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(continued on next page)

(54) Abstract Title: **Fuel filling nozzle assembly**

(57) A fuel filling nozzle assembly 3 for providing fuel to a fuel tank comprises a nozzle bore 18 within which is housed first and second valves 20, 22 located so as to provide respective exit and entry ports to the nozzle bore. A valve control assembly comprising a telescopic bolt assembly attached at opposite ends to the first and second valves, the valve control assembly being moveable relative to the nozzle bore, and a nozzle activation assembly acts on the valve control assembly so as to open the first and second valves consecutively, thereby providing a fuel flow through the nozzle. The telescopic bolt assembly may be provided with an inner bolt 26 and an outer bolt 27 and the first and second valves may be provided by poppet valves. An automatic cut off mechanism 6 may also be provided for closing the second valve once a level of fuel within the fuel tank has reached a predetermined level.

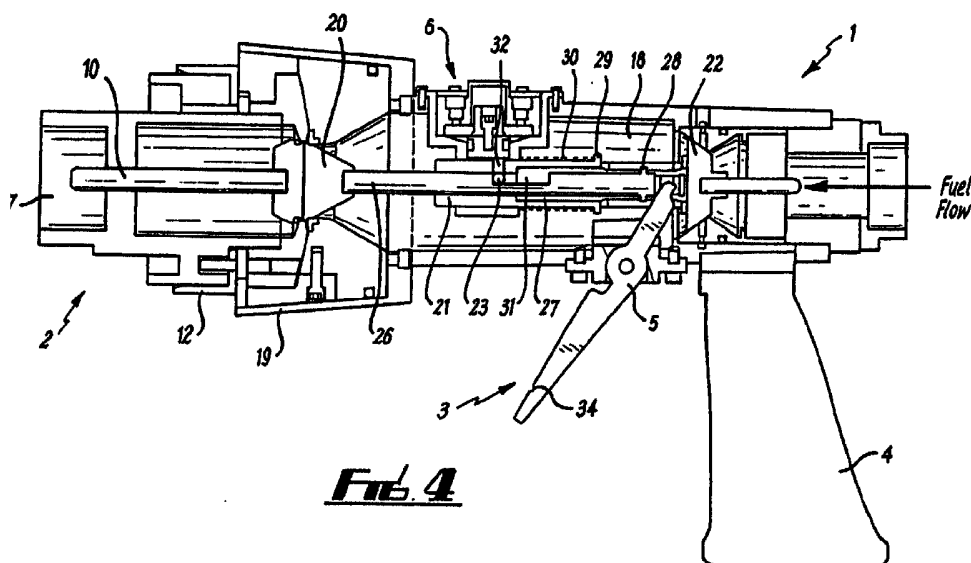


Fig. 4

GB 2425119 A continuation

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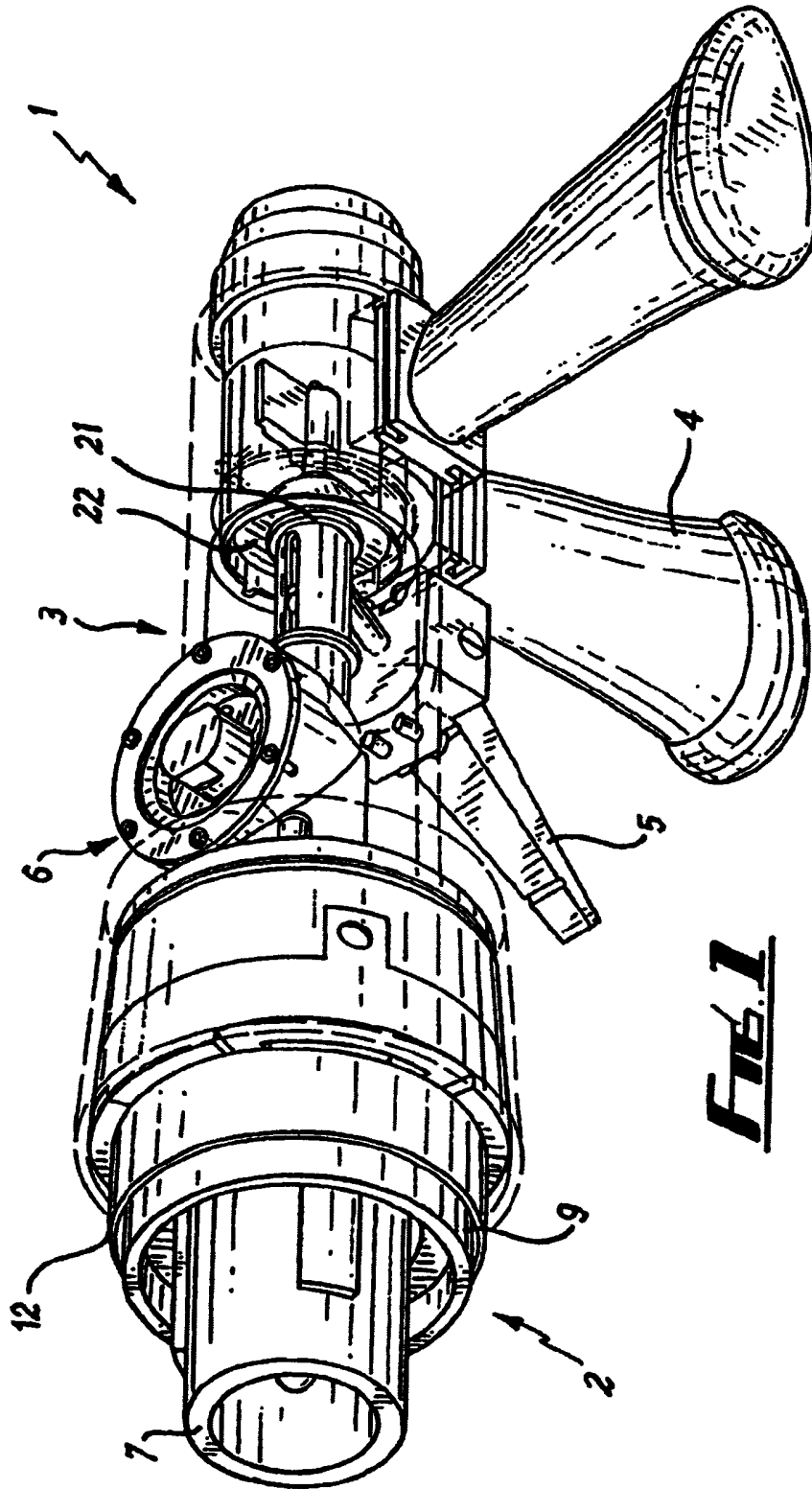
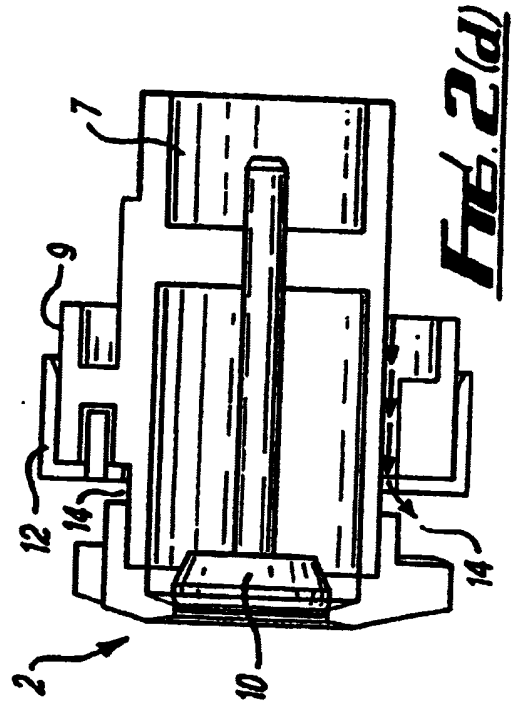
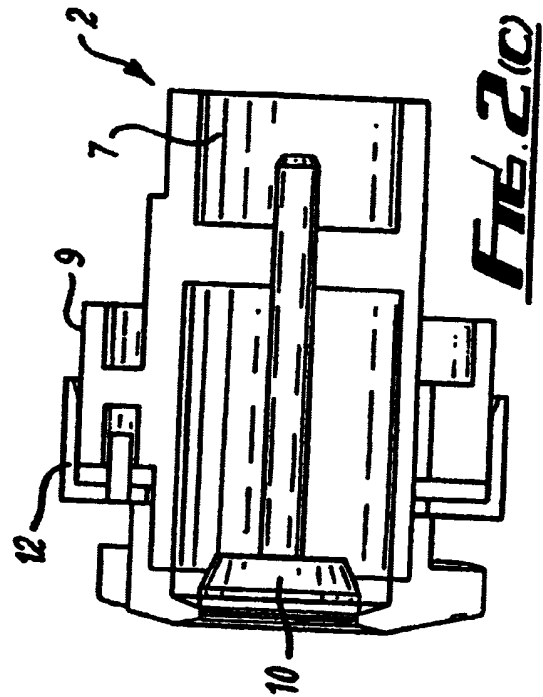
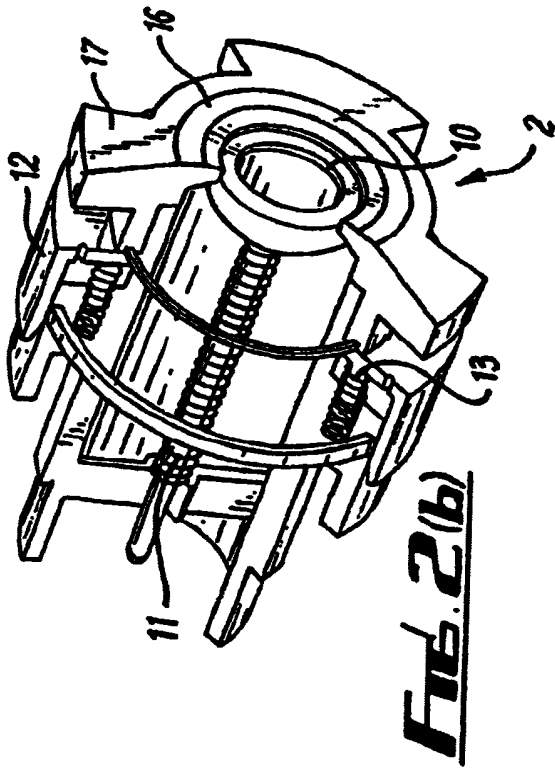
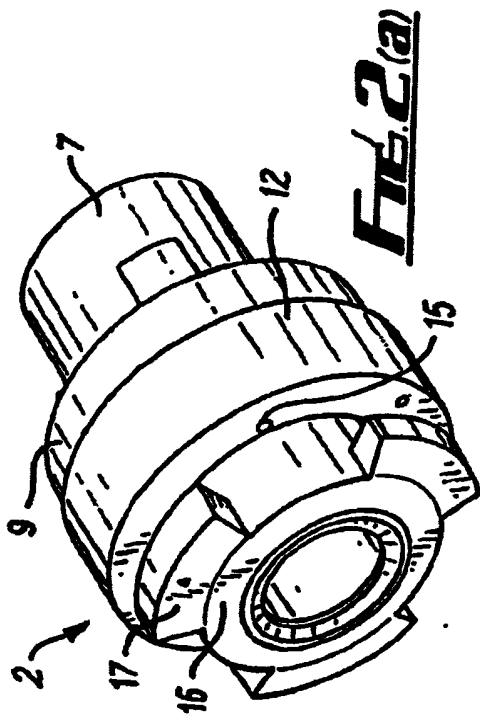
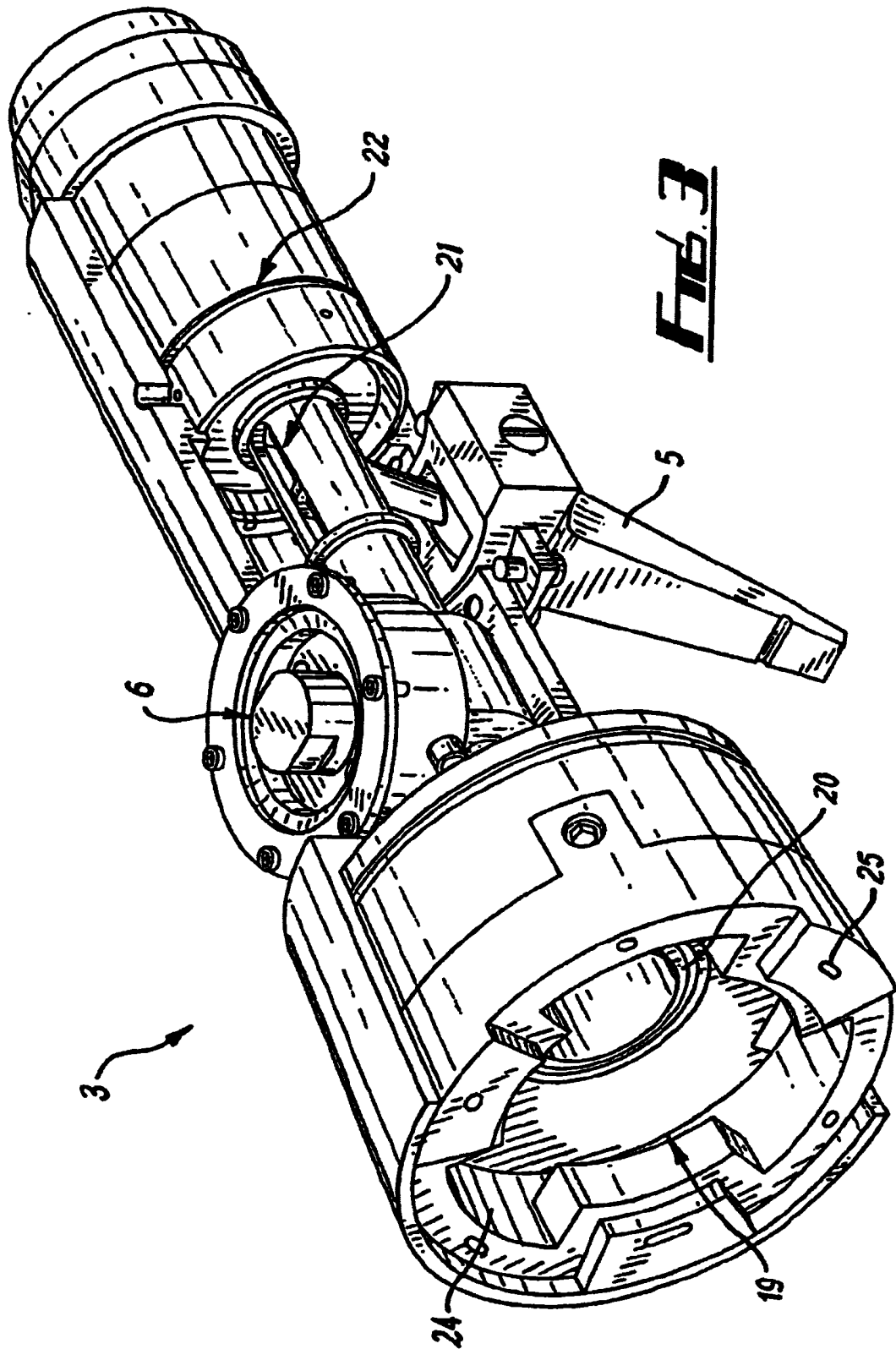
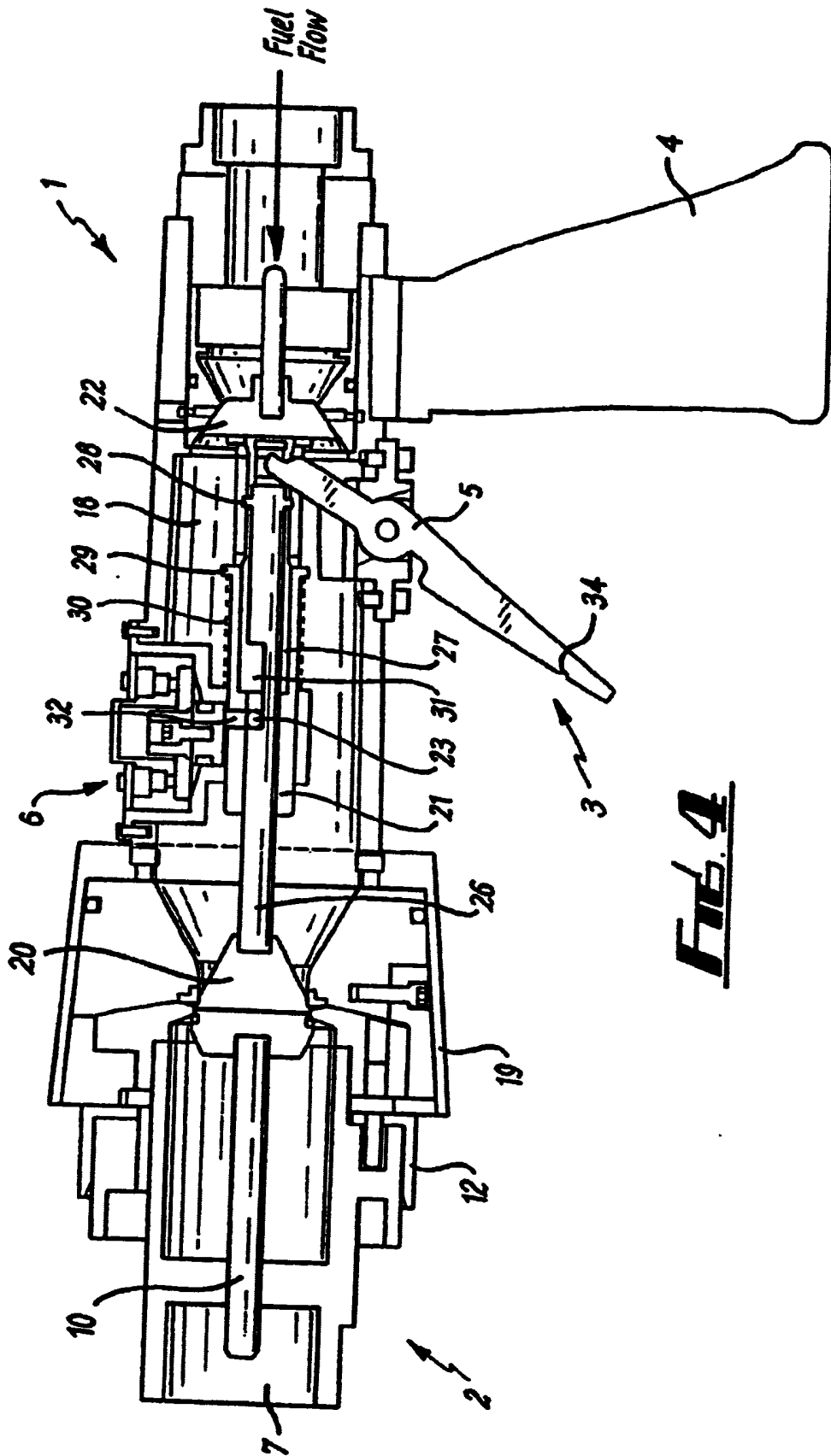


