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(54) Title: A HOT WATER FLOW REGULATOR SYSTEM AND THE OPERATION METHOD THEREOF

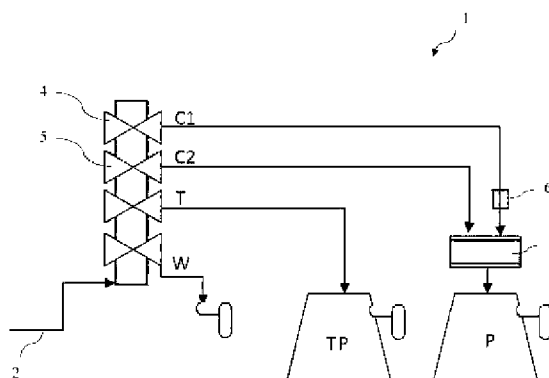


Fig. 1

(57) Abstract: The present invention relates to a system design and algorithmn reducing effects of calcification by improving MTBF (mean time between failure) parameters (6-9 months) in order to protect the hot drink preparation inserts in air vehicles from limescale. The aim of the present invention is to detect the amount of limescale deposited in hot beverage preparation inserts in aircrafts, and accordingly making required smart adjustments on the water line, in particular on limescale-sensitive filter coffee preparing line. Another aim of the present invention is to minimize operation and maintenance costs by enabling a beverage preparation appliance to serve a long time without requiring repairs.



Description**A HOT WATER FLOW REGULATOR SYSTEM AND THE OPERATION METHOD THEREOF**

[0001] TECHNICAL FIELD

[0002] The present invention relates to a system design and algorithm reducing effects of calcification by improving MTBF (mean time between failure) parameters (up to 6-9 months) in order to protect the hot drink preparation inserts in air vehicles from limescale.

[0003] PRIOR ART

[0004] In aircrafts used for civilian passenger transportation, the quality of the offered food and beverages have a significant role in preferring an airline. The compartments in which such caterings are prepared are called galleys and the appliances such as ovens, coffee machines, refrigerators, ice makers, espresso machines and the like, which are custom made for galleys are called inserts. Rapid operation, lightness and minimal energy consumption are some of the principal design objectives of these inserts which should comply with challenging aviation standards.

[0005] Almost all hot beverage preparation appliances used in aircrafts can be assembled and disassembled easily and rapidly to the electrical and water systems of galleys. Inserts for preparing beverages in aircrafts have three-phase 110 VAC electrical connections with a variable frequency of 380-800Hz, a water line with a pressure of 2,5 bars, a data line and a waste water outlet connection, all with galley access.

[0006] The variety of beverage preparation machines used in aircrafts can be listed as:

- machines preparing solely filter coffee;
- machines preparing filter coffee and tea;
- water heating machines also preparing filter coffee and tea;
- espresso machines; and
- machines preparing espresso and cappuccino.

[0007] One of the most significant problems experienced by airliner companies in operating such above-mentioned beverage preparation appliances is malfunctions occurring due to calcification in the system and the

consequent need for frequent maintenance operations. Aircrafts flying to many destinations every day replenish also water at the airports they land. Contents of water considerably differ particularly if supplied from under-developed countries with poor water conditioning and transmission infrastructures. In some of the replenished waters, the concentration of particulates and bacteria, as well as of minerals forming water hardness may be in critical levels.

- [0008] Maintenance centers assess the above-mentioned problem and the beverage preparation appliances using the MTBF (mean time between failure) parameter. According to information acquired from Turkish Teknik, the MTBF for an average beverage preparation appliance is approximately 3 months (independent of the route).
- [0009] Such accumulations in coffee machines are mostly calcium carbonate based. Accumulation of small amounts of magnesium carbonate can also be observed. Such precipitates are mainly observed in heating tanks, and over time they obstruct the flow in the tubes through which hot water passes. These precipitates adhering to the walls of tanks and tubes should be regularly removed by means of chemicals. Limescale removal operations are cumbersome in that they take a long time and are challenging, and they require costly chemical products and subsequent intensive rinsing. Presence of residues of these chemicals in a beverage prepared in a such treated coffee machine adversely affect the taste of said beverage and may create risk of intoxication.
- [0010] In order to eliminate the adverse effect of limescale on appliances, water hardness filters are provided, mounted on the water line of hot beverage preparation appliances used in aircrafts. These structures are not greatly preferred as they are bulky, have high operational costs and require frequent filter replacement.
- [0011] State of the art United States patent application no. US2012/0121769 A1 mentions a magnetic field generator mounted on a water line to prevent calcification on the hydraulic system of a coffee machine. Said system is claimed to decrease calcification up to %40.
- [0012] State of the art international patent application no. WO2008/072271 A1

mentions a system reducing used detergent amounts and calcification by means of a filter made of bio-ceramic.

[0013] State of the art Irish patent application no. IE20060106 A1 mentions the nozzle spraying water to coffee capsules being detachable after operation to prevent limescale deposits thereon.

