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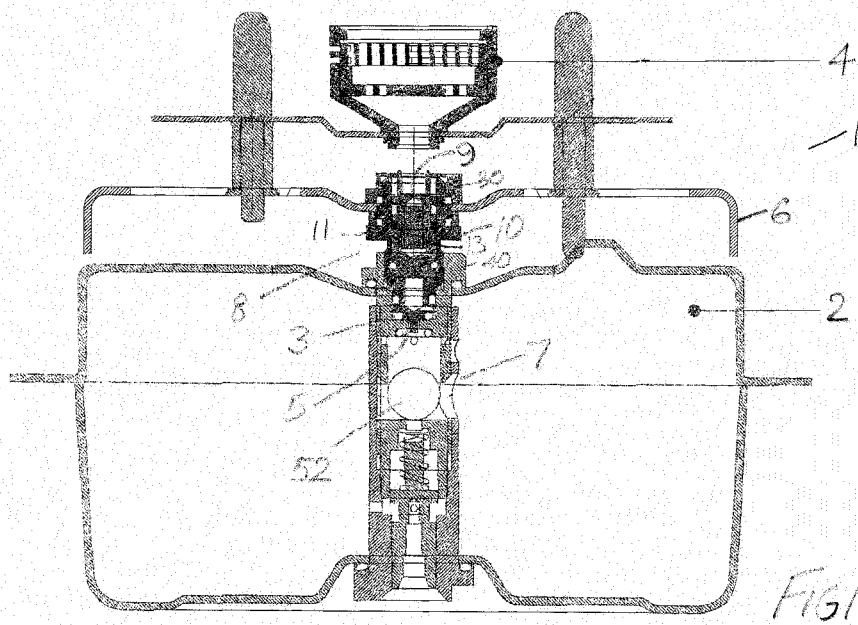
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(57) Abstract: A stove (1) has a fuel reservoir (2) which communicates via fuel supply line (8) with a burner (4). A stop valve (3) in the fuel supply line (8) controls fuel supply from the fuel reservoir (2) to the burner (4). A normally-open emergency shut-off valve (10) in the fuel supply line (8) is operable to close the fuel supply line (8) if the fuel pressure rises a preset amount above a normal operating pressure due to overheating of the fuel reservoir (2) for example.

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“A Stove”**Introduction**

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This invention relates to stoves, and in particular to chafing burners and the like.

The invention is particularly concerned with compact portable freestanding stoves of the type used in the catering industry and also for leisure activities, such as camping, hiking, sailing and the like. A stove of this type is described in PCT Patent Application Publication No. WO2008/119796, which discloses a stove having a burner, a fuel reservoir, a fuel supply line communicating between the fuel reservoir and the burner, a stop valve in the fuel supply line which is operable to control the supply of fuel from the reservoir to the burner, and a normally open emergency shut-off valve which is operable to close the fuel supply line, when the stove is tipped away from a normal upstanding operating position by a preset amount. This provides a safety cut off of fuel gas supply to the burner if the stove is accidentally knocked over. Because of the proximity of the burner to the fuel reservoir, and particularly when the burner is used for extended periods, some of the heat generated at the burner may cause heating of the reservoir, with a consequent increase in pressure in the fuel gas contained therein. This is undesirable from a safety point of view and also presents difficulties in regulating the temperature produced by the burner and possible overheating and spoiling of the foodstuffs being heated by the burner in use. There is also the possibility of damage to the burner and the food display unit.

The present invention is directed towards overcoming these problems.

Summary of the Invention

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According to the invention, there is provided a stove, including:

a burner,

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a fuel reservoir,

a fuel supply line communicating between the fuel reservoir and the burner,

5 a stop valve in the fuel supply line which is operable to control the supply of fuel from the fuel reservoir to the burner, and

a normally open emergency shut-off valve in the fuel supply line which is operable to close the fuel supply line,

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characterised in that said emergency shut-off valve is operable to close the fuel supply line in response to the fuel pressure in the fuel supply line, when said fuel pressure reaches a preset excess fuel pressure above a preselected normal operating fuel pressure.

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Thus, advantageously, the stove of the invention will automatically shut down if the fuel reservoir is overheated causing the pressure of the fuel contained therein to be increased by an undesirable amount.

20 In one embodiment of the invention, the emergency shut-off valve includes:

a valve housing having a through bore,

a complementary valve plunger slidably mounted in the bore,

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said valve plunger being movable relative to the bore between an open position and a closed position,

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said valve plunger cooperating with the bore such that, in the open position, a fuel passage through the bore is provided and in the closed position, fuel flow through the bore is prevented.

