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(54) Method to deliver a gas with an anti-theft function and relative device

(57) Method to deliver a gas in the form of smoke with an anti-theft function, the method being suitable to deliver quickly a required quantity of vaporised substance having the appearance of smoke (25), the method using as a starting substance a liquid substance (16) contained within first container means (11), the vaporisation of the liquid substance (16) taking place by heat exchange, at least one ignition source (15) being activated upon the signalling that an intrusion has taken place, the ignition source (15) causing the start-up of a reaction or combustion of a combustible/ combustion-supporting mixture (17) positioned within second container means (14), the increase of temperature due to this reaction or combustion causing the transfer of the liquid substance (16) at least to the vicinity of the outer sidewall of the second container means (14) with a resulting transfer of heat and progressive vaporisation of the liquid substance (16), this reaction or combustion of the combustible/ combustion-supporting mixture (17) providing all the thermal energy required for completion of at least one cycle of use of the device (10), this cycle of use ending with the complete exhaustion of the combustible/combustion-supporting mixture (17) and/or of the liquid substance (16).

Device to deliver a gas with an anti-theft function, the device being suitable to deliver quickly a required quantity of a vaporised substance having the appearance of smoke and comprising at least one signalling source connected to activation means (18, 20, 21), the activation means (18, 20, 21) advantageously forming part of a conventional anti-intrusion security system, there being included at least first container means (11) containing in the liquid state the substance (16) to be vaporised and to be delivered in the form of smoke, the vaporisation of the liquid substance (16) taking place by heat exchange, device comprising second container means (14) containing a combustible/combustion-supporting mixture (17) cooperating with an ignition source (15), the second container means (14) cooperating peripherally with means to heat the liquid substance (16) in the vicinity of the outer sidewall of the second container means (14), these heating means cooperating with at least one outlet (24) for the substance in the state of a vapour in the form of smoke (25).

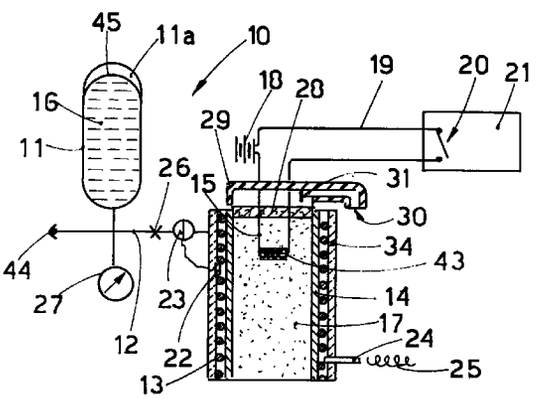

fig.1

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Description

This invention concerns a method and the relative device to deliver a gas with an anti-theft function, as set forth in the respective main claims.

The invention has been conceived for use within premises in a building and has the purpose of delivering quickly a quantity of gas or smoke able to saturate those premises, thus making difficult the vision and movement of persons unlawfully present at that time within those premises.

This delivery of gas or smoke has the purpose also of assisting possible identification, from the outside, of the occurrence of anomalous situations within those premises.

The device to deliver gas according to the invention is, advantageously but not only, connected to the common anti-theft security devices present in dwellings or premises in general and obtains advantageously from those devices the signal for its own activation.

The device according to the invention can also be used on movable means for the carriage of persons and/or goods such as caravans, campers, trailers, motor vehicles, etc.

The state of the art includes the anti-intrusion security devices normally arranged within dwellings, commercial premises, buildings in general or even motor vehicles for the purpose of preventing attempts at thefts.

These security systems are able to provide a wide range of alarm signals of an acoustic and/or visual type both in the immediate vicinity of the premises or motor vehicle subject to the attempt of theft and possibly in premises at a distance, such as a suitably connected police station for instance.

However, it is known that these security systems, when activated, while acting as a deterrent and often forcing an intruder to flee, are not fully satisfactory, particularly in the case of isolated dwellings, of intrusions on special days such as holidays for instance, and of unlikely timeliness of corrective action, etc.

