

Description

FIELD OF THE INVENTION AND RELATED ART STATEMENT

1. FIELD OF THE INVENTION

The present invention relates generally to a gas shutoff apparatus for a gas equipment using a town gas or liquefied petroleum gas, and more particularly to a gas shutoff apparatus for preventing gas explosion or gas poisoning due to a gas escape from a gas supply tube or gas equipment.

2. DESCRIPTION OF THE RELATED ART

The greater part of gas accidents are caused by escape of unburned gas such as town gas or liquefied petroleum gas (hereinafter is referred to as the gas). The gas escapes when a main cock for supplying the gas to a gas equipment is opened without burning of the gas, when unexpected disconnection of a rubber tube supplying the gas to the gas equipment occurs or the rubber tube has cracks thereon, for example. In order to prevent escape of the gas in the prior art, an automatic shutoff valve, a reinforced tube, an alarm to detect the escaped gas and an automatic gas shutoff system which is connected to the alarm etc. are used.

However, the automatic shutoff valve usually cannot be activated under a small flow rate of the escaping gas, and the escape of the gas cannot be interrupted. On the other hand, in the gas alarm, it merely generates an alarm, therefore if a person is absent from there, the alarm is failed to be noticed. Thus dangerous escape of the gas cannot be interrupted. Furthermore, with regard to the automatic gas shutoff system connected to the alarm, implementing such system to existing houses is difficult owing to its high cost and necessity of connecting construction. Moreover, the above-mentioned conventional countermeasures are not effective to gas suicide which is liable to cause gas explosion.

In order to improve these defects, recently, a gas shutoff apparatus for preventing the gas explosion or gas suicide is developing for household use. In such gas shutoff apparatus, a flow rate of the gas is detected, and when a total amount of the gas per a predetermined time period exceeds a predetermined value, occurrence of an abnormal state is detected and supply of the gas is interrupted (shutoff function at excess of a predetermined total amount of gas). Then, when the flow rate greatly increases and is significantly larger than a predetermined flow rate, an abnormal state is detected, and supply of the gas is interrupted

(shutoff function at excess of a predetermined limit of flow rate). Moreover, when the gas equipment continuously consumes the gas without variation of a flow rate and the continuous time of gas consumption with the flow rate exceeds a predetermined time period which is determined responding to an average normal consumption rate thereof, the above status is detected as an abnormal state, and supply of the gas is interrupted (gas shutoff function at excess of a predetermined continuous use time).

The respective predetermined reference values of these "total amount of the gas," "limit of flow rate" and "continuous use time" are set, for example, corresponding to a rated measurement capacity in the individual consumer. A gas shutoff apparatus embodying the above-mentioned method is disclosed in the Japanese published unexamined patent application Sho 63-108118 and JP 63-101619 (EP-A-264856), for example.

FIG.1 is a block diagram of the gas shutoff apparatus of Sho 63-108118. Referring to FIG.1, a flow rate measurement means 3 detects a flow rate of the gas flowing from a gas supply tube to a gas equipment and generates a flow rate signal corresponding to the flow rate. A consumption state detection means 6 detects "a consumption state" which is represented by a data set of a maximum flow rate of gas, a total amount of gas consumption and a time length of gas consumption on the basis of the flow rate signal.

A "reference consumption condition" is represented by a data set of a reference value of the maximum flow rate of gas, a reference value of the total amount of gas consumption and a reference value of a time length of gas consumption. An initial consumption condition is determined by an initial consumption condition setting means 7. Then the initial consumption condition is set in a changing means 12 of reference consumption condition for starting operation of the gas shutoff apparatus.

Data of the reference consumption condition of the changing means 12 of reference consumption condition is applied to a consumption state judging means 8. On the other hand, data of the consumption state detection means 6 is also applied to the consumption state judging means 8. Then, the data of the consumption state detecting means 6 is compared with the data of the reference consumption condition in the consumption state judging means 8. When the consumption state exceeds the reference consumption condition, a shutoff signal for closing a valve is output.

A timer 9 measures a predetermined time period by a starting signal from a starting signal generating means 10. A consumption state memory 11 memorizes the consumption state on the basis of the flow rate signal from the flow rate

measurement means 3 during an operation time period of the timer 9. The time period is selected two weeks or one month, for example. Then an amount of the gas consumption, maximum flow rates and a continuous time of the gas consumption which are measured by the flow rate signal of the flow rate measurement means 3 are memorized in the consumption state memory 11 from start of the timer 9. A data set of the amount of gas consumption, the maximum flow rate and the continuous consumption time is called as "a gas consumption pattern". The gas consumption pattern represents character of a consumer in gas consumption. The consumption state of the gas is concrete representation of the gas consumption pattern. Memorized data in the consumption state memory 11 represents the consumption state. The maximum data of the consumption state is applied to the changing means 12 of the reference consumption condition and is compared with the data of the initial consumption condition set in the initial consumption state setting means 7, after finding of the operation of the timer 9. Subsequently, in case that the maximum data is different from the data of the initial consumption condition, the maximum data is set in the changing means 12 of consumption state as a new reference consumption condition. After once setting of the new reference consumption condition, a consumption state is compared with the new reference consumption condition.

In the above-mentioned prior art, in case that a new gas equipment is introduced in the consumer after the new reference consumption condition has set, for example, the gas consumption pattern of the consumer varies. Thus normal operation of the gas shutoff apparatus cannot be expected.

GB-A-1182786 describes a method and apparatus for preventing the accumulation of an explosive amount of a gas in a chemical reactor to which the gas is fed as a reactant. The flow rate of the gas is measured and compared with a delayed flow rate signal. Reduction of flow or shut-off occurs when a predetermined difference occurs.

Patent Abstracts of Japan vol. 7 no.47 (M-196)-(1192) 24th February 1983 & JP-A-57195978 describes apparatus to control discharge of unburnt gas by measuring flow rate, determining average flow rate at intervals, and comparing with a standard average value, or a duration time, to issue a shut off signal when necessary.

US-A-4589435 discloses a water shut-off valve which shuts off if water flows for more than a predetermined time.

OBJECT AND SUMMARY OF THE INVENTION

An object of the present invention is to provide a gas shutoff apparatus in which a consumption state of gas in each gas-consumer is measured during a predetermined time length and is compared with a reference consumption condition. When the consumption state has varied, the reference consumption condition is changed corresponding to the varied consumption state.

The gas shutoff apparatus in accordance with the present invention is defined in claims 1, 2, 3 and 5

In the present invention, an actual consumption state is measured during a time period determined by the first timer, and a first reference consumption condition is set on the basis of the data of the actual consumption state after finish of operation of the first timer. Then a monitor range is set, and a second timer is started. During operation of the second timer, when a consumption state exists in the monitor range, the first reference consumption condition is temporarily replaced with other reference consumption condition.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is the block diagram of the gas shutoff apparatus in the prior art;

FIG.2 is a block diagram of a gas shutoff apparatus of a first embodiment in accordance with the present invention;

FIG.3 is a graph of a reference consumption condition in the first embodiment;

FIG.4 is other graph of the reference consumption condition in the first embodiment;

FIG.5, FIG.6 and FIG.7 are flow charts in operation of the first embodiment;

FIG.8 is a block diagram of the gas shutoff apparatus of a second embodiment in accordance with the present invention;

FIG.9 is a graph of a reference consumption condition in the second embodiment;

FIG.10 is other graph of the reference consumption condition in the second embodiment;

FIG.11 is a block diagram of the gas shutoff apparatus of a third embodiment in accordance with the present invention;

FIG.12 is a graph of a reference consumption condition in the third embodiment;

FIG.13 is a block diagram of the gas shutoff apparatus of a fourth embodiment in accordance with the present invention;

FIG.14 is a graph of a reference consumption condition in the fourth embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG.2 is a block diagram of a gas shutoff apparatus of a first embodiment in the present invention. Referring to FIG.2, a flow rate measurement means 3 detects a flow rate of the gas flowing from a gas supply tube to a gas equipment, and generates a flow rate signal corresponding to the flow rate. A consumption state detection means 6 detects "a consumption state" of the gas which is defined as a data set of physical values on gas consumption, or elements such as maximum flow rate, total amount and consumption time of the gas in a predetermined time period, for example. Alternatively, the consumption state may be defined as a data set of the elements of a flow rate, the flow rate of a gas equipment which is maximum in gas consumption and a total amount of the gas in a predetermined time period.

A "reference consumption condition" is defined as a condition for examining the consumption state and is represented by a set of respective reference values of the maximum flow rate, the total amount and the consumption time of the gas, for example. An initial consumption condition is determined by an initial consumption condition setting means 7. Then the initial consumption condition is set in a changing means 12 of reference consumption condition for starting operation of the gas shutoff apparatus.

