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(71) Applicant: **Redfern, Eric**
Saddleworth, Oldham OL3 7DX (GB)

(72) Inventor: **Redfern, Eric**
Saddleworth, Oldham OL3 7DX (GB)

(74) Representative: **Downey, William Gerrard et al**
Wilson, Gunn, M'Caw,
41-51 Royal Exchange,
Cross Street
Manchester M2 7BD (GB)

(54) Gas dispensing apparatus for inflating balloons

(57) Apparatus for dispensing amounts of gas, particularly for the inflation of balloons, including a gas flow control means (2,3,5) for controlling a supply of gas and a pressure sensing means (7) to determine the pressure of dispensed gas downstream of the flow control means and means (8) for controlling the flow of gas in dependence upon the pressure sensed. The apparatus, when used for filling balloons, includes a nozzle (6) which may incorporate a sensor to determine when it is inserted into the neck of a balloon. The apparatus may also include a means for receiving a payment and a means for dispensing balloons.

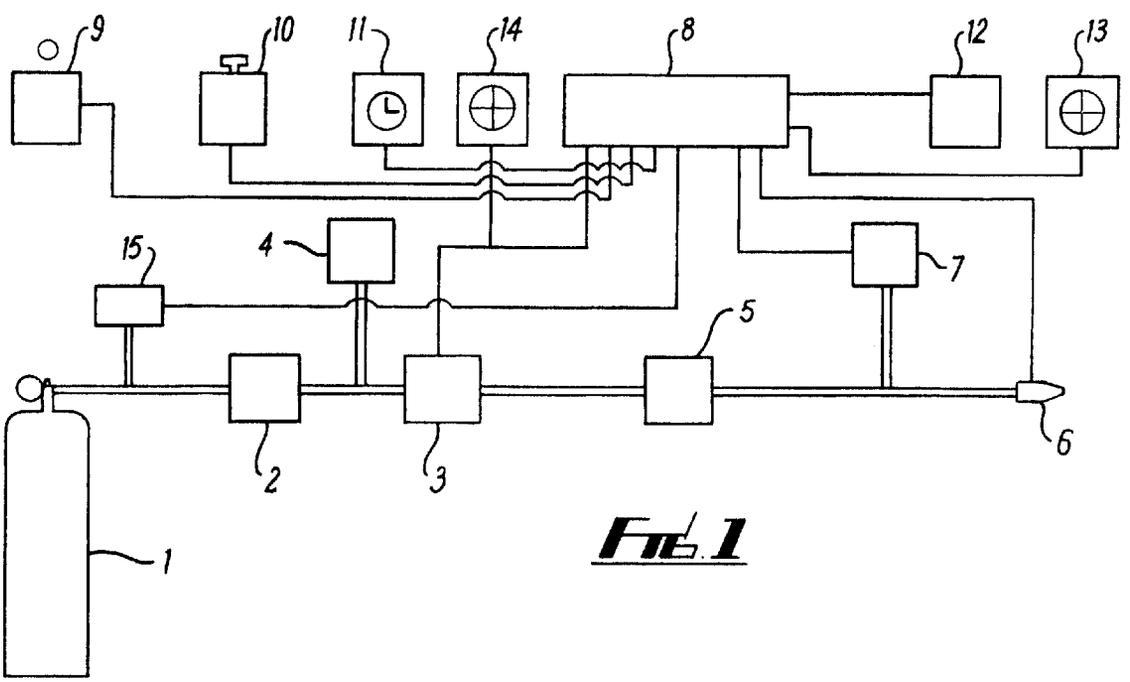

FIG. 1

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Description

The present invention relates to apparatus for dispensing gas and particularly, although not exclusively, to apparatus for dispensing gas for the inflating of balloons and balloon inflation apparatus.

Party balloons are widely used as objects of fun and enjoyment, such balloons are conventionally inflated manually or by the use of a mechanical pump. It is common to fill party balloons with a lighter than air gas mixture, typically containing helium. Balloons are conventionally filled with a lighter than air gas mixture using a high pressure gas cylinder, this can be hazardous. Consequently, although helium filled balloons are popular they are not commonly filled in a domestic environment owing to the possibility of an accident occurring. Indeed the filling of balloons from high pressure gas cylinders is usually carried out by skilled personnel.

One of the difficulties associated with the filling of party balloons using a high pressure gas cylinder is determining when the balloon is correctly inflated, particularly in the case of mylar balloons. Also, high pressure gas cylinders are not usually made available to the unskilled adult or child because of the hazards associated with using a high pressure gas supply and also that where such a gas supply is not supervised it may be abused. For instance, when equipment for the inflation of balloons is arranged to dispense a lighter than air gas mixture containing Helium persons may be tempted to inhale the dispensed gas as this causes them to speak in an amusing squeaky voice. This is undesirable from both the view of safety and the potential wastage of gas.

It is desirable therefore that any gas dispensing apparatus is arranged so that gas will not be dispensed unless it is connected to an appropriate receptacle and/or that gas will not be dispensed when a person is attempting to inhale the gas.

An attempt to solve the problems associated with the filling of party balloons using a high pressure gas supply has been discussed in United Kingdom Patent Application No. 9312672.0. In particular there is described apparatus for dispensing measured amounts of gas which employs a chamber of predetermined size for receiving an amount of gas and then delivering this gas for the inflation of a balloon. There are however a number of problems associated with this apparatus. Particularly, because the amount of gas delivered is measured by a chamber of fixed size this restricts the size and type of balloon that can be filled using any single apparatus. Provision to supply greater or lesser amounts of gas can only be made by changing the size of the receiving chamber.

It is an object of the present invention to overcome both the problems of balloon filling described above and also problems associated with existing balloon filling equipment as described in Patent Application No. 9312672.0.

