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TITLE OF THE INVENTION

Compact Stove

FIELD OF THE INVENTION

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This invention relates to a stove, generally of the catalytic type and often also referred to as a chafing stove or unit or a bain-marie. Such stoves are typically used in combination with metal dishes or pans and are used to cook food or keep it warm at the table. Of particular interest are portable stoves of the type having a burner to which a
10 compressed gas reservoir is directly attached - the burner being for combustion of the compressed gas. Of special interest is a stove of a type that is easily carried by hand.

Chafing stoves are primarily used in the cooking areas of restaurants to keep food warm following preparation in the kitchen, before the cooked food is brought to
15 diners. Catalytic stoves of the type to which the present invention is directed are not generally used in the actual dining area. Further applications of the catalytic stove of the invention include use for cooking during outside pursuits, such as hiking, mountaineering, camping, or fishing.

20 BACKGROUND OF THE INVENTION

The present invention relates to stoves generally and in particular those stoves of the type which burn gas fuel. Such stoves consist of two main parts - a reservoir which holds the gas fuel, and a burner unit which connects to the reservoir and serves for
25 burning fuel from the reservoir. Stoves of this kind may be portable, for example for use as camping stoves or as chafing stoves of the type for maintaining cooked food at a temperature suitable for serving for eating. Of particular interest are compact stoves of the type that are readily portable. Such stoves often have a burner which is directly attachable to a reservoir of gas. The burner and reservoir together form a self-supporting
30 structure where the burner is arranged above the reservoir in the working orientation of the device. Normally such stoves do not require any additional support or equipment to stand upright and operate. In this respect, the stoves of the invention are distinguished

from trolleys or tables and the like which may have one or more burners incorporated into a platform or some such other support for the material (normally food/water) to be heated.

5 There are many limitations associated with conventional stoves. Some suffer from the problem that the burner may easily be extinguished for example by a gust of wind etc. Other limitations include the fact that the vapour pressure in the gas reservoir can substantially fall off due to cooling when the gas expands from its compressed state. This may result in incomplete emptying of the reservoir or reduced amounts of gas
10 being available for combustion. Also disadvantageous is the fact that the gas reservoir is often a disposable one - not designed for ease of re-filling/re-use. Blocking of the burner nozzle may occur due to deposits from heavier hydrocarbons in the gas fuel, while there may be also an inability to regulate the temperature produced by the burner to a desirable extent - in particular to maintain relatively low temperatures such as about
15 100°C. Further limitations that can occur include the undesirable transmission of heat to parts of the stove proximate the burner, so that for example materials which have high resistance to heat have to be employed.

 US Patent No. 4,899,722 (Horewitch) describes a burner assembly for use with a
20 chafing dish of the type supported by legs. The burner is inserted under the chafing dish, which is a large platform supported on legs and covered with a cooking cover or lid. The burner is described as having a unique support structure with a fuel source coupled to the burner head by conduit means of sufficient length to position the fuel source beside the chafing dish.

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 There is therefore a need to provide an improved stove.

BRIEF SUMMARY OF THE INVENTION

30 Accordingly the present invention provides a gas fuelled stove which is adapted to overcome shortcomings associated with prior art apparatus. In a preferred embodiment the stove of the present invention is adapted to provide a stove which includes heat

transfer minimisation means which are adapted to minimise the transfer of heat generated at a burner element downwardly to the tank and reservoir below.

5 In a first embodiment this is effected by the provision of a stove for maintaining prepared food in a warm state. The stove comprises a fuel reservoir, a burner unit, flow means communicating between the fuel reservoir and the burner unit; and control means for regulating flow of fuel from the fuel reservoir to the burner unit. Preferably, the fuel reservoir is a gas tank and means are provided for controlling heat transfer from the region of the burner unit to the interior of the gas tank.

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The heat transfer controlling means may comprise a heat deflector located between the burner unit and the fuel reservoir. The heat deflector may comprise heat activated deformation means. The heat deflector may be mountable on one or more spacers, the height of the spacers determining the distance of the heat deflector above the control means. The heat deflector may be adapted to support the burner unit, such that the burner unit is separated from the control means by a height defined by the spacers. The provision of such heat transfer means serves to minimise the transfer of heat between the burner unit and the reservoir through one of radiative, conductive or convective processes.

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In one embodiment of the invention, the burner unit and the flow means are separated by an air gap. The air gap may be linear or circumferential.

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The fuel reservoir may comprise a reinforcing pillar. The reinforcing pillar may extend between a region of the reservoir in which said control means is incorporated and a base region of the reservoir.

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A gas fill valve may be accommodated in said pillar in the vicinity of the base region of the reservoir. Desirably, the fill valve is positively retained within said pillar.

Suitably, a seal may be provided to substantially inhibit discharge of liquid gas through a fill valve air vent passage, during a gas filling operation.

The reservoir may be substantially cylindrical with the central pillar centrally located within the reservoir along an axis of symmetry thereof. Desireably, the fuel reservoir is a refillable gas tank of less than 250 ml capacity.

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The diameter of the tank may be substantially equal to the height of the stove. Suitably, the fuel reservoir comprises a plastics material.

In a favoured embodiment, the fuel reservoir comprises a two-part structure consisting of a substantially cup-shaped body portion and a closure portion for co-operative sealing association with the body portion.

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Interconnection of the closure portion and body portion of the fuel reservoir may be effected by screwing together or by a bayonet-type coupling action.

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Preferably, at least the flow means incorporates heat exchange features.

The flow means may comprise a rotary valve assembly and the control means may include a rotary switch for displacement between end positions corresponding to full-flow and shut-off conditions.

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Preferably, the burner unit includes catalytic components. The catalytic components may be provided in one or more disc configurations, the burner unit being adapted to mount the one or more discs in a plane substantially transverse to an axis of flow of the fuel from the reservoir to the burner unit.

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The burner unit may be adapted to receive an upper portion of the flow means, the flow means being moveable within the burner unit.

In one embodiment, the burner unit and the flow means may be provided as an integral unit. In an alternative embodiment, the burner unit and the flow means may be provided as distinct separate components.

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Preferably, the stove further includes emergency shut-off means, the shut-off means, on activation, effecting a termination of flow of gas from the tank to the burner unit. Activation of the shut off means may be effected upon tilting the base of the stove through 90 degrees from a normal horizontal position. The shut-off means may be provided within the flow means and is moveable from a normal rest position wherein it is seated within a channel provided in the flow means to an activated position wherein it occludes at least a portion of a flow path for the gas passing from the tank to the burner unit.

These and other aspects of the invention will be apparent with reference to the embodiments described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention will now be described having regard to the accompanying drawings in which:

Figure 1 shows perspective view of a stove unit according to a first embodiment of the invention,

Figure 2 is a cross-sectional view of the stove unit of figure 1.

Figure 3 is a detailed view of a portion of the unit shown in Figure 2.

Figure 4 is a detailed view of a portion of the unit shown in Figure 1

Figure 5 is a perspective view of the combined nozzle, bush and fill valve assembly of the stove of figures 1 and 2.

Figure 6 is a cross-sectional view of the combined nozzle, bush and fill valve assembly of figure 5.

Figure 7 is a perspective view of the nozzle of figure 5

Figure 8 is a cross-sectional view of the nozzle of figure 5.

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Figure 9 is a perspective view of the nozzle and nozzle connector of the stove of figures 1 and 2.

Figure 10 is a cross-sectional view of the nozzle and nozzle connector of the stove of figures 1 and 2.

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Figure 11 is a perspective view of the bush shut off assembly of figure 5.

Figure 12 is a cross-sectional view of the bush shut off assembly of figure 5.

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Figure 13 is an end view of the bush shut off assembly of figure 5.

Figure 14 is a perspective view of the fill valve assembly of figure 5.

20 Figure 15 is a cross-sectional view of the fill valve assembly of figure 5.

Figure 16 is a cross-sectional view of a second embodiment of the stove of the present invention.

25 Figure 17 is a sectional view of a central pillar as used in the embodiment of Figure 16.

Figure 18 is a cross-sectional view of a third embodiment of the stove of the present invention.

30 Figure 19 is a perspective view of the stove of Figure 18.

Figure 20 is a cross-sectional view of a nozzle and nozzle connector for use in the embodiment of Figure 18.

Figure 21 is a perspective view of the nozzle and nozzle connector of Figure 20.

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Figure 22 is a cross sectional view of a central pillar assembly having a fill valve for use on the third embodiment.

Figure 23 is cross sectional view of a stove according to a fourth embodiment of the present invention.

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Figure 24 is a perspective view of the stove of Figure 23.

Figure 25 is a cross sectional view of a stove according to a fifth embodiment of the present invention.

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Figure 26 is a perspective view of the stove of Figure 25.

Figure 27 is a perspective view of a nozzle for use in the stove of Figure 25.

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Figure 28 is a cross sectional of the nozzle of Figure 27.

Figure 29 is a perspective view of a nozzle connector for use in the embodiment of Figure 25.

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Figure 30 is a cross sectional view of the nozzle connector of Figure 29.

Figure 31 is a perspective view of a stove according to a sixth embodiment of the invention.

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Figure 32 is a cross sectional view of the stove of Figure 31.

Figure 33 is an exploded view of the components of the stove of Figure 31.

Figure 34 is a perspective view of a stove according to a seventh embodiment of the present invention.

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Figure 35 is a cross sectional view of the stove of Figure 34.

Figure 36 is a perspective view of a fill valve for use in the present invention.

10 Figure 37 is a cross sectional view of the fill valve of Figure 36.

DETAILED DESCRIPTION OF THE DRAWINGS

The present invention will now be described with reference to the following
15 drawings of which Figures 1 and 2 show a stove according to a first embodiment of the invention. Figures 3 to 15 show the main features of the stove of Figures 1 and 2 in greater detail.

The stove of figures 1 and 2 is a refillable catalytic stove. The stove 1001
20 includes a fuel storage tank 1002 for storage of a gaseous fuel. The storage tank is provided with refilling means so as to enable a refilling of the gaseous fuel within the storage container. A burner unit or head 1004 is provided in fluid communication with the tank 1002 so as to provide for a burning or combustion of the gaseous fuel contained within the container. Flow means are provided between an interior portion of the
25 container and the burner unit so as to provide for fluid communication between the fuel storage tank 1002 and the burner head 1004. Desirably this fluid communication is controlled by the provision of flow control means adapted to enable a regulation of the flow of gaseous fuel from the tank 1002 to the burner head 1004. In the stove as shown in figure 2, the flow control means further includes a switch portion 3 which in an
30 assembled configuration of the stove, overlies and is substantially coextensive in area with the tank lid. A central aperture is provided in the centre of the switch, through which the flow means extends in an assembled configuration of the stove. The assembly

defines a substantially rigid structure which imparts a self-supporting nature to the stove with the base 1030 of the fuel storage tank 1002 acting as a stand for the entire stove unit 1001.

5 In use, gas is held under pressure in liquid form in the tank 1002. By adjustment of the flow control means the stove 1001 may be switched from a normally "off" position to an operable "on" position, thereby allowing the flow means to supply gas to the burner head 1004. Lighting means, such as a naked flame from a match, is introduced to the region of the burner head 1004, thereby igniting the gas flowing
10 through it. Combustion of the gas produces a heat output from the burner head 1004. The heat output is directed vertically upwards towards a chafing dish or other item to be heated, the item being positioned above the burner head 1004. The stove 1001 can only be turned off following ignition, by termination of gas flow to the burner head 1004. Such termination of gas flow leads to the flame being extinguished.

15 The tank 1002 is shown in detail in Figure 2. The main body of the tank 1002 of Figure 1 is of a two part construction, having a tank body 1002a and a tank lid 1002b. The tank's body 1002a and lid 1002b co-operate with one another to form a sealed reservoir within the tank 1002 in which gas is stored prior to and during use. The tank
20 body 1002a is substantially cup-shaped having a substantially flat or planar base 1030. The tank body 1002a defines the base and side walls of the fuel reservoir.

The tank lid 1002b is substantially disc-shaped having an integral downwardly-depending skirt 1012. In an assembled condition of the tank, the skirt portion 1012
25 engages with a seat 1100 formed about the upper rim of the tank body 1002a, thereby completing the sealed reservoir.

The capacity of the tank 1002 as represented in Figure 1 is about 160ml. A preferred diameter for the tank 1002 is 95 mm and the overall height of the entire stove
30 1001, from the base of the tank 1002 to the top of the burner head 1004, is suitably 95 - 101 mm. It will be appreciated therefore that the stove of the present invention is relatively small as compared with traditional refillable stoves.

A particular novel feature of the tank 1002 of the stove unit 1001 is that it is refillable. In an assembled condition of the tank 1002, filling means 1600 are provided which are accessible through an opening formed in the base of the tank body 1002. A
5 refilling feature is believed not to have been hitherto provided in a stove of the dimensions or proportions applied in the present instance.

The stove 1001 is suitably provided to an end user in a fully assembled condition ready for use. In the embodiment of Figure 1, the tank lid 1002b is coupled to
10 the tank body 1002a by a bayonet fitting 1036, although it will be appreciated that alternative coupling means such as a screw threading may be used. The bayonet fitting 1036 in the present embodiment of stove is most suitably a one-way arrangement, i.e. once the tank top 1002b and body 1002a have been assembled by a relative twisting movement, they cannot readily be separated again. Reverse movement of the bayonet
15 arrangement 36 is inhibited to preclude reopening the tank 1002 in this manner. Sealing between the two tank portions 1002a, 1002b is completed by a sealing ring 13 provided in the seat 1100 of the tank body 1002b.

Once the tank top and body have been interconnected it is possible to assemble
20 the additional components of the stove. It will be appreciated that the sequence of assembly may differ, but for the ease of explanation will be described with reference to one set of specific steps. In assembling the stove, the filling means 1600 is first introduced upwardly through an aperture 1510, provided in the base portion 1030 of the tank body 1002a, into the reservoir 1500 defined by the interior portion 1500 of the tank
25 1002. The filling means defines a valve housing 71 provided with a receiving portion 78 into which flow means 1610 may be received.

The tank lid 2b is provided with a substantially central aperture through which the flow means may be inserted during the next stage of assembly. Hereintobefore the
30 flow means has been described with reference to a single integral unit but in practice this may be separable into individual components, each of which co-operate to provide the functionality of the flow means. For example in the embodiment of Figure 2, the

flow means 1610 comprises three individual components; a bush housing 60, a nozzle 8 and a nozzle connector 51. The bush housing 60 is dimensioned so as to receive the nozzle connector 51 which is dimensioned so as to receive the nozzle 8. In an assembled condition of the stove, these portions of the flow means 1610 are in fluid communication with one another and the gas flow assembly extends along an axis of flow of the gas in a vertical direction, substantially perpendicular to the plane of the tank lid. During assembly, the bush housing 60 is inserted through the aperture in the tank lid and co-operates with the receiving portion 78 provided in the fill valve housing 71. Co-operation means are provided to secure the bush housing into the fill valve housing. In the stove of Figure 2, the co-operating means are provided in the form of co-operating screw threads on the periphery of the bush housing and the interior of the receiving portion of the fill valve housing. Once the bush housing has been secured with the receiving portion, the nozzle connector portion 51 may be inserted into a respective receiving portion 61 in the bush housing. In the embodiment shown in figure 2, screw threaded connection means are provided to effect this interengagement. The combined nozzle, nozzle connector, bush and fill valve assembly is shown in Figures 3 and 4.

As shown in figures 1 and 2, the burner head is mounted a predetermined distance above the switch portion by means of spacers 10 or posts, such that a vertical gap exists between the base of the burner head and the top of the nozzle portion of the stove. As best seen in figure 1, the stove according to the present embodiment has three spacers, although any plurality of spacers may be provided. One end of each spacer is dimensioned such that it can pass upwardly through an aperture (not shown) provided in a deflector disc 6 where it can be secured by means of a spacer nut 10a to the deflector disc 6, the deflector disc forming part of the burner head. In the embodiment shown in figures 1 and 2, the spacer nut is provided in a domed configuration. The other end of the spacer 10 is adapted to be received through an aperture provided in the switch portion 3 such that a portion of the spacer protrudes below the switch portion and can be secured by means of a nut 10b or alternative securing means on the underside of the switch portion. It will be appreciated that when mounted that the deflector disc extends circumferentially about the base portion of the burner head such that heat generated at the burner head can be deflected upwardly. As such, the material of the spacer must

withstand temperatures of up to 200 degrees Celsius and is typically formed of brass, steel or stainless steel.