Data of the reference consumption condition of the changing means 12 for reference consumption condition is applied to a consumption state judging means 8. A consumption state detected by the consumption state detection means 6 is applied to the consumption state judging means 8. In the consumption state judging means 8, the maximum flow rate, the total amount and the consumption time of the gas in the consumption state are compared with the reference values of the maximum flow rate, the total amount and the consumption time of the gas, respectively. Then, when at least one element of the consumption state exceeds the reference value of the element of the consumption condition, a shutoff signal for closing a valve is output to a shutoff means 4. Though data processing of the consumption state or consumption condition is accomplished with respect to the respective three elements, hereafter, the wordings of the "consumption state" or the "reference consumption condition" is used to imply only one element of the above-mentioned three ones for the simplicity of description.

A first timer 9 measures a predetermined time period by a starting signal from a starting signal generating means 10. A consumption state memory 11 memorizes the consumption state on the

basis of the flow rate signal from the flow rate measurement means 3 during the time period of the first timer 9. The time period is selected two weeks or one month, for example. Then the consumption state represented by an amount of the gas consumption, maximum flow rates and a continuous time of the gas consumption which are measured by the flow rate signal is detected and is memorized in the consumption state memory 11 from start of the first timer 9.

A computing means 16 for calculating "monitor range" of the consumption state generates a reference consumption condition on the basis of the reference consumption condition set in the changing means 12. The generated reference consumption condition is lower than the reference consumption condition set in the changing means 12, thus the monitor range is formed between these two reference consumption conditions. The data of the monitor range is memorized in a memory of the computing means 16.

The data of the monitor range is applied to a consumption state presence detector 15. The consumption state presence detector 15 detects presence of a consumption state in the monitor range, and a number of presence of the consumption state in the monitor range is counted during an operating time period of the second timer 13 and is memorized in a memory thereof. The second timer 13 is started by first occurrence of presence of the consumption state in the monitor range. The consumption state presence detector 15 also generates data of a new reference consumption condition on the basis of the consumption state which is present in the monitor range.

A computing means of a provisional reference consumption condition 14 generates data of a provisional reference consumption condition by multiplying data from the consumption state detection means 6 by a predetermined constant value. Then the provisional reference consumption condition is set into the changing means 12 in response to the input signal from the consumption state presence detector 15. In the above-mentioned operation, the reference consumption condition set in the changing means 12 is temporarily memorized in a reference consumption condition memory 5.

FIG.3 and FIG.4 are graphs showing operation of the first embodiment. Referring to both the graphs the abscissa is graduated by time, and the ordinate is graduated by a reference value of the consumption state. Cross marks designate levels of measured consumption states. A maximum limit M_1 of a consumption condition is designated by an alternate long and short dash line.

A time period T_1 from a time t_1 to a time t_2 is an operation time of the first timer 9. The maximum

consumption state P_1 of plural consumption states which are measured in the time period T_1 is selected, and a reference consumption condition M_2 is calculated by multiplying the maximum consumption state P_1 by a safety factor k (for example, $k = 1.5$) in the consumption state memory 11. Namely, the reference consumption condition in the time period T_1 is equal to the maximum reference consumption condition M_1 , and which is compared with the reference consumption condition M_2 in the changing means 12 at the time t_2 . Then the lower reference consumption condition M_2 is set in the changing means 12 as a new reference consumption condition. Moreover, a reference consumption condition L_2 which is lower than the reference consumption condition M_2 is computed by computing means 16, and a monitor range of the consumption state is formed between the reference consumption conditions L_2 and M_2 . In the above-mentioned status, when a consumption state exceeds the reference consumption condition M_2 , the consumption state judging means 8 detects abnormal state and outputs a signal for activating the shutoff means 4.

At a time t_3 , a consumption state P_2 exceeds the reference consumption condition L_2 and is present in the monitor range, and thereby operation of the second timer 13 is started. Subsequently, a reference consumption condition M_3 is calculated by multiplying the consumption state p_2 by the safety factor k , and the reference consumption condition M_3 is temporarily set in the changing means 12. On the other hand, the reference consumption condition M_2 is memorized in the reference consumption state memory 5 in order to preserve it. The time period T_2 between the time t_3 and a time t_4 is the operation time of the second timer 13. The monitor range is formed between the reference consumption condition L_2 and the reference consumption condition M_3 . In the time period T_2 , consumption states p_3 and p_4 are in the monitor range. Consequently, three consumption states p_2 , p_3 and p_4 exist within the monitor range during the time period T_2 . In this status, a reference consumption condition M_4 is calculated by multiplying the maximum consumption state p_3 by the safety factor k at the time of finish of operation of the second timer 13, and the reference consumption condition M_4 is set in the changing means 12. Subsequently, in order to provide a new monitor range, a reference consumption condition L_4 is calculated. Similarly, the above-mentioned operation of the gas shut off apparatus is continued after the time t_4 .

In the above-mentioned process, in case that three consumption states or more are in the monitor range, the reference consumption condition is changed. The number of the consumption state in

the monitor range is freely selected in response to shutoff condition of the gas shutoff apparatus. Furthermore, the time period T_2 can be divided into several time periods, and condition for changing the reference consumption condition can be determined by the number of the consumption state which exist in the monitor range during each divided time period. For example, plural consumption states which exist in the monitor range during a divided time period are regarded as one consumption state, and when a consumption state exists in the monitor range during each divided time period, the reference consumption condition in the changing means 12 is replaced with a new reference consumption condition. In the other method, the new reference consumption condition can be set when the condition for replacing is satisfied before finish of the time period T_2 .

FIG.4 is a graph showing other operation of the first embodiment. In the operation, only two consumption states p_2 and p_3 are within the monitor range during the time period T_2 , thus the condition for replacing the reference consumption condition is not satisfied. Then, when operation of the second timer 13 has finished, the provisional reference consumption condition M_3 is replaced with the preceding consumption state M_2 which is memorized in the reference consumption state memory 5. Accordingly, the lower reference consumption condition of the monitor range is identical with the reference consumption condition L_2 .

In the above-mentioned operation, though the reference consumption condition which is calculated on the basis of a measured consumption state is employed as the upper reference consumption condition of the monitor range, the upper reference consumption condition can be selected from predetermined plural reference consumption conditions in the neighborhood of and over the calculated reference consumption condition.

The lower reference consumption condition L can be calculated by multiplying the reference consumption condition M by a constant value (for example, 80 % of reference consumption condition M), whereas a fixed predetermined value corresponding to the reference consumption condition M is applicable to the reference consumption condition L . The above-mentioned calculation process is accomplished by a microcomputer, for example.

FIG.5, FIG.6 and FIG.7 are flow charts of the steps of operation of the gas shutoff apparatus in the first embodiment.

Referring to FIG.5, an initial consumption condition is set for a reference consumption condition from the initial consumption condition setting means 7 (step 17). A flow rate is measured (step 18), and a consumption state is detected on the basis of the output signal of the flow rate measure-

ment means 3 (step 19). In a step 20, operation of the first timer 9 is examined, and when the first timer 9 is in operation, the present consumption state is detected and the maximum consumption state thereof is memorized (step 21). When the first timer 9 is not in operation, operation of the second timer 13 is examined (step 22). When the second timer 13 is in operation, a consumption state which exists in the monitor range is detected and memorized in the detector 15 (step 23). When the second timer 13 is not in operation, and after the steps 21 and 23, the present consumption state is compared with the reference consumption condition in the consumption state judging means 8 (steps 24 and 25). When result of judgment in the consumption state judging means 8 is abnormal, a gas shutoff signal is output (step 26). When the result of judgment is normal, it is examined whether the reference consumption condition in the changing means 12 was replaced with the output from the consumption state memory 11 (step 27). When the reference consumption condition has been replaced, the process goes to step 36 of FIG.7. When the reference consumption condition is not replaced, the process goes to step 28 in FIG.6.

Referring to FIG.6, operation of the first timer 9 is examined (step 28). When the operation of the first timer 9 has finished, the initial consumption condition is compared with a consumption state from the consumption state memory 11 (step 29), and a lower one is selected for a reference consumption condition M_2 , and the reference consumption condition M_1 in the changing means 12 is replaced with the low reference consumption condition M_2 (step 30). Then, a reference consumption condition L is calculated for forming a monitor range of a consumption state on the basis of the replaced reference consumption condition M_2 (step 31). On the other hand, when operation of the first timer 9 does not finish, operation of the first timer 9 is examined (step 32). When the first timer 9 is in operation, the counting operation of the first timer 9 is continued (step 33). When the first timer 9 is not in operation, occurrence of a starting signal from the starting signal generating means 10 is detected (step 34). When the starting signal has inputted, the first timer starts operation (step 35). When the starting signal is not output, and after the steps 31, 33 and 35, the process return to the step 18 in FIG.5, and a flow rate is measured.

