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(54) DEVICE FOR BOILERS OR THERMIC GENERATORS

VORRICHTUNG FÜR KESSEL ODER THERMISCHE GENERATOREN

DISPOSITIF POUR CHAUDIÈRES OU GÉNÉRATEURS THERMIQUES

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Description

[0001] The present invention relates to a device for boilers or thermic generators, particularly for home or industrial heating, able to monitor the energy performance thereof.

[0002] To contain the energy consumption of boilers in charge of room heating, insulating materials are used for the rooms. Then, biennial checks to boilers try to find boilers that are malfunctioning and have low efficiency. The user is not able from the outside to understand if the boiler is not working at its best.

[0003] DE 10 2008 003866 A1 and US 2016/076950 disclose devices for managing energy efficiency in domestic or industrial premises.

[0004] The main object of the invention is a device for improving the energy balance of a boiler, especially for heating.

[0005] Another object is to allow a user to perform a check on the efficiency of the boiler without resorting to the assistance of a field technician.

[0006] The device for controlling the energy balance of a boiler, in particular for heating, is defined in the attached claims.

[0007] The device is for domestic or industrial heating boilers wherein

the boiler comprises

an input pipe for water to be heated, and
a heated-water output pipe,
a fluid-fuel inlet pipe for heating the water,

the device comprising
sensors for measuring the water's flow rate and temperature in the input pipe, a sensor for measuring the fluid's flow rate in the fluid input pipe.
an electronic circuit connected to the sensors configured to detect the data output thereof,
the electronic circuit being configured to calculate from the output data two information or parameters, i.e.
the potential energy-contribution of the fluid within a unit of time, and
the caloric energy transferred from the boiler to the outgoing water during that unit of time.

[0008] The electronic circuit is configured to calculate from said information an efficiency parameter of the boiler on the basis of which to drive the combustion operation of the boiler.

[0009] Preferably, the electronic circuit is configured to compare the processed data with characteristic data of the boiler, e.g. stored during a configuration phase. From the comparison of the data the electronic circuit calculates the two said information.

[0010] Preferably, the circuit is connected to a data transmitter. Through the data transmitter the electronic circuit can transmit the data detected by the sensors and/or the calculated parameter and/or the state of the boiler to a remote user or electronic receiver.

[0011] Likewise, via the data transmitter the electronic circuit may transmit a warning signal on the state of the boiler. It's convenient to take advantage of the object that everyone now has, the mobile phone or *smartphone*, for notifying the user; thus for this purpose the data transmitter may comprise an Internet or Ethernet network card and/or a GSM card and/or a WI-FI or Bluetooth® card.

[0012] An *app* that periodically communicates with the electronic device in order to receive a data indicating the state of the boiler may be installed on the mobile phone or *smartphone.*

[0013] Further features and advantages of the device will result more evident from the description of a preferred embodiment, illustrated in the attached drawings, in which:
figure 1 schematically illustrates a device as associated with a boiler.

[0014] A device MC serves to improve the energy efficiency of a gas boiler 6, which includes for example:

a tube 20 for the introduction of a gas to be burned,
a pipe 26 coming from the aqueduct that brings cold water to the boiler 6 (water used for sanitary heating),
a return pipe 30 for the water which returns to the boiler 6 from the radiators of the heating system (not shown);
a pipe 46 for supplying hot water to the radiators of the heating system, and
a pipe 40 for the exit of hot water for the sanitary facilities.

[0015] The tube 30 and the tube 46 belong to a same closed water-circuit; the tube 26 and the tube 40 belong to a second open water-circuit, separated from the first one.

[0016] The number of the heated water circuits - closed or open - served by the boiler 6 may in any case vary from what is illustrated. The tube 20 generically may inject any gas or fluid to be burned inside the boiler 6, such as for example

LPG, diesel, methane or other. The invention is not limited to a particular combustible fluid.

