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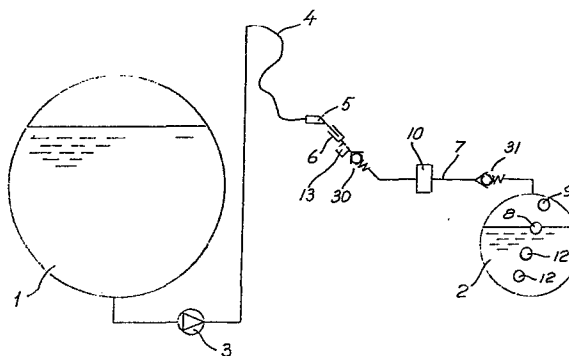
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Automatic limited delivery apparatus for liquefied gas.

An apparatus for automatically limited delivery of a flow of liquid, e.g. gasol in its liquid phase, from a store (1) provided with pressurizing means (3) to a tank (2), e.g. a vehicle tank. The delivery takes place via a supply line (4) connectable to a tank inlet line (7). A non-return valve (30) is disposed in or downstream of a connection means (6) for the supply line in the tank inlet line. An overfill monitor (8 - 10) breaks off the delivery by closing a filling valve (10). The filling valve is situated downstream of the non-return valve and implemented with a constricted bypass passage affording, in the closed position of the valve, pressure equalization between the inlet and outlet of said valve.



Delivery Apparatus for LiquidDESCRIPTION

The invention relates to apparatus for automatically limited delivery of a stream of liquid, particularly liquid petroleum gas such as butane or propane, or another gas in its liquid phase, to a tank from a store
5 provided with pressurizing means and usually flow-measuring metering means. Delivery is carried out via a supply line, the outlet of which is connectable to a connection means in communication with the tank via a tank inlet line. A non-return valve is disposed in the
10 connection means, or downstreams thereof, in the tank inlet line. For a predetermined filling level, overfill protection is also arranged to initiate breaking off the supply by closing a filling valve.

Such apparatus will have come into practical
15 execution in gas stations for filling tanks in motor vehicles to the predetermined level, as a maximum, indicated for reasons of safety with regard to the gas's expansion at increased temperature, usually a level corresponding to 80 % of the tank's total volume. By
20 "gas station" is hereinafter to be understood a place where the gas mentioned in the introduction may be supplied to motor vehicles. The filling valve already mentioned is then arranged in the vehicle tank, in the shape of a float valve. The supply line outlet is
25 provided with a filling nozzle for connecting the supply line to the connection means on the vehicle, and the non-return valve in, or downstream of the means serves to prevent gas loss from the tank inlet line when the filling nozzle is taken away from the vehicle. The fill-
30 ing pistol is usually implemented with a manually operable valve. A further non-return valve can be arranged in the tank inlet line, closer to the tank. When the filling valve closes, there is a pressure increase in the tank inlet and supply lines, the pressurizing and
35 metering means of the gas station being disposed to

allow the pump of the pressurizing means to stop automatically or be shunted, the counting mechanism then stopping.

5 The described float valve, serving as overfill protection and filling valve, does not afford the combination of cheapness and reliability which is desirable.

The object of the invention is therefore to cheapen the apparatus and improve its reliability at
10 the same time.

The intended result is obtained by the apparatus having been given the characterizing features apparent from the following claim 1.

One embodiment of the invention is described
15 in the following in detail with reference to the appended drawings.

Figure 1 schematically illustrates a gas storage and a tank, with means disposed in conjunction therewith for performing filling.

20 Figure 2 is a longitudinal section through a solenoid valve serving as a filling valve.

Figure 3 is a functional diagram illustrating the coaction between the components of the apparatus.

The apparatus schematically illustrated in
25 Figure 1 is disposed for providing an automatically limited delivery of a stream of the gas to a tank 2 from a store 1 of gas in liquid phase. The tank 2 may be arranged as a fuel tank in a vehicle, the gas then being motor gas, preferably commercial butane or
30 propane or mixtures thereof. The store 1 is placed in a gas station, in such a case, and equipped with a pressurizing means 3, as well as flow-measuring metering means (not shown) for motor gas in its liquid phase.

Liquid from the tank 1 is taken via a supply
35 line 4 comprising in its terminal portion a hose with a filling nozzle 5 at the outlet end thereof. The nozzle 5 is connectable to a connection means 6 in the upstream end of a tank inlet line 7.

A non-return valve 30 is disposed in the connection means 6, or immediately downstream thereof in the tank inlet line 7.