Referring to FIG.7, finish of operation of the second timer 13 is examined (step 36). When the operation of the second timer finishes, it is examined that three consumption states P are in the monitor range (step 37). When three consumption states are present in the monitor range, the reference consumption condition in the changing means 12 is replaced with a consumption state from the

consumption state memory 11 (step 53). On the other hand, in case that the condition in the step 37 is not satisfied, the reference consumption condition which is memorized in the reference consumption state memory 5 is reset into the changing means 12 (step 54). Then, a lower reference consumption condition L_n ($n = 1, 2, 3 \dots$) for a monitor range is calculated on the basis of the reference consumption condition set in the changing means 12 (step 38). Subsequently, the second timer 13 is reset (step 39). When operation of the second timer 13 does not finish, operation of the second timer 13 is examined (step 40). When the second timer 13 is in operation, the counting operation is continued (step 41). When the second timer is not in operation, a consumption state which is in the monitor range is detected (step 42). When a consumption state is in the monitor range (consumption state P_2 in FIG.3), operation of the second timer 13 is started (step 43), and the present reference consumption condition in the changing means 12 is temporarily memorized in the reference consumption condition memory 5 (step 44). Subsequently, the reference consumption condition is replaced with a consumption condition from the computing means 14 of provisional consumption condition (step 45). On the other hand, in case that no consumption state is in the monitor range, or after the steps 39, 41 and 45, the process returns to the step 18 as shown in FIG.5.

In the above-mentioned embodiment, the monitor range is arranged between the reference consumption condition M_n ($n = 1, 2, 3 \dots$) and the reference consumption condition L_n which is lower than the reference consumption condition M . Furthermore, a reference consumption condition S_n which is lower than the reference consumption condition L_n can be arranged for an additional function of the embodiment as shown in FIG.3 and FIG.4. In operation of such function of the gas shutoff apparatus, when a consumption state which exceeds the reference consumption condition S is not present during a predetermined time period, the process returns to start of operation. Consequently, the upper reference consumption condition M_n is lowered, and the monitor range is inevitably lowered, thus a suitable monitor range is arranged corresponding to reduction of gas consumption because of reduction of a gas equipment or change of the season, for example.

As mentioned above, in the gas shutoff apparatus in accordance with the present invention, a consumption state of the gas is always monitored and is compared with a predetermined reference consumption condition. Therefore, when the consumption state exceeds the reference consumption condition because of escape of the gas or significant increase of gas consumption, the consumption

state is determined to be abnormal, and the shutoff means is activated to shutoff supply of the gas. Consequently, gas explosion or gas poisoning can be prevented previously.

Furthermore, an actual consumption state of a consumer is measured during a predetermined time period of the first timer, and a reference consumption condition is set on the basis of the measured consumption state. Consequently, character of the consumer in gas consumption is introduced into the reference consumption condition, thus, function for preventing gas accident is significantly improved. Moreover, in case that the consumption state of the consumer is changed by replacement of a gas equipment or purchase of a new gas equipment, the reference consumption condition is amended to an optimum reference consumption condition.

FIG.8 is a block diagram of a gas shutoff apparatus of a second embodiment, wherein elements similar to the elements of FIG.2 are identified by like numerals. In the second embodiment, a cycle counter 46 for counting the number of operation of the second timer 13 is added into the block diagram shown in FIG.2. Moreover, the consumption state existence detector 15 outputs a signal to restart the second timer 13 until a predetermined number of signals is output from the cycle counter 46.

Operation of the second embodiment is elucidated in reference with FIGs. 9 and 10.

Referring to FIG.9, the time period T_1 is of the first timer 9, and the maximum consumption state P_1 measured in the time period T_1 is multiplied by a safety factor K (for example $K = 1.5$), and thereby a reference consumption condition M_2 is attained. A consumption state M_1 is a reference consumption condition during the time period T_1 , and is equal to the maximum consumption state. At a time t_2 , the consumption state M_1 is compared with the reference consumption condition M_2 , and the reference consumption condition M_2 of a lesser one is set as a new reference consumption condition. subsequently, a lower reference consumption condition L_2 for forming a monitor range of the consumption state is calculated by the computing means 16, and an actual consumption state is monitored within the monitor range.

In the above-mentioned status, when an actual consumption state exceeds the reference consumption condition M_2 , the consumption state judging means 8 detects an abnormal consumption state, and outputs a signal for activating the shutoff means 4.

At a time t_3 , for example, a consumption state P_2 exceeds the reference consumption condition L_2 and is present in the monitor range. Then, a reference consumption condition M_3 is calculated

by multiplying the consumption state P_2 by the safety factor K and is set as a provisional reference consumption condition. At the same time, operation of the second timer 13 is started, and the reference consumption condition M_2 is memorized in the reference consumption state memory 5. A time period T_{2-1} from the time t_3 to a time t_4 is the operation time period of the second timer 13. A monitor range during the time period T_{2-1} is from the reference consumption condition L_2 to the reference consumption condition M_3 , and the lower reference consumption condition is equal to the previous reference consumption condition L_2 . In the time period T_{2-1} , a consumption state P_2 exists in the monitor range. In due time, operation of the second timer 13 finishes at the time t_4 , and one number of operation of the second timer 13 is counted in the cycle counter 46. The second timer 13 is immediately restarted after finish of the operation at the time t_4 , and is operated during a time period T_{2-2} until a time t_5 . A consumption state is monitored during the time period T_{2-2} . As shown in FIG.9, a consumption state P_3 exists during the time period T_{2-2} .

Operation of the second timer 13 finishes at a time t_5 , and one number of the operation of the second timer 13 is also counted in the cycle counter 46. Consequently, the number of operation counted in the cycle counter 46 becomes two. Furthermore, the second timer 13 is restarted after finish of the operation at the time t_5 , and continues its operation during a time period T_{2-3} until a time t_6 . A consumption state P_4 is present during the time period T_{2-3} . When operation of the second timer 13 has finished at the time t_6 , the cycle counter 47 counts one number of operation of the second timer 13, and as a result, the total operation number of the second timer 13 becomes three.

In the embodiment, in case that at least one consumption state is present in the monitor range during the respective operation time periods T_{2-1} , T_{2-2} and T_{2-3} of the second timer 13, the reference consumption condition is changed. In order to change the reference consumption condition, a new reference consumption condition M_4 is calculated by multiplying the maximum consumption state P_4 which is measured during the three operation time periods T_{2-1} , T_{2-2} and T_{2-3} by the safety factor K . Subsequently, in order to refine the monitor range, a lower reference consumption condition L_4 is calculated. in a similar manner, monitor of the consumption state is continued after the time t_6 .

In the embodiment, it is a condition for amending the reference consumption condition that at least one consumption state is present in the monitor range during the respective time periods T_{2-1} , T_{2-2} and T_{2-3} , and thereby, in case that the operation time of the second timer 13 is 24 hours,

for example, variation of every day's consumption state can be monitored. Namely, when an increased consumption state has continued during three days, it is reasonable to suppose that a new gas equipment had introduced into the consumer. However, in case that increase of the consumption state is temporary by making a party, for example, such increased consumption state is not supposed to continue during three days. According to the above-mentioned manner, temporary increase of the gas consumption is distinguished from a successive increase because of introduction of the new gas equipment. Consequently, the reference consumption condition is not amended in such temporary increase. The number of operation of the second timer 13 can be selected to an arbitrary number corresponding to the consumer's condition.

Referring to FIG.10, though a consumption state P_3 is in the monitor range during the time period T_{2-1} , no consumption state is present in the monitor range during the time period T_{2-2} . In the above-mentioned case, the reference consumption condition M_3 is replaced with the reference consumption condition M_2 which is equal to the preceding one. Namely, only the consumption state P_3 is present in the monitor range during the time period T_{2-1} and no consumption state is present therein during the time period T_{2-2} . Therefore, the condition for changing the reference consumption condition is not completed in this case, and the reference consumption condition M_2 which is maintained in the reference consumption state memory 5 is reset in the changing means 12. Accordingly the lower reference consumption condition L_2 is equal to the preceding lower reference consumption condition. In a similar manner, in case that no consumption state is present in the monitor range during the time period T_{2-3} , the original reference consumption condition M_2 is reset as the reference consumption condition.

In the above-mentioned example, though the upper reference consumption condition M_n is calculated on the basis of a measured consumption state, the reference consumption condition can be selected from predetermined plural constant values.

