Economies in pot still distillation using modified procedures and equipment

A method of recovering alcohol from residues in a recovery still is outlined. A method of manufacturing pot still distilled alcoholic product, preferably whisky, comprising: (a) providing at least one pot still for pot still distillation; (b) providing a charge for the pot still provided in step (a); (c) distilling the charge in the pot still and collecting distilled product; (d) finishing the distillation at a predetermined cut point defined by the concentration of alcohol in the distillate being condensed from the pot still; (e) providing a recovery still for recovering alcohol from the residue of the charge remaining in the pot still after distillation is finished in step (d); (f) adding at least part of the residue remaining from the charge in the pot still after distillation, to the recovery still and recovering alcohol using the recovery still; (g) providing a further charge comprising at least some of the recovered alcohol; (h) distilling the further charge in a pot still and collecting the distilled product. A method or apparatus in which the pot still distillation is carried out in respect of a volatile liquid other than alcohol or an alcoholic spirit and so is applicable to other pot still distillation industries is also outlined.
Economies in Pot Still Distillation using Modified Procedures and Equipment

Figure 1: Malt Whisky distillation
Economies in Pot Still Distillation using Modified Procedures and Equipment

Figure 2: Recovery Still
Economies in Pot Still Distillation using Modified Procedures and Equipment

Description

Introduction: All Pot Still distillation processes have similar characteristics to those described below. The basic premise is that Pot still distillation provides a unique product. In the production of Malt Whisky the distillation is an area of particular importance and Malt Whisky production will be used as an example of Pot Still distillation and similar processes. Energy is required to carry out all such processes and the economics of such production is much influenced by this requirement. This invention identifies procedures and equipment to make savings in energy requirements, cooling requirements and distillation time. The objectives of this invention is to reproduce the essential characteristics and the parts of the traditional process of Pot Still Distillation that lead to the unique products whilst minimising costs in areas of the process that are better addressed by the alternative means that are represented by this invention. To this end it is necessary to describe the traditional process, Malt Whisky distillation and identify how changes can be made and introducing equipment to overcome the disadvantages. This Invention describes these modifications.

Statement of Invention

In a first aspect of the invention there is provided a method of manufacturing pot still distilled alcoholic product comprising:

a) providing at least one pot still for pot still distillation;
b) providing a charge for the pot still provided in step (a);
c) distilling the charge in the pot still and collecting distilled product;
d) finishing the distillation at a predetermined cut point defined by the concentration of alcohol in the distillate being condensed from the pot still;

e) providing a recovery still for recovering alcohol from the residue of the charge remaining in the pot still after distillation is finished in step (d);
f) adding at least part of, optionally all, the residue remaining from the charge in the pot still after distillation, to the recovery still and recovering alcohol using the recovery still;
g) providing a further charge comprising at least some of the recovered alcohol;
h) distilling the further charge in a pot still and collecting distilled product.

Optionally, steps (c) and (h) are carried out in different pot stills.

Optionally, steps (a) to (d) are carried out in a first pot still and further wherein step (h) is carried out in a second or subsequent pot still in a series of pot still distillations.

Optionally, the first pot still is a wash still and the second pot still is a spirit still.

Optionally, steps (c) and (h) are carried out in the same pot still.
Optionally, steps (a) to (d) are carried out in a first pot still and/or a second pot still in a series of pot still distillations.

Optionally, the pot still is a wash still or spirit still.

Optionally, the pot still, or the second pot still where provided, is a spirit still.

Optionally, (a) to (h) are applied: to a wash distillation; and/or to a spirit distillation; and/or to first and second distillations in a series of at least two distillations; and/or to a distillation subsequent to both a first and a second distillation; and/or to all distillations.

Optionally, the further charge in step (g) comprises at least part of the residue from the charge remaining after step (d) whereby at least part of the residue is recycled to the next or subsequent distillation in the same or a different pot still.

Optionally, the at least part of the residue is recycled to the charge for the next distillation in the same pot still.

Optionally, the at least part of the residue from a first or wash distillation in a first or wash pot still is recycled to the charge for the next distillation in the same first or wash pot still.

Optionally, the at least part of the residue from a second or spirit distillation in a second or spirit pot still is recycled to the charge for the next distillation in the same second or spirit pot still.

Optionally, all distillation charges from all pot stills comprise at least part of the residue from a previous distillation in the same or a different pot still.

Optionally, the cut point in step (d) is earlier, for example earlier in time, than in normal distillation practice and is selected from one or more of the following: the cut point is at 2% alc. v/v or above, the cut point is between 2% and 30% alc. v/v, the cut point is between 2% and 25% alc. v/v.

Optionally, the method comprises finishing the distillation at the cut point when the concentration of alcohol in the distillate being condensed is:

- between about 5% and about 16% alc. v/v; or
- is between 5% and 16% alc. v/v; or
- is between 5.0% and 16.0% alc. v/v; or
- is selected from the group of 5%, 10% and 16% alc. v/v; or
- is selected from the group of 5%, 6%, 7%, 8%, 9%, 10%, 11%, 12%, 13%, 14%, 15%, 16% alc. v/v; or
- is selected from the group of 5.0%, 6.0%, 7.0%, 8.0%, 9.0%, 10.0%, 11.0%, 12.0%, 13.0%, 14.0%, 15.0%, 16.0% alcohol v/v.

Optionally the method comprises finishing the distillation when the concentration of alcohol in the distillate being condensed is:

- between about 10% and about 16% alc. v/v; or
- is between 10% and 16% alc. v/v; or
- is between 10.0% and 16.0% alc. v/v; or
- is selected from the group of 10% and 16% alc. v/v; or
- is selected from the group of 10%, 11%, 12%, 13%, 14%, 15%, 16% alc. v/v, or
- is selected from the group of 10.0%, 11.0%, 12.0%, 13.0%, 14.0%, 15.0%, 16.0% alcohol v/v.

Optionally, the distillate being condensed is collected in a distillate or spirit safe for measurement of concentration.

Optionally, the residue of the charge has a concentration of between 0.2% and 3.0% alc. v/v or between 0.4% and 1.5% alc. v/v or between 0.43% and 1.43% alc. v/v or as designated by the distiller.