During the next stage of assembly, following the insertion of the nozzle portion
5 into the nozzle connector portion 51, the switch portion 3 is lowered into position over
the nozzle portion 8. Serrated portions 27 provided within the central aperture of the
switch co-operate with serrated portions 77 on the external peripheral surface of the
nozzle connector portion 51, so that, in use, rotation of the switch 3 effects
corresponding rotation of the nozzle connector portion 51 relative to the bush housing
10 60. A retaining nut 5 secures the switch portion 3 to the nozzle connector portion 51. As
best seen in Figure 1, the switch 3 is disc shaped with a downwardly extending
peripheral skirt 22, the disc portion of the switch 3 having a diameter approximately
equal to that of the tank 2. The downwardly extending peripheral skirt 22 is substantially
coaxial with a cylindrical outer wall of the gas tank 2. As shown clearly in figure 1, the
15 peripheral skirt region 22 is provided with raised radially projecting vertical grips or ribs
23 for ease of gripping for manual turning of the switch.

Figures 3 and 4 show the burner head in more detail. The burner unit or head
1004 operates substantially in accordance with catalytic principles, but nonetheless
20 incorporates a number of innovative technical features directed to the specific objective
of achieving a relatively low cost of production. The burner head 1004 comprises a
burner expansion region 17 and a flow passage 15. The burner head 1004 operates in
catalytic manner by employing catalytic material of the type that will be well known to
those skilled in the art. The catalytic material ensures that the flame, once ignited, will
25 not extinguish, even under windy conditions, as the catalytic material will cause the gas
to re-ignite immediately if the flame is extinguished by a gust of wind or such like. The
catalytic material is desirably formed in a disc configuration, such that one or more discs
can be employed.

30 In a preferred embodiment of burner head, and as shown in Figures 3 and 4, the
burner head 1004 has a stepped construction, each step holding an individual catalyst
disc 16a, 16b of equal diameter. The burner head 1004 of Figures 1 and 2 has two steps

associated with its expansion region 17, but as few as one or as many as five steps may be provided. Multiple steps of increasing step size in the direction of flow of the gas through the burner head expansion region 17 may be provided to facilitate expansion of the gas flow.

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The temperature of the catalytic elements 16a, 16b is controllable within a temperature range of between 100⁰C and 1300⁰C.

As shown in Figures 3 and 4, a lateral heat dissipating fin 20 is provided on a peripheral surface of the burner head 1004. Although the stove as shown in Figures 1 and 2 has only one heat dissipating fin 20, it will be appreciated that a plurality of fins may be used in alternative embodiments. The heat dissipating fin 20 increases the surface area of the burner head 1004, thereby increasing the rate at which heat is dissipated from the burner head 1004. The fin therefore acts as a heat sink, thereby contributing in an innovative manner to the successful performance of the stove 1001 of the invention.

As discussed above the burner arrangement desirably includes a deflector arrangement provided at the base of the flow passage of the burner head. The deflector arrangement comprises a deflector in the form of a flat annular deflector disc 6 which extends in a plane substantially perpendicular to the gas flow axis of the burner head 1004. An aperture (not shown) is defined in a central region of the deflector disc and is dimensioned such that an edge portion 1520 of the aperture is seatable upon a deflector connector 1501. The deflector connector has a seat portion 1502, which in use will be positioned below the deflector disc. Wall portions 1503 extend upwardly through the aperture and are provided with screw threaded portions 1504 which are adapted to cooperate with corresponding screw threaded portions 1505 provided on an inner surface of the burner head. Interengagement of the deflector connector with the burner head thereby secures the deflector disc between the two components.

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In use, the deflector disc 6 has dual functionality, acting not only as a heat shield to protect the fuel storage tank 1002 from heat generated at the burner head, but

also as a deflector, for returning radiant heat towards a food container located, in use, above the burner head 1004, thereby increasing the efficiency of the stove 1001. The deflector disc 6 is preferably between 60 mm and 100 mm in outer diameter. A suitable material for the deflector disc 6 is a heat reflecting material, preferably a metal.

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In an assembled configuration a vertical or linear air gap 1506 is defined between the base of the burner head 1004 and the top of the nozzle 8. The burner head and nozzle are aligned along the vertical axis of flow such that gas passing from the nozzle to the burner head 1004 traverses the air gap, while heat conduction from the burner head 1004 back into the body of the tank 1002 is reduced. By eliminating a physical connection between the burner head and the nozzle there is no heat conduction across the air gap. The only transfer of heat across this air gap is by radiation.

As mentioned above, a unitary structure is provided by the interconnection of the combined nozzle, nozzle connector, bush and fill valve assembly. The unitary structure of the assembly acts as a central supporting pillar which extends throughout the axial extent of the fuel tank 1002. The pillar structure carries central forces within the assembled tank 1002 to improve its structural stability under pressurisation and provides reinforcement of the tank 1002 along its central axis of symmetry. Suitable sealing features ensure gas-tightness of the assembled stove structure and in particular of the central pillar with respect to the tank 1002 or reservoir 1500.

Figures 7 and 8 shows the nozzle 8 in greater detail. The nozzle comprises a substantially cylindrical housing 50 having a central flow passage 52 formed along its longitudinal axis. An orifice holder 53 is accommodated in the central flow passage of the nozzle, and is retained by screwthread means 1510. The orifice holder 53 has two main functions, namely to provide a domed end 55 defining therein an orifice through which the gas passes, and to hold an orifice filter 54 which filters the gas exiting through the orifice. The orifice acts as the jet for combustion of the gas. The domed shape of the end of the orifice holder 53 provides for clean burning of the gas fuel, as deposits are less likely to collect about the orifice. O-rings 56 are provided within recesses on the periphery of the nozzle housing so that the nozzle is sealingly engageable in the nozzle

connector 51. An air inlet 1511 is provided in the housing of the nozzle adjacent to the orifice and is suitably dimensioned to enable a supply of the requisite air for combustion of the gas exiting through the orifice.

5 Figures 9 and 10 show the nozzle 8 within the nozzle connector 51, the nozzle connector having a central flow passage 1512 and a nozzle receiving portion 1513. One end of the nozzle is accommodated within the receiving portion of the nozzle connector 51, and secured by means of screw threaded connection means 1514. Means for adjusting 1516 the rate of flow of gas through the nozzle are provided within the flow
10 passage of the nozzle connector 51. The adjustment means 1516 includes a flow spool 1517, a serrated disc 1518, a compressible filter sponge 1519, a mesh 1520 and a seat 1521; the components being provided in a configuration that enables a fluid passage such that the gas fuel can flow thereby. Rotation of the nozzle 8 relative to the nozzle connector 51 within the screw thread, effects a translational movement of the nozzle 8
15 within the connector towards the flow spool. This effects a corresponding translational movement of the flow spool within the central flow passage. The end of the flow spool distal to the nozzle 8 acts upon the serrated disk, which effects a compression of the filter sponge against the mesh 1520 positioned across the gas flow path. The mesh 1520 rests upon the seat 1521. A gas inlet 1522 is provided in the external wall of the nozzle connector 51 and is in fluid communication with the central flow passage. The
20 adjustment means are provided to enable the manufacturers to set the compression of the sponge prior to the assembly of the stove. It will be appreciated that as the sponge compresses, the rate of flow of gas through the connector portion decreases, due to increased resistance to the flow of gas through the sponge. As such the level of
25 compression will determine the flow rate possible through the sponge. It is not intended that the compression of the sponge be altered post assembly of the stove.

 The O-rings 56 are provided within recesses on the periphery of the nozzle connector 51 so that the nozzle connector is sealingly engageable in the receiving
30 portion 61 of the bush housing 60. A shut-off o-ring 1523 is provided in a recess 1524 at the end of the connector distal to the nozzle receiving portion. The function of this shut-off o-ring will be described hereinafter with respect to the bush housing.

In use, a rotation of the switch 3 effects a corresponding rotation of the nozzle connector 51 relative to the bush housing. The rotation of the nozzle connector relative to the bush housing effects a translation of the nozzle connector 51 within the bush housing toward the base of the tank. This translation causes a compression of the shut-off o-ring between the nozzle connector 51 and a seat 1525 formed within the receiving portion 61 of the bush housing. The seat 1525 is provided adjacent to a conduit 1526 from which the gas passes upwardly into the receiving portion 61. Compression of the o-ring 1524 regulates the rate of flow of gas from the bush housing to the connector portion to open/close/adjust the gas flow path through the nozzle 8.

The switch arrangement 3 as described herein enables close and accurate regulation of the supply of fuel from the tank 1002 of the unit to the burner head 1004 and thereby facilitates adjustment of the heat release from the stove 1001 to the items to be heated. In this way, not only is economy in usage of fuel achieved, but in chafing use, the degree of heating applied to the food to be kept warm can be matched exactly to requirements, so that the correct temperature is maintained, but there is minimal continuing cooking of the prepared dishes. Thus excellent chafing performance is provided by the unit 1001 of the invention.

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The bush housing, according to a preferred embodiment of the present invention, is shown in greater detail in figures 11 to 13. In addition to the components discussed above, the bush housing may be further provided with emergency shut-off means 1530, activated upon tilting the base of the stove through 90 degrees from a typical horizontal position. The emergency shut-off means is adapted to be moveable from a normal rest position wherein it is seated within a channel 1531 provided in the bush housing. The channel 1531 forms part of the flow path for gas that passed from the reservoir through an aperture 1534 in the bush housing upto the nozzle 8. The shut-off means desirably includes a plunger 1532 which is provided at one end thereof with a stopper 1533 which projects above the plunger. The plunger is desirably positioned substantially coincident with the positioning of the conduit 1526 such that movement of the combined stopper/plunger towards the conduit 1526 will effect a blocking of the

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conduit 1526 by the stopper, thereby preventing the passage of gas upwardly into the receiving portion 61. The plunger is desirably provided in a low friction type material such as brass which is freely slideable within the channel 1531. The stopper is typically formed of a material such as nitrile. In a normal rest position the plunger sits
5 downwardly in the channel. If the stove is displaced such that it falls over, the plunger will freely slide to block the conduit 1526. When the stove is returned to its normal position, the plunger falls under gravity back to its resting position and the flow of gas through the bush housing 61 is resumed.

10 An example of a fill valve which may be used in the tank of the present invention is shown in detail in Figures 14 and 15. The fill valve comprises a housing 71 and a valve spool 73 displaceable against a compression spring 76. An internal O-ring 75 provides internal sealing and an external O-ring 74 provides sealing between the fill valve housing and valve-receiving portion of the tank 1002. An external serrated portion
15 72 may be provided on the fill valve for engagement with corresponding serrations within valve-receiving portion of the tank, or elsewhere, to prevent rotation of the fill valve housing relative to the tank 1002.

The fill valve in the present embodiment is modified to preclude possible
20 discharge of liquid gas during filling operation by way of the air venting feature of the fill valve structure. The avoidance of such unwanted discharge of liquid gas is achieved, inter alia, by the provision of an additional sealing member such as the external o-ring 75 within the fill valve structure. When the fill valve is depressed, gas flows into the valve through an axial channel 79 within the valve member and flows out to the sides of
25 the valve member at suitable windows 1540 or transversely directed openings. In this way, gas enters into the interior of the tank 1002. Air to be vented exits through a further transverse passage 1541, above the liquid level of the gas in the inverted disposition of the tank 1002, this air exit passage being located near the outer or tank base end of the valve. The vented air then reaches the external ambient environment through a small air
30 gap 1542 defined between the sliding member of the valve and an outer sleeve of the valve structure. This air gap is of controlled dimensions to regulate the rate of exit of the

air. The seal provided in the present embodiment of the fill valve precludes any liquid gas from being entrained in this air flow.

In the present construction, the valve is part of the combined flow means
5 assembly and is retained positively against possible expulsion from the tank 1002 under extreme conditions. As previously described, the fill valve is assembled as part of the overall assembly operation and is not inserted as an independent unit following completion of the remaining assembly operations.

10 Refilling can be effected using standard butane or propane containers. Each such standard container of capacity 300 ml provides approximately two refills for the tank 1002 of the unit of the invention.

The liquefied gas used is preferably butane or a propane/butane mix ratio of
15 30:70 to 1:100. A particular statutory requirement for the pressure resistance of propane/butane containers is 20 bar. The designs of tank 1002 provided in conjunction with the present invention are expected to be pressure resistant up to 50 to 60 bar.

In order to achieve this strength, the material of the tank 1002 is suitably a
20 particularly tough plastics material, for example a glass-filled nylon with a glass transition temperature greater than 60 degrees Celsius. The temperature of the tank of the burner can reach 40 Celsius in operation, and it is important that the physical characteristics are not compromised during operation. Alternatively, nylon may be used on its own, with no glass-filling. Typical wall thickness is 4 mm to 5 mm, and the range
25 of wall thickness is normally at least 3 mm to 6 mm. In general, it is anticipated that the minimum wall thickness will not be less than 3 mm, while the maximum wall thickness is unlikely to require to be greater than 6 mm. Above 6 mm, the balance between economy and strength becomes less favourable.

30 The structure of the tank 1002 as described herein is resistant to any pressure exerted by the liquid gas within the tank 1002. At ambient pressure, the contents of the tank 1002 in liquid form in fact exert a pressure of no greater than 4-6 bar, but because

of the relatively large quantity of fuel held within the tank 1002, the consequences of any inadvertent leakage or fracture of the tank 1002 are nonetheless potentially hazardous, possibly explosive. Hence the necessity for the tank 1002 to possess appropriate strength and to be substantially leak-proof.

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In order to provide a visually attractive construction, the tank 1002 may be finished in a choice of colours, or alternatively, the finished unit may be coated in a shiny metallic material or otherwise metallised.

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As seen in Figure 1, the stove is provided with a top cover 14 to enclose the burner region of the stove during transport or storage. The top cover 14 is arranged to snap down onto the tank portion perimeter over the control switch 3, thereby preventing accidental rotation of the switch during transport or storage, which could result in the gas supply accidentally being turned on

15

The top cover 14 is preferably made from a material similar to that of the tank 1002 and may be transparent.

20

Figures 16 to 37 describe alternative embodiments of a stove according to the invention. The same reference numerals will be used for equivalent components and where appropriate only the changes from the previously described embodiment will be discussed.

25

In the embodiment of Figure 16, which is a second embodiment of the invention, the nozzle 50 of the gas release valve assembly 8 extends through a hole formed in the centre of the switch 3, similarly to that described above. In this embodiment, however, and as shown in figure 16, a portion of the nozzle 50 extends a short distance into a central flow passage formed in the flow passage 15 of the burner head 1004. The diameter of the outer wall of the nozzle 50 is less than the diameter of the inner wall of the flow passage or nozzle receiving portion 15 of the burner head 1004. This arrangement results in a circumferential air gap being defined between the external wall of the nozzle 50 and the internal wall of the nozzle receiving portion or flow passage 15

30

of the burner head 1004. There is no heat conduction across the air gap. The only transfer of heat across this air gap is by radiation. The deflector disc 6 is formed from a metal which deforms or buckles under the actions of heat, such as brass or copper. The disc 6 may alternatively be bimetallic. When the disc 6 heats up, controlled buckling or deformation occurs, so that as the deflector deforms, the centre of the deflector disc 6 is displaced vertically, i.e. in the direction of the axis of gas flow. Upward displacement of the disc, away from the tank portion 1002 of the stove 1, raises the burner head 1004 so that the distance between the burner head 1004 and the tank is increased in a controlled manner. The objective is thereby achieved of getting as much heat as possible into the gas fuel in the tank 1002 at the start of the operation, in order to warm it up as quickly as possible to encourage gasification. As soon as the gas in the tank 1002 is warmed up sufficiently, the widening of the gap controls and reduces the extent of the heat transfer from the burner head 1004 back into the tank 1002. As the distance between the burner portion and the tank will vary, it will be appreciated that there is a corresponding movement of the nozzle end portion within the nozzle receiving portion 15, although the provision of a physical air gap of the same dimensions of the first embodiment is unlikely to be achieved.

Figure 17 is a cross-sectional view of the fuel tank's central pillar of the stove shown in figure 16. The central pillar houses the stove's gas release valve assembly and fill valve assembly. The majority of the lower portion of the pillar is mounted in the fuel storage tank 1002 and is hidden from external view, as will be apparent from Figure 16. The central supporting pillar extends throughout the axial extent of the fuel tank 1002. The pillar structure carries central forces within the assembled tank 1002 to improve its structural stability under pressurisation and provides reinforcement of the tank 1002 along its central axis of symmetry. The pillar is held in position by a nut. Suitable sealing features ensure gas-tightness of the assembled stove structure and in particular of the central pillar with respect to the tank 1002 or reservoir.

