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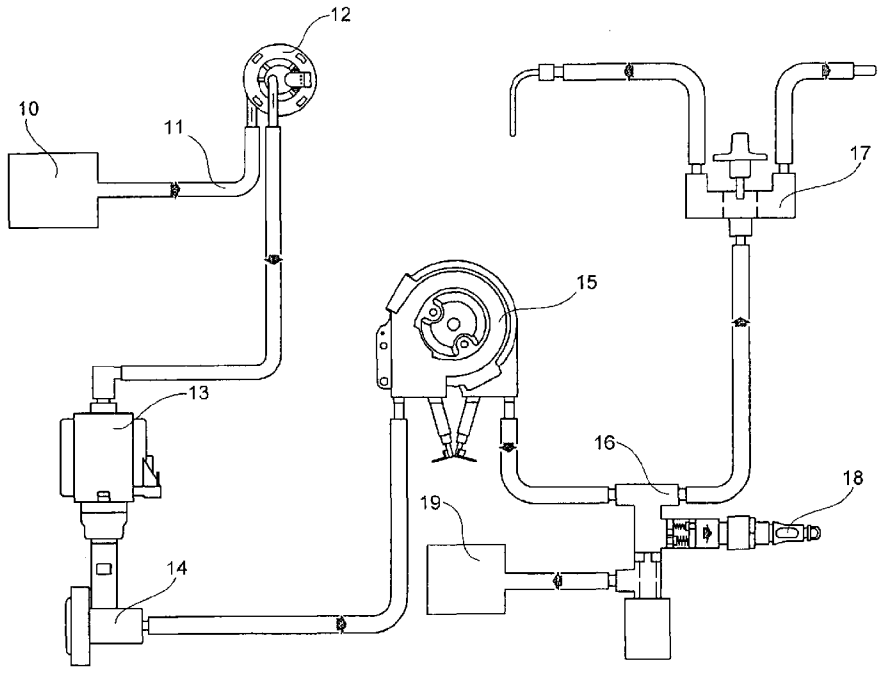
(54) Title: HYDRAULIC CIRCUIT FOR INSTANT BEVERAGE MACHINES, RELIEF AND SAFETY VALVE FOR SAID CIRCUIT AND METHOD FOR THE PREPARATION OF INSTANT BEVERAGES



(57) Abstract: Hydraulic circuit for instant beverage machines comprising a tank (10), a water extraction pipe (11) contained in said tank (10), a flow-meter (12) connected to said extraction pipe (11), a pump (13), a first vibration-damping valve (14), a boiler (15), a second relief and safety valve (16), a water/steam faucet (17), a third beverage flow valve (18), a recovery tank (19).

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Hydraulic circuit for instant beverage machines, relief and safety valve for said circuit and method for the preparation of instant beverages

FIELD OF THE INVENTION

The present invention relates to machines used for the preparation of instant beverages such as coffee and the like

STATE OF THE ART

Different types of instant beverage machines are known in the art, for example machines for making instant coffee.

They are provided with a hydraulic circuit which generally comprises a water tank, an infusion chamber for preparing the beverage, devices for feeding the powder of said beverage to said infusion chamber, devices for pumping water from the tank through the hydraulic circuit and toward the infusion chamber and an outlet spout for the instant beverage.

Typical hydraulic circuits used for the above purpose have a valve called electromagnet with a one-way (or multi-way) solenoid valve, used for performing many adjustment functions.

The water coming from the boiler enters said valve and controls the excess water discharge, the water delivery at high temperature or steam from special external spouts that can be used by the user, and the inlet of water at high temperature into the infusion chamber where the instant beverage is prepared, which is then delivered via the external spout.

The valves used are typically provided with an electromagnet and are known as Electromagnets with stem (or needle) valve. These valves have numerous drawbacks:

- they can be affected by scale;
- they are noisy;
- they can only control the discharge phase, hence they do not have multiple uses unless they are connected in series or in parallel with each other and equipped with additional boilers or heat exchangers to control the steam phase and maximum-pressure valves to control the safety of the circuit;
- recharge or drainage (when necessary) is not guaranteed when the circuit is unused for long periods of time

- they cannot control the passage from the vapor state to the liquid state because in certain applications it is necessary to use special self-priming valves - expensive and not reliable – which may be used with the pumps. In other cases, complex and ineffective manual operations may have to be carried out by the user.

