

Chapter 8

DISTILLATION

The object of distillation is the preparation of alcohol or pure spirits, which is obtained from brandy, rum, arrack and whiskey, prepared from wine, sugar, rice and malt. It also includes compound spirits, or those which, in addition to alcohol, contain some volatile or pungent oil or essence, as gin, hollands, caraway and peppermint; the essential oils, as oil of cinnamon, oil of cloves, oil of peppermint, and otto of roses, and the simple distilled waters which retain the fragrant flavor of the particular herbs with which they have been distilled.

To manage Distillation.

Previous to distilling, the process of brewing and fermentation are necessary. The distiller, however, need not take the precautions of the brewer or wine-maker in moderating his fermentations so as to secure the good flavor and keeping qualities of the product. His object is to get as thorough a fermentation, and therefore as much alcohol, as possible. Hence large quantities of yeast are used, which is not skimmed off, but worked into the wort. He also mixes a quantity of raw grain with his malt in the mash, the diastase of the malt sufficing to convert all the starch of the raw grain into sugar. The quantity of raw grain may be twenty times that of the malt. All the saccharine matter cannot be converted into alcohol, the large quantity of alcohol formed towards the last of the process checking the fermentation. About one-fifth of all the saccharine matter remains in the grains. These are fed to cattle.

Utensils.

In a distillery are required a variety of utensils, such as still, worm-tub, pump, a water-cask, a strong press, hair-cloths 3 or 4 iron-bound tubs capable of containing from a hogshead to a pipe of any liquor, 3 or 4 cans capable of holding from 2 to 6 galls. by measure, an iron-bound wooden funnel having a strong iron nosel or pipe, a

pewter syphon about 6 feet long and 4 inches in circumference, flannel bags for refining the thick and succulent matter at the bottoms of the casks and other vessels.

Operation of the Still.

When the still is charged let the fire under it be lighted, and whilst it burns up the joints should be carefully luted.

By laying the hand on the still and capital, as the fire gains strength, the process of the operation will be ascertained; for whenever the head or capital feels hot, it is a proof that the volatile particles have arisen, and are about to enter the worm. When the still head is about to become hot, prepare a damp, made of the ashes under the grate, mixed with as much water as will properly wet them. This mixture is to be thrown upon the fire, to moderate its action, at the instant when distillation has commenced. Continue the heat as long as the distilled liquid is spirituous to the taste. When the distilled liquor carries with it any particular flavor, it should be re-distilled with essential oils, in order to convert it into a compound spirit, as gin, peppermint, and other cordials.

When all the spirituous fluid is drawn off, the still should be emptied by a cock in the side. The head etc., should then be removed, and the several lutes taken clean off. The still may now be charged a second time, and luted. If the spirit or compound to be made is of a different nature or flavor from that procured by the last distillation, the still, capital and worm should be thoroughly cleaned by hot water, sand and a scrubbing brush, to remove the oily particles that adhere to their internal surfaces. The worm is best cleansed by passing hot water through it repeatedly, until the water flows out quite flavorless.

Great care should be taken that no grease, tallow, soap, or any other unctuous matter, fall into the tubs, pieces, rundlets, or cans. Above all things, lighted candles, torches, or papers should not be brought near any vessel containing spirits. The flue or chimney should be kept

constantly clean.

To Use a Portable Furnace.

In the laboratories of experimental chemists, portable furnaces are employed. Charcoal is the only fuel that can be used in them, except the occasional use of the finer kinds of stone coal that yield a bright flame, and burn to a white ash without forming clinkers. When the fire is regulated by the admission of only the necessary quantity of air through the charcoal, and the whole heat of the fuel is directed upon the subject exposed to it, the expense is not so great as might be supposed, for no other fuel gives out so much heat. One lb. of charcoal will boil away 13 lbs. of water, whereas the same weight of Newcastle coal will boil away only 8 or 9 lbs. A pound of coke will only boil away 4 lbs. of water, and a pound of peat seldom more than 5 lbs., or, by a skilful mode of using it, at the utmost 10 lbs.

To Build Fixed Furnaces.

Fire bricks are generally used, as they may be cut as easily as chalk, and yet bear a violent heat without alteration; they must be set in clay of the same kind. The parts distant from the fire may be of common bricks set in mortar, but this mortar must be carefully removed before the other part is begun, as an accidental admixture of it with the clay would cause the latter to run into glass, and thus spoil the furnace. These furnaces are generally built as thin as possible, that they may take up the less room, and to save fuel in heating them, as they have seldom fire constantly in them; in this case they should be surrounded with iron braces, to prevent the alternate contraction and expansion destroying them as soon as they otherwise would.

To make a Portable Sand-pot.

For a portable one the ash pit may be an iron cylinder 17 inches in diameter and 8 deep, closed at bottom. In the front is cut a hole 3 inches high and 4 wide, with sliders to shut close. Three pins are riveted on the inside about an inch below the upper edge; these are to support the fireplace. The bottom of this ash pit is lined with clay, beat up with charcoal dust and formed into a kind of saucer. The fireplace is a small cylinder of nearly the same width, so as to fit easily into the top of the ash-pit, and rest on the three pins; its height is 15 inches, and it has a flat border at each end leaving a circular opening of 10 inches in diameter. Around the lower border are riveted 3 screws, to which are fixed by nuts a grate. In the upper border, towards the circumference,