Optionally, the pot still is a wash still and step (b) comprises providing an initial charge to the wash still and step (c) comprises collecting low wines as distilled product and step (f) comprises recovering low wines using the recovery still and step (h) comprises distilling the further charge comprising the recovered low wines in a spirit pot still and collecting spirit product as the distilled product.

Optionally, a first pot still and a further pot still are provided and the further charge comprises: distillate from the first pot still and/or distillate from the previous run of the further pot still and/or recovered alcohol from the residue from the first pot still and/or recovered alcohol from the residue from the further pot still.

Optionally, the further charge comprises at least part of the residue from the previous run of the same or a different pot still.

Optionally, the further charge comprises:

- collected low wines from the wash still; and/or
- foreshots from the previous spirit run; and/or
- collected feints from the previous spirit run; and/or
- recovered low wines from residue comprising intermediate pot ale from a wash distillation; and/or
- recovered feints from residue comprising intermediate spent lees from a spirit distillation.

5 Optionally, the further charge comprises intermediate spent lees from a previous spirit distillation.

Optionally, the method comprises adding residue from a previous distillation to the further charge and adjusting the level of residue added to the further charge to maintain concentration of alcohol in the initial composition of the further charge at a predetermined level.

Optionally, the residue is intermediate spent lees from a spirit distillation and the further charge is a spirit charge for a further spirit distillation.

Optionally, the method comprises providing a heat source for the recovery still comprising residue from at least one first and/or further pot still and/or hot water generated via a heat exchanger in a condenser on the at least one pot still and/or a further pot still.

Optionally, the method comprises providing intermediate pot ale from a wash still as the heat source and/or intermediate spent lees from a spirit still as the heat source and/or hot water generated in a heat exchanger in a condenser on the wash still or on the spirit still as the heat source.

20 Optionally, the method comprises using one or more additional heat sources selected from thermal or mechanical recompression, direct steam or other sources of heat.

Optionally, the method comprises heating the recovery still by pot ale from a wash still and/or spent lees from a spirit still and/or intermediate pot ale from a wash still and/or intermediate spent lees from a spirit still and/or hot water generated in a condenser on a pot still.

25 Optionally, the method comprises operating the recovery still at atmospheric pressure.

Optionally, the method comprises operating the recovery still under vacuum at lower than atmospheric pressure.

Optionally, the method comprises providing a single recovery still to each pot still or a single recovery still to each pair of first and second pot stills.

30 Optionally, the method comprises providing a single recovery still for multiple pot stills or a single recovery still for multiple pairs of pot stills.
Optionally, the method comprises collecting intermediate pot ale and/or intermediate spent lees in a tank and supplying a recovery still continuously from the tank.

Optionally, the method comprises providing a heat exchanger in the recovery still for receiving heat from residue from a first or second pot still (such as pot ale and/or spent lees) and adding the heat to the final residue (such as final pot ale) in the recovery still.

In a further aspect there is provided a method of manufacturing pot still distilled alcoholic spirit comprising:

a) providing at least one pot still for pot still distillation;

b) providing a charge for the pot still provided in step (a);

c) distilling the charge in the pot still and collecting distilled product;

d) finishing the distillation at a predetermined cut point defined by the concentration of alcohol in the distillate being condensed from the pot still;

e) optionally providing a recovery still for recovering alcohol from the residue of the charge remaining in the pot still after distillation is finished in step (d);

f) optionally adding at least part of, optionally all, the residue remaining from the charge in the pot still after distillation to the recovery still and recovering alcohol from the at least part of the residue using the recovery still;

g) providing a further charge optionally comprising at least some of the recovered alcohol;

h) distilling the further charge in a pot still and collecting distilled product;

and further comprising:

i) adding residue to the further charge from a previous distillation and adjusting the level of residue added to the further charge so that the concentration of alcohol in the initial composition of a further charge is at a predetermined level.

Optionally, the predetermined level is between about 20% alc. v/v and about 28% alc. v/v or is about 24% alc. v/v or is 24.2% alc. v/v or is as designated by the distiller.

In a further aspect there is provided apparatus for carrying out a method according to any of the paragraphs above comprising at least one pot still and at least one recovery still.

In a further aspect the invention comprises a method or apparatus as described herein in which the pot still distillation is carried out in respect of a volatile liquid other than alcohol or alcoholic spirit and so is applicable to other pot still distillation industries.
In one aspect there is provided a method of production of pot still distilled products wherein the distillation is shortened and the residue distilled in a recovery still for recovery of product from that residue.

Optionally, the recovery still is operated at atmospheric pressure.

Optionally, the recovery still is operated under vacuum at lower than atmospheric pressure.

Optionally, the method is applied to the first or wash distillation.

Optionally, the method is applied to the second or spirit distillation.

Optionally, the method is applied to distillations subsequent to the first and second distillations.

Optionally, the method is applied to the first and second distillations.

Optionally, the method is applied to all distillations.

Optionally, the distillate is produced to a stage (a cut point) when the distillate strength reaches between 1 and 50% alc. v/v or is preferably at 2% alc. v/v or above or more preferably is between 2% and 50% alc. v/v or more preferably is between 2% and 30% alc. v/v or more preferably is between 2% and 25% alc. v/v or more preferably is between 5% and 16% alc. v/v or more preferably is between 10% and 16% alc. v/v.

Optionally, distillation residues are recycled to the next distillation.

Optionally, the first or wash starting charge contains recycled residual material from previous first distillations.

Optionally, the second or spirit starting charge contains recycled residual material from previous second distillations.

Optionally, all distillation starting charges contains recycled residual material from previous distillations.

In a further aspect, the invention comprises the application of these methods, procedures and principles as outlined above and below to other pot still distillation industries.

The method of the first and further aspects of the invention may comprise any one or more of any of the features described in the preceding paragraphs, the claims or elsewhere herein.

**Detailed Description**

**Key Features:** In many Pot still processes the main component is alcohol and distillation reaches a stage where most of the alcohol has been distilled from the residue and the residue has low alcohol content. Most of the essential flavour congeners are recovered early in the distillation. The condensed distillate being produced at the end of distillation is also relatively low in alcohol strength. This is very expensive to produce in energy, cooling and time for distillation but the alcohol requires to be recovered. This patent concerns limiting the production of low strength distillate in the traditional Malt Distillery Pot stills and then
distilling and recovering Low Wines and Feints from the residues in a Recovery Still or stills. This still is much more efficient in recovering alcohol, saving energy, cooling and time.

