(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 019 655 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.10.2002 Bulletin 2002/43

(21) Application number: **98948940.6**

(22) Date of filing: **08.09.1998**

(51) Int Cl.[7]: **F22B 1/28**

(86) International application number:
PCT/EP98/05728

(87) International publication number:
WO 99/017056 (08.04.1999 Gazette 1999/14)

(54) **PROCESS FOR RESTORING THE LEVEL OF WATER IN BOILERS OF STEAM GENERATING MACHINES**

VERFAHREN ZUM WIEDERHERSTELLEN DES WASSERSTANDES IN KESSELN VON DAMPFERZEUGERMASCHINEN

PROCEDE DE RETABLISSEMENT DU NIVEAU DE L'EAU DANS DES CHAUDIERES DE MACHINES DE PRODUCTION DE VAPEUR

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IE IT LI LU NL PT SE
Designated Extension States:
RO SI

(30) Priority: **30.09.1997 IT UD970173 U**

(43) Date of publication of application:
19.07.2000 Bulletin 2000/29

(73) Proprietor: **Vapor Service S.R.L.**
33080 Fiume Veneto (IT)

(72) Inventor: **COMELLI, Gianluigi**
I-33094 Cordenons (IT)

(74) Representative: **Porsia, Dino, Dr.**
c/o Succ. Ing. Fischetti & Weber
Via Caffaro 3/2
16124 Genova (IT)

(56) References cited:
WO-A-97/21057
DE-A- 3 720 583
US-A- 4 948 947
US-A- 5 189 726

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 1 019 655 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a process for restoring the level of water in boilers of steam generating machines.

[0002] The invention applies to the steam generating machines to be associated with various appliances such as flatirons, cleaning devices, air humidifiers, etc., and is directed to obtain a controlled and precise filling of the boiler in order to ensure that the functioning of the steam generator is always in condition of best efficiency.

[0003] Steam generators are known incorporating a boiler constituted by an hermetically closed container tank, provided with heating resistors having the function of transforming the water into steam.

[0004] The known boilers normally have a level sensor which provides to disconnect the resistors as soon as the level of the water reaches a predetermined minimum level, as well as to signal to the user such condition so that he can provide for the manual filling of the boiler.

[0005] The addition of new water is possible only when said boilers have cooled down or when the steam within them has lost its pressure.

[0006] Presently it has been proposed to use, in cooperation with said boilers and within a single casing, auxiliary water tanks which, through pumps started by an input from said level sensor, automatically supply the boiler as soon as the water goes below the said minimum level.

[0007] This allows to avoid the waiting times for the cooling of the boiler and/or the waiting times for the lowering of the steam pressure, to reduce the time required to bring the water in the boiler to evaporation temperature, to ensure more safety for the user and to spare the manual filling operations.

[0008] According to Italian patent application No. UD 96 A 000 224 published 22 May 1998 in the name of the same applicant as in the present invention, there has been proposed a steam generator with automatic refilling, capable to be set for operating with two functions depending upon the desire of the user. a first function operation with fractioned and frequent automatic restoration of the water and a second function operation with the restoration of the water through the same pump substantially for the total useful capacity of the boiler, which is normally at about 2/3 of its inner volume.

[0009] Nevertheless it has occurred a problem with the filling of the boiler in the second function operation. It is, in fact, known that the pump flow rate is a function of the pressure in the container to which the water is fed.

[0010] In such a situation, a control based on the pump operation time to effect the filling has resulted to be inaccurate since the water quantity introduced through the pump, in a same period of time, changes depending from the pressure inside the boiler.

[0011] This causes operating problems due to the fact that if the boiler is filled too much or to little, with respect to the pre-established maximum level, the working conditions of the appliance connected to the steam generator are not optimal, since there can be produced steam which results to be excessively humid, or scarcely humid, for an effective use.

[0012] Document DE 37 20 583 A1 discloses a process for restoring the level of water in a boiler of a steam generating machine of the type comprising a boiler, an auxiliary water supply, a pump connecting the auxiliary water supply to the boiler, means for detecting a predetermined minimum level of water inside the boiler and a control device for controlling the operation of the pump. According to the cited prior art document, whenever the minimum level of water inside the boiler is detected, the pump is operated for a predetermined constant operating time.

[0013] Document US 4 948 947 A discloses a process for restoring the level of water in a boiler of a steam generating machine of the type comprising a boiler, an auxiliary water supply, a pump connecting the auxiliary water supply to the boiler, means for detecting a predetermined minimum level of water inside the boiler, means for detecting a predetermined maximum level of water inside the boiler and a control device for controlling the operation of the pump. Whenever the water level inside the boiler reaches the minimum level the pump is started and it is stopped when the water reaches the maximum level.

