Candidat's answer

A Boiler For Moka Coffee Machine

The present invention relates to a boiler for a moka coffee machine.

Background

Conventional moka coffee machines are known which comprise a boiler, a ground coffee holder and an upper part. In use, water in the boiler is heated until it starts to boil and thereby turns into steam. This causes the pressure above the surface of the water to increase so as to force the steam out of the boiler and into the ground coffee holder. Here, the water passes through the coffee and dissolves aromatic substances to form prepared coffee.

It is known that coffee tastes best when the temperature of the water passing through the ground coffee is between 75^{o}C and 90^{o}C. In a conventional machine the water is at 100^{o}C (approximately) and this therefore leads to substandard coffee.

D1 and D2 provide machines which are able to make coffee with water at a lower temperature.

D2 uses a temperature indicator to show when the water has reached the required temperature.

In order to expel the water from the boiler, a compressed air source is provided which can be operated when the indicator indicates the correct temperature. However, this requires the user to continuously monitor the indicator, otherwise the water will be too hot. Furthermore, it is necessary to have a supply of compressed air which only provides sufficient air for limited uses.

D1 on the other hand, which is considered to be the closest prior art since it uses an expandable pouch to reduce the volume of the water reservoir (as opposed to a reservoir containing water that is not used to prepare coffee; see temperature indicator of D2), automatically monitors the temperature in order to force the water out of the boiler at the appropriate temperature, and in a repeatable manner.

Specifically, D1 comprises a first pouch attached to the sidewall outside of the boiler and a second pouch attached to the sidewall inside the boiler. The first and second pouches are in fluid communication with one another and are filled with water. A pump is provided which is operable to pump water between the pouches. A battery powered control unit monitors the temperature of the water in the reservoir and when it reaches the desired temperature, pumps water from the first pouch into the second pouch thereby reducing the volume of the reservoir and forcing the water out of the reservoir so as to make the coffee.

However, the machine of D1 has a number of disadvantages. Namely, the operation of the machine is battery powered and these will inevitably run out, preventing the coffee from being prepared at the correct temperature. Furthermore, the complexity of

the electronic components adds to the cost of the boiler and presents an area wh
likely to fail before the normal working life of a conventional coffee machine.

This is particularly emphasised since D1 acknowledges that if the water in the pouches boils it will damage the pump leaving the machine inoperable. A possible way of overcoming this is to use a liquid with a boiling point greater than 100^{o}C at average sea level air pressure.

The pouch outside of the boiler may also become damaged when the boiler is not in use, for example when stored in a cupboard.

The present invention seeks to overcome the above mentioned disadvantages of D1. The objective problem is how to adapt D1 to make it more robust and improve longevity.

In accordance with an aspect of the invention, there is provided a boiler for a moka coffee machine having the features of claim 1 below.

Advantageous features are set out in the subclaims.

The present invention eliminates all pumps and electrical components by using a chamber filled with a liquid which boils at a lower temperature than water. The chamber is completely contained in the reservoir and thus when the liquid begins to boil it causes a displaceable element to move thereby reducing the volume of the reservoir and forcing the water out to prepare the coffee.

This process is entirely passive and does not require any additional energy/gas source to cause it to occur, other than the heat source used to heat the water. Therefore, the boiler of the present invention will always cause the water to be expelled at the correct temperature for the entire working life of the boiler.

By removing the requirement of a pump, it does not matter whether the liquid in the chamber boils.

The present invention is simple as it does not contain any electronics, and thus is both cheap and easy to manufacture. Furthermore, from an aesthetical point of view, the present invention looks exactly like a conventional boiler/machine and does not have any unsightly pouches or compressed air sources outside of the boiler. This makes the boiler more pleasing to the eye and more compact. Furthermore, the chamber is completely contained within the boiler and thus cannot be damaged so easily.

D1 teaches away from using a liquid with a boiling point of less than 100^{o}C since this would damage the pump. The skilled person would therefore not seek to modify D1 to arrive at the present invention.

1. A boiler (1) for a moka coffee machine, the boiler (1) comprising:
a reservoir (14) having a volume for containing water used to prepare coffee, and having an opening (26);
a chamber (15); and
a displaceable element (9, 10, 13) which separates the reservoir (14) from the chamber (15);
characterised in that:
the chamber (15) contains a liquid having a boiling point below 100^{o}C at average sea level air pressure, such that, in use, the pressure in the chamber (15) increases as the liquid starts to boil thereby displacing the displaceable element (9, 10, 13) and reducing the volume of the reservoir (14) so as to force the water out of the reservoir (14) through the opening (26).

2. A boiler (1) as claimed in claim 1, wherein, in use, a base plate (23) of the boiler (1) is heated and the liquid is heated either directly by the base plate (23) or via the water contained in the reservoir (14).

3. A boiler (1) as claimed in claim 1 or 2, wherein the liquid is boilanol or ethanol.

4. A boiler (1) as claimed in any preceding claim, wherein the displaceable element comprises an elastic membrane (9, 10a).

5. A boiler (1) as claimed in claim 4, wherein the elastic membrane (9) forms a sealed pouch which completely encloses the chamber (15).

6. A boiler (1) as claimed in claim 4, wherein the elastic membrane (9, 10a) is connected to an inner surface of the boiler (1).

7. A boiler (1) as claimed in claim 6, wherein the elastic membrane (9, 10a) is connected to the inner surface of the boiler (1) via a metal flange (27), which may [NOTE: I know this is not limiting but I spotted this feature after writing out 15 claims!] comprise heat-exchanging fins (11).

8. A boiler (1) as claimed in any of claims 4 to 7, wherein the displaceable element further comprises a heat exchanging structure (10b) having fins (11) which is connected to the elastic membrane (9, 10a).

9. A boiler (1) as claimed in any of claims 4 to 8, wherein the elastic membrane (9) is connected to a base plate (23) and to a sidewall (24) of the boiler (1), so that the elastic membrane (9) is arranged diagonally inside the boiler (1).

10. A boiler (1) as claimed in any of claims 1 to 3, wherein the displaceable element is a piston (13).

11. A boiler (1) as claimed in claim 10, wherein the reservoir (14) is formed within a cylinder (16) and the piston (13) is displaceable within the cylinder (16).

12. A boiler (1) as claimed in claim 10 or 11, wherein the piston (13) and/or cylinder (16) are provided with heat-exchanging fins (11).

13. A boiler (1) as claimed in any preceding claim, wherein a side wall (24) of the boiler (1) comprises protrusions (20) which ensure that water in the reservoir (1 can pass between the side wall (24) and the displaceable element (9, 10a).

14. A boiler (1) as claimed in any preceding claim, further comprising a grid (12) located in the reservoir (14); wherein the grid (12) is permeable to water but limits the displacement of the displaceable element (9, 10, 13).

15. A moka coffee machine comprising a boiler as claimed in any of the preceding claims.

EXAMINATION COMMITTEE I

Candidate No.

Paper A (Electricity/Mechanics) 2011 - Marking Sheet

Category	Maximum possible	Marks awarded	
		Marker	Marker
Independent claim	50	50	50
Dependent claims	35	30	30
Description	15	10	11
Total	**100**	**90**	**91**

Examination Committee I agrees on 91 marks and recommends the following grade to the Examination Board:

- [x] PASS (50-100)
- [ ] COMPENSABLE FAIL (45-49)
- [ ] FAIL (0-44)

30 June 2011

Chairman of Examination Committee I