A further procedure enables control of initial strength of alcohol for distillation to that required by the distiller.

**Drawings:** Figure 1: Malt Whisky Distillation shows a typical Malt Distillery process. There can be a number of variations in details but the fundamental arrangements are shown. Examples of variations are % alcohol in the fermented wash feedstock, condensers having multiple sections for heat recovery and heating can be by direct flame to the base of the still, or steam heating by coils within the pot of the still or heat exchangers external to the stills.

Figure 2: Recovery Still is the proposed still for collecting distillate from residues with intermediate levels of alcohol. The detailed design of this Still can have a variety of different arrangements but the fundamental requirement remains the same: the recovery of the alcohol from intermediate strength residues, for example Pot Ale or Spent Lees, with lower energy requirement.

**Malt Whisky Distillation:**

**Figure 1: Malt Whisky Distillation**

This description is an example of the typical present process. The concentration or strength of all products or intermediate products is measured as alcohol % by volume (that is the pure alcohol volume in 100 volumes of total Spirit, here abbreviated to % alc v/v). Congeners are other volatile components contained in the Wash that distil and concentrate with the alcohol in the spirit; they are low in concentration but are essential components in uniqueness within a product type and in differentiating the product from other alcoholic products. Procedure is as follows: a fermented liquid, made from malted barley and yeast, is produced containing alcohol and congeners and this is called Wash. The Wash feedstock can be transferred directly to the still, but in this case is transferred into the Wash Charger, W1. The required Charge is then transferred to a Pot Still, known as the Wash Still, W3, and heated to boiling using a heating system, W2. Usually the energy source, W7, is steam or direct firing. Heating is continued and the vapours containing higher concentrations of alcohol and congeners are condensed in the condenser, W3a, passed through the Spirit Safe, W5, and collected as Low Wines, W6. The condenser is usually cooled at least partially by cold water W4a/W4b. As the Wash distillation proceeds the strength diminishes and when the concentration of alcohol in the spirit being condensed, measured in the Spirit Safe, W5, reaches a particular strength that the distiller has designated, the distillation is finished. The condensed vapour concentration is related to the concentration of alcohol in the residual wash remaining in the Pot of the Wash Still, which is known as Pot Ale, W9. The Pot Ale is no longer required for the primary process and various means of disposal are practiced.
The Low Wines are then mixed in the vessel, S1, with Foreshots and Feints of previous Spirit Still distillations; together the mixture is called the Spirit Charge. The Spirit charge is the feedstock and is transferred to the Pot Still known as the Spirit Still, S3, (also known as the Low Wines Still). It is then heated as with the Wash Still using a heating system, S2, usually the energy source, S7, is steam or direct firing. Heating is continued and the vapours containing higher concentrations of alcohol and congeners are condensed in the condenser, S3a, usually cooled at least partially by cold water S4a/S4b. and passes to the Spirit Safe, S5. Here strength is measured and the condensed vapour, distillate, can be transferred to different collecting vessels. Usually three cuts are collected. Foreshots are collected first in the vessel, S6a, and will be returned to the next Spirit charge. The means of finishing the Foreshot collection is designated by the distiller; traditionally by adding water and observing the effect on appearance of the spirit and sometimes by timing alone or other reasons. The Spirit Cut, which is the main product from the process, is collected next in vessel, S6. Again the distiller decides when to finish the Spirit collection; it is usually at a particular strength of the condensed distillate that the distiller designates. The last cut collected is Feints (also called tailings) and this is returned to the next Spirit Still charge through the vessel, S6a. Some distilleries have separate vessels for the products of distillation. The Spirit distillation finishes when the measured concentration of alcohol in the spirit being condensed in the Spirit Safe, S5, reaches a particular figure that the distiller has designated. This is usually similar to that used in the Wash distillation for the end of the distillation. This condensed vapour concentration is related to the concentration in the residual material remaining in the Pot of the Spirit Still, known as Spent Lees, S9. The Spent Lees is no longer required and various means of disposal are practiced.

Discussion on normal procedure: Regarding the decision of the distiller to finally stop the distillations in both stills, it is based on the amount of alcohol in the residue that is considered to be uneconomic to recover. For example, if the last condensed spirit distillate recovered from the still is arranged to contain say 1.0 % alc. v/v, the Pot Ale left in the still will contain about 0.08% alc v/v. The exact figure is dependent on the operation and design of the stills. This means that this quantity of alcohol in the Pot Ale, or in Spent Lees, is lost and is disposed of with the Pot Ale and the Spent Lees. 0.08% lost in both stills will equate to just under one hundredth of the starting quantity of alcohol. To put the economics of these procedures and losses into perspective; A typical example would be; the whole collection of the Low Wines from the Wash Still will be say 21.2% alc. v/v. Thus, on average, 4.7 litres of spirit are distilled and collected for 1 litre of alcohol (1 L'alc) of new make/whisky Product. At the typical final distillate strength of 1.0% alc v/v, it would require the distillation and collection of 100 litres of spirit to recover 1 L'alc. Thus the final L'alc would have required at least 21 times more units of energy to distil than the overall average, as the volume distilled off is approximately proportional to the cost of the energy required. (Note: It should be noted that
the energy required to vaporise water is greater than that required to vaporise alcohol, which means that at low alcoholic strengths the cost is even greater than 21 times more energy units; the approximation mentioned above.) Thus the overall cost of this last L'alc is extremely expensive in comparison to average overall cost. A similar argument applies to the recovery of other litres of alcohol towards the end of the distillation. It should be noted that the distillate requires both energy to produce it and cold water to condense it and of course time to complete the distillation. This may point to accepting losses at greater amounts, but, some production costs, examples are malt and yeast, would be expended for a lower production, increasing the overall cost per L'alc. Greater alcohol in residues in some distilleries will also bring greater disposal problems for Pot Ale and Spent Lees.

