Leonard Monzert's
Practical Distiller

Leonard Monzert, Professional Distiller and Rectifier


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MONZERT'S
PRACTICAL DISTILLER
AN EXHORCISTIC TREATISE ON
THE ART OF DISTILLING AND RECTIFYING
SPIRITUOUS LIQUORS AND ALCOHOL
GIVING
DIRECTIONS FOR CONSTRUCTING AND OPERATING THE STILLS AND THEIR
APPARATUS IN PRACTICAL USE; A NEW PROCESS OF DISTILLATION
FREE FROM FUSEL OIL; THE BEST METHODS FOR DIS-
TILLING ESSENTIAL OILS, EXTRACTS, FLAVORINGS,
ETC.; THE MOST MODERN APPLIANCES FOR
THE MANUFACTURE OF VINEGAR; THE
FORMATION AND PROPERTIES OF
ALCOHOL, WITH OTHER
VALUABLE INFORMATION
FOR
DISTILLERS, COMPOUNDERS AND LIQUOR DEALERS
INCLUDING
TABLES OF PERCENTAGE, SPECIFIC GRAVITY, ETC.
AND
A COMPLETE DESCRIPTION OF THE FRENCH APPARATUS FOR THE
PRODUCTION OF PURITY ALCOHOL BY CONTINUOUS
DISTILLATION AND RECTIFICATION
ILLUSTRATED BY NUMEROUS DIAGRAMS

By LEONARD MONZERT
Professional Distiller and Rectifier
pots to the complicated alcohol rectifying apparatus, with its tall column and powerful condensers, are all clearly explained.

The distillation of essential oils, the production of flavoring extracts, the formation and purification of alcohol, the proper management of liquors, are all well worthy of consideration. Each subject is treated separately and in a manner which can not be misunderstood.

The author has been specially careful to avoid the introduction of abstruse problems and intricate chemical analysis, as tending to perplex rather than aid the practical operative.

