An apparatus for controlling a number of boilers.

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References cited:
DE-A-2 355 988
GB-A-2 011 659
US-A-3 428 784
US-A-3 513 662
US-A-3 529 173
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Description

In a publication Recknagel-Sprenger TASCHENBÜCH FÜR HEIZUNG UND KLIMATECHNIK, Editor R. Oldenbourg, München, Wein, 60. Ausgabe, 1979, page 770—771, is disclosed three boilers connected in terms of water circulation in parallel and are defined as “boilers in cascade”. This expression “in cascade” is a general term meaning that several devices are connected in order to be used as a unit. The US—A—3 513 662 discloses a number of compressors cascaded in some way not specified. The DE—A—2 355 988 discloses a device for heating water to be used in a shower or the like. There is no return conduit as the system is not a circulation system. The main object is to heat a volume of water as quickly as possible and to mix the heated water with cold water. Therefore the water volume around the electrical heating elements is made as small as possible and in this case the water tank is divided into three small tanks connected to each other and each containing a number of electrical heating elements. For all the small tanks together there is only one control equipment responding to a temperature sensor at the output from the last small tank. When the water volume around the electrical heating elements is very small as in this case, there is an immediate danger for high temperatures and overheating especially when the water flow is low and varies. Therefore a water flow sensor is provided to prevent connection of electrical heating elements to the power source even if the temperature sensor calls for an increase of the temperature of the water.

Nowhere in this prior art is disclosed anything about connecting a number of small boilers in series in order to replace one single boiler for attaining primarily an overall cheaper installation but also an installation which is less sensitive to disturbance and is thereby operationally more reliable because such an approach entails serious problems of regulation engineering, since the power increase of a boiler is perceived by a subsequent boiler as an increase of the temperature and, as a result, its control equipment reduces the power output. This gives rise to fluctuations in the system and the entire control arrangement is put out of operation.

The task which forms the basis of the present invention is to realize an apparatus which makes it possible to connect a number of small boilers in series, and therefore in normal cases fundamentally prevents an increase of the output in a subsequent boiler, until a preceding boiler has reached a certain, high output level and, in principle, prevents reduction of the output level in a preceding boiler until a subsequent boiler has reduced its output to a certain, low level.

The task forming the bases of the present invention is solved in that a number of boilers are, in terms of water engineering, interconnected in series in such a manner that return water from the circulation system enters the first boiler in the series and continues through the other boilers and is thereafter redischarged into the circulation system, each of said boilers is provided with a control equipment for heating water entering each boiler to a temperature set in the control equipment of each boiler in accordance with a temperature sensor in each boiler, in that the control equipment of each boiler is provided with first switch means for providing a signal “permission to increase”, which will allow the control equipment of the subsequent boiler in the series-connection to increase its power when the preceding boiler reaches a certain high power level, and with second switch means for providing a signal “permission to reduce”, which will prevent the control equipment of the preceding boiler in the series-connection to reduce the power level of said preceding boiler until the subsequent boiler has reduced its power to a certain low level. The control equipment of a boiler includes an excess temperature sensor means which provides said boiler with a signal “permission to reduce”, whether or not the boiler has received the signal from the subsequent boiler in the series, said excess temperature sensor means, on reduction of the output, being operable to break the signal “permission to increase” in order to prevent subsequent boilers in the series from compensating. Said control equipment is operative, in the event of an overload of more than, for example, 10% an amount above a preset value, internally to generate the signal “permission to reduce” and the signal “permission to increase”.

An apparatus according to the present invention realizes connection of a number of small boilers in series by a priority ranking of the boilers which are series-coupled in such a manner that the first boiler, in which the return water first arrives, has the highest priority, and the last boiler, from the water is redischarged into the circulation system, for example a riser, has the lowest priority. This thus makes possible that a subsequent boiler is not connected in until the preceding boiler has reached a certain output level, for example full output and similarly, a preceding boiler cannot reduce its output until the subsequent boiler has lowered its output to a desired level, for example zero output. There will thus be provided an extremely stable automatic regulating system.

The present invention will be described in greater detail below with reference to the accompanying drawings. Fig. 1 is an outline block diagram of one embodiment of an apparatus according to the present invention. Fig. 2 illustrates a further block diagram of one embodiment of an apparatus according to the present invention.

Fig. 1 illustrates a series-coupling of three boilers 1, 2 and 3. These boilers are, with regard to water engineering, connected in series in such a manner that the return water from a circulation system is fed into boiler 1 and passes thence to the boiler 2 and to the boiler 3, whereas the heated water is redischarged into the circulation system, for example a riser pipe.
Each boiler 1—3 is provided with regulator equipment of per se conventional type for increasing and reducing, respectively, the output of the boiler depending upon some desired quantity, for example the temperature in a premises which is heated by means of the water in the circulation system. Such a quantity may also include the temperature outdoors, wind speed and so on. Irrespective of the chosen regulating quantity or quantities, the regulating equipment of the boiler will either increase the output of the boiler or reduce its output.