[0017] The device MC envisages that on each of the tubes 26, 30, 40, 46 there is mounted respectively a sensor 28, 32, 42, 48 for detecting the flow rate of the water and the temperature of the water flowing in the pipe. The sensors 28, 32, 42, 48 e.g. are constituted by a flowmeter, capable of measuring the amount of fluid that runs through the tube, and by a thermocouple for the measurement of the fluid's local temperature.

[0018] A flow sensor 22 is mounted on the gas pipe 20.

[0019] The device MC comprises an electronic circuit 60.

[0020] The output of the sensors 22, 28, 32, 42, 48 is connected to the A/D inputs of the electronic circuit 60, which is able to read the values detected by each sensor. The electronic circuit 60 is e.g. a board with a microprocessor programmed to execute the functions described herein. This favors execution of calculations or mathematical functions on the data converted into digital input (a strictly analogical processing is also possible).

[0021] Associated with - or integrated in - the circuit 60 there is a data memory wherein the circuit 60 can store data in a non-volatile manner.

[0022] The circuit 60 is interfaced with various devices, in particular:

means 80 adapted to allow a manual release of the boiler 6, said means 80 being for example constituted by a button which allows the user to restore the normal operation of the boiler 6; and
means 70, e.g. consisting of a valve, for imposing a reduction of the working temperature of the boiler 6; and/or
a display 92; and/or
a transmitter 90 capable of sending a signal to a remote user. The transmitter 90 may be e.g. a GSM transmitter, an Internet network card, a WI-FI card, or a cabled line; and/or
a user interface 94 for entering data, such as a keyboard or a touch screen.

OPERATION

[0023] The circuit 60 is to be calibrated according to the operating characteristics considered optimal for the boiler 6 by memorizing into it one or more threshold values which represent the desired operating quality of the boiler 6. Below these values, entered e.g. with the interface 94, the circuit 60 will start to operate, e.g. to report the malfunction and the consequent excessive energy consumption or abnormal pollution.

[0024] When the boiler 6 starts working, a gas flow starts to run in the tube 20 and the boiler 6 burns it to heat the water for the heating and/or the health service. This flow is measured by the sensor 22 and detected by circuit 60.

[0025] When water is required by the boiler 6, for example for heating water for the sanitary items, there is a flow of water passing through the tube 26 and detected by the sensor 28, which also measures the water temperature coming from the aqueduct. Then, the water is heated inside the boiler 6 and proceeds to destination via the tube 40.

[0026] In the circuit 60, the value read by the sensors 28, 42 is processed to calculate the difference ΔT between the two water temperatures at the inlet and outlet of the boiler 6. Similar calculation can be made by the circuit 60 for the heating of the rooms, by considering in this last case the data read by sensors 32 and 48.

[0027] Furthermore, the electronic circuit 60 uses the data obtained from the sensor 22 to calculate the theoretical kilojoules (Kj) that each cubic meter of burned gas should produce to heat the water in the boiler 6.

[0028] Hence the circuit 60 measures a flow of water in the tube 26 and/or 30, and calculates the heat actually transferred from the boiler 6 to the circulating water as:

$$VAL1 = \Delta T * \text{specific heat of water} * \text{liters of water measured by sensor 28 or 32.}$$

[0029] The circuit 60 also calculates the heat theoretically yielded by the boiler 6 to the circulating water, i.e. the theoretical kilojoules (Kj) exchanged with the water, by multiplying the gas flow rate P by an optimal combustion coefficient K,

$$VAL2 = P * K.$$

[0030] The circuit 60 then compares the two values and by means of mathematical or logic functions calculates the deviation S (e.g. via the operation S = | VAL2 - VAL1 |) to compare it with preset or programmable thresholds. If the deviation is greater than a threshold - corresponding for example to a % of VAL1 or VAL2 (inefficiency not tolerated) - the circuit 60 may, for example, activate the means 70 for reducing the gas flow in order to bring the boiler 6 to a desired condition of minimum operation.

[0031] The calculation is the same also for the operation of room heating considering in this last case as input water into the boiler 6 the return water from the radiators in the tube 30.