According to a first aspect of the present invention there is provided apparatus for dispensing amounts of gas comprising a flow control means for controlling a supply of gas from a gas source, pressure sensing means to determine the pressure of dispensed gas downstream of the flow control means and means for controlling flow of gas in dependence upon pressure sensed.

According to a second aspect of the present invention there is provided a nozzle for dispensing gas comprising a body and a sensing means on the body to determine the nature of any material into which the nozzle is inserted.

Preferably the apparatus is adapted to dispense gas to balloons. The apparatus may be adapted to dispense gas to mylar (Registered Trade Mark) or latex balloons, or any other type of balloon. The flow control means preferably comprises a normally closed solenoid operated valve arranged in series with an adjustable flow control means to enable different gas flow rates to be selected although the flow control means may be comprised in a single component. The pressure sensing means preferably comprises a pressure operated switch, the switching pressure for which is adjustable. Alternatively the pressure sensing means may comprise a pressure gauge arranged to produce an electrical signal relating to pressure. More preferably the pressure sensing means comprises a digital pressure switch. The dispensing apparatus is preferably arranged so as to provide a supply of gas at a predetermined flow rate until the back pressure generated by the dispensed gas, for instance in a balloon, reaches a predetermined level and then to stop the supply of gas. A suitable gas source preferably comprises a cylinder containing pressurised gas, for example a lighter than air gas mixture, connected to a conventional pressure regulator to reduce the pressure of the gas supply to a safe level, preferably in the range 10 to 50 PSI, more preferably in the range 15 to 25 PSI, which is in turn connected to a conventional pressure relief valve set at a higher pressure than the pressure regulator and so arranged to release gas to the atmosphere should the regulator fail. Alternatively a gas supply could be provided by any other suitable means, for example a compressor. When the dispensing apparatus is arranged to fill balloons there is also preferably provided a nozzle, adapted to accommodate the neck of, or return valve fitted to the neck of a balloon. The nozzle preferably includes a sensing means to determine when it is inserted into the neck or non-return valve of a balloon. The nozzle preferably comprises a body and a sensing means on the body to determine the nature of any material into which the nozzle is inserted. The sensing means preferably comprises a means for determining the electrical resistance of the material into which the nozzle is inserted. The sensing means is preferably adapted to differentiate between the resistance of the neck of a balloon, or non-return valve, and the resistance of a human body, for example a child's lips.

The sensing means preferably comprises two or

more electrodes which may be connected to appropriate apparatus to determine the electrical resistance of any material into which the nozzle is inserted. The electrodes may comprise pieces of copper wire. Apparatus to which the electrodes are connected is preferably arranged to distinguish the difference in electrical resistance between the material into which the nozzle is intended to be inserted and parts of the human body. For example, in connection with apparatus for the inflation of balloons it is desirable to determine the difference in electrical resistance between the plastic non-return valve placed into the neck of a balloon and say, a person's mouth or lips.

Alternative sensor arrangements are possible, for example by providing a particular arrangement of electrodes on the nozzle which are intended to make contact with corresponding electrical connections in a particular valve or other fitting into which the nozzle is to be inserted.

Preferably the nozzle also includes a gas pressure sensor disposed in a gas flow path through the nozzle. The gas pressure sensor preferably comprises a solid state pressure sensor. The pressure sensor, when connected to appropriate apparatus preferably generates a signal the voltage of which corresponds to the gas pressure sensed.

By incorporating a pressure sensor on the nozzle this provides a convenient way to measure the pressure of gas supplied through the nozzle. Locating the pressure sensor on the nozzle also minimises the effect of back pressure in any gas delivery system to which the nozzle is connected and so gives a more accurate reading of the pressure of gas in the article to which gas is to be supplied by the nozzle. Provision of a gas sensor in the nozzle allows this component to be easily replaced in event of failure by simple replacement of the nozzle. Also, a nozzle including a pressure sensor enables a pressure sensor to be easily incorporated into gas dispensing apparatus not originally designed for or provided with a pressure sensor.

The nozzle body is preferably formed from a plastics material, preferably a hard plastics material. Electrical connection for the sensing means and pressure sensor is preferably made by wires which pass through the valve body and do not communicate with the gas flow path through the valve body.

Outlets of the nozzle and any other connection to the nozzle may be formed as required depending on the application.

Preferably the dispensing means is mounted in a housing. Preferably there is also mounted on the housing means to request that gas be dispensed, preferably a switch. In one embodiment the housing also contains a means for dispensing balloons.

Preferably the housing contains a means for receiving payment and a first indicating means for indicating when gas can be dispensed. The housing preferably also contains a second indicating means for indicating that the device is operable, a third indicating means to indicate that the dispensing operation is complete and a fourth indicating means for indicating that the gas supply requires replenishing.

Power to operate the system may be provided by mains electricity which may be supplied via a transformer mounted in or on the housing.

Alternatively power to operate the system may be provided by batteries, preferably mounted on the housing. The provision of batteries enables the apparatus to be completely portable.

The batteries are preferably rechargeable. Equipment to enable the batteries to be recharged from a mains electricity supply may also be provided.

The operation of the dispensing means is preferably co-ordinated by a control means. The purpose of the control means is to operate the flow control means in order to dispense a supply of gas.