In another embodiment, the bore has a bore fuel inlet communicating with the fuel reservoir,

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the plunger has a fuel passage extending through the plunger with a plunger fuel inlet and terminating in a fuel outlet nozzle,

5 said plunger fuel inlet being provided at a side wall of the plunger which slidably engages the bore,

resilient seals being provided at each side of the plunger fuel inlet which are engagable between the plunger and the bore to prevent through
10 passage of fuel between the bore and the plunger,

a bypass recess in the bore which cooperates with the plunger to allow fuel to bypass the resilient seal located between the plunger fuel inlet and the bore fuel inlet when the plunger is in the open position.

15 In a further embodiment, retaining means is provided for retaining the valve plunger in the open position, when the fuel pressure is below said preset excess fuel pressure.

20 In another embodiment, the retaining means comprises a resilient pressure ring mounted in a circumferential recess in the plunger and frictionally engaging with the bore.

In another embodiment, the retaining means projects outwardly of the plunger for
25 engagement within an associated annular groove in the bore when the plunger is in the open position.

In another embodiment, the retaining means is a spring mounted in the valve housing and engaging and urging the plunger towards the open position.

30 In another embodiment, a fuel filter is mounted within the fuel passage in the valve plunger.

In another embodiment, a cap is mounted at an outer end of the through bore,

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said cap being engagable with the valve plunger when said valve plunger is at the outer end of the through bore to retain the valve plunger within the through bore, said cap having an opening therein in alignment with the fuel outlet nozzle to allow through-passage of fuel gas discharged from the nozzle in use.

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In another embodiment, the valve plunger comprises an inner part and an outer part joined by a threaded connector, a lower end of the outer part forming a male threaded connector for engaging with a complementary female threaded socket formed at an upper end of the inner part, said recess for reception of the pressure ring being formed between said parts when they are engaged.

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In a further embodiment, the stop valve comprises a valve body mounted at a top of the canister, the valve housing of the emergency shut-off valve having an outer threaded portion in screw engagement with a complementary threaded bore in the valve body, a valve head at a lower end of the valve housing being engagable with an associated valve seat formed at an inner end of the bore at an outlet end of a fuel inlet opening communicating with the fuel reservoir.

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In another embodiment, said bore is stepped having an enlarged threaded outer portion which receives the valve housing and a smaller diameter smooth bored inner portion, the fuel inlet opening being formed by a port at an inner end of said inner portion, a seal being mounted in an associated circumferential groove at a lower end of the valve housing sealingly engaging between the valve housing and a wall of the inner portion above the bore fuel inlet in a gas-tight manner to ensure fuel gas must pass through the bore fuel inlet.

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Brief Description of the Drawings

The invention will be more clearly understood by the following description of some embodiments thereof, given by way of example only, with reference to the accompanying drawings, in which:

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Fig. 1 is a sectional elevational view of a stove according to the invention;

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Fig. 2 is an enlarged detail sectional elevational view of an emergency shut-off valve assembly forming portion of the stove, shown in an open position;

5 Fig. 3 is a view similar to Fig. 2, showing the emergency shut-off valve in a closed position; and

Fig. 4 is a view similar to Fig. 2 showing an alternative emergency shut-off valve assembly.

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Detailed Description of Preferred Embodiments

Referring to the drawings, and initially to Fig. 1 to Fig. 3 thereof, there is illustrated a stove according to the invention, indicated generally by the reference numeral 1.

15 The stove 1 has a fuel reservoir formed by a cylindrical canister 2. A stop valve 3 is mounted at a top of the canister 2 for regulating supply of fuel gas from the canister 2 through a fuel passage or supply line, indicated generally by the reference numeral 8, to an associated burner head 4. The fuel supply line 8 has a fuel inlet 5 within the canister 2 and an outlet nozzle 9 for directing fuel gas at the
20 burner head 4. A hand wheel 6 is rotatable to move the stop valve 3 between open and closed positions, as required. An emergency shut-off valve 7 is mounted at the fuel inlet 5 of the fuel supply line 8 and is operable when the stove 1 is knocked over to close the fuel supply line 8. The general construction of the stove 1 is largely similar to the stove already described in WO 2008/119796 and
25 thus for the sake of brevity does not need to be repeated here. In accordance with the present invention, a fuel gas emergency over-pressure shut-off valve 10 is provided in the fuel supply line 8 and is operable in response to the fuel pressure in the fuel supply line 8 to close when said fuel pressure reaches a preset excess fuel pressure above the normal operating fuel pressure.

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Referring in particular to Figs. 2 and 3, the fuel supply line 8, and in particular the emergency over-pressure shut-off valve 10, is shown in more detail. The emergency over-pressure shut-off valve 10 has a generally cylindrical valve housing 11 with a through bore 12. A complementary valve plunger 13 is slidably

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mounted within the bore 12. This valve plunger 13 is movable within the bore 12 between a lowered open position as shown in Fig. 2, and a raised closed position within the bore 12, as shown in Fig. 3.