Fig. 1







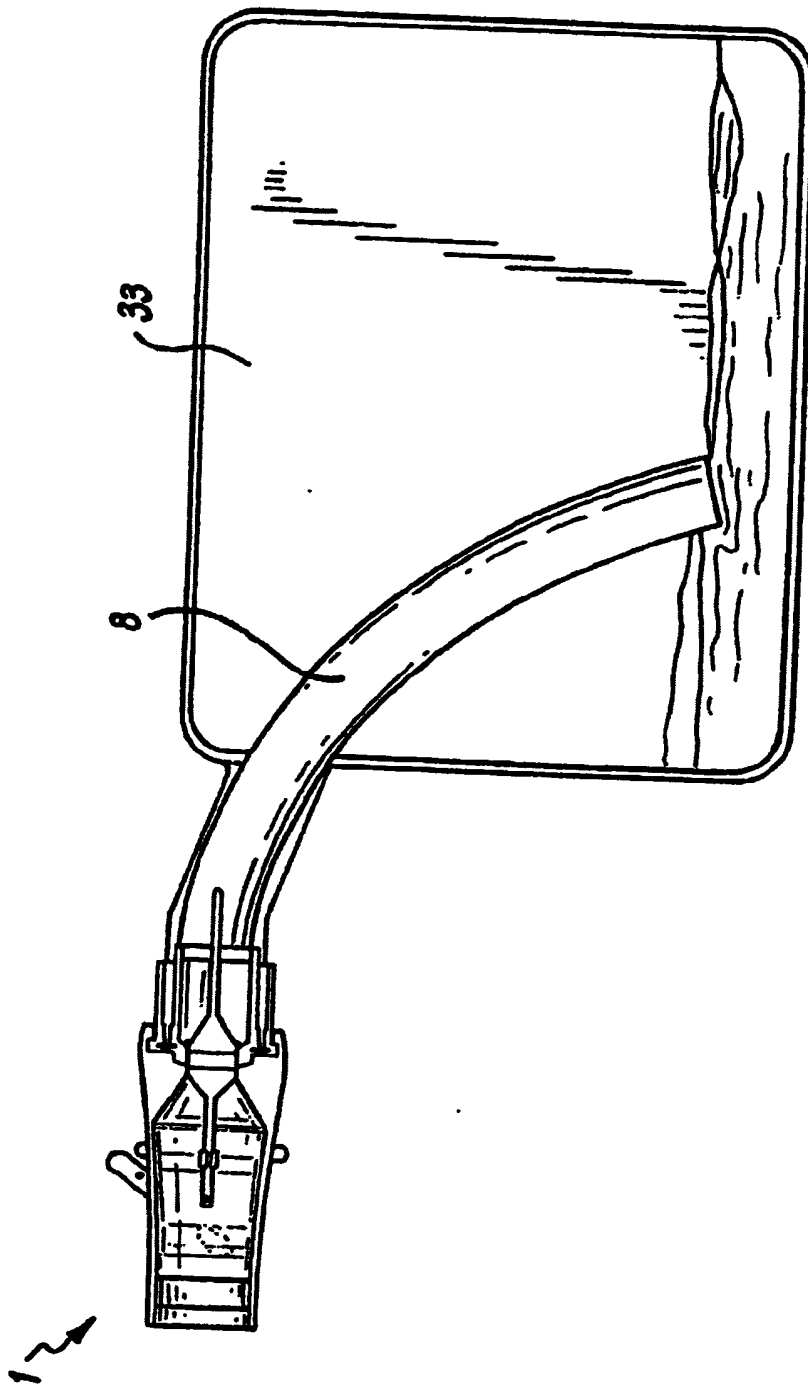


Fig. 5

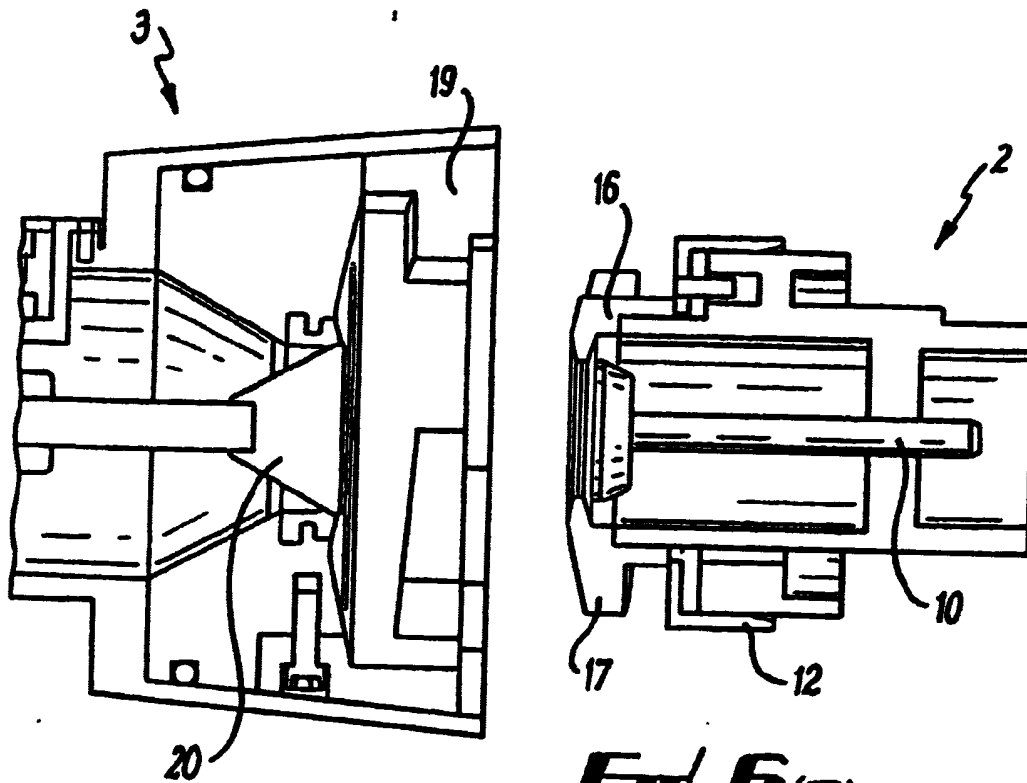


FIG. 6(a)

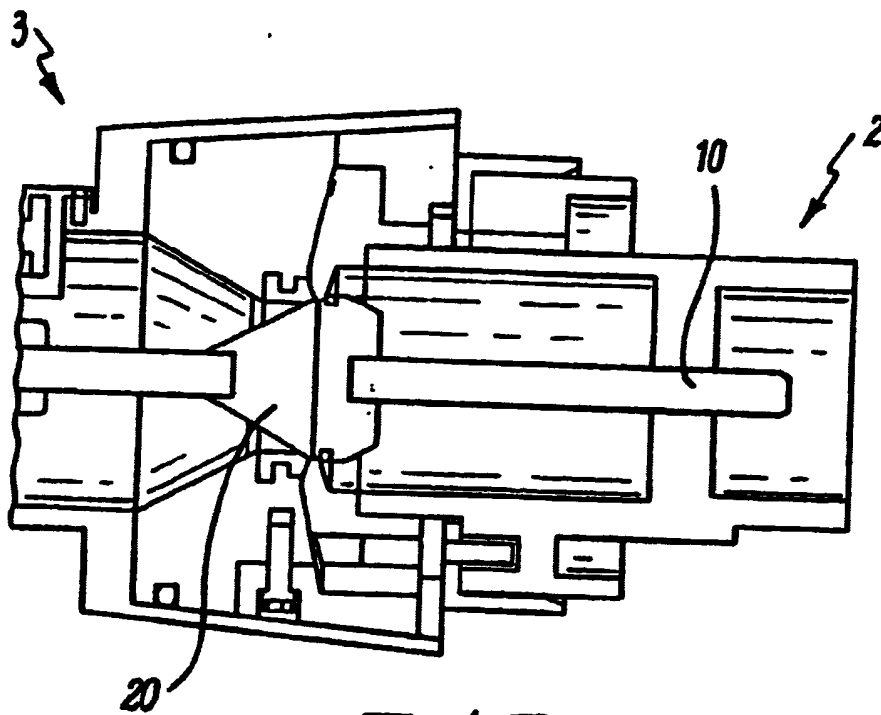


FIG. 6(b)