[0014] According to the present invention, there is provided for a process for restoring the level of water in a boiler of a steam generating machine of the type comprising a boiler, an auxiliary water tank, a pump connecting the auxiliary water tank to the boiler, means for detecting a predetermined minimum level of water inside the boiler and a control device for controlling the operation of the pump, the said process comprising the following steps:

- starting the pump when detecting that the water reaches the predetermined minimum level,
- detecting the actual pressure within the boiler or the flow rate of the water delivered by the pump to the boiler,
- determining, on the basis of the detected flow rate or pressure, a pump operating time required for the water to reach a desired maximum filling level in the boiler, and
- operating the pump for the determined operating time.

[0015] Further features of the invention will be apparent form the following detailed description of two preferred embodiments made with reference to the figures of the attached drawing, in which:

Figure 1 schematically shows the means for carrying out the process according to the invention;
Figure 2 shows a modified embodiment for carrying

out the process of the invention.

[0016] In the figures, reference numeral 10 indicates generically a detail of a steam generating machine using the process for restoring the level of water in the boiler 11, according to the process according to the invention.

[0017] Said machine 10 includes a water containing auxiliary tank 12 connected to a pump 13 connected to the boiler 11 through an inlet 14. The water of the tank 12 is introduced, at command, through the pump 13 to fill the boiler 11, where it is progressively heated and then led to evaporation by the electric heating resistor 15 to generate steam which is supplied to the appliance (not shown) through the delivery outlet 16.

[0018] The pump 13 is automatically operated, by a starting and control device 17, any time the water in the boiler 11 reaches a predetermined minimum level L0 which is calculated in such a manner to maintain the electric resistor 15 always submerged.

[0019] In the specific case, the reaching of said minimum level L0 is detected by the same inlet conduit 14 which acts as conduction probe as the water level reaches its lower edge 18.

[0020] In the embodiment according to Figure 1, whenever the said level L0 is reached the pump 13 is started and operated for the time, checked by the timer 20, which is necessary for reaching the level L1 corresponding to a desired filling maximum level.

[0021] In the specific case, the operation of the pump 13 is operatively controlled by the pressure measuring device 19 which, by utilising the continuously detected value of the pressure inside the boiler 11, controls the pump 13, through said starting and control device, to cause the said pump to modify its operating time according to the value of said pressure.

[0022] The flow rate of the pump 13 is variable depending upon the variation of the pressure in the boiler 11 and changes continuously, during the refilling operations, according to the variation of the quantity of water contained in the boiler 11.

[0023] The detection of the flow rate of the pump 13 according to the pressure in the boiler 11 allows to ensure under any circumstance and at any time the control of the filling conditions, by modifying the time of operation of the pump 13 to ensure the exact reaching of the maximum level L1.

[0024] Such detection of the flow rate, which is based on the characteristic pressure/flow rate curve of the specific pump 13 used, according to a first solution occurs in a substantially continuous way.

[0025] According to another solution, said detection occurs with a desired frequency, for instance every second, also depending upon the mechanical features of the pump 13.

[0026] According to a modified embodiment, shown in Figure 2, on the feeding duct connecting the pump 13 to the boiler 11 there is arranged an instantaneous flow rate reader 21.

[0027] Said reader 21 continuously detects the real instantaneous flow rate of the pump 13, as it changes according to the pressure within the boiler 11, and controls in feedback the starting and control device 17 in such a manner that it modifies the operating time of the pump 13 in order to obtain the desired and precise filling under any operating condition.

Claims

1. A process for restoring the level of water in a boiler (11) of a steam generating machine (10) of the type comprising a boiler (11), an auxiliary water tank (12), a pump (13) connecting the auxiliary water tank (12) to the boiler (11) means (14) for detecting a predetermined minimum level (L0) of water inside the boiler (11) and a control device (17) for controlling the operation of the pump (13),
   the process comprising:

   - starting the pump (13) when detecting that the water reaches the predetermined minimum level (L0),
   - detecting the actual pressure within the boiler (11) or the flow rate of the water delivered by the pump (13) to the boiler (11),
   - determining, on the basis of the detected flow rate or pressure, a pump operating time required for the water to reach a desired maximum filling level (L1) in the boiler (11), and
   - operating the pump (13) for the determined operating time.

2. A process according to claim 1, **characterized by** the fact that the instantaneous pressure within the boiler (11) is continuously detected by a pressure measuring device (19) connected in feedback to the starting and control device (17) of the pump (13).

3. A process according to claim 2, **characterized in that** the corrections of the operating times of the pump (13) are effected in a continuous manner.

4. A process according to claim 2, **characterized in that** the corrections of the operating times of the pump (13) are periodically made at any desired frequency.

