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Paper A(E/M)

Electricity / Mechanics

This paper comprises:

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Client's Letter

Dear Mr. Corretto,

1. I am a coffee lover and enthusiastic mountaineer. I live in a town called Mokaton, on the Atlantic coast. At weekends I travel to my cabin, which is 2500 meters above sea level in the Beverage Mountains. I always take a conventional moka coffee machine with me. I have invented a new type of moka coffee machine. To help you to understand my invention, I will first describe a conventional moka coffee machine.

2. Fig. 1a shows a cross section through a conventional moka coffee machine when it is disassembled. The moka coffee machine comprises a boiler 1, a ground coffee holder 2 and an upper part 3. All three of these parts can be purchased separately as spare parts. The boiler 1 is made of metal. It comprises a base plate 23 and a sidewall 24 which define a reservoir 14. The reservoir 14 has a volume for containing water and an opening 26. The boiler 1 has a safety valve 25 located in the sidewall 24 and an outer thread 18 around the opening 26.

3. The ground coffee holder 2 comprises a funnel 21, a first filter plate 5 and a cup-shaped compartment 4 for receiving ground coffee. The first filter plate 5 forms the bottom of the compartment 4.

4. The upper part 3 comprises a receptacle 8 for receiving prepared coffee, a conduit 17 having apertures 22 at its upper end, a second filter plate 6 and a seal 7. The upper part 3 has an inner thread 19 that matches the outer thread 18 of the boiler 1.

5. Before preparing coffee, the moka coffee machine must be filled with water and ground coffee. To do this, water is poured through the opening 26 into the reservoir 14 and ground coffee is placed in the cup-shaped compartment 4. The ground coffee holder 2 is then placed in the opening 26 so that it is retained by the upper rim of the sidewall 24. Finally the upper part 3 is screwed onto the boiler 1 by means of the threads 18 and 19 until the seal 7 seals the boiler 1 to the upper part 3.

6. Fig. 1b shows a cross section through the assembled moka coffee machine of Fig. 1a after it has been filled with water and ground coffee. The first filter plate 5 and the second filter plate 6 are permeable to water but prevent ground coffee from escaping from the compartment 4.

7. To prepare coffee, the moka coffee machine is placed on a heat source (not shown). The base plate 23 gets hot and heats the water in the reservoir 14 directly. When the water reaches its boiling point, which is 100 °C at average sea level air pressure, it starts to boil. Water thereby turns into steam and the pressure in the reservoir 14 above the water surface increases. Due to the increase in pressure, water is forced out of the reservoir 14 through the opening 26 after having passed through the funnel 21, the first filter plate 5 and the ground coffee. As the water passes through the ground coffee it dissolves aromatic substances to form prepared coffee. The prepared coffee then enters the receptacle 8 via the second filter plate 6, the conduit 17 and the apertures 22. The aromatic substances give coffee its distinctive pleasant taste. The safety valve 25 only opens if the pressure in the reservoir 14 becomes too high.

8. The coffee I prepare in my mountain cabin using my conventional moka coffee machine tastes better than the coffee I prepare using the same moka coffee machine in Mokaton. I did some research on the internet and found two documents D1 and D2, which explain that coffee tastes best when the temperature of the water passing through the ground coffee is between 75 °C and 90 °C.

9. I measured the temperature of the water passing through the ground coffee in a conventional moka coffee machine to be about 100 °C at sea level and to be about 90 °C at 2500 meters above sea level, which is the boiling point of water at this altitude.

10. The moka coffee machines I have invented prepare coffee at between 75 °C and 90 °C, even at sea level. They are simpler than the moka coffee machines disclosed in D1 and D2. I will now describe five examples of my invention.

11. Fig. 2a shows a cross section through a moka coffee machine according to a first example of my invention after the moka coffee machine has been filled with water and ground coffee but before the preparation of coffee. The moka coffee machine comprises a boiler 1, a ground coffee holder 2 and an upper part 3. The upper part 3 is the same as the upper part of the conventional moka coffee machine of Figs. 1a and 1b. The ground coffee holder 2 differs from the ground coffee holder of Figs. 1a and 1b in that it does not have a funnel.

12. The boiler 1 comprises a metal base plate 23, a metal sidewall 24, a safety valve 25 located in the sidewall 24, a metal flange 27, an elastic membrane 9, a grid 12, a reservoir 14 and a chamber 15. The flange 27 is arranged on the inside circumference of the sidewall 24. The elastic membrane 9 is glued to the flange 27 and thereby attached to the sidewall 24. The elastic membrane 9 and the flange 27 separate the reservoir 14 from the chamber 15. The reservoir 14 contains water and has an opening 26. The grid 12 is located in the reservoir 14. The chamber 15 contains a liquid known as boilanol. Boilanol is a liquid at room temperature and has a boiling point of 90 °C at average sea level air pressure.

13. To prepare coffee, the moka coffee machine is placed on a heat source (not shown). The base plate 23 gets hot and heats the boilanol in the chamber 15 directly. The water in the reservoir 14 is heated via the elastic membrane 9 and the flange 27. When the boilanol starts to boil, boilanol gas is formed and the pressure in the chamber 15 increases. The increase in pressure displaces the elastic membrane 9 so that the volume of the chamber 15 increases and the volume of the reservoir 14 decreases. Water is thereby forced out of the reservoir 14 through the opening 26 after having passed through the first filter plate 5 and the ground coffee. As the hot water passes through the ground coffee it dissolves aromatic substances to form prepared coffee. The prepared coffee then enters the receptacle 8 via the second filter plate 6, the conduit 17 and the apertures 22. The temperature of the water which passes through the ground coffee is about 87 °C when the coffee is prepared at average sea level air pressure.