[0014] State of the art Danish patent application no. DK1845828 (T3) mentions a valve-like component switching hot and cool water lines independently on and off and moving with water flow. Said valve protects the cold water line of the coffee machine from calcification by separating hot and cold water lines.

[0015] BRIEF DESCRIPTION OF THE INVENTION

[0016] The aim of the present invention is to detect the amount of limescale deposited in hot beverage preparation inserts in aircrafts, and accordingly making required smart adjustments on the water line, in particular on limescale-sensitive filter coffee preparing line.

[0017] Another aim of the present invention is to minimize operation and maintenance costs by enabling a beverage preparation appliance to serve a long time without requiring repairs.

[0018] DETAILED DESCRIPTION OF THE INVENTION

[0019] **"A hot water flow regulator system"** realized to achieve the aims of the present invention is illustrated in the accompanying drawings, wherein:
Figure 1: is a schematic view of the hot water flow regulator system of the invention.

[0020] The elements in the figures are numbered and the correspondence of these numbers are given hereinafter.

1. Hot water flow regulator system
2. Main water line
3. Brewing chamber
4. Primary filter coffee valve
5. Secondary filter coffee valve
6. Flow restrictor

[0021] P. Pot

[0022] C1. Principal valve system

- [0023] C2. Secondary valve system T: Tea line
- [0024] TP. Tea Pot
- [0025] W. Cold water line
- [0026] The hot water flow regulator system (1) of the invention is for preventing limescale-induced blockages in hot beverage preparation appliances in aircrafts from hampering usage of said appliance, and comprises
- [0027] • at least one water line (2),
- [0028] • a brewing chamber (3) adapted to brew filter coffee by water being passed through the filter coffee placed therein and to drain said brewed filter coffee to a pot (P),
- [0029] • at least one level detecting sensor provided at the upper portion of the pot (P) and adapted to detect the liquid level in the pot (P),
- [0030] • at least one primary filter coffee valve (4) regulating the water flow through the main water line (2) by allowing water to advance to the coffee brewing chamber (3) or blocking thereof,
- [0031] • at least one secondary filter coffee valve (5) operable upon the primary filter coffee valve (4) being turned off, regulating the water flow through the main water line (2) by allowing water to advance to the coffee brewing chamber (3) or blocking thereof, and
- [0032] • at least one control unit capable of: -regulating the flow advancing via the primary filter coffee valve (4) by sending a signal to a flow restrictor (6) provided upstream of the brewing chamber (3), -turning the primary filter coffee valve (4) off and the secondary filter coffee valve (5) on and -turning the secondary filter coffee valve (5) off, according to the level information received from the level detecting sensor.
- [0033] The operation method of the hot water flow regulator system (1) of the invention comprises the steps of
- [0034] - receiving the filling duration data which is the duration between beginning of the pot's (P) water intake and the pot (P) being completely filled, from the level detecting sensor provided at the upper portion of the pot (P),
- [0035] - controlling whether the change in the filling duration with respect to the duration by initial use is more than 10%
- [0036] - if the change in the filling duration is higher than 10%, turning on an alert

- light provided on the control panel of the beverage preparation appliance,
- [0037] - turning on the secondary filter coffee valve (5) which does not have a flow restrictor (6) (manually by a cabin attendant or automatically by the control unit),
- [0038] - keeping the secondary filter coffee valve (5) open throughout a t1 interval selected as the duration short enough for the secondary filter coffee valve (5) not to overflow the brewing chamber (3), and a t2 interval selected as the duration long enough for the brewing chamber (3) to drain the appropriately brewed coffee into the pot (P), and
- [0039] - turning the secondary filter coffee valve (5) off upon the level detecting sensor detecting filling of the pot (P).
- [0040] In the hot water flow regulator system (1) of the invention developed for a beverage preparation appliance, water for preparing various beverages is received into the system by means of a valve manifold. According to Figure 1;
- [0041] During coffee preparation, a given amount of water is received into a pot (P) of a given volume through the principal valve system (C1). The amount of water can be monitored through the time-dependent change in flow, or when the pot (P) is completely filled can be determined by means of the level detecting sensor disposed at the upper portion of the pot (P). If the filling duration representing the time between beginning of water intake and complete filling, is prolonged over time, this implies the water line being blocked by calcification which obstructs flow. If the filling duration is prolonged more than 10%, than the machine would prepare coffee with less water, which the passengers would perceive as having an excessively intense or bitter taste. The control panel of the hot beverage preparation appliance would give a limescale alert (yellow light) when the control unit determines a time increase of 10%, or a maintenance alert (red light) when the system is no longer operational. When the yellow light is illuminated, the secondary filter coffee valve (5) is turned on manually by a cabin attendant or automatically by the appliance, activating the secondary valve system (C2), and the water flow is executed through the secondary valve system (C2). Contrary the primary valve system (C1), the secondary valve

system (C2) lacks a flow regulator (6), thereby being more resistant to calcification. However, since it has a higher flow rate, it may quickly overflow the water in the brewing chamber. To prevent this, the secondary filter coffee valve (5) is turned on in short t_1 intervals before the brewing chamber overflows and is turned off in t_2 intervals. The t_2 intervals are selected as a duration long enough for the brewing chamber (3) to drain the appropriately brewed coffee into the pot (P), and the t_1 intervals are selected as a duration short enough not to overflow the brewing chamber (3). In this manner, the hot beverage preparation appliance enabling brewing coffee can continue serving. The secondary filter coffee valve (5) continues operating in this sequence until the pot (P) fills up.