**This Invention:**

The purpose of the present invention is to limit the energy requirement and other costs and identify the type of equipment required to put it into practice. The objective is to retain the Wash and Spirit distillations with a minimum of change to the existing normal distillation practice. The change proposed being to minimise the length of time that weak and expensive distillates are produced. Where comparisons are made between information from This Invention and “normal”, “normal” refers to the Malt Whisky Distillation described above.

Initially, the operation using the Wash Still shown in Figure 1 and described above is carried out in the normal manner. However, the distillate (Low Wines) is only allowed to continue to be collected until the concentration of alcohol in the distillate running in the safe is at a higher figure than is normally the case. The Pot Ale at this point, is then designated Intermediate Pot Ale and will contain the Later Low Wines that would have been collected as Low Wines in the normal wash distillation. Thus the Intermediate Pot Ale has a higher % alc compared with the normal situation. A Recovery Still is then used to recover the Later Low Wines remaining in the Intermediate Pot Ale. **Figure 2 Recovery Still** is an example of a still designed to recover the Later Low Wines in the Intermediate Pot Ale. Other designs using similar principles will achieve the same objectives.

**Note:** The principles described below are based on recovery distillation from Intermediate Pot Ale, the residue from a Wash Still, from which the Recovered Low Wines becomes part of the normal Low Wines and is recycled to the Spirit Still charge. The same principles and description also applies to the recovery distillation of Intermediate Spent Lees, the residue from a Spirit Still, from which the Recovered Feints becomes part of the normal Feints and is recycled to the Spirit Still charge. It also applies to mixtures of Intermediate Pot Ale and Intermediate Spent Lees processing in the same Recovery Still. The product from this is a mixture of Recovered Low Wines and Recovered Feints and is recycled to the Spirit Still charge.
Figure 2: Recovery Still.
At the start of the procedure the Intermediate Pot Ale that has the higher than normal alcohol content, is transferred to the Feed vessel shown as No 1 in the drawing. As the Intermediate Pot Ale has previously been boiled in the Wash Still, it will be at just below boiling temperature at atmospheric pressure. The Intermediate Pot Ale is then pumped continuously through the Heat Exchanger No 2. The heat in this Intermediate Pot Ale is there transferred to the Final Pot Ale withdrawn from, and returned by way of No 2b to the Recovery Still base vessel No 3. This Final Pot Ale has already been stripped of alcohol and leaves the Recovery Still at relatively low temperature and returns much hotter. As the Recovery Still base vessel No 3 is under vacuum the hot Final Pot Ale boils and the vapour produced rises into the section of the still No 3a. This area of the still contains plates or other means that concentrate the alcohol towards the top with low concentrations towards the base. From the Heat Exchanger No 2 the Intermediate Pot Ale ex the Wash Still will have transferred it’s heat and become colder and is passed, by way of No 2a, to the top section of section No 3a. The Later Low Wines that this Intermediate Pot Ale contains is stripped out as the Intermediate Pot Ale passes down through the section 3a, by the vapour rising from the boiling Final Pot Ale in the base vessel of the Recovery Still No 3. The vapour containing Later Low Wines at the top of section No 3a is condensed in the Condenser No 3b and is removed to the Recovered Later Low Wines (Recovered Alcohol) collection vessel No 6. The Condenser is cooled by water No 4a/No 4b or by other means and this cooling will partially provide the vacuum required.
The Vacuum Pump No 5 initiates and maintains the required vacuum conditions. Final Pot Ale contained in the Recovery Still base No 3 is removed to maintain the operating level in the base section by continuous withdrawal into a vessel for final disposal No 9. As the Recovery Still boils off, removes and concentrates the Later Low Wines, the Final Pot Ale in the base will have low alcohol levels. The collected Later Low Wines from the Recovery Still will be at a strength resulting from the design of that still and this will be returned to the Spirit Still feedstock.

The energy to boil the Recovery Still as described above is derived from the hot Intermediate Pot Ale from the Wash Still and other heat sources. Some distilleries have systems for the use of high grade heat sources such as Pot Ale. There are other options and some may be available as follows in particular circumstances within different distilleries. In the schematic drawing Figure 2 the use of other heat sources is shown as Other Heat Sources No 7 passing through the Heat exchanger No 8 with Intermediate Pot Ale being heated and returned to the Recovery Still base section No 3 boiling and producing vapour, assisting in the removal of alcohol from the Intermediate Pot Ale in section No 3a.

Some possible heat sources are:
1: As described the Pot Ale ex the Wash Still and Spent Lees ex the Spirit Still
2: Using hot water generated in specially designed Condensers on the Main Stills. Alternatively, the Final Pot Ale could be heated directly using such Condensers on the Main Stills.

3: It may be decided not to apply the system to the Spirit Still and the Spent Lees from that still would therefore be available.

4: There may be other sources of heating that may be used for example thermal or mechanical recompression systems.

5: In some circumstances it may be that the best option costing will conclude that some steam is used to heat the Recovery Still: such steam may be necessary at start up of the still.

6: It may be appropriate to apply the heat directly within the still base by way of coils or other means.

As noted above Spent Lees from the Spirit Still can be treated in a similar way.

**Note:** This description and the **Figure 2 Recovery Still** show the Recovery Still operating under vacuum, as this enables sources of energy with lower temperatures to transfer heat to the still with considerable savings. This is clearly desirable, but is not essential as the Recovery Still can be operated without vacuum using direct steam for example. This will enable some savings in energy use but considerable saving to be achieved in operating time and therefore distillation capacity. There are many features of different distilleries that will influence such decisions. An example would be a distillery operating a Pot Ale evaporator may prefer the pot ale to be at high temperature rather than having to reheat it from a vacuum operated Recovery Still.

The **feedstock to the Spirit Still** will consist of:

- **A:** The collected Low Wines from the Wash Still,
- **B:** Foshots, the initial collection from the previous Spirit Still run,
- **C:** The collected Feints from the previous Spirit Still run and in addition,
- **D:** Recovered Low Wines from the Intermediate Pot Ale and Recovered Feints from the Intermediate Spent Lees recovered by a Recovery Still or Stills,
- **E:** Intermediate Spent Lees from the previous Spirit Still run.

