

This article was originally circulating the internet as the "Blueflame" text. I have not edited any of the content, but merely present it as it was. I don't endorse it, nor vouch for its contents accuracy. Tony *le courageux mais pas téméraire...*

C'est plein de bons conseils, j'en ai mis certains **en évidence.**

How to brew your own booze (Formerly "FACTS, FANCY AND OTHERWISE") It is well-known that the making of intoxicating beverages is as old as recorded history, and probably a great deal older. In this treatise, we wish to present the easiest method to make a 'produce' that is both safe and pleasant to consume. The goal, naturally, is ethyl alcohol, or C₂H₅OH; the only base or stock from which good drinking whisky and other liquor is made. In fact, ethyl alcohol rapidly oxidises in the body to carbon dioxide and water, and no cumulative effect occurs. We will attempt in this article to combine the most useful chemical and technological information with 'homespun' procedures, as well as trying to keep the data simple and understandable. The text, by the way, is "Chemistry and Technology of Wines and Liquors" by Herstein and Jacobs (excerpts from this book are within quotation marks).

page 1
INDEX

Subject	Page
General Conditions of Alcoholic Fermentation	2
Rate of Fermentation	3
Alcoholic Yield and By-products of Fermentation	3
The Basic Batch	4
Distillation Theory	6
Cleaning the Still	6
Safety Precautions in Distillation	7
Common Pot Still	12
Running the Still	12
Reflux Column Distillation Units	15
Ageing	16
Endnote - please read	17

General Conditions of Alcoholic Fermentation

Fermentable sugar, water, the presence of a ferment (yeast) and a favourable temperature, usually between 75 F - 85 F and **NEVER over 90 F**, are inescapable requirements.

au delà les levures meurent

Concentration of sugar (2 lbs in 1 imperial gallon) and yeast and the acidity or pH of the fermentation mash are of great importance. The pH range is usually 4.0 to 4.5. **voire 3.5...**

page 2

Rate of Fermentation

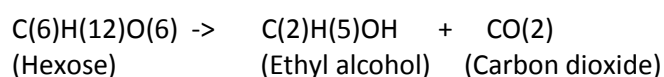
The rate of fermentation depends chiefly on the temperature and the CONCENTRATION of yeast. The rate of fermentation is twice as fast at 95 F as at 77 F. "However, the autolysis (decomposition of the yeast) is favoured by higher temperatures, and the rate of UNDESIRABLE by-processes increased; hence, it is usual to set 90 F as the upper limit." (In other words, it is definite that the

higher we go above 90 F, your probable loss of yield of alcohol will be from about 25% to 50% because yeast cells die, as well as undesirable products increasing at higher temperatures.) odeur d'oeuf pourri, de mercaptan

Une fermentation qui s'arrête peut avoir plusieurs causes, manque de propreté, trop chaud, pas assez d'oxygène pour permettre aux levures de se multiplier... trop d'oxygène = risque de piquûre acétique (vinaigre) due à l'acétobacter bactérie aérobie. Pour les levures : oxygène=multiplication, pas d'oxygène=production d'alcool...

Alcoholic Yield and By-products of Fermentation

[1] The overall chemical equation of the conversion of sugar to alcohol is:



[2] The weight of products from fermentation of one hundred pounds of sugar is as follows:

Alcohol	48.5 lbs
Carbon dioxide	46.7
Glycerol	3.2
Organic acids	0.6
Miscellaneous	1.2
Total	100.2 lbs

The extra 0.2 lb is due to the fixation of water in the formation of some of the by-products.

