



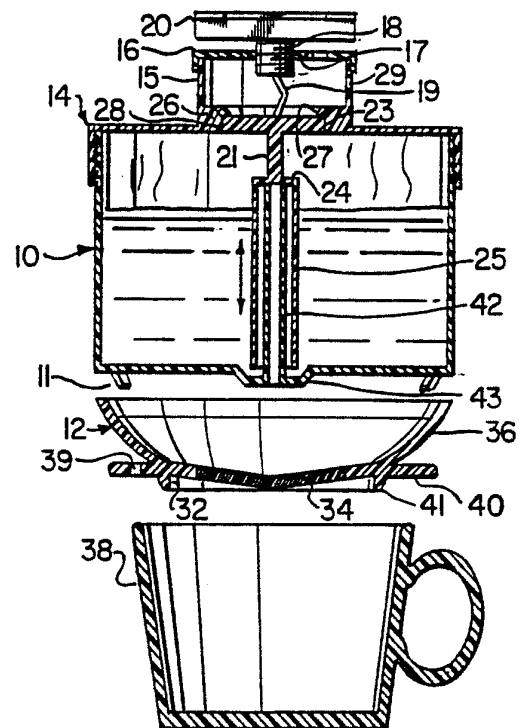
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : A47J 31/00, 31/46</p>	<p>A1</p>	<p>(11) International Publication Number: WO 91/12757 (43) International Publication Date: 5 September 1991 (05.09.91)</p>
<p>(21) International Application Number: PCT/CA90/00060 (22) International Filing Date: 23 February 1990 (23.02.90)</p> <p>(71) Applicant (for all designated States except US): MICRO CAFE INC. [CA/CA]; 90 Hewitt Crescent, Ajax, Ontario L1S 7B3 (CA).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): YU, Dong [CA/CA]; 90 Hewitt Crescent, Ajax, Ontario L1S 7B3 (CA).</p> <p>(74) Agent: OGILVY, Renault; 1981 McGill College Avenue, Montreal, Quebec H3A 3C1 (CA).</p> <p>(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent)*, DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent), US.</p>		<p>Published With international search report.</p>

(54) Title: MICROWAVE BREWING APPARATUS CONTROL VALVE AND METHOD OF MAKING A BEVERAGE

(57) Abstract

A method of making a beverage from an infusible material in a microwave oven, employing an apparatus having a microwave transparent pressurizable liquid reservoir, said pressurizable liquid reservoir having as valve to release fluid, means to control the rate of release of gas and fluid from the pressurizable liquid reservoir, said pressurizable liquid reservoir being mounted in fluid communication with a filter chamber, said filter chamber mountable above a beverage receptacle, the method comprising placing a supply of an infusible material in the filter chamber, mounting said filter chamber on a receptacle, pouring a liquid into the pressurizable liquid reservoir to a level below the top of the pressurizable liquid reservoir, securing the lid to the pressurizable liquid reservoir, mounting the pressurizable liquid reservoir in fluid communication with the filter chamber, adjusting the control means to control the rate of release of fluid from the pressurizable liquid reservoir, heating said liquid in said pressurizable liquid reservoir with microwave energy to raise the liquid vapor pressure in the pressurizable liquid reservoir sufficiently to move said valve sufficiently to open the lower valve and force said liquid from the pressurizable liquid reservoir through the lower valve into the filter chamber to make a beverage, and collecting the beverage in said receptacle.



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Mikrowave brewing apparatus control valve and method of making a beverage

BACKGROUND OF THE INVENTION

5 This invention relates to an apparatus for brewing coffee, tea or other beverages from respective infusible materials using microwave energy, and to a method of making such beverages. More particularly this invention relates to a valve for controlling the rate at which fluid flows through the infusible material.

