Aug. 23, 1966 E. VALENTE 3,267,996

HEAT EXCHANGE SYSTEM HAVING RECYCLING FLUENT MATERIAL RECEIVING AND DISCHARGING HEAT

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FIG. 1

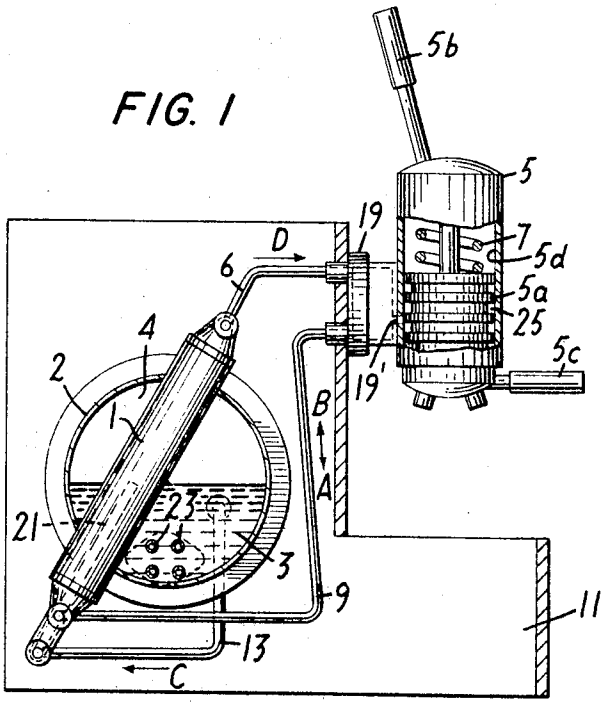
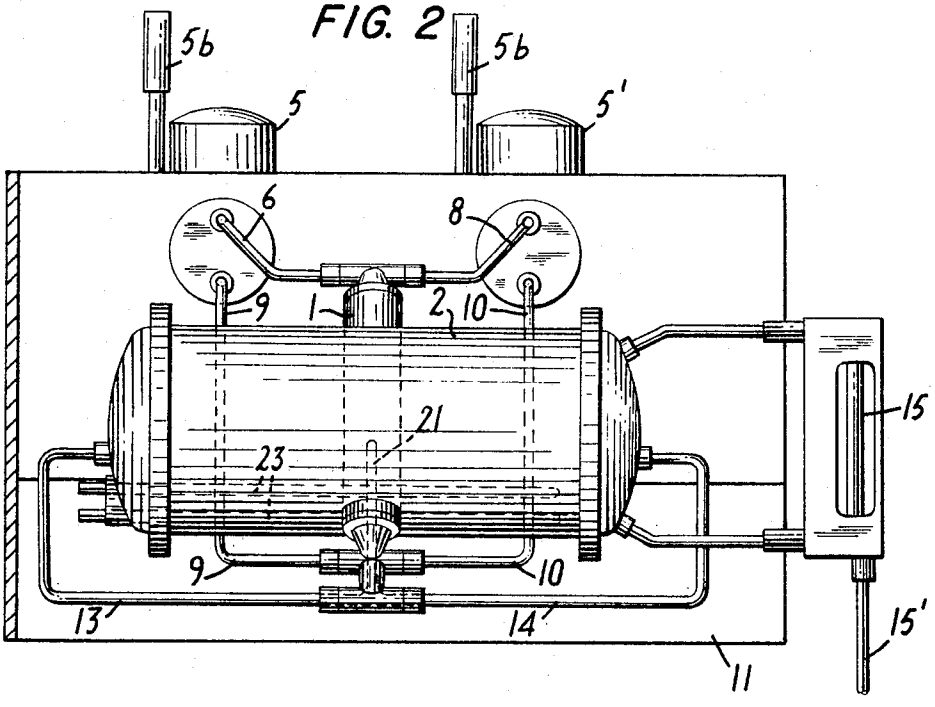