5 When in the lowered open position, shown in Fig. 2, a bottom face 14 of the plunger 13 locates a small distance above a land 15 at a stepped inner end of the bore 12 which allows through passage of gas fuel. The bore 12 has a fuel inlet 17 at an innermost end of the bore 12 which communicates with the fuel canister 2 through the stop valve 3.

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A fuel passage 18 extends through the plunger 13 between a plunger fuel inlet 19 and the fuel outlet nozzle 9. A sintered filter 20 is housed within the fuel passage 18. It will be noted that the plunger fuel inlet 19 is located at a side wall of the plunger 13 which slidably engages the bore 12.

15

Resilient seals are provided at each side of the plunger fuel inlet 19, namely, an upper O-ring seal 22 and a lower O-ring seal 23. The upper O-ring seal 22 is located within a complementary circumferential groove 24 adjacent an upper end of the plunger 13. Similarly, the lower O-ring seal 23 locates within a groove 25 at a lower end of the plunger 13. The upper O-ring seal 22 engages between the plunger 13 and a wall of the bore 12 at all times forming a gas-tight seal to prevent through passage of fuel between the bore 12 and the plunger 13 to ensure that all the fuel passes through the fuel passage 18 extending through the plunger 13 for delivery to the outlet nozzle 9.

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A bypass recess 27 is provided in the bore 12 adjacent an inner end of the bore 12. The bypass recess 27 essentially comprises a generally V-shaped circumferential channel extending around the wall of the bore 12 of the valve housing 11. This bypass recess 27 cooperates with the plunger 13 to allow fuel to bypass the lower O-ring seal 23 located between the plunger fuel inlet 19 and the bore fuel inlet 17, when the plunger 13 is in the lowered open position, shown in Fig. 2. Thus, fuel can be supplied from the fuel canister 2, through the open stop valve 3 and through the open emergency over-pressure shut-off valve 10 to the nozzle 9 and burner 4 during normal operation of the stove 1.

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However, if the fuel pressure increases by a preset amount, for example due to heating of the canister 2, fuel pressure acting on the bottom face 14 of the plunger 13 will raise the plunger 13 in the bore 12 to the raised closed position shown in Fig. 3, in which position the lower O-ring seal 23 sealingly engages with the wall of the bore 12 to prevent delivery of fuel past the lower O-ring seal 23 to the plunger fuel inlet 19. In the raised position, the plunger 13 abuts against a cap 30 screwed onto an upper end 31 of the valve body 11, as shown in Fig. 3.

A resilient pressure ring 34 is mounted in an associated circumferential recess 35 in the plunger 13 located between the O-ring seals 22, 23 and frictionally engages with the wall of the bore 12, being slightly oversized relative to the bore 12. When in the lowered open position shown in Fig. 2 the pressure ring 34 projects outwardly of the plunger 13 for engagement within an associated shallow annular groove 36 in the wall of the bore 12. During normal operating conditions, the frictional engagement of the pressure ring 34 with the wall of the bore 12, and also because the pressure ring 34 nests in the shallow annular groove 36, is sufficient to retain the plunger 13 in the lowered open position, shown in Fig. 2. However, if the fuel pressure rises significantly to a preset excess fuel pressure, for example due to heating of the canister 2, the fuel pressure acting on the bottom face 14 of the plunger 13 is sufficient to overcome this frictional resistance of the pressure ring 34 and raise the plunger 13 in the bore 12 to the raised open position shown in Fig. 3, shutting off fuel supply to the nozzle 9 and burner 4 as previously described.

The plunger 13 comprises two parts, namely, an inner part 37 and an outer part 38 joined by a threaded connector 39 which facilitates mounting the filter 20 in the outer part 38 and mounting the pressure ring 34 in the recess 35 which is formed between the two parts 37, 38, when they are engaged. When joined together a lower end of the outer part 38 forms a male threaded connector which projects into a complementary female threaded socket at an upper end of the inner part 37.

The stop valve 3 comprises a valve body 40 centrally mounted at a top of the canister 2. The valve housing 11 of the emergency over-pressure shut-off valve

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10 has an outer threaded portion 42 in screw engagement with a complementary threaded bore 43 at a top of the valve body 40. A valve head 44 at a lower end of the valve housing 11 is engagable with an associated valve seat 45 formed at an inner end of the bore 43. Turning the valve housing 11 by means of the hand wheel 6 moves the valve housing 11 axially in the bore 43 to engage and disengage the valve head 44 and valve seat 45 for closing and opening the stop valve 3, thus controlling the supply of fuel from the canister 2 to the burner 4. A central pin 50 at the lower end of the valve housing 11 is movable through the fuel inlet opening 5 at an inner end of the bore 43 when the stop valve 3 is closed to disengage a ball 52 of the emergency shut-off valve 7 as previously described in WO2008/119796.

