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(72) Inventor: **Dabrowski, Jaroslaw**
86-061 Brzoza (PL)

(74) Representative: **Wojcieszko, Jerzy**
Kancelaria Patentowa Patent-Partner
Jerzy Wojcieszko
ul. B. Ruminskiego 6
P. Box 62
85-001 Bydgoszcz 1 (PL)

(71) Applicant: **PLANIKA Sp. z o.o.**
86061 Brzoza (PL)

(54) **System of automatic feeding of furnaces with liquid fuel**

(57) The subject matter of the invention is the system of automatic of furnaces (1) feeding with liquid fuel (2) for a household heating device, in particular a fireplace (8), characterized according to important features in that in the power system a control system (3) has been applied, which is connected with the fuel quality sensor (12) installed in the fuel pipe (13) of the fuel system before

the inflow to the solenoid valve (14), whereby the power system includes an additional safety sensor (15) installed in the hearth (1) above the first degree safety sensor (16), which is connected only with the protective circuit (17) incorporated into the feeding system (18) of the control circuit (3), where the protective circuit (17) is connected with the main power switch (9).

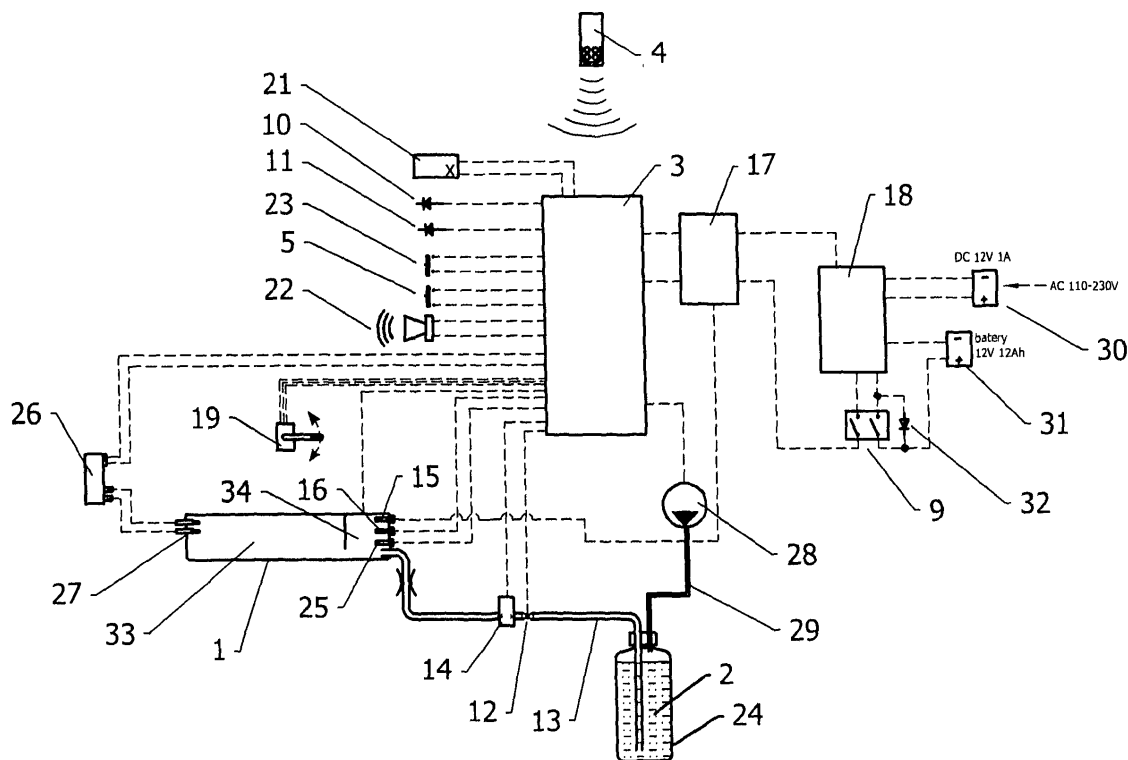


Fig. 1

Description

[0001] The present invention relates to the system of automatic feeding of furnaces or hearth with liquid fuel different types of liquid fuel to the hearth in household heating appliances, in particular fireplaces with or without chimney ducts, featuring characteristic scheme of power, fuel, and air connections and the method of operation.

[0002] Liquid fuel feeding systems for fireplaces are known in Poland from application P 369839 and additional applications thereto P 375121 and P 376361. The feeding system presented in these applications contains a power system, a fuel system and an air system, in which the remote-control-operated power system enables lighting and extinguishing fuel in the hearth as well monitoring the level of fuel in the hearth with the use of the fuel level sensor installed therein connected to the fuel system feeding the hearth with liquid fuel from the detachable fuel tank via the solenoid valve in the fuel pipe, and the installed air system is used to generate appropriate pressure in order to supply liquid fuel to the hearth. The power system also includes the safety sensor installed in the hearth, which is connected with the fuse included in the power feeding system of the power pump supplying liquid fuel to the hearth.

[0003] The aim of this invention is to improve the system of automatic hearth feeding with liquid fuel known from the patent applications mentioned in the current state of the art, which shall additionally increase safety of use, making the feeding system fully safe for the user, as well as rendering it impossible to use inappropriate liquid fuel, while also allowing feeding in case of voltage decay, and introducing a possibility of additional remote-control adjustment of the height of flame as well as additional signalling of the system's operating conditions, thus achieving a new method of operation of the system of automatic feeding with liquid fuel in household heating appliances.