Moreover, the reference consumption condition L of the monitor range is obtainable by multiplying the reference consumption condition M_n by a predetermined factor (for example, 0.8). On the other hand, a predetermined constant value according to the reference consumption condition M_n is applicable to the reference consumption condition L_n .

In the above-mentioned embodiment, when the gas consumption has temporarily increased, the reference consumption condition is replaced with a provisional reference consumption condition, and when the increase of the gas consumption has

returned to the original state, the reference consumption condition is replaced with the original reference consumption condition. Thus, easy-going change of the reference consumption condition which invalidates the function of the gas shutoff apparatus is preventable.

Furthermore, in a similar manner as described. In the first embodiment, a reference consumption condition S which is lower than the reference consumption condition L can be set to comply with reduction of gas consumption.

FIG.11 is a block diagram of a third embodiment of the gas shutoff apparatus, wherein elements similar to the elements of FIG.2 are identified by like numerals. This embodiment relates to a process for lowering a reference consumption condition, and combination with the process of the first or second embodiment is recommendable in practical use.

FIG.12 is a graph showing operation of the third embodiment. Referring to FIG.12, the reference consumption condition M_1 is an initial consumption condition and is a maximum limit of consumption state. The maximum consumption state P_1 which is measured in the time period T_1 of the first timer 9 is multiplied by a safety factor K (for example $K = 1.5$), and a reference consumption condition M_2 is attained. The reference consumption condition M_2 is compared with the initial reference consumption condition M_1 at the time t_2 which end of operation of the first timer 9, and a lower reference consumption condition M_2 is set into the changing means 12 as a new reference consumption condition. Subsequently, in order to form a monitor range of the consumption state, a lower reference consumption condition S_2 is calculated, thus the monitor range is formed between the reference consumption conditions M_2 and S_2 . In the above-mentioned status, when a gas consumption state exceeds the reference consumption condition M_2 , an abnormal consumption state is detected by the consumption state judging means 8, and a shutoff signal is output.

The second timer 14 starts operation at the time t_2 , and in case that a consumption state is present in the monitor range, operation of the second timer 14 is reset. Namely, counting operation of the second timer is interrupted, and the process is returned to the start. In the example, since a consumption state P_2 is present in the monitor range at the time t_3 , at which the second timer 14 is reset. A time period T_{2A} is a time period between start and reset of the second timer 14. Then, the second timer 14 starts operation at the time t_3 , and a consumption state P_3 is present in the monitor range at a time t_4 to interrupt operation of the second timer. Consequently, the second timer is again reset, and is started at a time t_4 .

During the time period from the time t_4 to a time t_5 , since no consumption state is present in the monitor range, operation of the second timer 13 is not suspended, and thus the second timer 13 finishes the operation at the time t_5 . Then at the time t_5 , a new reference consumption condition M_3 is calculated by multiplying the preceding reference consumption condition M_2 by a predetermined factor d (for example $d = 0.8$). Subsequently, a new lower reference consumption condition S_3 is calculated by the computing means 16 of the monitor range of consumption state.

The second timer 13 is operated in the similar manner as mentioned above after the time t_5 , and in case that a consumption state such as a consumption state P_4 , P_5 or P_6 comes in the monitor range within the time period T_2 of the second timer 13, the present monitor range between the reference consumption conditions M_3 and S_3 is maintained. On the other hand, in case that no consumption state exists in the monitor range during the time period T_2 , the present monitor range is replaced with a new lower monitor range. Therefore, the third embodiment relates to function for lowering a reference consumption condition.

FIG.13 is a block diagram of a fourth embodiment of the gas shutoff apparatus, wherein elements similar to the elements of FIG.2 are identified by like numerals. In the embodiment, a second consumption state memory 50 is provided instead of the computing means 14 of FIG.2 with respect to the first embodiment. The fourth embodiment also relates to a process for lowering a reference consumption condition, and the process is recommendable to combine with the process of the first or second embodiment.

The second consumption state memory 50 memorizes a consumption state during operation of the second timer 13, and calculates a reference consumption condition on the basis of the consumption state memorized in the second consumption state memory 50. The consumption state presence detector 15 detects presence of a consumption state in a monitor range which is formed by the computing means 16, and when the consumption state is present in the monitor range, data of the second consumption state memory 50 is initialized, and the second timer 13 is reset. An upper reference consumption condition of the monitor range is replaced with a consumption state from the second consumption memory 50 when the operation of the second timer 13 finished.

Detailed operation of the fourth embodiment is elucidated in reference with FIG.14. Operation between the times t_1 and t_4 is identical with that of the third embodiment. In this embodiment, a consumption state is memorized by the second consumption state memory 50 during the time period

T_2 of the second timer 13. After finish of operation of the second timer 13 at the time t_5 , a consumption state P_4 which is maximum between the times t_4 and t_5 is selected and is multiplied by the safety factor K , and thereby a new reference consumption condition M_3 is obtained. After the time t_5 , operation of the second timer 13 is restarted. However, since consumption states P_5 , P_6 and P_7 is present in the monitor range, the second timer 13 is reset at the respective times t_6 , t_7 and t_8 . The respective operation time periods T_{2C} , T_{2D} and T_{2E} are shorter than the full operation time of the second timer 13.

In the fourth embodiment, which is unlike the third embodiment, a new upper reference consumption condition is calculated on the basis of the maximum consumption state which is present in the monitor range in preceding time period T_2 of the second timer 13.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been changed in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

Claims

1. A gas shutoff apparatus comprising:
 - flow rate measurement means (3) for generating a flow rate signal corresponding to a flow rate of gas in a gas supply line.
 - consumption state detection means (6) for detecting particular consumption parameters, including flow rate and the time elapsed since consumption of gas has commenced, on the basis of said flow rate signal,
 - consumption state judging means (8) comprising means for comparing said detected consumption parameters with reference consumption parameter values and for generating a gas shutoff signal if a said consumption parameter value is greater than a reference consumption parameter value,
 - initial consumption condition setting means (7) comprising a memory for setting reference consumption parameter values in said consumption state judging means as an initial condition,
 - shutoff means (4) for interrupting said gas supply by reception of said shutoff signal,
 - a first timer (9) for measuring a first predetermined time period during which a consumption pattern is to be monitored, said pattern comprising data as to maximum flow rate occurring during said period, and longest time of consumption during said period,



During the time period from the time t_4 to a time t_5 , since no consumption state is present in the monitor range, operation of the second timer 13 is not suspended, and thus the second timer 13 finishes the operation at the time t_5 . Then at the time t_5 , a new reference consumption condition M_3 is calculated by multiplying the preceding reference consumption condition M_2 by a predetermined factor d (for example $d = 0.8$). Subsequently, a new lower reference consumption condition S_3 is calculated by the computing means 16 of the monitor range of consumption state.

The second timer 13 is operated in the similar manner as mentioned above after the time t_5 , and in case that a consumption state such as a consumption state P_4 , P_5 or P_6 comes in the monitor range within the time period T_2 of the second timer 13, the present monitor range between the reference consumption conditions M_3 and S_3 is maintained. On the other hand, in case that no consumption state exists in the monitor range during the time period T_2 , the present monitor range is replaced with a new lower monitor range. Therefore, the third embodiment relates to function for lowering a reference consumption condition.

FIG.13 is a block diagram of a fourth embodiment of the gas shutoff apparatus, wherein elements similar to the elements of FIG.2 are identified by like numerals. In the embodiment, a second consumption state memory 50 is provided instead of the computing means 14 of FIG.2 with respect to the first embodiment. The fourth embodiment also relates to a process for lowering a reference consumption condition, and the process is recommendable to combine with the process of the first or second embodiment.

The second consumption state memory 50 memorizes a consumption state during operation of the second timer 13, and calculates a reference consumption condition on the basis of the consumption state memorized in the second consumption state memory 50. The consumption state presence detector 15 detects presence of a consumption state in a monitor range which is formed by the computing means 16, and when the consumption state is present in the monitor range, data of the second consumption state memory 50 is initialized, and the second timer 13 is reset. An upper reference consumption condition of the monitor range is replaced with a consumption state from the second consumption memory 50 when the operation of the second timer 13 finished.

Detailed operation of the fourth embodiment is elucidated in reference with FIG.14. Operation between the times t_1 and t_4 is identical with that of the third embodiment. In this embodiment, a consumption state is memorized by the second consumption state memory 50 during the time period

T_2 of the second timer 13. After finish of operation of the second timer 13 at the time t_5 , a consumption state P_4 which is maximum between the times t_4 and t_5 is selected and is multiplied by the safety factor K , and thereby a new reference consumption condition M_3 is obtained. After the time t_5 , operation of the second timer 13 is restarted. However, since consumption states P_5 , P_6 and P_7 is present in the monitor range, the second timer 13 is reset at the respective times t_6 , t_7 and t_8 . The respective operation time periods T_{2C} , T_{2D} and T_{2E} are shorter than the full operation time of the second timer 13.

