(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
21 February 2008 (21.02.2008)

PCT

(10) International Publication Number
WO 2008/020760 A1

(51) International Patent Classification:
*C12C 13/10* (2006.01)

(21) International Application Number:
PCT/NO2007/000281

(22) International Filing Date: 13 August 2007 (13.08.2007)

(25) Filing Language: Norwegian

(26) Publication Language: English

(30) Priority Data:
20063690 16 August 2006 (16.08.2006) NO

(71) Applicant *(for all designated States except US)*: **HOUSE BREWERY NORWAY AS** [NO/NO]; Storgt. 25B, N-2004 Lillestrøm (NO).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **HVERVEN, Per Erik** [NO/NO]; Magnus gt. 13, N-2004 Lillestrøm (NO).

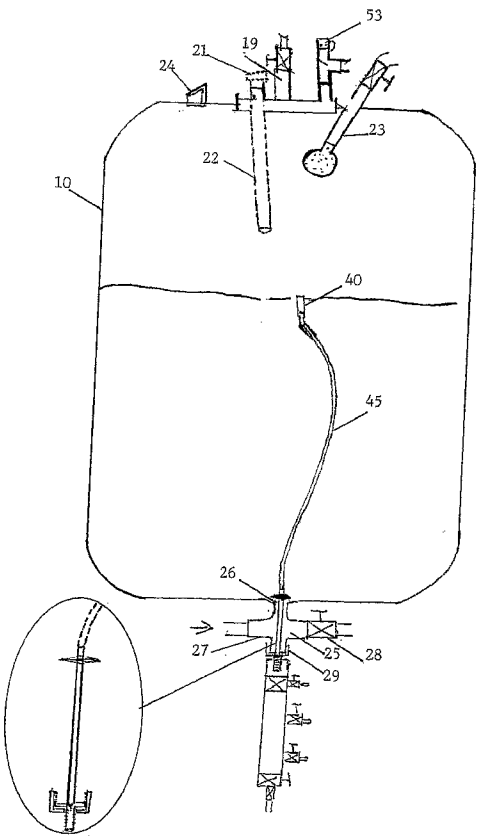
(74) Agent: **ABC-PATENT, SIVILING. ROLF CHR. B. LARSEN A.S**; Brynsveien 5, N-0667 Oslo (NO).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(54) Title: APPARATUS AND METHOD FOR BREWING BEER




(57) Abstract: Method for brewing and serving of beer, where fermentation occurs at a self-produced pressure from the fermentation process, the pressure being controlled to approximately 1.8 bar and a temperature controlled to below 30 °C, in order for the beer to preserve/accept a part of its own C02-production such that the beer gets a higher $CO_2$-content than what is normal for a top fermentation process. The brewing and serving can be done by using the apparatus described below. Apparatus for brewing and serving of beer comprising a closed single vessel (10), an outlet unit (40) arranged with a float (42) and a weight (44) to secure that liquid is let out from a tapping zone (11), and a water spreading organ (31) arranged over a passage (26) in the bottom of the vessel (10) such that water being let in, is spread in order to obtain a close to optimal final mix of liquid mixture (13) in the vessel (10).

WO 2008/020760 A1

APPARATUS AND METHOD FOR BREWING BEER

The present invention relates to methods and apparatus for brewing and serving beer. More particularly, the present invention relates to a method and apparatus for producing and serving beer where both the production and the tapping unit is built as one unit which can be easily operated without special skills in beer brewing. The invention allows for the brewing of beer of high quality and content of carbon dioxide in a closed vessel.

**Background art**

A conventional way to brew beer at home involves the use of labor-intensive apparatus and techniques passed down through the years. Because of the long tradition of home beer brewing, a considerable art has attached to this activity. Generally, this art of home-brewing beer is an adaptation or extrapolation of from large-scale brewing techniques.

Traditional brewing of beer at home requires considerable dedication and care from the home brewer, especially in view of the tradition attached with the making of good beers at home. This brewing process requires tedious preparation and assembly of the equipment coupled with precise addition of ingredients under carefully controlled conditions. Such rigors are not easily followed by the average home brewing hobbyist, and this can lead to the production of batches of beer with inconsistent and poor quality, spoiled beer, and other failures of the process.

Beer, "ale" (top fermentation beer), and other fermented malted grain alcoholic beverages generally consist of four ingredients: water; fermentable sugars (usually derived from malt or malt extracts); hops for flavor, bitterness, and aroma; and yeast (both for flavor

and for the fermentation used to produce alcoholic content, and carbon dioxide). In some cases, part of the sugars and carbohydrates consumed by the yeast in the fermentation process are acquired by steeping grain in hot water.

The traditional home brewer may use a wort pot, and bucket fermenter with a gasketed lid and a fitting for a water-filled fermentation lock. Also used in the process are a bottling bucket, bottling siphon, hydrometer, wort chiller, bucket brush, and sanitizing chemicals so that all the apparatus can be sanitized before use. A starter of a good live brewer's yeast is also necessary. Careful sanitizing and particular procedures carried out in a particular order are generally necessary in order to make good beer, and to prevent spoiled beer. Spoiling of beer happens, for example, when microbes from the environment get into the wort and grow instead of or along with the working yeast (i.e., the "wort" is the weak solution of sugars and organic ingredients from grains, malt, and hops which will become beer after a first fermentation at ambient pressure to produce alcohol, and a second fermentation in a pressure vessel [i.e., in a beer bottle] to provided carbonation). Wort is both a fermentation medium, and also provides a fertile culture medium for undesirable microbes from the environment.

In the brewing of beer at home, after all the equipment is sanitized the brewer does not touch certain parts of the equipment, and is even cautioned against breathing on the equipment. The actual process of home brewing beer involves making and fermenting "wort". The usual home brew recipe makes about 20 liters of beer. The wort is made, for example, by putting 20 liters of water into a stock pot, adding malt or malt extract to the water, crushing grain, placing the grain in a fabric bag

(a muslin bag, for example), and adding this bagged grain to the hot water, heating the water and grain bag toward but short of a boil, holding the water at about 71 °C to steep the grains for a period of time, increasing the heat and removing the grain bag before the water boils, and then bringing the water to a boil.

After the water reaches a boil a liquid malt extract is added and stirred into the mixture. Spray-dried malt extract may also be added. Again the wort is brought to a full boil, a first addition of hops (bittering hops) is carried out, and the wort is held at a boil for 60 minutes, with care being exercised to not boil the pot over. Next, a second addition of hops (flavoring hops) is added. The last addition of hops (aroma hops) are added and heating of the wort is stopped. A wort chiller or ice packing of the stock pot is used to cool the wort as quickly as possible to about 32 °C or less.

Next, the yeast is added to the bucket fermenter. Various strains of yeast are used to modify the flavor of the beer. This yeast is added to the bottom of a fermenting bucket, and the wort is poured carefully from the stock pot into the bucket fermenter using care to maintain the pre-sanitized condition of the vessels. The temperature of the yeast and wort should not to differ by more than 9 °C, in order to avoid shocking or killing the yeast. Next, the fermenter is capped, and water is added to the fermentation lock to allow carbon dioxide produced by fermentation to escape, while preventing the introduction of ambient air and microbes. The total time requirement for the home brewer to this stage of the process is from a minimum of about 2 hours and 40 minutes to as much as 8 hours of time.

After a number of days have passed (usually 8 to 10 days) and the bubbling at the fermentation lock has

ceased, the bucket fermenter is opened and the hydrometer is used to check for an appropriately low sugar level and desired level of alcohol. Next, priming sugar is added to a bottling bucket, and the wort is poured into this bottling bucket without allowing aeration. Care is taken to see that the residue and fermentation by-products in the bottom of the fermentation bucket, does not pour from the fermentation bucket into the bottling bucket. The wort and sugar are carefully stirred, and the bottling syphon is started. With the bottling siphon the sugar-primed wort is transferred to bottles, filling them from the bottom to the top - again to prevent aeration. Next, the bottles are capped and aged. After five weeks or so, if everything was done properly, the home brewer hopes to have good tasty home-brewed beer. However, failures do occur.

WO 92/18606 presents an apparatus and method for making a fermented beverage. A pressure vessel is made of two separable portions which have a removable seal placed there between. A spigot is positioned in the lower one of the two separable portions. An inert gas producing cylinder is mounted on the pressure vessel to maintain the mixture in the vessel under pressure. A pressure relief valve maintains the pressure vessel at the appropriate pressure. A float is maintained at or near the surface of the liquid and a tube extends from the float to the spigot through which the liquid travels. In a preferred embodiment the pressure relief valve is located on the outside of the vessel and is provided with defoaming means between the valve and the interior of the vessel.