10 In Canadian Patent Application Number 591,303-7 filed on February 16, 1989 entitled "Microwave Brewing Apparatus and Method" I disclosed an apparatus comprising a pressurizable water reservoir and a filter chamber disposed below the reservoir. The reservoir was provided
15 with pressure overflow means which, in operation, prevented water in the reservoir from overflowing into the filter chamber until vapor pressure in the reservoir was built up due to the influx of microwave energy to form steam so as to force the heated water to overflow
20 into the filter chamber to mix with the infusible material, e.g. ground coffee, to make a beverage. The present invention relates to an improvement in my above noted invention and more particularly to the addition of a control valve to control the flow of fluid through the
25 overflow means to the filter chamber to control the concentration of infusible material in the drink.

Microwave coffee makers are known in the art. U.S. Patent No. 4,104,957 issued to Freedman et al. discloses a drip-type appliance containing a thermally controlled
30 valve in a microwave transparent water reservoir which is positioned over a coffee compartment which in turn is placed above a receptacle. For use, the reservoir is filled with an amount of water, ground coffee is placed on the filter in the coffee compartment, the appliance is
35 placed in a microwave oven and the oven is operated for a selected period of time. When the temperature of water reaches a predetermined level, the valve opens allowing the heated water to flow down through the coffee grounds.

U.S. Patent No. 4,381,696 issued to Koral proposes a similar solution except for the valve between the water reservoir and the coffee compartment being manually operated. After water has been placed in the reservoir, the valve is opened manually immediately before or during the activation of the microwave oven with the coffee maker disposed therein.

U.S. Patent No. 4,386,109 issued to Bowen et al. teaches an espresso-type coffee maker for use in a microwave oven. Water is stored in a microwave transparent reservoir which is separated from a receptacle by a layer of coffee grounds placed over a strainer. The coffee layer is compressed and forms a pressure resistant seal over the water outlet from the reservoir. When the water in the reservoir is heated by microwave energy the pressure in the reservoir rises to a level sufficient to force steam and water through the coffee layer into the receptacle.

Another drip-type coffee maker is described in U.S. Patent No. 4,577,080 to Grossman. The maker comprises a water container positioned above a coffee compartment which is separated from the container by a partition. The partition has perforations sealed with a thermally responsive material that melts when the water is heated to the desired temperature in the microwave oven, allowing the heated water to flow from the upper reservoir through the coffee grounds into a receptacle placed below the coffee maker.

The latter design is apparently intended to be a disposable coffee maker.

It will be appreciated that these and similar microwave coffee makers can be designed to prepare small quantities of coffee, such as a single cup, or to brew larger quantities. In any case, their dimensions, of course, must be such as to allow the appliances to be accommodated in an average microwave oven.

While the above-described microwave coffee makers are useful, there is still a need for a simple and reliable drip-type brewing appliance for use in a

microwave oven, an appliance employing a simple control valve to control the flow of fluid through the infusible material and thus control the concentration of infusible material in the drink.

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STATEMENT OF THE INVENTION

According to the present invention, there is provided an apparatus for brewing coffee, tea or a similar beverage from a respective infusible material, i.e. ground coffee beans, tea leaves, etc., using a typical microwave oven.

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The apparatus is comprised of a receptacle, adapted to receive the final liquid product; a filter chamber adapted to receive infusible material, i.e. ground coffee beans, tea leaves etc. placed over the receptacle; a pressurizable liquid reservoir to retain the liquid which is to be pushed by vapor pressure through the filter chamber into the receptacle and a reciprocating control valve to control the flow of steam out of the top of the pressurizable liquid reservoir and liquid out of the bottom outlet of the pressurizable liquid reservoir into the filter chamber and subsequently into the receptacle. The pressurizable liquid reservoir is made of microwave transparent material so as to allow the fluid in the pressurizable liquid reservoir to be readily heated.