5 The sensor portion 8, 9 of an overfill monitor 8 - 10 is adapted to initiate breaking off the supply by closing a filling valve 10, at a predetermined filling level in the tank 2.

10 A further non-return valve 31 is arranged in the vicinity of the tank 2 in the tank inlet line 7, as an extra safety measure, so that should there be leakage in the line or line fittings between this valve 31 and the connection means 8, any leakage from the tank 2 will be inhibited.

15 The overfill monitor 8 - 10 has two temperature-sensitive resistors 8, 9, as shown in Figure 1 and 3, preferably PTC resistors, of which one 8 is situated at the predetermined level in the tank 2 and the other 9 at a higher and constantly liquid-free level in the tank. Both resistors are naturally supplied with
20 current, at least during filling. During filling, when the liquid in the tank 2 approaches the PTC resistor 8 at the predetermined maximum level, the heat transfer between the surface of this resistor and the surroundings is improved, in comparison to the situation where
25 this resistor was surrounded by the gas phase, similar to the situation of the upper resistor 9. The more effective cooling lowers the temperature of the resistor immersed in liquid, and thereby its resistance.

30 Conventional electronic means, not illustrated in detail, are commonly denoted 11 in Figure 3, these means comparing the voltage or current parameters of the resistors 8 and 9 in order to automatically determine any deviation between them, indicating that the resistor 8 has come into contact with motor gas in
35 the liquid phase. A signal in response to the comparison is thus provided for urging the filling valve 10 to close.

Both Figures 1 and 3 illustrate further temperature-sensitive resistors 12, which are disposed at lower levels in the tank 2 for serving in combination with the previous ones, to indicate the liquid level in the tank when running the vehicle. These are preferably PTC resistors also. A level indicator 20 is provided for indicating the level, and consists of at least one light-emitting diode (LED) for each resistor.

It will further be seen from Figures 1 and 3 that a pressure-sensitive electrical breaker 13 is disposed in the tank inlet line 7 between the non-return valve 30 and the connection means 6 for activating, via the electronic means 11, the temperature-sensitive resistors when it closes after being put under pressure by the pressurizing means 3, i.e. after the supply line 4 has been coupled to the connection means 6, and usually after manually opening a valve in the filling nozzle 5. Similarly via the electronic means 11, the now-closed breaker 13 simultaneously causes the filling valve 10 to open, so that filling can take place. Suitably, the resistors 12 and level indicator 20 are also activated.

Figure 3, primarily intended to illustrate the application of the invention in filling motor gas into the fuel tank of a vehicle, illustrates further that the breaker 13 is disposed in a circuit 14 also having a relay 15. When the circuit 14 is closed by the breaker 13, the relay 15 interrupts the circuit 16 of the vehicle start motor 17, resulting in that the vehicle cannot be started as long as filling pressure remains on the breaker 13.

The vehicle is also equipped, as will be seen from Figure 3, with a switch consisting of a selector 18 for the selection of driving fuel, and having position B for petrol and position G for gasol. When the position G is selected, all the PTC resistors 8, 9 and 12 are activated for indicating the liquid level in the tank 2,

providing that the conventional ignition lock 19, in series with the selector 18, is set in the position T. The measurement result is taken out via the electronic means 11 to the level indicator 20.

5 When driving on motor gas the electronic equipment is thus fed with voltage from the initiation lock 19 via the selector 18, the sensor's resistors 8, 9, 12 as well as the level indicator 20 thus being activated, whereas the electronic means causing the
10 filling valve 10 to open are not activated.

 The filling valve 10 is placed, as will be seen from Figure 1, downstream of the non-return valve 30 in the tank inlet line 7. As shown in Figure 2, it is implemented with a bypass passage 21 affording, in the
15 closed position of the valve, pressure equalization between the inlet 22 and outlet 23 of the valve. The bypass passage 21 is constricted in comparison with the through-flow area of the valve in its open position.

 In this case the valve comprises a solenoid valve
20 which, as a result of the pressure equalization, only requires moderate operational force. The valve has a valve housing 24 in which a valve seat 25 is disposed between the inlet 22 and outlet 23. A valve body 27, provided with said bypass passage 21, is urged sealing-
25 ly against the seat 25 for closure with the aid of a spring 26. The valve body is provided with a core 28 which is actuatable by a coil 29.