In every case there is always a given interval of time between the moment when the intrusion is detected and the alarm sounds and the moment of the first possible action of the owner, of the police or of any other person appointed for that action.

Moreover, the security systems of the state of the art can be put out of action, for instance by interruption of the electricity supply.

Any security systems additional to the simple acoustic and/or visual alarms should not cause damage within the premises to be protected nor should they cause serious problems in the event of undesired activation by the owner or user of the premises or of the motor vehicle.

The state of the art discloses security systems which employ devices delivering non-toxic gases having the appearance of smoke; these devices are normally activated by the conventional security system of the premises in which they are installed.

These devices to deliver gas (see WO-94/07223 for instance) comprise typically means to generate a vapour having the appearance of smoke, means to distribute this vapour within the premises, starter means generally associated with the conventional anti-intrusion means included in the premises and electricity supply means.

The devices to deliver gas of the state of the art entail a plurality of shortcomings.

First of all, the devices of the state of the art are generally connected to an external supply source, from which they receive the electrical energy for activation and carrying out of the process of delivery of the gas.

This may provide an easy method of disactivation for any intruders and also a greater source of possible breakdowns due to the wear of the components.

Even when the electricity supply source is integrated with the device itself or when buffer systems are included which take action in the event of disactivation of the external source of electricity, this situation entails just the same the addition of a delicate component to the device with the resulting problems in terms of maintenance, power consumption, wear, difficulty of recharging, etc.

The delivery devices of the state of the art are also generally not compact nor easy to handle.

Moreover, they entail a great consumption of electrical energy both in the start-up phase and in the working phase.

The present applicants have designed, tested and embodied this invention to overcome the shortcomings of the state of the art and to achieve further advantages.

This invention is set forth and characterised in the respective main claims, while the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to embody a device for the delivery of gas or smoke with an anti-theft function, the device being able also to be associated with conventional anti-intrusion security systems and providing an effective instrument for the active protection of premises or motor vehicles against possible attempts at theft.

Another purpose of the invention is to provide a device to deliver gas which is simple, very functional and reliable, versatile, economical, capable of being readily recharged after use with a very modest consumption of electrical energy and having very modest dimensions.

Yet another purpose of the invention is to provide a device which requires only a minimum quantity of electrical energy for its initial ignition and is then fully independent from an energy point of view and is only disactivated when its own internal source of supply has been exhausted.

The device to deliver gas according to the invention comprises first container means which contain in the liquid state the substance which, upon activation of the device, is vaporised and is then delivered and distributed in the form of smoke in a desired manner.

According to the invention this device comprises also second container means which contain a mixture consisting of at least one combustible substance and at least one combustion-supporting substance, this mixture being located in cooperation with at least one source of ignition.

These second container means advantageously cooperate peripherally with conduit means positioned in close proximity to their outer sidewall.

These conduit means include at least one inlet associated with the first container means holding the liquid substance to be vaporised and at least one outlet for the delivery and distribution of the vaporised substance.

According to the invention, when an intrusion is notified by a signal, the source of ignition starts the ignition of the combustible/combustion-supporting mixture contained in the second container means, and this ignition causes a combustion reaction within the second container means.

According to the invention, when the reaction has been started, the combustion proceeds independently and feeds itself until the mixture has been completely exhausted.

In this way the combustion process, when started with a minimum contribution of energy, is independent of external supplies and thus cannot be easily disactivated.

Moreover, this combustion process cannot be stopped before complete exhaustion of the combustible/combustion-supporting mixture.

Owing to the increase in temperature and/or pressure resulting from the combustion, the liquid substance is induced to flow within the conduit means, follows a path in direct contact with the outer sidewall of the second container means, is vaporised by heat exchange and emerges from the conduit means in the vaporised state.

According to the invention the second container means holding the combustible/combustion-supporting mixture are associated with cover means which comprise at least filtering means which prevent the emerging of the cinders of the combustion but let the air pass through.

According to the invention these cover means include also sealing means which prevent the entry of humidity into the second container means during inactive conditions.