It will be seen upon perusal that this work has been written by one who, although laying no claim to literary ability, is thoroughly conversant with the subjects upon which it treats, and he submits with full confidence the results of his labor to a discerning and appreciative public.
<table>
<thead>
<tr>
<th>CONTENTS.</th>
<th>PAGE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISTILLATION OF LIQUORS—Continued.</td>
<td></td>
</tr>
<tr>
<td>GIN</td>
<td>48</td>
</tr>
<tr>
<td>RUM</td>
<td>49</td>
</tr>
<tr>
<td>BRANDY</td>
<td>50</td>
</tr>
<tr>
<td>RECTIFYING OR LEACHING</td>
<td>51</td>
</tr>
<tr>
<td>THE COLUMN</td>
<td>52</td>
</tr>
<tr>
<td>THE GOOSE</td>
<td>57</td>
</tr>
<tr>
<td>DISTILLATION OF ALCOHOL</td>
<td>58</td>
</tr>
<tr>
<td>ALCOHOL REFINING</td>
<td>64</td>
</tr>
<tr>
<td>DISTILLATION OF VOLATILE OILS</td>
<td>68</td>
</tr>
<tr>
<td>SEPARATION OF VOLATILE OILS AND WATER</td>
<td>68</td>
</tr>
<tr>
<td>STILL FOR VOLATILE OILS</td>
<td>69</td>
</tr>
<tr>
<td>APPLE OIL</td>
<td>70</td>
</tr>
<tr>
<td>PINE-APPLE OIL (BUTYRIC ETHER)</td>
<td>72</td>
</tr>
<tr>
<td>EXTRACTS</td>
<td>72</td>
</tr>
<tr>
<td>THE WATER-BATH STILL</td>
<td>73</td>
</tr>
<tr>
<td>ESSENCES AND LIQUEURS</td>
<td>76</td>
</tr>
<tr>
<td>ESSENCE OF GIN</td>
<td>76</td>
</tr>
<tr>
<td>RED KALAMIA</td>
<td>77</td>
</tr>
<tr>
<td>ANISETTE</td>
<td>79</td>
</tr>
<tr>
<td>ABSINTHE SCISSE</td>
<td>80</td>
</tr>
<tr>
<td>MARASCHINO</td>
<td>82</td>
</tr>
<tr>
<td>CURACAO</td>
<td>83</td>
</tr>
<tr>
<td>DOUBLE CURACAO DE HOLLANDE</td>
<td>83</td>
</tr>
<tr>
<td>BLENDING AND COMPOUNDING</td>
<td>84</td>
</tr>
<tr>
<td>COMPOSITION OF WINES AND LIQUEURS</td>
<td>85</td>
</tr>
<tr>
<td>PERCENTAGE OF ALCOHOL IN WINES, &amp;c.</td>
<td>86</td>
</tr>
<tr>
<td>HINTS FOR COMPOUNDERS</td>
<td>87</td>
</tr>
<tr>
<td>TO REMOVE A BAD TASTE</td>
<td>87</td>
</tr>
<tr>
<td>FLAVORINGS FOR COMPOUNDED LIQUEURS</td>
<td>88</td>
</tr>
<tr>
<td>THE FORMATION OF ALCOHOL</td>
<td>90</td>
</tr>
<tr>
<td>CONVERSION OF STARCH INTO GRAPE SUGAR</td>
<td>91</td>
</tr>
<tr>
<td>CONVERSION OF SUGAR INTO ALCOHOL</td>
<td>91</td>
</tr>
<tr>
<td>ALCOHOL WITHOUT DISTILLATION</td>
<td>93</td>
</tr>
<tr>
<td>ABSOLUTE ALCOHOL</td>
<td>94</td>
</tr>
<tr>
<td>ALCOHOLIC ETHER</td>
<td>96</td>
</tr>
<tr>
<td>FUSEL OIL</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>THE MANUFACTURE OF VINEGAR</td>
<td>97</td>
</tr>
<tr>
<td>VINEGAR GENERATOR</td>
<td>98</td>
</tr>
<tr>
<td>CONVERTING ALCOHOL INTO VINEGAR</td>
<td>98</td>
</tr>
<tr>
<td>VINEGAR BY THE QUICK METHOD</td>
<td>100</td>
</tr>
<tr>
<td>FRENCH VINEGAR</td>
<td>101</td>
</tr>
<tr>
<td>FRENCH VINEGAR—POWDER</td>
<td>102</td>
</tr>
<tr>
<td>TO STRENGTHEN VINEGAR BY DISTILLATION</td>
<td>102</td>
</tr>
<tr>
<td>THE CONTINUOUS RECTIFIER</td>
<td>103</td>
</tr>
<tr>
<td>ITS CONSTRUCTION</td>
<td>104</td>
</tr>
<tr>
<td>THE COLUMN AND COTONETTE</td>
<td>104</td>
</tr>
<tr>
<td>THE CLAMPS</td>
<td>109</td>
</tr>
<tr>
<td>TO OPERATE THE CONTINUOUS RECTIFIER</td>
<td>112</td>
</tr>
<tr>
<td>THE FRENCH CONDENSER</td>
<td>113</td>
</tr>
<tr>
<td>THE ACTION OF THE COLUMN</td>
<td>120</td>
</tr>
<tr>
<td>THE EPIVOUETTE</td>
<td>123</td>
</tr>
<tr>
<td>FACTS ABOUT ALCOHOL</td>
<td>125</td>
</tr>
<tr>
<td>PROPERTIES OF ALCOHOL</td>
<td>126</td>
</tr>
<tr>
<td>TESTS FOR ALCOHOL</td>
<td>127</td>
</tr>
<tr>
<td>PHYSICAL EFFECTS OF ALCOHOL</td>
<td>128</td>
</tr>
<tr>
<td>ALCOHOL AS AN ANTISEPTIC</td>
<td>130</td>
</tr>
<tr>
<td>ALCOHOL AS A STIMULANT</td>
<td>131</td>
</tr>
<tr>
<td>ADULTERATION OF LIQUORS, &amp;c.</td>
<td>133</td>
</tr>
<tr>
<td>SHRINKAGE IN ALCOHOLIC LIQUORS</td>
<td>136</td>
</tr>
<tr>
<td>CHEMICAL COMPOSITION OF ALCOHOL</td>
<td>137</td>
</tr>
<tr>
<td>CARBON</td>
<td>138</td>
</tr>
<tr>
<td>HYDROGEN</td>
<td>139</td>
</tr>
<tr>
<td>OXYGEN</td>
<td>139</td>
</tr>
<tr>
<td>WATER</td>
<td>143</td>
</tr>
<tr>
<td>PROOF SPIRITS AND PERCENTAGE</td>
<td>146</td>
</tr>
<tr>
<td>TABLE OF PERCENTAGE AND SPECIFIC GRAVITY</td>
<td>149</td>
</tr>
<tr>
<td>TABLE OF PERCENTAGE AT ANY TEMPERATURE</td>
<td>152</td>
</tr>
<tr>
<td>BRAUMÉ'S HEAVY HYDROMETER</td>
<td>152</td>
</tr>
<tr>
<td>TABLE OF SPECIFIC GRAVITY OF BRAUMÉ</td>
<td>153</td>
</tr>
<tr>
<td>TO REDUCE THE STRENGTH OF ALCOHOL</td>
<td>153</td>
</tr>
<tr>
<td>TABLE FOR REDUCING ALCOHOL</td>
<td>154</td>
</tr>
<tr>
<td>TO INCREASE THE STRENGTH OF ALCOHOL</td>
<td>154</td>
</tr>
<tr>
<td>BOILING HEAT OF SATURATED SOLUTIONS</td>
<td>155</td>
</tr>
</tbody>
</table>
THE PRACTICAL DISTILLER.

PRELIMINARY OBSERVATIONS.

The production of spirituous liquors, or what may be called the art of converting the substance of plants, seeds and fruit into alcoholic spirits, is a remarkably extensive as well as remunerative industry, not only in the United States, but in nearly all parts of the Civilized World. Every country produces alcoholic spirits of some sort under various denominations, such as Brandy, Gin, Rum, Whiskey, Arrac, Poteen, etc., all of which owe their respective intoxicating properties to the amount of alcohol which they contain.

Brandy (Eau de vie) is the French spirits; Gin is that of Holland; Great Britain produces Whiskey; India, Arrac, and the West Indies, Rum; while in the United States, liquors of every description are produced in abundance.

These liquors differ in quality and flavor, according to the nature of the material from which they are obtained, as well as the manner of their production.

Fermentation and distillation are the two principal operations by which alcoholic substances are obtained.
Malting and masking are subservient to these and in many instances are dispensed with altogether.

At what remote period of the world's history distilling became known is only a matter of conjecture. We are told that many centuries ago, when the Alchemist was looked upon as something more than human, a fiery liquid was produced by some Monks which was supposed to possess unlimited curative powers. This was called by them "The Spirit of the Wine," and subsequently "Spirits of Wine" (in French, "Esprit du vin", in German, "Weingeist"), and was employed as a most wonderful medicinal agent.

A century or two afterwards, a hermit in the South of France discovered that by boiling wine in earthen pots, and condensing the vapors, a highly aromatic cordial was obtained; which, when imbibed, produced such stimulating effects that it became known as the "water of life" (Eau de Vie). *

This was in all probability the first alcoholic liquor produced; and, as generation succeeded generation, the crude earthen pots were discarded to make way for the more modern appliance called the Still or Alembic.