The recycling of this Intermediate Spent Lees, under **E:** is optional but, without the Intermediate Spent Lees, the starting strength of the Spirit Charge will be significantly higher than "normal" and the volume will be smaller for the same production amount. Raising the strength at the start of a Spirit Still run will change the profile of the early part of the distillation and may influence the new make/final whisky product. If the volume is smaller the arrangement between the capacities of the Wash and Spirit Stills with one distillation of each being matched together, will become unbalanced and other arrangements would have to be put in place. By using this recycle of Intermediate Spent Lees the % alcohol and volume at the start of the Spirit Still run can be arranged to be identical to normal practice. Spent Lees
are a normal constituent of the charge to the Spirit Still. It is a straight forward arrangement to carry this out.

There are therefore four advantages to this recycling:

1: the Spent Lees will be at higher temperature than that of the components in the normal charge, reducing the heat required to bring the still charge to temperature.

2: the volume charged to the still will be normal; without it, the volume in the still will be much smaller or the number of Spirit Still distillations would need to be reduced as indicated above.

3: the size of the Recovery Still will be smaller than otherwise.

4: the Spent Lees quantity required could be left in the Spirit still prior to adding the other components A to D: above.

Balanced against these advantages of recycling spent lees are the disadvantages that the Spirit Still distillation will cost more in time, energy and cooling.

Discussion on The Invention: The decision to finish the distillation at a particular strength in the Pot Still, measured by the condensate strength, has to be made taking into consideration many factors. If the strength chosen is too low the procedure will not generate sufficient advantage for justifying the capital expenditure. If it is too high then the heat requirement and design requirements for high volumes and thus capital expenditure for the Recovery still will be too high. It is considered that the figure chosen is likely to be between 5 and 16% condensate strength, depending on factors specific to the particular distillery as mentioned elsewhere.

However, as described elsewhere herein, it is possible to benefit at figures outside those mentioned. Among the Examples shown below are those based on cut points of 5%, 10% and 16% condensate strength in the safe, which fall within the preferred range of 2% to 30% alc. v/v and within the more preferred range of 5% to 16% alc. v/v.

Advantages of the procedure where the Wash and Spirit distillations are finished with significantly higher alcohol content are:

1: The principle areas of distillation are carried out in a very similar way to normal conditions.

2: A very considerable saving in energy required to boil off the distillates.

3: A saving in water or cooling requirement to condense the distillates.

4: Most distilleries have multiple Wash and Spirit Stills and one large Recovery Still can accommodate all or if required two Recovery Stills, one for Pot Ale and one for Spent Lees.

5: Production Capacity of Wash Stills and, to a lesser extent, of Low Wines Stills will be increased, which will enable less expenditure to increase production in the distillery.

6: Concentration of alcohol in Spent Lees may be lower and this will reduce the load on a biological disposal plant. Where used, a Pot Ale evaporator may have a lower capacity.
concentration of alcohol in evaporator condensate disposed of through a biological disposal plant. These alcohol levels are dependent on the detailed design adopted.

7: Where Spent Lees recycling is practiced the quantity of Spent Lees finally requiring disposal will be reduced, the degree depending on the detailed design adopted.

8: The feedstock components A: to C: above of the Spirit Still Charge mentioned above will be smaller than normal with higher concentration of alcohol and will require less heat to reach boiling point when distilled in the Spirit Still.

Disadvantages of the procedure where the Wash and Spirit distillations are finished with significantly higher alcohol content in Low Wines and Feints are:

1: The Final Pot Ale quantity will be greater than normal, the degree depending on the detailed design adopted.

2: Where Spent Lees recycle is not practiced the Spent Lees quantity will be increased.

3: Where the distillation technique in the Recovery Still uses vacuum the still residues will be colder and this may be a disadvantage for some means of disposal and may conflict with preheating uses elsewhere in the distillery.

4: It will be clear from the foregoing that heat is of major concern and, excluding the existing Wash and Spirit Stills, all vessels, pipe work, the Recovery Still and etc. containing hot materials will benefit from being insulated to a very high standard. Hatches, and vents on hot vessels will benefit from being modified to prevent vapour losses. Safety measures may require to be reviewed.

Using the procedure detailed in This Invention the following are examples of calculated results after a series of distillations have been carried out to achieve equilibrium in successive results.

Examples
(Note on these examples: In the normal situation, all volumes collected are taken as 100%. In the later examples the change in volume as a consequence of the modification described, is shown as % by comparison to normal at 100%. The starting quantity of alcohol is the same for all cases.

In all cases the % alc v/v used is the same at 8.0%. At higher or lower strengths similar trends apply.

Example 1: Normal Operation basis: Cut Point 1.0% in the safe.

The Wash distillation is carried out normally up the point when the condensed distillate running in the safe reaches 1.0% alc v/v and the distillation is then stopped. The Low Wines collected contains nearly 100% of the quantity of alcohol in the original wash and the strength of collected Low Wines is 21.2% alc v/v and the volume normal (100%) The Total
Pot Ale is left with a strength of 0.08% alc v/v and disposed of in this case by evaporation, with the condensate going to a bio-plant. The volume of Pot Ale is normal (100%).

The Spirit Charge contains the three different parts, Low Wines, Foreshots and Feints and has the normal strength of 24.2% alc v/v. The Spirit Charge volume is normal (100%). Distillation commences with the collection of Foreshots and the Spirit Cut final product is carried out normally and the volumes of each are normal (100%). The Feints collection is completed when the condensed distillate running in the safe reaches 1% alc v/v as in the Wash distillation. The strength of the collected Feints is 28.2% alc v/v and by volume is the normal amount (100%). The Spent Lees containing 0.08 alc v/v is disposed of by bio-plant and the volume is normal (100%). The energy used is normal and taken to be 100% for comparison with other examples.

Example 2: Cut Point 5% in the safe. Two vacuum operated Recovery Stills, spent lees recycle, separate disposal of final pot ale and final spent lees.

The Wash distillation is carried out normally up to the point when the condensed distillate running in the safe reaches 5% alc v/v and the distillation is then stopped. The Low Wines collected contains 96.3% of the quantity of alcohol in the original wash and the strength of the collected Low Wines is 27.6% alc v/v and the volume is 73.8% of the normal amount. Thus 26.2% less volume is distilled when compared with “normal” wash distillation.