14. Fig. 2b shows the moka coffee machine of Fig. 2a after all the boilanol in the chamber 15 has turned into boilanol gas. The volume of the reservoir 14 has decreased so much that nearly all the water it originally contained has been forced out of the reservoir 14. The grid 12 is permeable to water but limits the displacement of the membrane 9 to prevent it from blocking the first filter plate 5.

15. In order to heat the water in the reservoir 14, heat must be transferred from the boilanol in the chamber 15 to the water in the reservoir 14. Because the flange 27 is made of metal, it conducts heat better than the elastic membrane 9.

16. In order to increase the temperature at which water passes through the ground coffee, the flange may be made wider or it may comprise heat-exchanging fins (not shown). If the flange comprises such heat-exchanging fins, the temperature of the water that passes through the ground coffee is about 89 °C when the coffee is prepared at average sea level air pressure.

17. Some people prefer coffee which has been prepared at temperatures substa below 90 °C because it tastes milder. For preparing such coffee, I have develope two further moka coffee machines as alternatives to the one shown in Figs. 2a and 2b. To develop the first alternative, I took the moka coffee machine of Figs. 2a and 2b, removed the flange and attached the elastic membrane directly to the sidewall with glue. Because the elastic membrane 9 is not a good heat conductor, the water passing through the ground coffee has a temperature of about 75 °C when the coffee is prepared at average sea level air pressure. To develop the second alternative, I took the moka coffee machine of Figs. 2a and 2b and replaced the boilanol in the chamber with ethanol. Because ethanol boils at 78 °C at average sea level air pressure, the water passing through the ground coffee has a temperature of about 75 °C when the coffee is prepared at average sea level air pressure.

18. Fig. 3 shows a cross section through a moka coffee machine according to a second example of my invention before the preparation of coffee. The moka coffee machine differs from the one shown in Fig. 2a in that it has no grid and in that the elastic membrane of Fig. 2a is replaced by a displaceable element 10 in Fig. 3. The displaceable element 10 separates the reservoir 14 from the chamber 15. The displaceable element 10 comprises a ring-shaped elastic membrane 10a and a circular metal heat-exchanging structure 10b having fins 11. The elastic membrane 10a and the heat-exchanging structure 10b are arranged concentrically. The outer edge of the elastic membrane 10a is glued to the flange 27 and thereby attached to the sidewall 24. Because the flange 27 and the heat-exchanging structure 10b are made of metal, they conduct heat better than the elastic membrane 10a. Together the flange 27 and the heat-exchanging structure 10b present a large surface area for efficiently exchanging heat between the boilanol in the chamber 15 and the water in the reservoir 14. In this example the flange 27 can be made narrow. When coffee is prepared using this moka coffee machine, the water passing through the ground coffee has a temperature of about 89 °C at average sea level air pressure.

19. Fig. 4 shows a cross section through a moka coffee machine according to a third example of my invention. The moka coffee machine of this example differs from the moka coffee machine of the first example in that it has no flange and no grid and in that the elastic membrane 9 is arranged differently. The elastic membrane 9 is directly attached to the base plate 23 and to the sidewall 24, so that the membrane 9 is arranged diagonally inside the boiler 1.

20. To prepare coffee, the moka coffee machine is placed on a heat source (not shown). The base plate 23 gets hot and heats both the boilanol in the chamber 15 and the water in the reservoir 14 directly. When the boilanol starts to boil, the pressure in the chamber 15 increases. The increase in pressure displaces the elastic membrane 9 so that the volume of the chamber 15 increases and the volume of the reservoir 14 decreases. Water is thereby forced out of the reservoir 14 through the opening 26 after having passed through the first filter plate 5 and the ground coffee. Because the boilanol in the chamber 15 and the water in the reservoir 14 have substantially the same temperature during heating, the temperature of the water which passes through the ground coffee is about 90 °C when the coffee is prepared at average sea level air pressure.

21. Fig. 5 shows a cross section through a moka coffee machine according to a fourth example of my invention. In this example, the boiler 1 comprises a sealed pouch. The wall of the pouch is an elastic membrane 9 that completely encloses a chamber 15. The pouch is filled with ethanol. The pouch is not attached to the rest of the boiler 1. The pouch is retained in the boiler 1 by a grid 12. I bought the ethanol filled pouch in a supermarket. The supermarket also sells such pouches filled with boilanol instead of ethanol. People normally freeze these liquid filled pouches and then use them to cool drinks. The sidewall 24 of the boiler 1 comprises protrusions 20 on its inner side. The protrusions 20 ensure that water in the reservoir 14 can always pass between the sidewall 24 and the membrane 9.

