second upstream orifice, and wherein a combined surface area of said first and second upstream orifices is less than a combined surface area of said first, second and third downstream orifices.

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11. The carburetor as claimed in claim 1, wherein said fuel nozzle further comprises a base portion that is keyed to fit into said carburetor body in a discrete orientation.

12. The carburetor as claimed in claim 1, wherein said
5 fuel nozzle further comprises:

a body including first and second distinct pieces, said body having an open first end and a second end closed by said first piece.

SMART & BIGGAR

PATENT AGENTS

OTTAWA, CANADA

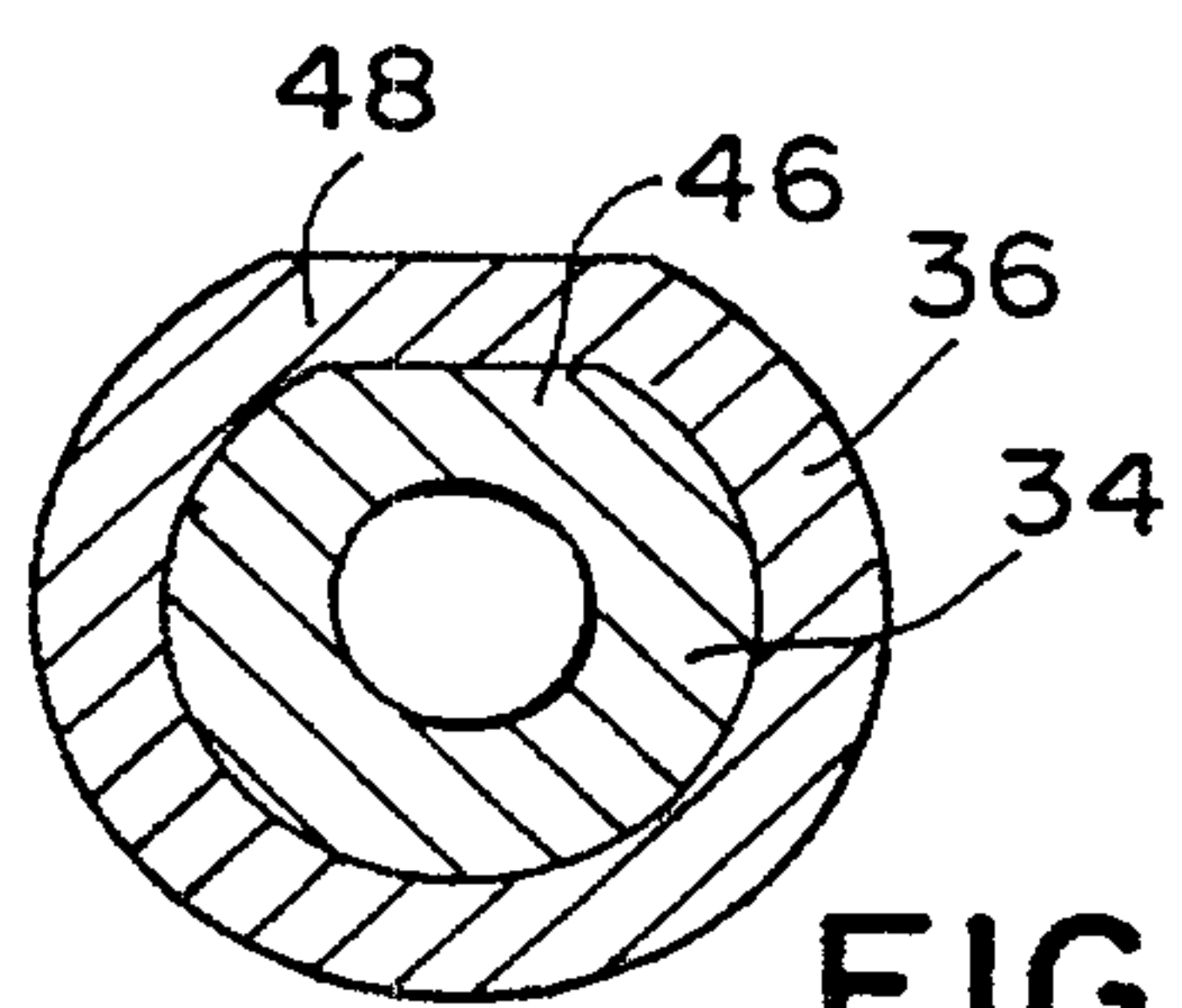
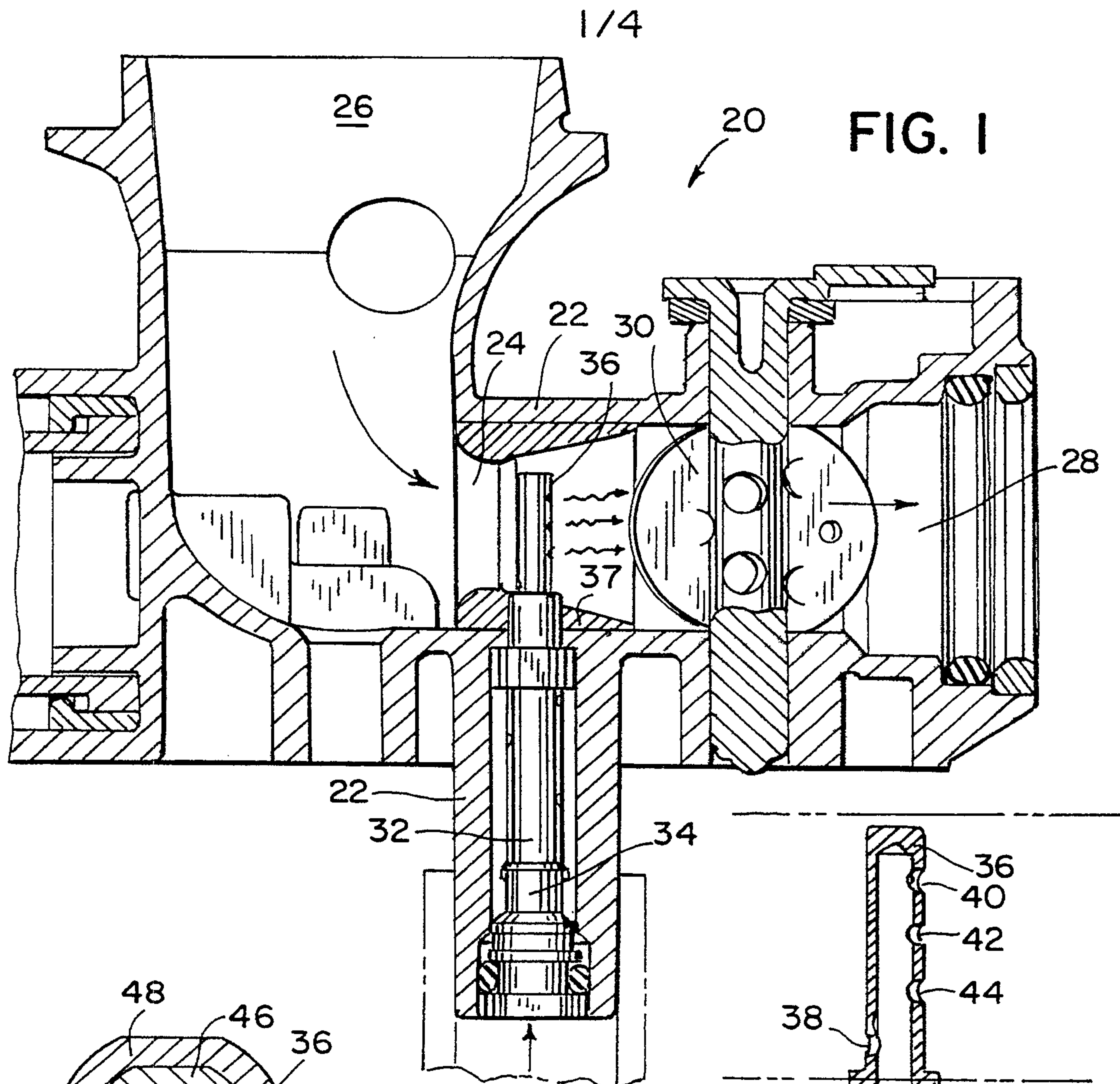
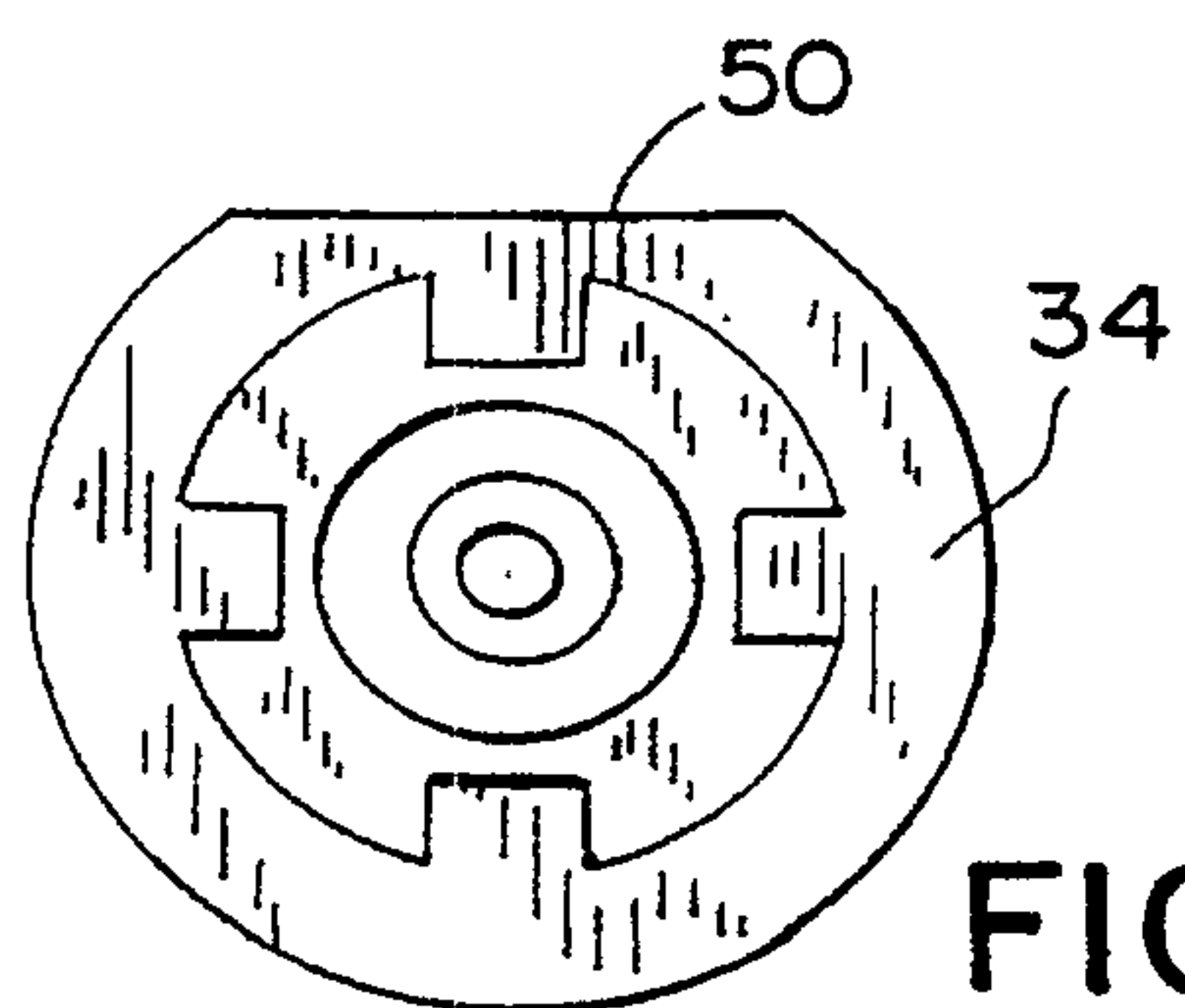