[3] In general, the chief products of vinous fermentation are alcohol and carbon dioxide (94% - 95% of the sugar), glycerol (2 5% - 3 6%), acids (0 4% - 0 7%), and appreciable quantities of fusel oils (higher alcohols), acetaldehyde and other aldehydes, and esters. The minor products of fermentation are:

Formic acid, Acetic acid, Propionic acid, Butyric acid, Lactic acid, Ethyl Butyrate, Ethyl Acetate, Ethyl caprate, ...

page 3

[4] Very little methyl alcohol is found in grape wine, about 0 15%. Methyl alcohol is NOT produced by the fermentation of pure sugar, its sole source appears to be the hydrolysis of pectins. Pectins are found in grapes, commercial orange juice and other fruits. The addition of several cans of orange juice is not necessary and may, in fact, increase methyl alcohol content. It is far safer to use a chemical 'booster' such as ammonium phosphate-dibasic, or a close substitute containing nitrogen and phosphate.

Les moûts à base de grains contiennent naturellement ces nutriments, donc pas besoin de rajouter du diphosphate d'ammonium...ici ils utilisent du sucre, donc il faut nourrir les levures...

Calgon water softener is also a fair substitute. Perhaps we should explain that the reason for adding an ingredient to the sugar, water and yeast mix is solely for the yeast to have 'food' in order to 'work' properly. It has been established that yeast needs nitrogen, phosphate and potassium for 'food', but only in very small proportions. In other words, the ammonium phosphate-dibasic has the nitrogen and phosphate, and the raw water has the potassium.

The Basic Batch

There are a great many ferments or batches and trying to catalogue them in all varieties would be a tremendous task; therefore, we will discuss only a 'basic' ferment that proves itself reliable and gives optimum results time after time. Keep in mind that it is only possible to produce a certain per cent of alcohol, 9% to 16% by volume, depending on what type of yeast you use (at the right temperatures), regardless of 'pet' additions such as molasses, corn sugar, cornmeal, wheat, large quantities of juices, etc. Therefore the 'basic' ferment saves money.

[1] Ten pounds refined sugar (always 2 lbs per imperial gallon) dissolved in lukewarm (80 F) RAW WATER before pouring into your container.

[2] One cup of baker's yeast. If this large amount causes raised eyebrows, read over "Rate of Fermentation", page 3, again. Also, according to the text, yeasts multiply most rapidly in the presence of a supply of air; however, by using a large amount of yeast at the start (one cup per five-gallon mix) it is not necessary to start a culture of sugar-water-yeast and later add this mixture to the batch.

[3] One teaspoon of ammonium phosphate-dibasic, or, as explained in [4] under "Alcoholic Yield and By-products of Fermentation", page 3, a close substitute. The addition of this chemical booster will shorten the time the batch works.

page 4

[4] After the above items have been put into the mash container, fill the container to the 5-gallon mark. THE BEST METHOD OF ELIMINATING UNWANTED OXYGEN AFTER THE REACTION HAS STARTED IS TO STOPPER THE CONTAINER AND LEAD A HOSE OR TUBE FROM THE CONTAINER TO A CAN OR BOTTLE FILLED WITH WATER. This allows the carbon dioxide gas to bubble off through the water, thereby preventing oxygen from entering the container, otherwise, if the ferment stands too long without an adequate 'check valve', a vinegar process could start turning the mix sour.

[5] As stated under "General Conditions of Alcoholic Fermentation", page 2, and "Rate of Fermentation", page 3, temperature control of the ferment is very important. Keep your batch within the 75 F - 85 F range and never over 90 F.

[6] Up to now, if the steps have been faithfully followed, your mix will stop working in about 6 to 9 days. Although the ferment might stop working in this time estimate, it takes several days more for the batch to settle. The best practice is to keep two or three batches in the various working stages so that you can allow the ferment to clear up or settle before running. Apparently, although this point is not covered in the text, the longer a stoppered batch 'sits' up to a certain time limit, the better the yield. The reason the mix stops working is that the higher the percentage of alcohol in your batch, the more yeast cells die until the alcoholic content is so high that all yeast cells die, and your mix stops working. Baker's yeast yields around 9% to 10% alcohol, wine yeast, on the other hand, yields 14% to 16%, because wine yeast has a greater tolerance for alcohol. Therefore, a cup of baker's yeast (dry) for each 10 lbs of refined sugar is about the right concentration of yeast for our purpose. We are also reasonably sure that the distilled product from a sugar-water-yeast-chemical booster ferment will contain only ethyl alcohol, carbon dioxide and distilled water at the end of a four-run process as described in this article.