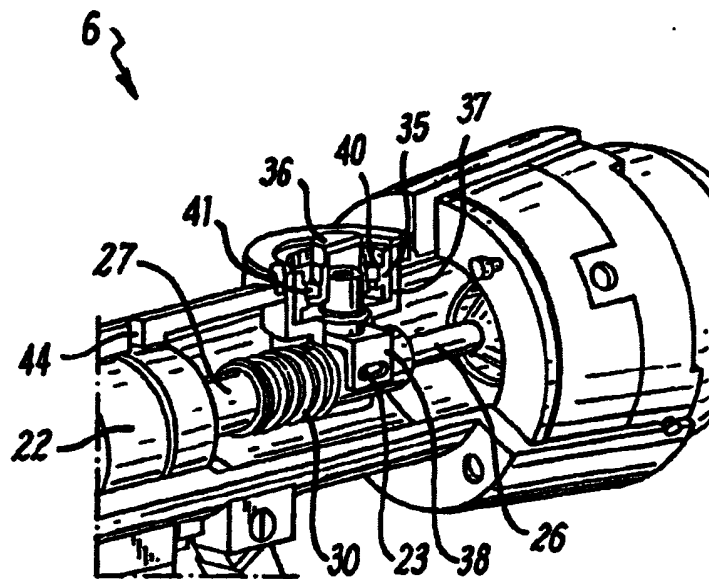


FIG. 7

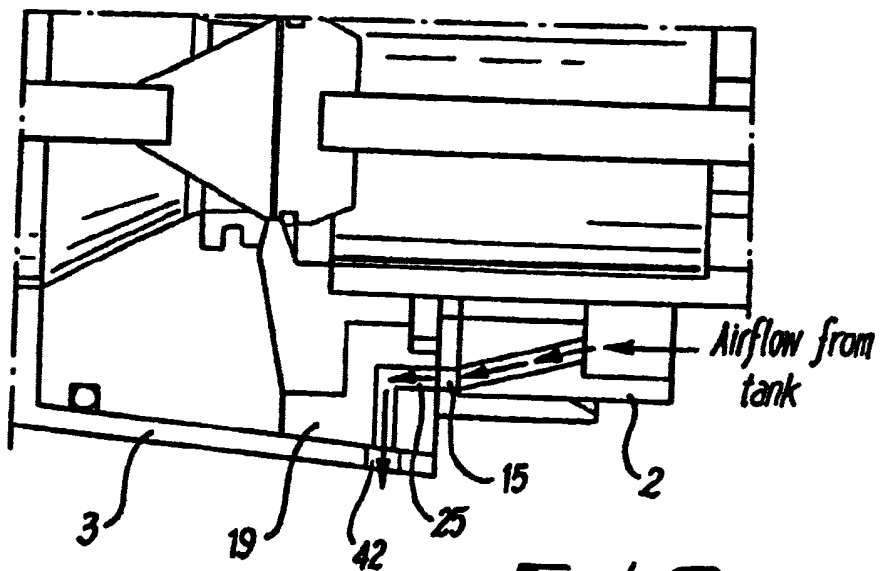


FIG. 8

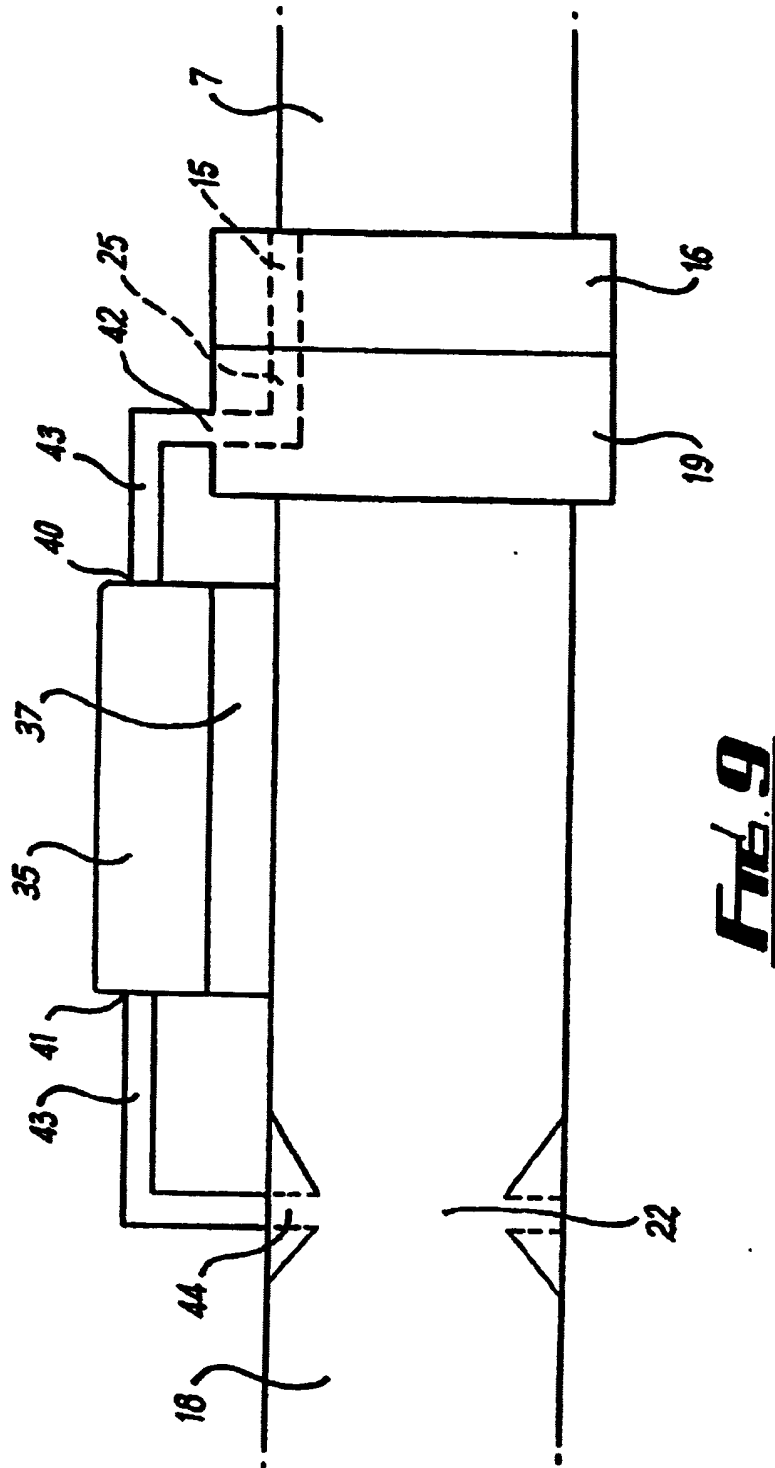


Fig. 9

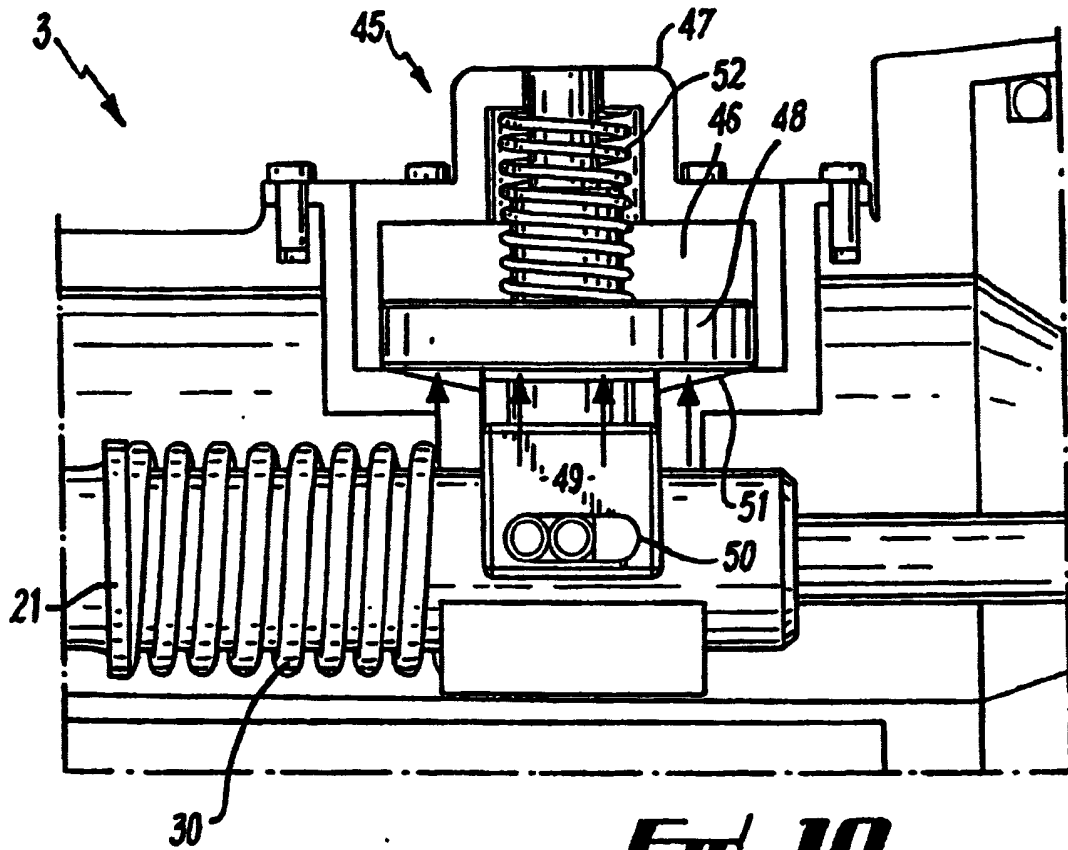


FIG. 10

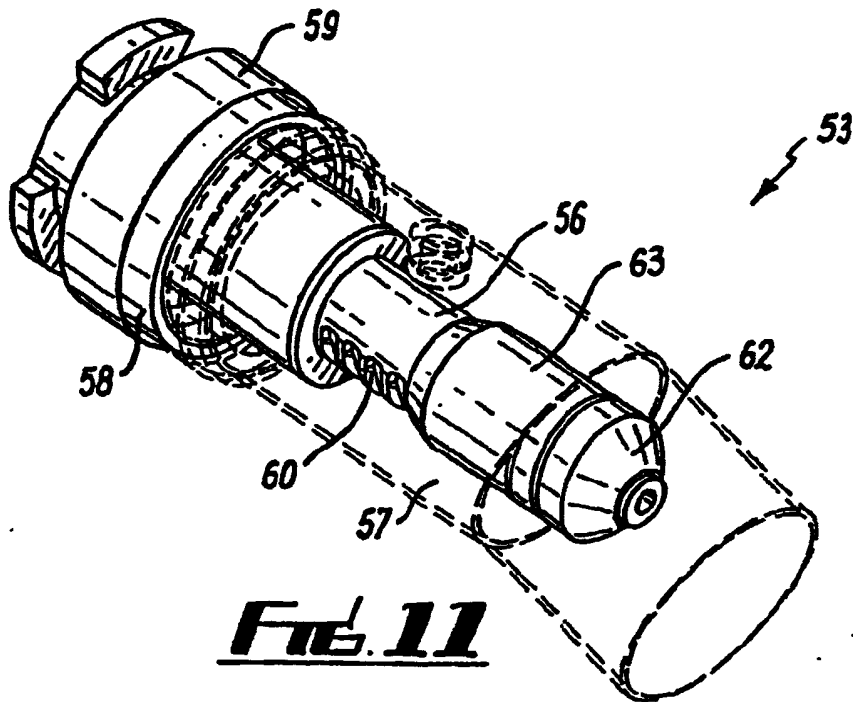


FIG. 11

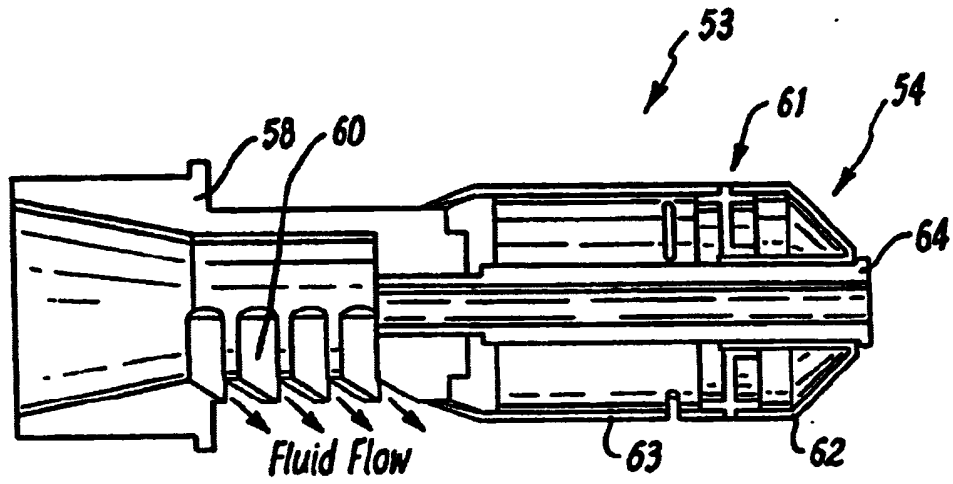


FIG. 12

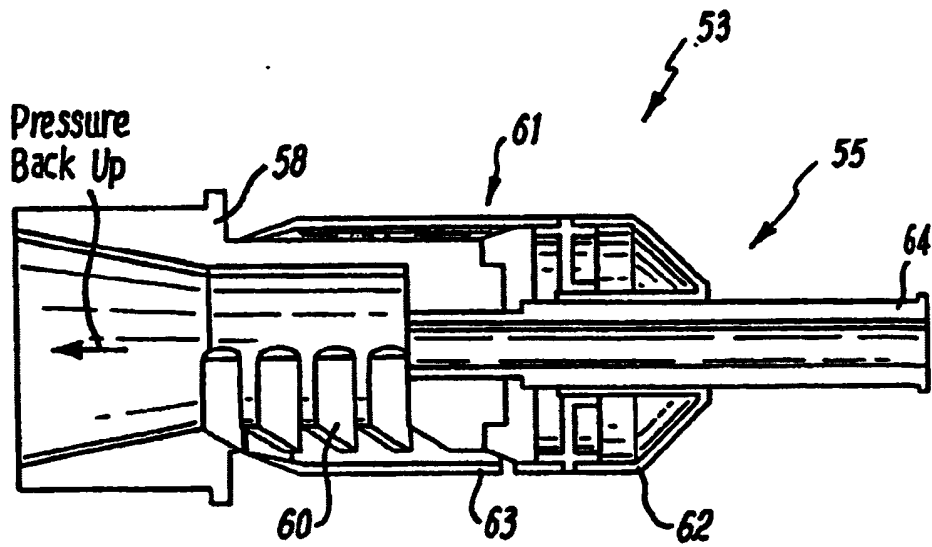


FIG. 13

1 **Improved Fuel Filling Apparatus**

2

3 The present invention relates to the field of fuelling
4 apparatus for motor vehicles and in particular to an
5 improved fuel filling apparatus suitable for use in the
6 refuelling of commercial motor vehicles.

7

8 Refuelling of motor vehicles is a major problem faced by
9 operators of large fleets of commercial vehicles such as
10 bus companies and HGV operators, as is appreciated by
11 those skilled in the art. The vast majority of these
12 vehicles are diesel operated and refuelling is typically
13 done at depots overnight by fuelling operators. Over and
14 above the obvious inconvenience, the penalties incurred
15 by public transport operators if a vehicle runs out of
16 fuel on the road are severe. As a result the most common
17 approach to the refuelling of these vehicles is through a
18 "fill to spill" policy in order to ensure that the fuel
19 tank is filled to capacity.

20

21 This policy causes a considerable spillage problem. The
22 alternative requires the fuelling operators to stop
23 filling so as to observe whether or not there is a fuel

1 presence in the neck of the tank. This method of filling
2 causes a considerable wasted time period for each vehicle
3 filled. A direct result of the above methods is that
4 fuel spillage constitutes a major waste of fuel and
5 therefore money.

6
7 In relation to commercial bus operators, the design of
8 fuel tanks often exacerbates the effects of foaming of
9 the fuel during the filling process. This foaming
10 generally acts to further increase the level of fuel
11 spillage that occurs.

12
13 Fuel spillage is also a health, safety and environmental
14 hazard that can result in severe penalties for any
15 occupational or environmental damage caused. It is known
16 to those skilled in the art that prolonged exposure of
17 fuel to human skin can result in harmful effects. Indeed
18 studies have shown a greater incidence of various type of
19 cancer in mice on repeated exposure to diesel fuel. The
20 level of diesel spillage that exists in depot fuelling
21 areas can also lead to an excessively slippery ground
22 surface. This creates an obvious hazard for the safety
23 of the fuelling operators.

24
25 The above detrimental effects highlight the obvious
26 benefit in being able to reduce the level of fuel
27 spillage wherever possible.

28
29 Further technical problems experienced by commercial
30 vehicle operators employing the present design of fuel
31 filling apparatus results from the fact that the
32 equipment used in many operator's sites is identical to
33 that used on garage retail forecourts. Generally this

1 equipment is unfit for the harsh industrial environment
2 in which it must operate. As a result the level of
3 damage sustained by the equipment during operation is
4 generally unacceptable for the purpose of large scale
5 vehicle refuelling.

6

7 A yet further problem particularly associated with diesel
8 vehicle refuelling systems is that the fuel nozzles
9 described in the prior art principally exhibit the same
10 basic operating principals that were originally designed
11 for use with petrol fuelling systems. This leads to
12 further problematic features in relation to the automatic
13 cut off systems used. Often the automatic cut off
14 systems employed within petrol based filling systems are
15 unsuitable for use with diesel systems as the foaming
16 nature of the diesel during filling causes the nozzle cut
17 off to be activated before the fuel tank is full.

18

19 Sabotage, damage to fuel tanks and siphoning are also
20 common problems experienced by commercial vehicle
21 operators. It is known for paper towels, sugar, latex
22 gloves and the like, or siphoning apparatus to be
23 inserted via the filler necks into the fuel tanks so
24 resulting in either damage to the engine of the vehicles
25 or theft of a vehicle's fuel. Therefore, it is of
26 obvious advantage to a commercial vehicle operator if the
27 fuel filling apparatus could also act to assist in
28 reducing the potential for sabotage of, or fuel siphoning
29 from, the vehicle's fuel tank.

30

31 **Summary of Invention**

32

33 According to a first aspect of the present invention

1 there is provided a fuel filling receiver assembly
2 suitable for locating within a filler neck of a fuel tank
3 comprising a receiver bore and one or more first vents
4 located externally to the receiver bore wherein the
5 receiver bore provides a means for directing a fuel into
6 the fuel tank while the one or more first vents provide
7 an exhaust means for one or more gases located within the
8 fuel tank.