WO9850521 presents an automated home beer brewing machine and method makes beer in a single vessel under automatic control. The machine and method allows making of wort for beer without requiring apparatus to be sanitized, without boiling the wort, without the use of a traditional

water-filled fermentation lock, and without using a wort chiller or ice-packing of a brewing pot. The inventive single vessel automated brewing operation allows the user to load ingredients, conducts a grain-steeping if desired, and then automatically carries out the rest of the brewing process in a single vessel until summoning the user days later to sugar-prime and bottle the bear. Thus, the user is required to provide much less time and labor than conventional home beer brewing, and the invention also frees the home-hobby brewer of much of the current are traditionally attached to home brewing.

Traditional brewing is based on low fermentation where the beer ferments in traditional, open fermentation vats at a temperature of 0 - 1.5 °C. After completion of the fermentation the beer is coarsely filtered before it is transferred to the storage vessel. In the storage vessel the beer is cooled and matured before it is filtered for transfer to final vessel.

So called "Micro breweries" are based on methods corresponding to the ones applied by the traditional breweries, but they use high fermentation beer. High fermentation implies that the fermentation process takes place at a temperature of 20 - 22 °C. The beer from this process has low $CO_2$-content and more taste.

The present invention differs from prior art by being based on the idea of producing a high fermentation beer, but that the beer during the fermentation process is compelled to accept a content of carbon dioxide corresponding to low fermentation beer, which gives a fresher and more "springy" beer compared to what high fermentation beer normally is.

Brewing according to the present invention named "House Brew" differs considerably from traditional breweries and "Micro breweries", amongst other things, by

using only a single vessel. The production takes place with DME ("Dry Malt Extract"). The mixing of malt and water takes place at a temperature of 22 °C at different levels so that the whole brew mixture is thoroughly mixed before the fermentation starts. This represents an important improvement which none of the known methods comprises. Also "House Brew" applies high fermentation, but the production takes place under an increased pressure (1.8 bar corresponding to 27 psi). The pressure falls to the pressure of the beer when the beer cools down. Then the beer has accepted its self-produced $CO_2$-content, and which has a value as if the beer had been fermented based on the principle of low fermentation i.e. between 0 - 10 °C. In unceremonious language this is referred to as "turning the beer inside out". The process guarantees a beer of high quality and a carbon dioxide content that gives the preferred "springiness".

WO 92/18606 "Method and Apparatus for Making a Fermented Beverage", henceforth referred to as "The Beer Machine", is like "House Brew" based on a single vessel system. "The Beer Machine" however has a number of disadvantages/problems which are solved by "House Brew". Since "The Beer Machine" comprises a vessel which is designed with two separable halves, it can not build up the pressure which is required to make a beer of the desired quality. "House Brew" establishes in a controlled way a higher pressure which results in a considerably better product when it comes to taste, springiness and $CO_2$-content. As opposed to "The Beer Machine", "House Brew" provides separate tapping with cooling directly to tap faucet. "House Brew" also facilitates tapping at a considerably higher pressure. Further the production capacity of "House Brew" corresponds to the requirements of a supplementary beer production at typical serving

establishments. "The Beer Machine" does not fulfill the needs of this market segment. One additional problem with "The Beer Machine" is that the cleaning is time consuming and labor intensive for different reasons including the fact that the machine must be separated in two to be cleaned. "House Brew" effectively solves this problem by an integrated cleaning and rinsing system that does not require disassembling of parts of the machine. "House Brew" can address both the professional and private market because the machine has a volume adapted to the needs of serving establishments. "House Brew" can be manufactured in embodiments with a production capacity of e.g. 50 liters, 200 liters or 20.000 liters. "House Brew" does not have to produce the full capacity, but can produce as little as 10 liters a time in the same vessel. Among other things, due to the large extent of automation, "House Brew" produces beer of professional quality.

"House Brew" constitutes a unique concept where a single unit produces beer of high quality and the desired content of carbon dioxide, as well as providing tapping directly to vessel, barrel, glass or bottle. The space requirements are limited to 1 $m^2$ for a version of the apparatus with 200 liters production capacity. The extent of automation of the apparatus combined with a closed concept makes it possible to guarantee high quality of the end product without requiring high competence or labor intensive effort of the operator. The concept also involves economic advantages when it comes to low investments, low operating expenses and increased turnover.

"House Brew" offers a solution to the problems of known inventions. "House Brew" thereby constitutes a new and valuable contribution to the area of beer brewing both for the home market, the serving establishments and for

breweries.

**Summary of the invention**

A main objective of the present invention is to avoid the disadvantages of apparatus and methods according to prior art.

More particularly an object of the invention is to produce and serve beer of high quality when it comes to taste, aroma, content of alcohol, springiness (i.e. content of carbon dioxide) and temperature, using an essentially closed and automatically controlled apparatus.

A further object of the invention is to produce beer in accordance with the needs of home brewing for private use, supplementary delivery of beer at serving establishments and brewery production in a small scale. This implies among other issues, the following:

- facilities for scaling in capacity (typically 20 liters for home use, 200 liters for serving establishments, 2.000 liters for micro breweries),
- making limited demands on the operators, but still achieve said high quality, and
- contributing to a favourable total economy.

The apparatus according to the invention comprises all the functionality required from the brewery to the serving establishment. Thereby the whole process may be executed in one and the same location, and in one and the same vessel. Amongst the advantages of this is reduced transport cost because the water which is the heaviest and most voluminous ingredient of the beer does not have to be transported. Further the invention facilitates that anyone can produce his own beer with a quality comparable with quality achieve by the large breweries.

The invention relates to an apparatus and a method for brewing and serving beer, comprising cleaning of the apparatus, filling up of water, malt and hops, mixing and

fermentation of the brew and cooling for serving of beer, where the fermentation takes place at self-produced pressure from the fermentation process controlled to approximately 1.8 bar (1.5 - 2.2 bar) and a temperature controlled to below 25,5 °C in order for the beer to accept to take up a part of its own $CO_2$-production such that the beer gains a higher $CO_2$-content than what is normal for a high fermentation process. The brewing takes place in a closed single vessel, and the serving is done directly from the closed single vessel. The filling in of water is done by introducing fractions of the total amount of water in a defined sequence alternately in an upper part of the vessel above the level of the liquid and from a passage in the lower part of the vessel under the level of the liquid, to ensure an optimal mixture of liquid for starting of the fermentation process.

The apparatus further comprises a water spreading organ specially arranged to secure said optimal mixing, and an outlet unit designed to guarantee that beer is fetched in a tapping zone.

**Brief description of the drawings**

Figure 1 presents a sketch in perspective of an embodiment example of apparatus for brewing and serving beer according to the invention.

Figure 2 presents a view of a vessel with inlet and outlet devices.

Figure 3 presents a sketch in perspective of through-pipe with union and water spreading organ.

Figure 3b presents a view of pass-through-pipe with union and water spreading organ.

Figure 4a presents a sketch of an outlet unit with float, outlet part with outlet passage, and weight.

Figure 4b presents a vertical view of a outlet unit

with float, outlet part with outlet passage and weight.

Figure 4c presents a horizontal view of the outlet part and an outlet unit.

Figure 5 presents a sketch of devices for pressure control by carbon dioxide.

Figure 6 presents a sketch of devices for tapping and cooling.

**Detailed description of the invention**

The invention is described further in two sub-chapters; namely related to the apparatus and the method for brewing and serving beer. The description is best understood by referring to the figures in the list above. Further, to get a best possible understanding of the invention, said two sub-chapters should be seen in view of each other.

*Apparatus*

The apparatus forms a complete and compact unit which solves the problems and provides the advantages detailed in the chapter related to prior art.

The total brewing and serving process which comprises the steps of

- cleaning
- filling in of water, malt, yeast and hops,
- fermentation,
- storing,
- serving,

are performed in <u>one</u> apparatus with <u>one</u> closed vessel. The apparatus accordingly provides both the brewing process which normally takes place in a brewery, and the serving process which normally takes place in a serving establishment (e.g. a restaurant or a pub), by the use of said apparatus.