[0004] The goal presented in the subject matter of the invention was accomplished in such a manner that the improved system of automatic feeding of the hearth with liquid fuel in household heating appliances, especially fireplaces with or without chimney ducts, including the power system, the fuel system, and the air system, is characterized in its crucial features by the fact that a power control circuit was applied in the power system, and connected with a traffic sensor and a fuel quality sensor installed in the fuel system in its fuel pipe before the solenoid valve, whereby the power system comprises an additional safety sensor installed in the hearth over the first degree safety sensor, which is connected only with the protective circuit inserted in the feeding circuit of the control circuit, whereby the protective circuit is connected with the main power switch.

[0005] An important feature of the feeding system solution is also the structure of the hearth, in which the combustion chamber is connected with the separated sensor chamber with an installed fuel level sensor, a first

degree safety sensor and an additional safety sensor, whereby the fuel inlet is located in the sensor chamber, and from the top it is closed with a cover with ventilating holes, which also has a formed screen in the part adjoining the combustion chamber and slantwise shaped bottom, while the combustion chamber includes in its upper part a sliding screen operating in connection with a servo-mechanism, which allows smooth regulation of the flame.

[0006] The next important feature is constituted by the fact that in the power system the feeding circuit is also connected with the servo-mechanism for sliding of the hearth screen, with the traffic sensor and micro-loud-speaker for acoustic signalling of the system's operating conditions, as well as with a reset button for turning on after installing a new fuel holder, a button for turning the system into operation mode, and elements visually indicating the operating conditions, which are installed in the control panel located in the fireplace.

[0007] Moreover, the fact that in the power system the feeding circuit constitutes a system of buffer feeding, which is connected with the main power switch, detachable low-voltage feeder and a battery in the circuit of which a blocking diode is installed, constitutes yet another important feature of this system.

[0008] As far as the method of operation is concerned, the functioning of the system of automatic hearth feeding with liquid fuel is characterized mainly by the fact that by means of the signal produced by the remote control or the button on the control panel the control circuit is actuated which starts the air pump generating excess pressure in the fuel holder, and opens the solenoid valve feeding the hearth with liquid fuel, whereby at the same time in the operating mode the fuel quality sensor that monitors the flowing fuel comes on, the fuel level sensors in the hearth and safety sensors also come on, and after the hearth is filled with liquid fuel, the spark-gap generator comes on automatically resulting in the flashover between permanent magnet machine electrodes, also the servomechanism of screen sliding in the hearth and the diodes indicating the working conditions of the system come on.

[0009] An important feature of the method of operation is also the fact that in the control circuit the stand-by mode turns on automatically, which without any interference from the user causes turning on of information functions related to the working condition of the feeding system.

[0010] A crucial feature of the method of operation of the system is the fact that in case of failure of the first degree protective sensor, an additional safety sensor shall be actuated, being continuously in the working mode, after turning on of the main feeding, resulting in autonomous isolation of the feeding circuit and therefore turning off the operating mode of the system. Permanent setting of the additional protection sensor in the operating mode, ever since turning on the main power switch, aims also at protection against attempts by the user to add liquid fuel manually to the hearth.

[0011] Favourable results that have been achieved in

this new system of automatic feeding with liquid fuel are most of all obtaining full safety of the user and ensuring continuity of operation of the device fed with liquid fuel, together with visual and sound information on working conditions, as well as obtaining the possibility of smooth adjustment of the height of flame in the hearth. The new system also eliminates emergencies that may occur when using fuel of inadequate quality, which is absolutely vital, for example, in fireplaces without chimney ducts. Application of an additional sensor chamber in the hearth, where the fuel level sensor and two safety sensors as well as the liquid fuel inlet were installed, renders access to sensors impossible for unauthorized persons, also, the flame from the combustion chamber is not allowed in, which increases the reliability of sensors operation and extends their life time. The fuel inflow located in the sensor chamber in the direct proximity of sensors and its askew shaped bottom ensures also smaller inertia of their operation and decreases the hysteresis of fuel level in both the chambers, which in turn ensures quicker reaction of sensors.

[0012] The application of the internal battery power supply allows for uninterrupted operation of the device for a few days without necessity of connecting to any external current generator, while the battery charging system enables charging of the battery in the course of operation as well as when the system is turned off.

[0013] Also a very important advantageous feature of the system, as far as the safety of operation of the system is concerned, is the introduction of an additional protective system with an additional safety sensor located in the sensor chamber above the first degree safety sensor. This system, incorporated into the supply line, and connected neither with the control circuit nor with any other element of the feeding system, is free from possible influences on its operation by the said elements, and is reliable as it bases exclusively on the said additional sensor and a fusible cut-out.

[0014] A further advantageous feature of the system is the protection of the device against the situations of inadvertent stirring or attempts to move the device in the course of its operation. This is ensured by the traffic sensor. The protection is also effective when using the device on the seismically active areas, in which case the sensor switches the system off when vibrations exceed the set amplitude, and thus preventing operation in hazardous conditions.