and at equal distances from each other, are made 4 circular holes an inch over. The inside of the fireplace is lined with clay and charcoal, whose surface is adjusted to a core, made by drawing on a board an ellipsis, having its foci 15 inches asunder, and its semiordinates at the foci 5 inches, sawing off the board at each focus, and also down the greatest diameter, so that the internal cavity may represent an ellipsoid of those dissensions, cut off at the foci. A fire hole about 6 inches wide and 4 1/2 high, with the lower limit about 3 inches above the grate, is left in the front to be closed with a lined stopper, both the firehole and stopper having a border to retain the lining. When the lining is dry, 4 openings are cut sloping through it, corresponding to the openings in the upper border, to serve as vents for the burnt air, and to regulate the fire by sliding pieces of tile more or less over them. In the central opening at the top of the fire-place is hung a cast-iron pot, either hemispherical, or, which is most usual, cylindrical, about 6 inches deep at the edge, with a rounded bottom, so that the axis is about an inch deeper. The common pots have only a reflected border, by which they hang, but the best kind have also an upright edge that rises an inch higher, to which a stone-ware head is fitted, and thus the pot serves for many distillations that require a strong fire. It is usual to cut a notch on one side of the top of the fireplace, sloping upwards to the edge of the pot about 3 inches wide and 2 deep, to admit a low retort to be sunk deeper into the pot, by allowing a passage to its neck.

To make a Sand-heat Furnace.

A furnace of this kind may be stationary, and built of bricks that will stand the fire, and in this case the ash-pit is built about 12 inches high, and has an ash-door opening into it about 6 inches square; a grate is then laid, and a fire-door 6 inches by 8 opens immediately into the fireplace, even with the grate. The fire-place is made cylindrical, 2 inches wider than the sand pot, and about 8 inches deeper, the grate being a square whose side is about two-thirds the internal diameter of the Sand-pot. This pot hangs by its border in an iron ring placed at the top of the furnace; we have not yet adopted Teichmeyer's method of sloping the pot. As stone coal is generally used in fixing furnaces, instead of the 4 register holes used as vents in the portable furnaces, only one opening, about as wide as the grate and 3 inches high, either in the back or on one side, is made to vent the burned air into the chimney. This, however, has the inconvenience of heating the pot unequally, next the vent becoming much the hottest, in spite of the endeavor to equalize the heat by bringing the fire from under the centre of the pot as forward as possible, by raising the

wall opposite to the vent perpendicularly, and enlarging it only on the other three sides; sometimes with the same view several small vents are made round the pot, leading into the chimney. A notch for the neck of the retort is generally made on one side. As much heat passes through the vent, it is usual to cause the heated air to pass under a large cast-iron plate, placed on a border of bricks surrounding a platform of the same materials, and leaving a cavity of about 2 1/2 inches deep at the farther end of which another opening leads into the chimney. On this iron plate sand is laid to form a sand heat, and thus several operations are carried on at the same time. If that in the sand-pot is finished, and it is desired to keep on those in the sand-heat without interruption, the vessel may be drawn out of the sand, some warm sand thrown on that remaining in the pot, and a fresh vessel with materials introduced. But if this new operation should require the heat to be more gradually exhibited, a pot of thin plate-iron, filled with cold sand, containing the vessel, may be partly slid into the heated sand-pot, and, being supported by pieces of brick placed under the edge or otherwise, kept there until it be necessary to increase the heat when it may be slid down lower until at length it is permitted to reach the bottom of the sand-pot.

To make a Pot Still.

Portable pot stills should have an ash-pit and fireplace exactly similar in dimensions to those used with the sand-pot, or the same furnace may be used with a hot still, if economy and not convenience is the principal object. The copper or tin-plate cucurbite will, of course, be 10 inches wide and about 12 deep, and hang 7 inches within the fireplace. The mouth should be wide, that the water-bath to be occasionally hung within it so as to reach within 3 inches of the bottom, may be the larger. Between this wide neck and the circumference there should be a short pipe, through which the liquor left after distillation may be drawn off by a vane without unluting the vessels; fresh liquor added; or, in distilling with the water-bath, the steam may escape. This pipe has a ring round it, that the cork with which it is stopped may be firmly tied down, and like the other joinings be luted, for which purpose slips of paper smeared with flour and water, or common paste, are usually esteemed sufficient; but the best material is bladders rotted in water until they smell extremely offensive and adhere to the fingers when touched, and then worked between the hands into rolls, which are to be applied to the joinings. These small stills have usually a Moor's head that fits both the cucurbite and the waterbath, their necks being of equal diameter, and is furnished with a groove round

the lower part on the inside to direct the condensed vapor to the nose of the alembic, and this head is surrounded by a refrigerator containing cold water, which is not so cumbersome as and less expensive than a worm and tub. But the most advantageous way of cooling the vapors is to use a Moor's head without a surrounding refrigerator, or only a plain bent tube, which should be at least 18 inches long, that the small globules of the boiling liquor which are thrown up near a foot high should not pass over and render the distilled liquor unfit for keeping. To this is to be adapted a pewter pipe about 8 feet long, if spirits of wine is to be distilled, or shorter for watery liquors, and in both cases 3/4 of an inch in diameter on the inside, inclosed in a tinned plate tube with a funnel. With an adopter of this kind, and the consumption of 1 1/2 pints of water in a minute, or about 9 galls. in an hour, spirits of wine may be distilled at the rate of a gallon by the hour from one of these portable stills. Another convenience of these straight pipes is, that they may be cleansed in the same manner as a fowling piece.

To make a Large Still.