The bore 43 of the valve body 40 is stepped having an enlarged threaded outer portion 47 which receives the valve housing 11 and a smaller diameter smooth bored inner portion 48. The fuel inlet opening 5 is formed by a central port or a passage at an inner end of said inner portion 48 of the bore 43.

An o-ring seal 49 is mounted in an associated circumferential groove 53 at a lower end of the valve housing 11 and sealingly engages between the valve housing 11 and a wall 51 of the inner portion 48 above the bore fuel inlet 17 in a gas-tight manner to ensure fuel gas must pass through the bore fuel inlet 17.

The cap 30 has a circular top 54 with a downwardly depending peripheral skirt 55 which threadedly engages an exterior of the upper end 31 of the valve body 11. A circular opening 56 in the top 54 allows through passage of an upstanding cylindrical guide 57 at a top of the plunger 13. It will be noted that a peripheral rim 58 of the opening 56 projects inwardly of a side wall of the bore 12. An annular shoulder 59 at the top of the plunger 13 extending around the guide 57 abuts against an inner face of the peripheral rim 58 when the plunger 13 is in the raised closed position shown in Fig. 3, retaining the plunger 13 within the bore 12. The opening 56 is in alignment with the nozzle 9 to allow through-passage of fuel gas discharged through the nozzle 9 in use.

In operation, the stop valve 3 is opened by turning the hand wheel 6 to screw the

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valve housing 11 upwardly in the valve body 40. With the plunger 13 in the lowered position shown in Fig. 2 fuel gas from the canister 2 passes through the inlet opening 5 and the valve 3 to the bore fuel inlet 17. The fuel gas then travels up through the bore 12, around the lower O-ring seal 23 via the bypass recess 27
5 to the plunger fuel inlet 19. Travelling through the fuel passage 18 in the plunger 13, through the filter 20 the fuel gas exits the plunger 13 through the fuel outlet nozzle 9 for burning at the burner head 4. Should the fuel pressure in the canister 2 rise by an unacceptable amount, due for example to heating of the canister 2, then the fuel pressure acting on the bottom face 14 of the plunger 13 moves the
10 plunger 13 upwardly in the bore 12, overcoming the frictional resistance of the pressure ring 34, to the raised cut-off position shown in Fig. 3, the seal 23 cutting off fuel supply to the burner 4 as it moves upwardly out of the bypass recess 27. The emergency over-pressure shut-off valve 10 can be reset when the fuel pressure in the canister 2 has dropped back to normal. Re-setting the emergency
15 over-pressure shut-off valve 10 to the open position is simply achieved by manually pushing the plunger 13 back down the bore 12 into the lowered normal operating open position wherein the seal 23 again locates at the bypass recess 27 as shown in Fig. 2.

20 Referring to Fig. 4 there is shown another emergency shut-off valve 60 according to the invention. In this case a spring 61 is mounted in the valve housing 11 to engage and urge the plunger 13 towards the open position. This spring 61 may be provided instead of or in addition to the resilient pressure ring 34.

25 The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail within the scope of the appended claims.

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CLAIMS

1. A stove (1), including:

5 a burner (4),

a fuel reservoir (2),

10 a fuel supply line (8) communicating between the fuel reservoir (2)
and the burner (4),

a stop valve (3) in the fuel supply line (8) which is operable to
control the supply of fuel from the fuel reservoir (2) to the burner (4),
and

15 a normally open emergency shut-off valve (10) in the fuel supply
line (8) which is operable to close the fuel supply line (8),

20 characterised in that said emergency shut-off valve (10) is operable to
close the fuel supply line (8) in response to the fuel pressure in the fuel
supply line (8), when said fuel pressure reaches a preset excess fuel
pressure above a preselected normal operating fuel pressure.

25 2. The stove (1) as claimed in claim 1 wherein the emergency shut-off valve
(10) includes:

a valve housing (11) having a through bore (12),

a complementary valve plunger (13) slidably mounted in the bore,

30 said valve plunger (13) being movable relative to the bore (12)
between an open position and a closed position,

said valve plunger (13) cooperating with the bore (12) such that, in

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the open position, a fuel passage (17,18,27) through the bore (12) is provided and in the closed position, fuel flow through the bore (12) is prevented.