 The bypass passage 21 is dimensioned such that, at the pressure normally prevailing in the supply line 4
30 during filling, it provides pressure equalization sufficiently rapidly for the filling valve 10 to be capable of opening within about 5 seconds after the filling nozzle 5 of the supply line has been coupled to the connection means 6. In other words, this is a
35 dimensioning consideration requiring a given least capaciousness in the through-flow cross-section of the

bypass passage, i.e. a given maximum permitted pressure drop across the ends of the passage. A reverse demand that must be met by the passage is that it must be sufficiently constricted, i.e. it must afford a
5 pressure drop, such that the flow-measuring metering means of the store is disabled when the filling valve is closed. This normally signifies that the pump stops or is shunted, the counter mechanism then stopping, and that the manual grip on the filling nozzle trigger
10 is released so that the filling nozzle valve closes, and communication with the connection means 6 can be broken by removing the nozzle.

A suitable width at the portion of the bypass passage 21 having the least through-flow cross-section
15 is a diameter of about 0,5 - 1 mm, preferably about 0,8 mm for motor gas.

The pressure drop in the bypass passage 21 and the closing force of the non-return valve 30 may be balanced such that the valve 30 closes when the filling
20 valve 10 closes, whereby gas loss on the removal of the filling nozzle is reduced to a minimum.

The bypass passage 21 does not necessarily need to be disposed in the valve body 21, 17, but may be situated in the valve housing 24, for example, or in a
25 separate shunt line (not shown). In both the latter cases, it can easily be implemented so as to be adjustable with the aid of some simple valve means, e.g. a set screw made as the active portion of a needle valve.

The filling valve 10 can be adapted for assuming
30 an open position when unactuated, instead of a closed position as in the illustrated embodiment, the electronic means being adapted for urging it to closed position when the predetermined level has been arrived at during filling, and to hold it closed until the non-return
35 valve 30 has closed, i.e. usually until the filling pistol 5 has been removed from the connection means 6.

The means adopted for preventing starting or moving the vehicle during filling may be of some other kind than what has been described. Thus, the engine ignition circuit and/or another circuit controlling starting the engine or moving the vehicle can be activated when the pressure sensitive breaker 13, or other means sensing the presence of filling pressure or the presence of the filling nozzle 5 in the connection means 6, indicates that communication with the gas supply 1 has been established.

The filling valve provided with the bypass passage does not need to be a solenoid valve either, but other kinds of directly or indirectly electrically controlled valve may be used.

The invention is not restricted to the illustrated embodiment either by what has been stated above or in other respects, but may be varied within the scope of the claims.