[0015] The subject matter of the invention, is shown in the drawing as an example model, where Fig. 1 presents a schematic diagram of the automatic hearth feeding system in a household fireplace without a chimney duct; Fig. 2 shows a sketch of the front view of a household fireplace with indication of the control panel installed on its front plate; Fig. 3 shows a control panel, Fig. 4 shows the perspective view of the hearth with visualization of the sliding screen cut out above the sensor chamber; Fig. 5 shows a perspective view of the hearth without the screen with visualization of the cover of the sensor chamber; Fig. 6

to Fig. 8 shows in a diagrammatic and perspective view the 3 phases of the sliding screen over the hearth .

[0016] The schematic diagram in Fig. 1 presenting the automatic furnace or hearth 1 feeding system with liquid fuel 2 includes the control circuit 3 actuated with the remote control 4 or the button 5 installed in the control panel 6 on the front plate 7 of the household fireplace 8 presented in Fig.2 and Fig. 3. Prior to turning on the control circuit 3, it is necessary to turn on the main power switch 9, which actuates the first indicating diode 10, which in turn informs that the system has been switched on and that it is ready to light up the fireplace 8. Turning on of the control circuit 3 and that the system is in operating mode are signalled by switching on of the second indicating diode 11 also installed on the control panel 6.

[0017] The system presented in Fig. 1 in its important features is characterized by the fact that the control circuit 3 is connected with the quality sensor 12 of liquid fuel 2 installed in the fuel pipe 13 before the inflow to the electrovalve 14. The quality sensor 12, made by Remtor, Poland, checks conductivity of liquid fuel 2 if conductivity value of liquid fuel 2 has predefined value it is assumed that the fuel can be fed to the furnace or hearth 1 of the fireplace. The electric system of the system comprises an additional safety sensor 15 installed in the hearth 1 above the first degree safety sensor 16, which is connected only with the protective circuit 17 incorporated into the supply circuit 18 of the control circuit 3, whereby the protective circuit 17 is connected with the main power switch 9. The control circuit 3 is also connected with the servo-mechanism 19 for the slide of the screen 20 of the hearth 1, with the traffic sensor 21 and with the micro loud-speaker 22 for acoustic signalling the of the working conditions of the device, as well as with the reset button 23 for turning on after installation of a new fuel tank 24, and with the button 5 for switching the system into the operating mode, which are installed on the control panel 6 of the household fireplace 8. The control circuit 3 is also electrically connected with the fuel level sensor 25, with spark-gap generator 26, which is further connected with the electrodes of the permanent magnet machine 27 installed in the hearth, and with an electric air pump 28, that via the air duct 29 supplies air to the fuel tank 24 in order to generate pressure inside, which results in the flow of liquid fuel 2 to the hearth 1. In the presented system the supply circuit 18 constitutes the buffer feeding system, which is connected with the main power switch 9, with low-voltage feeder 30 and a battery 31, into the circuit of which a blocking diode 32 is also incorporated, which enables the passage of current only in one direction during the process of battery charging 31 from the supply circuit 18.

[0018] Fig. 4 and Fig. 5 present the hearth 1 with the structure in which the combustion chamber 33 comprises, in the upper part, a sliding screen 20, functioning in connection with the servo-mechanism 19, which allows flame adjustment in a continuous manner. The combustion chamber 33 is connected with a separated sensor

chamber 34, with the possibility of fuel flow, with the fuel level sensor 25 installed inside, with the first degree safety sensor 16, and an additional safety sensor 15, where the fuel inlet 35 is located in the sensor chamber 34, which is closed from the top with a cover 36 with ventilating holes 37, which also consists of a formed screen 38 in the part adjoining the combustion chamber 33 and an askew shaped bottom 341.

[0019] The automatic feeding system presented in Fig. 1 is, as far as the method of operating conditions are concerned, characterized by the fact that by the signal generated from the remote control 4 or the button 5, the control circuit 3 activates the power air pump 28 generating positive gauge pressure in the fuel tank 24 and opens the solenoid valve 14 feeding the hearth 1 with liquid fuel 2, whereby at the same time in the operating conditions the fuel quality sensor 12 turns on, which monitors the flowing liquid fuel 2 and then the following come on: fuel level sensor 25 in the hearth 1 and the first degree safety sensor 16, while the additional safety sensor 15 is turned on at the moment when the main power switch 9 is turned on. After filling in of the hearth 1 with liquid fuel 2, the spark-gap generator 26 turns on automatically resulting in the spark-over between the permanent magnet machine 27 electrodes, also switched on are the servo-mechanism 19 of the screen slide 20 in the hearth 1, diodes 10 and 11 signalling the operating mode of the system, as well as the acoustic signal.

[0020] Another important feature of the method of operation is the fact that in the control circuit 3 the standby mode turns on automatically during operation, which without interference from the user actuates the information functions on the conditions of the feeding system operation. An essential feature of the method of operation in the system is also the fact that in case of a break-down of the fuel level sensor 25 or the first degree protection sensor 16, an additional safety sensor 15 turns on, resulting in an automatic isolation of the supply circuit 18 and as a result of this - turning off of the operating mode of the system.