These sealing means, when determined values of temperature and/or pressure have been reached within the second container means, deteriorate and thus permit free expansion of the air inside the second container means during the combustion process.

According to the invention the first and second container means are separate components at a distance from each other and are connected by conduit means by means of at least one shut-off valve.

According to a variant the first and second container means have reciprocally mating conformations and are associated with each other by the coupling of their shapes and can be detached from each other so as to permit an easy recharging process after use.

According to another variant the first and second container means are provided by dividing into two separate chambers a containing element consisting of one single piece, these separate chambers including at least means for access to enable recharging to be carried out after use.

The attached figures are given as a non-restrictive example and show some preferred embodiments of the invention as follows:-

Fig.1	shows a longitudinal section of a first form of embodiment of the invention;
Fig.2	shows a partial section of a variant of Fig.1;
Fig.3	shows a variant of Fig.2;
Fig.4	shows a variant of Fig.3;
Fig.5	shows means to cool the gas which are associated with the outlet;
Fig.6	shows a variant of Fig.5;
Fig.7	shows a longitudinal section of a second form of embodiment of the invention;
Fig.8	shows a variant of Fig.7;
Fig.9	shows another variant of Fig.7;
Figs.10 and 11	show two further variants of Fig.7.

A device 10 to deliver smoke is shown in Fig.1 in its first preferred form and comprises at least first container means 11 holding a substance 16 in the liquid state to be vaporised.

This substance 16 in the liquid state consists advantageously of glycol to which water is added for the purpose of preventing decomposition and of enhancing the stabilisation of the mixture.

These first container means 11 advantageously include an upper chamber 11a, which is possibly divided by a resilient membrane 45 and which holds air, nitrogen or another inert gas under pressure.

These first container means 11 cooperate with charging valve means 44.

In this case, the first container means 11 are associated by means of a conduit 12 with a coil 13 arranged peripherally in direct contact with the outer sidewall of second container means 14.

A mixture 17 advantageously in the form of a powder, is held within the second container means 14 and consists of at least one combustible substance and at least one combustion-supporting substance.

In a preferred formulation of the invention the combustible substance consists of zinc (60%), whereas the combustion-supporting substance consists of manganese dioxide (40%) or barium chromate, but other like or analogous substances can be used equally well within the scope of the invention.

A source of ignition is inserted into the second container means 14 and consists in this case of a small

resistor 15 associated with a source of electric supply 18.

In this case, the resistor 15 is connected by electric cables 19 to a switch 20, which is normally switched off and is associated with a conventional anti-intrusion security system 21.

According to the invention, when the security system 21 detects the presence of an intruder within the premises where it is installed, the switch 20 is switched on and the source 18 supplies a feed impulse to the resistor 15.

This impulse provides the ignition for start-up of the combustion of the mixture 17 in the second container means 14.

According to a variant, so as to assist this ignition and to make the burning phase secure and more effective, the resistor 15 is associated with means 43 that propagate the flame.

In the example of Fig.1 a temperature measurement means, such as a thermostat 22, is included on the sidewall of the coil 13 and is positioned in immediate proximity to the outer sidewall of the second container means 14.

When a desired temperature threshold is reached, the thermostat 22 sends a signal for the opening of a valve 23 located on the conduit 12, and this valve 23 enables the liquid substance 16 to pass from the first container means 11 to the coil 13.

According to a variant, a choke or a gauging hole 26 is included on the conduit 12 feeding the liquid substance 16 so as to dose as required the quantity of the liquid substance 16 being fed to the coil 13.

The liquid substance 16 is thus caused to flow in close contact with the outer sidewall of the second container means 14, from which the liquid substance 16 obtains heat by heat exchange and changes progressively to the state of a vapour.

The substance 16 in the state of a vapour is thus delivered through an outlet nozzle 24 in the form of a gas having the appearance of smoke 25 and is then distributed as required within the premises or the vehicle in which the device 10 is installed.

According to a variant the first container means 11 are associated at least with a pressure switch 27 which detects anomalous situations.

According to the variant shown in Fig.2 an assembly 49 having the function of a valve is included in cooperation with the sidewall of the coil 13 and in immediate proximity to the sidewall of the second container means 14.