FIG. 2



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HEAT EXCHANGE SYSTEM HAVING RECYCLING FLUENT MATERIAL
RECEIVING AND DISCHARGING HEAT
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FIG. 3

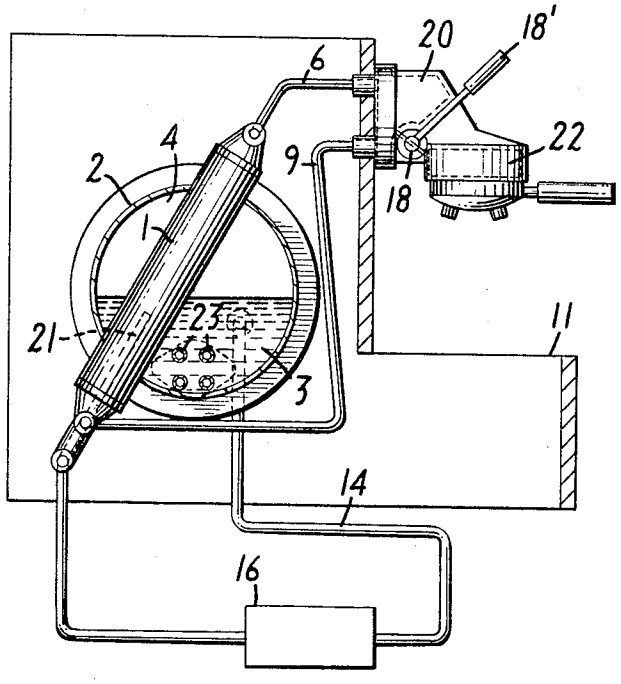
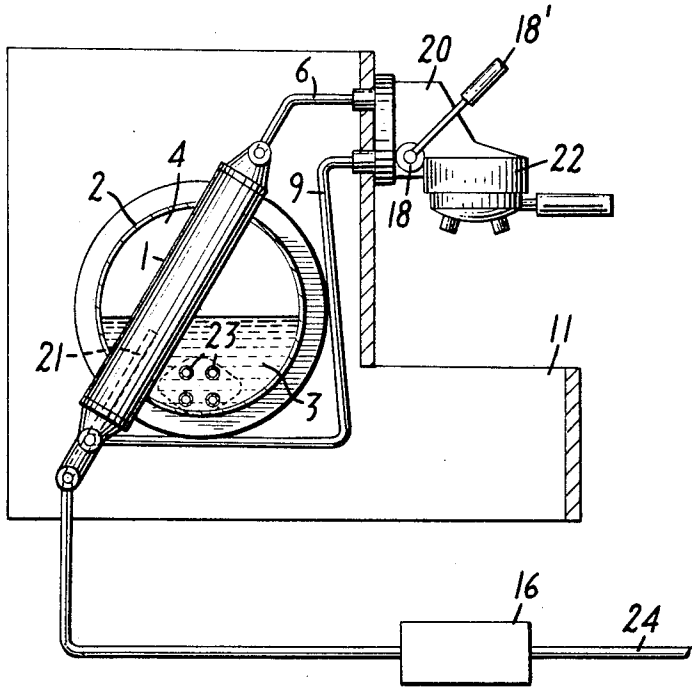


FIG. 4



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HEAT EXCHANGE SYSTEM HAVING RECYCLING FLUENT MATERIAL RECEIVING AND DISCHARGING HEAT

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3 Claims. (Cl. 165—106)

This application is a continuation-in-part of Serial No. 109,375, filed May 11, 1961.

Problems still existing in the technology of coffee making are both the need of maintaining the same temperature in the infusion chamber and in the distributing heads, (1) during the intermittent distribution of the drinks and (2) during the practically unbroken distribution of the same during rush hours, and (3) the need of avoiding the formation of calcareous incrustations with all the resultant harmful consequences. The infusion chamber is, as is well known in the art, the chamber in which the coffee grounds are placed for infusion.

The first (1) of the above-mentioned problems has been already solved, for instance, with a coffee machine where distributing heads are fed by an unbroken circulation of hot water coming from the water chamber of a boiler, as taught for example in British Patent No. 808,538 to Giampietro Saccani, filed November 14, 1956.