[0032] The device MC, upon signaling an anomaly of efficiency, induces the user to carry out a check of the generator. From the check there can emerge both necessary system maintenance and a poor quality of the used fuel.

[0033] The circuit 60 is able to simultaneously perform the real time control of all the hydraulic circuits, thus in the illustrated example it is able to recognize which of the circuits is inefficient.

[0034] To this aim, the tolerated inefficiency threshold or percentage values are distinct for the two hydraulic circuits, e.g. settable by programming the circuit 60 via the interface 94.

[0035] In the same way, by programming the circuit 60 through the interface 94 one can continuously display the control during operation, or at set time intervals.

[0036] If the means 70 have been activated by the circuit 60, the latter detects the condition of the means 80 to verify a user action. If it detects one, the circuit 60 restores the normal operation of the boiler 6 by inhibiting the means 70, e. g. hourly.

[0037] This repeated intervention for the manual reactivation of the boiler 6 becomes a repeated prompt to the user to intervene to solve the problem.

[0038] Preferably, the circuit 60 stores in the memory a history of the data detected by the sensors.

[0039] Preferably, the circuit 60 is programmed to drive e.g. the display 92 to display the data and to allow consultation and navigation thereof to the user by receiving navigation commands from the interface 94.

[0040] Preferably, the circuit 60 is programmed to drive e.g. the interface 94 (which is equipped for example with a USB port) to save on a medium the stored sensed and/or calculated data.

[0041] Preferably, the circuit 60 is programmed to detect the instantaneous flow rate from the sensor 22 and display it in real-time on the display 92.

[0042] Preferably, the circuit 60 is programmed to remotely send a warning signal when it detects that the boiler 6 works with efficiency below the threshold. The warning signal may be sent via the transmitter 90 and/or displayed on the display 92 and/or generated as an acoustic signal from a sound warner connected to circuit 60.

[0043] Usually the boiler 6 is installed in an unfrequented place, therefore the sound warner could be an inefficient warner. Advantageously then the transmitter 90 comprises

an Internet or Ethernet network card to send a message to the remote user via a more readily accessible format, such as e.g. an e-mail; and/or
a GSM card to send an alert SMS to a mobile phone of the user; and/or
a WI-FI or Bluetooth® card to send a text message or a notice message on a user's mobile phone via social networks (e.g. Facebook® or Whatsup®).

[0044] On the mobile phone e.g. an app can be installed that periodically communicates with the device 60 in order to receive a data indicating the state of the boiler.

Claims

1. Device (MC) for domestic or industrial heating boilers or thermic generators (6), the boiler or generator comprising

an input pipe (26, 30) for water to be heated, and
a heated-water output pipe (40, 46),
a fluid-fuel inlet pipe (20) for heating the water,
the device comprising
sensors (28, 32) for measuring the water's flow rate and temperature in the input pipe (26, 30).
sensors (42, 48) for measuring the water's flow rate and temperature in the output pipe (40, 46).
a sensor (22) for measuring the fluid-fuel's flow rate in the fluid-fuel input pipe (20),
an electronic circuit (60) connected to the sensors (22, 28, 32, 42, Z 48) configured to detect the data output thereof,
the electronic circuit (60) being configured to calculate from the output data two information or parameters, i.e.
the potential energy-contribution of the fluid fuel within a unit of time, and
the caloric energy transferred from the boiler (6) to the outgoing water during that unit of time,
characterized in that
the circuit (60) is interfaced with
first means (80) adapted to allow a manual release of the boiler (6), and
second means (70) for imposing a reduction of the working temperature of the boiler (6);

and the circuit (60) is configured to

- compare said two information, and
- by means of mathematical or logic functions - calculate a deviation (S) thereof to compare it with preset or programmable thresholds,

and, if the deviation (S) is greater than a threshold, to activate the second means (70) for reducing the gas flow in order to bring the boiler (6) to a desired condition of minimum operation, and to detect the condition of the first means (80) to verify a user action thereupon, and
if the circuit (60) detects a user action, to restore the normal operation of the boiler (6) by inhibiting the second means (70).