[0042] A hot beverage preparation appliance is enabled to serve for a long time without requiring repairs thereby minimizing operation and maintenance costs, thanks to detecting the amount of limescale deposited and accordingly making required smart adjustments on the water flow system, in particular on the limescale-sensitive coffee preparation line, within the scope of the hot water flow regulator system (1) of the invention. A system design and algorithm is thus devised, reducing effects of calcification by improving MTBF (mean time between failure) parameters (up to 6-9 months) of the hot drink preparation inserts in air vehicles.

Claims

1. A hot water flow regulator system (1) for preventing limescale-induced blockages in hot beverage preparation appliances in aircrafts from hampering usage of said appliance, the system **comprising**
 - at least one water line (2), and
 - a brewing chamber (3) adapted to brew filter coffee by water being passed through the filter coffee placed therein and to drain said brewed filter coffee to a pot (P), **characterized by:**
 - at least one level detecting sensor provided at the upper portion of the pot (P) and adapted to detect the liquid level in the pot (P)
 - at least one primary coffee valve (4) regulating the water flow through the main water line (2) by allowing water to advance to the coffee brewing chamber (3) or blocking thereof,
 - at least one secondary coffee valve (5) operable upon the primary coffee valve (4) being turned off, regulating the water flow through the main water line (2) by allowing water to advance to the coffee brewing chamber (3) or blocking thereof,
 - at least one control unit capable of regulating the flow advancing via the primary coffee valve (4) by sending a signal to a flow restrictor (6) provided upstream of the brewing chamber (3), turning the primary coffee valve (4) off and the secondary coffee valve (5) on and turning the secondary coffee valve (5) off, according to the level information received from the level detecting sensor.
2. The operation method of a hot water flow regulator system (1) according to claim 1, **comprising the steps of**
 - receiving the filling duration data which is the duration between beginning of the pot's (P) water intake and the pot (P) being completely filled, from the level detecting sensor provided at the upper portion of the pot (P),
 - controlling whether the change in the filling duration with respect to the duration by initial use is more than 10% if the change in the filling duration is higher than 10%, turning on an alert light provided on the control panel of the beverage preparation appliance,
 - turning on the secondary coffee valve (5) which does not have a flow

restrictor (6) (manually by a cabin attendant or automatically by the control unit),

- keeping the secondary filter coffee valve (5) open throughout a t1 interval selected as the duration short enough not to overflow the brewing chamber (3), and a t2 interval selected as the duration long enough for the brewing chamber (3) to drain the appropriately brewed coffee into the pot (P), and
- turning the secondary filter coffee valve (5) off upon the level detecting sensor detecting filling of the pot (P).

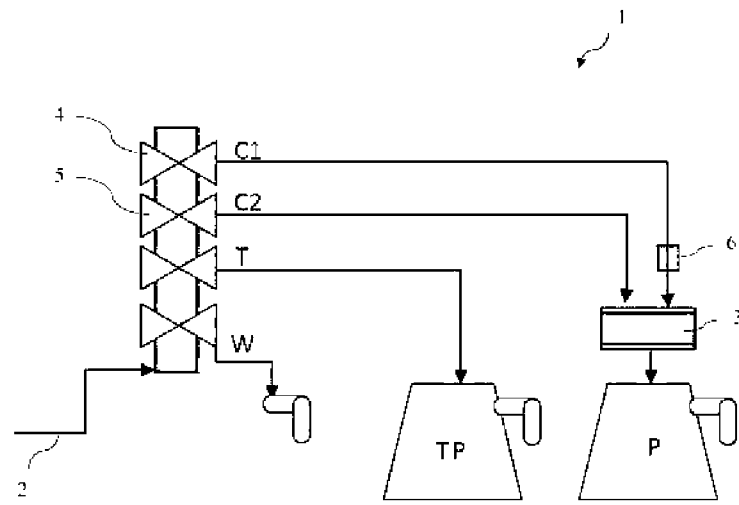


Fig. 1

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/121769 A1 (CASTELLANI ANDREA [IT] ET AL) 17 May 2012 (2012-05-17) cited in the application the whole document	1,2
A	US 2010/236660 A1 (OZANNE MATTHIEU [CH] ET AL) 23 September 2010 (2010-09-23) paragraphs [0009] - [0014]; claims; figures	1,2
A	US 2010/203209 A1 (FISHBEIN WILLIAM [US] ET AL) 12 August 2010 (2010-08-12) paragraphs [0026] - [0032]; claims; figures	1,2



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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