The central pillar includes an external O-ring seal 63 for sealing engagement of the central pillar within the tank lid 1002b when the central pillar is assembled with the tank lid 1002b. An adjuster screw may also be provided in the gas flow path.

In this embodiment, the central pillar is effectively in two parts; an upper part and a lower part or as were previously termed the bush housing 60 and the fill valve housing 71.

5

As best seen in Figure 16 and similar to that of the first embodiment, the switch portion 3 of the unit overlies an upper surface 34 of the top part or lid 1002b of the fuel tank 1002. The upper surface 34 is not normally visible to the user. The switch portion 3 co-operates with the serrated portions on the external periphery of the gas valve assembly, such as by way of the serrations or splines 27, so that rotation of the switch 3 effects corresponding rotation of the nozzle connector 51 or gas valve assembly. A retaining nut 5 retains the switch portion 3 to the gas release valve assembly. The retaining nut is also shown in Figure 16.

15

Rotation of the switch 3 therefore effects rotation of the gas discharge valve assembly relative to the mounting arrangement (the bush housing) 60 provided in the central pillar in order to open and close the gas flow path through the nozzle.

20

In use, to switch the gas flow on and off and to control or regulate the flow rate of the gas through the nozzle 8, the switch 3 (and subsequently the entire burner head 1004, deflector disc 6, and nozzle connector portion 51) may be rotated through 270° between respective end positions. This rotary movement is accomplished by manual rotation of the switch 3.

25

The particular shape of the tank 1002 represented in the accompanying figures is not definitive, and it will be appreciated that in alternative embodiments for example, a dome shaped upper surface or other configurations may be provided.

30

In the present construction of the assembly of the fill valve, the valve is part of the central pillar assembly and is retained positively against possible expulsion from the tank 1002 under extreme conditions. The fill valve is thus not dependent on any kind of non-return claw type engagement, following initial insertion, and neither is it dependent

on any kind of latching holding arrangement such as a circlip or other spring clip feature.

Figures 18 to 22 show a 3rd embodiment of stove according to the invention.

5 This stove is similar to the stove of the previous figures, the deflector 6 and burner head 1004 arrangement are supported at a substantially defined distance above the top surface of the switch 3 on legs or posts/spacers 10.

10 The main difference in this and the second embodiment of stove is that this arrangement results in a vertical air gap being defined between the burner head portion 1004 and an upper portion of a gas discharge or release valve assembly (the nozzle assembly), in a manner similar to that of the first embodiment.

15 A further difference in this embodiment from both of the earlier described embodiments is the configuration of a gas release or discharge valve assembly, hereinbefore also described as a nozzle and nozzle connector assembly. An example of assembly according to this embodiment is shown in Figures 20 and 21. A cross-sectional view is shown in Figure 20. The majority of the lower portion of the assembly is mounted in the upper part of the fuel storage tank 1002 and is hidden from external
20 view, as will be apparent from Figure 18 or 19.

The main parts of the assembly are an upper flow portion 800 defined by a sleeve 850 and a nozzle connector portion 851 which has an internal cavity 852. An orifice holder 853 is accommodated in the cavity 852. The orifice holder 853 has two
25 main functions, namely first of all to provide a domed end 855 in which there is defined an orifice (not shown) through which the gas passes, and secondly to hold an orifice filter 854 which filters the gas exiting through the orifice. This orifice acts as the jet for combustion of the gas. The dome shape 855 provides for clean burning of the gas fuel, as deposits are less likely to collect about the orifice. An O-ring 856 is provided so that
30 the sleeve portion 850 is sealingly engageable in the nozzle connector 851. An external serrated portion 877 enables co-operation of the gas control valve assembly with corresponding serrations 827 on the switch portion 3 for rotation of the gas release valve

between open and closed end positions and optionally also to vary and control or regulate the rate of gas discharge from the reservoir.

5 The entire gas valve assembly structure is adapted to be received into a corresponding mounting arrangement 861 provided in a central pillar of the tank 1002, as shown in Figure 22. The central pillar is held in position by a nut 805 which locks the top and bottom of the tank 1002 together. This detachable feature of the assembly allows for removal of the nozzle and gas valve assembly for servicing and/or replacement of the filter 854.

10

Figure 22 shows a fill valve assembly 870 of the stove of figure 16 in greater detail. The valve comprises a housing 871 and valve spool 873 displaceable against a compression spring 876. An internal O-ring 875 provides internal sealing and external O-rings 874 provide sealing between the fill valve assembly and valve-receiving portion of the tank 1002. An external serrated portion 872 enables retention of the valve portion within the tank base against rotation.

15

The filler valve in the present embodiment is modified to preclude possible discharge of liquid gas during filling operation by way of the air venting feature of the filling valve structure. The avoidance of such unwanted discharge of liquid gas is achieved, inter alia, by the provision of an additional sealing member within the filling valve structure. When the filling valve is depressed, gas flows into the valve through an axial channel within the valve member and flows out to the sides of the valve member at suitable windows or transversely directed openings. In this way, gas enters into the interior of the tank. Air to be vented exits through a further transverse passage, above the liquid level of the gas in the inverted disposition of the tank, this air exit passage being located near the outer or tank base end of the valve. The vented air then reaches the external ambient environment through a small air gap defined between the sliding member of the valve and an outer sleeve of the valve structure. This air gap is of controlled dimensions to regulate the rate of exit of the air. The seal provided in the present embodiment of the filling valve precludes any liquid gas from being entrained in this air flow.

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The fill valve is also mounted in a central structural pin 880, preferably of brass, when enables positive retention of the fill valve within the structural unit (the tank 1002), so that it cannot blow out of the tank and stove assembly. The central structure also acts a central supporting pillar, extending throughout the axial extent of the tank and linking the lid to the base, so that lid and base are securely fastened together in the assembled condition of the stove. Thus the fill or filler valve is assembled as part of the overall assembly operation and is not inserted as an independent unit following completion of the remaining assembly operations.

10

The pillar structure carries central forces within the assembled tank to improve its structural stability under pressurisation and provides reinforcement of the substantially cylindrical tank along its central axis of symmetry, coupling the tank lid or flange to the base of the tank. The pillar is held in place but a nut which engages against the lid or flange. Suitable sealing features ensure gas-tightness of the assembled stove structure and in particular of the central pillar with respect to the tank or reservoir. In the present construction, the valve is part of the central pillar assembly and is retained positively against possible expulsion from the tank under extreme conditions. The filler valve is thus not dependent on any kind of non-return claw type engagement, following initial insertion, and neither is it dependent on any kind of latching holding arrangement such as a circlip or other spring clip feature.

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The central pillar includes an external O-ring seal 863 for sealing engagement of the central pillar within the tank lid 1002b when the central pillar is assembled with the tank lid 1002b. An adjuster screw may also be provided in the gas flow path.

25

Figures 23 and 24 show a stove according to a fourth embodiment of the invention. In this embodiment, the burner head 904 can be removed from the valve assembly in one piece by virtue of, for example, a screw connection to the valve assembly.

30

A cylindrical jet 915 (equivalent to the flow passage 15 in the earlier embodiments), is positioned within the burner head 904, beneath a plurality of catalytic discs 16a, 16b. The jet or conduit provides a pathway for flow of gas from the tank or reservoir to the burner 904.

5

A deflector in the form of a flat annular deflector disc 906 extends circumferentially about the burner head 904 and is suitably positioned adjacent to a lower portion of the burner head 904. The top of the tank 902 houses, in the present embodiment, a switch or control feature 903 substantially coextensive in area with the tank top surface 934.

10

In the fourth embodiment shown in Figures 23 to 24, a substantially pot-shaped lower tank body portion 402a closed at its upper periphery by a tank lid or cover portion 402b. Those features of these drawings which are the same as those of earlier figures are indicated by the same reference numerals. The principal differences reside in the tank top 402b being connected to the tank body 402a by a bayonet fitting 436 rather than the screw thread previously described. This embodiment also incorporates an overall top cover 414, to enclose the burner region during transport or storage. The top cover 414 is arranged to snap down onto the tank portion perimeter over the control switch 403. The bayonet assembly 436 is most suitably one-way, i.e. once the tank top 402b and body or base 402a have been assembled by a relative twisting movement, they cannot readily be separated again. Reverse movement of the bayonet arrangement is inhibited to preclude reopening the tank in this manner.

15

20

Figures 25 and 26 show a stove according to a fifth embodiment of the invention, this being of generally similar construction to that of the sixth embodiment which will be described below. The same reference numerals are applied in the drawings as for Figures 27 to 28, which illustrate a nozzle assembly for use in this embodiment.

25

Such a nozzle assembly for use with this embodiment of stove is shown in Figures 27 and 28. The nozzle assembly is generally designated 508 and is shown in perspective view in Figure 27. A cross-sectional view is shown in Figure 28. The nozzle

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assembly is shown without the catalytic head. The main parts of the assembly are a body portion or housing 541, having a cavity 542 defined therein. In the cavity 542 is housed a holder 543. The holder 543 has two main functions, namely first of all to hold a sintered filter 544 which filters the gas coming through the nozzle assembly, and
5 secondly to hold a domed piece 545. Dome 545 in turn has defined therein an orifice through which the gas passes. This orifice acts as the jet through which the gas is burned. An O-ring 546 is provided so that the nozzle is sealing engageable in the structure of the burner. The dome shape provides for clean burning of the gas fuel as deposits are less likely to collect about the orifice. The remainder of the assembly
10 includes fins 547 on the body and a head 548 for accommodation of the burner head having the catalytic element(s).

Figures 29 and 30 show a connector piece 560 for connecting the nozzle assembly of Figures 27 and 28 to the tank 502. When in place, the connector piece 560
15 is seated between an upper portion 502b of the tank 502 and a switch portion 503. The connector piece 560 has two main body parts - a first upper part 561 for engagement with the switch portion 503 and a second lower part 562 which engages with the upper part 502b of the tank 502. The parts 561 and 562 are rotatable relative to each other to open and close gas flow. There is sealing between parts 561 and 562 by an O-ring 564
20 disposed between internal surfaces 565 of the connector. Internal O-rings 566, 567 are provided in grooves along the periphery of the part 561 to provide sealing between the outer surface of part 561 and the internal surface of part 562.

The connector piece 560 includes an external O-ring seal 563 for sealing
25 placement of the connector within the overall assembly. The serrated or keyed rim engages within the top part 502a of the tank. An adjuster 568 is also provided in the gas flow path.

Figures 31 to 33 show a sixth embodiment of the burner 904 and deflector 906
30 arrangement which are fixedly attached to each other and are together releasable attached to a substantially standard gas valve 908.

Within the valve 908, a fixed flow nozzle is provided, resulting in an economical and cheap construction. The nozzle is desirably of the type known as a Venturi type nozzle. The nozzle also contains a replaceable filter 954. The nozzle of Venturi construction is designed so as to be self-cleaning. A major problem with many conventional nozzle types is that they have a tendency to block with dust. This may happen due to heavier hydrocarbon impurities in the gas collecting about the orifice of the nozzle due to their generally lower expulsion velocity from the nozzle. These hydrocarbon deposits can attract dust and other particles and may eventually block the nozzle orifice. One particular method of avoiding such blockage is to adopt the nozzle arrangement shown in the present invention where the expanding fuel flow path (stepped in the embodiments shown) allows the heavier hydrocarbons to fall away from the orifice of the nozzle.

The entire nozzle, valve 908 and burner head 904 assembly can be readily taken apart for servicing and/or replacement of the filter 954 and any other component as may be required. The valve 908 is provided with lateral heat dissipating fins 919 about its upper cylindrical portion 908a which extends upwardly toward the top of the burner head 904. A second set of larger more spaced apart fins 920 are provided closer to the top end 932 of the burner head 904. The heat dissipating fins, in particular the set 920 on the burner head, contribute in an innovative manner to the successful performance of the stove of the invention. A lower portion 908b of the valve assembly 908 is mounted in the upper part of the fuel storage tank 902 and is hidden from external view, as will be apparent from the Figures.

The flow of fuel from the tank 902 to the burner 904, is controlled by relative rotation of the burner head 904, and the tank 902. For example, in the embodiment shown in Figures 23 to 24, the entire upper end of the burner structure, namely the upper valve portion 908a and burner head 904, may be rotated through 270° , to switch the flow on and off and to control or regulate the flow rate of the fuel. The switch is thus displaceable between respective end positions. This rotary movement is accomplished by an external switch portion 903, of the tank 902, mounted to surround the valve assembly 908 a short distance below the heat dissipating fins 920.

In particular, the switch portion 903 engages around the external periphery of the valve assembly 908, such as by way of splines, so that rotation of the switch effects corresponding rotation of the valve. Rotation of the valve controls the flow rate of gas through the valve and thus from the tank 902 to the burner. Suitably, the switch 903 is disc shaped with a downwardly extending peripheral skirt 922, the disc portion of the switch having a diameter approximately equal to that of the tank 902. The downwardly extending peripheral skirt 922 is substantially coaxial with a cylindrical outer wall 933 of the gas tank 902. The switch portion 903 overlies the upper surface 934 of the fuel tank 902, which is not normally visible to the user. The peripheral skirt region 922 is provided with raised radially projecting vertical grips or ribs 923 for ease of gripping for manual turning. End stops 924 to limit the rotational displacement of the control disc 903 are provided on the underside of the switch portion 903 for co-operation with upstanding projections or lugs 925 extending from the upper portion or top surface 934 of the tank 902. These technical features of the switch 903 are hidden from external view in the assembled structure as seen in Figure 23. A retaining nut 905 is provided to secure the switch portion 903 on the valve 908.

The switch arrangement 903 described enables close and accurate regulation of the supply of fuel from the tank 902 of the unit to the burner head 904 and thereby facilitates adjustment of the heat release from the stove 901 to the items to be heated. In this way, not only is economy in usage of fuel achieved, but in chafing use, the degree of heating applied to the food to be kept warm can be matched exactly to requirements, so that the correct temperature is maintained, but there is minimal continuing cooking of the prepared dishes. Thus excellent chafing performance is provided by the unit 901 of the invention.

The entire valve 908 and burner 904 assembly structure is screw threadingly connected to a mounting arrangement in an upper portion of a fuel storage portion of the apparatus, i.e. the tank 902. This detachable feature of the assembly allows for compact storage of the stove 901, in particular during hiking, camping etc. The tank 902 contains a gas supply for providing the requisite heat output by combustion of the gas in the

vicinity of the catalyst discs 916a and 916b. The gas is held in liquid form in the tank 902.

The main body of the tank 902 according to the embodiment of the invention shown in Figures 31-33 is of a two part construction 902a, 902b. A plastic cup-shaped portion 902a with a concave base forms the base and sides of the tank, closed off at its upper end by an upper closure portion 902b which is screwed into the main body or cup-shaped lower portion 902a of the tank 902. Top portion 902b is defined by a dished or concave generally disc-shaped part with an integral downwardly-depending skirt, which extends into the cup-shaped base 902a in the assembled condition of the gas tank. The screwing-in takes place by way of a deep cut thread 926 provided on the downward peripheral skirt of closure portion 902b, which thread is resistant to any pressure exerted by the liquid gas within the tank 902. Sealing between the two portions is completed by a sealing ring 913 held in a recess on the periphery of the downwardly-directed skirt of the upper closure portion 902b near its lower edge. The top surface of the upper closure portion 902b is, as already noted, concave. The centre of the concavity is provided with an aperture to furnish the mounting arrangement into which the valve assembly 908 fits and in which it is secured by a nut 909. The nut 909 further comprises an annular receiving portion or lip at its base, onto which a heat transmitter such as a spring may be attached, as will be described below.

The lower portion 908b of the valve assembly 908 extends through the mounting arrangement into the interior of the tank 902. A hole is provided horizontally through the lower end of the valve, through which a cylindrical wick 933 is fed. Inside the tank 902, this lower portion 908b of the valve is surrounded by a bell-shaped heat spring 912, the top of which is associated with the body of the tank and the valve assembly 908 by means of the receiving portion of the nut 909. The heat spring 912 defines a conductive feedback system which returns heat from the burner and valve assembly back into the heat tank 902. As the gas boils off, it cools. The conductive feedback system keeps the gas reservoir at temperatures around 20°C, thus helping the gas to maintain its vapour pressure.

The design of the individual parts of the stove according to this embodiment of the invention allows for ease of assembly as described below.