We make this statement even though it is contrary to the facts as set forth in "Alcoholic Yield and By-products of Fermentation", but keep in mind that we said 'reasonably sure', and it only deals with the fermentation process, whereas our statement concerns the product after the four- run distillation process.

page 5

Distillation Theory

A simple definition of distillation is: the separation of the components of a mixture by partial vaporisation of a mixture and the separate recovery of the vapour and the residue; i.e. distillation is a method of separation and concentration, based on differences in volatility. The apparatus in which this process is carried on is called a STILL, of which the essential parts are:

- [1] The kettle in which vaporisation is achieved.
- [2] The connecting tube which conveys the vapour to the condenser.
- [3] The condenser where the vapours are re-liquified.
- [4] The receiver in which the distillate is collected.

Modifications involving the addition of other parts to the still are introduced for various purposes such as conservation of heat and to effect rectification. The condensed vapours, returning to accomplish rectification, are called reflux. In other words, a simple distillation is a means of separating a volatile liquid from a non-volatile residue. A fractional distillation is a means of separating liquids of different volatility. Fractional distillation rests on the fact that no two liquids of different chemical composition have the same vapour pressure at all temperatures, nor very often the same boiling point. However, every liquid has a definite vapour pressure at any given temperature. The various types of stills may be classified as: Pot stills; Coffey or Patent stills; Vat stills; and Continuous stills. *Il y a le pot still, simple alambic comme en Charente pour le Cognac ou en Ecosse pour certains single malts ; Coffey est un alambic en continu pour les whiskies courants ; moi je me fabrique un reflux still a géométrie variable, soit gestion du reflux, soit gestion de la vapeur : lire le PDF de Nixon...*

Cleaning the Still

There are too many variations of the four types of still in our interesting hobby to attempt an explanation of each 'cooker', but our chief worry, regardless of type, is cleanliness and the prevention of accidents and fires.

Keeping a clean still is only common sense and is greatly simplified if your cleaning begins immediately after the last run while the metal is warm. Use water to wash out all parts and keep the kettle well-scrubbed. Do not use soap, as it might impart a disagreeable taste to your product. It is necessary to supplement the plain water rinse by establishing the following cleaning practice at least once a month:

page 6

Dissolve cup of salt in about 16 oz of vinegar and pour this solution back and forth through the tubing several times, then rinse thoroughly with water.

This procedure is all that is necessary for the pot still, but the reflux types need special attention to the cleaning of the reflux chamber and the 'marbles', helices, etc.

Safety Precautions in Distillation

The home distillation of alcohol CAN be either very hazardous or reasonably safe, depending upon the degree of care taken. Unfortunately, accidents have occurred resulting in burns to people and

destruction of property. These accidents can be well summed-up in General "Hap" Arnold's message, in which we have substituted the word `distilling' for `flying'. "DISTILLING IS NOT INHERENTLY DANGEROUS, BUT, LIKE THE SEA, IT IS TERRIBLY UNFORGIVING OF CARELESSNESS, INCAPACITY OR NEGLIGENCE."

In this discussion the unsafe practices which produce the majority of all distilling accidents are described and the proper method of operation to eliminate the hazards is set forth for your safety.