The Intermediate Pot Ale strength is 0.41% alc v/v and is distilled in a vacuum operated Recovery Still for Pot Ale only using the heat from the Pot Ale and hot water at 95 degrees Celsius, produced with pre-condensers operating on the wash stills. The Recovered Low Wines is collected to be recycled, and the resulting Final Pot Ale contains 0.009% alc, is at a temperature of 60 degrees Celsius and is greater in volume by 9%. Final Pot Ale is disposed of by transport to a central disposal unit.

The Spirit Charge contains the low wines, foreshots, feints, recovered low wines, and recovered feints and is at the normal strength of 24.2% alc v/v having been adjusted by recycling some of the previous Spirit distillation Intermediate Spent Lees. The Spirit Charge volume is similar to the normal charge. Distillation commences as normal and the collection of Foreshots and the Spirit Cut final product is carried out normally with quantities and strengths similar to normal. The Feints collection is completed when the condensed distillate running in the safe reaches 5% alc v/v as in the Wash distillation. The strength of the collected Feints is 35.0% alc v/v and by volume is only 80% of the normal amount.

For the Spirit Still the overall amount of distilled products, Foreshots, Spirit Cut product and Feints represent 86.9% of that normally distilled. Thus 13.1% less volume is distilled when compared with “normal” spirit distillation.

The Intermediate Spent Lees containing 0.41% alc v/v is partly recycled to adjust strength of the spirit charge and the remainder is distilled in a separate vacuum operated...
Recovery Still only using the heat from the Spent Lees and hot water at 95 degrees Celsius, produced with pre-condensers operating on the wash stills. The Low Wines are recovered and, because of recycling part of the Intermediate Spent Lees, the Final Spent Lees to be disposed of is 68% of the normal amount and at 0.009% alc v/v. Final Spent Lees is disposed of by bio-plant.

The total quantities distilled in the two Pot Stills amounts to 79.6% of that normally found. On the basis of energy used directly to distil, the quantity used is 75.7% of normal.

**Example 3: Cut Point 10% in the safe, Single Recovery Still, spent lees recycle and final disposal by long sea outfall.**

The Wash distillation is carried out normally up to the point when the condensed distillate running in the safe reaches 10% alc v/v and the distillation is then stopped. The Low Wines collected contains 91.8% of the quantity of alcohol in the original wash and the strength of the collected Low Wines is 32% alc v/v and the volume is 60% of the normal amount. Thus 40% less volume is distilled when compared with "normal" spirit distillation.

The Intermediate Pot Ale strength is 0.85% alc v/v and, when mixed with Intermediate Spent Lees is distilled in a vacuum operated Recovery Still, using the heat from the Pot Ale, Spent Lees and hot water at 95 degrees Celsius, produced with pre-condensers operating on the wash stills. The Recovered Low Wines and Recovered Feints are collected together to be recycled to the next Spirit Charge and the resulting Final Pot Ale mixed with Final Spent Lees contains 0.018% alc and is at a temperature of 60 degrees Celsius. It is disposed of by sea discharge with a long outfall.

The Spirit Charge contains the low wines, foreshots, feints, recovered mixed low wines and feints and is at the normal strength of 24.2% alc v/v having been adjusted by recycling some of the previous Spirit distillation Intermediate Spent Lees. The Spirit Charge volume is similar to the normal charge. Distillation commences as normal and the collection of Foreshots and the Spirit Cut final product is carried out normally with quantities and strengths similar to normal. The Feints collection is completed when the condensed distillate running in the safe reaches 10% alc v/v as in the Wash distillation. The strength of the collected Feints is 39.4% alc v/v and by volume is only 68% of the normal amount.

For the Spirit Still the overall amount of distilled products, Foreshots, Spirit Cut product and Feints represent 79.7% of that normally distilled. Thus 20.3% less volume is distilled when compared with "normal" spirit distillation.

The Intermediate Spent Lees containing 0.85% alc v/v is partly recycled to adjust strength of the spirit charge and the remainder is distilled along with Pot Ale in the same Recovery Still described above. The Low Wines are recovered and, because of recycling part of the Intermediate Spent Lees, the Final Spent Lees to be disposed of is 55% of the normal amount and at 0.014% alc v/v.
The total quantities distilled in the two Pot Stills amounts to 69% of that normally found. On the basis of energy used directly to distil, the quantity used is 63% of normal.

**Example 4: Cut Point 16% in the Safe.** Pot Ale Recovery Still using direct steam only, Spent Lees Recovery Still using vacuum, Spent Lees recycle, Pot Ale Evaporated and bio-plant disposal of Spent Lees and evaporator condensate.

The Wash distillation is carried out normally up to the point when the condensed distillate running in the safe reaches 16% alc v/v and the distillation is then stopped. The Low Wines collected contains 86% of the quantity of alcohol in the original wash and the strength of Low Wines collected is 36% alc v/v and the volume is 50% of the normal amount. Thus 50% less volume is distilled when compared with “normal” spirit distillation.

The Intermediate Pot Ale strength is 1.43% alc v/v and is distilled in a separate Recovery Still using direct steam as the Final Pot Ale is evaporated to syrup. The Recovered Low Wines are collected to be recycled, and the resulting Final Pot Ale, that has 0.02% alc v/v and volume 119% of that normally found, is evaporated and the syrup sold. The Evaporator condensate, has a lower %alc v/v than normal, is disposed of by bio-plant.

The Spirit Charge contains the low wines, foreshots, feints, recovered low wines, and recovered feints and is at the normal strength of 24.2% alc v/v having been adjusted by recycling some of the previous Spirit distillation Intermediate Spent Lees. The Spirit Charge volume is similar to the normal charge. Distillation commences as normal and the collection of Foreshots and the Spirit Cut final product is carried out normally with quantities and strengths similar to normal. The Feints collection is completed when the condensed distillate running in the safe reaches 16% alc v/v as in the Wash distillation. The collection of Feints strength is 43.6% alc v/v and by volume is only 59% of the normal amount.

For the Spirit Still the overall amount of distilled products, Foreshots, Spirit Cut product and Feints represent 74% of that normally distilled. Thus 26% less volume is distilled when compared with “normal” spirit distillation.