FIG. 2



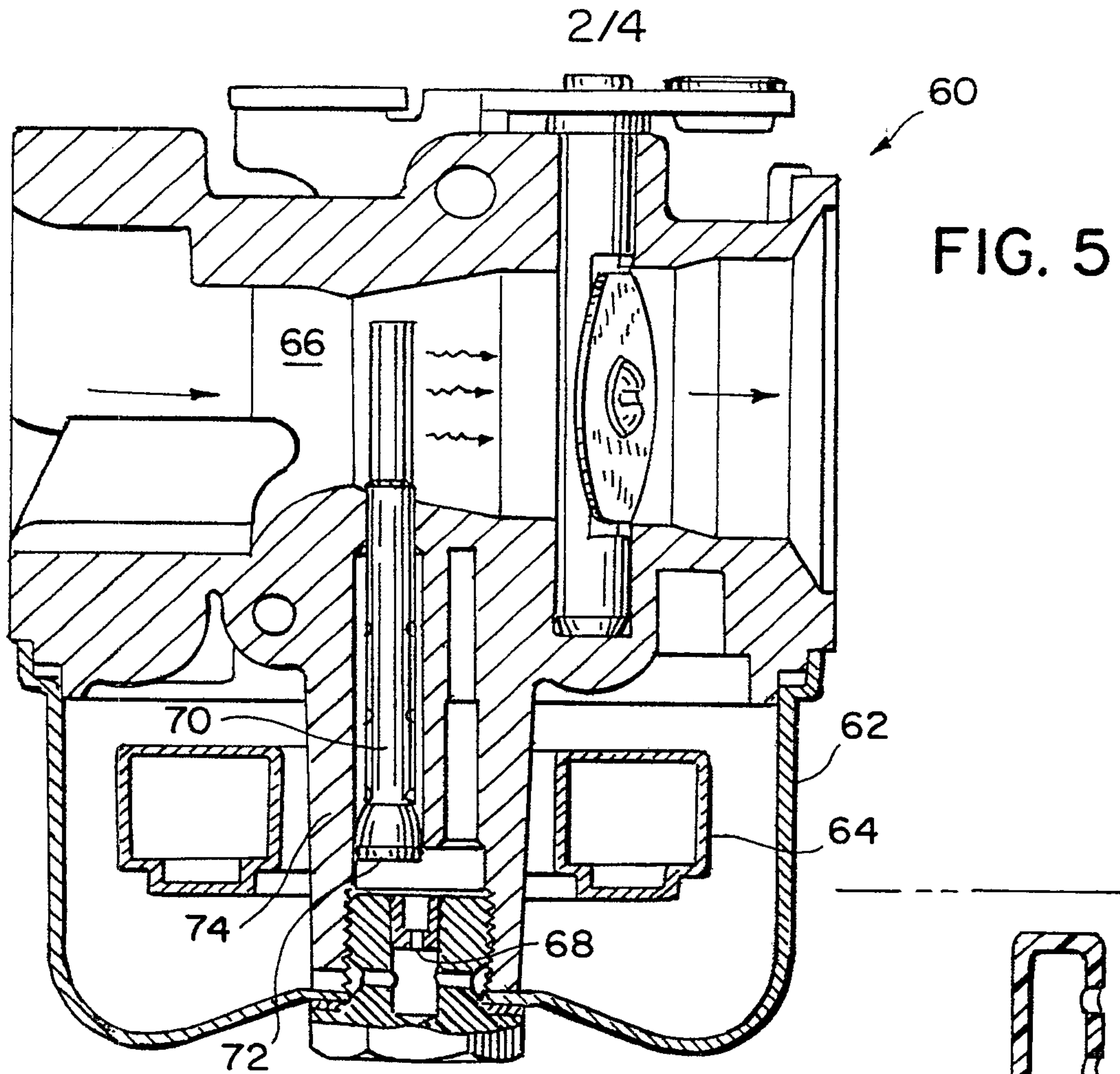