First, we must recognise and accept the fact that for all practical purposes, **WHEN DISTILLING ALCOHOL WE MIGHT JUST AS WELL BE DISTILLING GASOLINE**. Take a look at the comparable properties, given in the table on the following page:

page 7

Characteristic	Alcohol (160 proof)	Gasoline (Average grade)
Flash point (alcohol from condenser is well above this temperature)		68 F 45 F
Ignition temperature (any flame or electric spark is above temperature)		793 F 536 F
Explosive limits (% by volume -note wide range of vapour/air mixture which can be ignited)	4.3% to 19%	1.4% to 7.6%
Vapour density (Air = 1) (although there is a tendency for rich alcohol vapours to settle, it should be noted that alcohol/air mixtures in the flammable range have a specific gravity only very little greater than that of air (1.02 - 1.11); therefore, air currents will distribute such mixtures widely)		1.59 3 to 4

IT SHOULD BE OBVIOUS FROM THE ABOVE DATA THAT, FROM THE FIRE POINT OF VIEW, ALCOHOL IS ALMOST AS HAZARDOUS AS GASOLINE. BOUM!!!

page 8

[1] IF YOU USE GLASS BOTTLES FOR MASH, BE SURE THAT THE BOTTLES ARE TAPED WITH MASKING TAPE to avoid the hazard of cuts from broken glass. Should the bottle break, there is no fire hazard from the mash, because the alcohol content of the mash is too low to create a flammable mixture at ordinary room temperatures. Never attempt to carry heavy 10-gallon bottles: their structural strength may be insufficient and they have been known to fracture upon the slightest impact. Also, the strength of your back is inadequate in an awkward position. Use a dolly to transport the bottle on or, better yet, siphon into the still. The best bet is to get metal or plastic containers from one of the main mail order houses.

[2] **NEVER FILL A STILL ON THE STOVE**. Of all the dangerous things to do, the second most hazardous is to fill a still with second or subsequent runs when the still is on the stove. Even though the fire is out, the pilot light or oven may be lit. Any spillage of alcohol at this time can get you into serious trouble. If the vapour flashes, you will probably drop the dispensing container, with the likelihood of splashing flaming alcohol on yourself or others, as well as starting a large fire.

ALWAYS CHARGE THE STILL ON THE FLOOR AWAY FROM THE OVEN and, if it is too heavy for one person to lift, get help. Any of your friends will help in this important endeavour. To form correct habits, this practice should be followed even to charge the still with mash.

[3] **NEVER LEAVE A STILL UNATTENDED** - THIS IS THE MOST HAZARDOUS ACTION OF ANY AND IS ABSOLUTELY INEXCUSABLE.

First: Condenser water can fail due to -

- a. Failure of hose lines.
- b. Low water pressure.
- c. Shutdown of utilities.
- d. Failure of condenser shell.

Without adequate condensing means, alcohol vapours will rapidly spread within the room until a source of ignition is reached. The degree of flash fire will depend upon the accumulation of vapours, but in most cases the fire is immediately beyond control. If the concentration of vapour is sufficiently widespread, an explosion can occur. **REBOUM!!!**

Second: The receiver can overflow. This will create a large area from which the alcohol can vaporise. Usually under these conditions the flash point is reached. Flash point is defined as the lowest temperature at which a liquid will give off flammable vapour at or near its surface. This vapour forms an intimate mixture with air, and it is this mixture which ignites.

page 9

[4] LOCATE THE DISTILLED ALCOHOL RECEIVER AT AS LOW A LEVEL AS POSSIBLE and extend the run-down tube from the condenser to the bottom of the receiver. L'alcool est plus lourd que l'air !

First: Placing the receiver at a low level will tend to keep any alcohol vapour away from the flames at the top of the stove. Note that any flames (main burners or pilots) in the oven or boiler units are usually lower and tend to draw the air for combustion from a low level; therefore, all flames, including the pilots, in ovens or boilers, should be turned off. In a few of our stoves (older Wedgewood models) all pilots are controlled from a single safety shut-off valve that shuts down the entire stove if an oven pilot goes out - on these stoves it is impossible to cut off the oven pilot and keep the top burners operating, therefore, for such cases, the receiver should be located at least 3 feet away from the bottom of the stove and the recommendation in "PLACE THE RECEIVER IN AN AUXILIARY CONTAINER", paragraph [6], must be followed.