Previous to entering into the details of constructing and operating the Still and the manner of obtaining alcoholic liquors, it may be well to offer a few brief remarks, which are intended to serve as a preliminary or rudimentary review of the whole system by which alcoholic products are obtained.

The art of distilling consists of extracting the sugar, or what is known as the saccharino matter, which is contained in various vegetable substances, and converting it into alcohol, which is the basis of all intoxicating liquors. This result is obtained by fermenting the juice of grapes, apples, and other fruit and also the extract of grain. The fermenting process differs according to the nature of the material employed.

Grapes and fruit juices contain a natural ferment, which, as soon as exposed to the air, becomes active and produces what appears to be a spontaneous fermentation, which converts the juice into wine. As soon as this transformation is complete, the wine is distilled and the result is brandy.

When grain is employed, as is the case in the manufacture of whiskey, high-wines and alcohol, the system is more complicated; more skill is required, and a greater amount of vigilance is necessary, than when grapes or other fruits are used.

The substance of grain consists principally of starch. This body is not fermentable, and must therefore be converted into grape-sugar previous to being transformed into alcohol. This is done by the action of a process called "malting."

This newly formed substance is extracted from the grain by another process known as "mashing"; it is then fermented and distilled, and the distillate is whiskey.

These four operations, Malting, Mashing, Fermenting and Distilling will be explained, each under its proper heading.

* In all parts of France the common name of brandies is Eau de Vie.
MALTING.

The first operation toward converting the substance of grain into spirits consists of malting. This in itself is a simple and yet a very tedious process, which must be done in a well-ventilated room.

Put a quantity of barley into a tub; pour cold water over it until the water reaches six inches above the grain. Allow it to remain until it becomes stale and emits a foul odor, then draw it off and replace with fresh water.

Let this stand as before until the grain becomes quite soft, and can be easily pressed between the fingers.

Draw the water off, and pile the grain up on the floor in separate heaps, about ten inches high.

It will be observed that the outside of these heaps soon becomes dry, while the interior becomes warm; the grain is then turned with great care so as to avoid breaking the seed.

When well mixed (the dry with the wet, the warm with the cold,) pile it up again as before. Repeat this operation every six hours until the germ has grown as long as the seed.

Spread the grain on the floor to the thickness of about two inches; turn it often, in order that it may dry very rapidly.

When dry, remove the germ from the seed by sifting through a sieve coarse enough to allow the germ to pass through but not the seed. When this has been done, dry it again until not a particle of moisture remains.

The result is Malt;—the basis of Ale, Beer, Porter, Whiskey, High-wines and Alcohol. The malt is ground into coarse meal, or crushed, two days before it is required for use.

MASHING.

Pure malt is sometimes employed in the production of liquors; this however is very seldom the case, especially for whiskey, although it is an acknowledged fact that pure malt makes the best liquor. The usual proportions are, one bushel of malt to from four to seven bushels of unmalted grain ground into coarse meal, and eighteen gallons of water to each bushel of this mixed meal. The water is heated to 160 degrees Fahrenheit, and run into a very shallow tub (See Mash Tub). Pour in the meal slowly while stirring briskly, and when it is well mixed allow it to stand two hours; then draw off two-thirds of the water from the meal and replace it by the same quantity that was drawn off, this second water being heated to 180°.

When this second water is well mixed with the grain, it is allowed to stand three-quarters of an hour, and is run off separately from the first.

Repeat this the third time with water heated to 190°, and allow it to stand one hour; then draw this off from the dregs.
The first drawing is run into cooling pans and as soon as cold enough, is then fermented. The other two are reserved for a second mashing and take the place of the same amount of first water, thus making the subsequent drawing much stronger. This is the system usually employed in making good whiskey.

In making high-wines the whole substance is boiled in order to extract every particle of saccharine matter from the meal; in this case the first and second drawings are run into the fermenting tub together, while the third is reserved to assist in the next mash.

Distillers differ in the manner of performing this operation. Some use more water than others; one may prefer boiling, another will insist that the whole substance can as well be extracted by steeping. One thing, however, can be vouched for;—if quantity is desired without regard to quality, boiling is decidedly the best; but long standing without boiling makes the finest liquor.

THE MASH TUB.

This is a very broad, shallow tub about fifteen feet wide by three feet in height; in the center is an upright revolving shaft, with two or four blades, each one foot wide, extending from the shaft to within three inches of the sides of the tub; (See Diagram No. 1) this is worked by steam or horse power. The blades are perforated with holes, which served to mix the water and meal.

In small distilleries the shaft is worked by hand.
and in many instances it is dispensed with altogether, the stirring being done with paddles, shaped like an oar, and operated by hand.

In large distilleries, a more effectual apparatus is employed. An upright shaft A (Diagram No. 2) is pivoted in a beam at F and works in a socket G in the centre of the tub's bottom. Four, and sometimes eight, horizontal arms extend at right angles to the upright A; at the end of each arm is a cog-wheel E which works in slotted gearing which extends around the entire rim of the tub. The arms are supplied with short paddles H H, &c., which reach to within two inches of the bottom of the tub. As the upright revolves the cog-wheel E causes the paddle to revolve in the mash tub as the wheel travels around the rim of the tub. Only one of the four (or eight) arms are shown in the diagram No. 2.

The construction of the horizontal arm and paddles will be better understood by Diagram No. 3.

A is the upright.

B is one of the horizontal arms, serving as an axle, and firmly secured to the upright.

C is a tubular collar, fitting on to the axle B, and having a cog-wheel E, securely fastened on the other end.

H is one of the paddles, which fit on the collar C, and are held in place by the screw I.

By this method of construction the collar C with its paddles, revolves freely on the axle B, the paddles revolving rapidly as the wheel E travels around the rim of the tub.