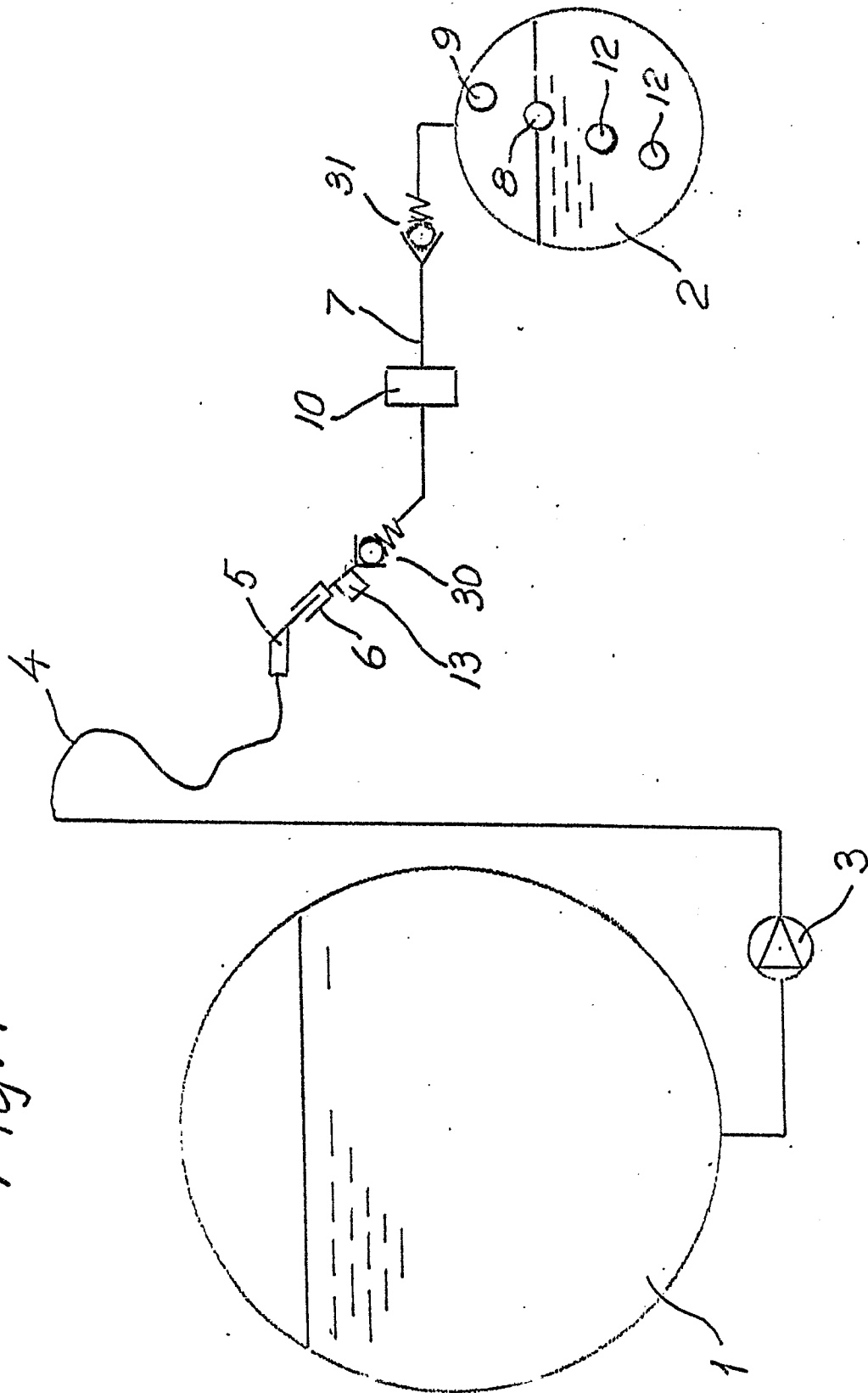
CLAIMS

1. Apparatus for automatically limited delivery of a stream of liquid, particularly liquid petroleum gas, such as butane or propane, or another gas in its liquid phase, from a supply (1) provided with pressurizing means (3) and usually flow-measuring and metering means, to a tank (2) via a supply line (4), the outlet (5) of which is connectable to connection means (6) in communication with the tank via a tank inlet line (7), there being a non-return valve (30) disposed in the connection means (6) or downstream thereof in the tank inlet line (7), and an overfill monitor (8 - 10) adapted for interrupting the supply at a predetermined filling level by closing a filling valve (10), characterized in that the filling valve (10) is situated in the tank inlet line (7) downstream of the non-return valve (30) and implemented with a bypass passage (21) which is constricted in comparison with the through-flow area of the valve in its open position, said passage being situated between the inlet (22) and outlet (23) of said filling valve (10) and preferably disposed in the valve body (27) or housing (24) of said valve.
2. Apparatus as claimed in claim 1, characterized in that the filling valve (10) is a solenoid valve.
3. Apparatus as claimed in claim 1 or 2, characterized in that the bypass passage (21) is dimensioned sufficiently capaciously as to provide such rapid pressure equalization in the pressure present in the supply line (4) that the filling valve (10) is capable of opening within about 5 seconds after the outlet of the supply line (4) has been connected to the connection means (6).
4. Apparatus as claimed in claim 3, characterized in that the bypass passage (21) is dimensioned so constricted that the flow-measuring metering means of the supply is disabled when the filling valve (10) is closed.

5. Apparatus as claimed in claim 4 for the case where it is adapted for motor gas, characterized in that the bypass passage (21) consists of a hole with a diameter of 0.5 - 1 mm, preferably about 0.8 mm at its most constricted place.
6. Apparatus as claimed in claim 1 or 2, characterized in that the bypass passage (21) and non-return valve (30) are dimensioned such that the valve (30) closes when the filling valve (10) closes.
7. Apparatus as claimed in any of claims 2 - 6, characterized in that the solenoid coil (29) of the filling valve (10) is situated in an electrical operational circuit (14) via which the filling valve (10) is controlled for opening when a pressure-sensitive electrical breaker (13) situated upstream of the filling valve (10) is put under pressure after the supply line (4) has been coupled to the connection means (6).
8. Apparatus as claimed in claim 7, for the case where the tank (1) is adapted as a fuel tank in a vehicle, characterized in that the breaker (13), when it closes the operational circuit (14) opening the filling valve (10) is also adapted for breaking the start motor circuit (16) of the vehicle engine, and/or the ignition circuit and/or actuating another circuit controlling starting the engine or moving the vehicle for the inhibition of such starting or moving.
9. Apparatus as claimed in any of claims 2 - 8, characterized in that for closing, the filling valve (10) has its solenoid coil (29) connected to electrical control means (11) comprising the overfill monitor (8 - 10) and having at least two resistors, said resistors during the supply of the flow of liquid being supplied with current and sensitive to temperature, one resistor (8) being situated at the predetermined level in the tank and the other (9) at a higher and continuously liquid-free level in the tank, the level

of the liquid and its contact with the resistor (8) at the predetermined level being automatically determined by electronic means (11) comparing the voltage or current parameters of both resistors (8, 9), for actuating the
5 filling valve (10) to close when the heat transfer from the resistor (8) to its surroundings increases towards the predetermined level as a result of contact with the liquid.