The Intermediate Spent Lees containing 1.43% alc v/v a separate vacuum operated Recovery Still only using the heat from the Spent Lees and hot water at 95 degrees Celsius, produced with pre-condensers operating on the wash stills.

The total quantities distilled in the two Pot Stills amounts to 61% of that normally found. On the basis of energy used directly to distil, the quantity used is about 68% of normal, taking into account the direct steam used in the Recovery still.

**Example 5: Cut Point 16% in the Safe.** Single Vacuum Recovery Still with partial direct steam, sea disposal by long outfall, Spent Lees recycle.

The Wash distillation is carried out normally up to the point when the condensed distillate running in the safe reaches 16% alc v/v and the distillation is then stopped. The Low
Wines collected contains 86% of the quantity of alcohol in the original wash and the strength of Low Wines collected is 36% alc v/v and the volume is 50% of the normal amount. Thus 50% less volume is distilled when compared with "normal" spirit distillation.

The Intermediate Pot Ale is left with a strength of 1.43% alc v/v and is mixed with the Intermediate Spent Lees at the same strength and distilled in a vacuum operated Recovery Still using the heat from the Pot Ale, some direct steam and hot water at 95 degrees Celsius, produced with pre-condensers operating on the wash and spirit stills. The Recovered Low Wines and Recovered Feints are collected to be recycled to the spirit charge, and the resulting Final Pot Ale mixed with Final Spent Lees contains 0.014% alc and is at a temperature of 60 degrees Celsius. It is disposed of by sea discharge with a long outfall.

The Spirit Charge contains the low wines, foreshots, feints, recovered low wines, and recovered feints and is at the normal strength of 24.2% alc v/v having been adjusted by recycling some of the previous Spirit distillation Intermediate Spent Lees. The Spirit Charge volume is similar to the normal charge. Distillation commences as normal and the collection of Foreshots and the Spirit Cut final product is carried out normally with quantities and strengths similar to normal. The Feints collection is completed when the condensed distillate running in the safe reaches 16% alc v/v as in the Wash distillation. The collection of Feints strength is 43.6% alc v/v and by volume is only 59% of the normal amount.

For the Spirit Still the overall amount of distilled products, Foreshots, Spirit Cut product and Feints represent 74% of that normally distilled. Thus 26% less volume is distilled when compared with "normal" spirit distillation.

The Intermediate Spent Lees containing 1.43% alc v/v is partly recycled to adjust strength of the spirit charge and the remainder is mixed with Intermediate Pot Ale as described above.

The total quantities distilled in the two Pot Stills amounts to 61% of that normally found. On the basis of energy used directly to distil, the quantity used is about 58% of normal, taking into account the partial direct steam used in the Recovery Still.
1. A method of manufacturing pot still distilled alcoholic product comprising:
   a) providing at least one pot still for pot still distillation;
   b) providing a charge for the pot still provided in step (a);
   c) distilling the charge in the pot still and collecting distilled product;
   d) finishing the distillation at a predetermined cut point defined by the
      concentration of alcohol in the distillate being condensed from the pot still;
   e) providing a recovery still for recovering alcohol from the residue of the charge
      remaining in the pot still after distillation is finished in step (d);
   f) adding at least part of the residue remaining from the charge in the pot still
      after distillation, to the recovery still and recovering alcohol using the recovery
      still;
   g) providing a further charge comprising at least some of the recovered alcohol;
   h) distilling the further charge in a pot still and collecting distilled product.

2. A method according to claim 1 in which steps (c) and (h) are carried out in different pot
   stills.

3. A method according to claim 2 in which steps (a) to (d) are carried out in a first pot
   still and further wherein step (h) is carried out in a second or subsequent pot still in a series of
   pot still distillations.

4. A method according to claim 3 in which the first pot still is a wash still and the second
   pot still is a spirit still.

5. A method according to claim 1 in which steps (c) and (h) are carried out in the same pot
   still.

6. A method according to claim 5 in which steps (a) to (d) are carried out in a first pot still
   and/or a second pot still in a series of pot still distillations.

7. A method according to claim 5 or 6 in which the pot still is a wash still or spirit still.

8. A method according to any preceding claim in which the pot still, or the second pot still
   where provided, is a spirit still.

9. A method according to any preceding claim in which steps (a) to (h) are applied: to a
   wash distillation; and/or to a spirit distillation; and/or to first and second distillations in a series
   of at least two distillations; and/or to a distillation subsequent to both a first and a second
   distillation; and/or to all distillations.
10. A method according to any preceding claim in which the further charge in step (g) comprises at least part of the residue from the charge remaining after step (d) whereby at least part of the residue is recycled to the next or subsequent distillation in the same or a different pot still.

11. A method according to claim 10 in which the at least part of the residue is recycled to the charge for the next distillation in the same pot still.

12. A method according to claim 11 in which the at least part of the residue from a first or wash distillation in a first or wash pot still is recycled to the charge for the next distillation in the same first or wash pot still.

13. A method according to claim 11 or 12 in which the at least part of the residue from a second or spirit distillation in a second or spirit pot still is recycled to the charge for the next distillation in the same second or spirit pot still.

14. A method according to any of claims 10 to 13 in which all distillation charges from all pot stills comprise at least part of the residue from a previous distillation in the same or a different pot still.

15. A method according to any preceding claim in which the cut point in step (d) is earlier than in normal distillation practice and is selected from one or more of the following: the cut point is at 2% alc. v/v or above, the cut point is between 2% and 30% alc. v/v, the cut point is between 2% and 25% alc. v/v.

16. A method according to any preceding claim comprising finishing the distillation when the concentration of alcohol in the distillate being condensed is:
   - between about 5% and about 16% alc. v/v; or
   - is between 5% and 16% alc. v/v; or
   - is between 5.0% and 16.0% alc. v/v; or
   - is selected from the group of 5%, 10% and 16% alc. v/v; or
   - is selected from the group of 5%, 6%, 7%, 8%, 9%, 10%, 11%, 12%, 13%, 14%, 15%, 16% alc. v/v, or
   - is selected from the group of 5.0%, 6.0%, 7.0%, 8.0%, 9.0%, 10.0%, 11.0%, 12.0%, 13.0%, 14.0%, 15.0%, 16.0% alcohol v/v.