As a precautionary measure it may be well for the
inexperienced operator to observe the following precepts in order to insure a successful result.

In heating the water for mashing the grain, the temperature should conform to the requirements of the material employed. Pure malt will mix with much hotter water than unmalted grain; it is not so liable to clod up and form into lumps. The proper temperature is as follows:

For equal portions of ground malt and unmalted meal, heat the water to 160 degrees, Fahrenheit;
For one part malt, and two of grain, 150 degrees;
For one part malt and five of grain, 145 degrees;
For one part malt to ten of grain, 140 degrees.

The more malt is used the sooner will the wort clarify. The time required for the liquor to draw and become clear enough to run into the cooling pans is from one to two and a half hours.

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**FERMENTATION OF GRAIN.**

Fermentation is the third, and most difficult operation in the whole system. This is the great bug bear of the distiller, *La Bête Noire*, as the French say. The practical manner of conducting this operation will be first shown; and for the benefit of those who would become experts, an exhaustive, scientific review will be found on page 91 of this book.

Mix together five bushels of ground malt and fifteen of corn meal, or other grain not malted. Soak
the lot in hot water (See "Mashing") or boil it; then draw the liquor from the dregs.

Run it into a wide tub, and add to this liquor one gallon of good brewer's yeast, as soon as it has cooled down to 170 degrees.

This will start the fermentation.

The room in which the tub is placed must be kept at a temperature, not less than 65 nor more than 85 degrees. If the temperature can be raised or lowered so much the better, as the fermentation can be increased or checked at pleasure.

In a short time bubbles of gas will be seen to rise from all parts of this liquor. A ring of froth will form, at first around the edge, then gradually increasing and spreading until it meets in the center, and the whole surface becomes covered with a white creamy foam.

These bubbles rise and break in such numbers that they emit a low hissing sound. The white foam continues to increase in thickness, breaking into little pointed heaps of a brownish hue on the surface and edges. This stage of fermentation is called "making yeast."

The yeast gradually thickens, and finally forms a tough viscid crust which, when fermentation slackens, breaks, and falls to the bottom. In most cases this must be prevented, by skimming it off as soon as the fermentation is complete, which will be indicated by the liquor becoming clear, and the stopping of the hissing noise.

This liquor is then run into the still at once and the distillate is whiskey. (See "Distilling.")

THE FERMENTATION OF MOLASSES FOR RUM.

Molasses is employed quite extensively in the production of New England rum.

Take forty gallons New Orleans or West Indies molasses; add to it two hundred and forty gallons of water heated to 100 degrees Fahrenheit, mix it thoroughly.

Run this mixture into a tub made to hold three hundred gallons, rather broader than high.

Add to this three gallons of fresh brewer's yeast. Keep the temperature in the room as near as possible at 75 degrees.

The fermentation starts rapidly and in course of from 18 to 60 hours, the yeast bubbles will break on the surface, the scum will drop to the bottom and the fermentation is complete.

Run the liquor into the still, distill according to directions and the product is rum.

ACETIC FERMENTATION.

This is the dread of the distiller, the wine maker, and the brewer. When this once sets in, the material is hopelessly lost. It comes with very little warning, and by an inexperienced operator may be very easily and quite likely mistaken for the vinous fermentation. Its presence is detected in the following manner:
When the vinous fermentation is complete, as has already been described, the crust, or yeast, falls to the bottom. This is the turning point.

If the liquor is not at once drawn off from the sediment, another and far more destructive operation takes place.

The hissing monotonous noise is heard again, the temperature of the liquor rises, a slight inward movement is observable, floating particles appear on the surface and form partly into a jelly cake; this becomes thicker by degrees, the liquor becomes nearly transparent, the vinous taste disappears, and a sour taste takes its place. This is caused by the alcohol, which was contained in the liquor at the end of the vinous fermentation, having been converted into vinegar.

FERMENTATION OF GRAPE JUICE, ETC.

In the wine-producing countries, the grapes are gathered and pressed until the whole substance forms a pulp. This pulp is put into a fermenting tub.

The fermentation starts as soon as the grapes are pressed; this softens the skins and dissolves a portion of the coloring and astringent matter which the skins, stems and stalks contain.

The liquor is drawn off from the sediment (called in French Le Marc) into a clear tub in which it is allowed to ferment until complete. The proper temperature for fermenting grape juice is 70 degrees Fahrenheit. The fermented liquor is then distilled in the same manner as whiskey and the result is brandy.

The mark, together with stems and whatever remains after pressing, is then diluted with water, and fermented separately and run through the still into brandy. These two mixed together make a better liquor than either when left separate. It is worthy of note that the grapes which are suitable for wine-making are seldom, if ever, used in the production of brandy.

The fermentation of apple juice, pear juice, berries, etc., is produced in the same manner as grape juice, and requires no artificial means, as it contains its own ferment, which acts spontaneously.

REGULATING FERMENTATION.

A perfect fermentation is the most essential part in the production of all alcoholic distillates; and in order to ensure success, the following rules must be observed, and should be committed to memory before proceeding to apply them:

1st. The larger the quantity of mash or extract the more perfect will be the fermentation.

2d. A temperature of 65 to 85 degrees is absolutely necessary in the fermenting room.

3d. There must be a sufficient quantity of saccharine matter present.

4th. Fermentation of grain-extract must be started by some active body in a state of decomposition, such as yeast.

5th. There must be water enough to completely dilute the material.
6th. Good ventilation to carry off the gases which are discharged during the process.

When it is found that the operation proceeds too slowly, it will require immediate attention. The best thing, when it can be done, is to increase the temperature in the apartment, then heat some water to a boiling point, fill a lot of bottles with this, and immerse them in the mash or extract.

If the temperature is at the proper degree, then add more yeast to it, mix it well and cover the tub.