5 The pre-assembled gas valve 908 is lowered into the central aperture of the upper closure portion of the tank and is secured at its base by the nut 909. The heat spring may then be attached to the nut/valve assembly. The wick 933 is fed through its corresponding hole at the base of the valve 908 and the assembled upper closure portion 902b of the tank is subsequently screwed into the lower cup-shaped portion 902a of the tank. The switch portion 903, followed by the valve nut, is lowered over the upper part
10 of the valve which is now extending from the top of the tank 902. The switch comes to rest on the top surface of the tank. Tightening of the nut secures the switch to the valve. Finally, the burner and deflector arrangement is attached to the top of the valve. The assembled stove is now ready for filling before operating.

15 Figures 34 and 35 show a seventh embodiment 101 of the stove according to the invention. In this embodiment, as shown in Figure 35 in particular, the stepped construction of the burner head 104 again narrows or tapers in a downward direction (in the opposing direction to the direction of flow of the gas), with each step holding an individual catalyst disc 116a, 116b, 116c. As shown in Figure 35, the burner head 104
20 has three steps and is provided with three catalytic discs 116a, 116b, 116c, each of increasingly greater diameter in the upward or ascending direction. The burner unit 104 of the invention preferably has a minimum of two steps, but as many as five steps may be provided. The provision of multiple steps with a widening or tapering outflow region in the upward direction is to provide for expansion of the gas flow. (Expansion occurs in
25 the direction of flow). It is a further feature of the invention that this catalytic head 104 can be removed from the valve 108 in one piece by virtue of, for example, a screw connection to the valve 108.

30 Moving downward from the burner head 104, the feed tube or valve 108 is provided with lateral heat dissipating fins 119, as also is the lower region of the burner head 104 itself. The burner head fins are designated by reference 120. The use of the

heat dissipating fins 119 in both sections contributes in an innovative manner to the successful performance of the unit 101 according to the invention.

Within the valve 108, a fixed flow nozzle 117 is provided, resulting in an economical and cheap construction. The valve region of the unit also contains a replaceable filter 118. The entire nozzle 117, valve 108 and catalyst head 104 assembly can be readily taken apart for servicing and/or replacement of the filter 118 and any other component as may be required. In particular, the lower end 108b of the valve is screw threadingly connected to a mounting arrangement fitted into the top of the tank 102 and adapted to secure and accommodate the nozzle portion 117 and the filter 118.

In order to control the flow of fuel from the tank 102 to the burner 104, the entire upper end of the burner structure, namely the valve 108 and burner head 104, may be rotated through 180° between end positions, to switch the flow on and off. This rotary movement is accomplished by an external adjustment knob 103 mounted to surround the lower end 108b of the valve 108 and engaging on the external periphery of the valve by way of splines or longitudinal protrusions 121. Referring again to Figure 34, a radially extending lug or tab 128 provides for displacement of the knob between the open and closed positions by manual engagement. End stops (not shown) to limit the rotational displacement are provided within the adjustment knob structure 103 for co-operation with at least one upstanding projection or lug 125 between the switch 103 and body of the tank 102. Suitably the switch 103 is of disc shape with a downwardly extending peripheral skirt 122, within which the other technical features of the knob arrangement are hidden from external view in the assembled structure as seen in Figure 34. The diameter of the switch 103 is approximately half that of the fuel tank 102.

This alternative embodiment does not feature the heat shield or deflector of the construction first described. The control switch arrangement is of lesser diameter than that of the gas tank and requires therefore a lesser degree of shielding than does the larger switch of the first embodiment.

The main body of the tank 102 consists of an inverted cup-shaped portion 102a, closed off at its lower end by a closure portion 102b which is screwed into the main body or inverted cup part 102a of the tank. The screwing in takes place by way of a deep cut thread 126, which is resistant to any pressure exerted by the liquid gas within the tank 102. Sealing is further guaranteed by an O-ring or similar seal accommodated in a peripheral groove provided in the threaded annular skirt portion of closure 102b, which skirt portion carries the screw thread 126. At ambient pressure, the contents of the tank 102 in liquid form in fact exert a pressure of no greater than 4-6 bar, but because of the relatively large quantity of fuel held within the tank 102, the consequences of any inadvertent leakage or fracture of the tank 102 are nonetheless potentially hazardous, possibly explosive. Hence the necessity for the tank 102 to possess appropriate strength and to be substantially leak-proof.

Figures 36 and 37 show a fill valve assembly 270 for use in any of the stoves of the 5th, 6th or 7th embodiments in greater detail. The fill valve comprises a housing 271 and valve spool 273 displaceable against a compression spring 276. An internal O-ring 275 provides internal sealing and external O-rings 274 provide sealing between the fill valve assembly and valve-receiving portion of the tank. An external serrated portion 277 enables retention of the valve portion within the tank base.

It will be appreciated that although the present invention has been described with reference to specific embodiments and arrangements of each embodiments, that components or features of one embodiment may equally be interposed or exchanged for features or components of other embodiments. It will be further appreciated that the use of the wording "upwardly", "downwardly", "upper", "lower" or the like has been for ease of explanation and it is not intended to limit the present invention to any one specific orientation. furthermore, although the invention has been described with reference to specific embodiments it is not intended to limit the scope or protection except as may be deemed necessary in the light of the appended claims. additionally, it will be appreciated that the words "comprises/comprising" and the words "having/including" when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps or components but does not

preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

CLAIMS

1. A stove for maintaining prepared food in a warm state, comprising:
 - (a) a fuel reservoir,
 - 5 (b) a burner unit,
 - (c) flow means communicating between the fuel reservoir and the burner unit; and
 - (d) control means for regulating flow of fuel from the fuel reservoir to the burner unit, and
 - 10 (e) heat transfer control means for controlling heat transfer from the region of the burner unit to the fuel reservoir.
2. A stove according to Claim 1, wherein said heat transfer control means comprises a heat deflector located between the burner unit and the fuel reservoir.
- 15 3. A stove according to Claim 2, wherein said heat deflector comprises heat activated deformation means.
4. A stove according to any preceding claim, wherein said burner unit and said flow means are separated by an air gap.
- 20 5. A stove according to Claim 4, wherein the air gap is linear.
6. A stove according to Claim 4, wherein the air gap is circumferential.
- 25 7. A stove according to any preceding claim wherein the fuel reservoir comprises a reinforcing pillar.
8. A stove according to Claim 7, wherein said reinforcing pillar extends between a region of the reservoir in which said control means is incorporated and a base region of the reservoir.
- 30

9. A stove according to Claim 8, wherein a gas fill valve is accommodated in said pillar in the vicinity of the base region of the reservoir.

10. A stove according to Claim 9, wherein said fill valve is positively retained
5 within said pillar.

11. A stove according to Claim 9 or Claim 10, wherein a seal is provided to substantially inhibit discharge of liquid gas through a fill valve air vent passage, during a gas filling operation.

10

12. A stove according to any of Claims 8 to 11, wherein the reservoir is substantially cylindrical and the central pillar is centrally located within the reservoir along an axis of symmetry thereof.

15 13. A stove according to Claim 7, wherein said fuel reservoir is a refillable gas tank of less than 250 ml capacity.

14. A stove according to Claim 13, wherein the diameter of the tank is substantially equal to the height of the stove.

20

15. A stove according to any preceding claim, wherein the fuel reservoir comprises a plastics material.

16. A stove according to Claim 15, wherein the fuel reservoir comprises a two-part
25 structure consisting of a substantially cup-shaped body portion and a closure portion for co-operative sealing association with the body portion.

17. A stove according to Claim 16, wherein interconnection of the closure portion and body portion of the fuel reservoir is effected by screwing together or by a bayonet-type coupling action.
30

18. A stove according to any preceding claim, wherein at least the flow means incorporates heat exchange features.
19. A stove according to any preceding claim, wherein the flow means comprises a rotary valve assembly and the control means includes a rotary switch for displacement between end positions corresponding to full-flow and shut-off conditions.
20. A stove according to any preceding claim wherein the burner unit includes catalytic components.
21. A stove according to claim 20 wherein the catalytic components are provided in one or more disc configurations, the burner unit being adapted to mount the one or more discs in a plane substantially transverse to an axis of flow of the fuel from the reservoir to the burner unit.
22. A stove according to any preceding claim wherein the burner unit is adapted to receive an upper portion of the flow means, the flow means being moveable within the burner unit.
23. A stove according to any preceding claim wherein the burner unit and the flow means are provided as an integral unit.
24. A stove according to any one of claims 1 to 22 wherein the burner unit and the flow means are provided as distinct separate components.
25. A stove according to claim 2 wherein the heat deflector is mountable on one or more spacers, the height of the spacers determining the distance of the heat deflector above the control means.
26. A stove according to claim 25 wherein the heat deflector is adapted to support the burner unit, such that the burner unit is separated from the control means by a height defined by the spacers.

27. A stove according to any preceding claim further including emergency shut-off means, the shut-off means, on activation, effecting a termination of flow of gas from the reservoir to the burner unit.

5

28. A stove according to claim 27 wherein activation of the shut-off means is effected upon tilting the base of the stove through 90 degrees from a normal horizontal position.

10 29. A stove according to claim 27 or 28 wherein the shut-off means is provided within the flow means and is moveable from a normal rest position wherein it is seated within a channel provided in the flow means to an activated position wherein it occludes at least a portion of a flow path for the gas passing from the reservoir to the burner unit.

15 30. A stove substantially as described herein with reference to and as shown in any one or more of the accompanying drawings.