Before activating the flow control means the control means is preferably arranged to require that, where payment receiving means are provided an appropriate payment has been received, and that where sensing means are provided that a suitable balloon or similar has been placed onto the nozzle, and that a request has been made for gas. When these criteria are met the control means preferably opens the flow control means to dispense gas, until such time as the pressure sensing means indicates that the dispensed gas has reached a predetermined pressure and then to shut said flow control means. More preferably after the activation of the flow control means there is introduced a short delay, for example 1 to 2 seconds, before the back pressure is monitored by the pressure sensing means. In this manner, this prevents the flow control means from being prematurely shut due to a temporary increase in the pressure of the dispensed gas. For example, where a balloon with a built in non-return valve is being filled, the gas pressure required to open the valve may be similar to or higher than the predetermined pressure to which the balloon is to be filled. Where a delay is not introduced between the commencement of gas flow and, the monitoring of supplied gas pressure the build up of gas pressure before the balloon non-return valve opens may be sufficient to cause the control means to stop the gas flow and the balloon will not be filled. A similar problem can occur where latex balloons are filled and where an initial higher pressure is required to separate parts of the balloon that have adhered together. The delay period is preferably variable to enable the equipment to be easily adapted for the filling of different articles.

In one embodiment there is also provided a timing means which is activated when the flow control means are opened to dispense gas. In this embodiment the control means are adapted to close the flow control means after either a predetermined period or when the pressure sensing means indicates that a predetermined pressure has been reached, whichever occurs sooner. In this manner the supply of gas will be stopped if, for

example, the dispensing apparatus is being abused or if a balloon which is being filled fails. The control means may be effected by an electronic or electrical control means.

Where a balloon is filled to a predetermined pressure a problem can arise when the temperature of the environment where the balloon is filled differs from that where it is intended to be displayed or used. For example in summer, if a balloon is filled to a predetermined pressure in an air conditioned store at an ambient temperature of, say 20°C, and is subsequently taken outside of the store where the ambient temperature is higher, say 25°C, then as the balloon heats up the pressure of gas inside the balloon will increase. This may be dangerous as the balloon could explode. In contrast, where a balloon is filled to a predetermined pressure at an ambient temperature which is higher than the ambient temperature to which the balloon is subsequently taken, then the pressure inside the balloon will fall. This may cause the shape of the balloon to distort, spoiling the appearance of the balloon, although this does not represent any danger. The apparatus of the present invention preferably includes means to enable the pressure to which a balloon, or other, is filled to be varied to take into account any difference in the ambient temperature a filled balloon is likely to experience. For example, where the outside air temperature is higher than the air temperature where the apparatus is located, then the pressure to which balloons are filled should be reduced accordingly.

The pressure adjusting means are preferably calibrated in terms of temperature, for example to allow the ambient temperature surrounding the machine and outdoor temperature to be input to the apparatus and the apparatus is then preferably arranged to automatically determine the appropriate pressure to which a balloon is filled.

There may be provided one or more temperature sensors able to monitor the ambient temperature surrounding the apparatus and/or in other areas, for example outside, to enable the apparatus to automatically determine the correct pressure to which a balloon is inflated.

The calculation of the appropriate pressure to which a balloon is to be inflated is preferably performed by an electronic control means.

The present invention conveys a number of advantages over the prior art. By providing both an adjustable gas flow control and pressure sensing means the apparatus can be easily adapted to fill a number of different designs of balloon, or for other applications. The provision of a flow control means enables balloons or similar to be filled safely from a high pressure gas supply by controlling the rate with which the balloon fills, without the provision of a gas receiving means. The provision of a pressure sensing means enables balloons, or similar, of any size to be filled as gas is supplied until a desired pressure is reached. This apparatus can be readily adapted for different applications, for example to fill latex or mylar balloons. The provision of a nozzle including sensing means increases the safety of the device, by attempting to ensure that the apparatus is only used for its intended purpose. The provision of means to adjust the pressure to which balloons are filled depending on the ambient temperature and/or outside temperature enables balloons to be filled safely and still retain their appearance where they are to be used in a different environment to that in which they are filled.

It will be appreciated that the apparatus described provides a convenient and safe way for unskilled persons to fill balloons from a pressurised gas supply. The filling of the balloon is, once the apparatus has been activated, entirely automatic. Balloons are filled gently and safely until a predetermined pressure is reached. In the event of failure of the balloon or pressure sensing means the provision of a timing means prevents the continued dispensing of gas.

The provision of a sensing means on the nozzle improves the safety of the apparatus. This is particularly important when the equipment is installed in a public place for use by unskilled persons.

In order that the invention be more clearly understood there are now described embodiments thereof, by way of example, with reference to the accompanying drawings , in which:-

Fig. 1 is a schematic view of a balloon gas dispenser;

Fig.2 is an external perspective view of a balloon gas dispenser;

Fig.3 is an external elevational view of an alternative balloon gas dispenser, hidden detail is shown by dashed lines;

Fig.4 is a front elevation of the balloon gas dispenser illustrated in Figure 3; hidden detail is shown by dashed lines;

Fig. 5 shows an elevational view of a nozzle for use with apparatus of the present invention with hidden detail shown by way of dashed lines;

Fig.6 shows an elevational view of a second embodiment of a nozzle for use with apparatus of the present invention with hidden detail shown by way of dashed lines;

Fig.7 shows a third embodiment of a nozzle for use with apparatus according to the present invention with hidden detail shown by dashed lines; and

Fig.8 is an external perspective view of a further alternative balloon gas dispenser.

Referring to Fig.1 there is illustrated a high pressure gas storage cylinder 1, connected by high pressure piping to pressure regulator 2 and pressure sensor 15. The pressure regulator reduces the high cylinder pressure of the gas supply to a safe working level of approximately 20 PSI. The outlet of the pressure regulator 2 is connected to both solenoid valve 3 and pressure relief valve 4. The pressure relief valve 4 is arranged to allow gas to escape to the atmosphere if the pressure exceeds approximately 50 PSI, this protects the apparatus and any users thereof from the consequences of failure of the pressure regulator 2. The solenoid valve 3 is a normally closed valve, it is electrically connected to control unit 8. The gas outlet from the solenoid valve 3 is connected to flow control valve 5, the outlet of flow control valve 5 is connected to both nozzle 6 and digital pressure sensor 7. Nozzle 6 incorporates a sensor which is electrically connected to the control unit 8, digital pressure sensor 7 is also electrically connected to the control unit 8.