The apparatus constitutes a unique total concept also comprising special devices which are absolutely necessary to have the process operating satisfactory. Said devices comprise liquid inlet devices with a water spreading organ arranged for providing a close-to-optimal final mix of the mixture of liquid in the vessel, and an outlet unit guaranteeing that beer is fetched in a tapping zone. Said devices are presented in more detail in the following.

Figure 1 presents an embodiment example according to the invention of an apparatus for brewing and serving beer. The embodiment example is typically adapted for use in serving establishments. The apparatus according to the invention, however, may be implemented in both larger and smaller versions where the larger variants typically are used for production of beer in breweries, while the smaller variants may be used in e.g. households. Embodiments of the apparatus in other sizes than the one presented in the present example, are also comprised by the invention.

The apparatus for production and serving of beer according to the invention comprises a vessel 10, filling in devices for malt 21, 22, inlet and outlet devices for liquids such as water and cleaning liquids, devices for controlling the pressure in the vessel 10, tapping devices including a tapping tower with a tap faucet 61 and a tap line 62, cooling devices, devices for controlling the process and electrical cables for control signal transmission, these cables are indicated with dotted lines in the figure.

The main part of the apparatus according to the invention is a closed single vessel 10 where brewing and cleaning takes place without needing to open the vessel 10. The vessel 10 is dimensioned for the pressure required to brew beer of high quality. The dimensioning is done

with an adequate safety margin indicating that the vessel can withstand at least 2.5 - 3.5 bar. The embodiment for serving establishments typically comprises a vessel of approximately 200 liters. For use in private households, the vessel is typically considerably smaller (e.g. 50 liters). The apparatus may also be used for beer production in larger quanta which requires a larger vessel (e.g. 20.000 liters). In the top and bottom parts of the vessel 10 smaller openings are arranged to let ingredients in and/or out, these ingredients comprising liquids and malt, waste matters and brewed beer. These are further explained below.

Figure 2 shows a view of the vessel 10 with inlet and outlet devices. One of the ingredients to be let into the vessel 10 is malt. Malt applied for brewing beer according to the invention is powder malt or so-called DME ("Dry Malt Extract"). The malt is supplied in accordance with the pre-selected volume to be brewed, in the form of a number of malt bags. In order to let the malt into the vessel 10, malt inlet devices 21, 22 are arranged at the top of the vessel 10. The malt inlet devices comprise a gun formed filling organ 22 with a long sleeve to be inserted in the malt opening 21. The filling organ 22 facilitates adding the malt sufficiently deep in the vessel to avoid the malt getting moist. A vacuum pump 16 and a vacuum valve 19 are arranged to establish an under-pressure in the vessel 10. Said under-pressure of typically approximately 0.3 bar causes the malt to be drawn into the vessel 10. The malt inlet devices 21, 22 are integrated with the devices for controlling the processes, facilitating presentation of the necessary instructions for the operator. This is described in more detail below and in the chapter regarding the method.

The inlet and outlet devices also comprise devices

for inlet and outlet of liquid in the form of water and cleaning liquid. The inlet devices for liquid comprise upper 23 and lower liquid inlet devices 25-29 arranged to facilitate controlled inlet of liquid from the upper and the lower part of the vessel 10. The same liquid inlet devices are used both under the brewing and the cleaning processes, and they are arranged to obtain a close to optimal, final mix of the liquid mixture 13 in the vessel 10 during the brewing process and effective cleaning of the apparatus under the cleaning process. The cleaning and the brewing process are described in more detail, below in the chapter regarding the method according to the invention.

The upper liquid inlet device 23 can be in the form of a so called washing ball, arranged in the upper part of the vessel 10 over liquid level for facilitating inlet of water and washing liquid. The embodiment of the device facilitates flushing of the vessel 10 with washing liquid under pressure to ensure effective cleaning.

At the upper part of the vessel 10 also a peep hole 24 for visual inspection the upper part of the vessel 10.

The lower liquid inlet and liquid outlet devices 25 - 29 are arranged in connection with a standard crosspiece 25. The crosspiece is connected to the vessel 10 at a passage 26 in the lower part of the vessel. Further the crosspiece 25 connects

- a water inlet valve 27,
- a liquid outlet valve or a drain valve 28 for outlet of water, washing liquid and waste matter, and
- a union 29 arranged to facilitate outlet of the final brewed beer through a through-pipe 30.

The liquid outlet valve 28 is of a manual type and arranged to let out water, washing liquid and other waste matters.

The devices for liquid inlet, liquid outlet and outlet of beer plus the interconnection of these, form a tightly integrated system which contributes to facilitate a solution based on only one vessel 10.

Figure 3a and Figure 3b illustrate the devices that form an integrated solution for tapping of beer and spreading of incoming water for mixing of the liquid mixture 13 in the vessel 10.

Tapping of beer from the vessel 10 takes place from the outlet unit 40 through a tapping hose 45 which is connected to the before mentioned through-pipe 30, and out in the tap line 62 leading to the tapping tower 61. The beer tapping device is described more closely below related to Figure 6.

Near optimal final mixing of the liquid mixture 13 in the vessel 10 is achieved with the help of the water spreading organ 31. The water spreading organ 31 is arranged on said through-pipe or outlet pipe 30 through the passage 26 in the bottom of the vessel 10. Water being let in through the lower water inlet valve 27 passes the water spreading organ 31 which is arranged to spread the water in order to achieve the desired final mix of the liquid mixture 13.

The water spreading organ 31 typically has a slope of approximately 10 degrees for spreading at the lower edge and approximately 25 degrees for draining at the upper edge relative to the perpendicular to the through-pipe 30. The water spreading organ 31 comprises at least two holes 32 arranged evenly along a circumference with origo in the center of the through-pipe 30 for optimal spreading of the inflowing water. Said at least two holes 32 in the water spreading organ 31 have a diameter of approximately 1 - 2 mm (typically 1.5 mm) for a vessel of 200 liters, or dimensioned in accordance with the size of the vessel 10

for other sizes of the vessel. Further the water spreading organ 31 is arranged in the vessel 10 with a clearing in a circular relationship with the edges of the passage 26 which gives optimal spreading of the inflowing water given the dimensions of the vessel 10 and the lower water inlet devices. The clearance to the edges of the passage is typically approximately 2 mm for a vessel of approximately 200 liters, or dimensioned according to the size of the vessel 10 for other sizes of the vessel.

Figure 4A presents a view of said outlet unit 40 for letting out liquid from the vessel 10, while figure 4B presents an axial view of the same outlet unit 40. The outlet unit 40 comprises a float 41 arranged at one end of the outlet unit 40, outlet part 42 with an outlet passage 43 in the form of a number of holes in the outlet unit 40, a weight 44 arranged at the opposite end of the outlet unit 40 of where the float is arranged, and an outlet tube 45 which at one end is attached to the outlet unit 40. The outlet part 42 is placed between the float 41 and the weight 44. In the embodiment example sketched in figure 4, the outlet part 42 and the weight 44 are integrated in the form of one unit. This unit may typically be made of acid-resistant and stainless steel for alimentary reasons.

The outlet tube 45 is connected to the outlet unit 40 at the same end as the weight 42 in order for the outlet part 42 to stay in the tapping zone 11 approximately 3 cm from the top level of liquid and fetch beer in this zone, for the actual levels of liquid in the vessel 10, and at the same time guarantees that the outlet passage 43 does not bring $CO_2$ to the vessel 10 from the buoyancy volume 12. The outlet tube 45, which at one end is connected to the outlet unit 40, is at the opposite end connected to the abovementioned through-pipe 30. The outlet tube 45 designed in order not to impede the attached outlet unit

40 being positioned as desired (e.g. in the tapping zone 11) in the vessel 10. Therefore the tube 45 is designed with dimensions and in a material such that the buoyancy and the elasticity characteristics do not impede the desired positioning of the outlet unit 40.

Figure 5 presents devices taking part in controlling the pressure inside the vessel 10. In addition to what is taking place internally in the vessel 10, the pressure in the vessel 10 may be caused by an external input by gas in the form of $CO_2$/nitrogen in gas bottle 51 which can be let into the vessel 10 through a pressure and relief valve 53 arrange at the topside of the vessel 10. The pressure is measured by a pressure gauge 52, also called a manometer. For pressures below approximately 1.8 bar, the pressure in the vessel 10 is controlled by a pressure control unit arranged at the gas bottle 51. The valve 53 arranged at the topside of the vessel, has a double function. Firstly it controls the pressure in the vessel 10 to the desired pressure of preferably 1.8 bar while brewing. Secondly the valve 53 is taking part in securing that the vessel 10 is not subjected to higher pressure than it is designed for. Additionally, as introductory mentioned, the vessel 10 is designed with an adequate security margin for pressure load.