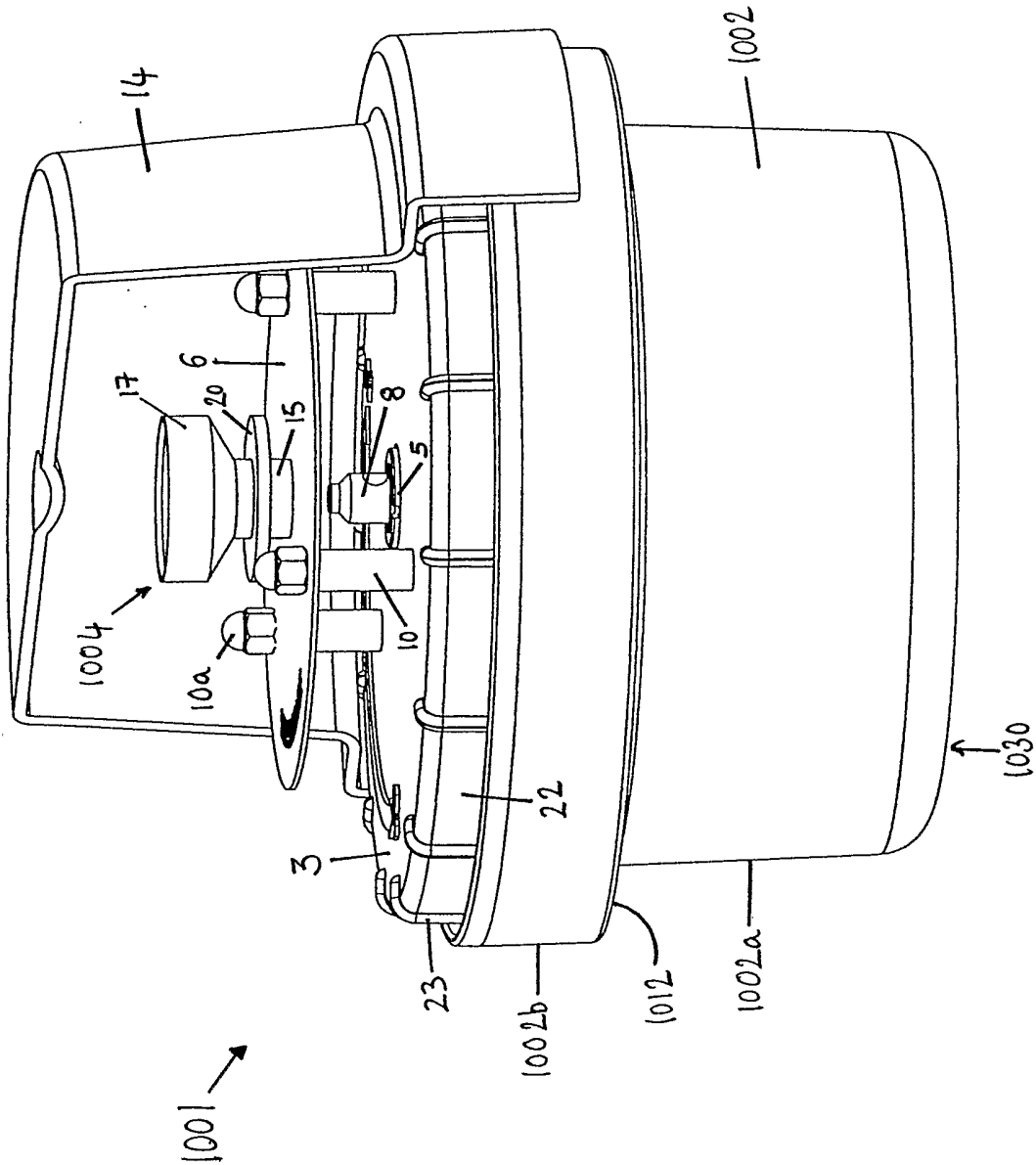


Fig. 1

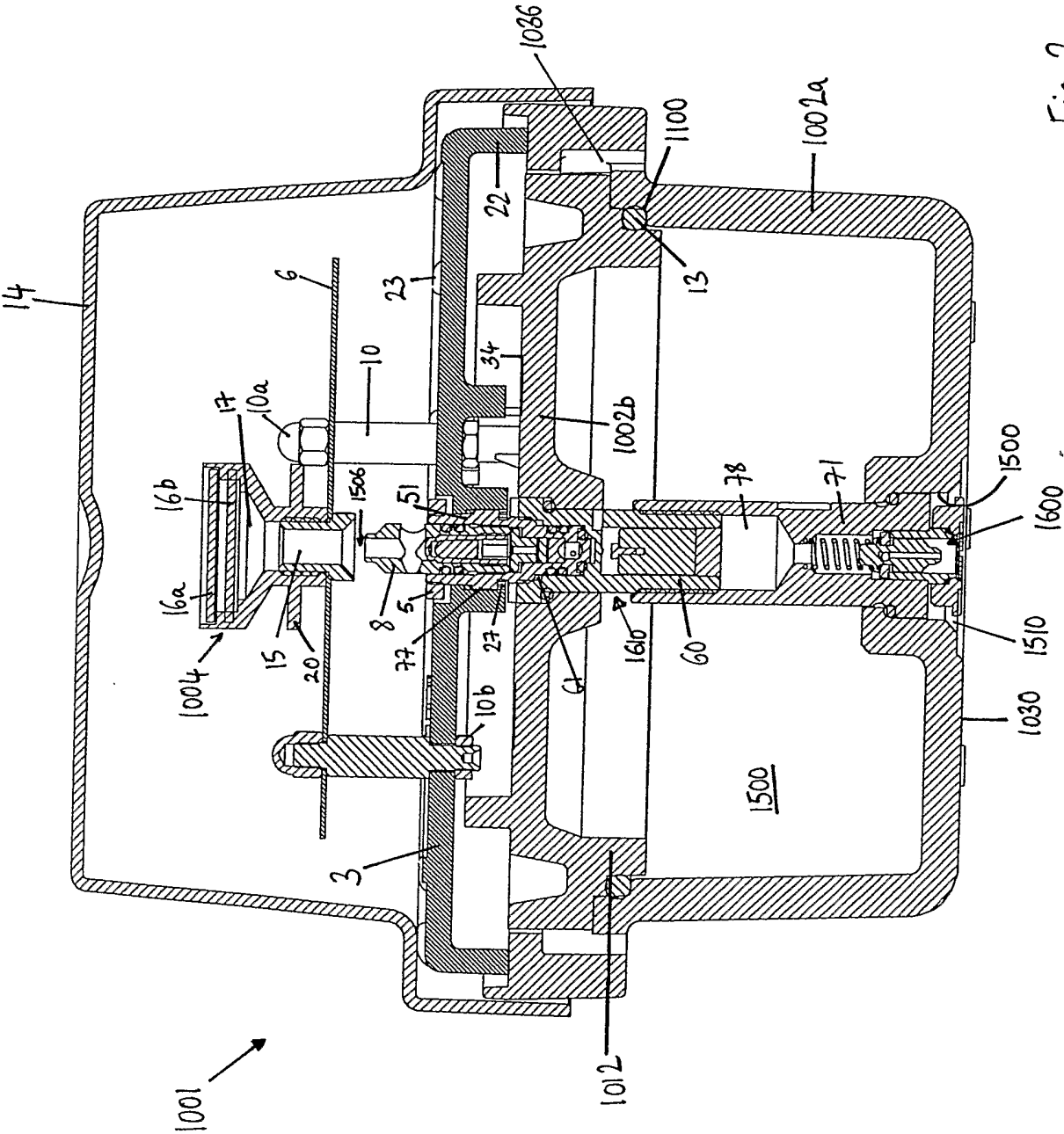


Fig. 2

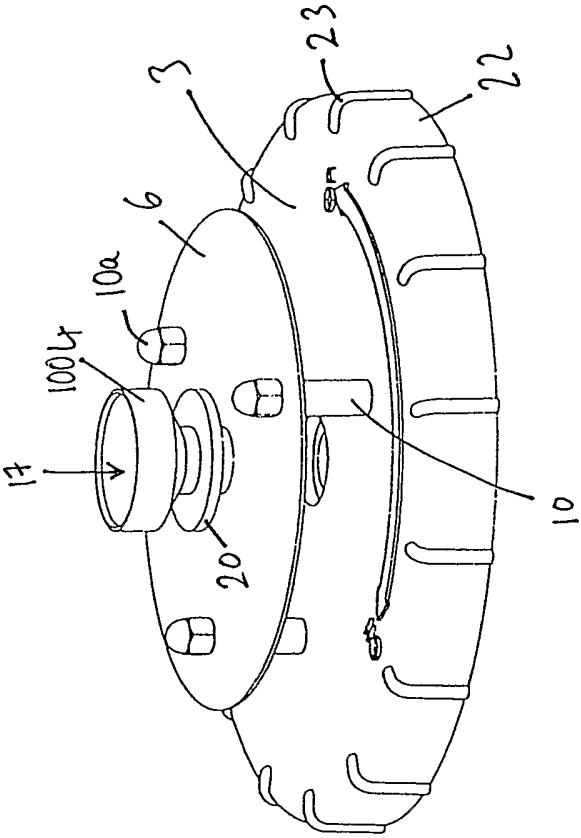


Fig. 4

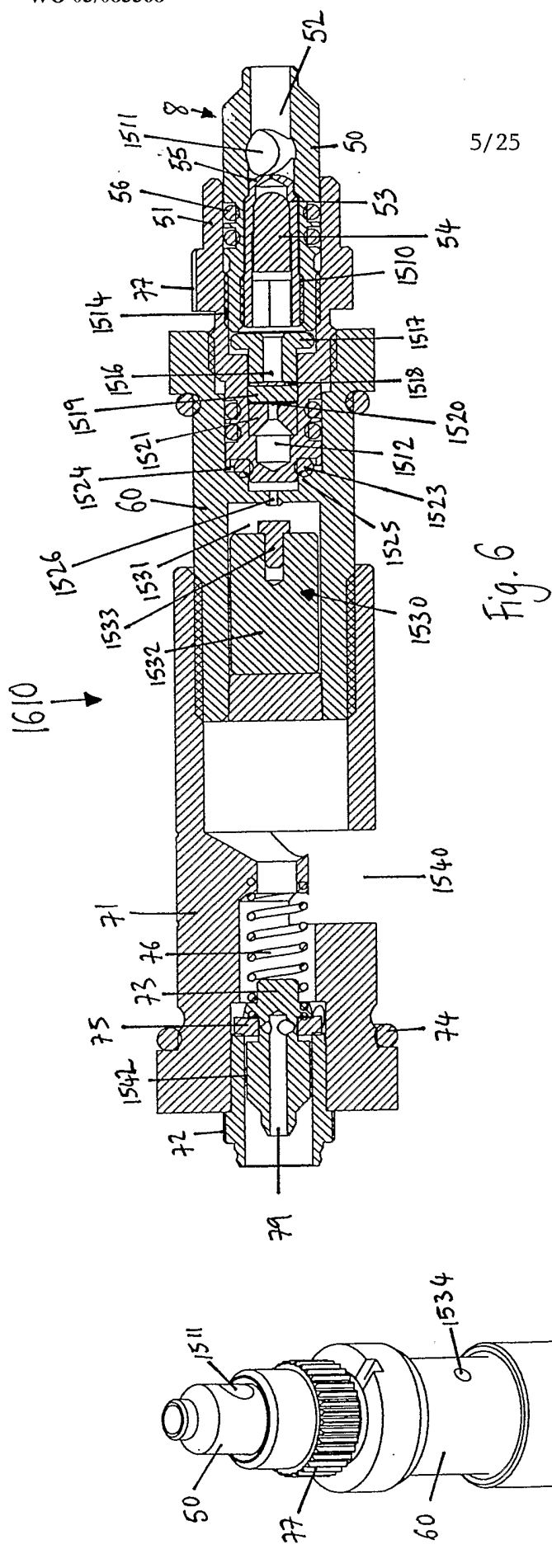
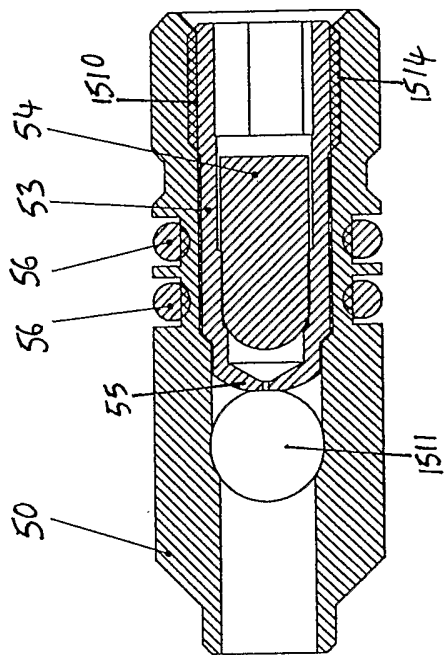


Fig. 5



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Fig. 8

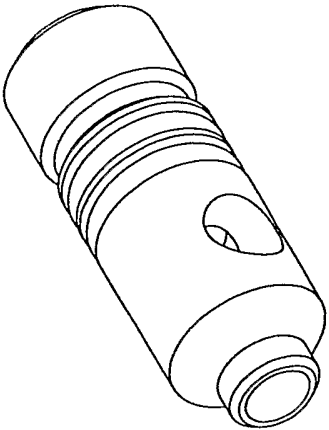
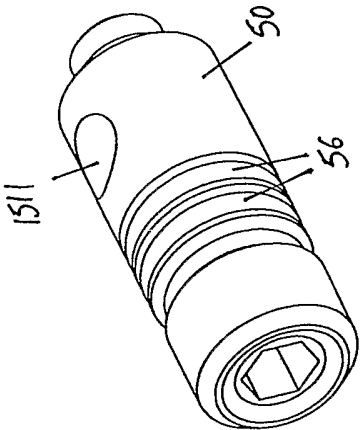


Fig. 7

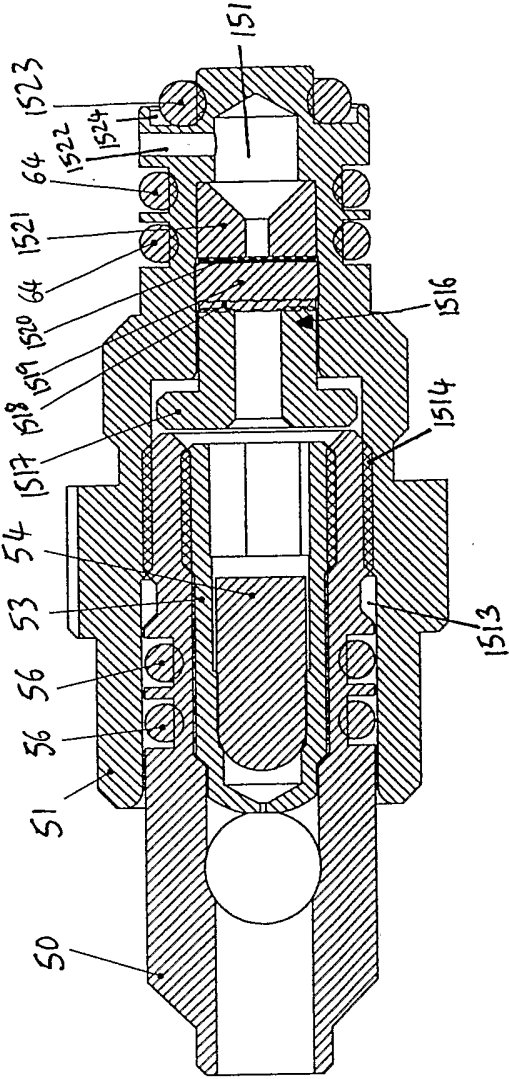


Fig. 10

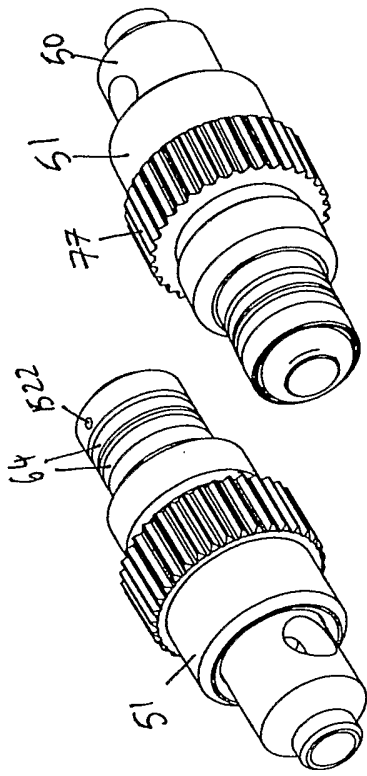
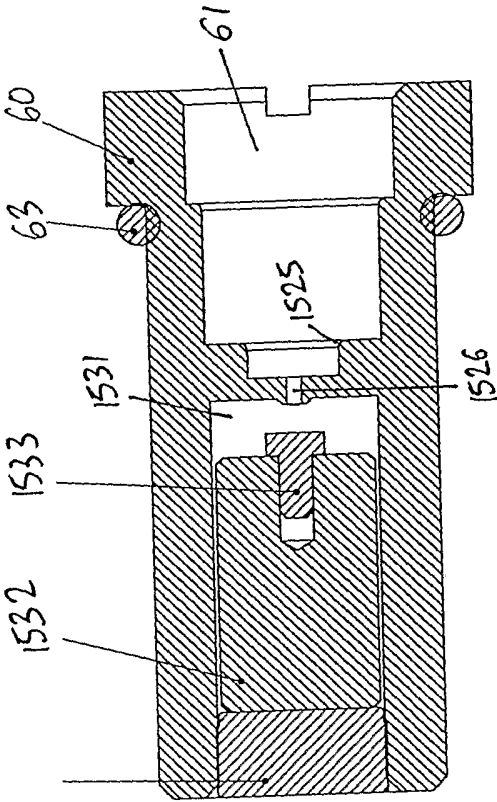