22. To prepare coffee, the moka coffee machine is placed on a heat source (not shown). The base plate 23 gets hot and heats the water in the reservoir 14 directly. The ethanol in the chamber 15 is heated via the elastic membrane 9. When the ethanol starts to boil, the pressure in the chamber 15 increases. The increase in pressure displaces the elastic membrane 9 so that the volume of the chamber 15 increases and the volume of the reservoir 14 decreases. Water is thereby forced out of the reservoir 14 through the opening 26 after having passed through the first filter plate 5 and the ground coffee. Because the elastic membrane 9 is a not a good heat conductor, the water passing through the ground coffee has a temperature of about 85 °C when the coffee is prepared at average sea level air pressure.

23. I have developed a further moka coffee machine as an alternative to the one shown in Fig. 5. I replaced the pouch shown in Fig. 5 with a pouch having a wall defined by an elastic membrane and a metal heat-exchanging structure comprising fins. The pouch either contains ethanol or boilanol. Such pouches are known. Because the heat-exchanging structure exchanges heat between the liquid in the chamber and the water in the reservoir efficiently, the water passing through the ground coffee has a temperature close to the boiling point of the liquid in the pouch.

24. Fig. 6 shows a cross section through a moka coffee machine according to a fifth example of my invention. In this example, the boiler 1 comprises a metal base plate 23, a metal sidewall 24, a safety valve 25 located in the sidewall 24, a cylinder 16, a piston 13, a reservoir 14 and a chamber 15. The reservoir 14 containing water is formed within the cylinder 16. The base of the reservoir 14 is defined by the piston 13. The chamber 15 containing boilanol surrounds the cylinder 16 and is separated from the reservoir 14 by the piston 13. The piston 13 is displaceable within the cylinder 16. The piston 13 and the outside wall of the cylinder 16 are provided with heat-exchanging fins 11 that ensure good heat transfer between the boilanol and the water.

25. To prepare coffee, the moka coffee machine is placed on a heat source (not shown). The base plate 23 gets hot and heats the boilanol in the chamber 15 directly. The water in the reservoir 14 is heated via the piston 13 and the cylinder 16. When the boilanol starts to boil, the pressure in the chamber 15 increases. The increase in pressure displaces the piston 13 upwards so that the volume of the chamber 15 increases and the volume of the reservoir 14 decreases. Water is thereby forced out of the reservoir 14 through the opening 26 after having passed through the first filter plate 5 and the ground coffee. The water passing through the ground coffee has a temperature close to the boiling point of boilanol. The safety valve 25 only opens if the pressure in the chamber 15 becomes too high.

26. I have developed two further moka coffee machines as alternatives to the one shown in Fig 6. These moka coffee machines prepare coffee at temperatures below 90 °C. The first of these moka coffee machines is the same as the moka coffee machine of Fig. 6 except that it has no fins on the piston and/or the cylinder. The second of these moka coffee machines is the same as the moka coffee machine of Fig. 6 except that its chamber contains ethanol instead of boilanol.

27. All the moka coffee machines shown in Figs. 1-6 have an upper part which comprises a receptacle for receiving the prepared coffee. However all the boilers of the moka coffee machines of my invention can be used in combination with other known upper parts, such as an upper part comprising a conduit for conveying the prepared coffee directly into a cup. My invention can be carried out using boilanol, ethanol or any other liquid having a boiling point below 100 °C at average sea level air pressure.

28. Please draft a set of claims and an introductory part of the description for a European patent application to protect my invention. Please note that for financial reasons I will not pay any claim fees for this patent application or fees for any further patent application. Documents D1 and D2 are appended.