The control unit 8 comprises an electronic control means which is arranged to control the solenoid valve 2, in response to signals received from coin mechanism 9, switch 10, timer 11, pressure sensor 7 and nozzle 6. The control means 8 is also connected to counter 12, low gas indicator 13, operating indicator 14 and pressure sensor 15.

The operation of the control means 8 is arranged so that on receipt of appropriate coins by the coin mechanism 9, a signal from nozzle 6 to indicate that a suitable balloon has been placed over the nozzle, a signal from pressure sensor 15 to indicate that there is sufficient gas in the cylinder and on receipt of a signal from an operator via switch 10 the solenoid valve 3 is opened to allow gas to flow and simultaneously the timer 11 is activated. Opening solenoid valve 3 causes a controlled flow of gas to be delivered to the nozzle 6. Then, after a predetermined delay, on receipt of either a signal from timer 11 to indicate that a predetermined time period has elapsed or on receipt of a signal from pressure sensor 7 to indicate that a predetermined pressure has been reached to allow solenoid valve 3 to close. The predetermined delay is arranged to be longer than the expected period of any temporary increase in the delivered gas pressure, for example that caused before a balloon non-return valve opens, but shorter than the predetermined time period. The predetermined time period is arranged to be longer than the expected time required to fill a balloon.

Indicator lamp 14 is arranged to illuminate when solenoid valve 3 is opened to indicate to an operator that gas is being dispensed and hence also when the dispensing operation is complete. After each filling operation a valve held by counter 12 is modified, this counter enables the number of fills to be monitored and also compared with the expected number of fills available from a gas cylinder, and therefore enables an estimate of the number of remaining balloon fills available in the gas cylinder. Indicator 13 is arranged to illuminate when pressure sensor 15 indicates that the cylinder pressure has fallen below a predetermined value.

Referring to Fig.2, there is illustrated a balloon gas dispenser which comprises a housing 16, which may carry sales information or other insignia. The housing has an aperture 17, through which there protrudes a nozzle 18. Mounted in a second aperture 19 is a panel which contains a slot 20 for receiving coins, a switch 21 for starting gas flow and also two indicator lights 22 and 23 to indicate when gas is being dispensed and when the gas cylinder requires replacement.

The above apparatus enables balloons to be filled easily and safely by unskilled persons. As the balloons are filled to a predetermined pressure this ensures that all balloons are filled to a similar level, despite the size of the balloon. The provision of a delay period before the delivered gas pressure is monitored prevents the gas flow being prematurely stopped due to any temporary increase in the delivered gas pressure before such time as a balloon is correctly filled, for example a surge in the gas supply or an increase in pressure necessary to open a balloon non-return valve. The provision of a timer prevents wastage of gas if the balloon being filled should fail. The provision of a nozzle incorporating a sensor further increases the safety of the apparatus by rendering the machine inoperative where persons try to use the apparatus other than to fill balloons. Particularly the apparatus is advantageous over prior art balloon filling equipment as it can be easily tailored to fill balloons of different sizes without changing component sizes.

Referring to Figs. 3 and 4 there is illustrated an alternative balloon gas dispenser which comprises a housing 25 having wheels 26 and a rest 27. The housing is also provided with a handle 28 to enable it to be moved easily.

The balloon gas dispenser also includes an on/off switch 29, low gas indicator 30, nozzle 31, fill button 32, provision to store a 24 volt battery 33 and provision to store a gas bottle 34.

As the balloon gas dispenser is totally self contained it is more easily portable than apparatus requiring a mains power supply.

This embodiment is illustrated having an on/off switch, this could be replaced with a coin mechanism.

Referring to Fig. 5 this nozzle comprises a plastic body 35 having provision for connection to a gas supply by way of a threaded portion 36 and a substantially conical nozzle section 37 for engagement with a variety of different non-return valves typically fitted to the foil or Mylar (RTM) type of party balloon.

A passage 38 is formed through the nozzle body to conduct a flow of gas.

A pressure sensor 39 is disposed in the nozzle body in communication with the gas flow passage 38. Electrical connection to the pressure sensor 38 is by way of two wires 40 which pass through the nozzle body, to facilitate their connection to appropriate apparatus.

Two sensor wires 41 also pass through the nozzle body and emerge, or are partially embedded in the surface of the nozzle section 37 to form electrodes 42. The sensor wires 41 are for connection to appropriate apparatus, typically to measure the electrical resistance between the two wires.

When the conical section 37 is exposed the resistance between the sensor wires 41 will be very high as little or no electrical current will flow between the wires through the body 35 of the nozzle. When the nozzle section 37 is inserted into a material or object this object will come into contact with both sensor electrodes 42. Any apparatus connected to the sensor wires 41 will then be able to measure the resistance of the matter or object to which the nozzle is inserted. It will therefore be possible to distinguish, for example, between the non-return valve of a balloon into which the nozzle is intended to be inserted and a person's mouth who is attempting to inhale the gas supplied through the nozzle. The presence of a person's mouth on the nozzle would be characterised by a lower resistance reading.

Whether or not any gas dispensing apparatus connected to the nozzle will supply gas can and indeed should, be made to be dependent on whether the nozzle is inserted into an appropriate valve or similar.

The nozzle is both more convenient and safer than existing nozzles. The provision of a pressure sensor integral with the nozzle negates the problem of locating the sensor elsewhere on gas dispensing apparatus and the problem of back pressure built up in dispensing apparatus for affecting the pressure measured. Provision of a pressure sensor on the nozzle enables easy replacement of the pressure sensor, complete with the nozzle.

Clearly the provision of electrodes on the surface of the nozzle significantly increases the safety of any device employing such a nozzle. This is particularly important with the use of balloon filling and vending apparatus which may be left unattended for operation by unskilled members of the public.