The hydraulic circuit, according to the present invention, is capable of overcoming the aforesaid drawbacks by introducing a topology based on one electromagnet and one boiler.

SUMMARY OF THE INVENTION

The present invention relates to a hydraulic circuit for instant beverage machines, a relief and a safety valve for said circuit and method for the preparation of instant beverages, as described in the claims which are an integral part of this description.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 Complete diagram of a hydraulic circuit for machines used for the preparation of instant beverages according to the present invention

Fig. 2 Structure of the relief and safety valve

Fig. 3 Structure of a preferred embodiment of the relief and safety valve

Fig. 4a, 4b, 4c Structure of a preferred embodiment of the water / steam faucet

DETAILED DESCRIPTION OF THE INVENTION

With reference to Fig. 1, we can see a diagram of a hydraulic circuit for machines used for the preparation of instant beverages according to the present invention.

There is a tank 10 which is connected to an extraction pipe 11 for the water contained in it. Said extraction pipe 11 leads the water into a pump 13 through a flow-meter 12. Said pump 13 is connected to the boiler 15 through a first vibration-damping valve 14 which releases the water into said tank if the pressure exceeds a specific threshold value. Downstream of said boiler is the relief and safety valve 16 provided with one inlet and three outlets. Downstream of said relief and safety valve 16 is a beverage flow valve 18 and a water / steam faucet 17 used for adjusting the delivery of steam or water / steam mixture towards the outside of the instant beverage machine, so that it can be used, for instance, to prepare other types of beverages.

When the user selects the beverage, the following operations take place:

1. the pump 13, pressurises the water contained in the hydraulic circuit,
2. when the pressure of the hydraulic circuit exceeds a predetermined threshold, preferably set at about three bars, the water is discharged in a recovery tank 19 through the relief valve 16
3. after a set time interval, the pump 13 stops and thus the hydraulic circuit is closed
4. by using the control circuit and at least one temperature sensor, the boiler can heat up the water to a preset temperature value.
5. At this stage, the beverage delivery unit moves to the operating position by engaging the delivery connector - pin, terminal connecting part of the hydraulic circuit.
6. When the pressure reaches about 3 bars, said relief valve 16 makes the water flow inside said delivery unit.
7. The beverage is delivered through the beverage flow valve 18
8. After releasing the beverage, a special command from the control circuit energises the control coil 31 of the relief valve 16 which opens up, thus reducing the pressure of the hydraulic circuit when the delivery unit is still engaged in the delivery connector – pin.
9. Likewise, the liquid pressurised in the delivery unit flows out through a hole with a spring calibrated at 0.2 bars and flows out of the drain towards said recovery tank 19
10. The delivery unit returns to its initial position.
11. The operation is repeated up to step 2. in order to empty possible beverage residues from the circuit.

According to the present invention, the hydraulic circuit, by following the aforesaid sequence of steps, is able to overcome numerous drawbacks associated with the instant beverage machines included in the state of the art.

As a result, steps 1 to 3 will help remove the water with inadequate temperature from the hydraulic circuit and preheat all conduits, thereby achieving a beverage at an ideal temperature.

If the pump is unable to operate due to irregular functioning or overpressure, through said flow-meter 12 placed along the hydraulic circuit, the electronic control

unit will warn you that there is no passage of liquid. Thus, the circuit will be discharged and self-recharging attempts will be performed. Without the aid of this system, everything would have to be carried out manually, thus making things difficult for the user.

Step 6 limits the pressure in the circuit to a typical value of about three bars. This will improve the safety and the reliability of the instant beverage machine, thereby also eliminating puffs in the infusion chamber, hence maintaining a constant temperature at higher values and achieving an optimum beverage.

Step 9, related to the post-infusion pressure release, allows better cleaning because the tablet for the preparation of the beverage is drier and the temperature remains constant.

Step 11 eliminates the reflux of any small particles coming from the infusion chamber toward the hydraulic circuit. Said particles can be harmful because they can damage the seals or contaminate the water or the steam coming out of the steam pipe, hence causing negative organoleptic consequences on the beverage to be prepared. This result is achieved, in the hydraulic circuits included in the state of the art, by introducing special one-way and/or two-way valve systems.

Placing said relief and safety valve 16 inside the hydraulic circuit, according to the present invention, will reduce the pressure inside the circuit and eliminate the safety valve normally used in machines for the preparation of instant beverages included in the state of the art. Furthermore, since said relief and safety valve 16 is of the "slide" type, it is able to achieve an active-type seal, thus allowing less noise – because the coil requires less pilot power considering that it is aided by the pressure of the circuit - and avoiding scale problems, such as sticking parts, and thus allowing its positioning in the warm and/or calcareous zone of the hydraulic circuit, which is perfect for its operation.