5 3. The stove (1) as claimed in claim 2 wherein:

the bore (12) has a bore fuel inlet (17) communicating with the fuel reservoir (2),

10 the valve plunger (13) has a fuel passage (18) extending through the valve plunger (13) with a valve plunger fuel inlet (19) and terminating in a fuel outlet nozzle (9),

15 said valve plunger fuel inlet (19) being provided at a side wall of the valve plunger (13) which slidably engages the bore (12),

20 resilient seals (22, 23) being provided at each side of the valve plunger fuel inlet (19) which are engagable between the valve plunger (13) and the bore (12) to prevent through passage of fuel between the bore (12) and the valve plunger (13),

25 a fuel bypass recess (27) in the bore (12) which cooperates with the valve plunger (13) to allow fuel to bypass the resilient seal (23) located between the valve plunger fuel inlet (19) and the bore fuel inlet (17) when the valve plunger (13) is in the open position.

30 4. The stove (1) as claimed in claim 2 or claim 3 wherein retaining means (34) is provided for retaining the valve plunger (13) in the open position, when the fuel pressure is below said preset excess fuel pressure.

5. The stove (1) as claimed in claim 4 wherein the retaining means comprises a resilient pressure ring (34) mounted in a circumferential recess (35) in the plunger (13) and frictionally engaging with the bore (12).

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6. The stove (1) as claimed in claim 4 or claim 5 wherein the retaining means (34) projects outwardly of the plunger (13) for engagement within an associated annular groove (36) in the bore (12) when the plunger (13) is in the open position.
- 5
7. The stove (1) as claimed in claim 4 wherein the retaining means is a spring (61) mounted in the valve housing (11) and engaging and urging the valve plunger (13) towards the open position.
- 10
8. The stove (1) as claimed in any one of claims 2 to 7 wherein a fuel filter (20) is mounted within the fuel passage (18) in the valve plunger (13).
9. The stove (1) as claimed in any one of claims 2 to 8 wherein a cap (30) is mounted at an outer end of the through bore (12), said cap (30) being engagable with the valve plunger (13) when said valve plunger (13) is at the outer end of the through bore (12) to retain the valve plunger (13) within the through bore (12), said cap (30) having an opening (56) therein in alignment with the fuel outlet nozzle (9) to allow through-passage of fuel gas discharged from the nozzle (9) in use.
- 15
10. The stove (1) as claimed in any one of claims 5 to 9 wherein the valve plunger (13) comprises an inner part (37) and an outer part (38) joined by a threaded connector (39), a lower end of the outer part (38) forming a male threaded connector for engaging with a complementary female threaded socket formed at an upper end of the inner part (37), said recess (35) for reception of the pressure ring (34) being formed between said parts (37,38) when they are engaged.
- 20
11. The stove (1) as claimed in any one of claims 2 to 10 wherein the stop valve (3) comprises a valve body (40) mounted at a top of the canister (2), the valve housing (11) of the emergency shut-off valve (10) having an outer threaded portion (42) in screw engagement with a complementary threaded bore (43) in the valve body (40), a valve head (44) at a lower end of the valve housing (11) being engagable with an associated valve seat (45)
- 25
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formed at an inner end of the bore (43) at an outlet end of a fuel inlet opening (5) communicating with the fuel reservoir (2).

12. The stove (1) as claimed in claim 11 wherein said bore (43) is stepped
5 having an enlarged threaded outer portion (47) which receives the valve housing (11) and a smaller diameter smooth bored inner portion (48), the fuel inlet opening (5) being formed by a port at an inner end of said inner portion (48), a seal (49) being mounted in an associated circumferential groove (53)
10 at a lower end of the valve housing (11) sealingly engaging between the valve housing (11) and a wall (51) of the inner portion (48) above the bore fuel inlet (17) in a gas-tight manner to ensure fuel gas must pass through the bore fuel inlet (17).