If this furnace is fixed, and made of bricks, it may be constructed with a sand heat like that annexed to the sandpot; but this is seldom practised, although it would be advantageous for digestions and evaporations with a gentle heat, because the fire is generally kept up at an even height. If the cucurbite is not wanted for distilling, it may be used as a boiler to keep water ready heated for use, and to be drawn off when wanted by a syphon or crane. But these fixed stills are usually furnished with a pipe and cock on a level with the bottom by which they can be emptied and have almost always a worm and tub to cool the vapors. The head is usually of that kind which is galled a swan's neck.

Astier's Improved Still.

It has been proved that as soon as a common still is in operation, the steam from the capital in the first turn of the worm is at a temperature of about 212 Fahr. Here water only condenses and the alcohol in vapor passes into the second turn where it condenses by the lowered temperature. If the condensed liquid is drawn off from the upper turn, it is mere phlegm, or water, while that from the second turn is alcohol or spirit. The mode of doing this is very simple, and can be applied to any old still; so that every advantage resulting from the most complicated and expensive stills can be obtained; that is to say, plain brandy, Dutch-proof, and even thirty-five and thirty-sixth; proof. The alterations are effected as follows: Each turn of the worm is to be furnished with a

very slender lateral pipe, ending in a faucet and tap. A crescent-shaped valve, placed just before the opening of the pipe into the worm, obliges the condensed liquid to trickle into the pipe, and a slight elbow above and below the pipe prevents any of the steam from running in the same direction. Each of these pipes follows the main worm in all its convolutions, comes out of the condenser at the same opening, and is led thence to its own receiver. The pipe of the first turn has also a second branch with a faucet, which lets out the phlegm (which is worthless) as fast as it is condensed. A prover indicates the moment when the feints should be separated, as simple brandy or proof-spirit is wanted. These feints are either detained in the boiler, or set aside for rectification, in all cases necessary, for the last spirit that comes over, without which it is worthless.

Besides producing more spirit, and saving threefourths out of the feints, the worm prepared as above shortens the term of distillation by one-half, and consequently reduces the expense of fuel. In addition to this, and what is of more consequence, a sour wine may be distilled as well as any other, and without the least taint being perceptible in the brandy. The spirit is, of course less in quantity, but whatever is obtained is good and all the acid separates and flows out by the first pipe, which gives an opportunity of profiting by the acetous portion.

Column or Continuous Distillation.

A copper boiler is set in masonry, with a fire beneath: the mouth of the boiler is fitted with a tall copper cylinder, standing perpendicularly over the boiler and fitting closely. About half way up the height of this cylinder, and in its axis, a slender tube enters it and discharges a continual but small stream of the wine or wash to be distilled. The wine is prevented from falling down directly into the boiler beneath by means of a number of diaphragms, through which the wine percolates in streams like rain, whereby it presents a large extent of surface to the vapor which passes it in a different direction. In some cases the ascending vapors have to force their way at each diaphragm through a thin stratum of liquid and they thus undergo a certain amount of pressure. The wine, when it enters the cylinder, is almost boiling, and, while it falls in small showers through the pierced shelves, a copious issue of watery vapor ascends from the boiling copper below. The watery vapor, at the temperature of boiling, comes in contact with the wine almost boiling; the latter, therefore, receives heat from the former, and by so doing there is a change of state; the watery vapor, losing heat, falls back as water, and the wine, acquiring heat, boils, and its alcohol, in a state

of vapor, rises higher up in the cylinder, where, meeting with wine, it is absorbed, and a wine richer in alcohol is produced. This more alcoholic wine readily parts with its alcohol, in the form of vapor, by the action of heat continually carried up the cylinder. This vapor of alcohol, ascending higher, meets with more wine, is absorbed, and again set free in larger quantity. At length the portions of wine high up in the cylinder become highly charged with alcohol, and the alcoholic vapors, meeting with no more wine, pass on to a worm, where they are condensed into very strong spirit. The worm-tub is filled with wine, which in cooling the worm becomes heated itself, and this heated wine flows through the slender tube into the cylinder, where it is distilled as already explained. As this worm is never perfectly cold, the alcoholic vapor which escapes condensation is passed through a second worm also surrounded by wine, which condenses it completely.

Should the watery vapor which ascends from the boiler into the cylinder, and becoming condensed, falls back into the boiler, carry any alcohol with it, the latter is again volatilized; so that the boiler contains nothing but water, derived from the wine; for, although the boiler had been filled with wine, it soon becomes water by parting with its alcohol. As fast as the boiler fills with water, it is emptied by a cock placed in the bottom. Two boilers are more efficient than one, and when arranged so that a tube proceeding from the head of one plunges to the bottom of the other, they act like two of the eggs in Adams's still.

The discharge of wine from the great reservoir is regulated by a ball-cock, and there is a constant supply of cold wine, first, to the two worms, for the purpose of cooling them (by which method of heating the wine fuel is economized); secondly, to the distillatory column. Having parted with its alcohol, the watery portion falls into the boilers whence it is let off entirely deprived of alcohol. The flow of wine being thus perpetual, no time is lost by an interval of discharging and charging. It must also be noticed, that when the alcoholic vapors enter the first worm they are condensed; but as the weakest or most watery alcohol condenses in the first rounds of the worm, it is so contrived that this watery portion shall run back by small tubes into the cylinder, where it is redistilled. The worm at all its rounds is provided with cocks and tubes, by which the portions condensed in any part may be let back to be redistilled; or they may be all shut, or some may be left open, so as to return the whole or any part into the cylinder. In this way, by means of these cocks, alcohol of any required degree of condensation, within certain limits, can be obtained.

To Extinguish Fires in Distilleries.

A woollen blanket or rug, hung over a roller in a water-butt, is the readiest and best extinguisher.

To Dulcify Spirits.