This assembly 49 having the function of a valve comprises within itself at least one element 48 shaped as a disk or a small plate consisting of tin, plastic or another material suitable to be destroyed at high temperatures.

When the combustion reaction within the second container means 14 has been started and the temperature reaches a determined threshold value, the element 48 is destroyed and the liquid substance 16 can flow freely through the valve assembly 49 and then into the coil 13.

In the embodiment of Fig.3 the first container means 11 do not include a separate chamber with air or another gas under pressure, but that air or other gas under pressure is held within third containing means 50.

In this embodiment, when the threshold temperature at which the element 48 is destroyed has been reached, the valve assembly 49 frees the passage for the air under pressure, which through a pipe 51 causes the pneumatic thrust to feed the liquid substance 16 to the coil 13.

In this case, a safety stopper 52, in addition to the gauging hole 26, is included on the feed line from the first container means 11 to the coil 13 and is disactivated by the passage of the fluid under pressure in the step of activation of the delivery device 10.

According to the variant shown in Fig.5, the outlet nozzle 24 cooperates with an element conformed as a Venturi tube 46, by means of which a mixture 47 of the gas in the form of smoke with the outside air is obtained.

This mixture 47 has the purpose of cooling the gas in the form of smoke before its delivery, and thus of preventing condensation of the gas along the distribution pipes.

This embodiment is recommended in particular in the case of distribution of this gas through suitable conveying pipes to a plurality of premises which may even be distanced from each other.

In the embodiment of Fig.6 the invention arranges to use a combustible/combustion-supporting mixture 17, such as sodium-azide for instance, the reaction of which produces a flow of inert combustion gas.

According to the invention these combustion gases are collected and conveyed into the Venturi tube element 46 to cause a further increase of heat contribution and the mechanical conveying of the gas delivered through the outlet nozzle 24.

In the variant of Fig.4 fourth container means 53 are included in direct cooperation with the second container means 14 and hold within them a mixture with is self-igniting at high temperatures and which produces combustion gases as a result of the reaction.

In this case the invention arranges to collect these combustion gases and to convey them towards the first container means 11 and possibly to feed them in required quantities and pressures through the gauging hole 26 so as to use their mechanical force for the purpose of thrusting the liquid substance 16 into the coil 13.

The second container means 14 include at their upper end at least one filter element 28, which has the task of preventing the exit of the combustion residues and at the same time of letting the internal air expand.

The second container means 14 are also associated with closure means such as a stopper 29 (Fig.1); this stopper 29 includes at least one pipe 30 communicating with the exterior so as to permit the passage of air.

According to the invention a closure membrane 31 is included in correspondence with the pipe 30 and, when the delivery device 10 is inactive, prevents the passage of air from the exterior so as to obviate occurrences of humidity in the mixture 17 held within the second container means 14.

This closure membrane 31 has a structure such that it melts, or is destroyed, upon start-up of the combustion because of the increase of the temperature or resulting pressure, thus freeing the pipe 30 and enabling the air to pass through freely.

According to a variant, an outer lining 34 is included on the coil 13 and consists of a thermally insulating material able to reduce heat exchange between the delivery device 10 and the exterior and to prevent damage to the neighbouring component structures.

According to the invention the second container means 14 can be replaced whenever the delivery device 10 has been used.

According to the variants of embodiments in Figs.7 to 10 the first 11 and second 14 container means are integrated into one single container and are associated with each other by the mating of their forms.

For instance, Fig.7 shows a case in which the second container means 14 are positioned directly within the first container means 11, and the coil 13 is embodied directly on the sidewalls of the first container means 11 cooperating with the sidewalls of the second container means 14.

In the embodiment of Fig.8 the second container means 14 are contained within a space provided in the first container means 11 and include a coil 13 in direct contact with the outer sidewalls of the second container means 14; this coil 13 is fed from the liquid solution 16 held in the first container means 11.

In the example of Fig.10 the second container means 14 have a section formed substantially as an overturned "U", which cooperates with the section of the first container means 11 formed substantially as an overturned "T".