9

10 Most preferably the receiver bore comprises a length
11 greater than the filler neck of the fuel tank so that
12 turbulence experienced by the fuel entering the fuel tank
13 is reduced.

14

15 Optionally the receiver bore further comprises a flexible
16 hose section.

17

18 Preferably the fuel filling receiver assembly further
19 comprises a vent cover that moves between a first
20 position that closes the one or more first vents and a
21 second position that opens the one or more first vents.

22

23 Most preferably the vent cover is resiliently biased to
24 the first position by one or more bias means.

25

26 Preferably the vent cover comprises one or more second
27 vents that provide a second exhaust means for the one or
28 more gases located within the fuel tank.

29

30 Preferably the one or more first vents provide a
31 substantially radial exhaust means for the fuel filling
32 receiver assembly. The one or more second vents provide
33 a substantially axial exhaust means for the fuel filling

1 receiver assembly.

2

3 Preferably the fuel filling receiver assembly further
4 comprises an entrance valve that moves between a first
5 position that closes one end of the receiver bore and a
6 second position that opens said end of the receiver bore.

7

8 Most preferably the entrance valve is resiliently biased
9 to the first position by one or more bias means.

10

11 Preferably the fuel filling receiver assembly further
12 comprises a receiver coupling component that provides a
13 means for securing a fuel filling nozzle assembly to the
14 receiver assembly.

15

16 Preferably the receiver coupling component comprises one
17 or more radially extending protrusions located on the
18 external surface of the receiver bore.

19

20 Preferably the fuel filling receiver assembly further
21 comprises an attachment means for securing the receiver
22 assembly to the filler neck of the fuel tank.

23

24 Optionally the attachment means for securing the receiver
25 assembly comprises a thread fitting.

26

27 Optionally the receiver assembly further comprises a shut
28 off unit, the shut off unit comprising a bore suitable
29 for locating with the receiver bore, at least one fuel
30 flow aperture that provides a means for the fuel to exit
31 the bore, a float, and a collar that is attached to the
32 float, wherein when the float is located within the fuel
33 that has exited from the bore the float acts to move the

1 collar so as to block the at least one fuel flow
2 aperture.

3

4 Preferably the at least one fuel flow aperture is
5 arranged to provide an off-axis fuel flow from the bore.

6

7 Optionally the shut off unit further comprises a float
8 guide rod that connects the float and the collar to the
9 bore wherein the float guide rod acts to assist the
10 movement of the collar so as to block the at least one
11 fuel flow aperture.

12

13 The above arrangement allows for fuel to be diverted from
14 the receiver bore into a discrete chamber formed between
15 the bore and the inner surface of the collar. As the
16 volume of the fuel increases within this chamber the
17 associated pressure within this chamber also increases.
18 This increased pressure assists the collar in being drawn
19 along the float guide rod so as to be in a position to
20 prevent the flow of fuel through fuel flow apertures.

21

22 According to a second aspect of the present invention
23 there is provided a fuel filling nozzle assembly for
24 providing fuel to a fuel tank comprising a nozzle bore
25 within which is housed first and second valves located at
26 respective ends of the nozzle bore that provide
27 respective exit and entry ports to the nozzle bore, a
28 valve control assembly moveable relative to the nozzle
29 bore, and a nozzle activation assembly wherein the nozzle
30 activation means acts on the valve control assembly so as
31 to open the first and second valves consecutively thereby
32 providing fuel flow through the nozzle bore.

33

1 Most preferably the valve control assembly comprises a
2 telescopic bolt assembly attached at opposite ends to the
3 first and second valves.

4

5 Preferably the telescopic valve comprises an inner bolt
6 that communicates at a first end with the first valve and
7 an outer bolt that communicates with the second valve.

8

9 Preferably the nozzle activation assembly is connected to
10 a second end of the inner bolt so that when activated the
11 inner bolt is axially translated relative to the outer
12 bolt.

13

14 Most preferably the telescopic bolt assembly further
15 comprises a latch that provides a means for coupling the
16 inner and outer bolts following a predetermined axial
17 translation of the inner bolt.

18

19 Preferably the fuel filling nozzle assembly further
20 comprises a nozzle coupling component that provides a
21 means for securing the nozzle assembly to a fuel filling
22 receiver assembly.

23

24 Preferably the nozzle coupling component comprises one or
25 more apertures suitable for receiving one or more
26 protrusions associated with the receiver assembly.

27

28 Optionally the fuel filling nozzle assembly further
29 comprises one or more handles that provide a means for
30 aiding the deployment of the nozzle assembly by a user.

31

32 The one or more handles may further comprise a clip for
33 locating within the nozzle activation assembly so

1 providing a means for securing the position of the nozzle
2 activation assembly.

3

4 Most preferably the fuel filling nozzle assembly further
5 comprises an automatic cut off mechanism that provides a
6 means for closing the second valve once a level of fuel
7 within the fuel tank has reached a predetermined value.

8

9 Preferably the automatic cut off mechanism comprises a
10 chamber, the chamber adapted to retain a movable plate,
11 the plate coupled via a latch assembly to the latch, and
12 the plate further adapted to move under the influence of
13 an applied pressure.

14

15 Preferably the plate is displaced by a predetermined
16 applied pressure acting thereon so as to move from a
17 first position wherein the latch is available for
18 communication with the telescopic bolt assembly to a
19 second position wherein the latch is not available for
20 communication with the telescopic bolt assembly.

21

22 Preferably the plate is resiliently biased to the first
23 position. The resilient bias may be provided by a
24 spring.

25

26 Alternatively the automatic cut off mechanism comprises
27 the second valve being axially tapered towards the first
28 valve so as to create an area of low pressure within the
29 fuel supply to the tank at the second valve. The
30 automatic cut off mechanism further comprises one or more
31 air passages, isolated from the nozzle bore that extends
32 from an anterior face of the nozzle coupling component
33 through to the area of low pressure, within which is

1 located a diaphragm chamber that is coupled via a latch
2 assembly to the latch.

3

4 Preferably the diaphragm chamber comprises a flexible
5 diaphragm that moves from a first position wherein the
6 latch is available for communication with the telescopic
7 bolt assembly and a second position wherein the latch is
8 not available for communication with the telescopic bolt
9 assembly.

10

11 Most preferably the flexible diaphragm moves from the
12 first position to the second when a predetermined vacuum
13 level is present in the diaphragm chamber.

14

15 Preferably the flexible diaphragm is resiliently biased
16 towards the first position by one or more bias means.

17

18 Preferably the automatic cut off mechanism further
19 comprises one or more bias means that provide a means for
20 resiliently biasing the second valve to a closed
21 position.

22

23 According to a third aspect of the present invention
24 there is provided a fuel filling apparatus comprising a
25 fuel filling receiver assembly in accordance with the
26 first aspect of the present invention and a fuel filling
27 nozzle assembly in accordance with the second aspect of
28 the present invention.

29

30 Preferably the fuel filling nozzle assembly is coupled to
31 the fuel filling receiver assembly via the nozzle
32 coupling component communicating with the receiver
33 coupling component.

1

2 Preferably the resiliently biased vent cover provides a
3 means for positively locking the fuel filling nozzle
4 assembly to the fuel filling receiver assembly.

5

6 Most preferably when the fuel filling nozzle assembly is
7 coupled to the fuel filling receiver assembly the one or
8 more air passages communicate directly with the one or
9 more second vents.

10

11 Preferably, the coupling of fuel filling nozzle assembly
12 to the fuel filling receiver assembly also acts to
13 automatically move the vent cover from the first position
14 that closes the one or more first vents to the second
15 position that opens the one or more first vents.

16

17 Preferably, the coupling of fuel filling nozzle assembly
18 to the fuel filling receiver assembly also acts to
19 automatically move the entrance valve from the first
20 position that closes one end of the receiver bore and the
21 second position that opens said end of the receiver bore.

22

23 According to a fourth aspect of the present invention
24 there is provided a shut off unit suitable for use with
25 fuel supply apparatus, the shut off unit comprising a
26 bore suitable for locating with a fuel supply apparatus
27 bore, at least one fuel flow aperture that provides a
28 means for the fuel to exit the bore, a float, and a
29 collar that is attached to the float, wherein when the
30 float is located within fuel that has exited from the
31 bore the float acts to move the collar so as to block the
32 at least one fuel flow aperture.

33

1 Preferably the at least one fuel flow aperture is
2 arranged to provide an off-axis fuel flow from the bore.

3

4 Optionally the shut off unit further comprises a float
5 guide rod that connects the float and the collar to the
6 bore wherein the float guide rod acts to assist the
7 movement of the collar so as to block the at least one
8 fuel flow aperture.

9

10 **Brief description of drawings**

11

12 Aspects and advantages of the present invention will
13 become apparent upon reading the following detailed
14 description and upon reference to the following drawings
15 in which:

16

17 Figure 1: presents a perspective view of a fuel filling
18 apparatus in accordance with an aspect of the
19 present invention;

20

21 Figure 2: presents:

- 22 a) a perspective view;
- 23 b) a cross sectional perspective view;
- 24 c) a cross sectional front view with a vent
25 ring in a closed position; and
- 26 d) a cross sectional front view with the vent
27 ring in an open position;
- 28 of a receiver assembly of the fuel filling
29 apparatus of Figure 1;

30

31 Figure 3: presents a perspective view of a nozzle
32 assembly of the fuel filling apparatus of
33 Figure 1;

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Figure 4: presents a cross sectional front view of the fuel filling apparatus of Figure 1;

Figure 5 presents a schematic representation of the fuel filling apparatus of Figure 1 in situ with a fuel tank;

Figure 6 presents a cross sectional front view of the coupling mechanism of the fuel filling apparatus of Figure 1;

Figure 7 presents a cross sectional perspective view of an automatic cut off employed within the fuel filling apparatus of Figure 1;

Figure 8 presents further detail of the automatic cut off of Figure 7 in the form of a cross sectional front view of interface between the nozzle assembly and the receiver assembly;

Figure 9 presents a schematic representation of the automatic cut off employed within the fuel filling apparatus of Figure 1;

Figure 10 presents a schematic representation of an alternative automatic cut off employed within the fuel filling apparatus;

Figure 11 presents a schematic representation of the receiver assembly adapted for operation with an alternative automatic cut off;

1 Figure 12 presents a cross sectional representation of a
2 shut off unit as employed in the alternative
3 receiver assembly, in an open position; and
4

5 Figure 13 presents a cross sectional representation of a
6 shut off unit as employed in the alternative
7 receiver assembly, in a closed position.
8

9 **Specific Description**

10

11 Referring initially to Figure 1 a perspective view of a
12 fuel filling apparatus 1 is presented in accordance with
13 an aspect of the present invention. The fuel filling
14 apparatus 1 can be seen to comprise a receiver assembly 2
15 and a nozzle assembly 3 that couple together (as
16 described below). The nozzle assembly 3 can be seen to
17 comprise two handles 4 that aid the deployment of the
18 apparatus 1 by a user. A trigger 5 provides a mechanism
19 for activating the apparatus 1 so as to allow fuel to be
20 supplied from a pump to a fuel tank, as appropriate. An
21 automatic cut off mechanism apparatus 6 is also present
22 so as to provide a means for automatically stopping the
23 supply of fuel to a tank when the tank has been filled.
24 Further detail of the automatic cut off mechanism 6 is
25 provided below.

26

27 Turning now to Figure 2 further detail of the receiver
28 assembly 2 can be seen from the various views presented.
29 The receiver assembly 2 comprises a central receiver bore
30 7 attached to one end of which is a fuel delivery hose 8.
31 For clarity purposes the fuel delivery hose 8 is not
32 included in Figure 2 but can be seen with reference to
33 Figure 5, that is discussed in further detail below.