In dulcifying, or sweetening the spirits, weigh the sugar, and dissolve it in one or more cans of the water with which the compound is to be made up, bruise the sugar, and stir it well till all is dissolved. Then empty it into the cask containing the spirits, mixing all together by drawing off several cans by the cock, and emptying them into the casks by the bung-holes. Now rummage all well together till they are perfectly compounded.

Spirits or compounds that are strong require no assistance in setting and becoming clear; but those that are weak must be refined by the addition of some other substance. To every hogshead of Geneva, or other spirituous compound put 6 oz. of powdered alum, previously dissolved in 3 or 4 galls. of the compound: stir all well together. In the course of 24 hours the whole will be rendered completely clear.

It is a good practice to leave the bung-holes of casks (containing spirits or compounds newly made) open for several days. This improves their flavor, and renders them clear sooner than they would otherwise be.

Table-salt thrown into the still, in the proportion of 6 oz. to 10 galls. of any liquid to be distilled, will greatly improve the flavor, taste, and strength of the spirit. The viscid matter will be fixed by the salt, whilst the volatile matter ascends in a state of great purity.

The flavor of malt spirits is highly improved by putting 3 1/2 oz. of finely-powdered charcoal, and 4 1/2 oz. of ground rice into a quart of spirits, and letting it stand during 15 days, frequently stirring it; then let the liquor be strained, and it will be found of nearly the same flavor as brandy.

To make Charcoal.

This is usually manufactured from coppice wood, cut every 16 years; the fagots are made into a large conical pile, covered up with clods of earth, leaving circular rows of holes from top to bottom. The wood is then kindled, and as it becomes red the holes are regularly closed to stop the further combustion, and when the whole has been closed up, the pile is left to cool; when the black skeleton of the wood is left, which differs from the raw wood in burning without any smoke, and with little or no flame, yielding at the same time no soot, although

some of the finer particles of the ashes are volatilized and adhere to the chimney. The air which passes through the burning charcoal has its oxygen converted into carbonic acid gas.

The air being thus rendered unfit for respiration, kills whatever animals or plants are confined in it. Numerous accidents have happened of persons being suffocated by sleeping in close rooms with a charcoal fire.

The charcoal for medical purposes should, like that for gunpowder, be made of soft woods, as willow, heated in iron retorts until no volatile matter is given out. Small quantities may be made by burying wood under sand in a covered crucible, and exposing the whole to fire.

To make Spirit of Wine.

Spirit of wine, as it is called, was formerly, and is still, in southern countries, obtained by distilling wine for its yield of brandy, and then slowly abstracting the more volatile part of the brandy, by a small fire and the use of tall vessels. In England, spirit of wine is, in general, obtained from ground meal, either of wheat, rye or barley, with from one-tenth to one-third of the same, or another grain, malted and ground, and then called malt spirit; or from treacle, and then called molasses spirit; some is also made from apples or cider-wash. In the United States, Indian corn is largely employed. The fermentation is carried on quicker and further than in brewing or making cider, in order that all the sugar in the waste may be converted into spirit and water. The infusion of the malt and meal is made so strong that its specific gravity is from 1.083 to 1.14 (whereas that for strong ale is generally 1.06, and for small beer 1.015 to 1.04), and is mixed with a large quantity of yeast, added by successive portions, until, in about 10 days, the specific gravity is reduced to 1.002, when it is fit for the still. In general, a third part is drawn off at the first stilling, under the name of low wines, the specific gravity being about 0.975. On re-distilling the low wines, a fiery spirit, of a milky east, comes over first, and is returned into the still; then follows the clean spirit; when it begins to grow too watery, the remaining spirit that comes over, as long as it will take fire, is kept apart, under the name of feints, and mixed with the next parcel of low wines. Instead of these trials the head of the still may have the bulb of a thermometer inserted into it, and by observing the temperature of the steam, an accurate judgment may be formed of the strength of the spirit that distills over. It is computed that 100 galls. of malt or corn wash will produce about 20 of spirit, containing about half its weight of water; molasses wash, 22 galls.; cider wash, 15 galls. The best French wines yield from 20 to 25 galls. The spirit

thus obtained is for chemical and pharmaceutical purposes mixed with water, to separate the oil it contains, and redistilled several times in tall vessels, with a very gentle heat, until its specific gravity is reduced to 0.82, though that usually sold is only 0.837, at 60° Fahrenheit. By distilling spirit of wine with purified pearl ashes, suit of tartar, chloride of calcium, lime, or common salt, all previously heated to redness and cooled, its specific gravity may be reduced still lower, even as low as 0.792, at 68° Fahrenheit.

To make Ether.

The old chemists, after mixing spirit of wine with an equal weight of oil of vitriol, digested it for a long time, and then distilled the most volatile part, which was called the sweet oil of vitriol. At present the mixture, whose temperature is considerably increased, is placed in a heated sandbath and distilled, without being suffered to cool until one-half the quantity of the spirit is come over; meanwhile, an inflammable gas also passes over. If the distillation is continued, sulphurous acid passes over, and a light yellow sweet oil of wine; the black residuary sulphuric acid contains charcoal diffused through it, which may be separated by admixture with water and filtration. If fresh alcohol is poured on the residuum, more ether may be obtained by distillation. The unrectified ether, as the first product is called, contains both water and alcohol: dry salt of tartar separates the first, and then pouring off the upper liquid, and adding dry chloride of calcium in powder, this salt unites with the alcohol, and the ether swims on the solution.

The Continuous Ether Process.