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The pressurizable liquid reservoir includes a gas valve at the top and a liquid outlet valve. A reciprocating control valve, comprised of a valve shaft having one upper valve head at the top and a second lower valve head on the bottom of the valve shaft, is biased in a downward closed position by a spring such that the upper valve head and the lower valve head are both seated when the liquid in the pressurizable liquid reservoir is not boiling sufficiently to create a pressure to overcome the downward bias created by the spring. The tension on the spring biasing the reciprocating valve downwardly may be adjusted by a knob to control the extent of reciprocation of the reciprocating valve which in turn

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controls the manner and rate of flow of liquid through the filter chamber.

In operation, the filter chamber is placed on the cup or beverage receptacle, a supply of infusible material is placed in the filter chamber, the
5 pressurizable liquid reservoir is mounted over the filter chamber, liquid is poured into the pressurizable liquid reservoir to a level below the top of the pressurizable liquid reservoir, the pressurizable liquid reservoir is
10 closed, the liquid in said pressurizable liquid reservoir is heated with microwave energy to raise the vapor pressure in the pressurizable liquid reservoir sufficiently to cause the reciprocating valve to move upwardly forcing liquid through the bottom outlet of the
15 pressurizable liquid reservoir.

If the adjustment of the spring biasing the reciprocating valve downwardly creates a light bias pressure, the vapor pressure will cause the reciprocating valve to move upwardly against the spring sufficiently to
20 release gas through the valve at the top of the pressurizable liquid reservoir. When the downward pressure exerted by the spring overcomes the vapor pressure caused by release of steam from the top valve of the pressurizable liquid reservoir, the valve will seat
25 in both the top and bottom valve seats until the vapor pressure increases sufficiently to raise the valve stem and release liquid through the valve in the base of the pressurizable liquid reservoir into the filter chamber. A light adjustment of the downward bias of the spring
30 causes a reciprocating motion of the valve stem resulting in an intermittent release of liquid from the pressurizable liquid reservoir to the filter chamber. The intermittent release of liquid through the filter chamber results in a stronger drink.

35 If the adjustment of the spring biasing the reciprocating valve downwardly creates a large bias pressure, the reciprocating movement of the valve stem is reduced. Liquid is released through the infusible

material more rapidly resulting in release of less infusible material and a lighter drink.

The valve stem includes an upper and lower valve head. However the upper movement of the valve stem does not open both the upper gas valve and the lower liquid valve at the same time. The lower valve seat releases liquid from the pressurizable liquid reservoir immediately upon upper movement of the valve stem. The upper valve head remains in contact with the bottom portion of the upper valve seat during the initial upper movement of the valve stem and only releases gas through the upper valve after further upper movement of the valve stem than that required to release liquid through the lower valve of the pressurizable liquid reservoir.

In one embodiment of the pressurizable liquid reservoir the outlet in the base of the pressurizable liquid reservoir is extended upwardly above the normal water level of the reservoir by a tube integral with the bottom of the pressurizable liquid reservoir. The lower valve head closing off the opening at the top of the tube is a flange on the bottom of the valve shaft. A tube integral with the outside of the flange at the bottom of the valve shaft extends downwardly concentrically about the central upstanding outlet tube to a point near the bottom of the pressurizable liquid reservoir.

A second embodiment of the pressurizable liquid reservoir features a central opening in the bottom of the pressurizable liquid reservoir with no upstanding tube. The reciprocating valve shaft extends all the way to the bottom of the pressurizable liquid reservoir. The lower valve head is connected to the bottom of the valve shaft to close off the liquid opening in the bottom of the pressurizable liquid reservoir except when heat is generated to create sufficient vapor pressure to cause the valve shaft to move upwardly to release liquid from the bottom of the pressurizable liquid reservoir.