With reference to Fig. 2, we can see the detailed structure of said relief and safety valve 16. We can see, in the order given, the water and steam inlet 20 from the boiler 15, a first water and steam outlet 21 directed towards the faucet 17, a second outlet 22 of the pressurised water directed towards the beverage delivery valve 18 and a third outlet 23 for discharging water into the recovery tank 19, which is operated by a solenoid valve equipped with a maximum pressure limiting

device – e.g. a pre-calibrated spring – which remains closed during normal operation and opens up if the pressure exceeds a specific threshold, usually around 16 / 20 bars, or if a specific command is sent to the control coil of the solenoid valve.

With reference to Fig. 3, we can see the detailed structure of a preferred embodiment of said relief and safety valve 16. Said outlet 22, which is connected to the beverage delivery unit, has a valve provided with a spring usually calibrated at about 3 bars. In addition, it is provided with an inlet 30 calibrated at 0.2 bars, which allows the passage of liquid in order to release the beverage delivery unit from the pressure. Said outlet 23, used for discharging water into the tank, is provided with a control coil 31 which is energised with an appropriate command and with a spring 32 calibrated at about 16 / 20 bars. As previously described, said relief and safety valve 16 is preferably of the "slide" type. This makes it possible to combine the safety valve and a double-exchange valve, placed between the electropilot and the beverage delivery unit, in one body.

With reference to Fig. 4, we can see the detailed structure of a preferred embodiment of said water / steam faucet 17. In Fig. 4a, we can see said faucet in the first, out of three, possible positions. There is an inlet 40 and two outlets 41, 42, one of which 41 is directed to the outlet nozzle of the machine used for delivering water or steam, whereas the other 42 is directed, for instance, toward possible devices connected to the instant beverage machine, such as the cappuccino device, in accordance with the published Italian Patent application No. MI2005A000880. Additionally, there is a faucet lever 43, a support 44 provided with sensors for detecting the position of said lever 43 and a slider 45 which opens and closes the passages of said faucet 17.

Figures 4b and 4c show other two positions that can be reached by said faucet 17. The selection of the outlets is carried out by turning the faucet lever 43. Said lever 43 is connected to said slider 45 which opens or closes the outlets, according to the position, by selecting the outlet required. The position of said lever 43 is detected by sensors, e.g. REED sensors, placed on the support of the faucet, and by a magnet 46 placed on said lever 43. Each position of the lever 43 corresponds to a specific function – for instance, position 1 delivers water and steam to the

faucet, the boiler heats the water to proper temperature and the pump delivers the water / steam mixture.

CLAIMS

1. Hydraulic circuit for instant beverage machines comprising a tank (10), a water extraction pipe (11) contained in said tank (10), a flow-meter (12) connected to said extraction pipe (11), a pump (13), a first vibration-damping valve (14), a boiler (15), a second relief and safety valve (16), a water / steam faucet (17), a third beverage flow valve (18), a recovery tank (19).
2. Hydraulic circuit for instant beverage machines according to claim 1 wherein said relief and safety valve (16) comprises a water / steam inlet (20), a first water / steam outlet (21) directed to said faucet (17), a second outlet (22) of the pressurized water directed to said beverage delivery valve (18) and a third outlet (23) for discharging water into the recovery tank (19).
3. Hydraulic circuit for instant beverage machines according to claim 2, wherein said third outlet (23) is controlled by a solenoid valve equipped with a control coil (31).
4. Hydraulic circuit for instant beverage machines according to claim 3, wherein said solenoid valve is equipped with a first maximum pressure limiting device.
5. Hydraulic circuit for instant beverage machines according to claim 4, wherein said first maximum pressure limiting device comprises a first pre-calibrated spring (32).
6. Hydraulic circuit for instant beverage machines according to any of the previous claims (from 2 – 5), wherein said second outlet (22), connected to the beverage delivery unit, is provided with a second maximum pressure limiting device.
7. Hydraulic circuit for instant beverage machines according to claim 6, wherein said second maximum pressure limiting device comprises a second pre-calibrated spring.
8. Hydraulic circuit for instant beverage machines according to claims 2 - 7, wherein said second outlet (22), connected to the beverage delivery unit, also has an inlet (30) which is provided with a valve equipped with a third maximum pressure limiting device which enables the passage of liquid in order to release the beverage delivery unit from the pressure.