This process is now generally followed. A vessel of alcohol is provided with a tube furnished with a stopcock, which tube dips to the bottom of a second vessel which contains sulphuric acid, and is provided with a thermometer. From the top of the second vessel a tube passes through a worm or condenser to the receiver. The alcohol is allowed to mix with the sulphuric acid until the boiling point of the mixture is 300° Fahr.; more alcohol will lower it, less raise it. The mixture is now kept boiling at 300°, fresh alcohol being steadily supplied. Ether and water distill, ever forming two layers, the ether on top. The sulphuric acid is unchanged, and the same quantity will convert an indefinite amount of alcohol into ether. If the alcohol contains oils, however, they will be charred and render the acid black.

To Purify Ether.

Agitate it well in a closed vessel with double its bulk of water to remove any alcohol. Decant the ether from the water on which it floats. Add quicklime to remove any water that may be left, and after it has slaked distill. The first third will be pure ether.

To Imitate Foreign Spirits.

A great desideratum among distillers, in this country, is to imitate foreign spirits, such as brandy, rum, Geneva, etc., to a tolerable degree of perfection; but, notwithstanding the many attempts that are daily made for this purpose, the success, in general, has been indifferent. The general method of distilling brandies in France differs in nothing from that practised here, with malt-wash or molasses; nor are the French distillers in the least more cleanly in their operations. Still, though brandy is distilled from wine, experience tells us that there is a great difference in the grapes from which the wine is made. Every soil, every climate, every kind of grape, varies with regard to the quantity and quality of the spirit distilled from them. A large quantity of brandy is distilled in France during the time of the vintage; for the poor grapes that prove unfit for wine, are usually first gathered, pressed, their juice fermented, and instantly distilled. It is a general rule with them, not to distill wine that will fetch any price as wine; for, in this state, the profits obtained are much greater than when the wine is reduced to brandies.

For a long time, this liquor was distilled only from spoiled wine, and afterwards from the dregs of beer and wine; and when, instead of these, the distillers employed rye, wheat and barley, it was considered as a wicked and unpardonable misuse of grain.

To Improve British Brandy.

Take 30 galls. of fine English brandy, 3 oz. of tincture Japonica, and 9 oz. of sweet spirit of nitre. Incorporate these with some of the spirit and then put it into the rest of the liquor, and stir it well about. This will make 30 galls. of brandy, and if it be a good clean spirit, it will much resemble French brandy.

To prepare Tincture Japonica.

Take of the best English saffron, mace bruised, of each 1 oz., infuse them in a pint of brandy till the whole tincture of the saffron is extracted, which will be in 7 or 8 days; then strain it through a linen cloth, and to the strained tincture add 2 oz. of terra Japonica powdered fine; let it infuse till the tincture is wholly impregnated.

To make Jamaica Rum.

This is obtained from the refuse of the raw sugar manufactory, by taking equal quantities of the skimmings of the sugar pans, of lees or returns as they are commonly called, and of water and to 100 galls. of this wash are added 10 galls of molasses. This affords from 10 to 17 galls. of proof rum, and twice as much low wines; it is sometimes rectified to a strength approaching to spirit of wine, and is then called double distilled rum.

To Obtain Rum from Molasses.

Mix 2 or 3 galls. of water with 1 gall. of molasses, and to every 200 galls. of this mixture add a gallon of yeast. Once or twice a day the head as it rises is stirred in, and in 3 or 4 days 2 galls. more of water is added to each gallon of molasses originally used, and the same quantity of yeast as at first. Four, 5 or 6 days after this, a portion of yeast is added as before, and about 1 oz. of jalaproot powdered (or in winter 1 1/2 oz.), on which the fermentation proceeds with great violence, and in 3 or 4 days the wash is fit for the still; 100 galls of this wash is computed to yield 22 galls. of spirit from 1 to 10 overproof. If the molasses spirit, brought to the common proof strength, is found not to have sufficient vinosity, it will be proper to add some sweet spirits of nitre; and if the spirit has been properly distilled by a gentle heat, it may, by this addition only, be made to pass with ordinary judges as French brandy. Great quantities of this spirit are used in adulterating foreign brandy, rum, and arrack. Much of it is also used alone in making cherry brandy and other cordials by infusion; in all which many prefer it to foreign brandies. Molasses, like all other spirits, is entirely colorless when first extracted; but distillers give it, as nearly as possible, the color of foreign spirits.

To Prepare Gin as in Holland.

The grist is composed of 10 qrs. of malt, ground considerably finer than malt distillers; barley grist, and 3 qrs. of rye-meal, or, more frequently, of 10 qrs. of rye and 3 qrs. of malt-meal. The 10 qrs. are first mashed with the least quantity of cold water it is possible to blend it with, and when uniformly incorporated, as much boiling water is added as forms it into a thin batter; it is then put into 1, 2, or more casks, or gyle-tuns, with a much less quantity of yeast than is usually employed by our distillers. Generally, on the third day, the Dutch distillers add the malt or ryemeal, prepared in a similar manner, but not before it comes to the temperature of the fermenting wash; at the same time adding as much yeast as at first.

The principal secret is the management of the mashing part of the business, in first thoroughly mixing the malt with the cold water, and in subsequently adding the due proportion of boiling water, that it may still remain sufficiently diluted after the addition of the fine meal; also in well rousing all together in the back, that the wash may be diluted enough for distilling without endangering its burning to the bottom.

Rectification into Holland Gin.

To every 20 galls. of spirit of the second extraction about the strength of proof, take of juniper-berries, 3 lbs.; oil of juniper, 2 oz.; and distill with a slow fire until the feints begin to rise, then change the receiving can; this produces the best Rotterdam gin.