1

2 On the external surface of the central receiver bore 7 is
3 provided a threaded fitting 9 that allows the receiver
4 assembly 2 to be fitted to a filler neck of a vehicle's
5 fuel tank. This is simply achieved by first removing an
6 existing filler cap and then screwing the threaded
7 fitting 9 into the neck of the vehicle fuel tank. Thus,
8 the receiver assembly 2 is fitted to the vehicle's fuel
9 tank without any requirement to modify the tank.

10

11 At the opposite end of the central receiver bore 7 is
12 located a receiver poppet valve 10 that is biased by a
13 receiver poppet valve spring 11 so as to provide the
14 required sealing for the receiver assembly when not in
15 use. The biased receiver poppet valve 10 also reduces
16 the risk of sabotage of a vehicle's fuel tank since the
17 first spring 11 helps prevent unauthorised access by a
18 foreign body.

19

20 Also located at receiver poppet valve 10 end of the
21 central receiver bore 7 is a vent cover 12 that is biased
22 towards a closed position by the presence of vent cover
23 springs 13, as shown in Figure 2(c). When an axial force
24 is supplied to the vent cover 12, so as to overcome the
25 bias force of the vent cover springs 13, the vent cover
26 moves from the closed position of Figure 2(c) to the open
27 position of Figure 2(d). In this open position a
28 plurality of radial vents 14 provide a means for air
29 contained within a fuel tank being filled to vent to the
30 surrounding environment (as discussed in further detail
31 below).

32

33 On the front face of the vent cover 12 are located a

1 plurality of axial vents 15. These axial vents 15
2 provide a means for air to move axially through the
3 receiver assembly 2.

4

5 Located on a front face of the receiver assembly 2 is a
6 receiver coupling component 16 that comprises three "cam
7 type" protrusions 17. The receiver coupling provide part
8 of the coupling means by which the receiver assembly 2
9 can be attached to the nozzle assembly 3, as described in
10 further detail below.

11

12 Further detail of the nozzle assembly 3 can be seen from
13 Figure 3 and 4 which present a perspective view of the
14 nozzle assembly 3 and a cross sectional front view of the
15 fuel filling apparatus 1, respectively. The nozzle
16 assembly 3 can be seen to comprise a central nozzle bore
17 18. Starting at one end of the central nozzle bore 18
18 the nozzle assembly 3 can be seen to further comprise a
19 nozzle coupling component 19, a first poppet valve 20, a
20 bolt assembly 21 that runs co axially along the length of
21 the central nozzle bore 18 and a second poppet valve 22.
22 Located between the first 20 and second poppet valves 22
23 is a latch 23 that couples the bolt assembly 21 to the
24 automatic cut off mechanism 6

25

26 Located on the nozzle coupling component 19 are three
27 coupling apertures 24 suitable for receiving a cam type
28 protrusions 17 of the receiver coupling component 16. A
29 plurality of vents 25 are also present within the nozzle
30 coupling component 19. These axial vents 25 provide a
31 means for air to move axially through the nozzle coupling
32 component 19 for use by the automatic cut off mechanism
33 6, as described in detail below.

1

2 The bolt assembly itself comprises an inner bolt 26 and
3 an outer bolt 27 that can move relative to each other in
4 a telescopic manner. A ring 28 located on the outer
5 surface of the inner bolt 26 interacts with lip 29 on the
6 outer bolt 27 so as to prevent the inner bolt 26 becoming
7 separated from the outer bolt 27. The inner bolt 26 is
8 connected directly at one end to the first poppet valve
9 20 and to the trigger 5 at the opposite end. The outer
10 bolt 27 is arranged to communicate directly at one end to
11 the second poppet valve 22 and is biased by a bolt
12 assembly spring 30 so as to maintain the second poppet
13 valve 22 in a closed position. An axial slot 31 is
14 located within the inner bolt 26 while there is also
15 located a radial slot 32 in the outer bolt 27.

16

17 The latch 23 is coupled to the automatic cut off
18 mechanism 6 and interacts with the inner bolt 26 and the
19 outer bolt 27 via the axial slot 31 and the radial slot
20 32, respectively. It is the latch 23, in combination
21 with the trigger 5 and the bolt assembly 21 that provides
22 a control means for opening and closing the second poppet
23 valves 22, as described below.

24

25 Figure 5 presents a schematic representation of the fuel
26 filling apparatus 1 when deployed to fill a fuel tank 33
27 with diesel. The first stage of the operation involves
28 the receiver assembly 2 being attached to the filler neck
29 of the fuels tank 33.

30

31 Next the nozzle assembly 3 is coupled to the receiver
32 assembly 2 by aligning the coupling apertures 24 with the
33 cam type protrusions 17 of the receiver coupling

1 component 16, as depicted schematically in Figure 7. An
2 axial pressure is then applied to the nozzle assembly 3
3 so as to overcome the bias force of the vent cover
4 springs 13 so as to move the vent cover 12 from the
5 closed position to the open position. Once the cam type
6 protrusions 17 have move passed through the coupling
7 apertures 24 the nozzle assembly is rotated by 60° so as
8 to turn and lock the nozzle assembly 3 in position with
9 the receiver assembly 2, as presented in Figure 1.

10

11 This turning motion acts to engage the angled mating
12 faces located on the receiver 16 and nozzle coupling
13 components 19 with the result that the nozzle assembly 3
14 is pulled further in towards the receiver assembly 2,
15 with the rotational movement provided by the user. Thus
16 the rotational movement has the effect of generating a
17 linear movement of the nozzle assembly 3 relative to the
18 receiver assembly 2. This linear movement acts to move
19 the vent cover 12 to the open position while locating the
20 first poppet valve 20 with the receiver poppet valve 10
21 ready for fuelling. The coupling components, 16 and 19,
22 also ensure that the nozzle assembly 3 can not experience
23 any further rotation than is necessary for the correct
24 operation of the apparatus 1.

25

26 Once the nozzle assembly 3 is coupled securely with the
27 receiver assembly 2 the next stage is for the operator to
28 depress the trigger 5. The manual application of a force
29 to the trigger 5 causes it to rotate 55° about the
30 connection point with the inner bolt 26. A clip attached
31 to the operator handle 4 can then be located within a
32 clip recess 34 located on the trigger 5 so as to fix the
33 position of the trigger 5.

1

2 Rotation of the trigger 5 transmits a linear force to the
3 inner bolt 26 of the bolt assembly 21. This linear force
4 causes the inner bolt 26 to move relative to the outer
5 bolt 27 so as to open the first poppet valve 20. As the
6 first poppet valve 20 is now in direct communication with
7 the receiver poppet valve 10 the bias force provided by
8 the receiver poppet valve spring 11 is overcome resulting
9 in the opening of the receiver poppet valve 10.

10

11 As the inner bolt 26 is further linearly translated by
12 the rotational movement of the trigger 5 the advancing
13 face of the axial slot 31 on the inner bolt 26 makes
14 physical contact with the latch 23. The latch 23 then
15 transmits the linear force experienced by the inner bolt
16 26 to the outer bolt 27. This causes the whole bolt
17 assembly 21 to be translated axially so that the outer
18 bolt provides a force to overcome the bolt assembly
19 spring 30. The overall result is that the second poppet
20 valve 22 also moves from the closed position to an open
21 position.

22

23 It should be noted that the second poppet valve 22 is
24 opened only by the linear distance moved during the
25 second phase of movement of the bolt assembly 21 i.e. the
26 linear translation corresponding to the movement of the
27 outer bolt 27 only. It is during this second phase of
28 movement that the fuel begins to flow as the second
29 poppet valve 22 provides a check to the fuel flow from
30 the fuel pump. Thus, at this stage fuel is free to be
31 pumped through the fuel filling apparatus 1 so as to fill
32 the fuel tank 33 with diesel.

33

1 As the level of fuel within the tank 33 rises the fuel
2 acts to dispel the air and vapour mixture that originally
3 filled the empty tank 33. As a result the air and vapour
4 mixture is able to vent to the surrounding atmosphere by
5 moving along the external surface of the fuel delivery
6 hose 8 to the radial vents 14 located on the external
7 surface of the receiver assembly 2. Due to the fact that
8 the fuel enters into the tank 33 through a sealed
9 delivery system the expelled air and vapour mixture
10 encounters no obstructing fuel flow as it vents and so
11 allows for greater flow rates to be achieved. Thus the
12 fuel filling apparatus 1 allows for faster fuelling
13 operations to take place then for those systems already
14 known in the art.

15

16 A further technical advantage of the radial vents 14 is
17 that they also provide a means for eliminating the risk
18 of the fuel tank 33 becoming pressurised during the fill
19 operation. Pressurisation of the fuel tank is known to
20 result in damage to the tank and so corresponding
21 potential health and safety hazards to the operator.

22

23 From Figure 5 it can be clearly seen that the end of the
24 distal end of the fuel delivery hose 8 generally lies
25 below the level of the fuel within the tank. As a direct
26 consequence of this arrangement the previously discussed
27 effects of foaming of the supplied diesel is
28 significantly reduced thus allowing the correct operation
29 of the automatic cut off mechanism 6, described now in
30 detail with reference to Figure 6, 7 and 8.

31

32 In particular, Figure 7 presents a cross sectional
33 perspective view of the automatic cut off 6 employed

1 within the fuel filling apparatus 1. Figure 8 presents
2 further detail of the automatic cut off 6 in the form of
3 a cross sectional front view of interface between the
4 nozzle assembly 3 and the receiver assembly 2. A
5 schematic representation of the automatic cut off 6
6 employed within the fuel filling apparatus 1 is then
7 provided in Figure 9.

8

9 When the receiver assembly 2 and the nozzle assembly 3
10 are coupled to each other the axial vents 15 and vents 25
11 become aligned so as to form a plurality of passages for
12 the air and vapour mixture to pass from the fuel tank 33
13 through the nozzle coupling component 19. This air flow
14 is schematically presented in Figure 8 by the presence of
15 the arrows. Further important features to note are the
16 diaphragm chamber 35, defined by a vacuum cap 36 and a
17 flexible diaphragm 37, and the latch attachment assembly
18 38 that physically connects diaphragm chamber 35 to the
19 latch 23. The latch attachment assembly 38 is biased
20 towards the bolt assembly 21 by means of a latch spring
21 contained with a latch spring guide 39. The diaphragm
22 chamber 35 also comprises an inlet 40 and an outlet
23 aperture 41 in the vacuum cap 36.

24

25 It should be noted that a vent outlet 42 is connected via
26 a hollow tube 43 to the inlet aperture 40. In a similar
27 manner the outlet aperture 41 is connected, by a hollow
28 tube 43, to a Venturi passage 44 associated with the
29 second poppet valve 22. As such there is defined an
30 isolated air passage from the fuel tank through to the
31 second poppet valve 22 within which is located the
32 diaphragm chamber 35.

33

1 The principle of operation of the automatic cut off 6 is
2 as follows. When fuel is flowing through the second
3 poppet valve 22 the reduced diameter introduced into the
4 flow path by this element causes the velocity of the fuel
5 flow to increase rapidly while the pressure within the
6 fuel flow drops rapidly, an effect known as the Venturi
7 effect. This low pressure area in the fuel flow sucks
8 air from any source it can and so results in the air and
9 vapour mixture being sucked from the fuel tank 33 through
10 the isolated air passage to the second poppet valve 22.
11 Whilst the fuel is flowing and there exists air and
12 vapour mixture within the fuel tank 33 to provide an air
13 flow there is no observable effect on the diaphragm
14 chamber 35. As the air and vapour mixture is sucked up
15 the air passage it simply passes back into the fuel flow
16 at the second poppet valve 22.