The control of the pressure in the vessel 10 is also applied when tapping the brewed beer. The tapping is facilitated by the pressure of the volume in the vessel 10 above the liquid mixture, also referred to as the buoyancy volume 12, being controlled to approximately 1.2 bar such that the beer gets the correct tapping pressure at the tap faucet 61. The beer is fetched in the tapping zone 11 by the outlet unit 40, and is transported via the outlet tube 45, through the through-pipe 30, via the tap line 62, and to the tap tower/tap faucet 61 where the beer can be

served directly in a glass or alternatively in another form of receptacle.

Figure 6 illustrates devices for controlling the temperature in the vessel 10 and in the beer being served. It is presumed that the ambient temperature in the environment where the apparatus is placed is approximately 20 - 24 °C. At such a temperature, only cooling and no heating devices are required. Accordingly heating devices are not included in the standard embodiment of the apparatus since they are not required by the ambient temperature mentioned above, and since such devices would have increased the initial cost and the operating cost of the apparatus. However the apparatus may also be implemented in embodiments comprising heating devices.

The temperature in the vessel 10 and in the beer being served is controlled by cooling devices based on water cooling with ice bank. The apparatus is designed comprising a required cooling machine 64 with low operating cost. Water is being cooled in the water cooling machine 64 and transferred in pipe line 67, the pipe line being helically arranged around the vessel 10 and around the tap line 62 to the tap tower or tap faucet 61 and back to the water cooling machine 64. The temperature of the liquid content in the vessel 10 is measured by a thermometer 69 arranged in the vessel 10 near its bottom. The control of the temperature is done by feeding the temperature back via a control board 17 in figure 1 and to a cooling control device 18 which controls the temperature of the water being let out into the pipe line for cooling.

The cleaning of the apparatus is as indicated performed essentially by applying the same devices being used for brewing. Water for cleaning is let in from an upper liquid inlet device 23 and from lower liquid inlet devices. The washing liquid is stored in washing liquid

receptacle 71 and flushed under pressure into the vessel 10 through the upper liquid inlet device 23 by a pump for washing liquid 72. Thereby washing liquid is let into the vessel 10 only from its upper side. Waste products from the cleaning process are let out through the outlet valve 28. Final cleaning of the lower liquid inlet and outlet devices is done by flushing with water from the water inlet valve 27 and out through said outlet valve 28.

The apparatus is designed to facilitate appropriate control of the total process which comprises sub-processes for cleaning, filling of ingredients, fermentation, storage and serving. This occurs primarily under automatic control. However certain sub-processes are better performed manually. Devices contributing to controlling the process comprise sensors such as pressure and temperature meters 69, 52, electrical cables for signal transmission (indicated with dotted lines in figure 1), an electrical control panel 17, a personal computer or PC 15 which executes a control program, an operator display 14 both for presenting information for an operator and receive commands from the actual and actuating input devices such as e.g. a vacuum pump 16, a cooling control device 18 and various valves. The description of the method below presents the control process in some more detail.

*Method*

According to a second aspect of the invention a method for brewing and serving beer is presented. The method presented below which comprises a number of steps, is an embodiment example.

The process for brewing and serving beer is mainly automatically controlled, but certain operations are for special reasons implemented with manual control. This is

particularly due to safety reasons and in order to guarantee control, but may also be motivated by other special conditions. An example of a manual solution that has been implemented is the manual control of the outlet valve 28.

The method is based on an apparatus that supports control and monitoring of the process. The operator is presented with instructions of what to do next, in addition to information regarding status and termination time for the current sub-process, in the operator display 14. A number of state variables of the process such as e.g. temperature, time and quantity, can be presented in the operator display 14. The process may be coded using the operator display 14 as interface. Such a recoding may e.g. concern the type of malt, the temperature or the quantity. Further the apparatus may be contacted via a telephone connection.

The process presumes an ambient temperature of approximately 20 - 24 °C, which is a normal temperature in the environment where the apparatus normally is used. The process also may be executed at different ambient temperatures, but that presumes an embodiment of the present invention comprising heating devices.

Prior to initiating the brewing process the apparatus automatically executes a cleaning process. In fact the brewing is not executable without having performed the prior cleaning. This is facilitated without opening the vessel 10 and substantially using the same devices which are applied in the brewing process. Prior to executing the cleaning process the operator opens a main water inlet valve. This is done manually for safety reasons, while further inlet is controlled automatically. Then the cleaning process is initiated by pushing the "Start wash" button on the operator display 14. The apparatus thereby

executes an automatically controlled program for washing and flushing of the vessel prior to brewing. The cleaning sequence comprises typically, but only as an example, the steps of first flushing the vessel 10 for approximately 3 minutes using an upper liquid inlet device 23 arranged at the top of the vessel 10, thereafter it is being correspondingly rinsed with washing liquid for approximately 6 minutes and finally it is rinsed for approximately 6 minutes also by the use of said upper liquid inlet devices 23. The opening of the outlet valve 28 is done manually to secure that the viscid sugar content does not impede outlet. The course of progress can all the time be monitored from the operator display 14.

When the cleaning process is completed the apparatus guides the operator further in the process by presenting the following in the operator display 14; "Filling of 1/3" and will then fill 33 % of the desired total quantity. All values are to be indicated prior to initiating the cleaning and brewing process. The operator keys in only the desired quantity of final brew. The apparatus thereafter automatically controls the filling of the indicated quantity. Filling of water takes place at a temperature of approximately 20 - 24 °C in the closed vessel 10 until the level of the liquid mixture 13 in the vessel 10 constitutes approximately 1/3 of the total volume 33 % of the desired total quantity. The filling is performed through an upper liquid inlet device 23 from the top of the vessel 10.

The apparatus thereafter indicates in the operator display 14 that malt is to be added. The operator adds malt according to the predetermined quantity of brew. Then a vacuum pump 16 starts drawing in. Addition of malt in the form of powder malt takes place by establishing an under-pressure of approximately 0.3 bar in the vessel 10

by the use of the vacuum pump 16. This causes the malt to be drawn in from the malt inlet device 21, 22 which is arranged at the top of the vessel 10. The malt inlet device in the vessel 10 is positioned lower than the upper liquid inlet device 23. When the volume of malt is filled into the vessel 10, a new key on the operator display lights up indicating to "Fill the next 1/3". The vacuum valve 19 has to be opened manually. A pistol 22 with a long sleeve is inserted into the malt lid 21 with access deeper in the vessel to avoid moistening the malt.

Thereafter water at a temperature of approximately 22 °C is filled into the vessel until the level in the vessel 10 constitutes approximately 66% of the maximum level. Filling is done both through an upper liquid inlet device 23 from the top of the vessel and through the main water inlet valve 27 at the bottom of the vessel 10 where the water is spread in the vessel 10 using the water spreading device 31 to obtain a near optimal final mix of the liquid mixture 13 in vessel 10. The filling is controlled automatically.

After a rest period (dependent on the malt) the apparatus presents that the rest of the water is to be filled in by presenting "Water rest-fill" in the operator display 14. Filling of the remaining quantity corresponding to 33 % of the desired total quantity, takes place at a temperature of approximately 22 °C until the level in the vessel 10 is the maximum level. Filling then takes place only through the water inlet valve 27 at the bottom of the vessel 10, and is still controlled automatically.

When the apparatus present "Filling complete, turn switch S1 to 0" in the operator display 14, the operator turns a main switch manually, thus initiating the actual brewing process. The fermentation process is limited to 30

°C. This is controlled automatically. After the preprogrammed fermentation process is completed, the cooling is started automatically. The fermentation of the wort takes place at a working pressure established in the vessel 10 as a result of the fermentation process. The working pressure is controlled to approximately 1.8 bar by the use of a pressure/safety valve 53 arranged at the top of the vessel 10 and fixedly adjusted to release pressure at the mentioned pressure level. The temperature is automatically controlled to a selected value which is maintained for a selected number of days (as e.g. a temperature of less than 30 °C for 2-4 days).

Cooling of the beer takes place automatically. The temperature of the beer is reduced to approximately 5 °C in the course of approximately 12 hours. During the cooling process the beer preserves its own $CO_2$-content, and the pressure in the vessel 10 over the brew falls to approximately 1 bar.