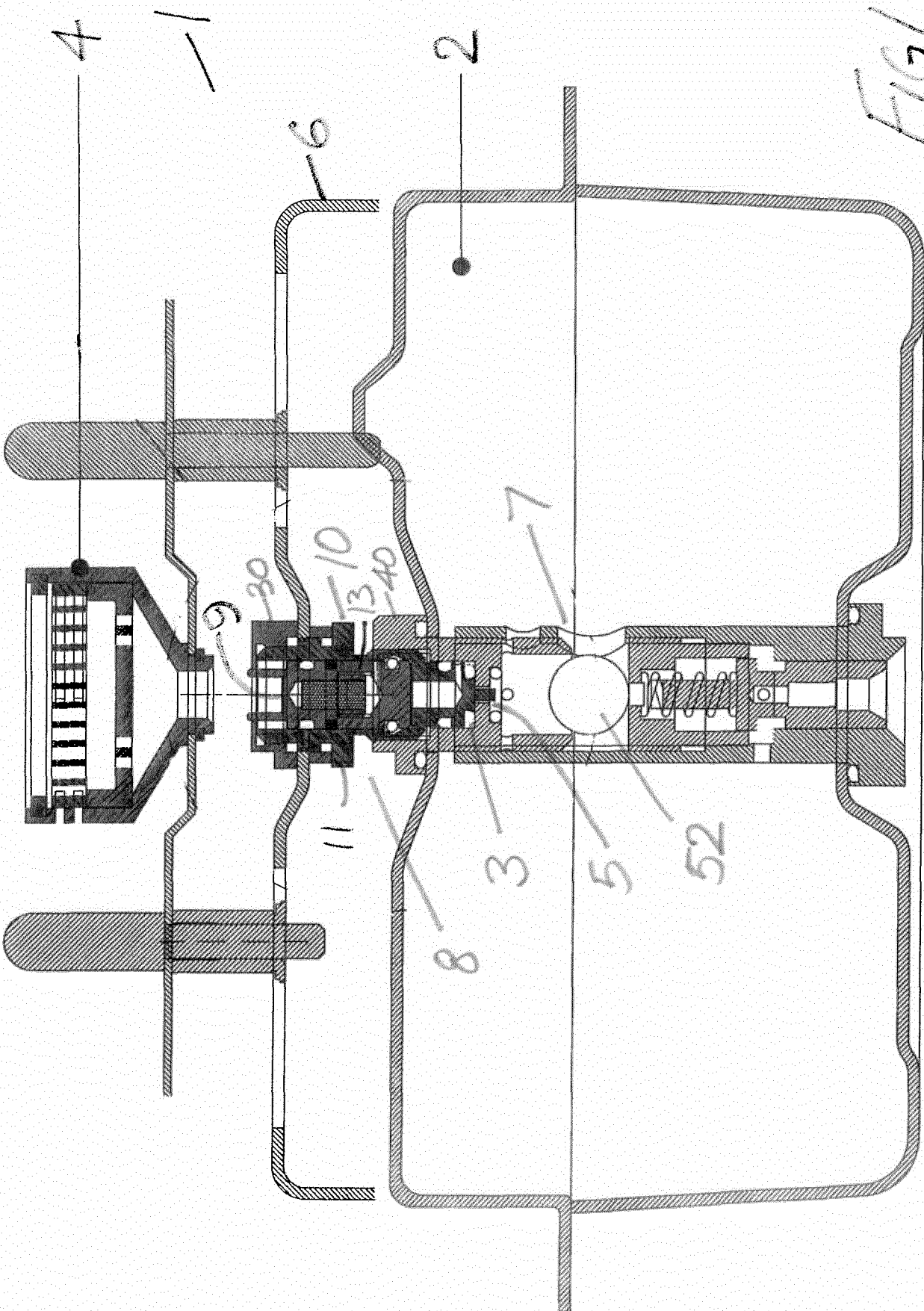


Fig 1