Fig. 9



A-A

Fig. 12

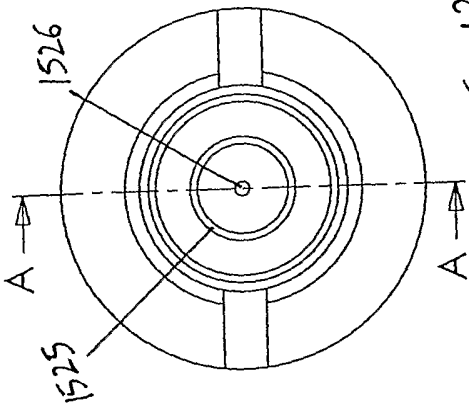


Fig. 13

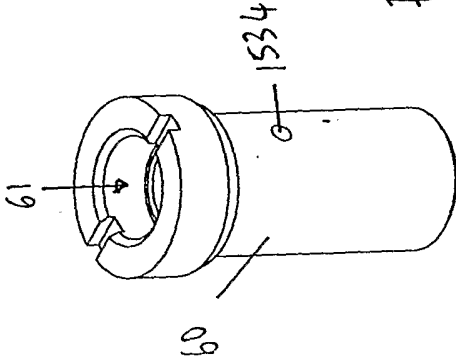


Fig. 11

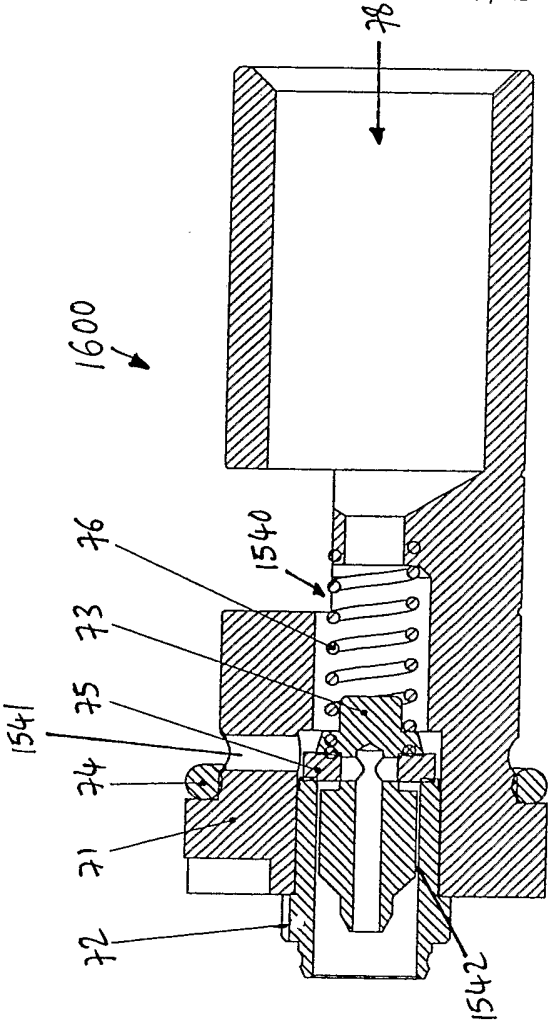


Fig. 15

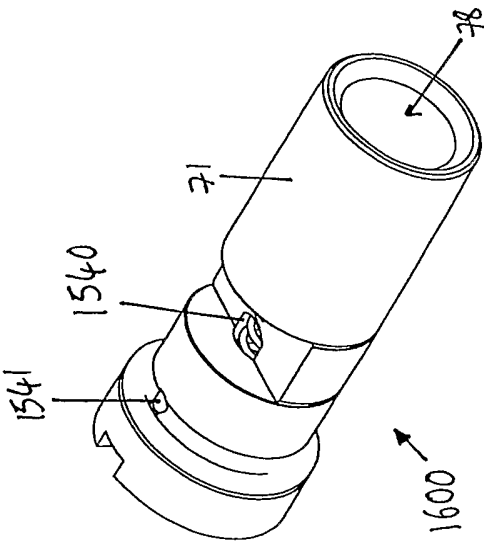


Fig. 14

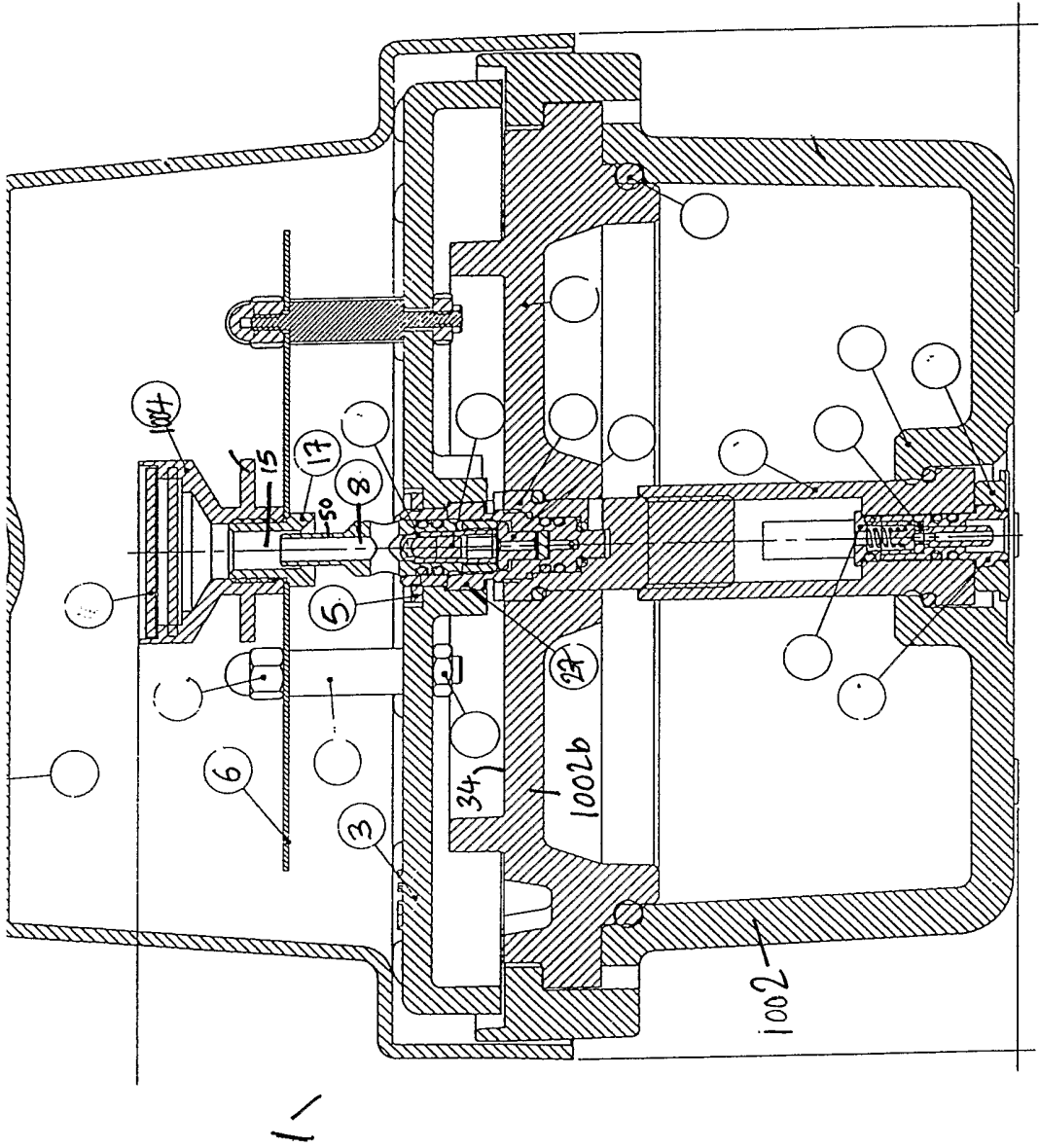


Fig. 16

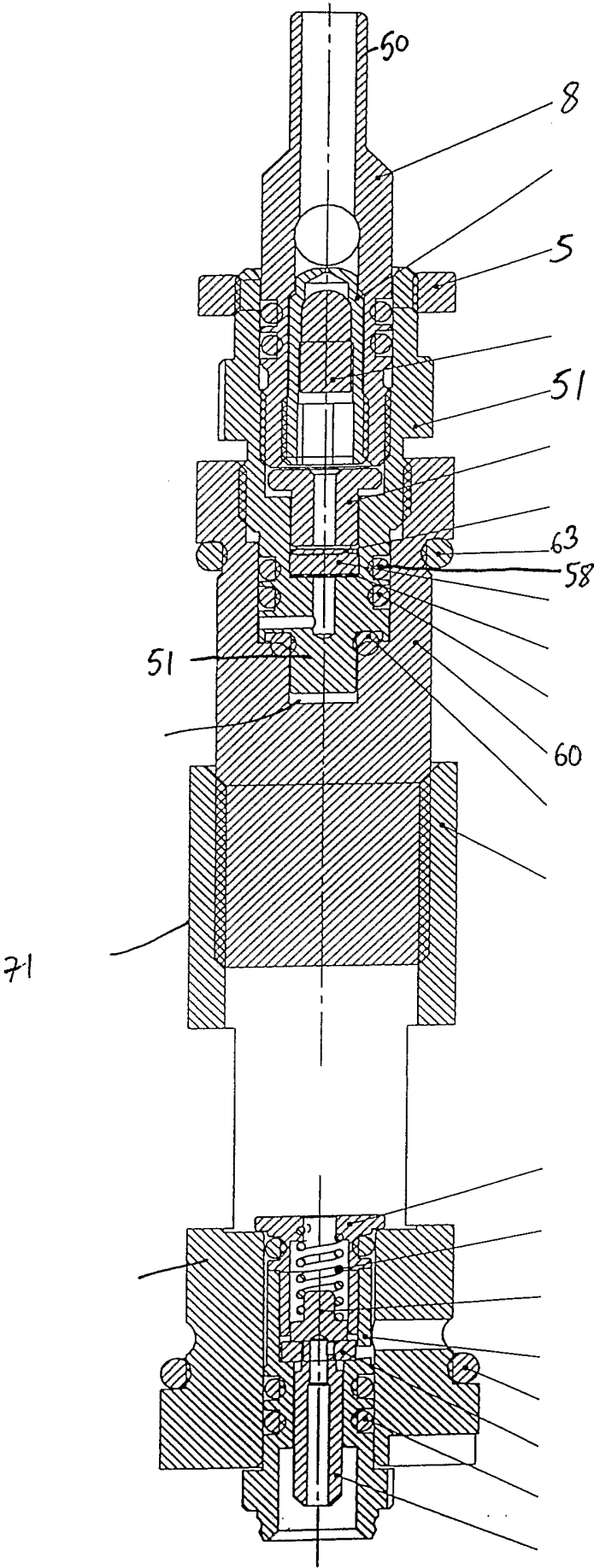


Fig. 17

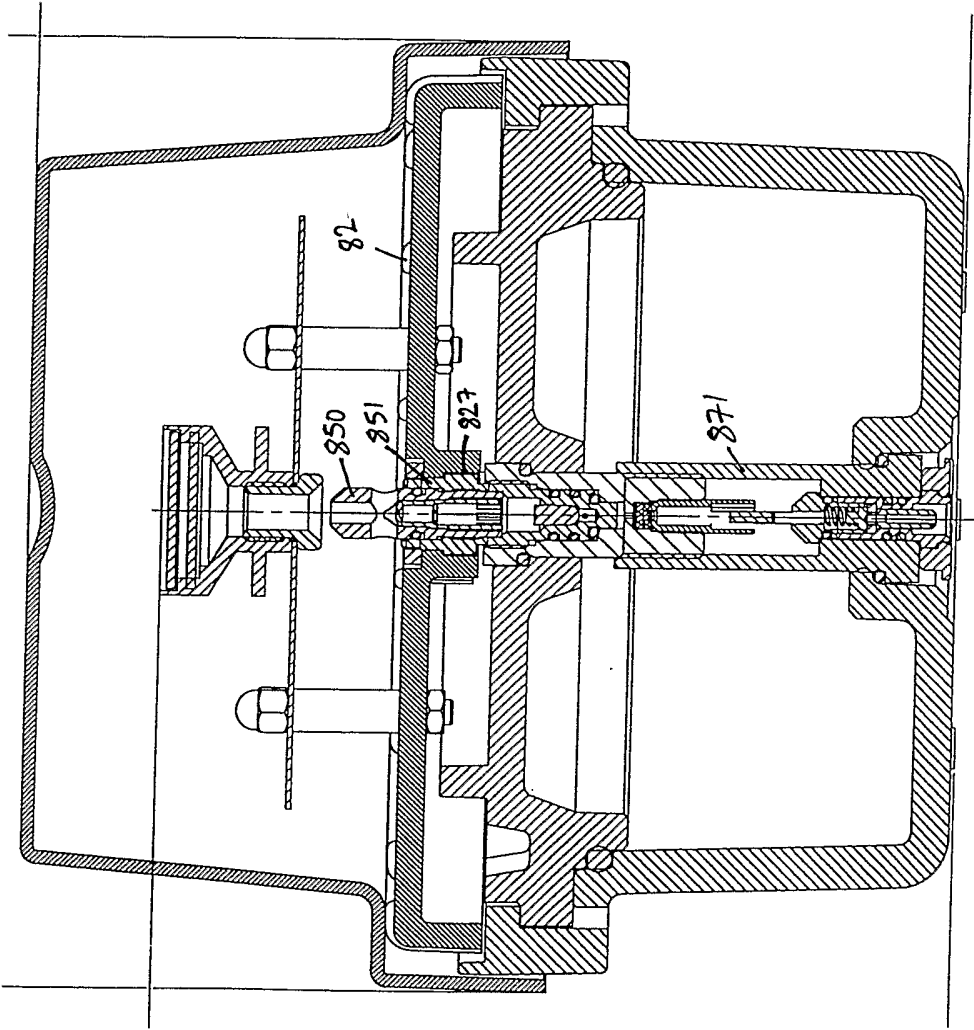


Fig. 18

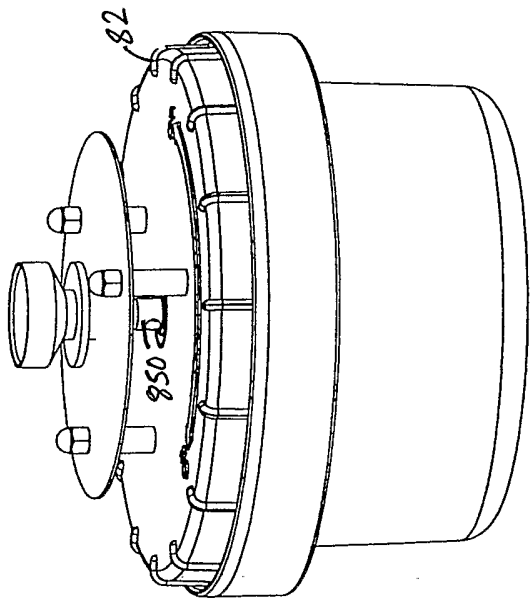


Fig. 19

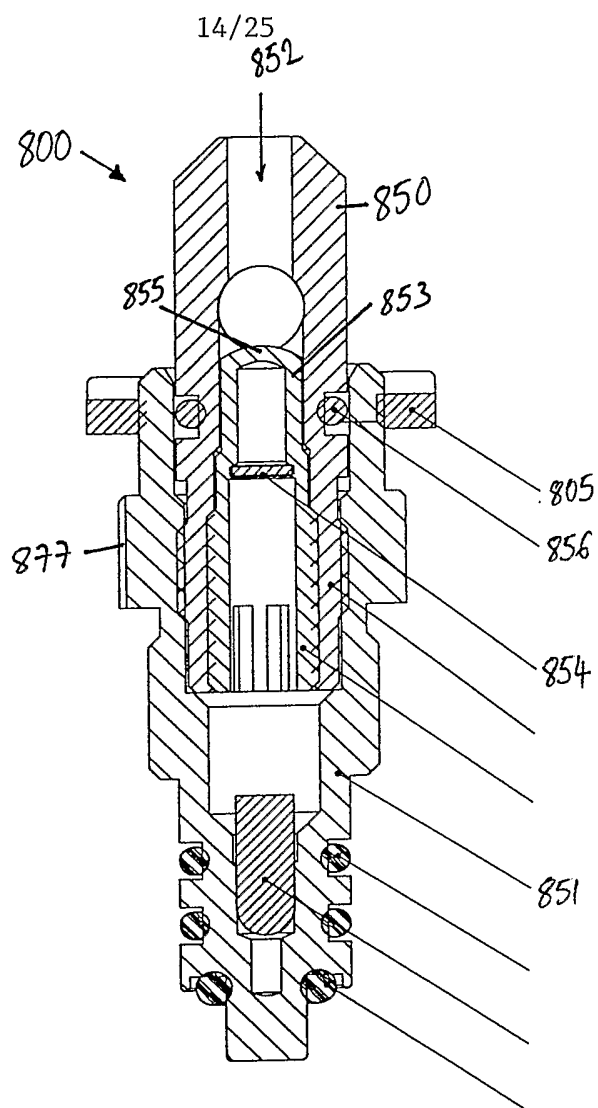


Fig. 20

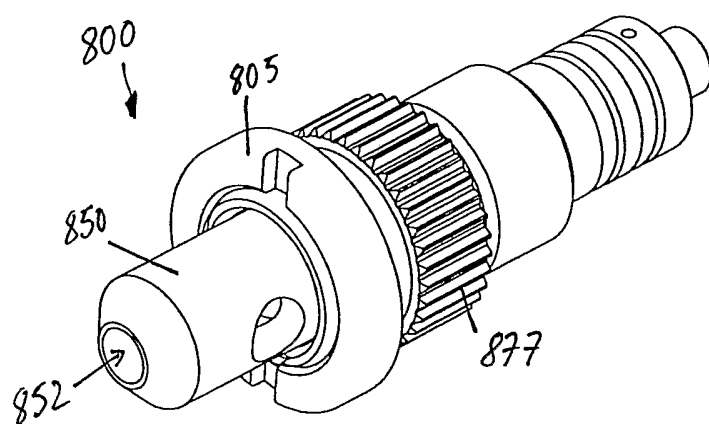