The beer conserves the carbon dioxide which it has been compelled to keep, thereby getting a natural $CO_2$-content, and the pressure falls to approximately 1 bar (or approximately 15 PSI). The natural pressure of the beer will then be approximately 0.5 - 0.7 bar.

The beer is then stored at a temperature of approximately 5 - 6 °C. During the storage process the aroma, the color and the clarity of the beer develop. The beer might also be filtered according to the needs.

Tapping of beer is facilitated by introducing $CO_2$/nitrogen in the vessel in the buoyancy volume 12 which corresponds to the volume above the mixture of liquid 13. The pressure is then controlled in order to give the beer the correct tapping pressure at the tap faucet 61. This inlet of $CO_2$/nitrogen must take place without being added to the self-produced $CO_2$ in the beer. The buoyancy pressure

is controlled to approximately 1 - 2 bar by the use of the manometer on the $CO_2$-container. The buoyancy pressure depends on the height and length of the tap line 62. Tapping of beer takes place in the tapping zone 11 where the beer is most completed, with the help of an outlet unit 40. The beer is thereafter transferred through a suitable tube 45, via a through-pipe 30, a tap line 62 and to the tap faucet 61 for filling directly in a glass, tapping in bottles or other receptacles.

Samples may be taken in the tapping zone 11 to evaluate the development of the beer when it comes to taste, aroma, color and content of alcohol. Samples of the deposits/yeast may independently be taken to evaluate the process without depreciating the clearing which has already taken place of the beer in the tapping zone 11.

Finally reset of the vessel 10 is executed. The main switch must be turned back in order to start the whole process from the first step, i.e. the cleaning program. By so doing we are back to the start of the chapter.

# C L A I M S

1. Method for brewing and serving beer, comprising the following steps:
   - cleaning of apparatus for brewing of beer,
   - filling of water,
   - filling of malt and hops,
   - mixing of the malt and the hops with water and yeast,
   - fermentation of brew,
   - cooling of beer,
   - serving of beer,

characterized in that
   - the fermentation occurs at a self-produced pressure from the fermentation process, where the pressures is controlled to approximately 1.8 bar (1.5 - 2.2 bar) and by a temperature controlled to below 30 °C, in order to have the beer containing/accepting a part of its own $CO_2$ production such that the beer obtains a higher $CO_2$-content than what is normal for a top fermentation process.

2. Method for brewing and serving beer according to claim 1, where
   - the brewing takes place in a closed single vessel (10).

3. Method for brewing and serving beer according to claim 1 or 2, where
   - the serving is done directly from the closed single vessel (10) where the brewing takes place.

4. Method for brewing and serving beer according to one of the preceding claims, where
   - the filling of water is done by letting parts of

desired total quantity of water in a defined sequence alternately in an upper part of the vessel over liquid level and from a passage (26) in the lower part of the vessel (10) under liquid level, to secure optimal liquid mixture (13) for starting the fermentation process.

5. Method for brewing and serving beer according to one of the preceding claims, where

- the addition of malt occurs by inserting malt in powder form from an upper part of the vessel (10), the malt being drawn in based on an under-pressure established in the vessel (10).

6. Method for brewing and serving beer according to one of the preceding claims, where

- the cooling reduces the temperature of the beer to approximately 5 °C in the course of approximately 12 hours after fermentation, such that the beer preserves/accepts $CO_2$-content during the cooling process.

7. Method for according to one of the preceding claims, where filling of water and malt comprises

- filling of water from upper liquid inlet device (23) in the upper part of the vessel (10),
- addition of malt in the upper part of the vessel (10),
- filling of water from the upper liquid inlet device (23),
- filling of water from a water inlet valve (27) via a passage (26) arranged at the bottom of the vessel (10) such that the water passes a water spreading organ (31) in the vessel (10),

- where said sequence contributes to obtain optimal final mix of the liquid mixture (13) in the vessel (10).

8. Method according to one of the preceding claims, where cooling and storage of beer for developing aroma, color, content of alcohol, carbon dioxide and clearing with or without filtering, takes place in the closed single vessel (10).

9. Method according to one of the preceding claims, where the tapping of beer is facilitated by controlling the pressure in a buoyancy volume (12) by letting gas in the form of $CO_2$ into said buoyancy volume (12).

10. Method according to one of the preceding claims, where the cleaning of the apparatus is facilitated by flushing with water and washing liquid in an automatically controlled, preprogrammed sequence, and where the cleaning is facilitated without opening the vessel (10).

11. Method according to claim 10, where the cleaning of the apparatus takes place with the use of the same liquid inlet devices (23) that are applied for letting water in for brewing, thus securing complete cleaning comprising the vessel (10), the liquid inlet devices, the liquid outlet devices and a tap line (62) to a tap tower (61).

12. Method according to claim 10 or 11, where the pre-programmed sequence comprises rinsing or flushing with water and washing liquid from upper liquid inlet device (23).

13. Apparatus for brewing and serving of beer, comprising:

- a vessel (10),
- liquid inlet devices,
- inlet devices for malt (21, 22),
- a tap faucet (61),
- cooling devices,

characterized in that

- the vessel (10) is a closed single vessel.

14. Apparatus according to claim 13, where the vessel (10) withstands at least approximately 2.5 bar.

15. Apparatus according to claim 13 or 14, where a crosspiece (25) is arranged at a passage (26) at the bottom of the vessel (10), where the crosspiece (25) contributes to letting liquid into, or out of the vessel (10).

16. Apparatus for producing and serving beer, according to one of the claims 13 to 15, where

- the liquid inlet devices (23, 26, 27) are arranged to fill water in the vessel (10) from both over liquid level and from under liquid level in the bottom of the vessel (10).

17. Apparatus for producing and serving beer, according to one of the claims 13 to 16, where

- the inlet devices for malt (20, 21, 22) are integrated with the devices for controlling pressure such that powder malt can be drawn in based on an under-pressure being established in the vessel (10).

18. Apparatus according to one of the claims 13 to 17, where the liquid inlet devices comprise

- a lower water inlet valve (27),

where

- the lower water inlet valve (27) is arranged at a passage (26) in the bottom of the vessel, and
- a water spreading organ (31) is arranged over the passage (26) in the bottom of the vessel (10) such that water being let in through the lower water inlet valve (27), passes the water spreading organ (31) which is designed to spread the water in order to obtain a close to optimal final mix of the liquid mixture (13) in the vessel (10).

19. Apparatus according to claim 18, where said water spreading organ (31) is arranged on a through-pipe (30) being at one end attached to an outlet tube (45) and at the other end to a tap line (62).

20. Apparatus according to claim 19, where said water spreading organ (31) has an inclination of approximately 10 degrees for spreading at the lower edge and approximately 25 degrees for draining at the upper edge relative to the perpendicular to the through-pipe (30).

21. Apparatus according to claims 19 or 20, where said water spreading organ (31) comprises two holes (32) arranged at even distance along a circumference with origo in the center of the through-pipe (30) for optimal distribution of the inflowing water.

22. Apparatus according to claim 21, where said at least two holes (32) in the water spreading organ (31) have a diameter of approximately 1 - 2 mm for a vessel (10) of

200 liters, and are dimensioned according to the size of the vessel for different vessel sizes.

23. Apparatus according to one of the claims 18 to 22, where said water spreading organ (31) is arranged in the vessel (10) with a clearing in circular relationship with the edges of the passage (26) giving an optimal spreading of the inflowing water, given the dimensions of the vessel (10) and the lower water inlet devices.

24. Apparatus according to one of the claims 18 to 23, where said water spreading organ (31) is arranged inside the vessel (10), where the clearing to the edges of the passage (26) is approximately 2 mm for a vessel of 200 liters, and dimensioned according to the size of the vessel for different vessel sizes.

25. Outlet unit (40) for letting liquid out of a vessel (10), comprising

- a float (41) arranged at one end of the outlet unit (40),
- an outlet passage (43) in the form of a number of holes in an outlet part (42) of the outlet unit (40), and
- an outlet tube (45) which at one end is connected to the outlet unit (40),

characterized in that

- a weight (44) is arranged at the other end of the outlet unit (40) than the end where the float (41) is arranged,
- the outlet passage (43) is arranged between the float (41) and the weight, and
- the outlet tube (45) is connected to the outlet unit (40) at the same end as the weight (44),

- such that the outlet passage (43) for the actual liquid levels in the vessel (10), stays in the tapping zone (11) approximately 3 cm from the top level of the liquid, and fetches beer there, while at the same time secures that the outlet passage (43) does not bring $CO_2$ to the vessel (10) from the buoyancy volume (12).