In each embodiment the receptacle and filter chamber may be identical. The difference in the two embodiments illustrated resides in a different arrangement within the

pressurizable liquid reservoir requiring a different design of the reciprocating control valve which controls the venting of gas through the top of the pressurizable liquid reservoir and the flow of liquid through the bottom outlet of the pressurizable liquid reservoir.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings which illustrate embodiments of the present invention,

Figure 1 is a vertical sectional view of one embodiment of the apparatus,

Figure 2 is a vertical sectional view of a second embodiment of the pressurizable liquid reservoir,

Figure 3 is a top view of the knob used to control the liquid flow through the pressurizable liquid reservoir.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings in which like numerals correspond to like parts or elements, the apparatus of the present invention comprises a pressurizable liquid reservoir 10 and a filter chamber 12. The pressurizable liquid reservoir 10 has a matching twist-closure lid 14 which ensures virtually hermetic closure of the pressurizable liquid reservoir 10. To facilitate its handling, the lid 14 has a number of ribs 16 on its external peripheral surface.

Threads 18 of the interior wall of the lid 14 serve to engage the lid 14 with threads 20 on the exterior of the pressurizable liquid reservoir 10.

Referring particularly to Figure 1, the pressurizable liquid reservoir 10 has an inclined wall 11 extending downwardly from the base to receive the filter chamber 12. The inner wall 11 may provide frictional engagement with the wall of the filter chamber 12, as shown in Figure 1, or a threaded connection may be employed, using threads 24 and 26 not shown. The pressurizable liquid reservoir 10 is supported on receptacle 38.

The filter chamber 12 has a concave bottom 32 with a metal filter 34 molded thereinto. The metal filter 34 has perforations of a size adapted to retain the particles of an infusible material, e.g. coffee grounds, and to allow the passage of a liquid therethrough. The filter chamber 12 also has a peripheral wall 36 of a size adapted to frictionally engage most of inclined wall 11 extending downwardly from the base of pressurizable liquid reservoir 10. It is preferable to provide a small passage 39 between the receptacle 38 and the outward extension 40 at the base of pressurizable liquid reservoir 10 for excess steam to escape. The small passage 39 may be at a point or points in the outward extension 40 of the base of filter chamber 12. An annular lip 41 is provided on the underside of the pressurizable liquid reservoir 10, which serves to locate the filter chamber 12 on the receptacle 38. The concavity of the bottom of the filter chamber 12 helps to keep the flow of liquid from the chamber close to the centre of the filter.

The filter chamber and pressurizable liquid reservoir may be used with any receptacle 38. It is preferable, however, that the receptacle 38 is of a microwave transparent variety.

As shown in Figure 1 the bottom of the reservoir 10 includes a central downward extension 43 in which overflow tube 42 is integrally formed. The lid 14 of pressurizable liquid reservoir 10 incorporates central upwardly projecting walls 15 adapted to receive and retain closure cap 16. Closure cap 16 contains a threaded aperture 17 adapted to receive a threaded shaft 18 having a spring 19 depending therefrom and a knob 20 projecting above the threaded shaft 18. As seen in Figure 1 a reciprocating valve shaft 21 has an upper valve head 23 and a lower valve head 24. Lower valve head 24 has an integral external tube 25 extending downwardly concentrically outside overflow tube 42 which extends outwardly from the bottom of pressurizable liquid reservoir 10. The lower valve head 24 of valve shaft 21

engages the top of overflow tube 42 in closed position. The upwardly projecting walls 15 of the lid 14 include a portion of increased thickness at the bottom inside portion of the projecting walls 15 forming a valve seat 26 to receive the upper valve head 23 of valve shaft 21. Valve seat 26 is comprised of an upper inclined portion 27 and a lower vertical portion 28 in which valve head 23 seats when the upper valve head 23 is seated.