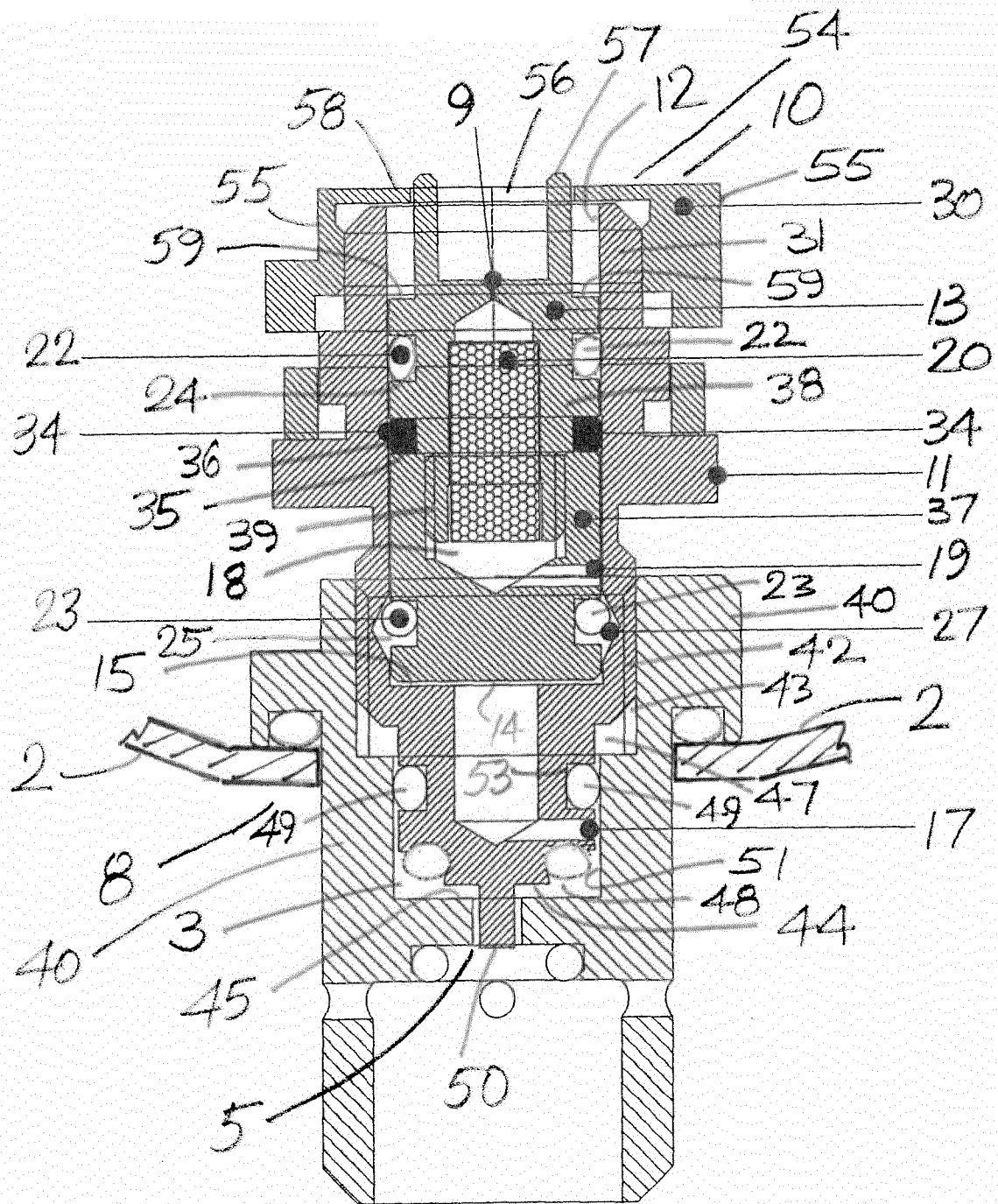
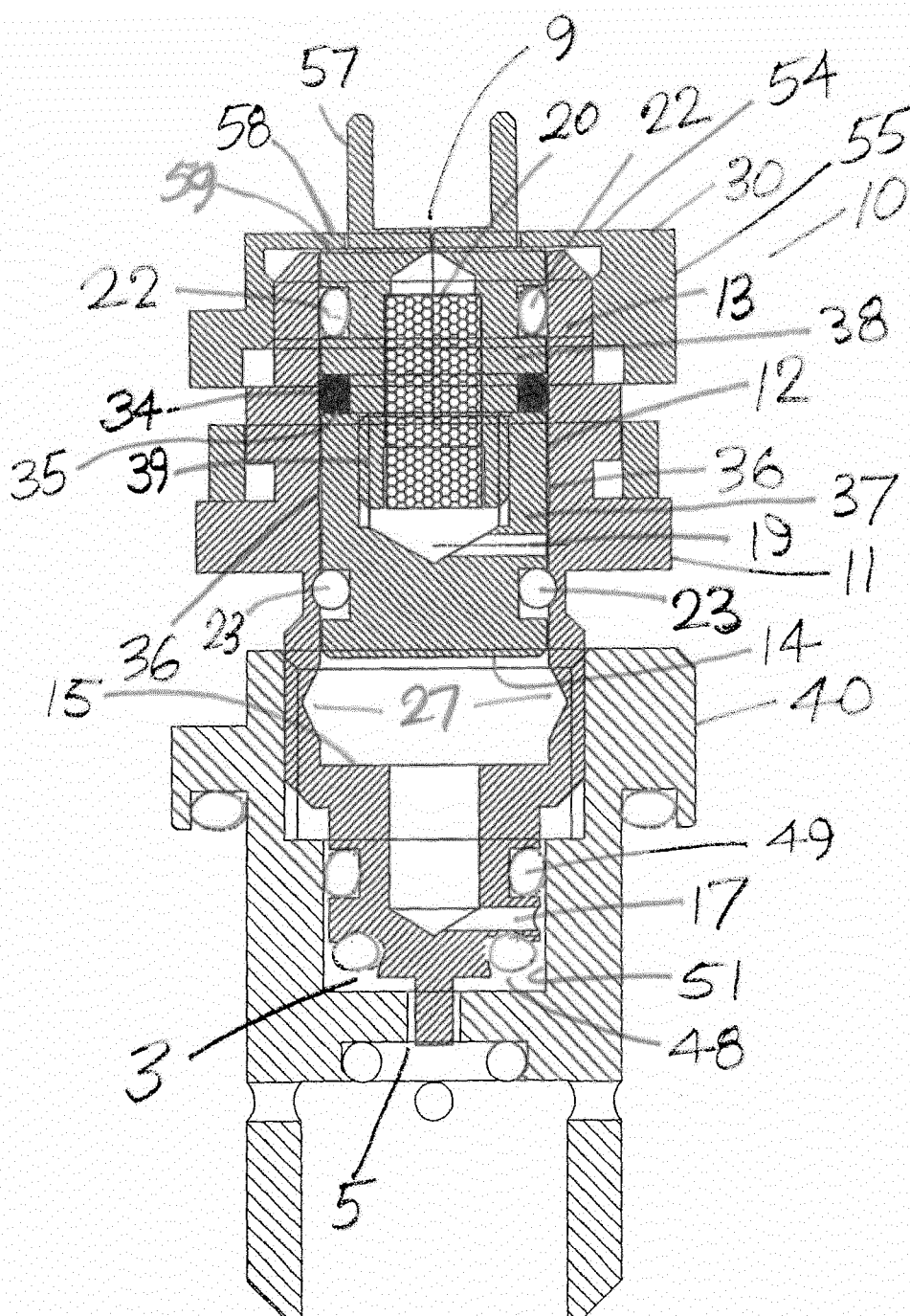