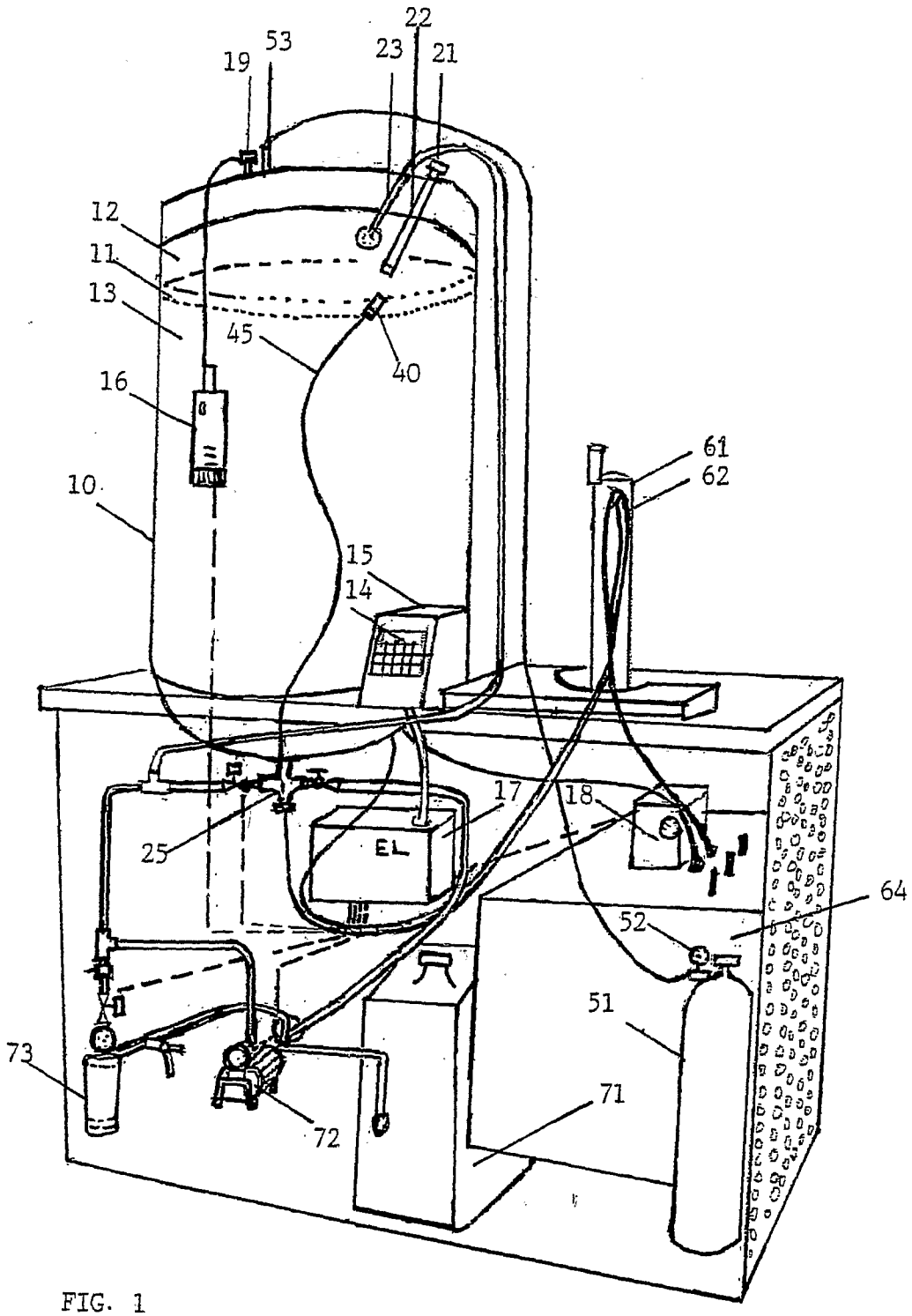

22
53
19
23
21
12
11
13
45
40
16
61
62
10
15
14
17
18
25
EL
64
52
51
73
72
71

FIG. 1

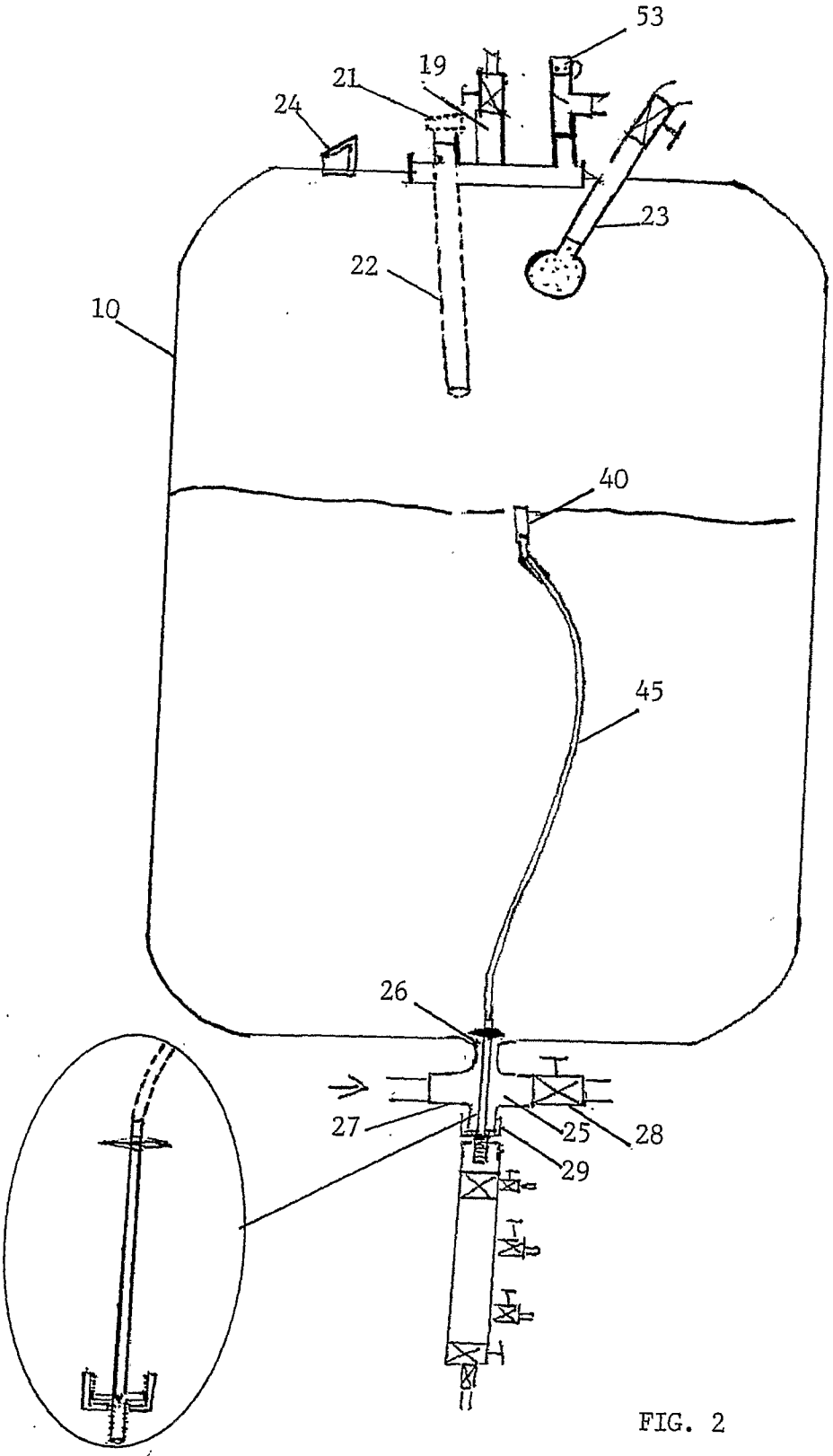



FIG. 2

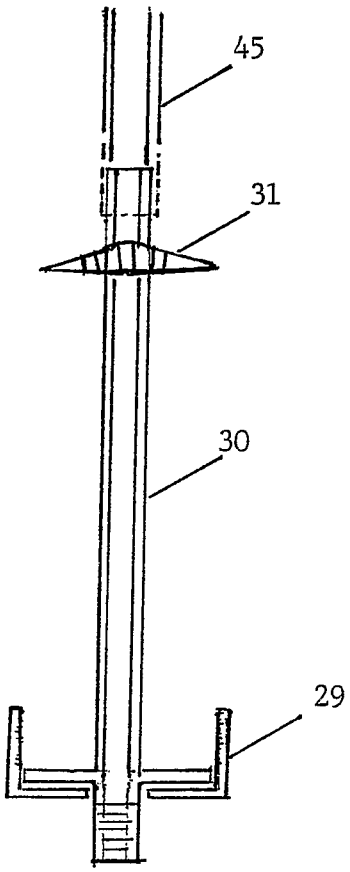



FIG. 3b