9. Hydraulic circuit for instant beverage machines according to claim 8, wherein said third maximum pressure limiting device comprises a pre-calibrated spring.
10. Hydraulic circuit for instant beverage machines according to the previous claims, wherein said relief and safety valve (16) is preferably of the "slide" type.
11. Hydraulic circuit for instant beverage machines according to the previous claims wherein said faucet (17) comprises an inlet (40), a first outlet (41), a second outlet (42), a faucet lever (43), a support (44) provided with sensors for detecting the position of said lever (43) and a slider (45) capable of opening and closing the passages of said faucet (17).
12. Hydraulic circuit for instant beverage machines according to claim 11, wherein said faucet is provided with a device for determining the position of said slider (45).
13. Hydraulic circuit for instant beverage machines according to claim 12, wherein said device for determining the position of said slider (45) comprises at least one REED sensor and at least one magnet (46).
14. Relief and safety valve specifically used for hydraulic circuits according to any of the previous claims (from 1 to 13).
15. Method for the preparation of instant beverages characterised in that it comprises the following steps:
    a) pressurise the water contained in the hydraulic circuit with a pump (13)
    b) when the pressure of the hydraulic circuit exceeds a predetermined threshold, discharge the water into a recovery tank (19) via the relief valve (16)
    c) after a set time interval, stop the pump (13) and close the hydraulic circuit
    d) heat up the water with the boiler (15) to a preset temperature value via the control circuit and at least one temperature sensor.
    e) move the beverage delivery unit to the operating position by engaging it to the delivery connector - pin, terminal connecting part of the hydraulic circuit.
    f) when a pressure limit is reached, make the water flow inside said delivery unit via said relief valve (16)
    g) release the beverage through the beverage flow valve (18)

h) after releasing the beverage, reduce the pressure of the hydraulic circuit when the delivery unit is still engaged in the delivery connector – pin via a special command from the control circuit which energises the control coil (31) of the relief valve (16), which will open up.

i) make the pressurised liquid in the delivery unit flow out through the hole with the spring calibrated at 0.2 bars from the drain towards said recovery tank (19)

j) reposition the delivery unit to its initial position.

k) repeat operation in step b) to empty possible beverage residues from the circuit.