In operation the fluid in pressurizable liquid reservoir 10 is heated by microwaves creating a gas phase in the upper portion of the pressurizable liquid reservoir 10. The gas pressure acts against the surface of the fluid forcing fluid upwardly between concentric tubes 42 and 25 against lower valve head 24. The steam in the top portion of pressurizable liquid reservoir 10 exerts pressure against upper valve head 23 pushing against spring 19 biasing upper valve head 23 downwardly. When the pressure pushing upper valve head 23 and lower valve head 24 upwardly overcomes the downward pressure on upper flange 23 being exerted by spring 19, the valve 21 will move upwardly unseating lower valve head 24 from valve seat 28 thus releasing liquid from pressurizable liquid reservoir 10 up tube 25 and down tube 42 into filter 12 until the downward pressure of spring 19 overcomes the upward pressure of the fluid acting against lower valve head 24 and upper valve head 23, at which time the fluid flow will be shut off momentarily and no fluid will flow through outlet tube 42 to filter 12. The downward pressure exerted by spring 19 on upper flange 23 is controlled by rotating the knob 20 in closure cap 16 downwardly or upwardly by turning knob 20 clockwise or counterclockwise.

The upper valve head 23 remains in contact with the vertical portion 28 of upper valve seat 26 for some distance before gas is freely released through upper valve seat 26. Thus upper movement of valve shaft 21 against the bias of spring 19 will first allow water through lower tube 42 and subsequent upward pressure will

unseat valve head 23 from upper valve seat 26 releasing steam from the top of pressurizable liquid reservoir 10.

Turning the knob 20 downwardly increases the downward bias of spring 19. When knob 20 is turned down, valve shaft 21 does not frequently release gas through upper valve seat 26 and liquid flows regularly from tube 42 into filter 12 removing some infusible material and producing a light drink.

Turning the knob 20 downwardly only a slight amount puts only a small bias on the spring 19. With the spring 19 exerting only a slight downward bias on the top of upper valve head 23, vapor pressure in the pressurizable liquid reservoir 10 will be more frequently released through upper valve seat 26 causing a reciprocating motion of valve shaft 21 resulting in an intermittent release of fluid through tube 42 into filter 12 and resulting in a stronger drink.

Referring to Figure 2, the top 23 of the reciprocating valve and the arrangement at the top of reservoir 10 remains the same as shown in Figure 1. As shown in Figure 2, the valve shaft 21 extends substantially to the bottom of the pressurizable liquid reservoir 10. Mounted on the bottom of valve shaft 21 is a lower valve head 50 adapted to fit in and seal the bottom aperture 51 in reservoir 10. The exterior shape of lower valve head 50 is the same as the interior shape of bottom projection 52 of pressurizable liquid reservoir 10 such that when the valve shaft 21 is biased downwardly by the spring 19 the bottom aperture 51 in the pressurizable liquid reservoir 10 is closed.

In operation, the valve shaft 21 operates in the same manner as described with respect to Figure 1, although no upward pressure is exerted against lower valve head 50 by fluid in Figure 2. On the contrary when lower valve head 50 is seated in bottom projection 52 in closed position, the vapor pressure acting against lower valve head 50 tends to keep the valve closed. The knob 20 is utilized in the same fashion as described in respect to the operation of Figure 1. When the knob 20

is moved clockwise to point to light (Figure 3),
increasing the bias of spring 19, a lighter drink will be
obtained. When the knob 20 is moved counterclockwise to
point to dark, Figure 3, decreasing the bias of spring
5 19, a darker drink will be obtained.

I CLAIM

1. A method of making a beverage from an infusible material in a microwave oven,
5 employing an apparatus having a microwave transparent pressurizable liquid reservoir,
said pressurizable liquid reservoir having a valve to release fluid,
means to control the rate of release of gas and
10 fluid from the pressurizable liquid reservoir,
said pressurizable liquid reservoir being mounted in fluid communication with a filter chamber,
said filter chamber mountable above a beverage receptacle,
15 the method comprising:
placing a supply of an infusible material in the filter chamber,
mounting said filter chamber on a receptacle,
pouring a liquid into the pressurizable liquid
20 reservoir to a level below the top of the pressurizable liquid reservoir,
securing the lid to the pressurizable liquid reservoir,
mounting the pressurizable liquid reservoir in fluid
25 communication with the filter chamber,
adjusting the control means to control the rate of release of fluid from the pressurizable liquid reservoir,
heating said liquid in said pressurizable liquid reservoir with microwave energy to raise the liquid vapor
30 pressure in the pressurizable liquid reservoir sufficiently to move said valve sufficiently to open the lower valve and force said liquid from the pressurizable liquid reservoir through the lower valve into the filter chamber to make a beverage, and
35 collecting the beverage in said receptacle.
2. The method of claim 1 wherein the control means is adjusted to provide both gas and fluid release from the

pressurizable liquid reservoir causing an intermittent release of liquid through the lower valve.