FIG. 6

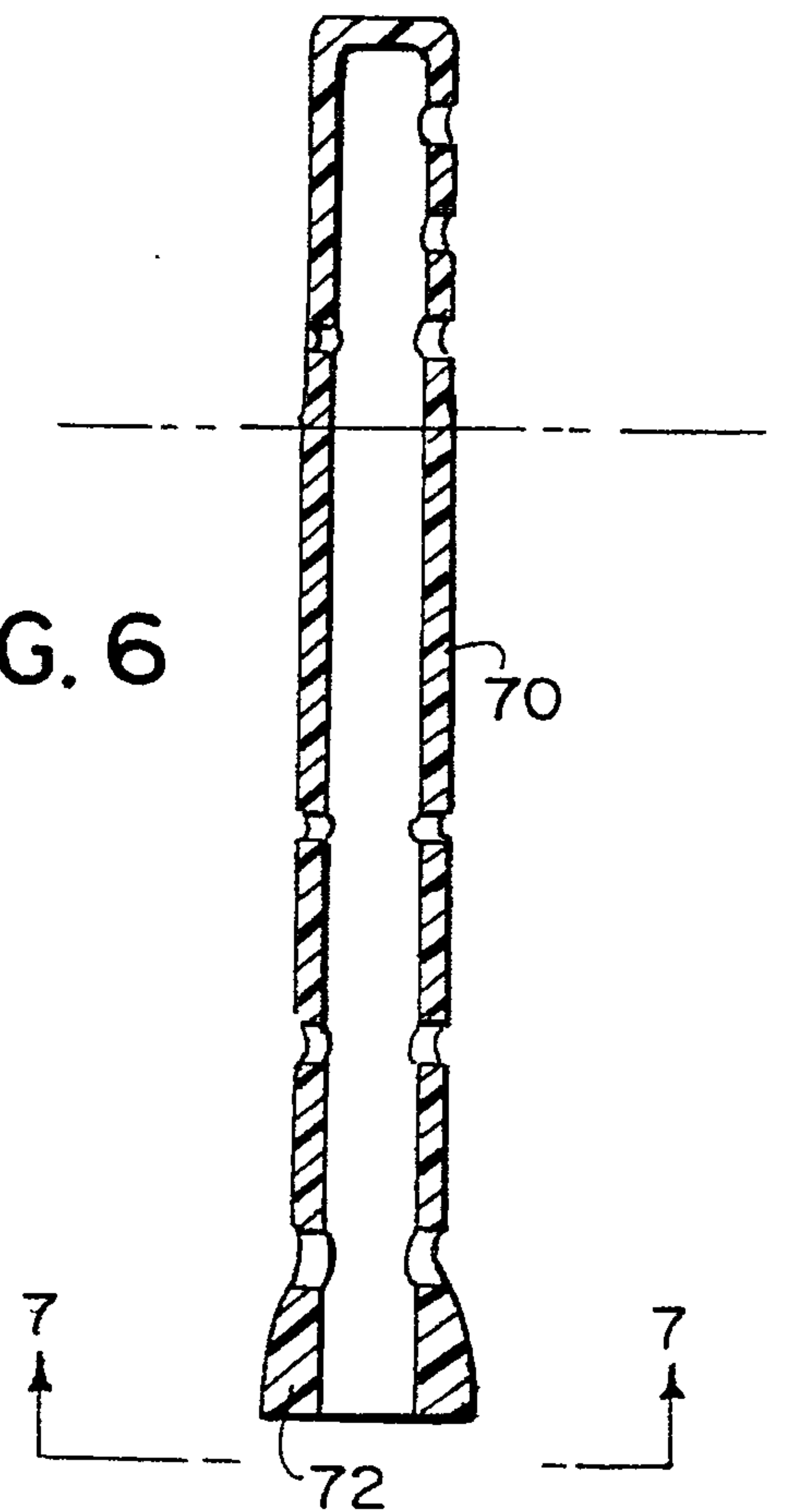