In this case, an open aspiration conduit 32, the intake 33 of which is positioned substantially in the proximity of the bottom of the first container means 11, is included in the first container means 11.

The aspiration conduit 32 also includes at least one loop 35 located in direct cooperation with the area of ignition and combustion of the mixture 17.

When ignition takes place, the increase of temperature within the second container means 14 causes vaporisation of the liquid substance 16 held in the first container means 11 in the zone cooperating with the loop 35.

This situation creates a "pumping" effect which thrusts the liquid substance 16 into the inner conduit 32 and progressively into an outer conduit 36 connected to the inner conduit 32.

From the outer conduit 36 the liquid substance 16 arrives into the coil 13, whence it is delivered in the form of a vapour through the outlet nozzle 24 with methods analogous to those described above.

The outer conduit 36 can also act as a level indicator.

The first 11 and second 14 container means can be associated with each other by quick attachment/release systems 37 and can be readily separated from each other by being withdrawn from each other during recharging.

According to the variant of Fig.11 the first 11 and second 14 container means can be provided in one single body by division thereof into two separate chambers.

In this embodiment means to recharge the first container means 11 are provided since the latter in this case are not directly accessible from above.

In this case, the recharging means consist of a tube 38 associated at its upper end with a plug 39, which is advantageously inserted in a seating provided directly in the stopper 39.

Fig.9 shows a further variant of Fig.10 with the use of the same working principle.

In Fig.11 is shown also a protection element 41 associated with the filtering closure membrane 31.

According to a variant an element 42 to deliver an irritating substance is included in cooperation with the outlet nozzle 24 and is activated by the delivery of the vaporised substance.

In the embodiment of Fig.11 the outer conduit 36 is positioned in an appropriate seating within the coil 13, possibly in a protected position and advantageously visible from the exterior, and coupling with insertion from below takes place by means of a quick coupling system 54.

Claims

1. Method to deliver a gas in the form of smoke with an anti-theft function, the method being suitable to deliver quickly a required quantity of vaporised substance having the appearance of smoke (25), the method using as a starting substance a liquid substance (16) contained within first container means (11), the vaporisation of the liquid substance (16) taking place by heat exchange, the method being characterised in that at least one ignition source (15) is activated upon the signalling that an intrusion has taken place, the ignition source (15) causing the start-up of a reaction or combustion of a combustible/combustion-supporting mixture (17) positioned within second container means (14), the increase of temperature due to this reaction or combustion causing the transfer of the liquid substance (16) at least to the vicinity of the outer sidewall of the second container means (14) with a resulting transfer of heat and progressive vaporisation of the liquid substance (16), this reaction or combustion of the combustible/combustion-supporting mixture (17) providing all the thermal energy required for

completion of at least one cycle of use of the device (10), this cycle of use ending with the complete exhaustion of the combustible/combustion-supporting mixture (17) and/or of the liquid substance (16).

2. Method as in Claim 1, in which the attainment of the temperature threshold is detected by thermostat means (22) governing valve means (23) positioned on the line which feeds the liquid substance (16) to the zone in the vicinity of the sidewall of the second container means (14).

3. Method as in Claim 1, in which the attainment of the desired temperature threshold causes directly the opening of a passage positioned on the line which feeds the liquid substance (16) to the zone in the vicinity of the sidewall of the second container means (14), this passage being momentarily closed by means (48) which can be disactivated at high temperatures.

4. Method as in any claim hereinbefore, in which the vaporised substance at the outlet nozzle (24) is mixed with other gases within a Venturi tube assembly (46).

5. Method as in any claim hereinbefore, in which the transfer of the liquid substance (16) to the zone in the vicinity of the sidewall of the second container means (14) is obtained by the mechanical thrust of gases under pressure cooperating at least with the upper part of the first container means (11).