[0021] The functioning of the automatic hearth feeding system 1 with liquid fuel 2 enables the fireplace 8 to burn, ensuring at the same time almost 100% safety of use, maintaining constant level of fuel 2 in the hearth 1 in the course of operation. This function is accomplished thanks to the previously described system, where a control circuit 3 has been used, and sensors connected with it: fuel quality sensor 12, first degree safety sensor 15, traffic sensor 21 and fuel level sensor 25, as well as an additional protective circuit 17, connected with an additional safety sensor 15. The presented system is additionally equipped with an internal feeding source - a battery 31, ensuring the possibility of continuous work for the period of several days and possibility of charging; the fireplace 8 may be operating in the course of the charging processes. The first indicating diode 10 lights up after the switching on the main power switch 9. It informs of the readiness of the system to operate (firing up the fireplace

8). The system may be turned on with the use of the remote control 4 or the button 5 installed on the control panel 6 of the fireplace 8. Turning on of the system is signalled by lightning up of the second indicating diode 11. After turning on of the system, the control circuit 3 activates the power air pump 28 generating positive gauge pressure in the fuel tank 24, forcing the flow of fuel 2 via the fuel pipe 13 to the hearth 1, and at the same time the solenoid valve 14 is opened. The fuel quality sensor 12, which continuously monitors the flowing liquid fuel 2 determining its suitability for use in the feeding system, is also turned into the operating mode. In case of detection of incorrect liquid fuel 2 or lack of fuel, the sensor sends this information to the control circuit 3, which activates an appropriate signal regarding diodes 10 and 11, informing the user on incorrect liquid fuel 2 or lack of fuel in the fuel tank 24. At the same time the servo-mechanism 19 is actuated sliding the screen 20 of the hearth 1 into the fully open position, as shown in Fig. 6. In the course of filling the hearth 1 with liquid fuel 2, the fuel level sensor 25 located in the hearth 1 checks the level of fuel and sends appropriate information to the control circuit 3. Also the first degree safety sensor 15 sends an appropriate signal to the control circuit 3 in case of exceeding of the level of liquid fuel 2 in the hearth 1. The additional safety sensor 14 is permanently turned into the operating mode immediately after turning on of the system, and it is not connected with the control circuit 3, which ensures the highest level of operational reliability. This sensor shall be actuated only in a situation when the level of fuel 2 in the hearth 1 is exceeded above the allowed one and the first degree safety sensor 15 fails to correct it.

[0022] After the appropriate level of fuel 2 is reached in the hearth 1, the fuel level sensor 25 sends a signal to the control circuit 3, which turns off the subassemblies responsible for filling in the hearth 1. It closes the solenoid valve 14 and activates the sequence of generating spark from the spark generator 26 to permanent magnet machine's electrodes 27. This spark sparking over between the electrodes of the permanent magnet machine 27 on the level of the contact of fuel 1 with electrodes of the permanent magnet machine 27 and lights up the liquid fuel 2. After completion of the spark feeding sequence, the fireplace 8 works independently, and the control circuit 3 monitors in a continuous manner the level of fuel 2 in the hearth 1, regularly adding fuel so as to keep the adjusted level. After approximately 8 minutes from turning on the fireplace 8, the control circuit 3 activates the servo-mechanism 19 that closes the screen 20 of the hearth 1 to the initial position, as shown in Fig. 6. Independent operation of the fireplace 8 continues up to the moment when it is turned off by the user or the liquid fuel 2 runs out in the fuel tank 24, or else until a situation which the system interprets as dangerous. If liquid fuel 2 runs out in the fuel tank 24, the fireplace 8 turns off and the lack of liquid fuel 2 shall be indicated by pulsation of one of the diodes, 10 or 11. In order to turn on the fireplace

8 again, a new fuel tank 24 has to be installed, and then the reset button 23 should be pressed, which shall result in the change of the diode's 10 lighting from pulsation into a constant lighting.

[0023] Turning off the fireplace 8 is possible by means the remote control 4 or the button 5. After turning off, the control circuit 3 switches off all the subassemblies and keeps the fireplace 1 open, to allow the remaining liquid fuel 2 to burn out. This is signalled by lighting of only a single diode 10. After approximately 8 minutes from turning off, the hearth 1 is completely closed with the screen 20, as shown in Fig. 8 (Fig. 7 shows sliding screen 20 in indirect position).

[0024] The feeding system of household heating devices to be used with a fireplace without a chimney duct presented in the example incorporating important features of the invention does not exhaust all the possible variations of its embodiments.

[0025] This detailed description of one of the examples of use should not be interpreted as limiting its inventive idea. For experts in the field, to which this invention belongs, it is obvious, that it may be subject to many modifications that shall not be too far-off from the important features of the invention and shall not be detrimental to the technical, use and economical effects achieved by it.

Claims

1. The system of automatic feeding of furnaces (1) with liquid fuel (2) of a household heating device, especially for a fireplace (8), including a power system, fuel system and air system, in which the power system is remote controlled (4) enables ignition and putting out of liquid fuel (2) in the furnaces (1), as well as monitoring the level of liquid fuel (2) in the furnaces (1) with the use of an installed sensor of liquid fuel (25) level, in tandem with the fuel system feeding the furnaces (1) with liquid fuel (2) from the removable fuel tank (24) via the solenoid valve (14) in the fuel pipe (13), whereby the installed air system is used for generating of appropriate pressure in order to supply liquid fuel (2) to the furnaces (1) **characterized in that** in the power system the control circuit (3) has been applied, which is connected with the fuel quality sensor (12) installed in the fuel pipe (13) of the fuel system before the inflow to the solenoid valve (14), and the power system includes an additional safety sensor (15) installed in the furnaces (1) above the first degree safety sensor (16), which is connected solely with the protective circuit (17) embodied in the supply circuit (18) of the control circuit (3), and the protective circuit (17) is connected with the main power switch (9).
2. The system according to claim 1, **characterized in that** the combustion chamber (33) in the furnaces (1) is connected with a separated sensor chamber

(34) with the fuel level sensor (25), the first degree safety sensor (16), and an additional safety sensor (15) installed in it, and the fuel inlet (35) located in the sensor chamber (34), and from the top it is closed with a cover (36) with ventilating holes (37), which also has, in the part adjacent to the combustion chamber (33), a formed screen (38), and an askew shaped bottom (20) operating in connection with the servo-mechanism (19).