2. Device (MC) as claimed in claim 1, wherein the second means (70) consist of a valve.

3. Device (MC) as in any one of the preceding claims, wherein said first means (80) are constituted of a button which allows the user to restore the normal operation of the boiler (6).

4. Device (MC) as in any one of the preceding claims, wherein the circuit (60) is connected to a display (92), the circuit (60) being configured to drive the display (92) to display the data detected by the sensors (32, 28, 42, 38) and/or the calculated parameter.

5. Device (MC) as in claim 4, wherein the circuit (60) is configured to drive the display (90) to display real-time information or as read from a memory in which the circuit (60) is configured to store over time data detected by the sensors (32, 28, 42, 38) and/or the calculated parameter.

6. Device (MC) as in any one of the preceding claims, wherein the circuit (60) is connected to a user interface (94), the circuit (60) being configured to interact with the user interface (94) to acquire the threshold value with which to process said parameter.

7. Device (MC) as in any one of the preceding claims, wherein the circuit (60) is connected to a data transmitter (90), the circuit (60) being configured to drive the data transmitter (90) for transmitting the data detected by the sensors (32, 28, 42, 38) and/or the calculated parameter to a remote user or electronic remote receiver.

8. Device (MC) as in claim 7, wherein the electronic remote receiver is a smartphone.

9. Device (MC) as in claim 7 or 8, wherein the data transmitter comprise an Internet or Ethernet network card and/or a GSM card and/or a WI-FI or Bluetooth® card.

10. Device (MC) as in any one of the preceding claims, wherein the circuit (60) is configured to perform said calculations continuously or at programmed time intervals.

11. Device (MC) as in any one of the preceding claims, wherein the circuit (60) comprises a mass memory in which to store over time data detected by the sensors (32, 28, 42, 38) and/or the calculated parameter.

12. Device (MC) as in any one of the preceding claims, wherein the electronic circuit (60) is configured to compare the processed data with characteristic data of the boiler stored during a configuration phase.

Patentansprüche

1. Vorrichtung (MC) für häusliche oder industrielle Heizkessel oder thermische Generatoren (6), wobei der Kessel oder Generator Folgendes umfasst

eine Zuleitung (26, 30) für das zu erwärmende Wasser und
ein Heizwasser-Ausgangsrohr (40, 46),
eine Zuleitung für flüssigen Brennstoff (20) zur Erwärmung des Wassers,
wobei die Vorrichtung umfasst
Sensoren (28, 32) zur Messung der Durchflussmenge und der Temperatur des Wassers in der Eingangsleitung

(26, 30).
Sensoren (42, 48) zur Messung der Durchflussmenge und der Temperatur des Wassers in der Ausgangsleitung (40, 46).
einen Sensor (22) zur Messung der Durchflussmenge des flüssigen Kraftstoffs in der Zufuhrleitung (20) für den flüssigen Kraftstoff,
eine elektronische Schaltung (60), die mit den Sensoren (22, 28, 32, 42, 48) verbunden und so konfiguriert ist, dass sie die von ihnen ausgegebenen Daten erfasst,
die elektronische Schaltung (60) so konfiguriert ist, dass sie aus den Ausgangsdaten zwei Informationen oder Parameter berechnet, d.h.
die potenzielle Energiezufuhr des flüssigen Kraftstoffs innerhalb einer Zeiteinheit, und
die während dieser Zeiteinheit vom Kessel (6) an das abfließende Wasser übertragene Wärmeenergie,
dadurch gekennzeichnet, dass
die Schaltung (60) ist verbunden mit
ein erstes Mittel (80), das eine manuelle Freigabe des Kessels (6) ermöglicht, und
ein zweites Mittel (70), um die Arbeitstemperatur des Kessels (6) zu senken;
und die Schaltung (60) ist so konfiguriert, dass sie