6. Device to deliver a gas with an anti-theft function, the device being suitable to deliver quickly a required quantity of a vaporised substance having the appearance of smoke and comprising at least one signalling source connected to activation means (18, 20, 21), the activation means (18, 20, 21) advantageously forming part of a conventional anti-intrusion security system, there being included at least first container means (11) containing in the liquid state the substance (16) to be vaporised and to be delivered in the form of smoke, the vaporisation of the liquid substance (16) taking place by heat exchange, the device (10) being characterised in that it comprises second container means (14) containing a combustible/combustion-supporting mixture (17) cooperating with an ignition source (15), the second container means (14) cooperating peripherally with means to heat the liquid substance (16) in the vicinity of the outer sidewall of the second container means (14), these heating means cooperating with at least one outlet (24) for the substance in the state of a vapour in the form of smoke (25).

7. Device as in Claim 6, in which the outer sidewall of the second container means (14) cooperates peripherally with means (13) for the forced conveying of the liquid substance (16) to be vaporised.

8. Device as in Claim 6 or 7, in which the second container means (14) cooperate with cover means (29) associated with at least protection and filtering means (28).

9. Device as in any of Claims 6 to 8 inclusive, in which the cover means (29) comprise a pipe (30) for the passage of air which is momentarily closed by closure membrane means (31) that can be disactivated at high temperatures.

10. Device as in any of Claims 6 to 9 inclusive, in which the source of ignition (15) comprises at least one electrical resistor having a modest absorption and momentarily fed, during the ignition step, by an outer supply source (18).

11. Device as in Claim 10, in which the electrical resistor is associated with means (43) that propagate and enhance the flame.

12. Device as in any of Claims 6 to 11 inclusive, in which at least the outer sidewall of the second container means (14) is associated with temperature detection means (22), which govern the opening of the valve means (23) positioned on the line (12) which feeds the liquid substance (16) to the forced-conveying coil means (13).

13. Device as in any of Claims 6 to 11 inclusive, in which at least the outer sidewall of the second container means (14) is associated with valve means (49) comprising at least means (48) positioned on the feed line (12) for the momentary interruption of the feed of the liquid substance (16) to the forced-conveying coil means (13).

14. Device as in any of Claims 6 to 13 inclusive, in which the first (11) and second (14) container means are separate elements distanced from each other.

15. Device as in any of Claims 6 to 13 inclusive, in which the first (11) and second (14) container means are separate elements associated together by coupling of their mating forms.