Provision of a nozzle as described can reduce the costs of third party liability insurance associated with such equipment.

Referring to Fig. 6 there is illustrated a similar nozzle to that illustrated in Fig. 5, also comprising a body 43, gas flow passage 44, electrodes 45, pressure sensor 46 and associated connections. The principal difference with this nozzle as compared to that illustrated in Figure 5 is the shape of the part of the nozzle indicated at 47. This nozzle is designed for the inflation of conventional latex party balloons fitted with an appropriate non-return valve. In this application this nozzle confers all the advantages associated with the first embodiment, illustrated in Fig. 5.

Referring to Fig. 7 there is shown a further alternative embodiment of a nozzle. The nozzle comprises a body 48, gas flow passage 49, and pressure sensor 50 with associated connections. The nozzle also comprises a T-section 51 which includes the pressure sensor 50 and means for connecting the nozzle to a gas supply comprising a length of PVC tubing 52.

Referring to Fig. 8 there is illustrated a balloon gas dispenser which comprises a housing 53, which may carry sales information or other insignia 54. The housing has a means for receiving payment 55 and a means for a customer to select a type of balloon to be dispensed comprising of a number of buttons, one of which is indicated at 56. Each button has a corresponding panel 57 which depicts the type of balloon. The balloons may be filled using the nozzle 58. Balloons are dispensed through the slot 59. The display 54 is illuminated, from behind.

The above embodiments are described by way of example only. Many variations are possible, without departing from the invention. For example, balloon dispensing apparatus could also be incorporated into the above embodiments to provide a self-service balloon vending machine.

Claims

1. Apparatus for dispensing amounts of gas comprising a flow control means for controlling a supply of gas from a gas source, pressure sensing means to determine the pressure of dispensed gas downstream of the flow control means and means for controlling flow of gas in dependence upon pressure sensed.

2. Apparatus according to claim 1 adapted to dispense gas to balloons.

3. Apparatus according to either claim 1 or 2 arranged to dispense gas at a predetermined flow rate until the back pressure generated by the dispensed gas reaches a predetermined level, and then to stop the flow of gas.

4. Apparatus according to either claim 2 or claim 3 when appendant to claim 2, wherein there is provided a nozzle adapted to accommodate the neck, or return valve fitted to the neck, of a balloon and the nozzle includes a sensing means to determine the nature of any material into which the nozzle is inserted.

5. Apparatus according to claim 4; wherein the sensing means is able to determine when the nozzle is inserted into the neck, or non-return valve fitted to the neck, of a balloon.

6. Apparatus according to either claim 4 or 5, wherein the nozzle comprises a means for determining the electrical resistance of any material into which the nozzle is inserted.

7. Apparatus according to any of claims 4 to 6, wherein the pressure sensing means is disposed in a gas flow path through the nozzle.

8. Apparatus according to any preceding claim, wherein there is provided a means for receiving payment.

9. Apparatus according to any preceding claim, wherein there is provided a control means to operate the flow control means.

10. Apparatus according to claim 9 when appendant to claim 8 when appendant to claim 5, wherein the control means is arranged to dispense gas only when payment has been received and the nozzle is inserted into the neck or return valve fitted to the neck of a balloon.

11. Apparatus according to either claim 9 or 10, wherein the control means is arranged such that after activation of the flow control means there is introduced a delay before pressure is monitored by the pressure sensing means.

12. Apparatus according to any of claims 9 to 11, wherein there is provided a timing means to limit the maximum period during which gas may be supplied.

13. A nozzle for dispensing gas comprising a body and a sensing means on the body to determine the nature of any material into which the nozzle is inserted.

14. A nozzle according to claim 13, wherein the sensing means comprises two or more electrodes.

15. A nozzle according to claim 14, wherein the sensing means is able to determine whether the nozzle is inserted into the neck, or non-return valve fitted to the neck, of a balloon.

16. A nozzle according to either claim 14 or 15, wherein the nozzle includes a gas pressure sensor disposed in a gas flow path through the nozzle.