In the fourth embodiment, which is unlike the third embodiment, a new upper reference consumption condition is calculated on the basis of the maximum consumption state which is present in the monitor range in preceding time period T_2 of the second timer 13.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been changed in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

Claims

1. A gas shutoff apparatus comprising:
 - flow rate measurement means (3) for generating a flow rate signal corresponding to a flow rate of gas in a gas supply line.
 - consumption state detection means (6) for detecting particular consumption parameters, including flow rate and the time elapsed since consumption of gas has commenced, on the basis of said flow rate signal,
 - consumption state judging means (8) comprising means for comparing said detected consumption parameters with reference consumption parameter values and for generating a gas shutoff signal if a said consumption parameter value is greater than a reference consumption parameter value,
 - initial consumption condition setting means (7) comprising a memory for setting reference consumption parameter values in said consumption state judging means as an initial condition,
 - shutoff means (4) for interrupting said gas supply by reception of said shutoff signal,
 - a first timer (9) for measuring a first predetermined time period during which a consumption pattern is to be monitored, said pattern comprising data as to maximum flow rate occurring during said period, and longest time of consumption during said period,



starting signal generating means (10) for starting operation of said first timer,

consumption state memory (11) for memorizing said consumption pattern during the time period of operation of said first timer, said memory being arranged to calculate a consumption condition on the basis of said memorized consumption pattern,

means (12) for changing the reference consumption condition stored in said consumption state judging means,

means (16) for computing a monitor range, the occurrence within which of consumption parameter values is to be detected during a second time period, the values in said monitor range being lower than said reference consumption parameter values,

a second timer (13) for measuring said second predetermined time period,

means (14) for computing a provisional reference consumption parameter condition to be set into said means (12) for changing reference consumption condition by multiplying data from said consumption state detection means by a predetermined constant,

a consumption state presence detector (15) for detecting an occurrence of a consumption parameter value within said monitor range to cause outputting of a signal for starting operation of said second timer for memorizing consumption parameter values present in said monitor range during operation of said second timer, and for calculating a reference consumption condition on the basis of said memorized consumption parameter values.

2. A gas shutoff apparatus comprising:

flow rate measurement means (3) for generating a flow rate signal corresponding to a flow rate of gas in a gas supply line.

consumption state detection means (6) for detecting particular consumption parameters, including flow rate and the time elapsed since consumption of gas has commenced, on the basis of said flow rate signal,

consumption state judging means (8) comprising means for comparing said detected consumption parameters with reference consumption parameter values and for generating a gas shutoff signal if a said consumption parameter value is greater than a reference consumption parameter value,

initial consumption condition setting means (7) comprising a memory for setting reference consumption parameter values in said consumption state judging means as an initial condition,

shutoff means (4) for interrupting said gas

supply by reception of said shutoff signal,

a first timer (9) for measuring a first predetermined time period during which a consumption pattern is to be monitored, said pattern comprising data as to maximum flow rate occurring during said period, and longest time of consumption during said period,

starting signal generating means (10) for starting operation of said first timer,

consumption state memory (11) for memorizing said consumption pattern during the time period of operation of said first timer, said memory being arranged to calculate a consumption condition on the basis of said memorized consumption pattern,

means (12) for changing the reference consumption condition stored in said consumption state judging means,

means (16) for computing a monitor range, the occurrence within which of consumption parameter values is to be detected during a second time period, the values in said monitor range being lower than said reference consumption parameter values,

a second timer (13) for measuring said second predetermined time period,

a cycle counter (46) for counting the numbers of cycles that said second timer operates,

means (14) for computing a provisional reference consumption parameter condition to be set into said means (12) for changing reference consumption condition by multiplying data from said consumption state detection means by a predetermined constant,

a consumption state presence detector (15) for detecting an occurrence of a consumption parameter value within said monitor range to cause outputting of a signal for starting operation of said second timer, which is caused to run for a predetermined number of consecutive cycles of operation, for memorizing consumption parameter values present in said monitor range during each cycle of operation of said second timer, and for calculating a reference consumption condition on the basis of said memorized consumption parameter values.

3. A gas shutoff apparatus comprising:

flow rate measurement means (3) for generating a flow rate signal corresponding to a flow rate of gas in a gas supply line.

consumption state detection means (6) for detecting particular consumption parameters, including flow rate and the time elapsed since consumption of gas has commenced, on the basis of said flow rate signal,

consumption state judging means (8) com-



prising means for comparing said detected consumption parameters with reference consumption parameter values and for generating a gas shutoff signal if a said consumption parameter value is greater than a reference consumption parameter value,

initial consumption condition setting means (7) comprising a memory for setting reference consumption parameter values in said consumption state judging means as an initial condition,

shutoff means (4) for interrupting said gas supply by reception of said shutoff signal,

a first timer (9) for measuring a first predetermined time period during which a consumption pattern is to be monitored, said pattern comprising data as to maximum flow rate occurring during said period, and longest time of consumption during said period,

starting signal generating means (10) for starting operation of said first timer,

consumption state memory (11) for memorizing said consumption pattern during the time period of operation of said first timer, said memory being arranged to calculate a consumption condition on the basis of said memorized consumption pattern,

means (12) for changing the reference consumption condition stored in said consumption state judging means,

means (16) for computing a monitor range, the occurrence within which of consumption parameter values is to be detected during a second time period, the values in said monitor range being lower than said reference consumption parameter values,

a second timer (13) for measuring said second predetermined time period,

a consumption state presence detector (15) for detecting an occurrence of a consumption parameter value within said monitor range to cause outputting of a signal for starting operation of said second timer, for memorizing consumption parameter values present in said monitor range during operation of said second timer, and for calculating a reference consumption condition to be set in said changing means after finish of operation of said second timer on the basis of said memorized consumption parameter value.

4. A gas shutoff apparatus in accordance with claim 3, wherein

the reference consumption condition is replaced with a reference consumption condition in which the reference consumption condition is multiplied by a predetermined factor at the time of finish of operation of said second timer.

5. A gas shutoff apparatus comprising:
flow rate measurement means (3) for generating a flow rate signal corresponding to a flow rate of gas in a gas supply line.

consumption state detection means (6) for detecting particular consumption parameters, including flow rate and the time elapsed since consumption of gas has commenced, on the basis of said flow rate signal,

consumption state judging means (8) comprising means for comparing said detected consumption parameters with reference consumption parameter values and for generating a gas shutoff signal if a said consumption parameter value is greater than a reference consumption parameter value,

initial consumption condition setting means (7) comprising a memory for setting reference consumption parameter values in said consumption state judging means as an initial condition,

shutoff means (4) for interrupting said gas supply by reception of said shutoff signal,

a first timer (9) for measuring a first predetermined time period during which a consumption pattern is to be monitored, said pattern comprising data as to maximum flow rate occurring during said period, and longest time of consumption during said period,

starting signal generating means (10) for starting operation of said first timer,

consumption state memory (11) for memorizing said consumption pattern during the time period of operation of said first timer, said memory being arranged to calculate a consumption condition on the basis of said memorized consumption pattern,

means (12) for changing the reference consumption condition stored in said consumption state judging means,

means (16) for computing a monitor range, the occurrence within which of consumption parameter values is to be detected during a second time period, the values in said monitor range being lower than said reference consumption parameter values,

a second timer (13) for measuring said second predetermined time period,

a second consumption state memory (50) for memorizing a consumption parameter value during the time period of operation of said second timer and arranged to calculate a consumption condition on the basis of said memorized consumption pattern, and for setting a reference consumption condition in said means for changing after finish of operation of said second timer,

a consumption state presence detector



(15) for detecting an occurrence of a consumption parameter value within said monitor range to cause outputting of a signal for restarting operation of said second timer at said occurrence of said consumption parameter value, and for initializing said second consumption state memory (50) at said occurrence of said consumption parameter value.