3. The system according to claim 1, **characterized in that** the control circuit (3) in the power system is also connected with the servo-mechanism (19) for sliding of the hearth (1) screen (20) with a motion sensor (21) as well as with a micro-loudspeaker (22), and the reset button (23), and the button (5) for turning the system into the operating mode, which are installed in the control panel (6) of the fireplace (8).
4. The system according to claim 1, **characterized in that** in the power system the feeding circuit (18) constitutes a system of buffer feeding, which is connected with the main power switch (9), low-voltage feeder (30) and a battery (31) into the circuit of which a blocking diode (32) is incorporated.
5. The method of operation of the automatic system, **characterized in that** the generated signal switches on the control circuit (3), which turns on the power air pump (28) generating positive gauge pressure in the fuel tank (24) and opens the electro-valve (14) feeding the furnaces (1) with liquid fuel (2), and simultaneously in the operating mode the fuel quality sensor (12) comes on, which monitors the flowing liquid fuel (2), and then the fuel level sensors (25) in the furnaces (1), and the safety sensors (15, 16) come on, upon filling of the furnaces (1) with liquid fuel, (2), the spark generator (26) comes on automatically generating a spark between the electrodes of the permanent magnet machine (27), and the servo-mechanism (19) of the screen (20) sliding in the furnaces (1) plus the diodes indicating (10, 11) that the system is in working mode also come on.
6. The method of operation according to claim 1, **characterized in that** in the control circuit (3) the standby mode turns on automatically when at work, which without any interference from the user turns on the information functions concerning the working conditions of the feeding system.
7. The method of operation according to claim 1, **characterized in that** in case of a failure of the first degree protection sensor (16), an additional safety sensor (15) comes on, resulting in an automatic isolation of the feeding circuit (18) and due to this turning off of the system operation mode.