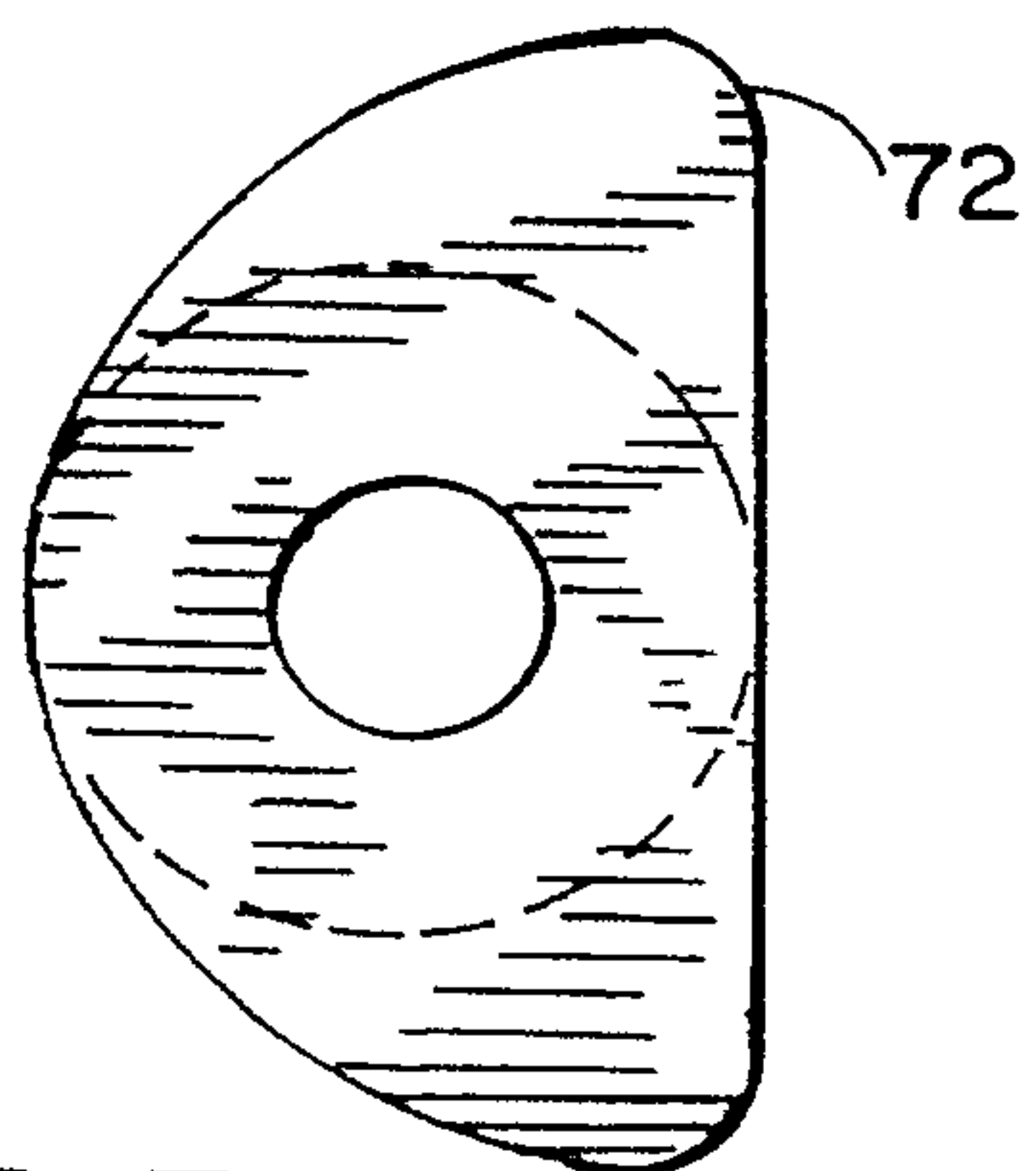