5 3. The method of claim 2 in which the control means is comprised of a valve shaft which is normally biased downwardly towards the base of the pressurizable liquid reservoir.

10 4. The method of claim 3 in which the downward pressure exerted on the valve shaft may be adjusted to increase or decrease the pressure to control the strength of the drink.

15 5. The method of claim 4 in which the downward pressure exerted on the top of the valve shaft is exerted by an adjustable spring exerting downward pressure on said valve shaft and adjustment of the pressure is effected by screwing or unscrewing a knob contacting the top of said adjustable spring.

20 6. A beverage brewing apparatus for use in a microwave oven, adapted to be placed over a beverage receptacle, comprising:

25 a microwave transparent filter chamber having a filter positioned in a bottom part thereof, the filter adapted for holding a quantity of an infusible material and for dispensing of a brewed beverage therefrom into the receptacle, and

30 a pressurizable microwave transparent reservoir adapted to hold a quantity of a liquid, said pressurizable microwave transparent reservoir being in fluid communication with said filter chamber,

35 said pressurizable microwave transparent reservoir having a valve to release gas from the top of the pressurizable microwave transparent reservoir and water into the filter chamber,

fluid control means in said pressurizable microwave transparent reservoir to control the rate of fluid flow from the pressurizable microwave transparent reservoir.

7. The apparatus of claim 6 wherein means are provided to control gas and fluid release from the pressurizable liquid reservoir causing an intermittent release of liquid through the lower valve.

8. The apparatus of claim 7 in which the control means is comprised of a valve shaft which is normally biased downwardly towards the base of the pressurizable liquid reservoir.

9. The apparatus of claim 8 in which the downward pressure exerted on the valve shaft may be adjusted to increase or decrease the pressure to control the strength of the drink.

10. The apparatus of claim 9 in which the downward pressure exerted on the top of the valve shaft is exerted by a spring exerting downward pressure on said valve shaft and adjustment of the pressure is effected by screwing or unscrewing a knob contacting the top of said spring.