17

18 This situation continues until the fuel level within the
19 tank 33 rises to a point where it obstructs the flow of
20 air and vapour mixture into the axial vents 15 within the
21 receiver assembly 2. At this point the Venturi effect
22 acts to suck up all the remaining air in the passage and
23 so begins to generate a vacuum within the diaphragm
24 chamber 35 as the fuel flow is still generating the low
25 pressure at the second poppet valve 22.

26

27 As this vacuum grows it becomes sufficiently strong so as
28 to result in the flexible diaphragm 37 overcoming the
29 bias force of the latch spring and so being moved towards
30 the vacuum cap 36. Since the latch attachment assembly
31 38 connects the flexible diaphragm 37 to the latch 23 the
32 latch 23 is also forced to move towards the vacuum cap
33 36. The overall effect of this movement is the

1 disengaging of the latch 23 from the bolt assembly 21.
2 The outer bolt 27 is then forced back to its original
3 position under the influence of the bolt assembly spring
4 30 so causing the second poppet valve 22 to return to the
5 closed position.

6

7 This whole process happens almost instantaneously when
8 the fuel level within the tank 33 obstructs the air and
9 vapour mixture flow. It should also be noted that the
10 inner bolt 26, and hence the first poppet valve 20,
11 remain in an open position until the trigger 5 is
12 returned to its original position. At this time the
13 latch 23 returns, under the bias force of the latch
14 spring, so as to once again engage with the inner bolt
15 26.

16

17 Figures 10 to 13 demonstrate an alternative fuel cut off
18 mechanism 45 in accordance with an aspect of the present
19 invention. Figure 10 illustrates a nozzle assembly 3
20 comprising the alternative cut-off mechanism 45.
21 Similarly to the previously described nozzle assembly,
22 the nozzle assembly 3 comprises a body with a nozzle bore
23 extending therethrough.

24

25 Further important features to note are the cut-off
26 chamber 46, defined by a cut-off chamber cap 47 and a
27 cut-off disk 48, and the latch attachment assembly 49
28 that physically connects the cut-off disk 48 to the
29 latch. The latch attachment assembly 49 is biased
30 towards the bolt assembly 21 by means of a latch spring
31 contained within a latch spring guide 50. The surface 51
32 of the cut-off disk 48 adjacent to the latch attachment
33 assembly 49 is tapered so as to force the disk 48 upwards

1 when the pressure of the fuel in the nozzle bore
2 increases. Furthermore, the cut-off disk is biased
3 towards the latch attachment assembly by means of a cut-
4 off biasing spring 52. The strength of the spring 52 can
5 be selected to allow the disk 48 to move under a
6 predetermined threshold cut-off pressure.

7

8 The principle of operation of the alternative cut-off is
9 as follows. When fuel is flowing through the second
10 poppet valve 22 the pressure within the nozzle assembly 3
11 reaches an equilibrium dependent on the rate of flow, as
12 long as the flow through the nozzle continues. Whilst
13 the fuel is flowing there is no effect on the cut-off
14 disk 48.

15

16 This situation continues until the fuel level within the
17 tank 33 rises to a point where it obstructs the flow of
18 fuel into the tank 33 through the receiver assembly 53
19 (see below). At this point the continued flow acts to
20 increase the pressure in the nozzle bore and so begins to
21 exert an increasing force on the surface of the cut-off
22 disk 48.

23

24 As this pressure increases it becomes sufficiently strong
25 so as to result in the cut-off disk 48 overcoming the
26 bias force of the cut-off biasing spring 52 and so being
27 moved towards the cut-off chamber cap 47. Since the
28 latch attachment assembly 49 connects the cut-off disk 48
29 to the latch the latch is also forced to move towards the
30 cut-off chamber cap. The overall effect of this movement
31 is the disengaging of the latch from the bolt assembly
32 21. The outer bolt 27 is then forced back to its
33 original position under the influence of the bolt

1 assembly spring 30 so causing the second poppet valve 22
2 to return to the closed position.

3

4 This whole process happens almost instantaneously when
5 the fuel level within the tank 33 obstructs the flow of
6 fuel. It should also be noted that the inner bolt 26,
7 and hence the first poppet valve 20, remain in an open
8 position until the trigger 5 is returned to its original
9 position. At this time the latch 23 returns, under the
10 bias force of the latch spring, so as to once again
11 engage with the inner bolt 26.

12

13 The alternative cut-off mechanism 45 described above may
14 be used with a modified receiver assembly 53 that shares
15 many common features with the previously described
16 receiver assembly 2.

17

18 Turning now to Figure 11 further detail of a modified
19 receiver assembly 53 can be seen, with cross-sectional
20 views of an open 54 and closed 55 configuration presented
21 in Figures 12 and 13 respectively. In summary, the
22 modified receiver assembly 53 comprises the receiver
23 assembly 2 wherein the fuel delivery hose 8 is replaced
24 by a shut off unit 56. For clarity purposes, Figure 11
25 shows the shut-off unit 56 disposed within the vehicle
26 tank filler neck 57.

27

28 On the external surface of the main body 58 of the shut-
29 off unit 56 is provided a threaded fitting 59 that allows
30 the receiver assembly to be fitted to a filler neck 57 of
31 a vehicle's fuel tank 33. This is simply achieved by
32 first removing an existing filler cap and then screwing
33 the threaded fitting into the neck of the vehicle fuel

1 tank. Thus, similarly to the receiver assembly 2
2 described above, the receiver assembly is fitted to the
3 vehicle's fuel tank without any requirement to modify the
4 tank.

5
6 Also, vents and a vent cover are provided (not shown) to
7 operate in a similar manner as to that described in
8 relation to Figure 2 above. In the open position a
9 plurality of radial vents provide a means for air
10 contained within the fuel tank being filled to vent to
11 the surroundings.

12
13 Angled slots 60 are provided on the underside of the main
14 body 58 of the receiver assembly. Fuel enters the tank
15 via these angled slots 60 which actively directs the flow
16 of fuel along the lower side of the vehicle tank filler
17 neck 57. This also improves airflow out of the tank
18 through the vehicle tank filler neck where it can then be
19 vented in accordance with alternative aspects of the
20 invention. Furthermore, the directionality that the
21 angled slots 60 imparts to the fuel flow prevents the
22 fuel flow itself from interfering with the operational
23 behaviour of the float and collar assembly 61 (see
24 below).

25
26 The shut-off unit 56 is itself made possible through the
27 employment of the float and collar assembly 61. In
28 particular a float 62 is attached to a collar 63, which
29 are both in turn mounted on a float guide rod 64 which
30 guides the motion of the float 62 and collar 63 within
31 the vehicle tank filler neck 57. The collar 63 is
32 designed so as to close over the angled slots 60 when in
33 a closed position 55, and to completely expose the angled

1 slots 60 when in an open position 54 (Figure 12). The
2 collar 63 moves between these positions under the
3 combined influence of the float 62, which will float on
4 the supplied fuel, and an increase in pressure produced
5 within a discrete chamber formed between the main body 58
6 and the inner surface of the collar 63.

7
8 In particular, when the fuel level rises and the float 62
9 is displaced such that the collar 63 begins to cover the
10 angled slots 60, a portion of the fuel flow from the
11 angled slots 60 enters the collar 63 whose inner surfaces
12 forms the discrete chamber with the main body of the
13 receiver assembly. This produces an increase in the
14 pressure within the discrete chamber such that the collar
15 63 rises almost instantaneously to entirely cover the
16 angled slots 60, thus preventing further fuel flow into
17 the tank (Figure 13).

18
19 When the collar 63 is in the closed position, fuel flow
20 causes a pressure back up which in turn causes a pressure
21 build up within the nozzle bore, thus activating the cut-
22 off mechanism 45 and closing the second poppet valve 22,
23 as described above. This stops the flow of fuel.

24
25 An advantage of the alternative cut-off mechanism 45 and
26 modified receiver assembly 53 is that the pressure
27 required is generated only within the float 62 and collar
28 63 assembly 61 and the nozzle bore, and thus the fuel
29 tank is not subject to any undue pressure build up. When
30 this system is in operation, it ensures that no more fuel
31 can be put into a full tank as the collar will remain in
32 place until the fuel level recedes and the float 62
33 resets under gravity.

1

2 In the above embodiment the shut-off unit 56 has been
3 described as being attached directly to the receiver
4 assembly. However, it will be readily apparent to those
5 skilled in the art that in a further alternative
6 embodiment the shut-off unit 56 can be attached directly
7 to the nozzle assembly so that it is located within the
8 tank filler neck 57, via the receiver assembly, when the
9 nozzle assembly and receiver assembly are connected
10 together. The shut-off unit 56 would then operate in a
11 similar manner to that described above.

12

13 The above described fuel filling apparatus 11 has several
14 advantages over those systems described in the prior art.
15 In the first instance the receiver assembly 2 is suitable
16 for retro fitting with presently existing fuel tank
17 filler necks. Therefore the present system does not
18 require any costly or time consuming modification to fuel
19 tanks or other vehicle body work. Furthermore the retro
20 fit process is further simplified by the use of existing
21 screw thread fittings.

22

23 A further advantage of aspects of the present invention
24 is that the employment of the fuel filling apparatus 1
25 does not produce any pressure within the fuel tank 33
26 during the filling process. Therefore the present
27 apparatus reduces the potential of damage to the fuel
28 tanks through repeated pressurisation as experienced by
29 those systems described in the prior art.

30

31 The presently described invention also provide a
32 simplified fluid flow path within the nozzle assembly 3,
33 as compared with those nozzles described in the prior

1 art. Furthermore, the incorporation of a fuel delivery
2 hose 8 means that fuel is generally delivered below the
3 level of fuel already present within the tank 33. This
4 has the significant advantage that it reduces the effects
5 of foaming of diesel fuel that is a common detrimental
6 side effect of those systems described in the art.
7 Reduced foaming can also be achieved by use of angled
8 slots which direct the flow of fuel along the underside
9 of the vehicle tank filler neck. This reduced foaming
10 allows the incorporation of an automatic cut off system
11 6, 45 that is significantly more reliable than those
12 presently described within the prior art and so removes
13 the requirement of the "fill to spill" methods presently
14 employed. The described apparatus therefore
15 significantly reduces the occurrence of the spillage of
16 fuel during the filling process and so reduces the
17 associated environmental and financial consequences for
18 commercial vehicle operators. With respect to the above,
19 it has further been discovered that the venturi valve
20 used in the previous cut off mechanism was the major
21 factor in foaming the fuel through entraining air into
22 the fuel as it passed through the valve. The removal of
23 the valve has removed the high levels of foamed fuel
24 previously seen and has resulted in more controlled fills
25 and a more accurate cut off as the float is being acted
26 upon by liquid fuel rather than foamed fuel.

27

28 The design of the apparatus 1 also allows for the supply
29 of fuel at an increased fluid flow rate and so results in
30 shorter filling times being required which has obvious
31 benefits for commercial vehicle operators.

32

33 In addition, the fact that the receiver assembly 2 is

1 biased to a closed position means that there is no longer
2 a requirement for the operator of the apparatus 1 to
3 remember to close the cap following the filling process.
4 Importantly, this fact eliminates the risk of fuel
5 spillage occurring when the vehicle is out on the road
6 and so removes the opportunity for associated road
7 accidents caused by such a spillage. Furthermore, this
8 fact also reduces the possibility of interference or
9 sabotage of the fuel tanks 33 by any third party
10 inserting a foreign body.

11

12 An additional advantage relates to the fact that as the
13 receiver assembly 53 shuts off completely when the fuel
14 tank is full, and only allows further insertion of fuel
15 once the fuel level has fallen again, prevents undue
16 over-pressurisation and negates the risk of inserting
17 more fuel into an already full tank.