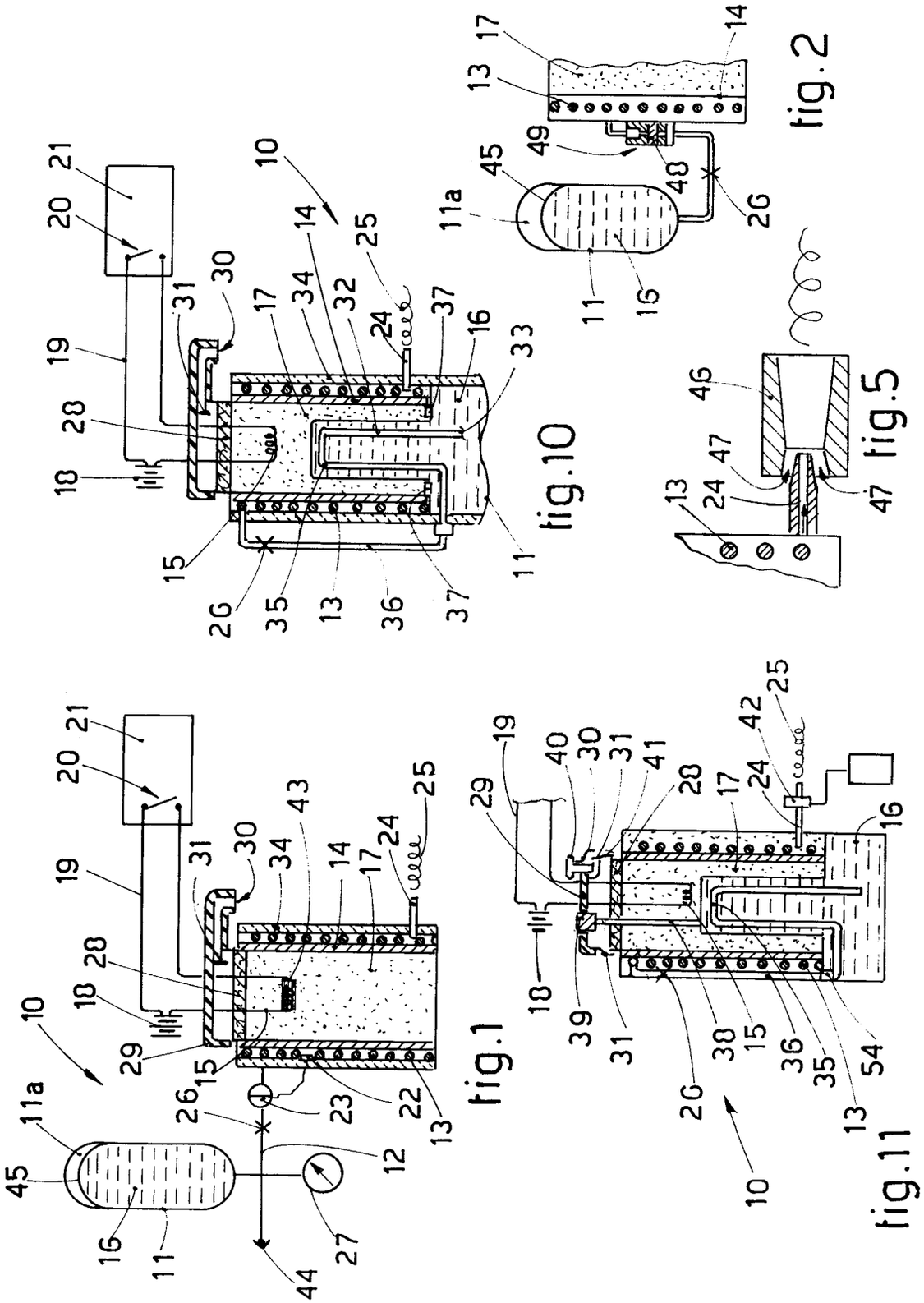
16. Device as in any of Claims 6 to 13 inclusive, in which the first (11) and second (14) container means are provided integrally from one single piece.

17. Device as in Claim 15 or 16, in which the first container means (11) are associated with aspiration conduit means (32) having at least one first end within the first container means (11) and a second

end communicating with the forced-conveying coil means (13).

18. Device as in any of Claims 6 to 17 inclusive, in which the outlet nozzle (24) of the forced-conveying coil means (13) is associated with mixing and cooling means in the form of a Venturi tube (46).

19. Device as in any of Claims 6 to 18 inclusive, in which the outlet nozzle (24) of the forced-conveying coil means (13) is associated with means (42) that deliver irritating substances.