An inferior kind is made with a still less proportion of berries, sweet fennel seed, and Strasburg turpentine, with a drop of oil of juniper, and a better sort, but inferior to the Rotterdam, is made at Weesoppe. The distiller's wash at Schiedam and Rotterdam is lighter than at Weesoppe, Strasburg turpentine is of a yellowish-brown color, a very fragrant agreeable smell, yet the least acrid of the turpentine. The juniper berries are so cheap in Holland, that they must have other reasons than mere cheapness for being so much more sparing of their consumption than our distillers.

To make Malt Spirit.

Mix 60 quarters of barley grist, ground low, and 20 quarters of coarse ground pale malt, with 250 barrels of water, at about 170°. Take out 30 barrels of the wort, and add to this 10 stone of fresh porter yeast, and when the remaining wort is cooled down to 55°, add 10 quarters more malt, previously mixed with 30 barrels of warm water; stir the whole well together, and put it to ferment, along with the reserved yeasted wort; this wash will be found to weigh, by the saccharometer, from 28 to 32 lbs. per barrel, more than water. In the course of 12 or 14 days, the yeast head will fall quite flat, and the wash will have a vinous smell and taste, and not weigh more than from 2 to 4 lbs. per barrel more than water. Some now put 20 lbs. of common salt, and 30 lbs. of flour, and in 3 or 4 days put it ins' the still, previously stirring it well together. Every 6 galls. of this wash will produce 1 gall. of spirit, at from 1 to 10 over-proof: or 18 galls. of spirit from each quarter of grain.

English Geneva.

The best English Geneva is made as follows: Take of juniper-berries, 3 lbs.; proof spirit, 10 galls., water, 4

galls. Draw off by a gentle fire, till the feint begins to rise, and make up the goods to the required strength with clear water.

To Distill Spirits from Carrots.

Take 1 ton and 8 stone of carrots, which, after being exposed a few days to dry, will weigh about 160 stone. The whole being cut, put one-third of the quantity into a copper, with 24 galls. of water, and after covering them up close, reduce the whole into a pulp. The other two-thirds are to be treated in the same manner, and as the pulp is taken from the copper, it is carried to the press, where the juice is extracted with great facility. The liquor obtained will amount to 200 galls., and will be of a rich sweet taste, resembling wort. It is then put into the copper with 1 lb. of hops, and suffered to boil about 5 hours, when it is put into the cooler, to remain till the heat comes down to 66°. From the cooler it is discharged from the vat, where 6 qts. of yeast are put to it, in the usual manner. Let it work 48 hours, or to 58°, when the yeast begins to fall. Then heat 12 galls. of unfermented juice, and put it to the liquor, and the heat will be raised to 60°. Work afresh for 24 hours longer, the liquor gradually lowering, as before from 66° to 58°. Tun the whole into half hogsheads, to work from the bung. After standing 3 days in the cask, 50 galls. may be drawn off, which is rectified the next day without any additional substance. Twelve galls. of spirit will be obtained.

To make Arrack.

Arrack is no other than a spirit produced by distillation from a vegetable juice called toddy, which flows out of the cocoanut tree. The operator provides himself with a parcel of earthen pots, climbs up the trunk of a cocoatree; and when he comes to the boughs, he cuts off one of the small knot or buttons, and applies the mouth of a bottle to the wound, fastening it to the bough with a bandage; in the same manner he cuts off others, and proceeds till the whole number is employed; this done, he leaves them until the next morning, when he takes off the bottles, which are mostly filled, and empties the juice into the proper receptacle. When a sufficient quantity is produced, the whole put together, is left to ferment. When the fermentation is over, and the liquor is a little tart, it is put into the still, and fire being made, the still is suffered to work as long as that which comes has any considerable taste of spirit. The liquor thus procured is the low wise of arrack; and distilled again to separate some of its watery parts, and rectify it to that very weak kind of proof spirit in which state we find it.

Tungusian arrack is a spirituous liquor made by the Tartars of Tungusia, of mare's milk, left to sour, and afterwards distilled twice or thrice between two earthen pots closely stopped, whence the liquor runs through a small wooden pipe.

To Fine Spirits.

Mix a small quantity of wheat flour in water as if for making paste, and pour the same into the vessel. The whole is then to be well roused, and in a short time the contents will become bright.

To Extract Alcohol from Potatoes.

Take 100 lbs. of potatoes well washed, dress them by steam, and let them be bruised to powder with a roller, etc. In the meantime take 4 lbs. of ground malt, steep it in lukewarm water and then pour into the fermenting back, and pour on it 12 qts. of boiling water; this water is stirred about, and the bruised potatoes thrown in, and well stirred about with wooden rakes, till every part of the potatoes is well saturated with the liquor.

Immediately 6 or 8 oz. of yeast is to be mixed with 28 galls. of water of a proper warmth to make the whole mass of the temperature of from 59° to 66; there is to be added 1/2 a pt. to 1 pt. of good brandy.

The fermenting back must be placed in a room, to be kept by means of a stove at a temperature from 66° to 72°. The mixture must be left to remain at rest.

The back must be large enough to suffer the mass to rise 7 or 8 inches without running over. If, notwithstanding this precaution, it does so some must be taken out, and returned when it falls a little; the back is then covered again, and the fermentation is suffered to finish without touching it - which takes place generally in 5 or 6 days. This is known by its being perceived that the liquor is quite clear, and the potatoes fallen to the bottom of the back. The fluid is decanted, and the potatoes pressed dry.

When the fermentation has been favorable, from every 100 lbs. of potatoes. 6 qts. and upwards of brandy, of 20° of the areometer are obtained. It contains much fusel oil, and is colored and sold as Marc brandy.