5. A process according to claim 1, **characterized in that** the operation of the pump (13) is operatively connected with a flow rate reader (21) positioned at the delivery outlet of the said pump and connected in feedback to the starting and control device (17).

Patentansprüche

1. Verfahren zur Wiederherstellung des Wasserstands in einem Kessel (11) einer Dampferzeugermaschine (10) des Typs umfassend einen Kessel (11), einen Zusatzwassertank (12), eine den Zusatzwassertank (12) mit dem Kessel (11) verbindende Pumpe (13), ein Mittel (14) zum Erfassen eines vorher festgelegten Mindeststands (L0) des Wassers im Inneren des Kessels (11) und eine Kontrollvorrichtung (17) zur Regelung des Pumpenbetriebs (13),

   wobei das Verfahren folgende Schritte umfasst:

   - Starten der Pumpe (13), wenn festgestellt wird, dass das Wasser den vorher festgelegten Mindeststand (L0) erreicht,
   - Ermitteln des aktuellen Drucks im Kessel (11) oder der Durchflussrate des von der. Pumpe (13) an den Kessel (11) gelieferten Wassers,
   - Auf der Basis der ermittelten Durchflussrate bzw. des Drucks Ermitteln einer Pumpenbetriebszeit, die erforderlich ist, damit das Wasser einen erwünschten Höchstfüllstand (L1) im Kessel (11) erreicht, und
   - Betrieb der Pumpe (13) über die ermittelte Betriebszeit.

2. Verfahren nach Anspruch 1, **gekennzeichnet durch** die Tatsache, dass der Augenblicksdruck im Kessel (11) von einem Druckmessgerät (19), das in Rückkopplung mit der Start- und Kontrollvorrichtung (17) der Pumpe (13) verbunden ist, kontinuierlich erfasst wird.

3. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** die Korrekturen der Betriebszeiten der Pumpe (13) auf kontinuierliche Weise durchgeführt werden.

4. Verfahren nach Anspruch 2, **dadurch gekennzeichnet, dass** die Korrekturen der Betriebszeiten der Pumpe (13) in beliebiger Frequenz periodisch durchgeführt werden.

5. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Betrieb der Pumpe (13) operativ mit einem Durchflussratenmessgerät (21) verbunden ist, das an der Zufuhrauslassöffnung der Pumpe positioniert und in Rückkopplung mit der Start- und Kontrollvorrichtung (17) verbunden ist.

Revendications

1. Procédé de rétablissement du niveau d'eau dans une chaudière (11) d'un dispositif de production de vapeur (10) du type comprenant une chaudière (11), un réservoir d'eau auxiliaire (12), une pompe (13) raccordant le réservoir d'eau auxiliaire (12) à la chaudière (11), un moyen (14) destiné à détecter un niveau minimum prédéterminé (LO) d'eau à l'intérieur de la chaudière (11) et un dispositif de commande (17) destiné à commander le fonctionnement de la pompe (13),

   le procédé comprenant:

   le démarrage de la pompe (13) lors de la détection du fait que l'eau atteint le niveau minimum prédéterminé (LO),
   la détection de la pression réelle à l'intérieur de la chaudière (11) ou du débit d'eau délivré par la pompe (13) à la chaudière (11),
   la détermination, sur la base du débit, ou de la pression, détecté, d'une durée d'activation de pompe requise pour que l'eau atteigne un niveau de remplissage maximum désiré (L1) dans la chaudière (11), et
   l'activation de la pompe (13) pendant la durée d'activation déterminée.

2. Procédé selon la revendication 1, **caractérisé par le fait que** la pression instantanée à l'intérieur de la chaudière (11) est détectée en continu par un dispositif de mesure de pression (19) raccordé en boucle au dispositif de démarrage et de commande (17) de la pompe (13).

3. Procédé selon la revendication 2, **caractérisé en ce que** les corrections les durées d'activation de la pompe (13) sont réalisées d'une manière continue.

4. Procédé selon la revendication 2, **caractérisé en ce que** les corrections sur les durées d'activation de la pompe (13) sont réalisées de manière périodique à une fréquence désirée quelconque.

5. Procédé selon la revendication 1, **caractérisé en ce que** l'activation de la pompe (13) est couplée de manière opérationnelle à un lecteur de débit (21) positionné à la sortie de distribution de ladite pompe et couplée en boucle au dispositif de démarrage et de commande (17).