Second: When the run-down tube extends to the bottom of the receiver and becomes submerged in the liquid, there are several safety features created:

- a. The alcohol liquid that contacts air is reduced to only the still surface in the receiver.
- b. If any alcohol vapour remains uncondensed, it will bubble in the liquid receiver and serve as a warning of insufficient condensing capacity.
- c. If there is abundant condensing capacity, the condenser will establish a partial vacuum in the system and draw up a liquid head that will stand in the run-down tube. This will be proof of adequate condensing capacity.

NOTE: When the still is first started, it contains air above the liquid. This air must be displaced; therefore, the end of the run-down tube may bubble at first.

[5] USE A RECEIVER WITH A SMALL FILLING OPENING. A small opening cut down on the quantity of vapours escaping into the room and it also saves you alcohol. If a fire does occur at the receiver, it will burn at the small opening and be easily controlled. With a large opening, the fire will be much larger, a lot more heat will be rapidly given off, and the fire will be more difficult to contain. If such should occur, extinguish all sources of flame and follow the suggestions in paragraph 10, "IN CASE OF ACCIDENT, IMMEDIATELY CALL THE FIRE DEPARTMENT".

[6] PLACE THE RECEIVER IN AN AUXILIARY CONTAINER. If the receiver is placed in a dishpan or other type of auxiliary container, an accidental overflow will be restricted much more than would be the case if it should run out on the floor.

[7] **BE SURE EXHAUST FANS OR OTHER MEANS OF VENTILATION ARE USED TO REDUCE THE POSSIBILITY OF ALCOHOL VAPOUR ACCUMULATION.!!!**

sinon: **REREBOUM!!!**

Ce n'est pas aussi dangereux si vous n'avez qu'un alambic de deux litres et demi, mais quand même

[8] NEVER USE A STILL IF YOU DO NOT HAVE COMPLETE CONFIDENCE IN THE EQUIPMENT. Stills should be of welded or brazed metal construction with metal tubing and tight-fitting slip joints or bolted gasket heads. All joints should be carefully made up to avoid leaks of either vapour or liquid alcohol. CONDENSER CAPACITY SHOULD BE ADEQUATE for the maximum rate of distillation. If you are not qualified to appraise the condition of your equipment or its method of operation, get a qualified friend to make the inspection for you.

[9] DON'T STORE UNCUT ALCOHOL. If a fire should involve this highly flammable liquid, the situation could rapidly become very serious. Cut your alcohol BEFORE you store it. Alcohol cut to 90 proof has a flash point of 77 F, whereas 160 proof alcohol has a flash point of only 68 F.

[10] IN CASE OF ACCIDENT, IMMEDIATELY CALL THE FIRE DEPARTMENT. DO NOT DELAY, OTHER THAN TO GET ALL OCCUPANTS OUT OF THE HOUSE. It is a good practice to have your garden hose attached to the outside faucet and readily available. An alcohol fire can be extinguished with water if the alcohol is sufficiently diluted. However, the heat release is so rapid that, except for very small fires, you will need trained help in handling the situation. DON'T DELAY IN EVACUATING THE HOUSE AND CALLING THE FIRE DEPARTMENT; then do the best you can to control the situation.

[11] Above all else:

- a. DON'T LEAVE A STILL UNATTENDED!
- b. DON'T DRINK AND RUN THE STILL!
- c. DON'T RUN THE STILL IF YOU ARE SLEEPY!!!

Distillation can be interesting and it can be reasonably safe, but don't spoil it through unintelligent operation or plain carelessness. Though you may be a brave soul with lots of luck, don't expose yourself and other people to serious injury or yourself to liability for serious property damages. REMEMBER, IF AN ACCIDENT OCCURS, YOU ARE THE CAUSE AND THE ONE LEGALLY RESPONSIBLE.