Two switches are disposed in the control equipment of each boiler 1—3. In Fig. 1, the switches in the boiler 1 are designated 4 and 5, whereas the switches in the boiler 2 are designated 6 and 7, and in the boiler 3, 8 and 9. The switches 4, 6 and 8 are interconnected in series and are connected to a voltage level of +12 V. The input terminals of the switches 4, 6 and 8 are each coupled to their respective boiler control equipment which is illustrated by means of the arrows 10, 12 and 14.

The switches 5, 7 and 9 are also interconnected in series and are connected to a voltage level of +12 V. The signal input terminal of these switches 5, 6 and 9 is each coupled to its respective boiler control equipment, as illustrated by means of the arrows 11, 13 and 15.

The thus realized series circuits may be increased or reduced to any optional degree.

The voltage level +12 V is fed into the boiler 1 in its control equipment and represents a signal "permission to increase". When this boiler has reached full output, its control equipment will throw the switch 4 into the position shown in Fig. 1, whereby the voltage level +12 V or the signal "permission to increase" is fed further to the boiler 2 and thereby to its control equipment by the intermediary of the input terminal of the switch 6 or the arrow 12. Because of the voltage level +12 V, this boiler 2 will be given permission to increase output, but the voltage level +12 V is not fed further by means of the switch 6 to the boiler 3 until the boiler 2 has attained a certain high output or full output. If, thus, the boilers 1 and 2 are running at full output, the switch 6 will be made so that the boiler 3 also receives the voltage level +12 V and thereby the signal "permission to increase" and can contribute to the heating output. The switch 8 is not made until the boiler 3 has reached a certain, high output or full output.

It may be desirable to reduce the joint heating output of boilers 1 and 2 from the situation illustrated in Fig. 1, but it is preferable first to reduce the heating output of the boiler 2 before the boiler 1 is permitted to commence output reduction. To this end, the switch 5, 7 and 9 are provided and a voltage level +12 V or a signal "permission to reduce" is passed from the boiler 3 by the intermediary of the arrow 15 and its control equipment to the arrow 13 and the control equipment of the boiler 2. Thanks to the voltage level +12 V from the switch 9 to the boiler 2 by the intermediary of the arrow 14, the boiler 2 is given permission to reduce its output. The voltage level +12 V or the signal "permission to reduce" is not, however, passed further from the boiler 2 by the intermediary of the switch 7 to the arrow 11 until such time as the boiler 2 has reduced its output to a desired, low level or zero output.

In brief, the above-outlined priority function may be described such that the switches 4, 6 and 8 are made when full output is produced by their boilers, whereas the switches 5, 7 and 9 are made when their boilers produce no output.

In the above described system, there may undoubtedly be a risk of overheating if, for example, a pump would stop, or if the main water supply faucet were to be closed etc. If, under such circumstances, there is no active signal "permission to reduce", great problems may arise. As a result, each control equipment unit is provided with an excess temperature sensor such that, if a boiler exceeds the preset temperature by a certain value, for example 6—7°C, the control equipment of the boiler will receive the "permission to reduce" signal. Naturally, in this way all boilers in the system having excess temperature will reduce their output in parallel with one another. Apart from the given signal "permission to reduce", the control equipment of the overheated boiler will break the signal "permission to increase". In this way, it will be ensured that no subsequent boiler will compensate for the output loss by an output increase.

Fig. 2 illustrates a similar series-connection of four boilers and, as will be apparent to the skilled reader, the switches in the different boilers are arranged in the same manner as in the embodiment according to Fig. 1 and, similarly, the voltage level source is common for the generation of the two signals "permission to increase" and "permission to reduce".

Fig. 2 further shows that the apparatus according to the present invention may be realized in an extremely simple manner by the passage of but one four conductor signal cable between the control equipment of each individual boiler. The switches may suitably consist of transistor switches or the like. In Fig. 2, the signal "permission to reduce" may be impressed on all boilers, whereas the signal "permission to increase" may be impressed only on the first boiler.

As soon as the boiler 1 begins to increase its output, the switch for the signal "permission to reduce" will be opened.

In most cases, the control equipment of such boilers is disposed to permit leapfrog increase and reduction of the output and one example of such control equipment includes fifteen steps with a step time of 10—20 seconds per step. It may thus be said that the signal "permission to reduce" is opened when the first control step is made and remains open as long as any step is made. When the boiler has reached the final step, the switch for the signal "permission to increase" is made, whereas the boiler 2 begins stepwise to increase output and thereby its switch for the signal "permission to reduce" is opened, the entire regulation proceeding thus.
In each unit of control equipment, there are also means for generating, in the event of an overload of more than, for example, 10% above a preset value, the signal "permission to reduce", and the signal "permission to increase" whereby the function will be the same as in the event of excess temperature.