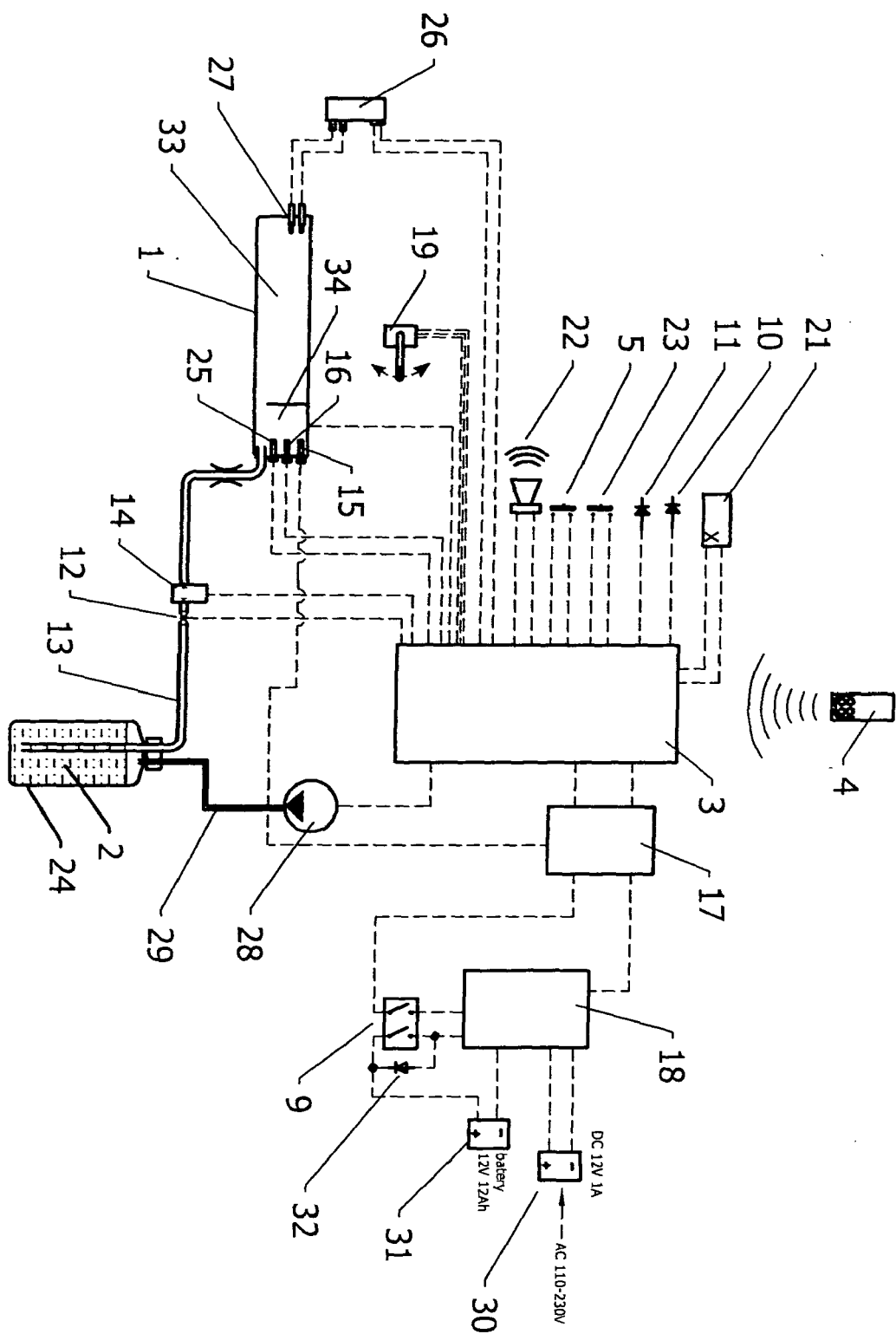


Fig. 1

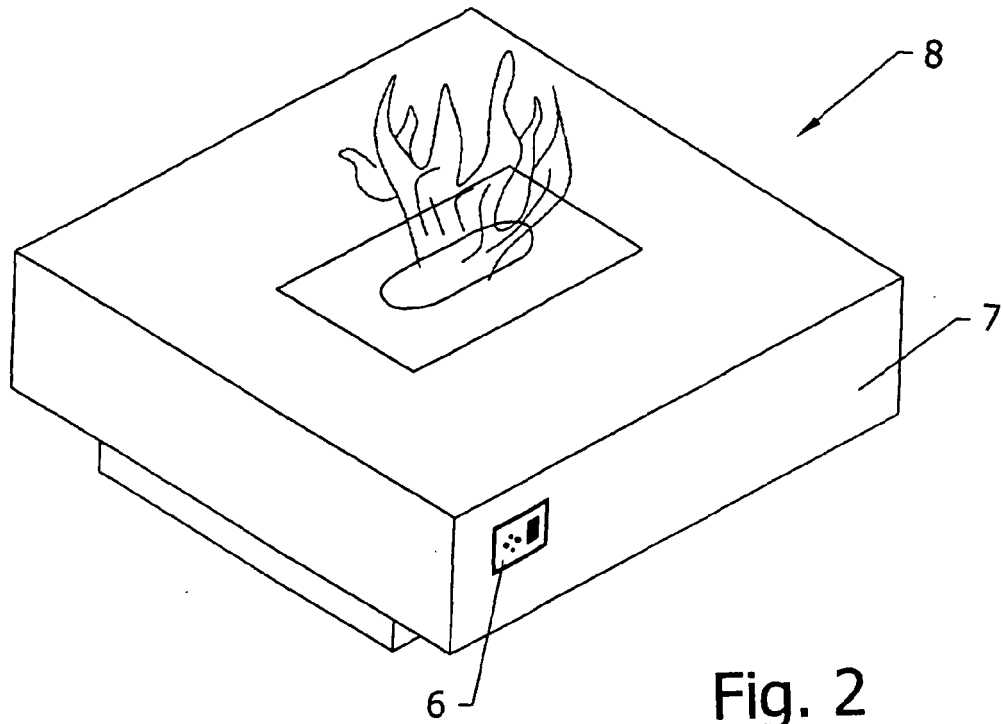


Fig. 2

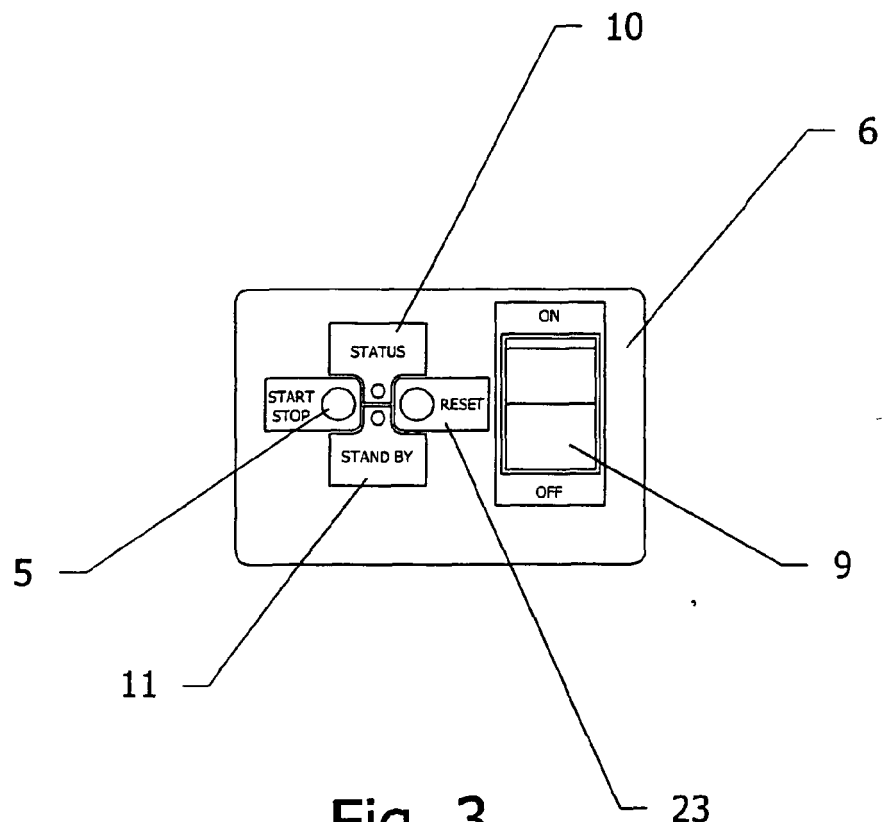


Fig. 3

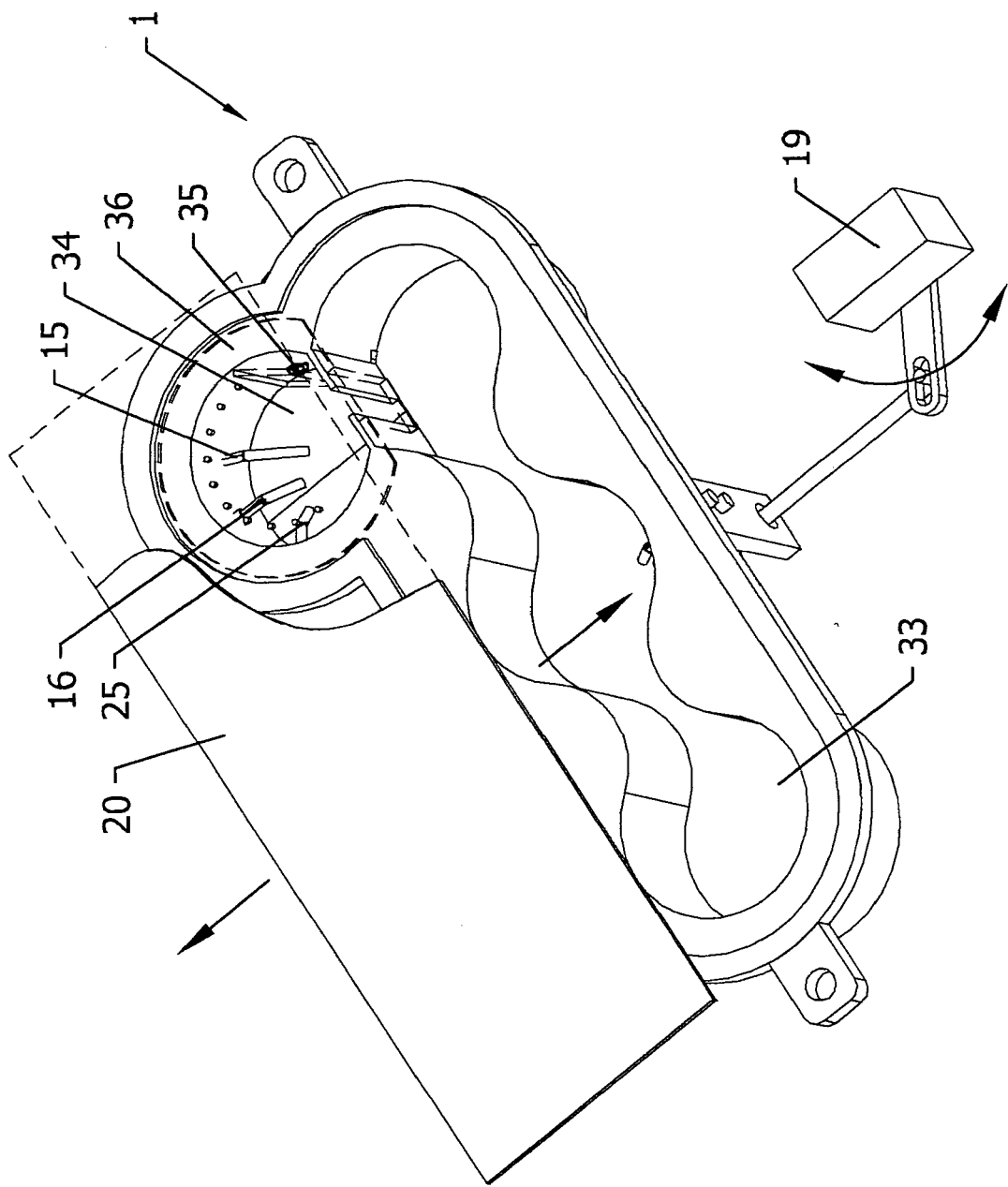


Fig. 4

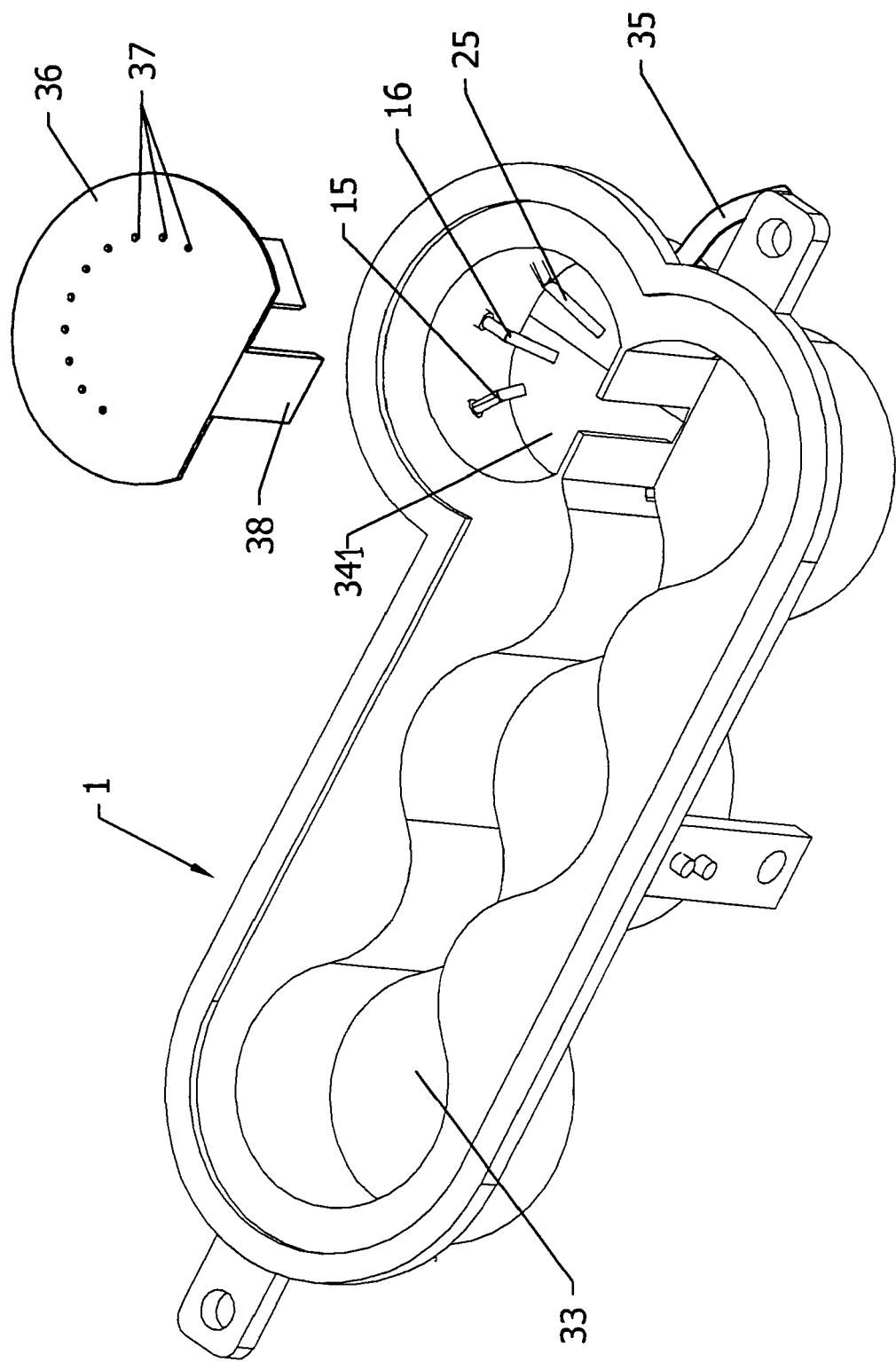