But again where large demands are put on the boiler, that is when coffee is being dispensed almost continuously, the consequent large amount of cold water which is required to replace the hot water used tends to reduce considerably the temperature of the water in the machine. Also, in the previous technology the formation of calcareous scale has not been appreciably reduced.

The object of the present invention is to provide a coffee-making machine, in which the above disadvantages are avoided.

According to the present invention, a coffee-making machine is provided which comprises a dispensing head and a boiler, and has a flow path comprising water conduits whereby hot water may continuously circulate through the head of the machine, means for the circulating of water, and means to provide the necessary pressure in the dispensing head. The machine is characterized by the fact that a part of one of the water circulation conduits passes through the boiler and serves as a heat exchanger portion.

The invention will be described further, by way of specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is an elevation side view, partly in section, of a first embodiment of the invention;

FIG. 2 is an elevation side view of the FIG. 1 apparatus in the direction of the arrow A;

FIG. 3 is an elevation side view, partly in section, similar to FIG. 1 of another embodiment of the invention;

FIG. 4 is an elevation view, partly in section, similar to FIGS. 1 and 3, of a third embodiment of the invention.

With reference to FIGS. 1 and 2, the coffee-making machine comprises a conventional low pressure steam boiler **2** (conventionally operated at a relative pressure of 16 to 22 lbs. per sq. in.), which contains, when in use, water **3** and steam **4**, and which is heated by heating elements **23** arranged longitudinally therein; infusion and dispensing heads **5** and **5'**, which are mounted on a frame **11** and are thus spaced from boiler **2** so that they are thermally insulated from the boiler **2**; heads **5** and **5'** are provided with a chamber **19** laterally arranged adjacent to a conventional infusion and dispensing chamber (not illustrated) and communicating with said latter chamber through an opening **19'** controlled in a known manner

(not illustrated); conventional water conduits **25** whereby water may continuously circulate through the chamber are incorporated in the said heads **5** and **5'** and communicate with outlet conduits **6** and **8** and return conduits **9** and **10**; heat exchanger **1**, which is a conduit of larger diameter then the conduits communicating with it, passes through boiler **2** and is arranged substantially vertically, and communicates at its upper end with conduits **6** and **8** and at its lower end to conduits **9** and **10**.

Hot water is supplied from boiler **2** to heat exchanger **1** through the conduits **13** and **14** which open immediately below the water level in boiler **2**, these conduits communicating with a pipe **21** inserted in heat exchanger **1**, inside of which pipe **21** opens at a determined level. When neither of the heads **5** and **5'** are operated in order to dispense coffee, the hot water flows from the upper end of the heat exchanger into the chambers **19** respectively of the heads **5** and **5'**, and then from chambers **19** to the heat exchanger **1** via conduits **9** and **10** to be recirculated. While the water is passing through the chamber **19** some cooling takes place at first but eventually a substantially constant temperature is achieved in chamber **19** and, consequently, in the infusion chamber. The water temperature in conduits **9** and **10** is considerably less than that in conduits **6** and **8**.

When dispensing head (**5** or **5'**) is operated in order to dispense coffee, hot water is driven through controlled opening **19'**, and into the infusion and dispensing chamber, from the infusion and dispensing chamber to the coffee powder contained in the filter.

In order to maintain the water level in the boiler constant, the water level being indicated in sight glass **15** which is simply a glass section of conduit arranged perpendicular to the major axis of boiler **2** and communicating with boiler **2** through conduits at the top and bottom and with fresh water supply conduit **15'**, a quantity of fresh water equal to that discharged in order to dispense coffee is introduced through supply conduit **15'**.

Referring still to FIGS. 1 and 2, head **5** is a conventional manually operated head for coffee-making machines. Piston **5***a* slides against and in watertight relation to the cylindrical walls **5***d* of head **5** and is biased against spring **7** incorporated in the head.