18

19 The coupling components, 16 and 19, for the receiver
20 assembly 2 and the nozzle assembly 3, respectively,
21 provide further advantages over those systems described
22 in the prior art. In the first instance the coupling
23 components, 16 and 19, positively secure the nozzle
24 assembly 3 to the receiver assembly 2. On completion of
25 the fuel filling operation a simple rotation of the
26 nozzle assembly 3, relative to the receiver assembly 2,
27 is sufficient to disengage the coupling components, 16
28 and 19, while the vent cover springs 13 act to eject the
29 nozzle assembly 3 from the receiver assembly 2. The
30 overall result of this design is that the receiver
31 assembly 2 and nozzle assembly 3 are easier to couple and
32 decouple than those systems described in the prior art.
33 This factor reduces the wear and tear of these components

1 and so provides the fuel filling apparatus 1 with an
2 increased lifetime.

3

4 The foregoing description of the invention has been
5 presented for purposes of illustration and description
6 and is not intended to be exhaustive or to limit the
7 invention to the precise form disclosed. The described
8 embodiments were chosen and described in order to best
9 explain the principles of the invention and its practical
10 application to thereby enable others skilled in the art
11 to best utilise the invention in various embodiments and
12 with various modifications as are suited to the
13 particular use contemplated. Therefore, further
14 modifications or improvements may be incorporated without
15 departing from the scope of the invention as defined by
16 the appended claims.

1 **Claims**

2

3 1) A fuel filling nozzle assembly for providing fuel to
4 a fuel tank comprising:
5 a nozzle bore within which is housed first and
6 second valves located so as to provide respective
7 exit and entry ports to the nozzle bore;
8 a valve control assembly, comprising a telescopic
9 bolt assembly attached at opposite ends to the first
10 and second valves, the valve control assembly being
11 moveable relative to the nozzle bore,
12 and a nozzle activation assembly wherein the nozzle
13 activation assembly acts on the valve control
14 assembly so as to open the first and second valves
15 consecutively, thereby providing a fuel flow through
16 the nozzle bore.

17

18 2) A fuel filling nozzle assembly as claimed in Claim 1
19 wherein the telescopic valve comprises an inner bolt
20 that communicates at a first end with the first
21 valve and an outer bolt that communicates with the
22 second valve.

23

24 3) A fuel filling nozzle assembly as claimed in Claim 2
25 wherein the nozzle activation assembly is connected
26 to a second end of the inner bolt so that when
27 activated the inner bolt is axially translated
28 relative to the outer bolt.

29

30 4) A fuel filling nozzle assembly as claimed in Claim 3
31 wherein the telescopic bolt assembly further
32 comprises a latch that provides a means for coupling
33 the inner and outer bolts following a predetermined

1 axial translation of the inner bolt.

2

3 5) A fuel filling nozzle assembly as claimed in any of
4 the preceding Claims wherein the fuel filling nozzle
5 assembly further comprises a nozzle coupling
6 component that provides a means for securing the
7 nozzle assembly to a fuel filling receiver assembly.

8

9 6) A fuel filling nozzle assembly as claimed in Claim 5
10 wherein the nozzle coupling component comprises one
11 or more apertures suitable for receiving one or more
12 protrusions associated with the receiver assembly.

13

14 7) A fuel filling nozzle assembly as claimed in any of
15 the preceding Claims wherein the fuel filling nozzle
16 assembly further comprises one or more handles that
17 provide a means for aiding the deployment of the
18 nozzle assembly by a user.

19

20 8) A fuel filling nozzle assembly as claimed in Claim 7
21 wherein the one or more handles further comprise a
22 clip for locating within the nozzle activation
23 assembly so providing a means for securing the
24 position of the nozzle activation assembly.

25

26 9) A fuel filling nozzle assembly as claimed in any of
27 the preceding Claims wherein the fuel filling nozzle
28 assembly further comprises an automatic cut off
29 mechanism that provides a means for closing the
30 second valve once a level of fuel within the fuel
31 tank has reached a predetermined value.

32

33 10) A fuel filling nozzle assembly as claimed in Claims

1 9 wherein the automatic cut off mechanism comprises
2 a chamber, the chamber adapted to retain a movable
3 plate, the plate coupled via a latch assembly to the
4 latch, and the plate further adapted to move under
5 the influence of an applied pressure.

6
7 11) A fuel filling nozzle assembly as claimed in Claim
8 10 wherein the plate is displaced by a predetermined
9 applied pressure acting thereon so as to move from a
10 first position wherein the latch is available for
11 communication with the telescopic bolt assembly to a
12 second position wherein the latch is not available
13 for communication with the telescopic bolt assembly.

14
15 12) A fuel filling nozzle assembly as claimed in Claim
16 11 wherein the plate is resiliently biased to the
17 first position.

18
19 13) A fuel filling nozzle assembly as claimed in Claim 9
20 wherein the automatic cut off mechanism comprises
21 the second valve being axially tapered towards the
22 first valve so as to create an area of low pressure
23 within the fuel supply to the tank at the second
24 valve.

25
26 14) A fuel filling nozzle assembly as claimed in Claim
27 13 wherein the automatic cut off mechanism further
28 comprises one or more air passages, isolated from
29 the nozzle bore that extends from an anterior face
30 of the nozzle coupling component through to the area
31 of low pressure, within which is located a diaphragm
32 chamber that is coupled via a latch assembly to the
33 latch.

1

2 15) A fuel filling nozzle assembly as claimed in Claim
3 14 wherein the diaphragm chamber comprises a
4 flexible diaphragm that moves from a first position
5 wherein the latch is available for communication
6 with the telescopic bolt assembly and a second
7 position wherein the latch is not available for
8 communication with the telescopic bolt assembly.

9

10 16) A fuel filling nozzle assembly as claimed in Claim
11 15 wherein the flexible diaphragm moves from the
12 first position to the second position when a
13 predetermined vacuum level is present in the
14 diaphragm chamber.

15

16 17) A fuel filling nozzle assembly as claimed in Claim
17 15 or Claim 16 wherein flexible diaphragm is
18 resiliently biased towards the first position by one
19 or more bias means.

20

21 18) A fuel filling nozzle assembly as claimed in any of
22 Claims 9 to 17 wherein the automatic cut off
23 mechanism further comprises one or more bias means
24 that provide a means for resiliently biasing the
25 second valve to a closed position.

26

Amendments to the claims have been filed as follows

35

1 **Claims**

2

- 3 1) A fuel filling nozzle assembly for providing fuel to
4 a fuel tank comprising:
5 a nozzle bore within which is housed first and
6 second valves located so as to provide respective
7 exit and entry ports to the nozzle bore;
8 a valve control assembly, comprising a telescopic
9 bolt assembly attached at opposite ends to the first
10 and second valves, the valve control assembly being
11 moveable relative to the nozzle bore,
12 and a nozzle activation assembly wherein the nozzle
13 activation assembly acts on the valve control
14 assembly so as to open the first and second valves
15 consecutively, thereby providing a fuel flow through
16 the nozzle bore.
17
- 18 2) A fuel filling nozzle assembly as claimed in Claim 1
19 wherein the telescopic valve comprises an inner bolt
20 that communicates at a first end with the first
21 valve and an outer bolt that communicates with the
22 second valve.
23
- 24 3) A fuel filling nozzle assembly as claimed in Claim 2
25 wherein the nozzle activation assembly is connected
26 to a second end of the inner bolt so that when
27 activated the inner bolt is axially translated
28 relative to the outer bolt.
29
- 30 4) A fuel filling nozzle assembly as claimed in Claim 3
31 wherein the telescopic bolt assembly further
32 comprises a latch that provides a means for coupling
33 the inner and outer bolts following a predetermined

1 axial translation of the inner bolt.

2

3 5) A fuel filling nozzle assembly as claimed in any of
4 the preceding Claims wherein the fuel filling nozzle
5 assembly further comprises a nozzle coupling
6 component that provides a means for securing the
7 nozzle assembly to a fuel filling receiver assembly.

8

9 6) A fuel filling nozzle assembly as claimed in Claim 5
10 wherein the nozzle coupling component comprises one
11 or more apertures suitable for receiving one or more
12 protrusions associated with the receiver assembly.

13

14 7) A fuel filling nozzle assembly as claimed in any of
15 the preceding Claims wherein the fuel filling nozzle
16 assembly further comprises one or more handles that
17 provide a means for aiding the deployment of the
18 nozzle assembly by a user.

19

20 8) A fuel filling nozzle assembly as claimed in Claim 7
21 wherein the one or more handles further comprise a
22 clip for locating within the nozzle activation
23 assembly so providing a means for securing the
24 position of the nozzle activation assembly.

25

26 9) A fuel filling nozzle assembly as claimed in any of
27 the preceding Claims wherein the fuel filling nozzle
28 assembly further comprises an automatic cut off
29 mechanism that provides a means for closing the
30 second valve once a level of fuel within the fuel
31 tank has reached a predetermined value.

32

33 10) A fuel filling nozzle assembly as claimed in Claim 9

1 wherein the automatic cut off mechanism comprises a
2 chamber, the chamber adapted to retain a movable
3 plate, the plate coupled via a latch assembly to the
4 latch, and the plate further adapted to move under
5 the influence of an applied pressure.
6

7 11) A fuel filling nozzle assembly as claimed in Claim
8 10 wherein the plate is displaced by a predetermined
9 applied pressure acting thereon so as to move from a
10 first position wherein the latch is available for
11 communication with the telescopic bolt assembly to a
12 second position wherein the latch is not available
13 for communication with the telescopic bolt assembly.
14

15 12) A fuel filling nozzle assembly as claimed in Claim
16 11 wherein the plate is resiliently biased to the
17 first position.
18

19 13) A fuel filling nozzle assembly as claimed in Claim 9
20 wherein the automatic cut off mechanism comprises
21 the second valve being axially tapered towards the
22 first valve so as to create an area of low pressure
23 within the fuel supply to the tank at the second
24 valve.
25

26 14) A fuel filling nozzle assembly as claimed in Claim
27 13 wherein the automatic cut off mechanism further
28 comprises one or more air passages, isolated from
29 the nozzle bore that extends from an anterior face
30 of the nozzle coupling component through to the area
31 of low pressure, within which is located a diaphragm
32 chamber that is coupled via a latch assembly to the
33 latch.

1

2 15) A fuel filling nozzle assembly as claimed in Claim
3 14 wherein the diaphragm chamber comprises a
4 flexible diaphragm that moves from a first position
5 wherein the latch is available for communication
6 with the telescopic bolt assembly and a second
7 position wherein the latch is not available for
8 communication with the telescopic bolt assembly.

9

10 16) A fuel filling nozzle assembly as claimed in Claim
11 15 wherein the flexible diaphragm moves from the
12 first position to the second position when a
13 predetermined vacuum level is present in the
14 diaphragm chamber.

15

16 17) A fuel filling nozzle assembly as claimed in Claim
17 15 or Claim 16 wherein flexible diaphragm is
18 resiliently biased towards the first position by one
19 or more bias means.

20

21 18) A fuel filling nozzle assembly as claimed in any of
22 Claims 9 to 17 wherein the automatic cut off
23 mechanism further comprises one or more bias means
24 that provide a means for resiliently biasing the
25 second valve to a closed position.

26

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Examiner: Mr Darren Williams

Claims searched: 1-18

Date of search: 9 August 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	JP 10035800 A (TATSUNO)
A	-	WO 03/059802 A1 (ADEL)
A	-	US 4919174 A (WARLAND)

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X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

B8N; B8T

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B67D

The following online and other databases have been used in the preparation of this search report

OPTICS, EPODOC, WPI