Should the fermentation proceed too rapidly, first reduce the temperature in the room, then skim off the head of the yeast. If this does not suffice, draw off the whole into a clean tub.

If any detention should occur, by which fermented liquors cannot be submitted to immediate distillation, the still being, perhaps, undergoing temporary repairs, or for some other reason,—a second fermentation is likely to occur which must be carefully guarded against.

In such case nearly all alkalies, such as lime, pearl ash, chalk, Fuller's earth, etc., may be stirred in the liquor. The fumes of burning sulphur will check fermentation for a while, but will not stop it altogether.

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THE STILL AND APPURTENANCES.

The general principles of distilling, although the still has undergone many changes within the present century, is the same now as it was during the time of our great-grand sires.

Evaporation and condensation are the only means by which the different bodies contained in liquids can be separated.

Stills are more or less complicated according to the uses for which they are employed.

The copper still with the worm is the most popular, but some stills are made of wood, others of boiler iron; and stills ranging from ten to twenty-five gallons capacity, are sometimes made of galvanized iron or heavy tin. These vary in form and shape as well as in the manner of operating them.

Some stills are heated by steam, some by the direct action of the fire underneath, others by being submerged in boiling water.

The larger distilleries usually employ steam for heating. This possesses many advantages over the other methods. It economizes time and fuel, and is safer; it is also more reliable in maintaining a uniform temperature while conducting the operation.

It is claimed, however, that liquors which are distilled by the direct action of the fire, are superior in quality to those that are produced by steam.

French brandies as well as fine Kentucky whiskeys are products of the ordinary copper still, set in brick work, and in many instances heated by a wood fire.

In order to explain the different methods now in use it is necessary to commence at the bottom and ascend step by step until we reach the pinnacle of the distiller's art; which is the production of fine inodorous alcohol, free from taste or smell.
PRIMITIVE DISTILLATION.

Stills are sometimes constructed in a rather crude manner, those, for instance that are employed for distilling liquors for home use, or for illicit distilling. These primitive stills are operated in all parts of the country—East, North, South and West. Usually in out of the way places, in caves, barns, cellars or garrets, on barges and canal boats, in the woods, in swamps, and very frequently in some honest farmer’s kitchen. One or two such instances will serve to illustrate the more note-worthy of the many contrivances or “make-shifts” which are employed as substitutes for the still.

THE POTEEN STILL.

In many parts of Ireland, especially among the peasantry, a much esteemed liquor is produced, called poteen. And although revenue officials are very numerous, the source from which it is obtained is very seldom discovered. This liquor is made from malted grain. Poteen is a low-proof alcoholic stimulant of a highly intoxicating nature, and is of Irish origin. It has never been successfully imitated. All sorts of contrivances are employed by these Irish peasants for distilling purposes.

While some use a regular still, others manage to obtain the wee drop, by means of pots or kettles.

A large three-legged iron pot, A (See Diagram No. 4) intended for boiling potatoes, is utilized. This serves the purpose of the still proper. A close fitting, cone-shaped tin cover B, with a small opening at the
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In many parts of Ireland, especially among the peasantry, a much esteemed liquor is produced, called poteen. And although revenue officials are very numerous, the source from which it is obtained is very seldom discovered. This liquor is made from malted grain. Poteen is a low-proof alcoholic stimulant of a highly intoxicating nature, and is of Irish origin. It has never been successfully imitated. All sorts of contrivances are employed by these Irish peasants for distilling purposes.

While some use a regular still, others manage to obtain the wee drop, by means of pots or kettles.

A large three-legged iron pot, A (See Diagram No. 4) intended for boiling potatoes, is utilized. This serves the purpose of the still proper. A close fitting, cone-shaped tin cover B, with a small opening at the
top, is connected with a long tube C of the same material. This tube sometimes leads through a running brook, the water of which serves to condense the vapor as it rises from the pot. Where there are no brooks, the same tin pipe is used in square coils D, fitted in a wash tub or barrels, (indicated by the dotted lines), which is filled with water. The fermented liquor is first put in the pot, the cover fitted on, the seams well closed, the tube which serves as a worm adjusted, a turf fire started, and the operation of distilling proceeds slowly. When all of the fermented liquor has been distilled, it undergoes a second distillation, the result is Poteen.

THE FARMER'S STILL.

The farmers in many parts of New England and elsewhere, find it more advantageous to convert their fruit into spirits than to dispose of them, which in many localities, it would not be possible to do, owing to the lack of transportation facilities.

The evasion of the Internal Revenue law is practised to a great extent. Kitchen utensils, such as large wash boilers, pot-ash kettles, as well as those intended for boiling maple sap, are brought into requisition. Tin, or galvanized iron pipe, serves for a worm.

In this rude manner, the fermented juice of apples, pears, peaches, grapes, currants and other fruits, are converted into spirituous liquors, such as apple jack, cherry brandy, peach brandy, etc.

A very ingenious substitute for a still was quite recently discovered in full operation in a steam sawmill. It was constructed in the following manner:

A strong ale hogshead was placed in a horizontal position with its bung upwards, a two-inch iron pipe was screwed into the bung hole; a two-inch cock inserted in the head of the cask at the lower edge; a half-inch iron pipe passed through one of the staves and connected with the steam boiler. The pipe from the bung was joined to a coil of pipe of the same dimensions, placed in a molasses hogshead, which stood upright, the upper head having been removed; the extreme lower end of the coil extended through the lower portion of the stave. Live steam was used for heating the liquor. Fermented molasses constituted the charge; the result was rum.

Enough has been said on this subject to convey a general idea of the arts and artifices employed by what are known as “moonshiners.” We now turn our attention to the legitimate still and its auxiliary appliances.

THE ORDINARY COPPER STILL.