FIG 2

FIG 3

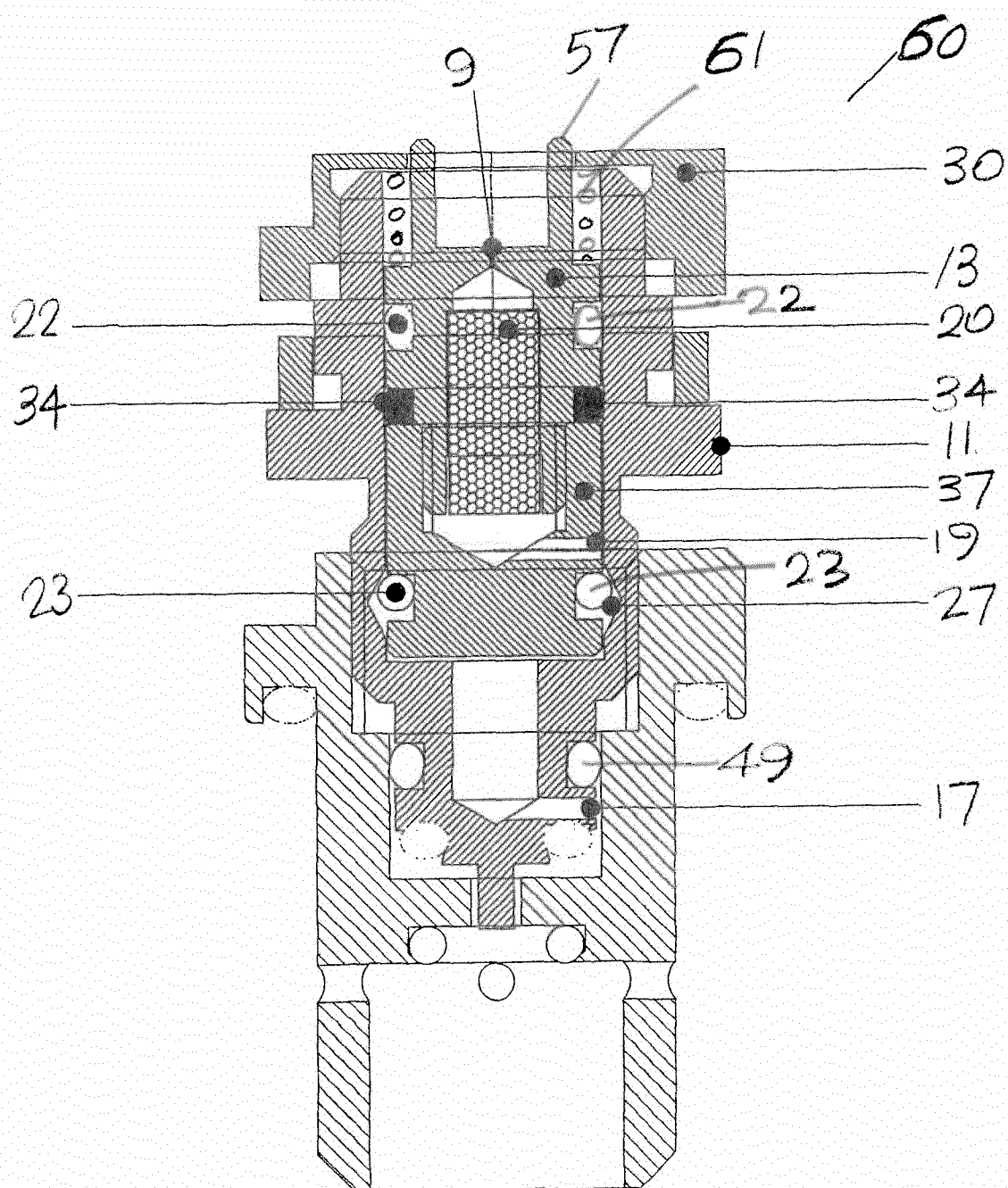


FIG 4