Fig. 1



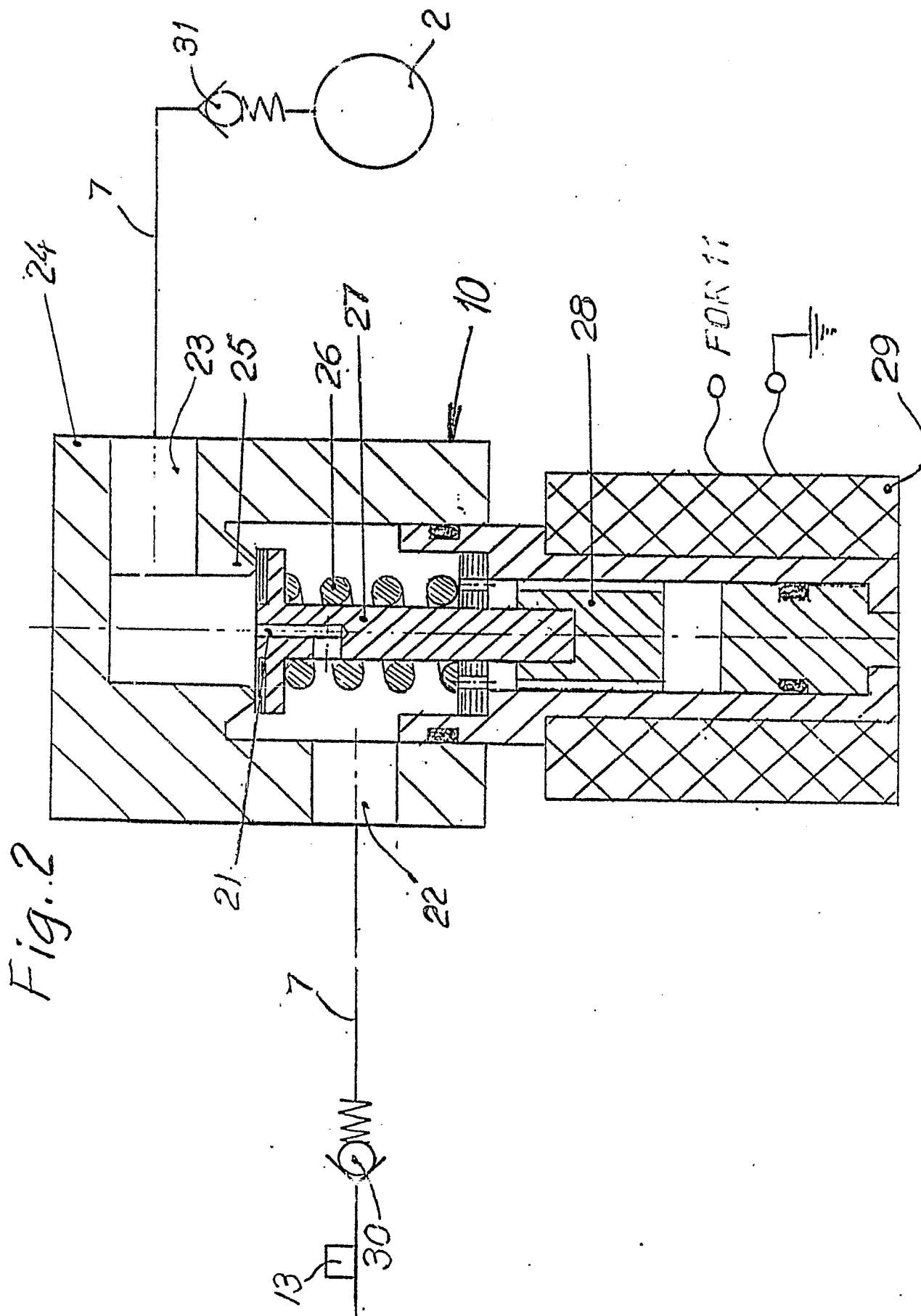


Fig. 3