The ordinary still, such as is used in regular distilleries, consists of a copper boiling kettle, known as the still proper, and a spiral copper tube, graduating in size, from top to bottom.

The kettle (See Diagram No. 5) is built very shallow, with a concave bottom, and convex upper surface, called the “Breast.” The top is somewhat broader than the bottom.

From the center of the Breast (A), a pipe connection (B) is made to extend to the upper portion of the tubing, called the “worm.” C is the opening on the breast of the still in which the tubing (B) is inserted.
There are other experiments which are sometimes

effective, the warm in every case forms the bottom

whether committed by one or more doubters, or

whatever their numbers may be.

No matter how complicated the still works may be,

the alcohol always appears into liquid.

Only part of the whole system capable of condensation

of the steam important to the distiller, its being the

which all distillation operations are completed, and is

The worm is that portion of the apparatus through

THE WORK.

A description of the still.

The condenser, the general outlines of which are

the top of, and serves as an indicator in changing

the position from the bottom, is a half-inch

the side of the still, and at a distance of three-

of the side of the still, and at a distance of three-

removed or adjusted, as occasion may require.

two-inch opening covered with a screw cap, to be

hole D, and near this, the drainage hole, E, which is a

On the summit of the still (in large one) is a man

having rim of the charge.

A large cock C is inserted at this side on a level

on the still surface.

intended to pass by steam, in which case the still reads

meant, and a tube around the sides, unless it be

The still is set in a brick work with a tile box under

choice of which will be explained hereafter.

The direct condensation tube II is employed only

THE ORDINARY STILL.
The direct connecting tubing II is employed only when no other connections are used, such as the Doubler, the Column, or the Condenser known as the Goose, all of which will be explained hereafter.

The still is set in brick work with a fire box underneath, and a flue around the sides; unless it be intended to heat by steam, in which case the still rests on a flat surface.

A large cock C is inserted at the side on a level with the bottom of the still. This is the discharge cock, and serves to empty the still of its contents after having run off the charge.

On the surface of the still (if a large one) is manhole D; and near this, the charge hole E, which is a two-inch opening covered with a screw cap, to be removed or adjusted, as occasion may require.

At the side of the still, and at a distance of three-quarters of the height from the bottom, is a half-inch try cock F, and serves as an indicator in charging.

This concludes the general outlines or rudimentary description of the still.

THE WORM.

The worm is that portion of the apparatus through which all distilling operations are completed, and is of the utmost importance to the distiller; it being the only part of the whole system capable of condensing the alcoholic vapors into liquid.

No matter how complicated the still works may be, whether consisting of one or more doublers, or column, the worm in every case forms the terminus.

There are other contrivances which are sometimes
employed as substitutes for the worm, but none so reliable. The following is the manner of constructing and adjusting a worm. (See Diagram No. 6). A copper pipe one hundred and fifty feet in length and graduating in size from four inches in diameter at one end, down to one and a half inches at the other, is bent so as to form from twelve to fifteen circles or spiral coils, all of which must be uniform in circumference, outside measurement, and separated one from the other about four inches. (See Diagram No. 6). These coils are held in position by short pieces of one-inch pipe soldered between them about three feet apart.

Heavy strap iron braces, reaching from the upper coil to the bottom one, are then bolted together in pairs, one inside and the other outside of the circles. Usually four pairs of these are used.

The lower ends of these braces rest on the bottom of the worm tub (See K, Diagram No. 6), when placed in position, and are secured to it by bolts running through the bottom of the tub, by this means the worm is held firm and secure.

In placing the worm in the tub, the lower coil should be eight inches above the bottom of the tub, with the small end projecting through the stave (See L, Diagram No. 6) into a square copper box, the bottom of which is supplied with a three-way cock.

The dimensions of this box are twelve inches by twelve in depth and breadth, and eighteen in length. In the centre of the worm tub and six inches above the bottom is a false bottom extending from the centre to the inner edge of the lower coil of the worm.

This serves to spread the cold water as it enters
into the tub by means of a two-inch iron pipe (See N, Diagram No. 5) at the centre of the bottom.

Six inches above the upper surface of the worm is a tin (or galvanized iron) pipe P three inches in diameter to carry off the overflow water while running a charge. The two-inch iron pipe which enters at the bottom is carried along the bottom to the outer edge where it ascends upward to the bottom of the reservoir tub, from whence it obtains its supply of water to cool the worm.

At a distance within convenient reach is a stop cock, which is used to regulate the flow of water, or shut it off when not needed. The water used for this purpose, should be at a temperature of sixty degrees Fahrenheit. When this can not be obtained, add ice to it, as much depends on cooling the worm in order to obtain a satisfactory result.

TO SET THE STILL.

When placed in its proper position, the still must be lower than any of its connections, in order to facilitate the management of the operation.

First of all, build the foundation upon which the still is to rest. This should be two feet in height with fire-box and ash-pit.

Place the still in position.

Build up the brick work (See M, Diagram No. 5), around the sides, up to the try-cock F, leaving a circular flue around the sides.

Set up the tub containing the worm K, in such a manner that the tail of the worm L may be two feet from the floor.

Connect the centre opening of the breast of the still with the upper portion of the worm by means of a copper pipe H made tapering from 6 to 4 inches in diameter.

The still is then ready for use.

Now for the tributaries, which include the Feed Tub and the Reservoir Tub. The first of these is placed in such a way that its contents can be drawn into the still by means of a hose.

The Reservoir Tub should be placed on the floor above, or what is still better, on the roof.

In most cases the gooseneck and worm tubs are placed outside of the building.