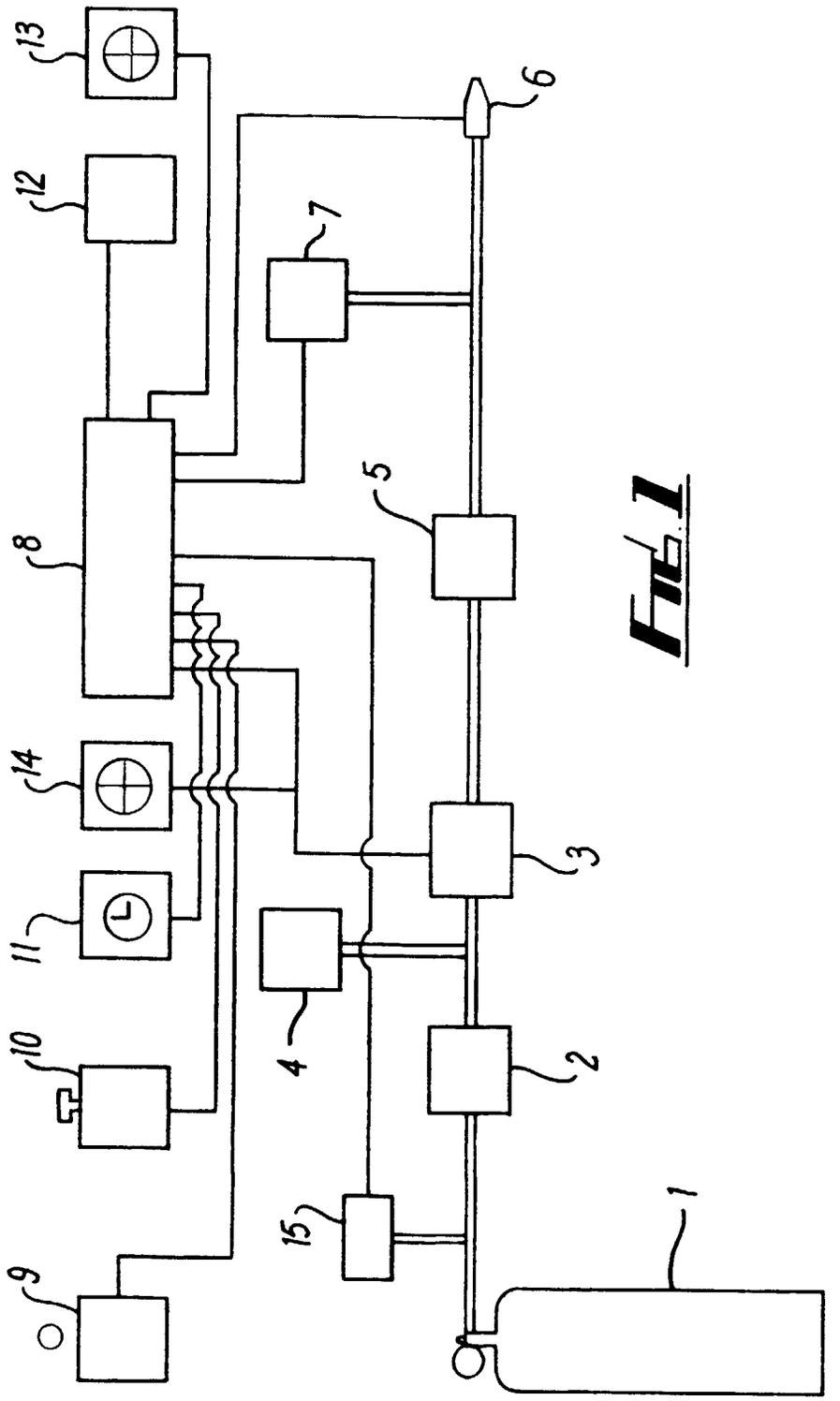
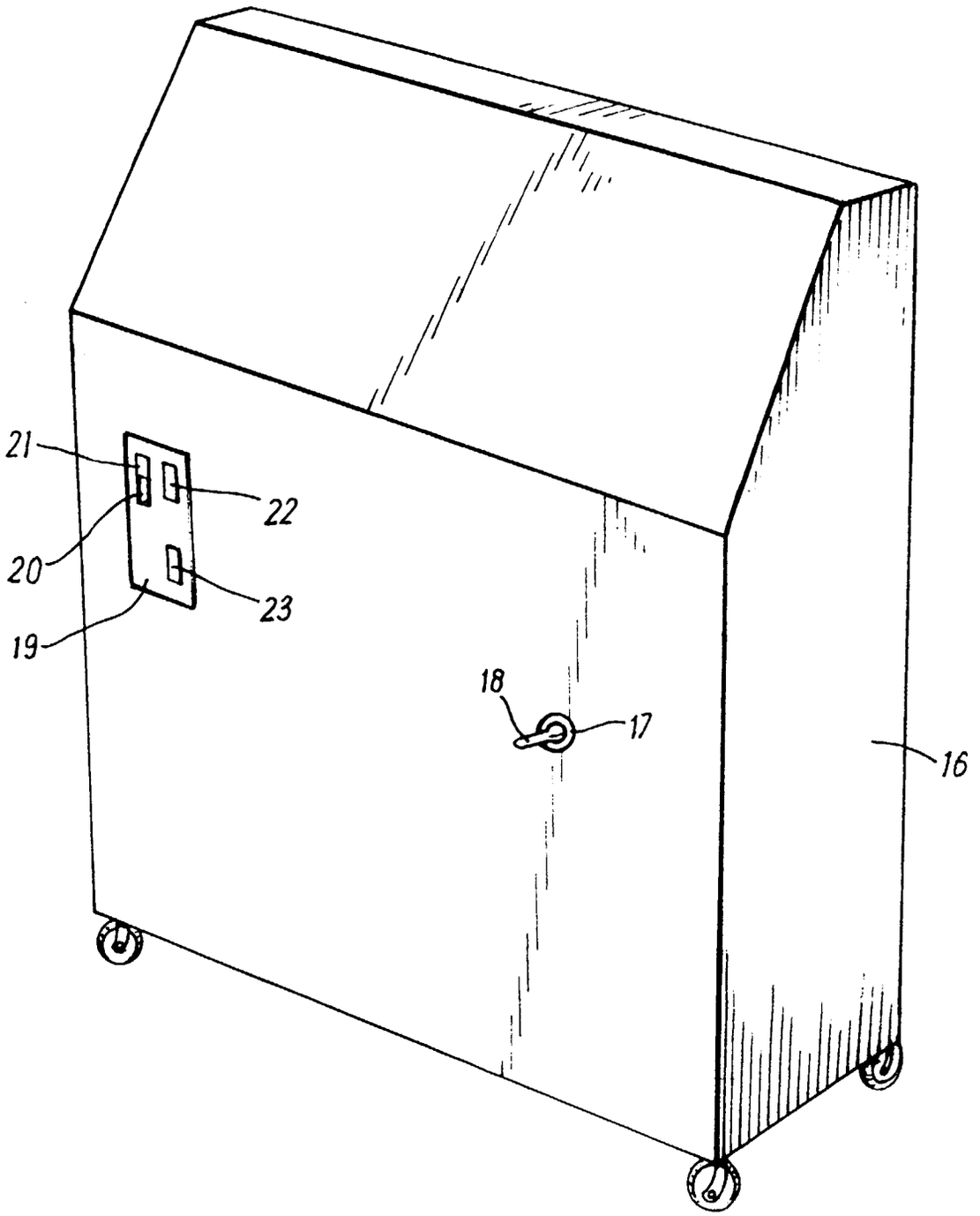