- die beiden Informationen zu vergleichen, und
- mittels mathematischer oder logischer Funktionen - eine Abweichung (S) zu berechnen und diese mit vorgegebenen oder programmierbaren Schwellenwerten zu vergleichen,

und, wenn die Abweichung (S) größer als ein Schwellenwert ist, das zweite Mittel (70) zur Reduzierung des Gasflusses zu aktivieren, um den Kessel (6) in einen gewünschten Zustand des Minimalbetriebs zu bringen, und den Zustand des ersten Mittels (80) zu erfassen, um daraufhin eine Benutzeraktion zu verifizieren, und wenn die Schaltung (60) eine Benutzeraktion feststellt, den normalen Betrieb des Heizkessels (6) wiederherzustellen, indem das zweite Mittel (70) gesperrt wird.

2. Vorrichtung (MC) nach Anspruch 1, wobei das zweite Mittel (70) aus einem Ventil besteht.

3. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei das zweite Mittel (80) aus einer Taste besteht, die es dem Benutzer ermöglicht, den normalen Betrieb des Heizkessels (6) wiederherzustellen.

4. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei die Schaltung (60) mit einer Anzeige (92) verbunden ist, wobei die Schaltung (60) so konfiguriert ist, dass sie die Anzeige (92) ansteuert, um die von den Sensoren (32, 28, 42, 38) erfassten Daten und/oder den berechneten Parameter anzuzeigen.

5. Vorrichtung (MC) nach Anspruch 4, wobei die Schaltung (60) so konfiguriert ist, dass sie die Anzeige (90) so ansteuert, dass sie Echtzeitinformationen oder aus einem Speicher gelesene Informationen anzeigt, in dem die Schaltung (60) so konfiguriert ist, dass sie die von den Sensoren (32, 28, 42, 38) erfassten Daten und/oder den berechneten Parameter über die Zeit speichert.

6. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei die Schaltung (60) mit einer Benutzerschnittstelle (94) verbunden ist, wobei die Schaltung (60) so konfiguriert ist, dass sie mit der Benutzerschnittstelle (94) interagiert, um den Schwellenwert zu erfassen, mit dem der Parameter verarbeitet werden soll.

7. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei die Schaltung (60) mit einem Datensender (90) verbunden ist, wobei die Schaltung (60) so konfiguriert ist, dass sie den Datensender (90) ansteuert, um die von den Sensoren (32, 28, 42, 38) erfassten Daten und/oder den berechneten Parameter an einen entfernten Benutzer oder elektronischen Fernempfänger zu übertragen.

8. Vorrichtung (MC) nach Anspruch 7, wobei der elektronische Fernempfänger ein Smartphone ist.

9. Vorrichtung (MC) nach Anspruch 7 oder 8, wobei der Datensender eine Internet- oder Ethernet-Netzwerkkarte und/oder eine GSM-Karte und/oder eine WI-FI- oder Bluetooth®-Karte umfasst.

10. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei die Schaltung (60) so konfiguriert ist, dass sie die Berechnungen kontinuierlich oder in programmierten Zeitintervallen durchführt.

11. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei die Schaltung (60) einen Massenspeicher umfasst, in dem die von den Sensoren (32, 28, 42, 38) erfassten Daten und/oder der berechnete Parameter über die Zeit gespeichert werden können.

12. Vorrichtung (MC) nach einem der vorhergehenden Ansprüche, wobei die elektronische Schaltung (60) so konfiguriert ist, dass sie die verarbeiteten Daten mit charakteristischen Daten des Heizkessels vergleicht, die während einer Konfigurationsphase gespeichert wurden.