[12] One special word of caution for those who use immersion heaters. These heaters must be completely immersed in liquid all the time. If they are not, they will overheat and be destroyed. If this happens while a flammable mixture of alcohol vapour and air is in the top portion of the still, an explosion will occur. Such an explosion would be extremely dangerous both from a standpoint of flying parts of the still and a very rapid spread of fire.

Common Pot Still

This section deals with the 3 or 4 run system, using a basic sugar-water-yeast-chemical booster ferment, and the common pot still apparatus. Incidentally, the reflux chamber stills are excellent

(one run equals four runs in pot stills) but the majority of us use a pot still over a gas flame; therefore, in this section we will concern ourselves with this method. Be sure your thermometer is mounted in the vapour space chamber so that temperatures will be vapour temperatures. Do not mount your thermometer in the liquid; keep it AT LEAST 3 inches above the liquid level.

Running the Still

Using the ferment described in "The Basic Batch", page 4. NOTE: TURN ON EXHAUST FAN FOR ALL RUNS.

First Run: Run to 207 F or 97.2 C

Pour your ferment into the kettle up to the 5-gallon mark and set up the apparatus. Adjust your condenser and turn on the flame or flames FULL BLAST. (This section is based on a one-burner heat source - if you can use two burners, your times will be considerably shorter.)

44 F indicates the start of air moving through the system. Depending on the alcohol and water proportions, as well as the temperature of the mix before heating, the run should start in about one hour between 170 F and 175 F. Approximately two hours later, when 207 F is reached, you will have a good working stock of about one or one and a fifth gallon. BUT if your ferment temperatures were too high, you might be unlucky and get only gallon! (See "Rate of Fermentation," page 3.)

page 12

Your first run distillate should amount to about 40% ethyl alcohol and 60% water and by-products. Disconnect the kettle and POUR OUT THE RESIDUE. Be careful while pouring out the hot residue, as splashes might cause you to drop the container resulting in painful burns. A good way to empty a large still is to use a piece of garden hose as a syphon. Put one end in the liquid and fill the hose by turning on the water faucet. As soon as all the air is removed, disconnect the hose from the faucet and let the liquid syphon down the drain. At this point it is a good idea to rinse out the tubing so that any lurking `solids are flushed away.

We might also add that sometimes one gets anxious and runs before the mix stops working the green or unsettled batch bubbles inside the pot. Consequently, if there is not enough space above the level of the liquid in the kettle, solids will come over and cause the condensate to turn milky in the receiver. This is also caused by running `full blast' or, in other words, there is too much heat applied to the pot.

If this should be the case, keep on running at a REDUCED HEAT and when you finish, be SURE to rinse out the entire apparatus thoroughly before starting the second run. Incidentally, unless you have had lots of experience, it is not a good idea to run at `full blast' for the entire run. Most of us use the high heat only to cut down the heating period of the batch.

Second Run: Run to 204 F or 95.6 C

Pour your first run into the kettle as it is, do NOT add water. Set up the apparatus again and turn on the heat TAKING GREAT CARE THAT THE KETTLE IS BUTTONED UP. This time results come faster. At about 170 F - 180 F (76.7 C - 82.2 C) it starts, and in about one hour the 204 F mark is reached. If you are lucky, you should have about 0.75 gallon of about 70% ethyl alcohol, and the remainder water and by-products. Once again, pour out the waste, and, if you wish, rinse out the tubing. We now have a pretty good stock, but yeast waste and other by-product traces are definitely there, although in very small proportions. At this point, remember, 70% alcohol is 140 proof and has a flash point of 70 F. **YOU NOW HAVE A VERY FLAMMABLE PRODUCT**