One thousand lbs. of potatoes at twice, gives 60 to 70 qts. of brandy. The residue of the distillation is used as food for stock.

Alcohol from Wood.

The wood is reduced to coarse saw-dust, in this state it is dried up to a temperature of 212°, so as to drive off the

water which it contains, often amounting to one-half of its weight. The wood is then suffered to cool, and concentrated sulphuric acid is poured over it with great care, and very small quantities at a time, so as to prevent the materials from heating. The acid is mixed with the wood as it is poured, then for 12 hours the mixture is let alone; after that it is rubbed up with great care, until the mass, which is at first dry, becomes sufficiently liquid to run. This liquid, diluted with water, is brought to the boiling point; the acid is saturated with lime, and the liquid, after filtration, is fermented, and the alcohol distilled in the ordinary way. In this experiment, the sulphuric acid must be at least 110 per cent. of the weight of the dry wood.

Kirsch Wasser.

Spirits of cherry. Ripe cherries are crushed by hand in an inclined wooden trough; the juice is collected, the stones added, the liquid left to ferment, and is then distilled. It is not necessary to crack the stones.

Apple Brandy

Is distilled from cider. Generally the apples are crushed and allowed to ferment thoroughly, which takes from 6 to 10 days, and distilled. A better plan is to collect only the juice and ferment it. The former gives a larger yield, but the quality is not so good.

Peach Brandy.

The peaches are mashed with pestles in a trough, the juice pressed out, collected, fermented, and distilled. The pomace still contains considerable juice, it is therefore covered with water, and after fermentation, distilled.

Raisin Spirit,

Much used to give a vinous flavor to inferior spirits, is made by infusing the raisins in water fermenting, and distilling with a quick fire. The quick fire is necessary in order to get all the flavor from the raisins.

Proof Spirit.

Contains half its weight of alcohol. Its specific gravity at 60° is .920. The strength, however, varies in different localities, and the idea is at best clumsy and antiquated.

To make Brandy from Beet-Root.

For the preparation of brandy, the water used in the first boiling of the roots, is boiled again, and poured out on the residuum from the first expression of the pounded roots; this must stand for a day or two, after which it is expressed, and the remaining dry pulp serves as a good food for cattle. The juice obtained in this way is mixed with the waste parts of the syrup and the mucilage which remains after the expression of the saccharine crystals, and all boiled together till half of it is evaporated. The liquor is then poured into a coop exposed to a temperature of 45°, and cooled to 65°. Having added a proportionate quantity of yeast, it is left to ferment, and in 3 or 4 days after the distillation may be undertaken.

To Obtain Sugar from Beet-Root.

The beet-roots best calculated for the extraction of sugar, are those which have a soft flesh, whitish towards the edges and not growing above ground. After being cleaned, they are boiled, cut into pieces and pounded in a wooden trough with wooden stampers, and afterwards pressed. The juice thus obtained is immediately put into a polished copper kettle and simmered, during which time the scum must continually be taken off. To 100 quarts of this juice add 2 oz. or less of slacked lime, diluted so as to have the appearance of milk, and continue the boiling till the juice is thickened to the half of it. Having strained it through a woollen cloth, thicken it to the consistency of a syrup, which afterwards is put into glass, stone, or wooden vessels. These being placed near a moderate fire, saccharine crystals appear, which being freed by expression from the mucilaginous juice, a very good raw sugar is obtained.

Fusel Oil

Is found in new whiskey, more especially from rye, corn, and potatoes. It is a nearly colorless liquid, of a powerful odor of new whiskey, causing irritation of the nostrils and fauces. It boils at 296 Fahr., and has a density of 0.818. In its solvent forms and chemical relation it resembles alcohol. Swallowed, it acts as an instant poison. When liqueurs containing it are long kept, it changes into ethers, and becomes innocuous. There are probably several bodies compounded together under the general name of fusel oil. It may be detected by adding to the suspected liquor in a glass some fused chloride of calcium. The oil, if present, will be liberated, and may be recognized by its smell.

To Remove Fusel Oil.

It may be separated by careful distillation especially if some soft wood charcoal be introduced into the still.

2d. By filtering the whiskey through bone-black; this is termed by the dealers "rectifying", which is incorrect.
3d. Oils are added to the whiskey and the whole shaken up, the oil unites with the fusel oil and rises to the surface, and may be skimmed off.

Liqueurs.

To make Ratafia d'Angelique.

Take of angelica seeds, 1 dr., stalks of angelica, bitter almonds, blanched, each 4 oz.; proof spirit 12 pts.; white sugar, 2 lbs. Digest, strain, and filter.

Anisette de Bourdeaux.

Take of sugar, 9 oz.; oil of aniseed, 8 drops. Rub them together, and add by degrees, spirit of wine, 2 pts.; water, 4 pts. Filter.

To make Real Creme des Barbades.

Take 2 doz. middling-sized lemons, 6 large citrons; loaf sugar, 28 lbs.; fresh balm leaves, 3 lb.; spirit of wine, 2 1/2 galls.; water, 3 1/2 galls. This will produce about 7 galls., full measure. Cut the lemons and citrons in thin slices, and put them into a cask; pour upon them the spirit of wine, bung down close, and let it stand 10 days or a fortnight then break the sugar, and boil it for 1/2 an hour in the 33 galls. of water, skimming it frequently; then chop the balm-leaves, put them into a large pan, and pour upon them the boiling liquor, and let it stand till quite cold; then strain it through a lawn sieve, and put it to the spirits etc., in the cask; bung down close, and in a fortnight draw it off; strain it through a jelly bag, and let it remain to fine; then bottle it.