Revendications

1. Dispositif (MC) pour chaudières de chauffage domestique ou industriel ou générateurs thermiques (6), la chaudière ou le générateur comprenant

un tuyau d'entrée (26, 30) pour l'eau à chauffer, et
un tuyau de sortie d'eau chauffée (40, 46),
un tuyau d'entrée de fluide-carburant (20) pour chauffer l'eau,
le dispositif comprenant
des capteurs (28, 32) pour mesurer le débit et la température de l'eau dans le tuyau d'entrée (26, 30).
des capteurs (42, 48) pour mesurer le débit et la température de l'eau dans le tuyau de sortie (40, 46).
un capteur (22) pour mesurer le débit du fluide-carburant dans le tuyau d'entrée fluide-carburant (20),
un circuit électronique (60) connecté aux capteurs (22, 28, 32, 42, 48) configuré pour détecter la sortie de données de ceux-ci,
le circuit électronique (60) étant configuré pour calculer à partir des données de sortie deux informations ou paramètres, c'est-à-dire
la contribution énergétique potentielle du combustible fluide dans une unité de temps, et
l' énergie calorique transférée de la chaudière (6) à l'eau sortante pendant cette unité de temps,
caractérisé en ce que
le circuit (60) est interface avec
des premiers moyens (80) adaptés pour permettre un déverrouillage manuel de la chaudière (6), et
des seconds moyens (70) pour imposer une réduction de la température de fonctionnement de la chaudière (6) ;
et le circuit (60) est configuré pour

- comparer lesdites deux informations, et
- au moyen de fonctions mathématiques ou logiques - en calculer un écart (S) pour le comparer à des seuils prédéfinis ou programmables,

et, si l'écart (S) est supérieur à un seuil, activer les deuxièmes moyens (70) de réduction du débit de gaz afin d'amener la chaudière (6) à une condition souhaitée de fonctionnement minimum, et détecter la condition de le premier moyen (80) pour vérifier une action de l'utilisateur à ce sujet, et
si le circuit (60) détecte une action de l'utilisateur, rétablir le fonctionnement normal de la chaudière (6) en inhibant les seconds moyens (70).

2. Dispositif (MC) selon la revendication 1, dans lequel les seconds moyens (70) sont constitués par une valve.

3. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel lesdits seconds moyens (80) sont constitués d'un bouton qui permet à l'utilisateur de rétablir le fonctionnement normal de la chaudière (6).

4. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel le circuit (60) est connecté à un afficheur (92), le circuit (60) étant configuré pour piloter l'afficheur (92) pour afficher les données détectées par les capteurs (32, 28, 42, 38) et/ou le paramètre calculé.

5. Dispositif (MC) selon la revendication 4, dans lequel le circuit (60) est configuré pour piloter l'affichage (90) pour afficher des informations en temps réel ou lues dans une mémoire dans laquelle le circuit (60) est configuré pour stocker plus de des données temporelles détectées par les capteurs (32, 28, 42, 38) et/ou le paramètre calculé.

6. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel le circuit (60) est connecté à une interface utilisateur (94), le circuit (60) étant configuré pour interagir avec l'interface utilisateur (94) pour acquérir

le valeur seuil avec laquelle traiter ledit paramètre.

7. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel le circuit (60) est connecté à un émetteur de données (90), le circuit (60) étant configuré pour piloter l'émetteur de données (90) pour transmettre les données, détecté par les capteurs (32, 28, 42, 38) et/ou le paramètre calculé à un utilisateur distant ou à un récepteur électronique distant.