Note: Multiply % alcohol x TWO to get `proof' i.e. 90 proof whisky is 45% alcohol

page 13

Third Run: Save everything from 170 F - 184 F (76 7 C - 84 7 C)

This is the run that counts, the first two runs served to get us a good working stock, now we start to refine it. Pour in your second run without adding water, button up the apparatus, and turn on the heat. Stand by to watch your thermometer. At about 150 F - 160 F the needle or column really moves fast to the 170 F - 172 F mark; this jump is normal, don't let it worry you. Throw away whatever comes off before 170 F (or that which comes off before the trickle steadies into a solid stream) and save the rest up to 184 F. Time for this third run is about hour, and the distillate will amount to about gallon, which will be around 82% to 87% ethyl alcohol and the remainder water and very, very small traces of by-products. Some of us stop here and call it quits. The elapsed time from start to this point is about 4 hours.

Fourth Run: Save everything from 170 F - 180 F (76 7 C - 82 2 C)

Now we are on the home stretch. Pour in your third run without adding water, button up and turn on the heat. As before, the needle will jump to the 170 F to 172 F mark. Throw away whatever comes off before 170 F to 172 F and keep the rest up to 180 F. This time the run will last only about hour and will amount to about gallon consisting of 90% to 95% ethyl alcohol and the remainder distilled water. We are betting our first drink on the fact that the by-products will be negligible. Now you have an excellent base for any type of liquor you care to concoct.

Notice that we have not once run according to proof; now, bring out your hydrometer, and let's cut the fourth run back to about 90 proofs. Be sure that you use your hydrometer at the correct temperature, usually 60 F; otherwise, if the product is warmer than prescribed, there will be an error in proof. After cutback, you should now have about 0 8 to 1 5 gallons of the finest raw whisky this side of the Esk (well ...). Here's a thought: don't worry if your ferment didn't start running at the temperature we've indicated; it is rare that two batches are exactly alike in alcoholic content; therefore, there will be differences in initial boiling temperatures as explained in the footnote below.

NOTE: These temperatures are approximate. It is very difficult to run exactly according to the prescribed degree because:

- a. Your thermometer might be off.
- b. Percentage of alcohol vs. water may vary considerably, even though you have followed correct instructions.

page 14

Therefore, as you gain experience, you will learn to judge both temperatures and the strength of the first trickle during the third and fourth runs. Usually you throw away that which comes off before the trickle steadies.

Reflux Column Distillation Units

[1] APPARATUS: Essentially there will be a pot (5 to 20 gallons), a packed column (1 to 3 feet) and a condensing system. Ce n'est pas votre potstill une « packed column » c'est un reflux still avec une colonne contenant des éponges à récuser les casseroles en paille d'inox

The pot requires little comment except to state that operators of gas-heated units should be careful because the produce is nearly pure ethyl alcohol and thus extremely combustible. The top and sides of the pot should be insulated.

The usual packing materials are - stainless steel mesh or turnings, glass beads or rings, and porcelain saddles. When packed normally, one can expect 6 inches of packed column height to be equivalent to one stage. Thus, the pot and 1 feet of packed column will be equivalent to the 4-run pot still. The outside of the column will need insulation, otherwise too much internal condensation will occur due to heat loss to atmosphere.

There are two schools of thought on the need of an internal reflux condenser. Certainly, if one is used, then careful control must be exercised, otherwise the column may become flooded and thus impair efficiency of separation. There should be a separate needle valve for controlling internal reflux water - do not allow the complete condenser water stream to pass through the internal reflux condenser. One way to decide on the need of internal reflux is the adequacy of the column insulation. If the column is not well- insulated, then the need for internal reflux is lessened.

[2] OPERATION: As in any distillation, the faster the rate of distilling, the lower the efficiency of separation. If a 3-foot column is used, the process can be forced and still yield good product with one run. If a short column (1 foot of packing) is used, a lower rate is desirable in order to get by with one run.