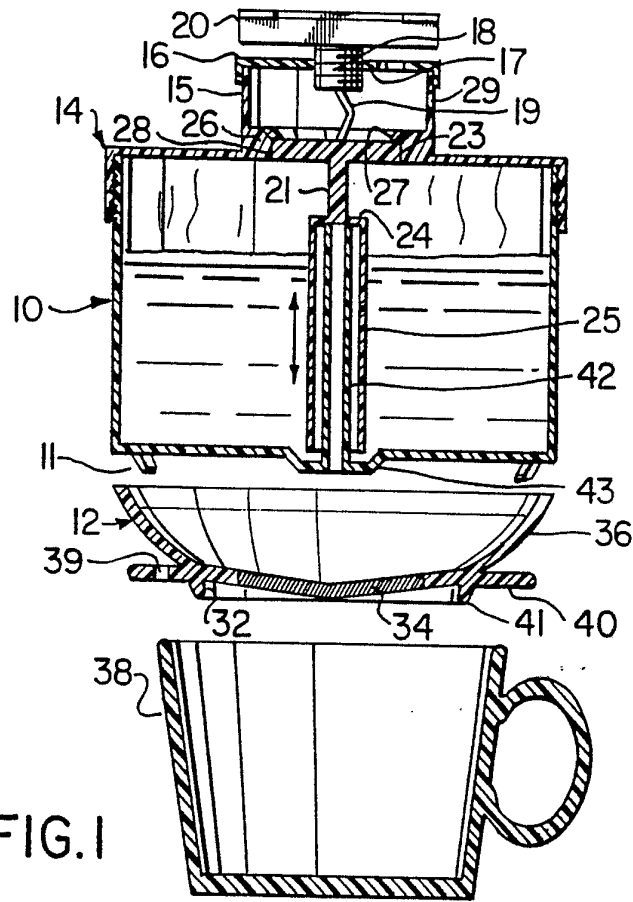


FIG. 1

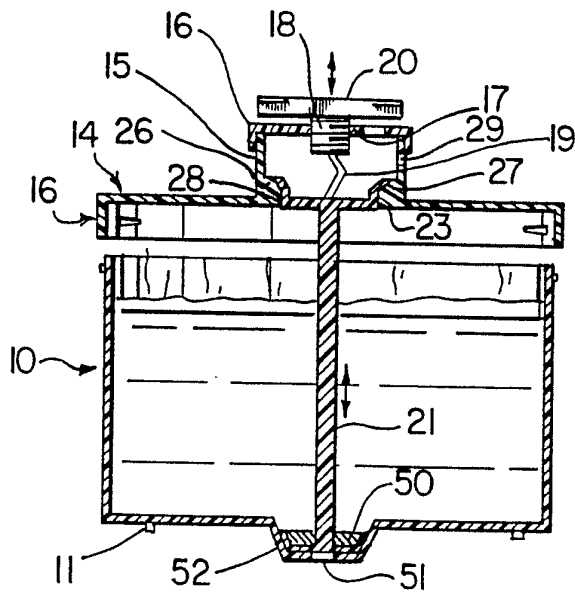


FIG. 2

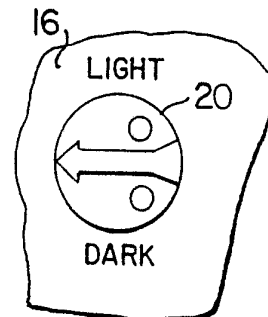
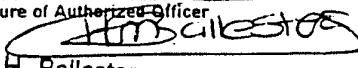


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No PCT/CA 90/00060

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC5: A 47 J 31/00, 31/46		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
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Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	GB, A, 1587331 (RAYTHEON COMPANY) 1 April 1981, see figures 3,4 details 32,50 and corresponding text --	1-10
Y	DE, A1, 3801896 (ABC-ELEKTROGERÄTE VOLZ, GMBH & CO) 3 August 1989, see column 3, line 52 - line 68; column 4, line 1 - line 9; figures 1,2 details 9,10,11,13 --	1-10
A	US, A, 4642443 (JORGENSEN ET AL) 10 February 1987, see the whole document --	1-10
<p>* Special categories of cited documents:¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
21st September 1990	09. 11. 90	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 H. Ballesteros	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 4381696 (KORAL) 3 May 1983, see the whole document --	1-10
A	DE, A, 2212283 (O & N ELECTRIC A/S) 27 September 1973, see the whole document --	1-10
A	DE, C2, 3312354 (ROBERT KRUPS STIFTUNG & CO KG) 13 November 1986, see the whole document -- -----	1-10

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. PCT/CA 90/00060**

SA 35051

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 1587331	01/04/81	CA-A- 1102884	09/06/81
		DE-A-C- 2829567	25/01/79
		JP-C- 1074976	30/11/81
		JP-A- 54040763	30/03/79
		JP-B- 56015891	13/04/81
		US-A- 4104957	08/08/78
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DE-A1- 3801896	03/08/89	NONE	
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US-A- 4642443	10/02/87	NONE	
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US-A- 4381696	03/05/83	NONE	
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DE-A- 2212283	27/09/73	NONE	
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DE-C2- 3312354	13/11/86	NONE	

For more details about this annex : see Official Journal of the European patent Office, No. 12/82