Fig. 21

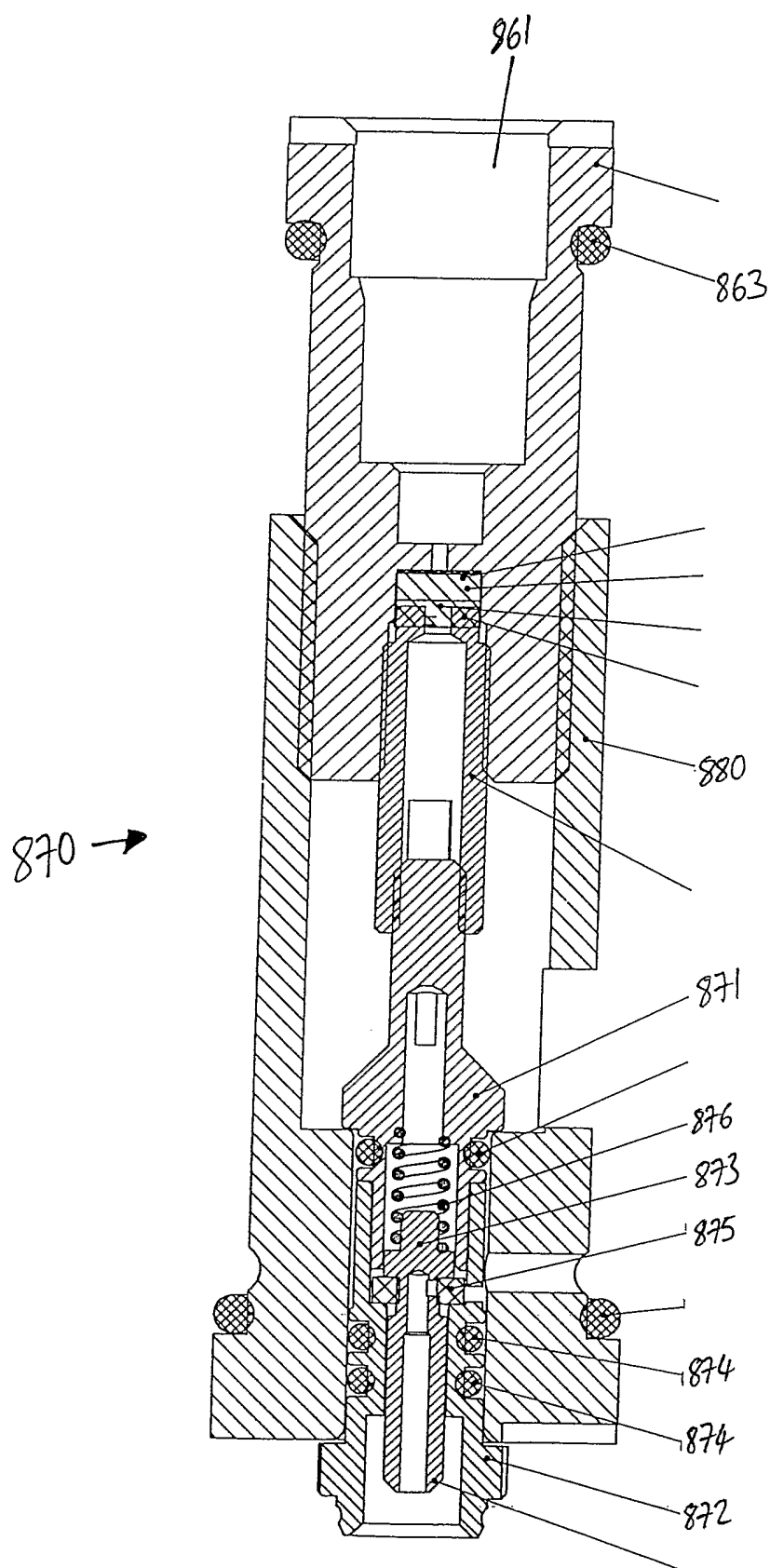


Fig. 22

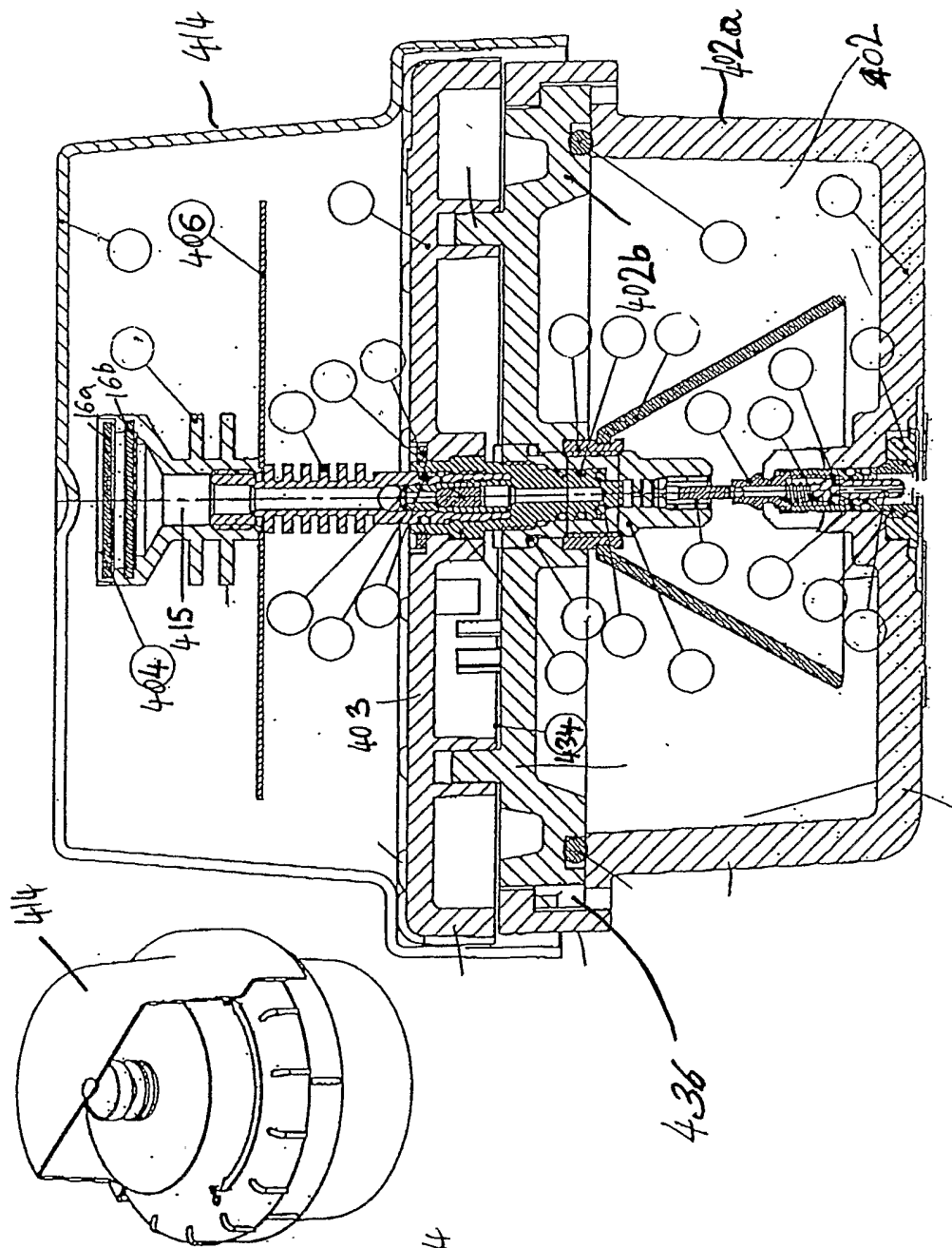


FIG. 24

FIG. 23

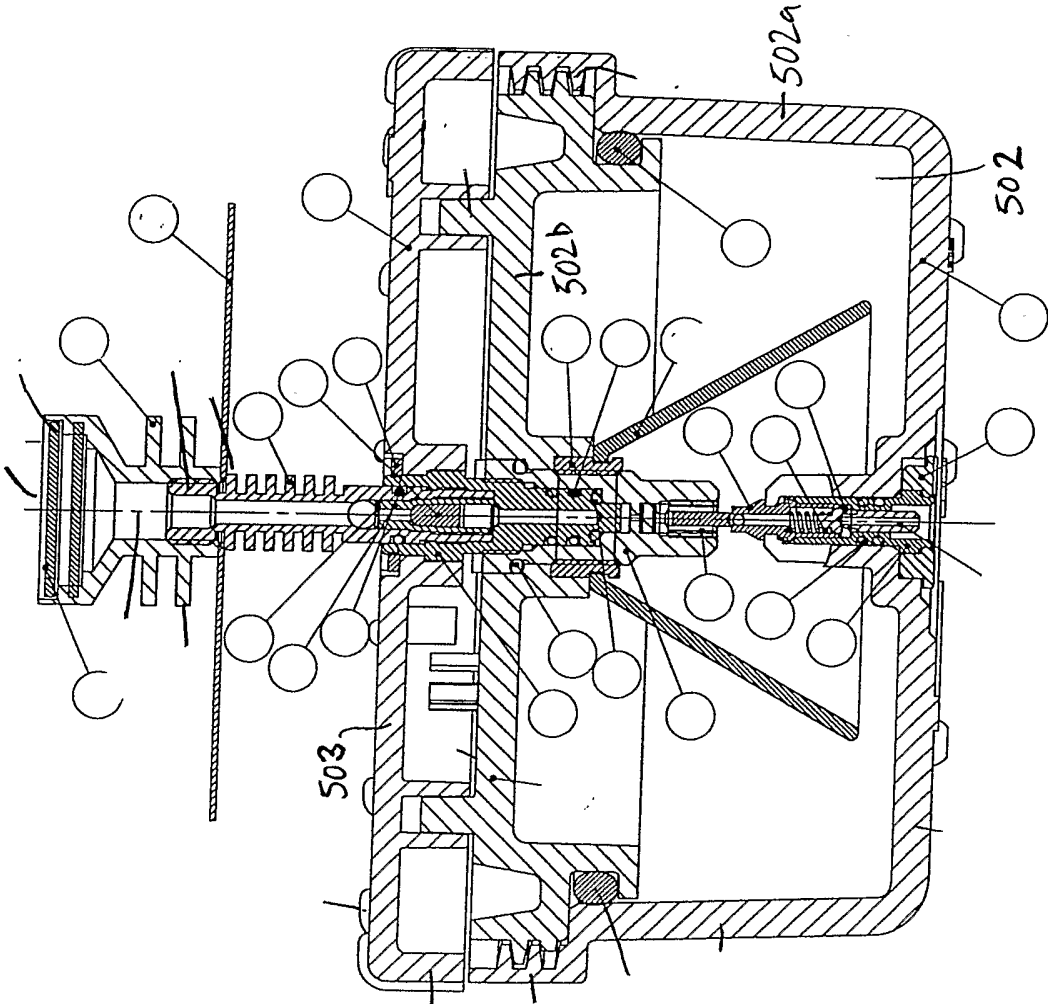
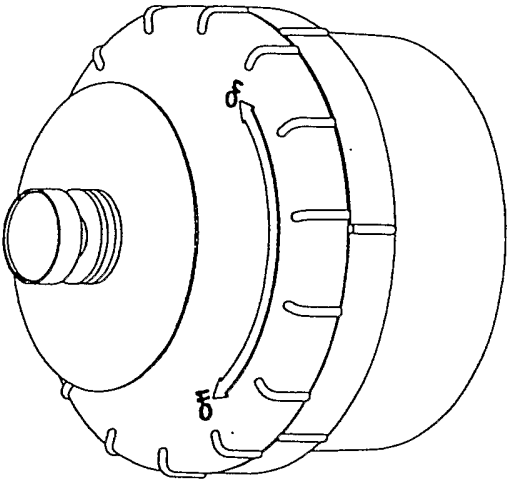


FIG. 25

FIG. 26



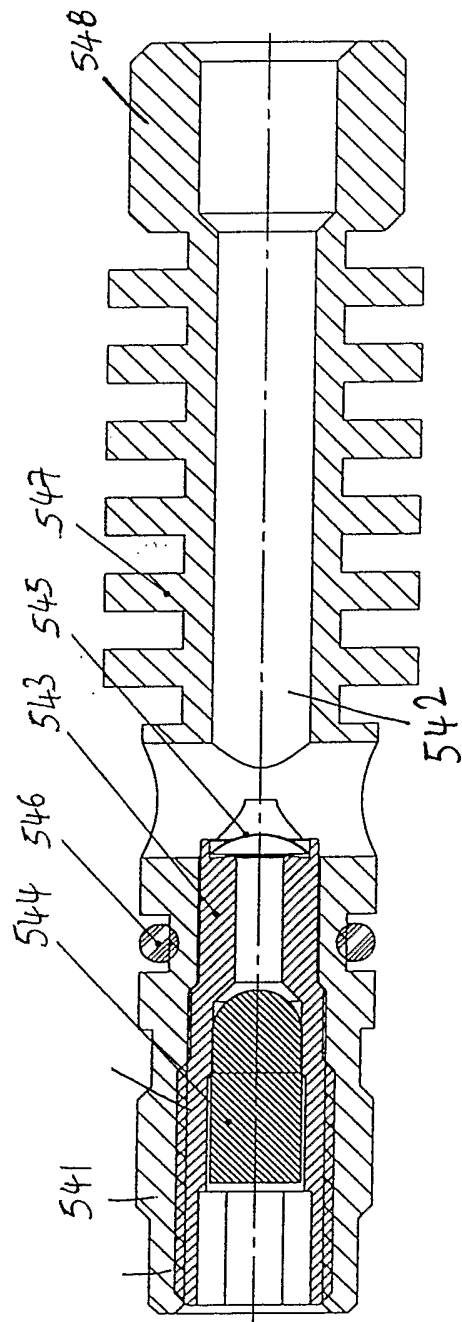


FIG. 28

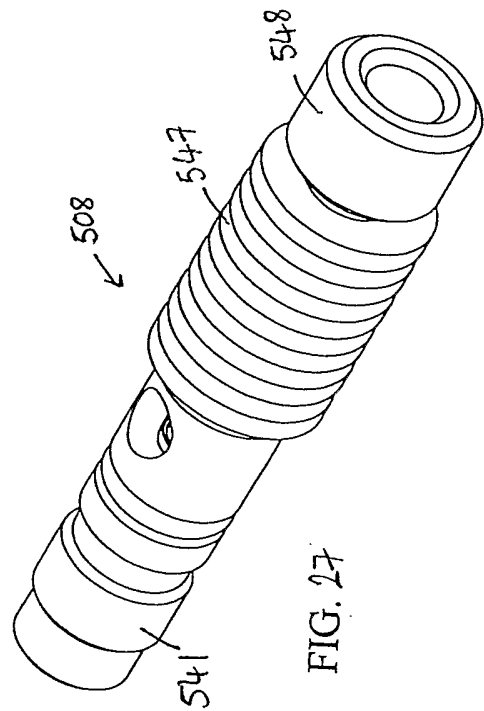
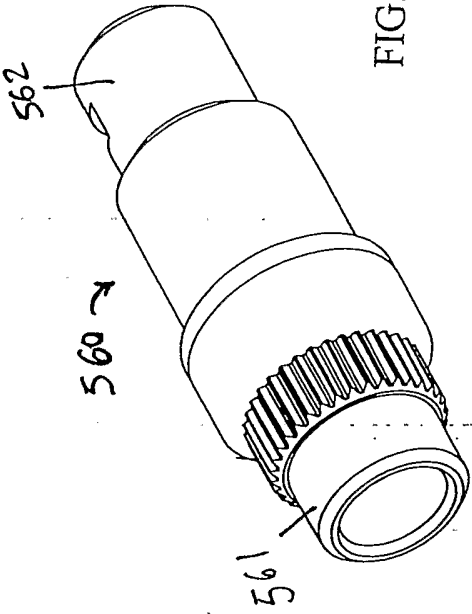
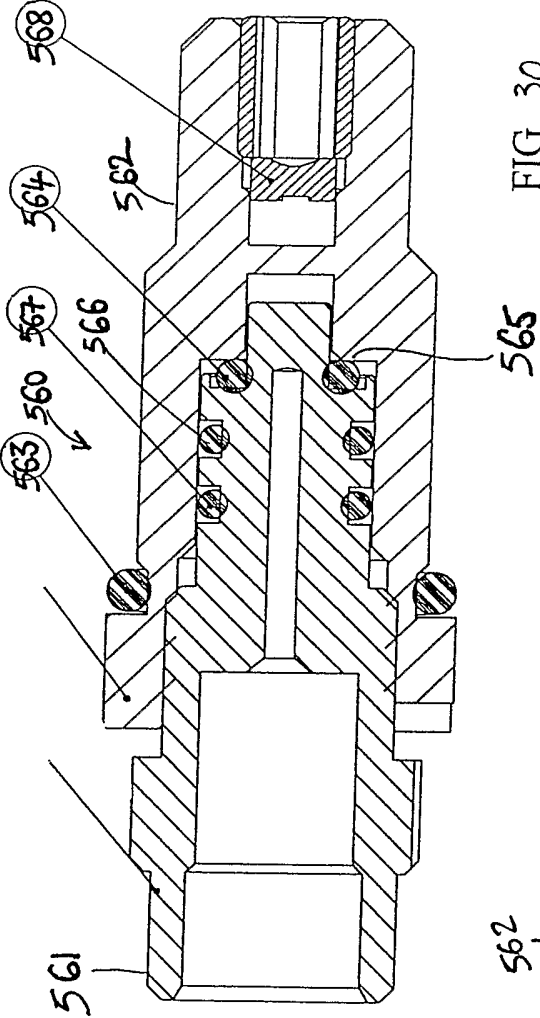


FIG. 27



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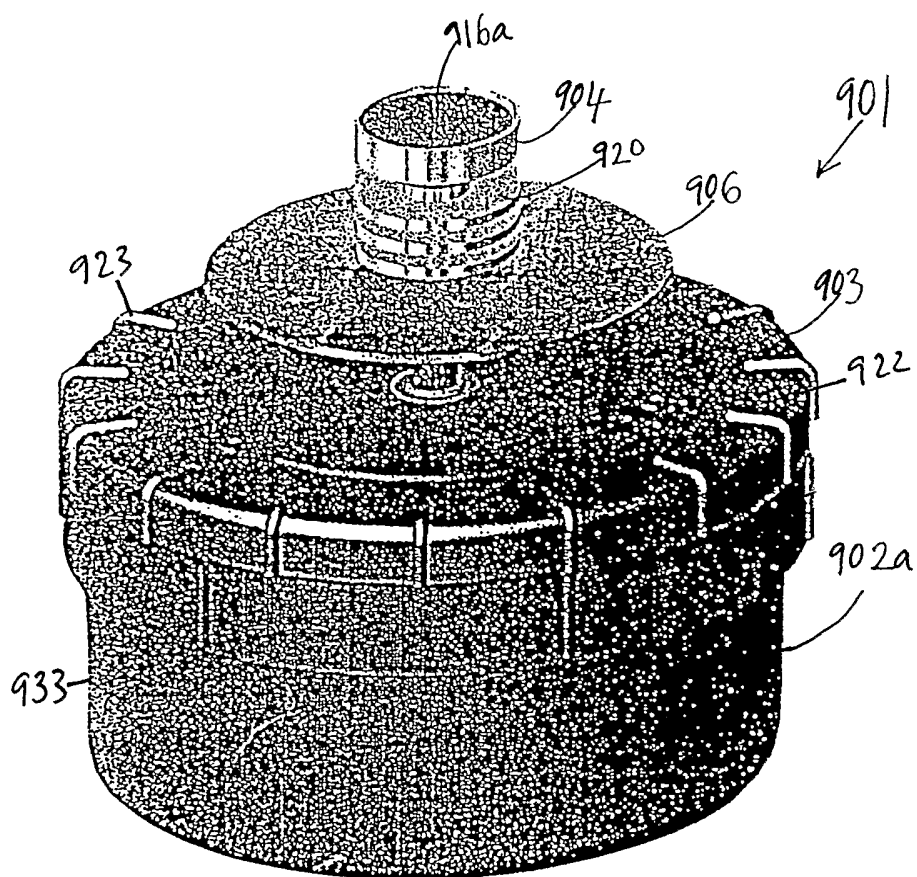