This large tub serves as a water reservoir. It is from this that the worm tub obtains its supply. When placed in position, a two-inch iron pipe is run from its side, nearer the bottom, and carried to the outside of the bottom of the worm tub N, where it connects with a two-inch cock T, which penetrates the bottom and allows the water to flow in when running a charge, or shuts off the water flow when not in use. About four inches below the top of each of these two tubs is a four-inch galvanized iron pipe P to carry off the overflow of water.

The water used for cooling the worm is usually obtained from a well on the premises and pumped into the reservoir, or from a brook or spring on some adjacent hill and carried by means of a wooden or iron conduit to the reservoir tub. In a room below the still, (in some cases on the same floor), the receiving tub, the low-wine tub, and the reception-tub for the joints are located.
This completes the ordinary distillery, with the exception of the mash tub, fermenting tubs, etc., a description of which will be found elsewhere.

By carefully observing the following directions, any person possessed of a reasonable amount of intelligence and the least particle of ingenuity, can in a short time master the art, not only of constructing, but of operating any distillery for no matter what purpose it may be intended.

DIRECTIONS FOR ERECTING A DISTILLERY.

Directions for constructing a still of medium capacity. For Whiskey, Brandy, Rum, or Gin.

Height of still from the floor to shoulder....3 feet.

Breadth of concave bottom..............42 inches.

Breadth of surface..................5 feet.

Rise of breast from shoulder to centre....1 foot.

Opening in centre..................6 inches.

Man hole..........................12 by 16 inches.

Charge hole with screw cap...........2½ inches.

Length of worm (See Diagram No. 6)...150 feet.

Diameter of upper section of worm....4 inches.

Diameter of lower section............1½ inches.

Height of worm tub..................9 feet.

Breadth of worm tub...................7 feet.

Discharge cock......................2 inches.

Try cock............................½ inch.

Breadth of worm coil, outside measure.54 inches.

RUNNING A CHARGE.

When about to charge a still be sure that the discharge cock at the bottom is securely closed, then open the try cock on the side, remove the cap from over the charge hole, screw the hose on the cock at the side of the charge tub, lead the other end to and insert it into the charge hole on the breast of the still.

Open the cock at the charge tub and allow the liquor to run into the still until it begins to trickle from the try cock; then close it, remove the hose, screw on the cap, and the still is charged.

Start the fire as soon as the liquor begins to run into the still and regulate it in such a manner that it may be drawn if necessary.

Keep a close watch on the apparatus to prevent it from running foul. When the liquor in the still becomes heated to the temperature at which alcohol boils, if the heat be too great it will cause not only the vapors to rise but the liquid itself. The volume arising being greater in bulk than the capacity of the worm to carry it off, owing to its tapering form, the apparatus becomes choked up or foul, and in many cases the bottom of the still is blown out and the contents lost.

This calamity can be avoided by adhering strictly to the directions as herein prescribed.

As soon as the surface of the still becomes heated, sound the connecting pipe between it and the worm with an iron-wire rod; if it emits a hollow sound, it is an indication that all is right; if on the contrary,
a dull sound is produced by sounding, then the still is running foul.

In this case no time should be lost in drawing or covering the fire with ashes, clay, or sand, and degaging the surface of the still with cold water until the apparatus is clear again; then start the fire again and heat very gradually until the liquor begins to flow from the tail of the worm. The first substance that rises and passes through the worm is a very offensive gas. This being excessively volatile does not condense in the worm but escapes into the air. As soon as this gas appears, the water supply must be turned on to the worm tub, and regulated so that the liquor may flow at the temperature of sixty degrees Fahrenheit. The first that comes over is highly impregnated with ether and fusel oil.

This first run is low wine, and should be received in a separate tub.

As the charge progresses the liquor becomes much sweeter and increases in proof, and, when it is made from grain, it is called whiskey. If from grape juice, brandy.

As soon as the sweet liquor is run off, which will be indicated by the sudden rise in the temperature, and a fall in the degree of proof, the remainder of the charge must also be run into a separate tub.

When it has been ascertained that all of the alcoholic substance has been obtained, the still is emptied, and charged again and run off as before. This is repeated until a sufficient quantity of sweet liquor has been obtained to compose a charge. It is then distilled over and over again, until the desired proof is obtained.

THE DOUBLER.

This appendage to the still is intended to double the alcoholic strength of the distilled liquor, and by this means to dispense with a second or third distillation. The action of the Doubler is to check the too rapid evaporation of water, by condensing and returning the condensed portion back into the still while allowing the vaporised alcohol to pass by and enter the worm. This is done in the following manner: Build a stout two-headed tub, of one and a half inch staves, and two-inch top and bottom. (See A, Diagram No. 7).

Length of staves four feet.

Breadth of tub, forty-two inches at the top by forty-six at the bottom.

Cut two four-inch holes B, C, in the upper surface; fit a four-inch collar flange to each. Insert a one-inch brass cock E in the side of the tub on a level with the bottom, and another D eight inches above it. Run a two-inch pipe F through the bottom of the tub midway between the centre and the stave. Let this project eight inches inside the tub, so that the top may be on a level with the upper side-cock. The lower end of this pipe is brazed to a collar flange, by means of which it may be connected with the still.

Run a four-inch copper pipe G through one of the collar flanges B; let the lower end descend to within three inches of the bottom of the tub and the upper end project twelve inches outward, and brazed
In a hydraulic form, the water passes from the retort into the still and is vaporized. The vapor passes through a condenser and returns to the retort through the two-inch return pipe X.

The water from the retort condenses and returns to the still. The condenser must be above the retort, and the apparatus is connected within two inches of the bottom, and the apparatus within the retort. The condenser is connected to the still, with the outlet X. The water is the condenser, and the condenser is connected with the retort. The water from the retort passes through the condenser, and the condenser is connected with the retort.
to a collar flange H so that it may be connected with the breast of the still. The other four-inch opening C connects by a four-inch pipe I with the worm contained in the worm-tub W.