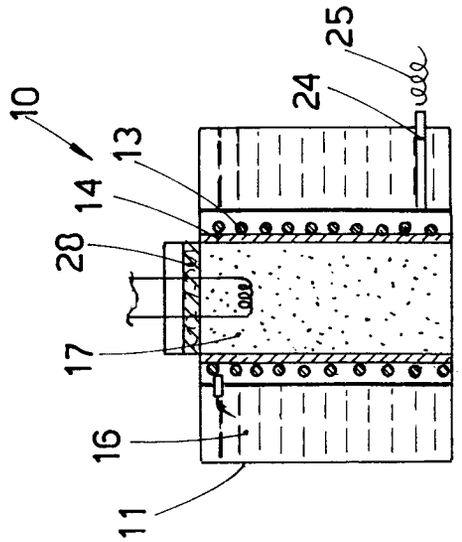


fig.8

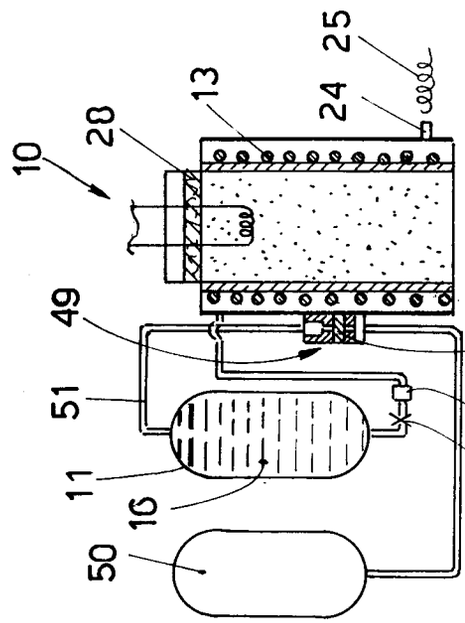


fig.3

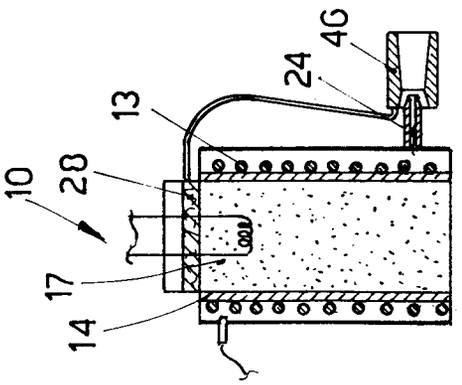


fig.6

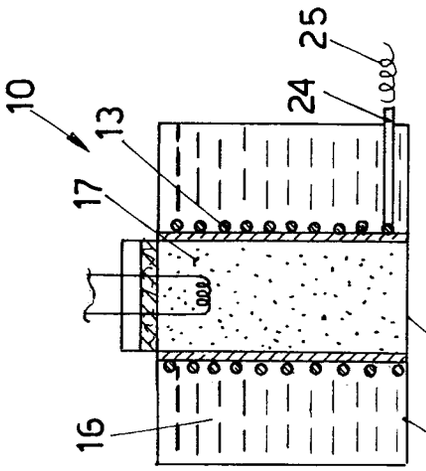


fig.7

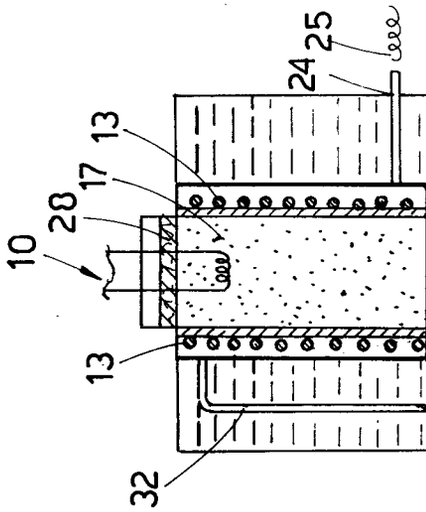


fig.9

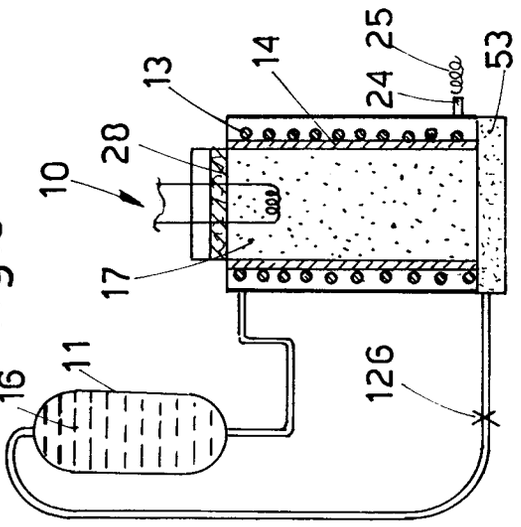


fig.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 1057

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	GB-A-2 270 396 (DARDS PAUL ANTON) 9 March 1994 * the whole document *	1,2,6	G08B15/02
A		3-5,7-19	

Y	US-A-4 818 843 (SWIATOSZ EDMUND) 4 April 1989 * the whole document *	1,2,6	
A		3-5,7-19	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

G08B
F41H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 May 1996	Crechet, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)