Yours sincerely,

Mr. Barista

Client's Drawings

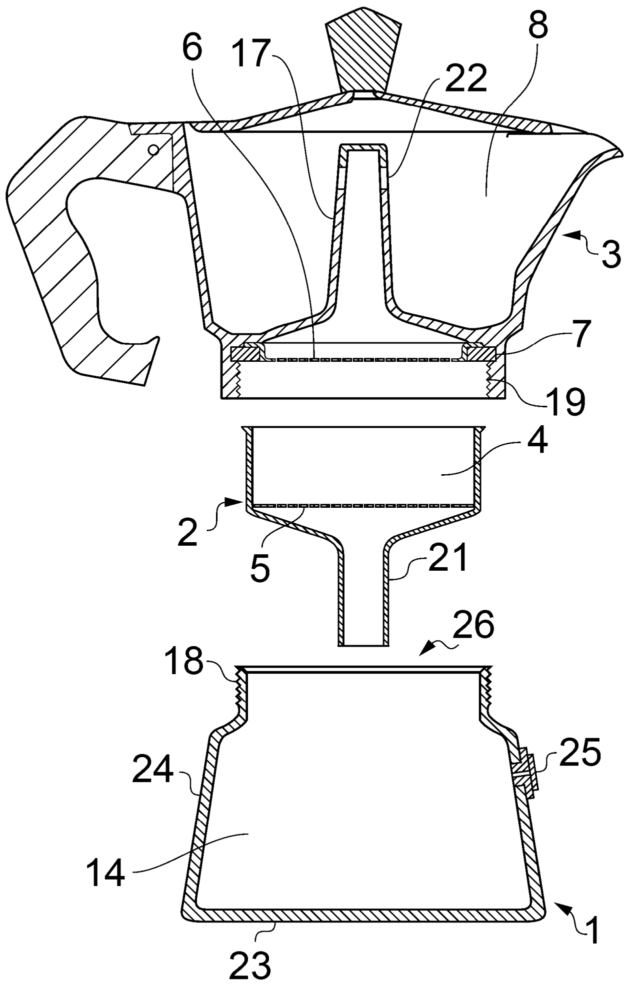

FIG. 1a

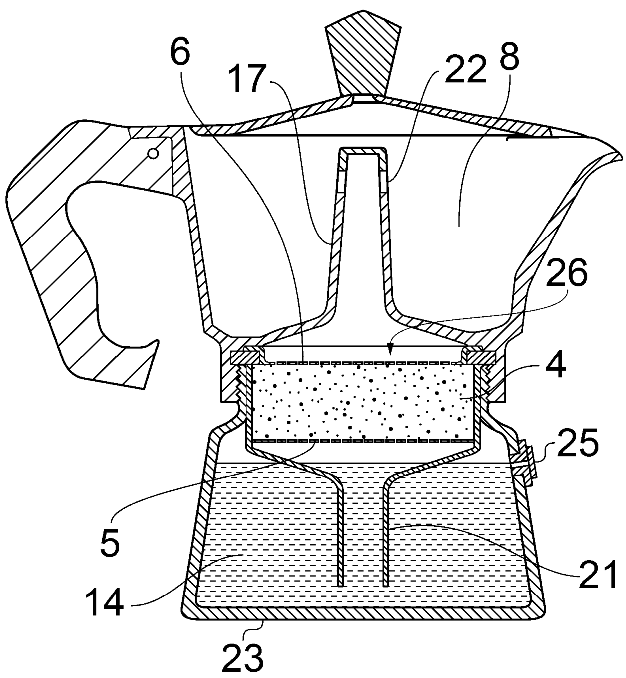

FIG. 1b

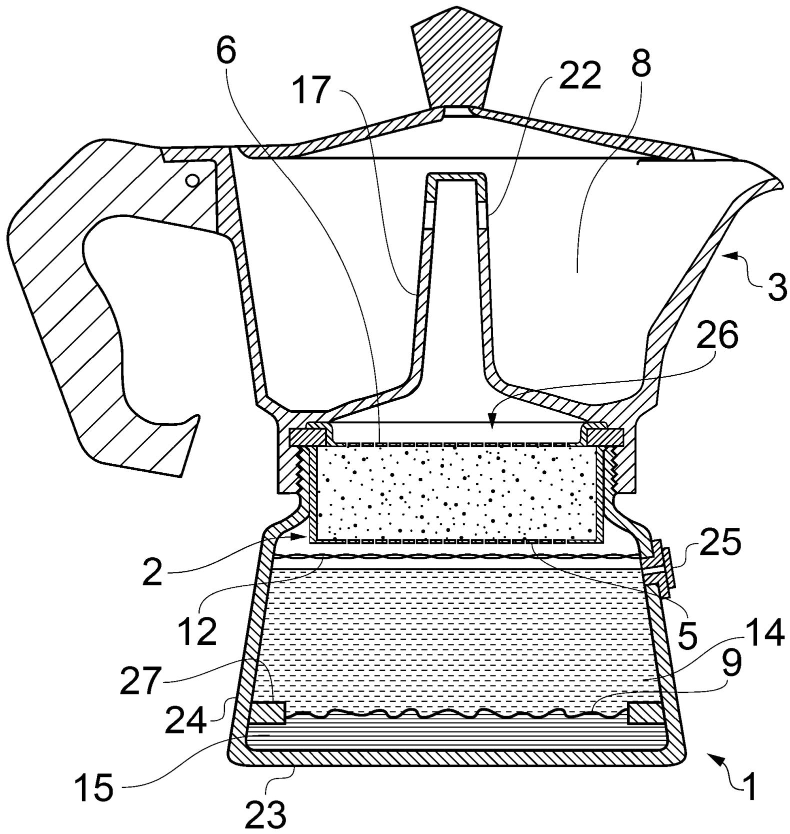

FIG. 2a

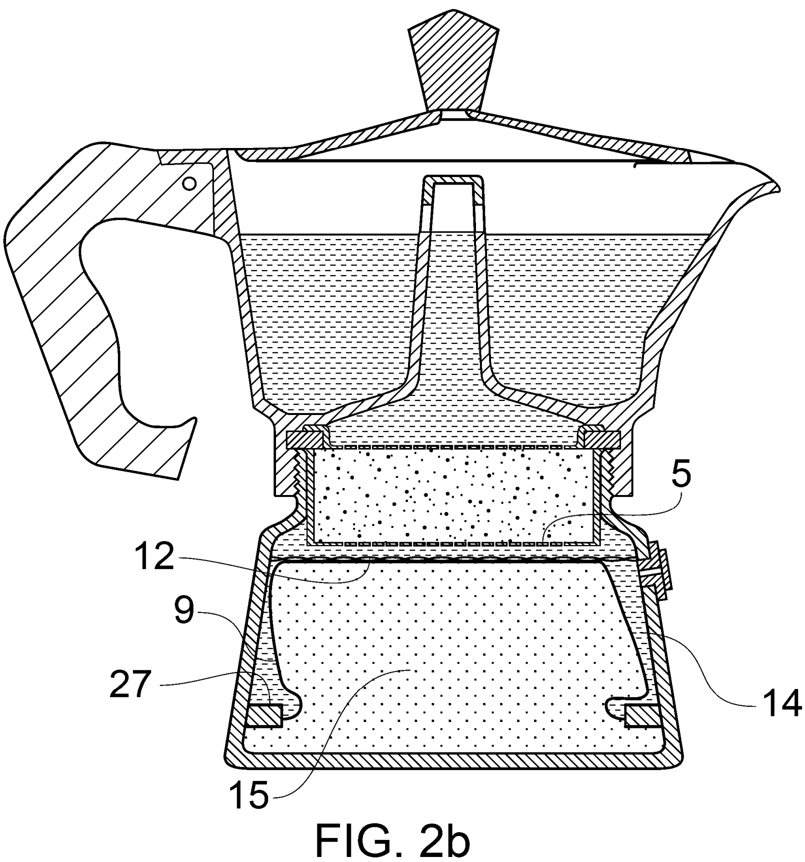

FIG. 2b

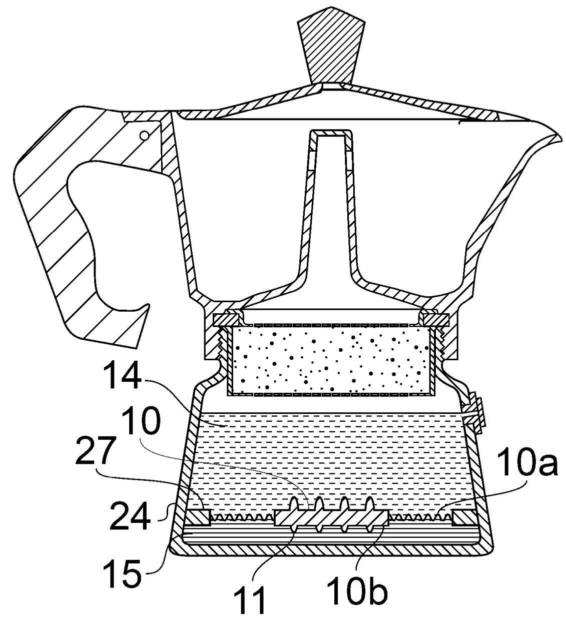

FIG. 3

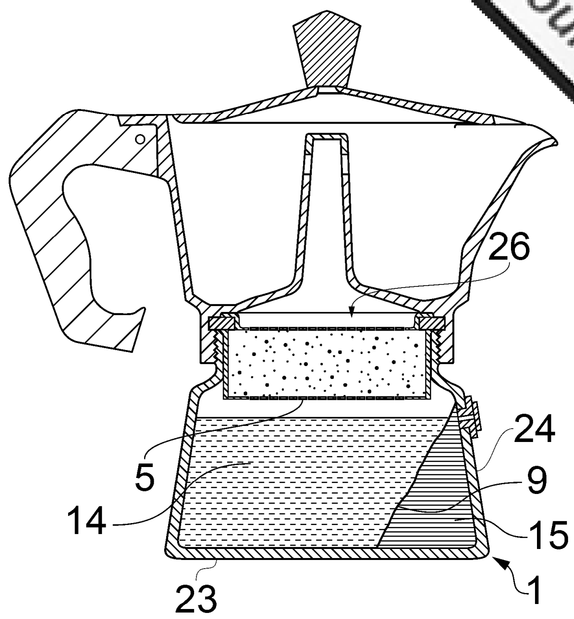

FIG. 4

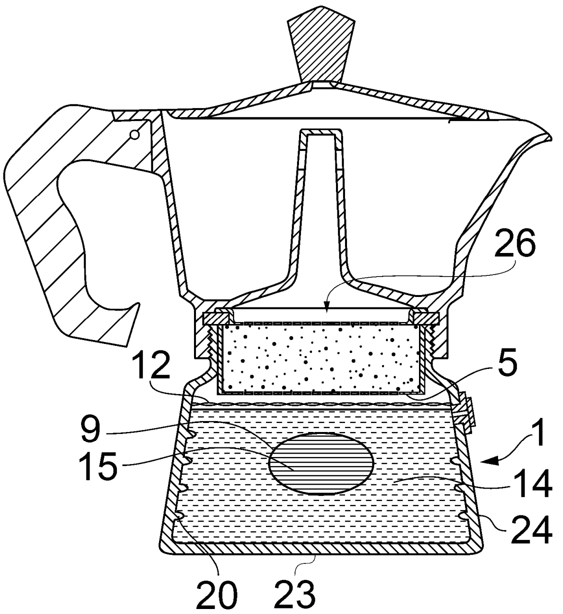

FIG. 5

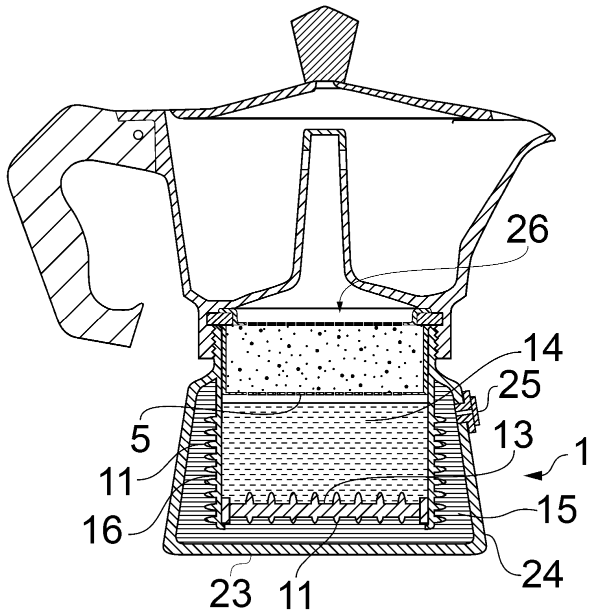

FIG. 6

Document D1

1. When preparing coffee with a conventional moka coffee machine, the temperature of the water that passes through the ground coffee is close to 100 °C. A lot of the pleasant tasting aromatic substances in ground coffee are destroyed at this temperature. To prevent this happening, the water that passes through the ground coffee has to have a temperature of 90 °C or below.

2. This article describes an automatic moka coffee machine in which the temperature of the water that passes through the ground coffee is 90 °C.

3. Fig. 1 is a cross section through the moka coffee machine which has been filled with water and ground coffee before the preparation of coffee.