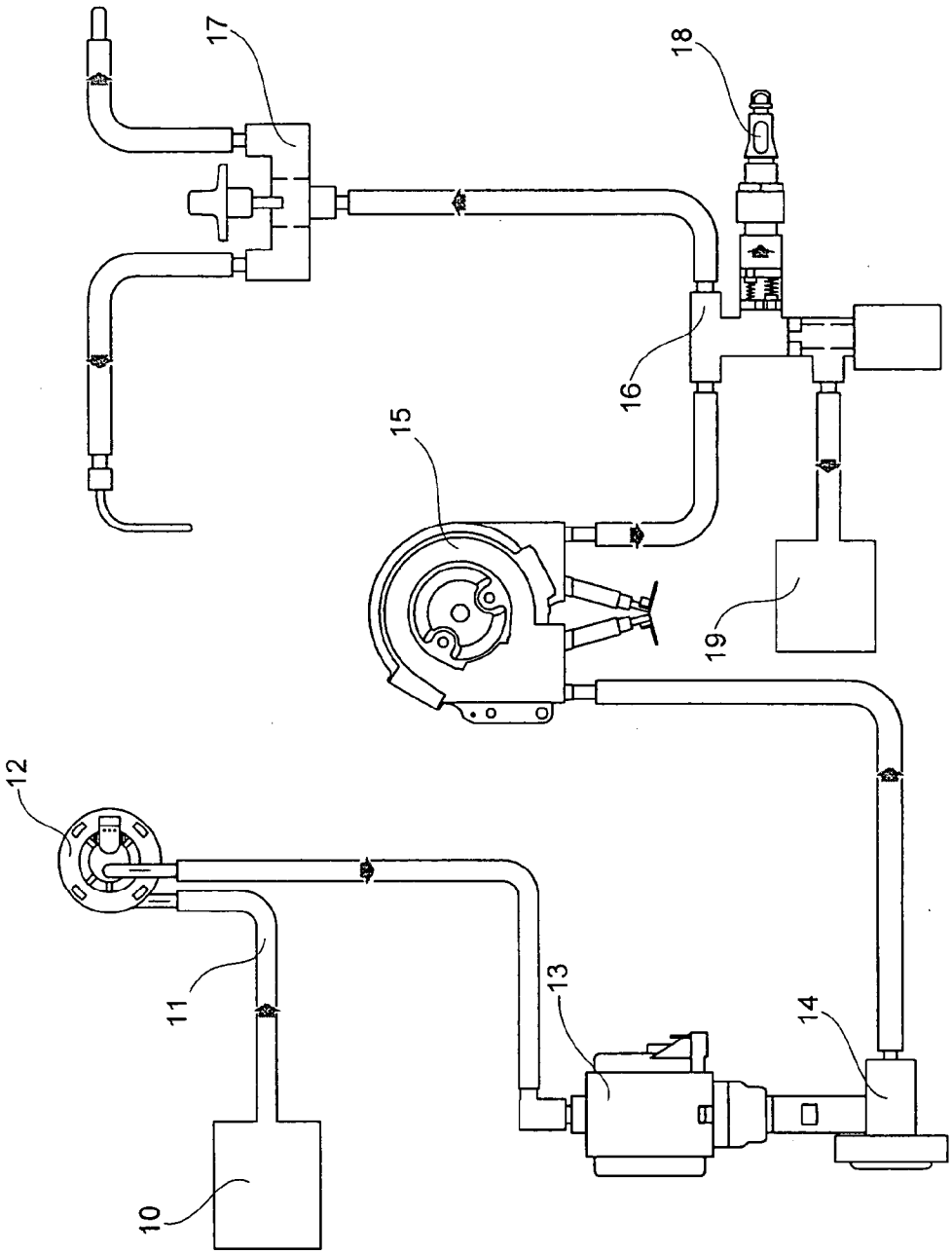

Fig. 1

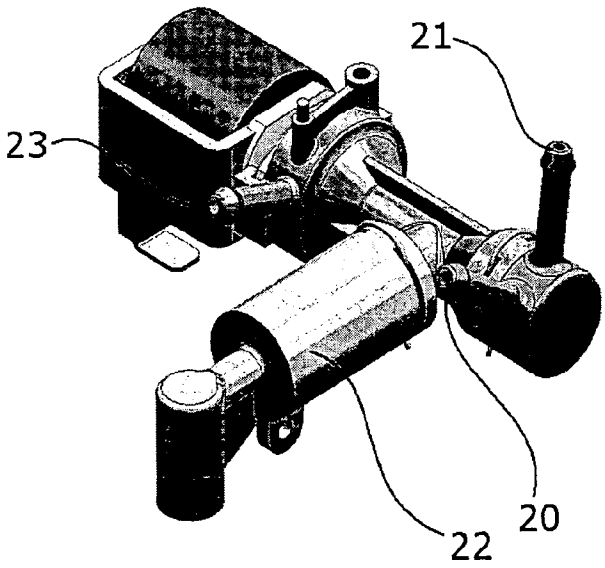

Fig. 2

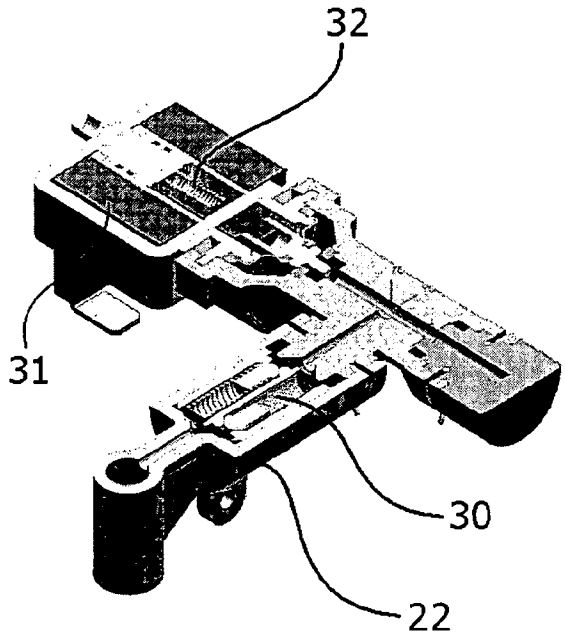

Fig. 3

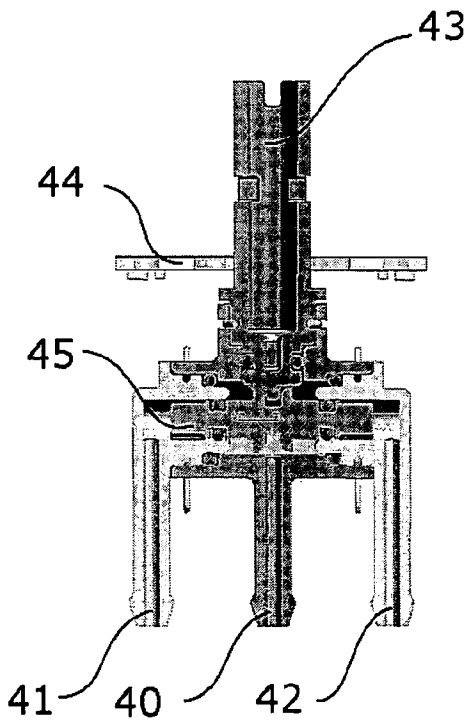

Fig. 4a

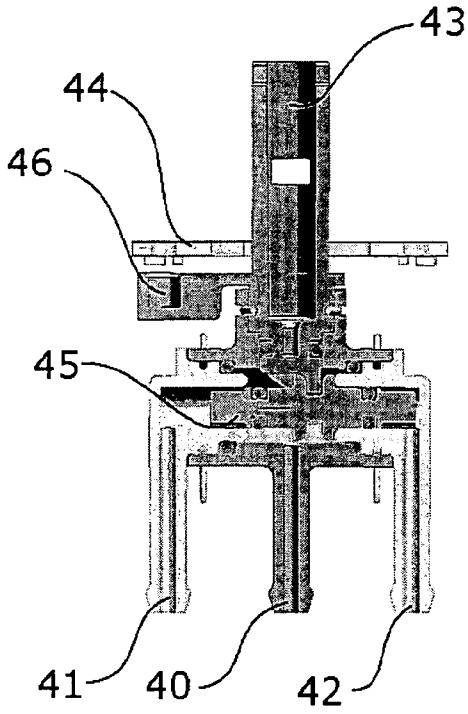

Fig. 4b

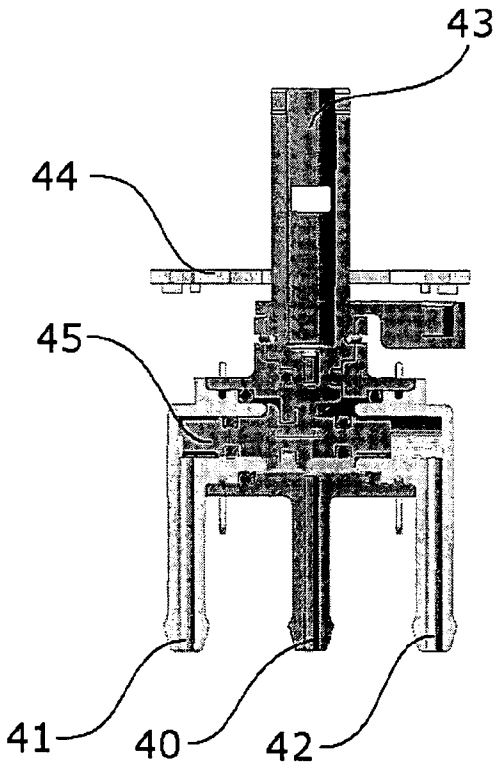

Fig. 4c

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/064678

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J31/46

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)
A47J

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	column 3, line 16 - column 4, line 2	11,12
A	column 5, line 58 - column 6, line 9 figure 1	15
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A	EP 0 676 163 A (SINTRA HOLDING AG; M. SCHAERER AG) 11 October 1995 (1995-10-11) figure 1	1,15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
16 October 2006	24/10/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Kempeneers, Johanna

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2006/064678

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 2004/079237 A1 (DENISART JEAN-PAUL [CH]) 29 April 2004 (2004-04-29) page 2, line 14, paragraph 34 - line 17, paragraph 34 figure 4	1,15
A	IT BO 930 236 U1 (SAECO S.P.A) 12 June 1995 (1995-06-12) page 4, line 5 - page 5, line 1 page 5, line 12 - line 18 page 6, line 15 - line 17 figures 1-3	1,15
A	EP 1 415 580 A (EUGSTER/FRISMAG AG) 6 May 2004 (2004-05-06) figure 1	1,15

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

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