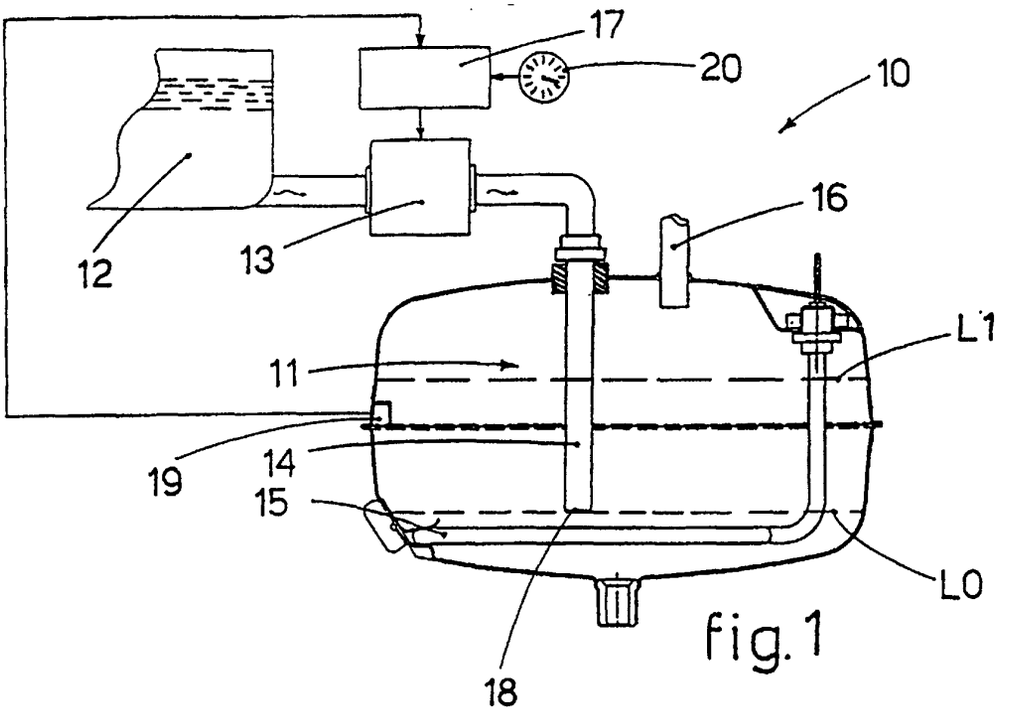

17
20
10
16
12
13
L1
11
19
14
15
L0
18

fig.1

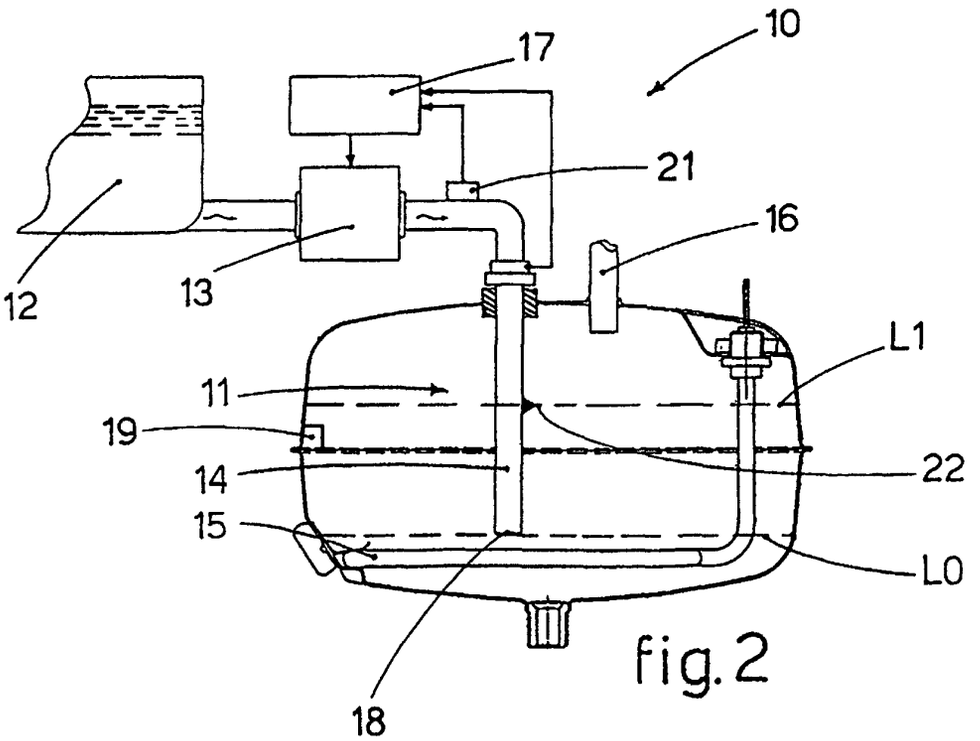

10
17
21
16
12
13
L1
11
19
22
14
15
L0
18

fig.2