4. The moka coffee machine comprises a boiler 101, a ground coffee holder 102 and an upper part 103 for receiving prepared coffee. The ground coffee holder 102 comprises a filter plate 105 and a cup-shaped compartment 104 containing ground coffee. The filter plate 105 forms the bottom of the compartment 104.

5. The boiler 101 comprises a reservoir 114 containing water, a first pouch 141, a second pouch 142, a water pump 132, a control unit 133, a battery (not shown) and a temperature sensor 131. The boiler 101 comprises a base plate 123, a sidewall 124 and an opening 126. The temperature sensor 131 measures the temperature of the water in the reservoir 114. The first pouch 141 is attached to the outside of the sidewall 124. The second pouch 142 is attached to the inside of the sidewall 124. The walls of the pouches 141,142 are elastic membranes. The pouches 141 and 142 are filled with water. Nearly all this water is in the first pouch 141. The pump 132 is located between the two pouches 141, 142 and is controlled by the control unit 133. The battery powers the control unit 133 and the pump 132. The lower side of the filter plate 105 and the inner side of the sidewall 124 are provided with protrusions 120.

6. To prepare coffee, the moka coffee machine is placed on a heat source (not shown). The base plate 123 gets hot and heats the water in the reservoir 114 directly. The temperature measured by the temperature sensor 131 is monitored by the control unit 133. When it reaches 90 °C, the control unit 133 activates the pump 132 which starts to pump water out of the first pouch 141 into the second pouch 142. This displaces the elastic membrane of the second pouch 142 so that the volume of the second pouch 142 increases and the volume of the reservoir 114 decreases. Water is forced out of the reservoir 114 through the opening 126 after having passed through the filter plate 105 and the ground coffee.

7. Fig. 2 shows the moka coffee machine of Fig. 1 after coffee has been prepared. Nearly all the water in the pouches is in the second pouch 142. The protrusions 120 on the sidewall 124 ensure that water in the reservoir 114 can always pass between the sidewall 124 and the elastic membrane of the second pouch 142. The protrusions 120 on the filter plate 105 prevent the elastic membrane of the second pouch 142 from blocking the filter plate 105.

8. Alternatively, the pouches can contain a liquid having a boiling point greater than 100 °C at average sea level air pressure. This minimises the risk of the liquid boiling and damaging the pump.