With further reference to FIGS. 1 and 2, when coffee is not being dispensed, the water heated in the heat exchanger **1** is supplied to dispensing head **5** through conduit **6** and to the second dispensing head **5'** through conduit **8**. The water cools on route to the dispensing head and is further cooled in head **5** and return conduits **9** and **10** so that a convection flow is established through conduits **9**, **10**, **6** and **8** which provides continuous recirculation as shown by arrows A and D. When coffee is being dispensed, the recirculation ceases and a new flow is established through the conduits **9**, **10**, **13**, **14** and **21** since a quantity of fresh water equal to that of hot water discharged through the dispensing head or heads flows into the boiler **2** from the supply line **15'** and thus the water from the boiler **2** is cooler than that heated by the heat exchanger. This cooler water enters heat exchanger **1** through conduits **13**, **14** and **21** in the direction shown by arrow C and comes down to the lower end of the heat exchanger **1** and partially flows through conduits **9** and **10** in the direction shown by arrow B and into chamber **19**. This motion is due to differences of density and gravity action. It will be appreciated that, thus, cooler water flows in the opposite direction to that of the recirculation flow in conduit **9** and precludes overheating of water in head **5** in the period of continuous dispensing from the coffee-making machine.

Referring now to FIG. 3, in this embodiment a coffee-making machine is provided with a single head which

consists in a chamber **20** and an infusion and dispensing chamber **22** communicating with one another through a simple known cock **18** manually operated by means of lever **18'**. A pump **16** is placed in conduit **14** through which water flows from boiler **2** to heat exchanger **1** and provides a high relative pressure, e.g., about 105 lbs. per sq. in., in the dispensing chamber. Otherwise, the operation of this machine is identical to that shown in FIGS. 1 and 2.

Referring to FIG. 4, this embodiment distinguishes from that of the FIG. 3 in that the quantity of fresh water equal to that of water discharged, when coffee is being dispensed, is supplied to heat exchanger **1** from water supply line **24** rather than from boiler **2**. Otherwise, the operation of this machine is identical to that shown in FIG. 3.

In each of the embodiments shown, the formation of calcareous scale in the conduits is prevented due to the fact that water supplied thereto from the boiler is not supplied from water in the lower region of the boiler but from water in the upper region of the boiler, wherein the water is less likely to contain suspended matter wich would result in the formation of scale. Also, the formation of scale is prevented in conduits wherein there is circulation thanks to the scraping and cleaning effect of the stream existing in said conduits.

What I claim and desire to secure by Letters Patent is:

1. A coffee-making machine comprising, a dispensing head having a valved outlet communicating with the ambient, a boiler disposed spaced from said dispensing head for heating water therein and having a space for receiving steam from water heated therein, means defining a water-flow path having a portion external to said boiler for recirculating heated water from said boiler through said dispensing head and back to said boiler, said heated water being cooled while in said external portion of said flow path, and having a portion defining a heat exchanger portion of said flow path passing through said boiler at an

inclination to the vertical and being partially immersed in the boiler water for extracting heat from the water and steam in said boiler, and said means defining said external portion of said flow path comprising a first conduit external of said boiler and communicating between said heat exchanger portion and said dispensing head for supplying heated water from said heat exchanger portion to said dispensing head and a return conduit external of said boiler and communicating between said heat exchanger portion and said dispensing head for returning water from said dispensing head to said heat exchange portion when said valved outlet of said dispensing head is closed, said return conduit communicating with said heat exchanger portion at a point spaced along said flow path from a point at which said first conduit communicates with said heat exchanger portion, and means for supplying water to said boiler, whereby water is circulated through said water-flow path automatically due to convection flow.

2. A coffee-making machine according to claim **1**, in which said heat exchanger portion has an internal diameter larger than the internal diameter of each of said first and return conduits.

3. A coffee-making machine according to claim **1**, in which said means for supplying water to said boiler comprises a pump to provide a pressure in said dispensing head.

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ROBERT A. O'LEARY, *Primary Examiner.*

N. R. WILSON, *Assistant Examiner.*