FIG. 7



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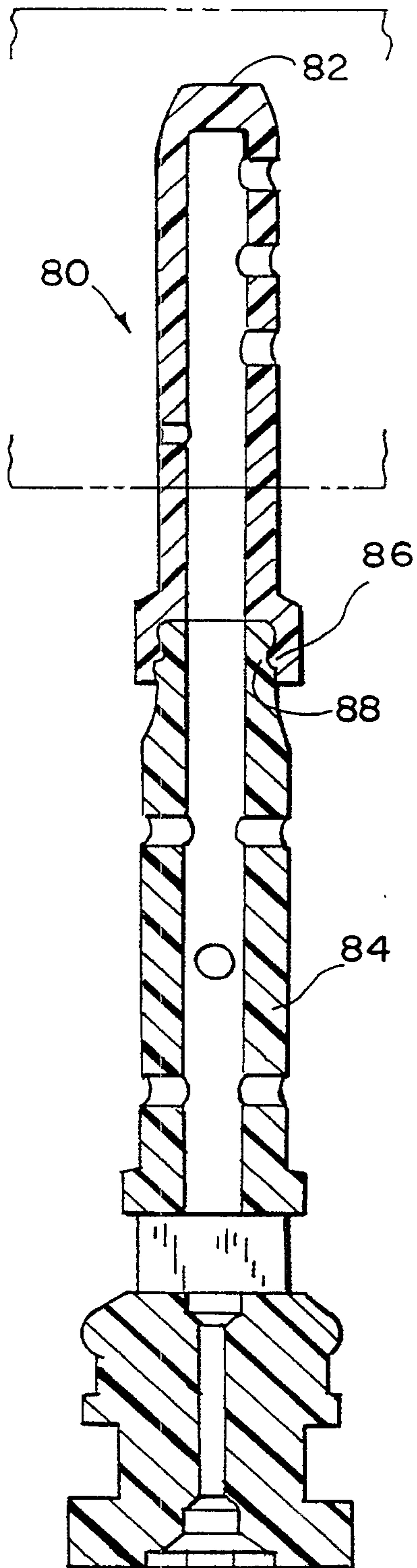