<u>Drawings Document D1</u>

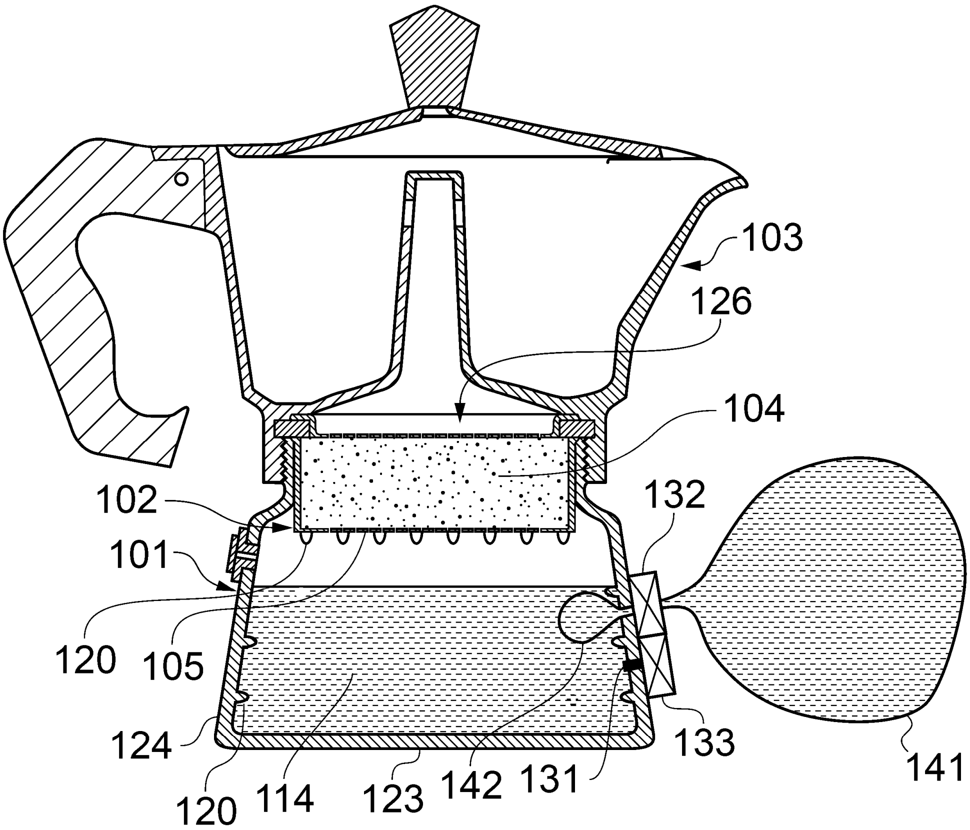

FIG. 1

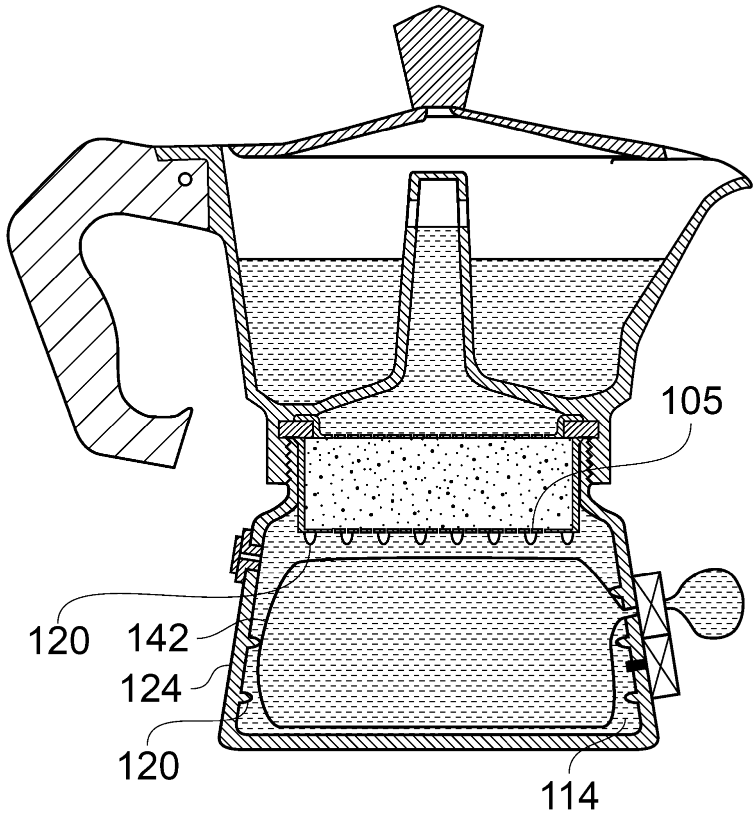

FIG. 2

Document D2

1. In order to prepare a mild tasting coffee with a moka coffee machine, the temperature of the water that passes through the ground coffee must be between 75 °C and 85 °C. These temperatures are too low to dissolve the bitter substances in ground coffee. This article describes a moka coffee machine system that can be manually operated to prepare coffee at approximately 78 °C.

2. Fig. 1 shows a cross section through the moka coffee machine system. It comprises a moka coffee machine which is filled with water and ground coffee. The moka coffee machine comprises a boiler 201, a ground coffee holder 202 containing the ground coffee and an upper part 203 for receiving prepared coffee.

3. The boiler 201 comprises a reservoir 214 containing the water, a base plate 223, a sidewall 224, and a temperature indicator 253. The reservoir 214 has an opening 226. The temperature indicator 253 is welded into an opening in the sidewall 224. The boiler 201 is connected to a compressed air source 251 via a tube 250 and a valve 252.

4. Fig. 2a shows a cross section through the temperature indicator 253 of the moka coffee machine of Fig. 1 at room temperature. The temperature indicator 253 comprises a housing 257, a first chamber 254, a second chamber 255 and an elastic membrane 209. The housing 257 comprises a transparent window 256. The elastic membrane 209 separates the first chamber 254 from the second chamber 255. The first chamber 254 contains ethanol, which boils at 78 °C at average sea level air pressure. The second chamber 255 is partially filled with coloured water. The level of the water in the second chamber 255 is below the window 256.

5. When the moka coffee machine is placed on a heat source (not shown), the b[illegible] plate 223 gets hot and heats the water in the reservoir 214 directly. The ethanol i[illegible] the first chamber 254 is heated via the housing 257. When the ethanol reaches its boiling point, ethanol gas is formed and the pressure in the first chamber 254 increases. The increase in pressure causes the elastic membrane 209 to be displaced so that the volume of the first chamber 254 increases and the volume of the second chamber 255 decreases.

6. Fig. 2b shows the temperature indicator 253 of Fig. 2a after all the ethanol in the first chamber 254 has turned into ethanol gas. The decrease in volume of the second chamber 255 causes the coloured water in the second chamber 255 to rise above the window 256 so that it can be seen through the window 256. This indicates that the temperature of the water in the reservoir 214 has reached approximately 78 °C and coffee can be prepared.

7. To prepare coffee, the valve 252 is opened so that compressed air enters the reservoir 214 via the tube 250. The compressed air forces water out of the reservoir 214 via the ground coffee and the opening 226. As the water passes through the ground coffee it dissolves aromatic substances to form prepared coffee.