Patentansprüche

1. Gasabschaltvorrichtung, umfassend:

eine Durchsatzmeßeinrichtung (3) zur Erzeugung eines Durchsatzsignals, das dem Gasdurchsatz in einer Gaszufuhrleitung entspricht, eine Einrichtung (6) zur Ermittlung eines Verbrauchszustands, um bestimmte Verbrauchsparameter, die den Durchsatz und die seit Beginn des Gasverbrauchs verstrichene Zeit umfassen, auf der Grundlage des Durchsatzsignals zu ermitteln, eine Einrichtung (8) zur Bewertung des Verbrauchszustands, umfassend Einrichtungen zum Vergleichen der ermittelten Verbrauchsparameter mit Bezugsverbrauchsparameterwerten und zur Erzeugung eines Gasabschaltsignals, wenn der Verbrauchsparameterwert größer ist als ein Bezugsverbrauchsparameterwert, eine Einrichtung (7) zum Einstellen eines Ausgangsverbrauchszustands, die einen Speicher zum Einstellen von Bezugsverbrauchsparameterwerten als einen Ausgangszustand in der Einrichtung zur Bewertung eines Verbrauchszustands umfaßt, eine Abschalteinrichtung (4) zur Unterbrechung der Gaszufuhr beim Erhalt des Abschaltsignals, einen ersten Zeitmesser (9) zum Messen eines ersten festgelegten Zeitraums, während dessen ein Verbrauchsmuster kontrolliert werden soll, wobei das Muster Daten bezüglich des in dem Zeitraum auftretenden Maximaldurchsatzes und der längsten Verbrauchszeit während des Zeitraums umfaßt, eine Startsignalerzeugungseinrichtung (10), um den Betrieb des ersten Zeitmessers zu starten, einen Verbrauchszustandsspeicher (11) zum Speichern des Verbrauchsmusters während des Betriebszeitraums des ersten Zeitmessers, wobei der Speicher vorgesehen ist, um einen Verbrauchszustand auf der Grundlage des gespeicherten Verbrauchsmusters zu berechnen, eine Einrichtung (12) zum Ändern des Bezugsverbrauchszustands, der in der Einrichtung zur Bewertung des Verbrauchszustands gespeichert ist, eine Einrichtung (16) zur Berechnung eines Kontrollbereiches, wobei das Vorliegen von

Verbrauchsparameterwerten in diesem während eines zweiten Zeitraums ermittelt werden soll, wobei die Werte in dem Kontrollbereich niedriger sind als die Bezugsverbrauchsparameterwerte,

ein zweiter Zeitmesser (13) zum Messen des zweiten festgelegten Zeitraums, eine Einrichtung (14) zur Berechnung eines vorläufigen Bezugsverbrauchsparameterzustands, der in der Einrichtung (12) zur Änderung des Bezugsverbrauchszustands festgelegt wird, indem man Daten von der Einrichtung zur Ermittlung des Verbrauchszustands mit einer festgelegten Konstanten multipliziert, ein Verbrauchszustandsdetektor (15) zum Ermitteln des Vorliegens eines Verbrauchsparameterwertes in dem Kontrollbereich, um die Ausgabe eines Signals zum Starten des Betriebs des zweiten Zeitmessers zu bewirken, zum Speichern der in dem Kontrollbereich während des Betriebs des zweiten Zeitmessers vorliegenden Verbrauchsparameterwerte und zur Berechnung eines Bezugsverbrauchszustands auf der Grundlage der gespeicherten Verbrauchsparameterwerte.

2. Gasabschaltvorrichtung umfassend:

eine Durchsatzmeßeinrichtung (3) zur Erzeugung eines Durchsatzsignals, das einem Gasdurchsatz in einer Gaszufuhrleitung entspricht, eine Einrichtung (6) zur Ermittlung eines Verbrauchszustands, um bestimmte Verbrauchsparameter, die den Durchsatz und die seit Beginn des Gasverbrauchs verstrichene Zeit umfassen, auf der Grundlage des Durchsatzsignals zu ermitteln, eine Einrichtung (8) zur Bewertung des Verbrauchszustands, umfassend Einrichtungen, um die ermittelten Verbrauchsparameter mit Bezugsverbrauchsparameterwerten zu vergleichen und ein Gasabschaltsignal zu erzeugen, wenn ein Verbrauchsparameterwert einen Bezugsverbrauchsparameterwert übersteigt, eine Einrichtung (7) zum Einstellen eines Ausgangsverbrauchszustands, die einen Speicher zum Einstellen der Bezugsverbrauchsparameterwerte als einen Ausgangszustand in der Einrichtung zur Bewertung eines Verbrauchszustands umfaßt, eine Abschalteinrichtung (4) zur Unterbrechung der Gaszufuhr beim Erhalt des Abschaltsignals, einen ersten Zeitmesser (9) zum Messen eines ersten festgelegten Zeitraums, während dessen ein Verbrauchsmuster kontrolliert werden soll, wobei das Muster Daten bezüglich eines in dem Zeitraum auftretenden Maximaldurchsatzes und der längsten Verbrauchszeit wäh-



rend des Zeitraums umfaßt,
 eine Startsignalerzeugungseinrichtung (10), um
 den Betrieb des ersten Zeitmessers zu starten,
 einen Verbrauchszustandsspeicher (11), um
 das Verbrauchsmuster während des Betriebs-
 zeitraums des ersten Zeitmessers zu spei-
 chern, wobei der Speicher vorgesehen ist, um
 einen Bezugsverbrauchsstatus auf der
 Grundlage des gespeicherten Verbrauchsmu-
 sters zu berechnen,
 eine Einrichtung (12) zum Ändern des in der
 Einrichtung zur Bewertung des Verbrauchszu-
 stands gespeicherten Bezugsverbrauchs-
 status,
 eine Einrichtung (16) zum Berechnen eines
 Kontrollbereiches, wobei das Auftreten von
 Verbrauchsparameterwerten in diesem wäh-
 rend eines zweiten Zeitraums ermittelt werden
 soll, wobei die Werte in dem Kontrollbereich
 niedriger sind als die Bezugsverbrauchspara-
 meterwerte,
 einen zweiten Zeitmesser (13) zum Messen
 des zweiten festgelegten Zeitraums,
 einen Taktzähler (46), um die Anzahl der Takte
 zu zählen, die der zweite Zeitmesser in Betrieb
 ist,
 eine Einrichtung (14) zum Erstellen eines vor-
 läufigen Bezugsverbrauchsparameterzustands,
 der in der Einrichtung (12) zum Ändern des
 Bezugsverbrauchsstatus eingestellt werden
 soll, indem Daten von der Einrichtung zur Er-
 mittlung des Verbrauchszustands mit einer
 festgelegten Konstante multipliziert werden,
 einen Verbrauchszustandsdetektor (15) zum
 Ermitteln des Vorliegens eines Verbrauchspara-
 meterwertes in dem Kontrollbereich, um die
 Ausgabe eines Signals zum Starten des Be-
 triebs des zweiten Zeitmessers zu bewirken,
 den man eine bestimmte Anzahl von aufeinander-
 folgenden Betriebstakten laufen läßt, zum
 Speichern der in dem Kontrollbereich vorlie-
 genden Verbrauchsparameterwerte während
 jedes Betriebstaktes des zweiten Zeitmessers
 und zur Berechnung eines Bezugsverbrauchs-
 status auf der Grundlage der gespeicherten
 Verbrauchsparameterwerte.

3. Gasabschaltvorrichtung, umfassend:
 eine Durchsatzmeßeinrichtung (3) zur Erzeu-
 gung eines Durchsatzsignals, das einem Gas-
 durchsatz in einer Gaszufuhrleitung entspricht,
 eine Einrichtung (6) zur Ermittlung eines Ver-
 brauchszustands, um bestimmte Verbrauchs-
 parameter, die den Durchsatz und die seit dem
 Beginn des Gasverbrauchs verstrichene Zeit
 umfassen, auf der Grundlage des Durchsatzsi-
 gnals zu ermitteln,
 eine Einrichtung (8) zur Bewertung des Ver-