FIG. 31

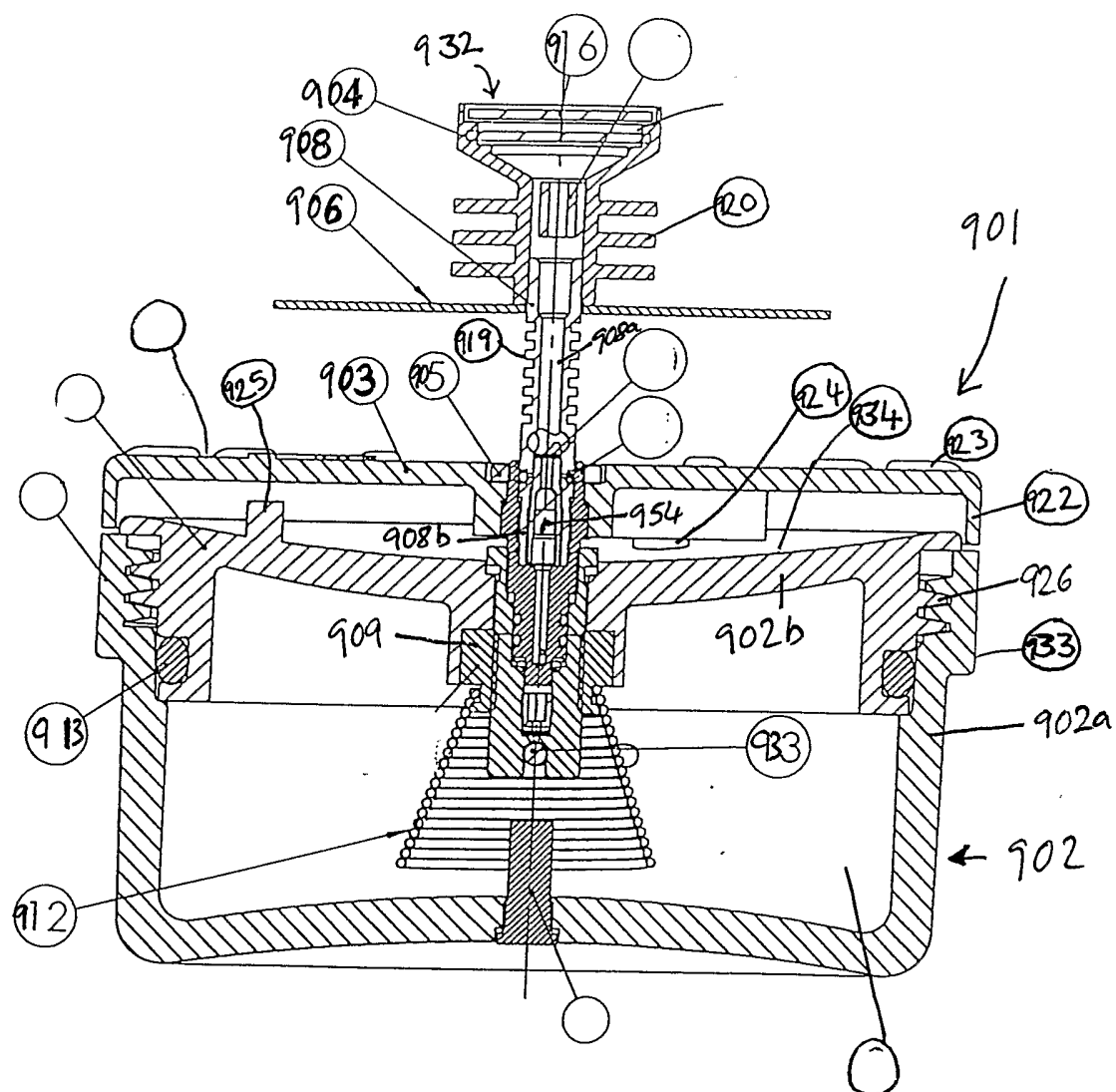


FIG. 32

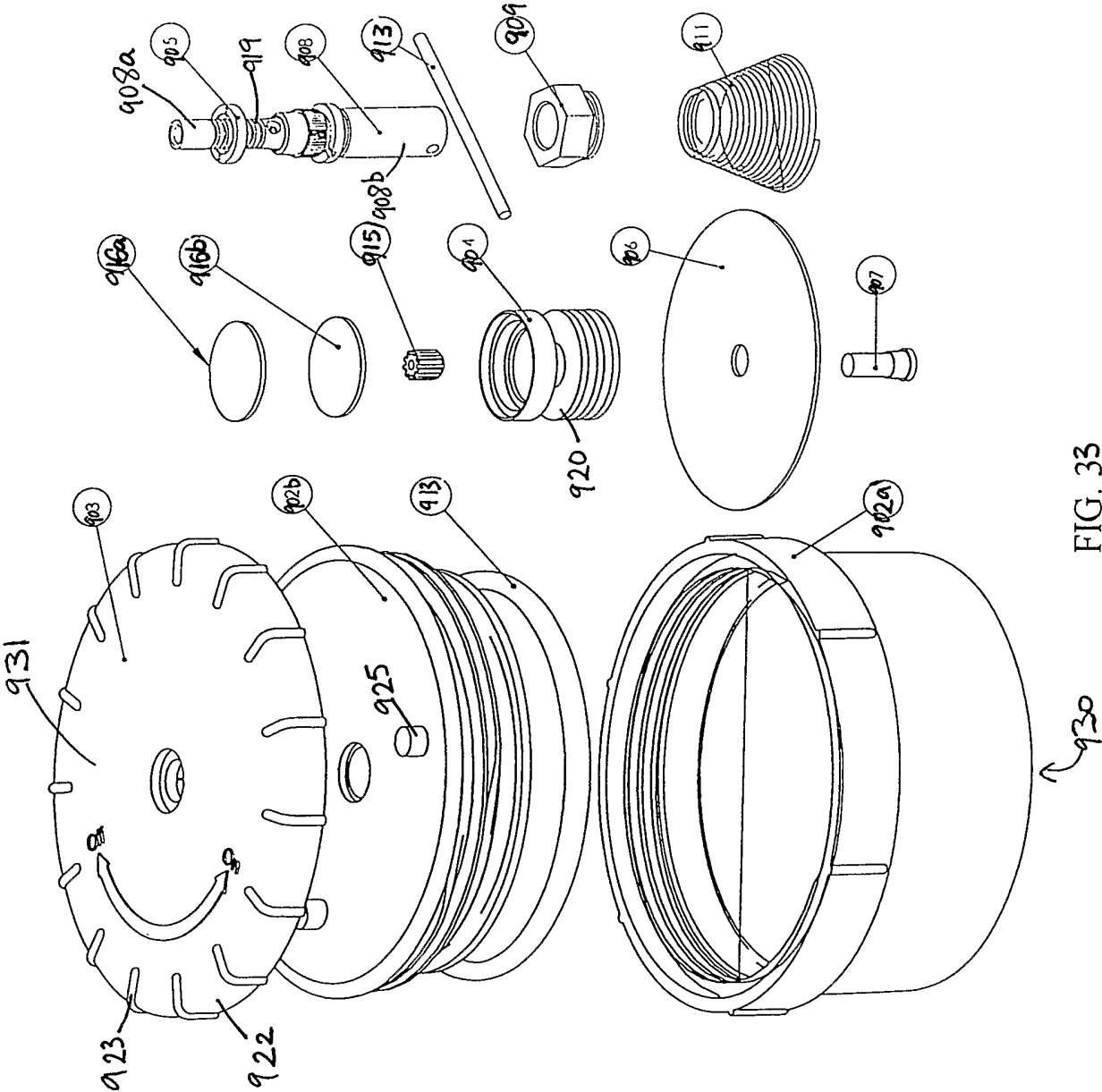


FIG. 33

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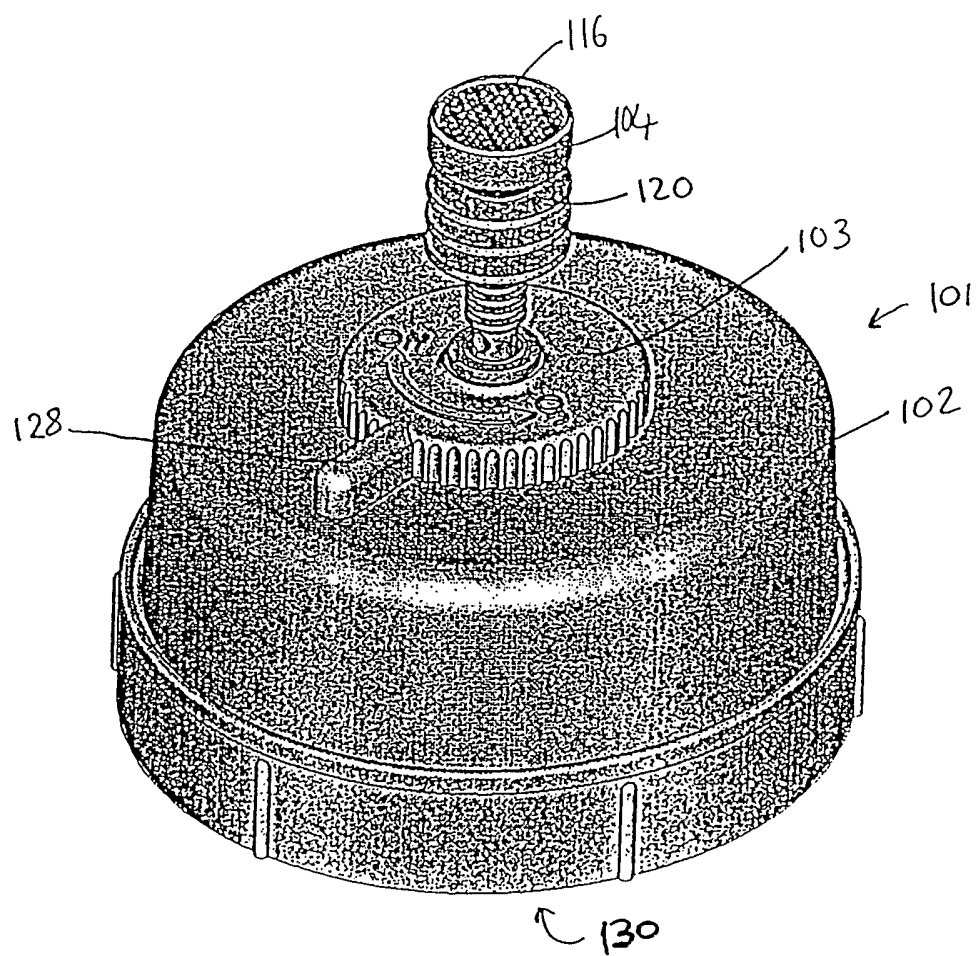


FIG. 34

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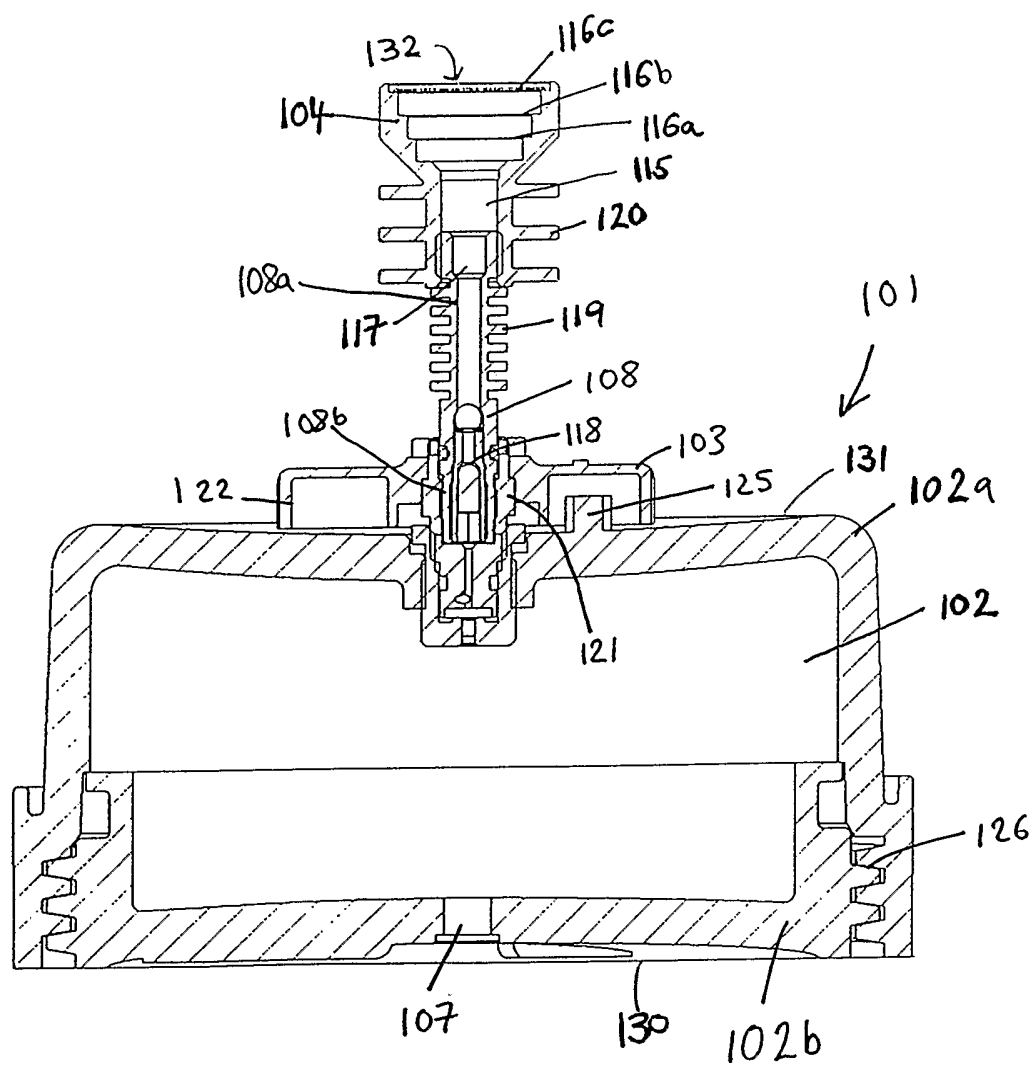


FIG. 35

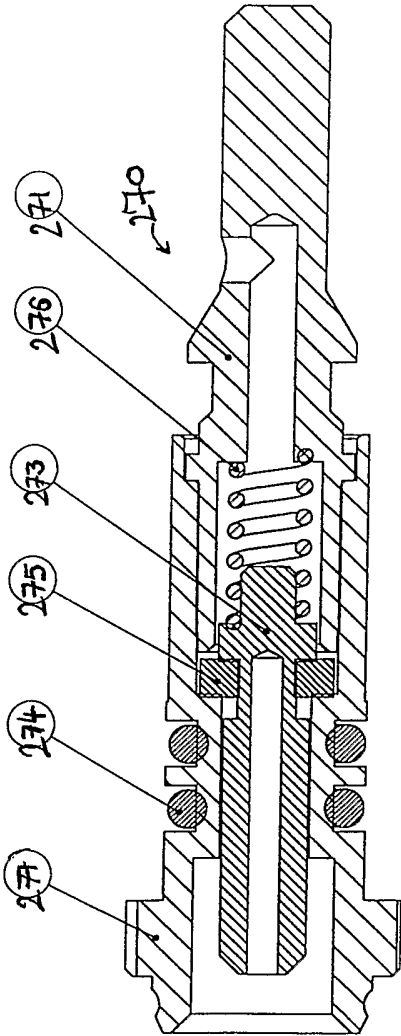


FIG. 37

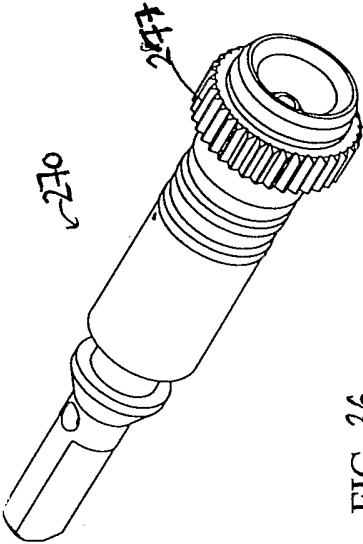


FIG. 36