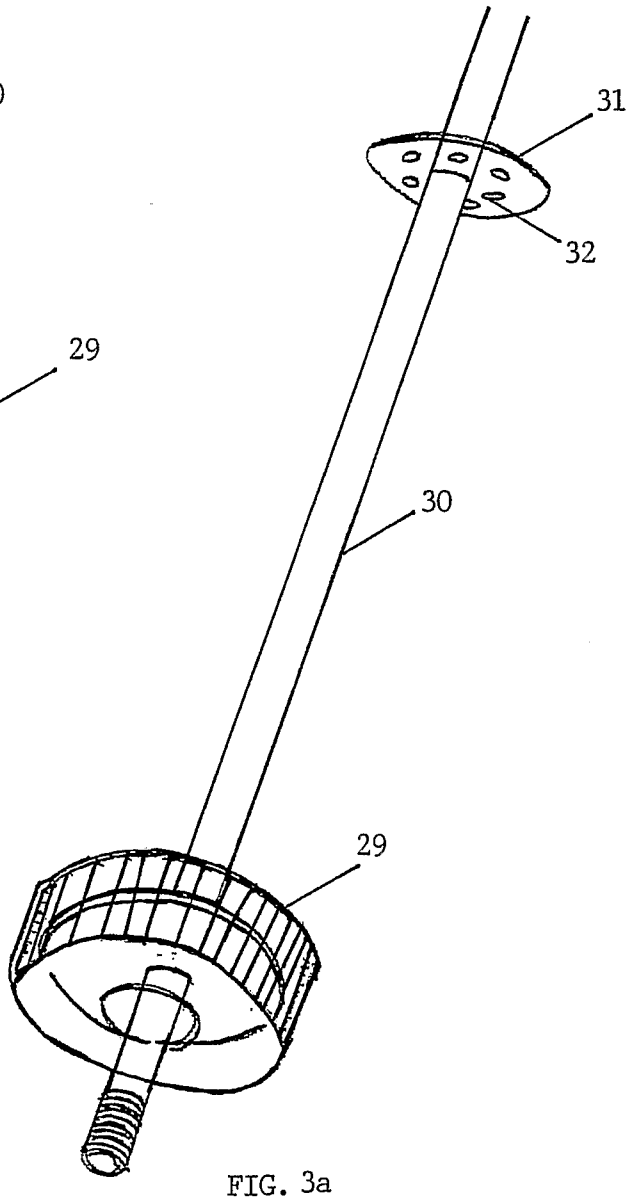



FIG. 3a

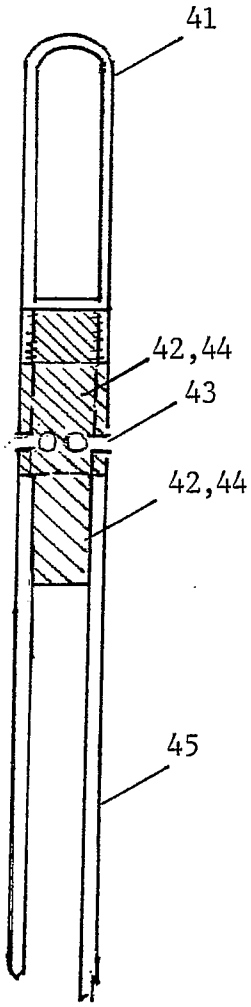



FIG. 4b

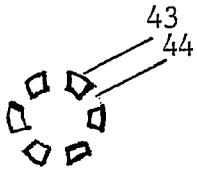



FIG. 4c

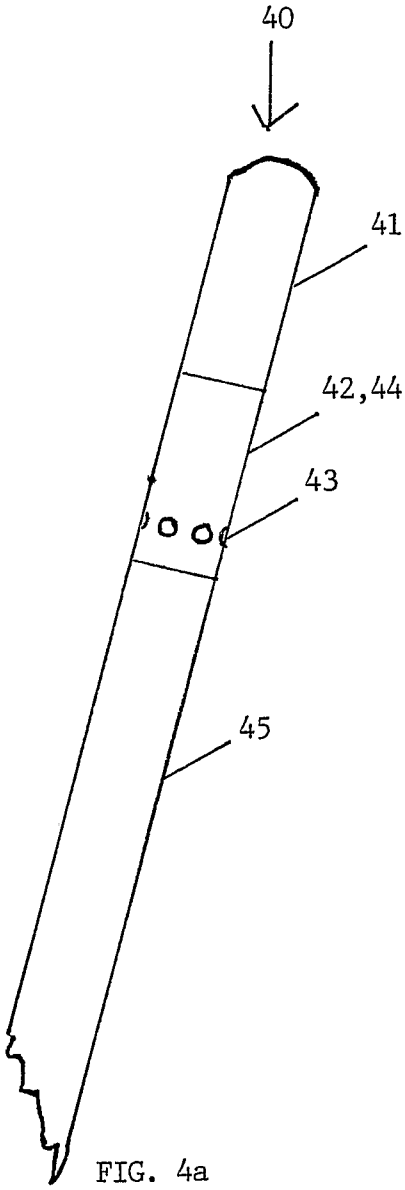
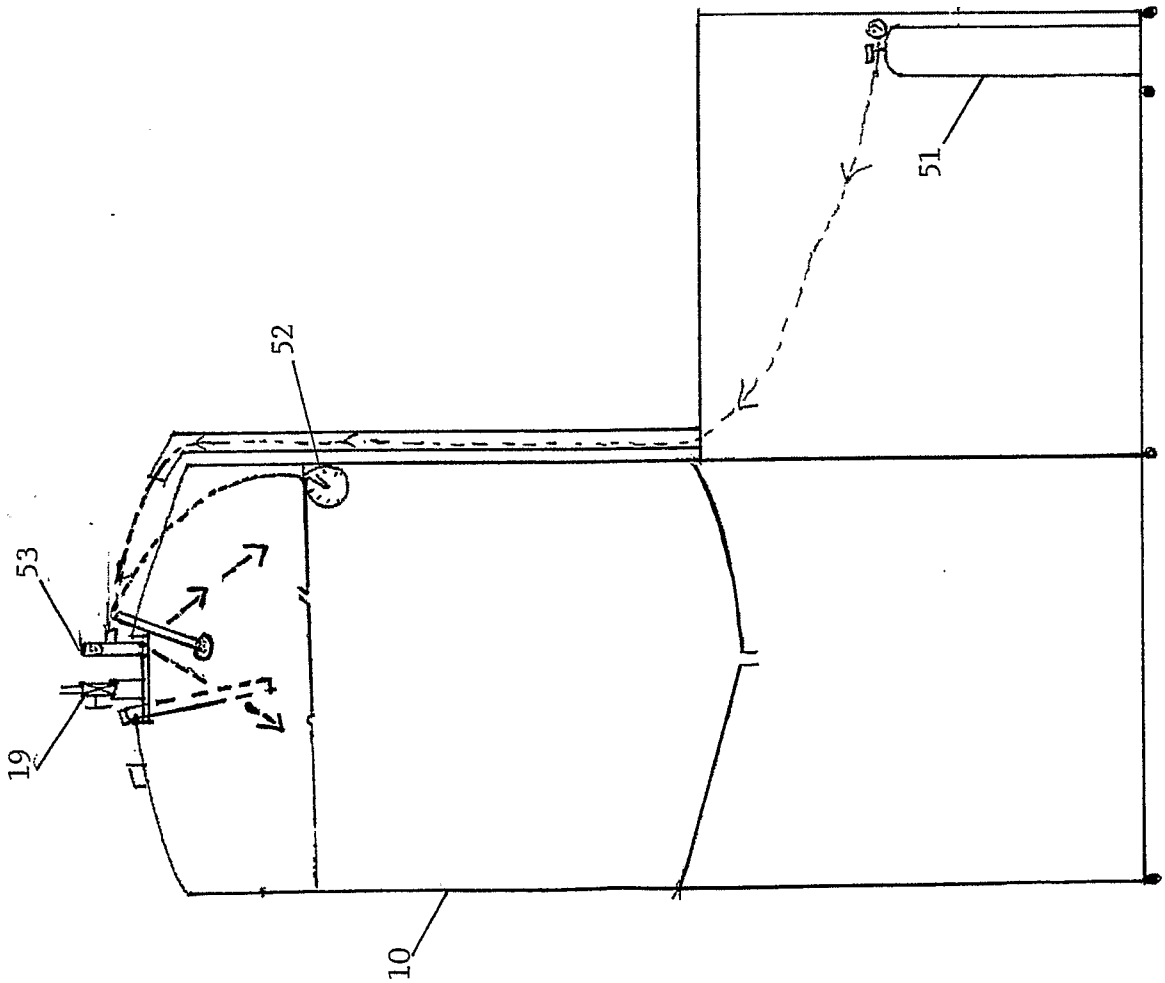