brauchszustands, umfassend Einrichtungen
 zum Vergleichen der ermittelten Verbrauchspara-
 meter mit Bezugsverbrauchsparameterwerten
 und zur Erzeugung eines Gasabschaltsignals,
 wenn ein Verbrauchsparameterwert größer als
 ein Bezugsverbrauchsparameterwert ist,
 eine Einrichtung (7) zum Einstellen eines Aus-
 gangsverbrauchsstatus, die einen Speicher
 zum Einstellen der Bezugsverbrauchspara-
 meterwerte als einen Ausgangszustand in der Ein-
 richtung zum Bewerten des Verbrauchszu-
 stands umfaßt,
 eine Abschalteinrichtung (4) zum Unterbrechen
 der Gaszufuhr beim Erhalt des Abschalt-
 signals,
 einen ersten Zeitmesser (9) zum Messen eines
 ersten festgelegten Zeitraums, während des-
 sen ein Verbrauchsmuster kontrolliert werden
 soll, wobei das Muster Daten bezüglich des
 während dieses Zeitraums auftretenden Maxi-
 maldurchsatzes und der längsten Verbrauchs-
 zeit während dieses Zeitraums umfaßt,
 eine Startsignalerzeugungseinrichtung (10), um
 den Betrieb des ersten Zeitmessers zu starten,
 einen Verbrauchszustandsspeicher (11) zum
 Speichern des Verbrauchsmusters während
 des Betriebszeitraums des ersten Zeitmessers,
 wobei der Speicher vorgesehen ist, um einen
 Verbrauchszustand auf der Grundlage des ge-
 speicherten Verbrauchsmusters zu berechnen,
 eine Einrichtung (12) zur Änderung des Be-
 zugsverbrauchsstatus, der in der Einrich-
 tung zur Bewertung des Verbrauchszustands
 gespeichert ist,
 eine Einrichtung (16) zur Berechnung eines
 Kontrollbereiches, wobei in diesem auftretende
 Verbrauchsparameterwerte während eines
 zweiten Zeitraums ermittelt werden sollen, wo-
 bei die Werte in dem Kontrollbereich niedriger
 sind als die Bezugsverbrauchsparameterwerte,
 einen zweiten Zeitmesser (13) zum Messen
 des zweiten festgelegten Zeitraums,
 einen Verbrauchszustandsdetektor (15) zur Er-
 mittlung des Vorliegens eines Verbrauchspara-
 meterwertes in dem Kontrollbereich, um die
 Ausgabe eines Signals zum Starten des Be-
 triebs des zweiten Zeitmessers zu bewirken,
 zum Speichern der Verbrauchsparameterwerte,
 die in dem Kontrollbereich während des Be-
 triebs des zweiten Zeitmessers vorliegen, und
 zur Berechnung eines Bezugsverbrauchs-
 status, der in der Änderungseinrichtung nach
 dem Ende des Betriebs des zweiten Zeitmes-
 sers auf der Grundlage des gespeicherten Ver-
 brauchsparameterwertes eingestellt werden
 soll.



4. Gasabschaltvorrichtung nach Anspruch 3, wobei der Bezugsverbrauchszustand durch einen Bezugsverbrauchszustand ersetzt wird, bei welchem der Bezugsverbrauchszustand mit einem festgelegten Faktor zu dem Zeitpunkt, zu dem der Betrieb des zweiten Zeitmessers beendet wird, multipliziert wird.
5. Gasabschaltvorrichtung, umfassend:
 eine Durchsatzmeßeinrichtung (3) zur Erzeugung eines Durchsatzsignals, das einem Gasdurchsatz in einer Gaszufuhrleitung entspricht,
 eine Einrichtung zur Ermittlung eines Verbrauchszustands (6), um bestimmten Verbrauchsparameter, die den Durchsatz und die seit dem Beginn des Gasverbrauchs verstrichene Zeit umfassen, auf der Grundlage des Durchsatzsignals zu ermitteln,
 eine Einrichtung (8) zur Bewertung des Verbrauchszustands, umfassend Einrichtungen zum Vergleichen der ermittelten Verbrauchsparameter mit Bezugsverbrauchsparameterwerten und zur Erzeugung eines Gasabschaltsignals, wenn ein Verbrauchsparameterwert einen Bezugsverbrauchsparameterwert übersteigt,
 eine Einrichtung (7) zum Einstellen des Ausgangsverbrauchszustands, die einen Speicher zum Einstellen der Bezugsverbrauchsparameterwerte als einen Ausgangszustand in der Einrichtung zur Bewertung des Verbrauchszustands umfaßt,
 eine Abschalteinrichtung (4) zur Unterbrechung der Gaszufuhr beim Erhalt des Abschaltsignals,
 einen ersten Zeitmesser (9) zum Messen eines ersten festgelegten Zeitraums, während dessen ein Verbrauchsmuster kontrolliert werden soll, wobei das Muster Daten bezüglich eines während des Zeitraums auftretenden Maximaldurchsatzes und einer längsten Verbrauchszeit während des Zeitraums umfaßt,
 eine Startsignalerzeugungseinrichtung (10), um den Betrieb des ersten Zeitmessers zu starten,
 einen Verbrauchszustandsspeicher (11), um das Verbrauchsmuster während des Betriebszeitraums des ersten Zeitmessers zu speichern, wobei der Speicher vorgesehen ist, um einen Verbrauchszustand auf der Grundlage des gespeicherten Verbrauchsmusters zu berechnen,
 eine Einrichtung (12) zum Ändern des Bezugsverbrauchszustands, der in der Einrichtung zur Bewertung des Verbrauchszustands gespeichert ist,
 eine Einrichtung (16) zur Berechnung eines Kontrollbereiches, wobei das Auftreten von Verbrauchsparameterwerten in diesem wäh-

rend eines zweiten Zeitraums ermittelt werden soll, wobei die Werte in dem Kontrollbereich niedriger sind als die Bezugsverbrauchsparameterwerte,
 einen zweiten Zeitmesser (13) zum Messen des zweiten festgelegten Zeitraums,
 einen zweiten Verbrauchszustandsspeicher (50), um einen Verbrauchsparameterwert während des Betriebszeitraums des zweiten Zeitmessers zu speichern und einen Verbrauchszustand auf der Grundlage des gespeicherten Verbrauchsmusters zu berechnen, und zum Einstellen eines Bezugsverbrauchszustands in der Änderungseinrichtung nach dem Ende des Betriebs des zweiten Zeitmessers,
 einen Verbrauchszustandsdetektor (15) zum Ermitteln des Vorliegen eines Verbrauchsparameterwertes in dem Kontrollbereich, um beim Auftreten des Parameterwertes die Ausgabe eines Signals zur Wiederaufnahme des Betriebs des zweiten Zeitmessers zu bewirken, und zur Initialisierung des zweiten Verbrauchszustandsspeichers (50) beim Auftreten der Verbrauchsparameterwerte.

Revendications

1. Appareil de fermeture du gaz comprenant :
 un moyen de mesure du débit (3) pour produire un signal de débit correspondant au débit du gaz dans une conduite d'alimentation en gaz,
 un moyen de détection d'état de consommation (6) destiné à détecter les paramètres de consommation particuliers, comportant le débit et le temps écoulé depuis que la consommation du gaz a commencé, sur la base du signal de débit,
 un moyen de jugement d'état de consommation (8) comprenant un moyen pour comparer les paramètres de consommation détectés à des valeurs de paramètre de consommation de référence et pour produire un signal de fermeture du gaz si la valeur du paramètre de consommation est supérieure à une valeur de paramètre de consommation de référence,
 un moyen de fixation de condition de consommation initiale (7) comprenant une mémoire pour fixer des valeurs de paramètre de consommation de référence dans le moyen de jugement d'état de consommation comme une condition initiale,
 un moyen de fermeture (4) pour interrompre l'alimentation en gaz grâce à la réception du signal de fermeture,
 un premier compteur (9) pour mesurer un premier intervalle de temps prédéterminé pendant lequel un modèle de consommation doit



être surveillé, le modèle comprenant les données comme un débit maximal se produisant pendant l'intervalle de temps, et le temps le plus long de consommation pendant l'intervalle de temps,

un moyen de production de signal de départ (10) pour lancer le fonctionnement du premier compteur,

une mémoire d'état de consommation (11) pour mémoriser le modèle de consommation pendant l'intervalle de temps de fonctionnement du premier compteur, la mémoire étant prévue pour calculer une condition de consommation sur la base du modèle de consommation mémorisé,

un moyen (12) pour changer la condition de consommation de référence mémorisée dans le moyen de jugement d'état de consommation,

un moyen (16) pour calculer une plage de référence, dont l'arrivée des valeurs de paramètre de consommation à l'intérieur de celle-ci doivent être détectées pendant un second intervalle de temps, les valeurs dans la plage de surveillance étant inférieures aux valeurs de paramètre de consommation de référence,

un second compteur (13) pour mesurer le second intervalle de temps prédéterminé,

un moyen (14) pour calculer une condition de consommation de paramètre provisoire qui doit être placée dans le moyen (12) pour changer la condition de consommation de référence en multipliant les données provenant du moyen de détection d'état de consommation par une constante prédéterminée,

un détecteur de présence d'état de consommation (15) destiné à détecter la présence d'une valeur de paramètre de consommation à l'intérieur de la plage de surveillance afin d'entraîner la sortie d'un signal pour lancer le fonctionnement du second compteur pour mémoriser les valeurs de paramètre de consommation présentes dans la plage de surveillance pendant le fonctionnement du second compteur, et pour calculer une condition de consommation de référence sur la base des valeurs de paramètre de consommation mémorisées.