Drawings Document D2

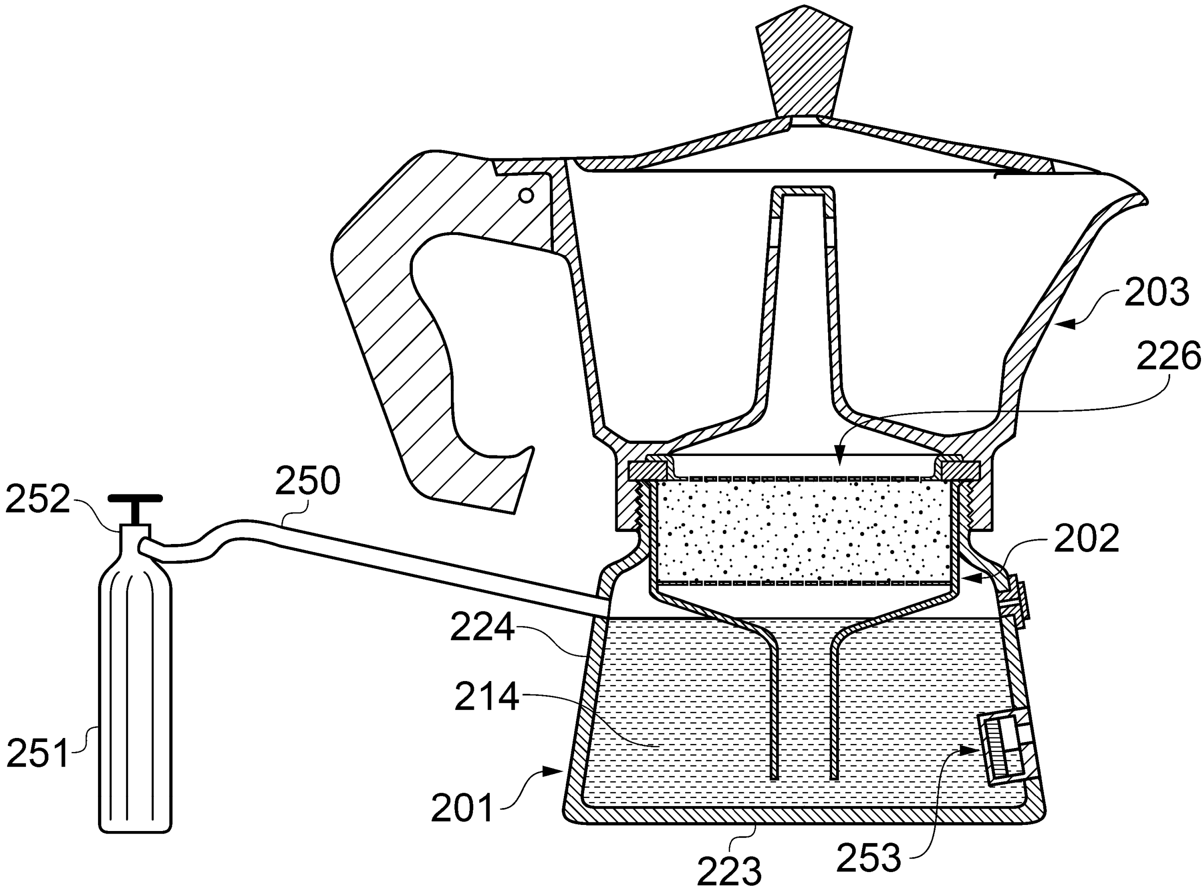

FIG. 1

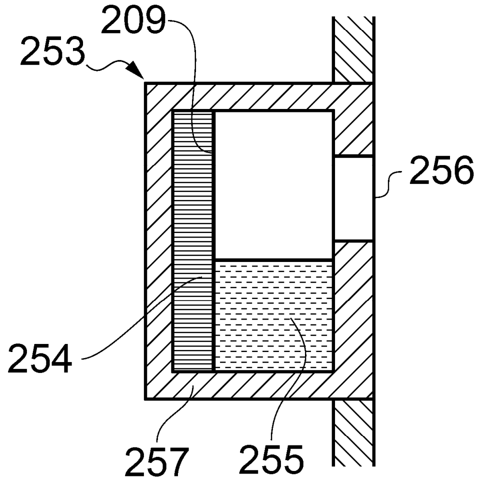

FIG. 2a

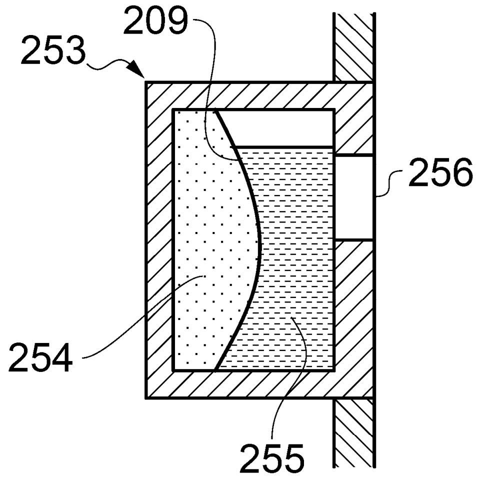

FIG. 2b