FIG. 1



Фиг. 2

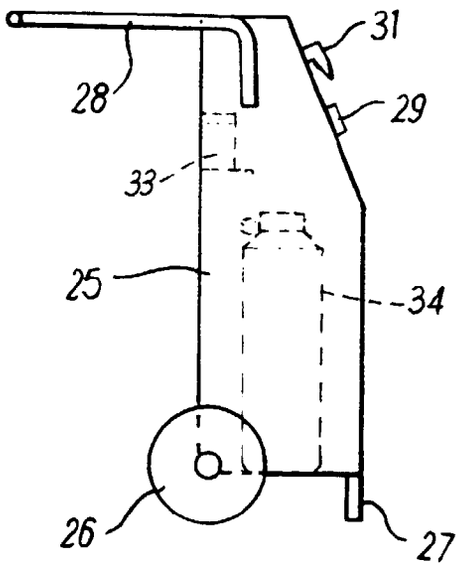


FIG. 3

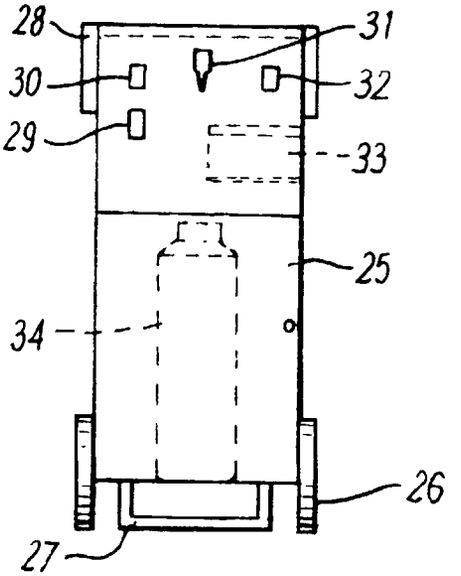


FIG. 4

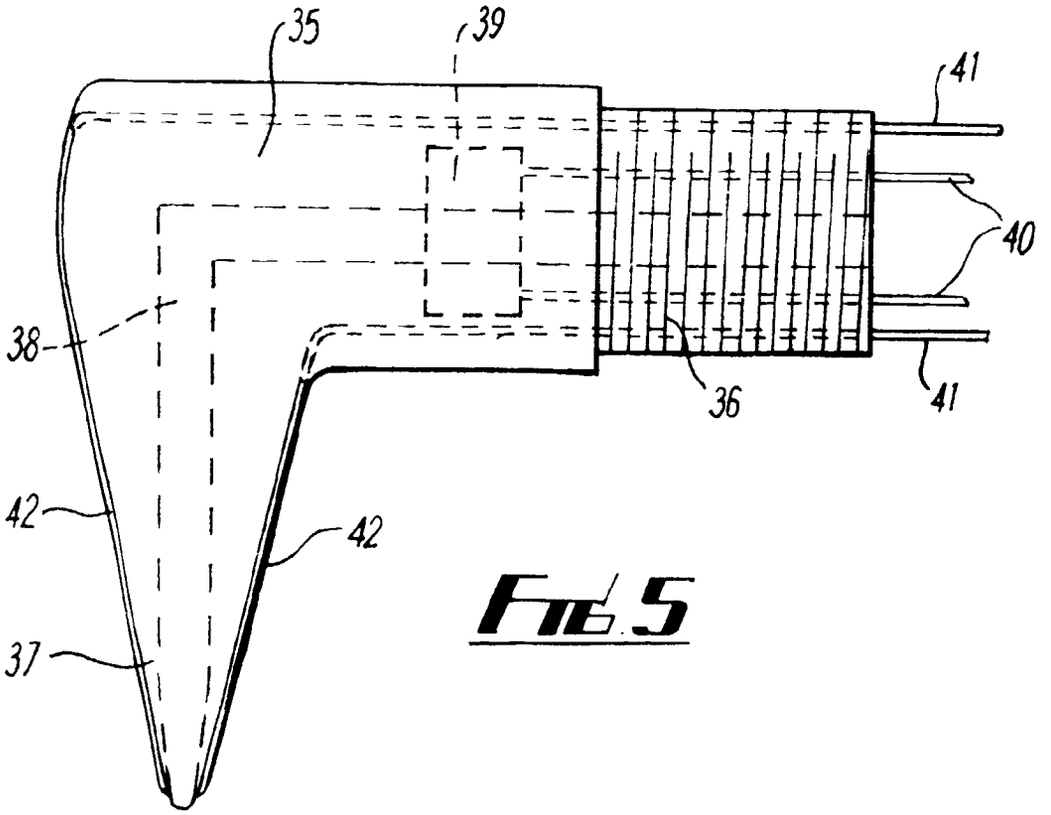