2. Appareil de fermeture de gaz comprenant :

un moyen de mesure de débit (3) pour produire un signal de débit correspondant à un débit du gaz dans une conduite d'alimentation en gaz,

un moyen de détection d'état de consommation (6) pour détecter des paramètres de consommation particuliers, comportant le débit et le temps écoulé depuis que la consomma-

tion du gaz a commencé sur la base du signal de débit,

un moyen de jugement d'état de consommation (8) comprenant un moyen pour comparer les paramètres de consommation détectés aux valeurs de paramètre de consommation de référence et pour produire un signal de fermeture du gaz si une valeur de paramètre parmi les valeurs de paramètre de consommation est supérieure à une valeur de paramètre de consommation de référence,

un moyen de fixation de condition de consommation initiale (7) comprenant une mémoire pour fixer les valeurs de paramètre de consommation de référence dans le moyen de jugement d'état de consommation comme condition initiale,

un moyen de fermeture (4) pour interrompre l'alimentation en gaz grâce à la réception du signal de fermeture,

un premier compteur (9) pour mesurer un premier intervalle de temps prédéterminé pendant lequel un modèle de consommation doit être surveillé, le modèle comprenant des données comme un débit maximal se produisant pendant l'intervalle de temps, et le temps le plus long de consommation pendant l'intervalle de temps,

un moyen de génération du signal de départ (10) pour lancer le fonctionnement du premier compteur,

une mémoire d'état de consommation (11) pour mémoriser le modèle de consommation pendant l'intervalle de temps du fonctionnement du premier compteur, la mémoire étant prévue pour calculer une condition de consommation sur la base du modèle de consommation mémorisé,

un moyen (12) pour changer la condition de consommation de référence mémorisée dans le moyen de jugement d'état de consommation,

un moyen (16) pour calculer une plage de surveillance, dont l'arrivée des valeurs de paramètre de consommation à l'intérieur de celle-ci doivent être détectées pendant un second intervalle de temps, les valeurs dans la plage de surveillance étant inférieures aux valeurs des paramètres de consommation de référence,

un second compteur (13) pour mesurer le second intervalle de temps prédéterminé,

un compteur de cycle (46) pour compter le nombre de cycles où le second compteur fonctionne,

un moyen (14) pour calculer une condition de paramètre de consommation de référence provisoire qui doit être placée dans le moyen (12) pour changer la condition de consomma-



tion de référence en multipliant les données provenant du moyen de détection d'état de consommation par une constante prédéterminée,

un détecteur de présence d'état de consommation (15) pour détecter une présence d'une valeur de paramètre de consommation à l'intérieur de la plage de surveillance afin d'entraîner la sortie d'un signal pour lancer le fonctionnement du second compteur, qui est amené à fonctionner pendant un nombre prédéterminé de cycles consécutifs de fonctionnement, pour mémoriser les valeurs de paramètre de consommation présentes dans la plage de surveillance pendant chaque cycle de fonctionnement du second compteur, et pour calculer une condition de consommation de référence sur la base des valeurs de paramètre de consommation mémorisées.

3. Appareil de fermeture du gaz comprenant :

un moyen de mesure du débit (3) pour produire un signal de débit correspondant au débit du gaz dans une conduite d'alimentation en gaz,

un moyen de détection d'état de consommation (6) destiné à détecter les paramètres de consommation particuliers, comportant le débit et le temps écoulé depuis que la consommation du gaz a commencé, sur la base du signal de débit,

un moyen de jugement d'état de consommation (8) comprenant un moyen pour comparer les paramètres de consommation détectés à des valeurs de paramètre de consommation de référence et pour produire un signal de fermeture du gaz si la valeur du paramètre de consommation est supérieure à une valeur de paramètre de consommation de référence,

un moyen de fixation de condition de consommation initiale (7) comprenant une mémoire pour fixer des valeurs de paramètre de consommation de référence dans le moyen de jugement d'état de consommation comme une condition initiale,

un moyen de fermeture (4) pour interrompre l'alimentation en gaz grâce à la réception du signal de fermeture,

un premier compteur (9) pour mesurer un premier intervalle de temps prédéterminé pendant lequel un modèle de consommation doit être surveillé, le modèle comprenant les données comme un débit maximal se produisant pendant l'intervalle de temps, et le temps le plus long de consommation pendant l'intervalle de temps,

un moyen de production de signal de départ (10) pour lancer le fonctionnement du

premier compteur,

une mémoire d'état de consommation (11) pour mémoriser le modèle de consommation pendant l'intervalle de temps de fonctionnement du premier compteur, la mémoire étant prévue pour calculer une condition de consommation sur la base du modèle de consommation mémorisé,

un moyen (12) pour changer la condition de consommation de référence mémorisée dans le moyen de jugement d'état de consommation,

un moyen (16) pour calculer une plage de référence, dont l'arrivée des valeurs de paramètre de consommation à l'intérieur de celle-ci doivent être détectées pendant un second intervalle de temps, les valeurs dans la plage de surveillance étant inférieures aux valeurs de paramètre de consommation de référence,

un second compteur (13) pour mesurer le second intervalle de temps prédéterminé,

un détecteur de présence d'état de consommation (15) pour détecter l'arrivée d'une valeur de paramètre de consommation à l'intérieur de la plage de surveillance afin d'entraîner la sortie d'un signal pour lancer le fonctionnement du second compteur, pour mémoriser les valeurs de paramètre de consommation présentes dans la plage de surveillance pendant le fonctionnement du second compteur, et pour calculer une condition de consommation de référence qui peut être placée dans le moyen de changement après la fin du fonctionnement du second compteur sur la base de la valeur de paramètre de consommation mémorisée.

4. Appareil de fermeture de gaz selon la revendication 3, dans lequel

la condition de consommation de référence est remplacée par une condition de consommation de référence dans laquelle la condition de consommation de référence est multipliée par un facteur prédéterminé au moment de la fin du fonctionnement du second compteur.

5. Appareil de fermeture du gaz comprenant :

un moyen de mesure du débit (3) pour produire un signal de débit correspondant au débit du gaz dans une conduite d'alimentation en gaz,

un moyen de détection d'état de consommation (6) destiné à détecter les paramètres de consommation particuliers, comportant le débit et le temps écoulé depuis que la consommation du gaz a commencé, sur la base du signal de débit,



un moyen de jugement d'état de consommation (8) comprenant un moyen pour comparer les paramètres de consommation détectés à des valeurs de paramètre de consommation de référence et pour produire un signal de fermeture du gaz si la valeur du paramètre de consommation est supérieure à une valeur de paramètre de consommation de référence,

un moyen de fixation de condition de consommation initiale (7) comprenant une mémoire pour fixer des valeurs de paramètre de consommation de référence dans le moyen de jugement d'état de consommation comme une condition initiale,

un moyen de fermeture (4) pour interrompre l'alimentation en gaz grâce à la réception du signal de fermeture,

un premier compteur (9) pour mesurer un premier intervalle de temps prédéterminé pendant lequel un modèle de consommation doit être surveillé, le modèle comprenant les données comme un débit maximal se produisant pendant l'intervalle de temps, et le temps le plus long de consommation pendant l'intervalle de temps,

un moyen de production de signal de départ (10) pour lancer le fonctionnement du premier compteur,

une mémoire d'état de consommation (11) pour mémoriser le modèle de consommation pendant l'intervalle de temps de fonctionnement du premier compteur, la mémoire étant prévue pour calculer une condition de consommation sur la base du modèle de consommation mémorisé,

un moyen (12) pour changer la condition de consommation de référence mémorisée dans le moyen de jugement d'état de consommation,

un moyen (16) pour calculer une plage de référence, dont l'arrivée des valeurs de paramètre de consommation à l'intérieur de celle-ci doivent être détectées pendant un second intervalle de temps, les valeurs dans la plage de surveillance étant inférieures aux valeurs de paramètre de consommation de référence,

un second compteur (13) pour mesurer le second intervalle de temps prédéterminé,

une seconde mémoire d'état de consommation (50) pour mémoriser une valeur de paramètre de consommation pendant l'intervalle de temps de fonctionnement du second compteur et prévue pour calculer une condition de consommation sur la base du modèle de consommation mémorisé, et pour placer une condition de consommation de référence dans le moyen destiné au changement après la fin du fonctionnement du second compteur,

un détecteur de présence d'état de consommation (15) destiné à détecter l'arrivée d'une valeur de paramètre de consommation à l'intérieur de la plage de surveillance afin d'entraîner la sortie d'un signal pour relancer le fonctionnement du second compteur à l'arrivée de la valeur de paramètre de consommation et pour initialiser la seconde mémoire d'état de consommation (50) sur arrivée de la valeur de paramètre de consommation.