FIG. 4a

FIG. 5



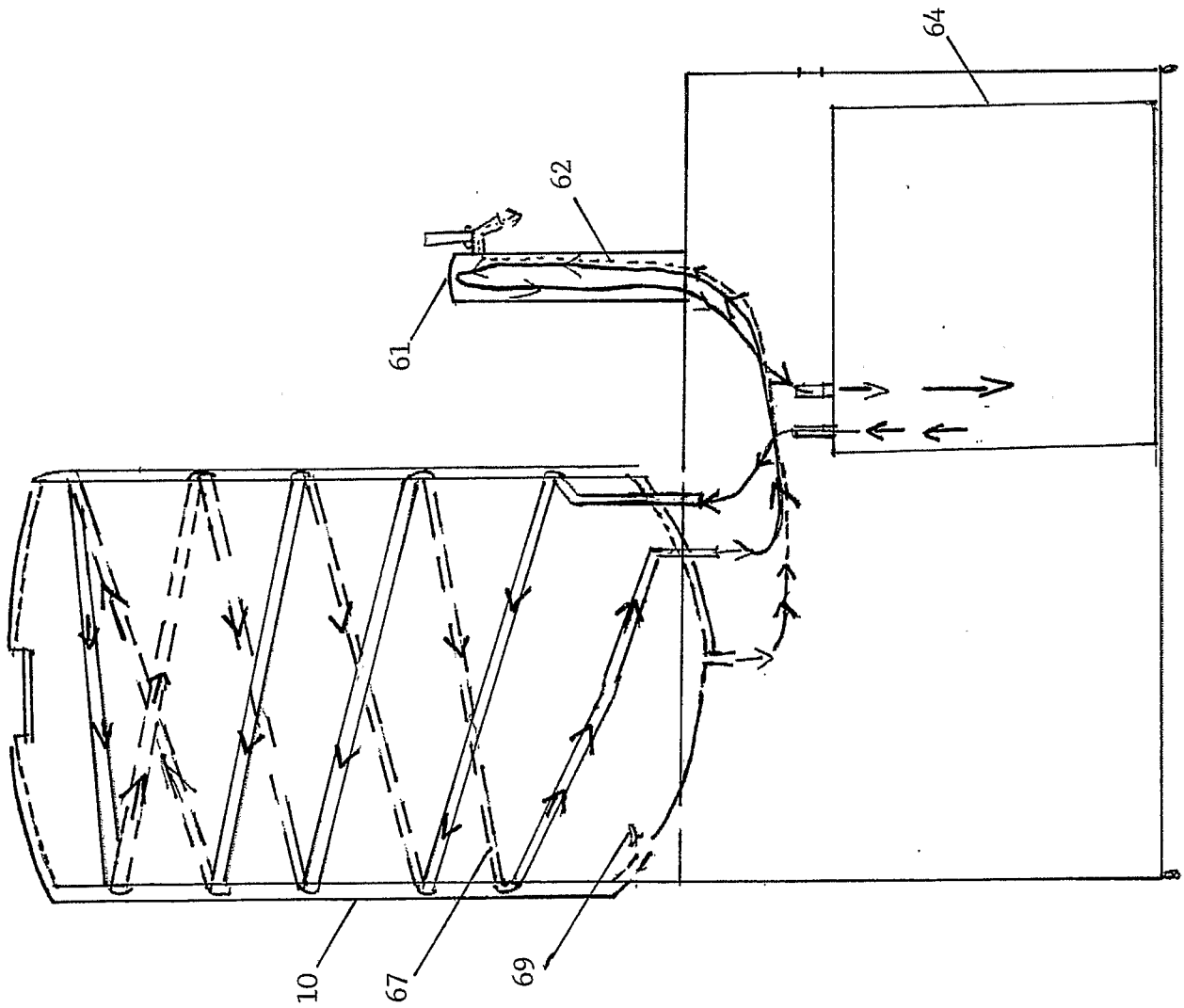



FIG. 6

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2007/000281

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet
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)

IPC: C12C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | BRIGGS D. E. ET AL, "Brewing: Science and practice", Cambridge, GBR: Woodhead Publishing Limited, 2004, pages 515-526 and page 655 page 517, line 8 - line 12, page 517, line 30 - line 34, page 526, line 34 - line 35, Figure 14.2 | 1-12 |
| X | | 13-24 |
| A | | 25 |
| | -- | |
| Y | US 20040129144 A1 (BEADLE L.P.), 8 July 2004 (08.07.2004) | 1-12 |
| X | | 13-24 |
| A | | 25 |
| | -- | |

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"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)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 4 December 2007 | 06 -12- 2007 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>Patrick Andersson/ELY<br>Telephone No. +46 8 782 25 00 |

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO2007/000281

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 936328 A (ETIENNE WILLIAMS KUHN), 12 October 1909 (12.10.1909), page 2, line 57 - line 68, figure 1 | 1-12 |
| X | | 13-24 |
| A | | 25 |
| | -- | |
| A | WO 9218606 A1 (MACLENNAN, I.M.), 29 October 1992 (29.10.1992) | 1-24 |
| X | | 25 |
| | -- | |
| A | GB 2138021 A (POLYTHENE DRUMS (LANCASHIRE) LTD (UNITED KINGDOM)), 17 October 1984 (17.10.1984) | 1-25 |
| | -- | |
| A | WO 9850521 A1 (PRODUCT DESIGN GROUP, INC.), 12 November 1998 (12.11.1998) | 1-25 |
| | -- | |
| | -------- | |

**International patent classification (IPC)**

***C12C 13/10*** (2006.01)

**Download your patent documents at www.prv.se**
The cited patent documents can be downloaded at www.prv.se by following the links:

- In English/Searches and advisory services/Cited documents (service in English) or
- e-tjänster/anförda dokument(service in Swedish).

Use the application number as username.
The password is **QNVSHEIUZS**.

Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| US | 20040129144 | A1 | 08/07/2004 | NONE | | | |
| US | 936328 | A | 12/10/1909 | NONE | | | |
| WO | 9218606 | A1 | 29/10/1992 | AT | 170218 | T | 15/09/1998 |
| | | | | AU | 667302 | B | 21/03/1996 |
| | | | | AU | 676650 | B | 13/03/1997 |
| | | | | AU | 1575692 | A | 17/11/1992 |
| | | | | AU | 4077296 | A | 07/03/1996 |
| | | | | CA | 2108024 | A,C | 13/10/1992 |
| | | | | DE | 69226791 | D,T | 20/05/1999 |
| | | | | EP | 0672108 | A,B | 20/09/1995 |
| | | | | SE | 0672108 | T3 | |
| | | | | JP | 6506346 | T | 21/07/1994 |
| | | | | US | 5235901 | A | 17/08/1993 |
| | | | | US | 5365830 | A | 22/11/1994 |
| GB | 2138021 | A | 17/10/1984 | GB | 8308566 | D | 00/00/0000 |
| WO | 9850521 | A1 | 12/11/1998 | AU | 7291798 | A | 27/11/1998 |
| | | | | CA | 2292606 | A | 12/11/1998 |
| | | | | US | 6032571 | A | 07/03/2000 |