17. A method according to claim 16 comprising finishing the distillation when the concentration of alcohol in the distillate being condensed is:
   - between about 10% and about 16% alc. v/v; or
   - is between 10% and 16% alc. v/v; or
- is between 10.0% and 16.0% alc. v/v; or
- is selected from the group of 10% and 16% alc. v/v; or
- is selected from the group of 10%, 11%, 12%, 13%, 14%, 15%, 16% alc. v/v, or
- is selected from the group of 10.0%, 11.0%, 12.0%, 13.0%, 14.0%, 15.0%, 16.0% alcohol v/v.

18. A method according to claim 16 or 17 in which the distillate being condensed is collected in a distillate or spirit safe for measurement of concentration.

19. A method according to any preceding claim in which the residue of the charge has a concentration of between 0.2% and 3% alc. v/v or between 0.4% and 1.5% alc. v/v or between 0.43% and 1.43% alc. v/v or as designated by the distiller.

20. A method according to any preceding claim in which the pot still is a wash still and step (b) comprises providing an initial charge to the wash still and step (c) comprises collecting low wines as distilled product and step (f) comprises recovering low wines using the recovery still and step (h) comprises distilling the further charge comprising the recovered low wines in a spirit pot still and collecting spirit product as the distilled product.

21. A method according to any preceding claim in which a first pot still and a further pot still are provided and the further charge comprises:
- distillate from the first pot still and/or
- distillate from the previous run of the further pot still and/or
- recovered alcohol from the residue from the first pot still and/or
- recovered alcohol from the residue from the further pot still.

22. A method according to claim 21 in which the further charge comprises at least part of the residue from the previous run of the same or a different pot still.

23. A method according to claim 21 or 22 in which the further charge comprises:
- collected low wines from the wash still; and/or
- foreshots from a previous spirit run; and/or
- collected feints from a previous spirit run; and/or
- recovered low wines from residue comprising intermediate pot ale from a wash distillation; and/or
- recovered feints from residue comprising intermediate spent lees from a spirit distillation.
24. A method according to claim 23 in which the further charge comprises intermediate spent lees from a previous spirit distillation.

25. A method according to any preceding claim comprising adding residue from a previous distillation to the further charge and adjusting the level of residue added to the further charge to maintain concentration of alcohol in the initial composition of the further charge at a predetermined level.

26. A method according to claim 25 in which the residue is intermediate spent lees from a spirit distillation and the further charge is a spirit charge for a further spirit distillation.

27. A method according to any preceding claim comprising providing a heat source for the recovery still comprising residue from at least one first and/or further pot still and/or hot water generated via a heat exchanger in a condenser on the at least one pot still and/or a further pot still.

28. A method according to claim 27 comprising providing intermediate pot ale from a wash still as the heat source and/or intermediate spent lees from a spirit still as the heat source and/or hot water generated in a heat exchanger in a condenser on the wash still or on the spirit still as the heat source.

29. A method according to claim 27 or 28 comprising using one or more additional heat sources selected from thermal or mechanical recompression, direct steam, or other heat sources.

30. A method according to any preceding claim comprising heating the recovery still by pot ale from a wash still and/or spent lees from a spirit still and/or intermediate pot ale from a wash still and/or intermediate spent lees from a spirit still and/or hot water generated in a condenser on a pot still.

31. A method according to any preceding claim comprising operating the recovery still at atmospheric pressure.

32. A method according to any preceding claim comprising operating the recovery still under vacuum at lower than atmospheric pressure.

33. A method according to any preceding claim comprising providing a single recovery still to each pot still or a single recovery still to each pair of first and second pot stills.

34. A method according to any preceding claim comprising providing a single recovery still for multiple pot stills or a single recovery still for multiple pairs of pot stills.
35. A method according to any preceding claim comprising collecting intermediate pot ale and/or intermediate spent lees in a tank and supplying a recovery still continuously from the tank.

36. A method according to any preceding claim comprising providing a heat exchanger in the recovery still for receiving heat from residue from a first or second pot still (such as pot ale and/or spent lees) and adding the heat to the final residue (such as final pot ale) in the recovery still.

37. A method of manufacturing pot still distilled alcoholic spirit comprising:
   a) providing at least one pot still for pot still distillation;
   b) providing a charge for the pot still provided in step (a);
   c) distilling the charge in the pot still and collecting distilled product;
   d) finishing the distillation at a predetermined cut point defined by the concentration of alcohol in the distillate being condensed from the pot still;
   e) optionally providing a recovery still for recovering alcohol from the residue of the charge remaining in the pot still after distillation is finished in step (d);
   f) optionally adding at least part of the residue remaining from the charge in the pot still after distillation to the recovery still and recovering alcohol from the at least part of the residue using the recovery still;
   g) providing a further charge optionally comprising at least some of the recovered alcohol;
   h) distilling the further charge in a pot still and collecting distilled product; and further comprising:
   i) adding residue to the further charge from a previous distillation and adjusting the level of residue added to the further charge so that the concentration of alcohol in the initial composition of a further charge is at a predetermined level.

38. A method according to claim 37 comprising features of any of claims 2 to 36.

39. A method according to claim 37 or 38 in which the predetermined level is between about 20% alc. v/v and about 28% alc. v/v or is about 24% alc. v/v or is 24.2% alc. v/v or as designated by the distiller.

40. Apparatus for carrying out a method of any of claims 1 to 39 comprising at least one pot still and at least one recovery still.

41. A method or apparatus according to any preceding claim in which the pot still distillation is carried out in respect of a volatile liquid other than alcohol or alcoholic spirit and so is applicable to other pot still distillation industries.
42. A method or apparatus substantially as described herein with reference to and/or as illustrated in the accompanying drawings.
Application No: GB1216068.5  Examiner: Dr Natalie Cole
Claims searched: 1-40, 42  Date of search: 18 December 2012

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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Field of Search:
Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

Worldwide search of patent documents classified in the following areas of the IPC:
B01D; C12G

The following online and other databases have been used in the preparation of this search report:
EPODOC, WPI
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