8. Dispositif (MC) selon la revendication 7, dans lequel le récepteur électronique distant est un smartphone.

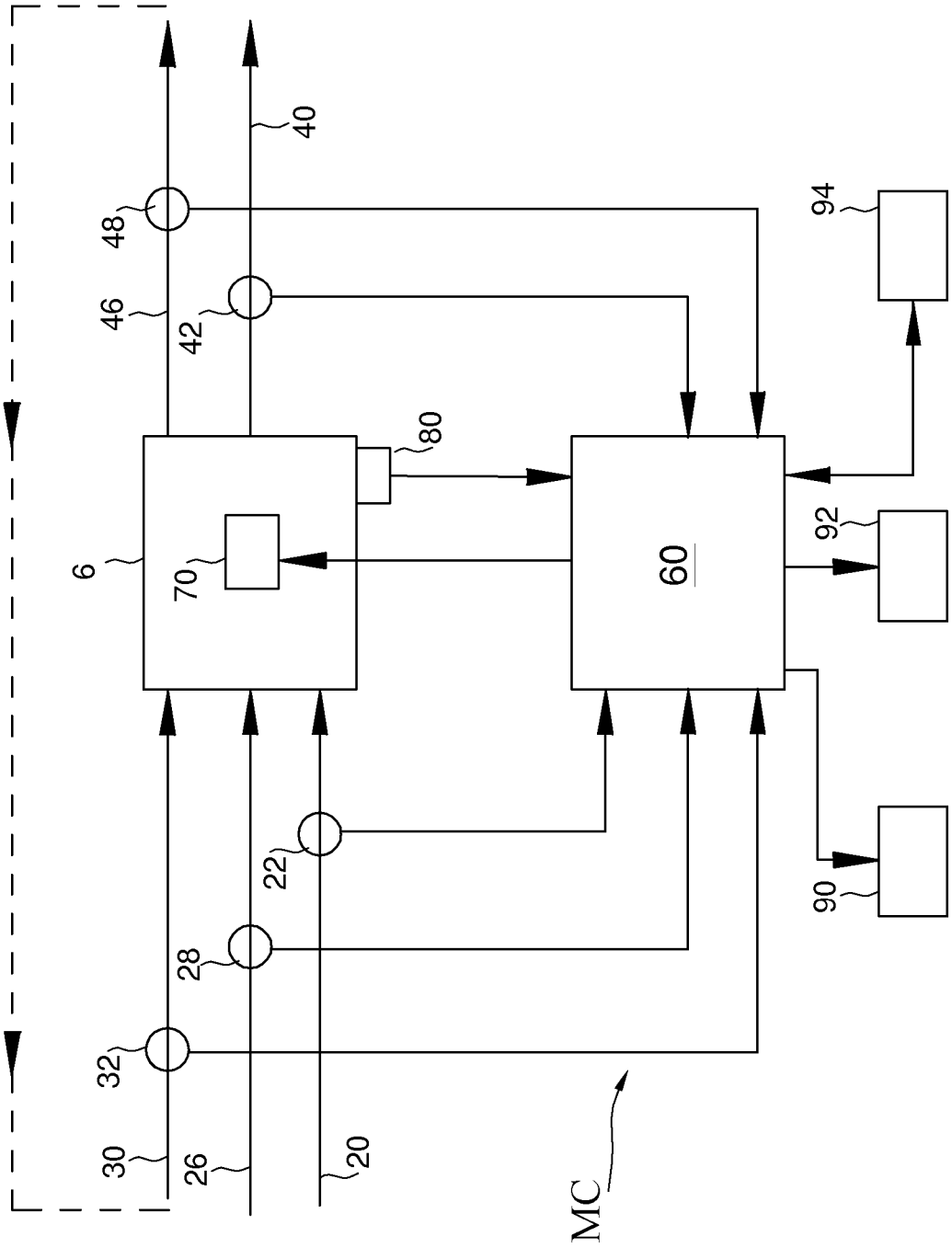
9. Dispositif (MC) selon la revendication 7 ou 8, dans lequel les émetteurs de données comprennent une carte réseau Internet ou Ethernet et/ou une carte GSM et/ou une carte WI-FI ou Bluetooth®.

10. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel le circuit (60) est configuré pour effectuer lesdits calculs en continu ou à intervalles de temps programmés.

11. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel le circuit (60) comprend une mémoire de masse pour stocker dans le temps les données détectées par les capteurs (32, 28, 42, 38) et/ou les calculées paramètre.

12. Dispositif (MC) selon l'une quelconque des revendications précédentes, dans lequel le circuit électronique (60) est configuré pour comparer les données traitées avec des données caractéristiques de la chaudière stockées lors d'une phase de configuration.

Fig. 1



REFERENCES CITED IN THE DESCRIPTION

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