The Doubler is placed midway between the still and the worm, its bottom being somewhat higher than the surface of the still, and the four-inch inlet turned towards it. In this position the inlet G is connected with the centre of the breast of the still, and the outlet I, which is the open four-inch flange, is joined to the worm. The two-inch pipe K called the return, passes through the breast of the still near the edge and is carried downwards inside the still to within two inches of the bottom, and the apparatus is ready for use.

When about to run a charge, fill the Doubler up to the side cock D with water. When heat is applied to the still, and the liquor which it contains vaporizes, it passes through the connecting pipe G from the still into the Doubler; here it meets a resisting force, in the shape of five inches of water, through which it must pass or condense.

The first portion condenses and returns to the still through the two-inch return pipe K.

As the water in the Doubler becomes heated to the degree at which alcohol boils, the alcoholic vapors pass through it, and are as it were filtered, leaving the heavier bodies behind to be returned into the still in a liquid form.

It will thus be seen that although it may take a little longer to run a charge, the product must be of a greater alcoholic strength.
DISTILLATION OF LIQUORS.

BRANDY.

Brandy. This well known stimulant is the direct product of fermented grape juice, and is obtained only by distillation. The quality and quantity obtained depend on the nature of the grapes employed. The American grapes, as a rule, contain much less saccharine matter than the French, hence the wines are weaker, and produce a less quantity of brandy; 100 gallons of ordinary grape juice should produce when distilled 25 gallons of brandy. The method for preparing and fermenting the grape juice is given on page 22. Distill in the same manner as described under the head of "Running a Charge." (See page 37.)

CIDER BRANDY.

This is also known as apple jack, or cider spirits. It is made by first grinding the apples into pulp, then expressing the juice. This is fermented, in the same manner as grape juice (See page 22); when the fermentation is complete it is distilled in a copper still and worm by the same method as employed for brandy.

BRANDY FROM BERRIES AND FRUITS.

Nearly all berries are capable of being converted, first into wine, then brandy. Strawberries, raspberries, huckleberries, currants, cherries, etc., are treated in the same manner as grapes.

WHISKEY.

Barley, rye, corn, wheat, and oats are employed in the production of whiskey, in various proportions, according to the method of the distiller; such as barley and corn-meal, barley and rye-meal, barley and coarsely ground wheat, and in some cases malted oats, or malted rye. An excellent whiskey can be made by mixing

- 5 bushels of barley-malt meal,
- 10 bushels of corn-meal,
- 10 bushels of ground wheat,
- 450 gallons of water.

Mash and ferment according to directions, given on pages 13 and 19.

Run the fermented liquor through a still and doubler, or an ordinary still and worm.

HOLLAND GIN.

The original Dutch method.

Take 40 gallons of neutral spirits at proof,
- 12 pounds juniper berries.

Put the spirits and berries together into an ordinary copper still, apply the heat very moderately and with great precaution, until the feints have come over (See Running a Charge, page 37), then increase the heat until the liquor flows regularly. Keep the fire uniform throughout the operation. The result will be Holland Gin.

WHEAT WHISKEY.

Take
- 50 bushels ground malt,
- 250 bushels coarsely ground wheat,
- 5,400 gallons water.
Heat the water until it indicates a temperature of 160 degrees Fahrenheit.

Run one-half of this water into the mash tub.

Sprinkle the meal into this water very slowly while stirring rapidly to prevent it from clodding.

When the meal has been thoroughly mixed with the water allow it to stand until it becomes quite clear. This will be in about two hours.

Then draw off 3,600 gallons of this liquor into cooling pans so that it may cool as rapidly as possible.

It will be found that when this liquor called “wort” is run into the cooling pans from the mash tub, it stands at 135 or 140 degrees temperature; this must be reduced to 80 degrees, then run into the fermenting tub. This cooling process requires about five hours in winter or eight hours in summer. The specific gravity of the wort when drawn off into the fermenting tub should be 1.050, this will insure a good fermentation. Having drawn off 3,600 gallons from the mash tub, replace this with the same amount of water heated to 180 degrees temperature. Mix it thoroughly with the dregs and after standing until clear, run this off into another tub. This second drawing is not fermented; it is used instead of water for mashing the second batch.

To the first drawing in the fermenting tub must be added two per cent. of fresh brewer’s yeast to start the fermentation. (See Fermentation, page 19.) When complete, this substance is distilled through an ordinary still with doubler. The above is the method by which the best quality of wheat whiskey is produced.

RYE WHISKEY.

Take 90 bushels malted Rye,

190 bushels Rye not malted,

these may be coarsely ground or crushed.

5,200 gallons of water.

Heat the water to 155 degrees temperature. Or, if it is more convenient, heat one-half at a time. When thus heated, allow one-half, that is to say, twenty-six hundred gallons to run into the mash tub.

Sprinkle the meal into this water very slowly while constantly stirring to prevent the mixture from becoming lumpy.

When well mixed let it stand fifteen minutes, then stir again for five minutes; repeat this four times, then allow the mixture to settle and when clear draw off 1,750 gallons into the cooling pans. These pans should be broad and shallow enough to contain the liquor without exceeding the depth of a few inches.

Heat the next water to 180 degrees and run thirteen hundred gallons on the substance remaining in the mash tub, while constantly stirring as before. When clear, which will take probably an hour, run off one thousand gallons of this liquor into the cooling pans.

Heat the balance of the water up to 190 degrees and repeat the operation of agitating and stirring.

After standing one hour draw this from the dregs into another tub to be employed for the next mashing, instead of the same quantity of water.

The first and second drawing when cooled down to 80 degrees are run into the fermenting tub, and when fermentation is complete (See page 19) are distilled. (See Running a Charge, page 37.)