In the event of excess temperature or overload, the priority ranking which is realized by means of the apparatus according to Figs. 1 and 2, will be broken whereby an "early" boiler in the system may reduce or step down in output without any compensatory increase being made by the subsequent boilers. Thus, the subsequent boilers cannot increase their output until the "early" boiler has returned to full output running.

Claims

1. A system for heating water in a circulation system for heating of a premises, characterized in that a number of boilers are, in terms of water engineering, interconnected in series in such a manner that return water from the circulation system enters the first boiler in the series and continues through the other boilers and is thereafter discharged into the circulation system, each of said boilers is provided with a control equipment for heating water entering each boiler to a temperature set in the control equipment of each boiler in accordance with a temperature sensor in each boiler, in that the control equipment of each boiler is provided with first switch means for providing a signal "permission to increase", which will allow the control equipment of the subsequent boiler in the series-connection to increase its power when the preceding boiler reaches a certain high power level, and with second switch means for providing a signal "permission to reduce", which will prevent the control equipment of the preceding boiler in the series-connection to reduce the power level of said preceding boiler until the subsequent boiler has reduced its power to a certain low level.

2. A system according to claim 1, characterized in that the control equipment of a boiler includes an excess temperature sensor means which provides said boiler with a signal "permission to reduce", whether or not the boiler has received the signal from the subsequent boiler in the series, said excess temperature sensor means on reduction of the output, being operable to break the signal "permission to increase" in order to prevent subsequent boilers in the series from compensating.

3. A system according to claim 2, characterized in that said control equipment is operative, in the event of an overload of more than, for example, 10% an amount above a preset value, internally to generate the signal "permission to reduce" and the signal "permission to increase".

Patentansprüche


2. System-gemäß Anspruch 1, dadurch gekennzeichnet, daß im Regler eines Boilers ein Übertemperaturfühler angeschraubt ist, der dem betreffenden Boiler das Signal "Erlaubnis zur Leistungsreduzierung" erteilt, unabhängig davon, ob der Boiler dieses Signal von dem in der Reihenverbindung nachfolgenden Boiler erhält oder nicht; dieser Übertemperaturfühler ist bei Reduzierung der Ausgabeleistung in der Lage, das Signal "Erlaubnis zur Leistungssteigerung" zu unterbrechen, um die in der Reihenverbindung nachfolgenden Boiler am Ausgleichen zu hindern.


Revendicaciones

1. Un sistema para chauffer l’eau dans un système de circulation pour le chauffage d’un local, caractérisé en ce qu’un certain nombre de chaudières sont, en termes de technique de l’eau, interconnectées en série de telle façon que l’eau de retour du système de circulation entre dans la première chaudière de la série et continue à travers les autres chaudières et est ensuite redéversée dans le système de circulation, chacune des chaudières étant dotée d’un équipement de commande pour chauffer l’eau qui entre dans chaque chaudière à une température réglée dans l’équipement de commande de chaque chaudière conformément à un capteur de température dans chaque chaudière, en ce que l’équipement de commande de chaque chaudière est doté d’un
premier dispositif de commutation pour fournir un signal "d’autorisation d’augmenter" qui permet à l’équipement de commande de la chaudière suivante de la série d’augmenter sa puissance lorsque la chaudière précédente atteint un certain niveau de puissance élevé, et d’un second dispositif de commutation pour fournir un signal "d’autorisation de réduire" qui empêchera l’équipement de commande de la chaudière précédente de la série de réduire le niveau de puissance de ladite chaudière précédente jusqu’à ce que la chaudière suivante ait réduit sa puissance à un certain niveau bas.

2. Un système selon la revendication 1, caractérisé en ce que l’équipement de commande d’une chaudière comprend un dispositif de captage d’excès de température qui fournit à ladite chaudière un signal "d’autorisation de réduire", que la chaudière ait reçu le signal de la chaudière suivante de la série ou non, ledit dispositif de captage d’excès de température à la réduction du rendement, pouvant fonctionner pour couper le signal "d’autorisation de d’augmenter" afin d’empêcher la compensation par les chaudières suivantes de la série.

3. Un système selon la revendication 2, caractérisé en ce que ledit équipement de commande fonctionne, dans le cas d’une surcharge de plus de, par exemple 10% d’un montant au-dessus d’une valeur préréglée, à l’intérieur pour générer le signal "d’autorisation de réduire" et le signal "d’autorisation d’augmenter".