FIG. 5

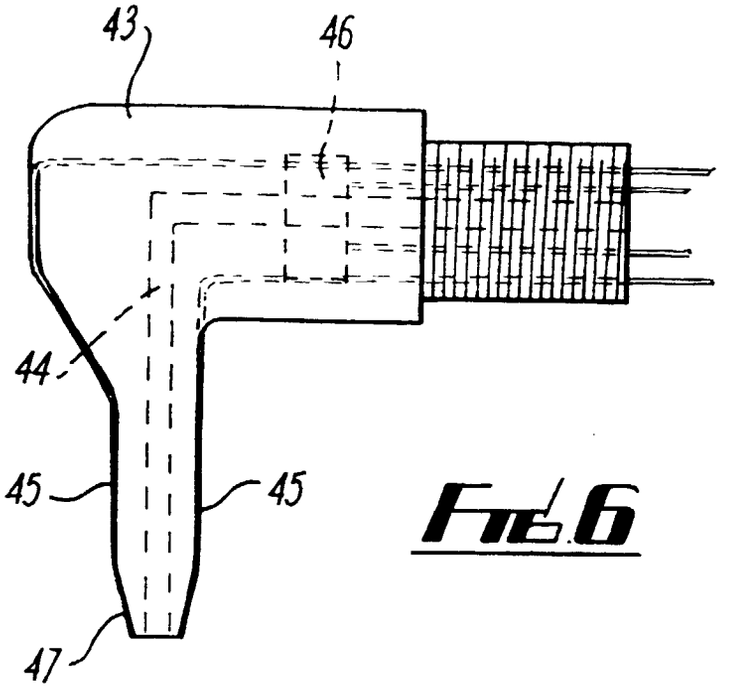


FIG.6

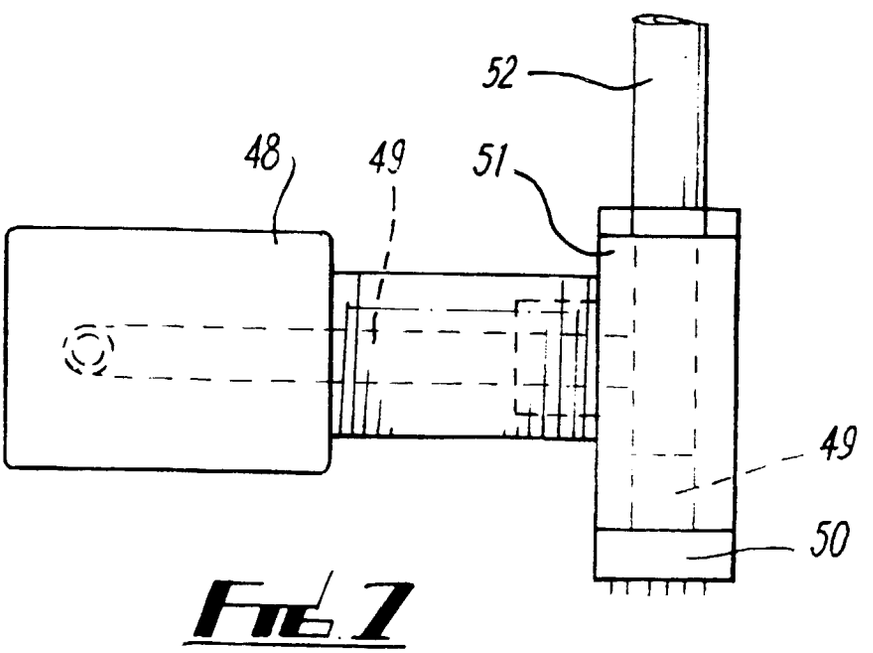
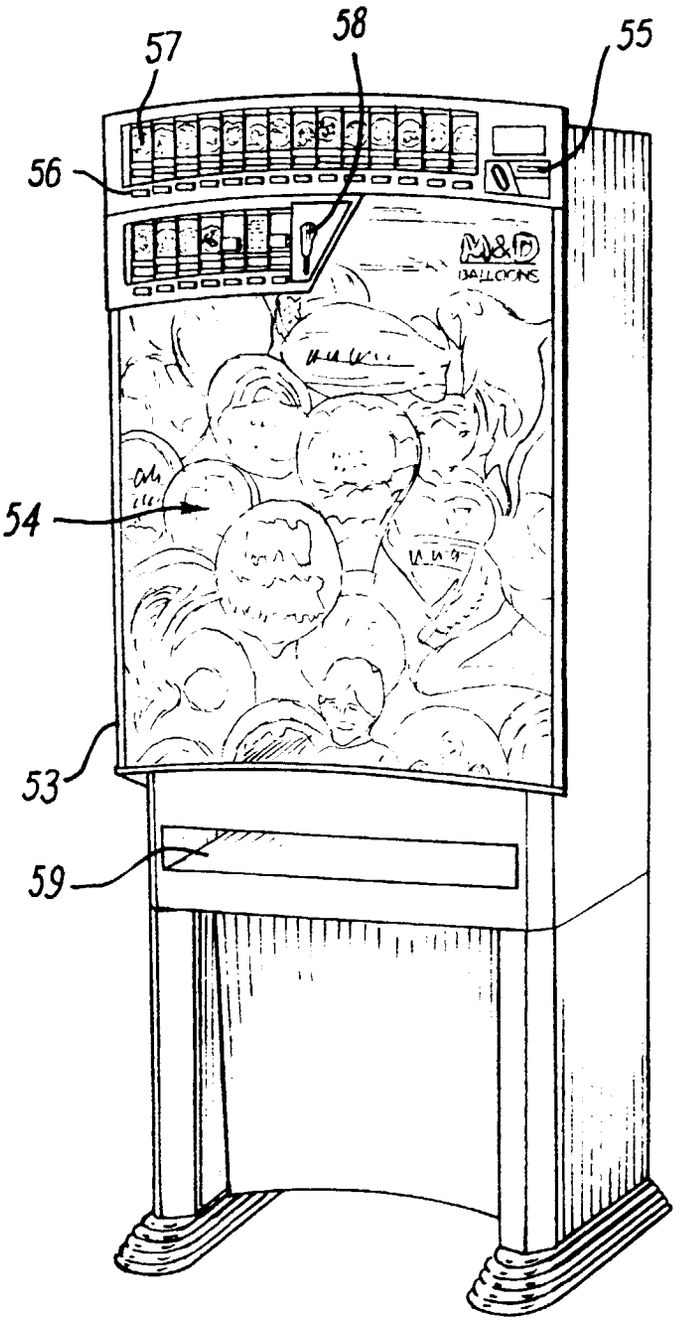


FIG.7



Фиг.8