Fig. 5

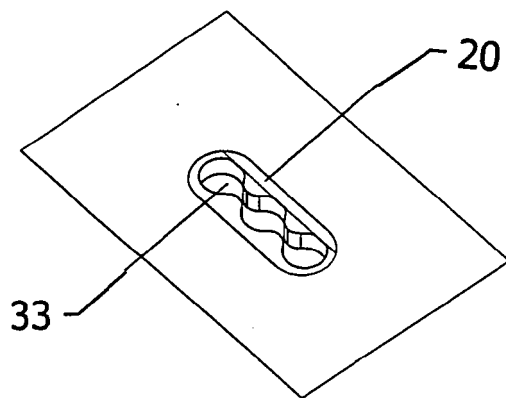


Fig. 6

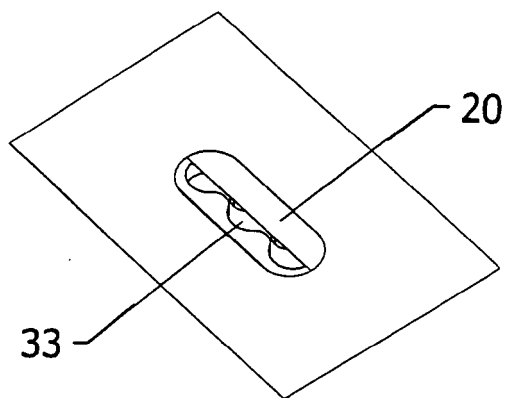


Fig. 7

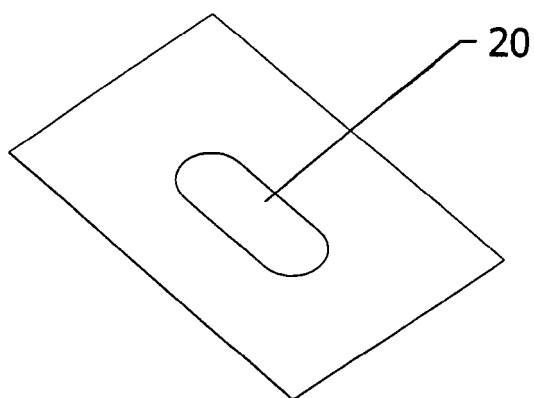


Fig. 8



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 46 0020

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Place of search Munich		Date of completion of the search 4 February 2008	Examiner Theis, Gilbert
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 07 46 0020

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