[3] CLEANING: The cleaning operations of a reflux column depend on one's techniques of distilling. After every batch, one should backwash the column, and after 4 or 5 batches, the column packing should be removed and cleaned thoroughly - hot, soapy water, vinegar rinse, raw water and sweet water.

page 15

Ageing

It was supposed for a long time that by ageing straight whisky in charred wood a chemical change took place which rid the liquor of fusel oils, and this destroyed the unpleasant taste and odour. It now appears by chemical analysis that this is untrue - that the effect of ageing is only to dissipate the odour and modify the raw, unpleasant flavour, but to leave the fusel oil still in the straight whisky. Fusel oil sont des composants lourds, huileux, de fin de distillation ou bien dus à une distillation trop rapide.

It is known that wood absorbs some of the undesirable components while some of the materials in the wood are, in turn, dissolved by the whisky. At the same time, some of the secondary products are changed into acids and esters, so that in matured whisky many of the secondary components are actually present in HIGHER content than in green liquor. The esters increase in matured whisky, but to a lesser extent, while the furfurol and higher alcohols, i.e. fusel oil, remain practically unchanged. There is also the change in proof in whisky stored in wooden barrels, since water diffuses more rapidly through the pores of the wood than does alcohol.

The above paragraph throws a new light on the subject. Apparently, it is not true that ageing in charred wood gets rid of the undesirable by-products, but still some of us like the taste of the esters because that's what gives the 'whiskey taste' to Stateside liquor.

It follows, then, that RUNNING ACCORDING TO TEMPERATURES IS ONE OF THE BEST WAYS OF GETTING RID OF UNWANTED BY-PRODUCTS.

In the past, some people have used the technique of accelerated ageing by double-boiler heating of 90 proof alcohol and wood chips. We definitely DO NOT recommend this method because, first, alcohol vapours are released above the flame of the stove, which is hazardous, and second, the method requires a loose-fitting cap on the alcohol container. It is difficult to specify what is loose and what is not. If the cap should accidentally be fastened too tightly, it is possible that pressure can build up inside the container, and it might explode. This is a double hazard because of the shrapnel-like articles of the container and the sudden release of the flammable alcohol vapours.

page 16

Endnote

The story is that "The Blue Flame" was written for circulation amongst expatriate Britons in countries where alcohol was difficult or impossible to get. One rumour, and it is probably no more than that, is that it was put together by the staff of one of Her Majesty's representations in the Middle East, the idea being that since people were going to do it anyway, they might as well be provided with instructions for doing it safely. (Cynics might think this too common sense an attitude for diplomats of any country to adopt.)

Would-be experimenters should be warned that, in the UK at least, a licence is required to manufacture poteen. These are not easy to get. Laws will vary from country to country, as will penalties for breaking them. In some countries the penalties can be violent and painful. In the UK they are merely undignified. In a country where the penalties are severe, you might prefer to let someone else take the risk if you can get a supply at an affordable price. Shabby, but 'watching the wall' means you don't get parts cut off you. It seems to be the case in practice that compounds of foreign workers in these countries will have well-established means of getting or making alcohol and are pretty safe. You just need to get to know someone.

I'm told the title "The Blue Flame" derives from a test for suspect alcohol. I can't vouch for the chemical reliability of the test, but here it is:

Heat a small amount of the spirit in a pan until it is well warmed. Turn off the heat, then put a flame to the warmed alcohol. If it is 'clean' spirit with few impurities, it should burn with a steady blue flame. If the flame is flecked with yellow or orange, or if the flame sputters while burning, do not drink it - use it as an embrocation instead. **Ca c'est vrai...**

If you value your organs, make sure any spirit made in this way is cut. If you don't have a hydrometer, a rule of thumb is equal quantities of tap-water and alcohol. Do this even if you intend to mix it further with tonic or fruit juice. Try cutting a cupful first - taste will guide you to the right proportions of water and firewater. Petite nature va...