FIG. 8

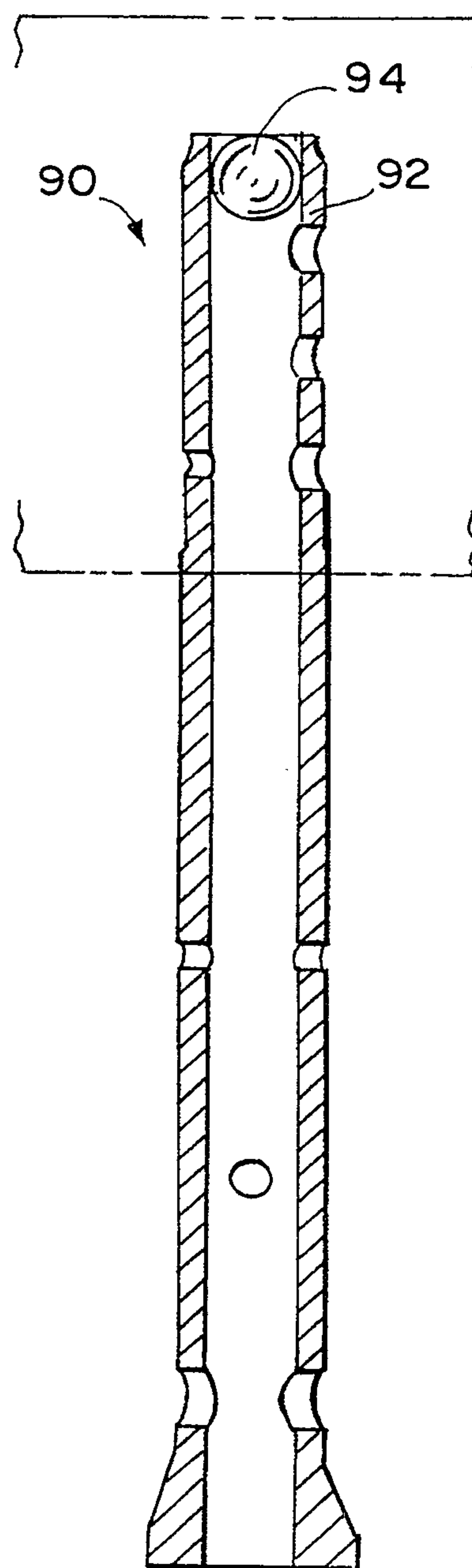


FIG. 9

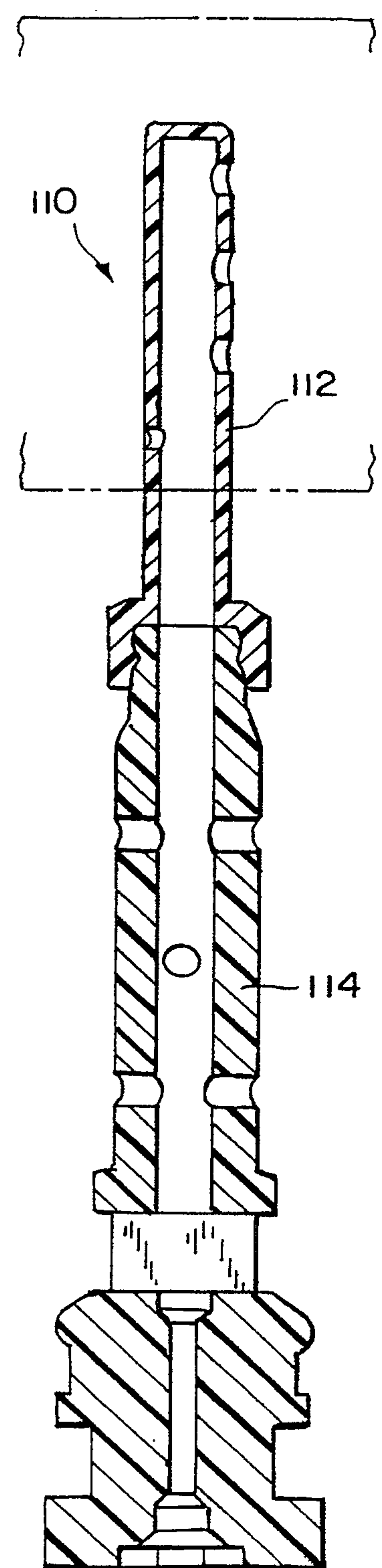


FIG. 11

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FIG. 10

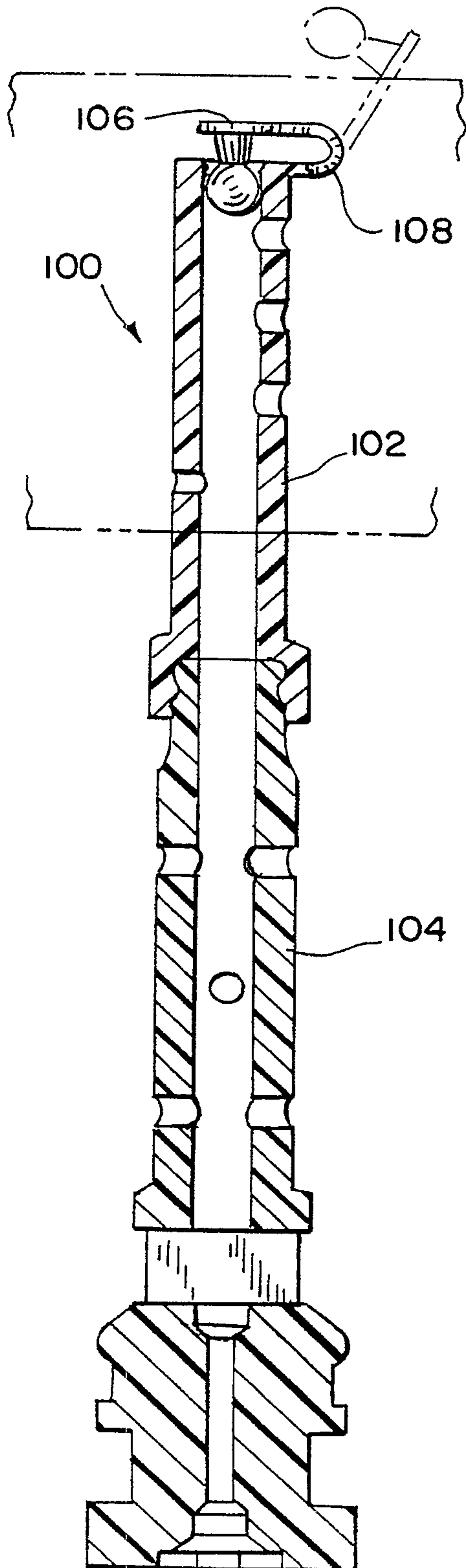


FIG. 12