Eau de Barbades.

Take of fresh orange-peel, 1 oz., fresh lemon peel, 4 oz., cloves, 1/2 dr.; coriander, 1 dr.; proof spirit, 4 pts. Distill in a bath heat and add white sugar in powder.

To make Ratafia de Cafe.

Take of roasted coffee, ground, 1 lb.; proof spirit, 1 gall.; sugar, 20 oz. Digest for a week.

Ratafia de Cassis.

Take of ripe black currants, 6 lbs.; cloves, 1/2 dr.; cinnamon, 1 dr.; proof spirit, 18 pts.; auger, 3 1/2 lbs. Digest for a fortnight.

Ratafia des Cerises.

Take of morello cherries, with their kernels, bruised, 8 lbs.; proof spirit, 8 pts. Digest for a month, strain with expression, and then add 1 1/2 lbs. of auger.

Ratafia de Chocolat.

Take of caracao cocoanuts, roasted, 1 lb.; West India cocoanuts, roasted, 1/2 lb.; proof spirit, 1 gall. Digest for a fortnight, strain, and then add sugar, 1 1/2 lbs.; tincture of vanilla, 30 drops.

Eau Divine.

Take of spirit of wine, 1 gall.; essence of lemons, and essence of bergamot, each 1 dr. Distill in a Lath heat; add sugar, 4 lbs. dissolved in 2 galls. of pure water; and, lastly, orange-flower water, 5 oz.

Elephant's Milk.

Take of gum benzoin, 2 oz., spirit of wine, 1 pt.; boiling water, 2 1/2 pts. When cold, strain; and add sugar, 1 1/2 lbs.

Ratafia de Grenoble.

Take of small wild black cherries, with their kernels, bruised, 12 lbs., proof spirit, 6 galls. Digest for a month, strain, and then add 12 lbs of sugar. A little citron peel may also be added at pleasure.

Marasquin de Groscilles.

Take of gooseberries, quite ripe, 102 lbs., black cherry leaves, 12 lbs. Bruise and ferment; distill and rectify the spirits. To each pint of this spirit add as much distilled water, and sugar, 1 lb.

Huile de Venus.

Take of flowers of the wild carrot, picked, 6 oz.; spirit of wine, 10 pts. Distill in a bath heat. To the spirit add as much syrup of capillaire; it may be colored with cochineal.

Liquodilla.

Take the thin peel of 6 oranges and 6 lemons, steep them in a gallon of brandy or rum, close stopped for 2 or 3 days; then take 6 qts. of water, and 3 lbs. of loaf sugar clarified with the whites of 3 eggs. Let it boil 1/4 of an hour, then strain it through a fine sieve, and let it stand till cold; strain the brandy from the peels, and add the juice of 5 oranges and 7 lemons to each gallon.

Keep it close stopped up 6 weeks, then bottle it.

Ratafia de Brou de Noix.

Take of young walnuts, whose shells are not yet hardened, in number 60; brandy, 4 pts.; sugar, 12 oz., mace, cinnamon, and cloves, each, 15 gr. Digest for 2 or 3 months, press out the liquor, filter, and keep it for 2 or 3 years.

Ratafia de Noyeau.

Take of peach or apricot kernels, with their shells bruised, in number 120, proof spirit, 4 pts. sugar, 10 oz. Some reduce the spirit of wine to proof with the juice of apricots or peaches, to make this liqueur.

Creme de Noyeau de Martinique.

Take 20 lbs. of loaf sugar; 3 galls. of spirit of wine; 3 pts. of orange-flower water; 1 1/4 lbs. of bitter almonds, 2 drs. of essence of lemon, and 4 1/2 galls. of water. The produce will exceed 8 galls.

Put 2 lbs. of the loaf sugar into a jug or can, pour upon it the essence of lemon, and 1 qt. of the spirit of wine: stir it till the sugar is dissolved, and the essence completely incorporated. Bruise the almonds, and put them into a 4 gall. stone bottle or cask, add the remainder of the spirit of wine, and the mixture from the jug or can; let it stand a week or 10 days, shaking it frequently. Then add the remainder of the sugar, and boil it in the 4 1/2 galls. of water for 3/4 of an hour, taking off the scum as it rises. When cold, put it in a cask; add the spirit, almonds, etc., from the stone bottle, and lastly, the orange flower water. Bung it down close, and let it stand 3 weeks or a month; then strain it through a jelly bag, and when fine bottle it off. When the pink is wanted add cochineal, in powder, at the rate of 1/2 a dr., or 2 scr. to a qt.

Ratafia d'Ecorces d'Oranges.

Take of fresh peel of Seville oranges, 4 oz.; proof spirit, 1 gall.; sugar, 1 lb. Digest for 6 hours.

Ratafia a de Fleurs d'Oranges.

Take of fresh flowers of orange-tree, 2 lb.; proof spirit, 1 gall.; sugar, 1 1/2 lbs. Digest for 6 hours.

Creme d'Orange of Superior Flavor.

Take 3 doz. middling sized oranges; orange-flower water, 2 qts.; loaf sugar, 18 lbs.; spirit of wine, 2 galls.; tincture of saffron, 1 1/2 oz.; water, 4 1/2 galls. This will produce 7 1/2 galls.

Cut the oranges in slices, put them into a cask, add the spirit and orange-flower water, let it stand a fortnight, then boil the sugar in the water for 1/2 an hour, pour it out, and let it stand till cold, then add it to the mixture in the cask, and put in the tincture of Saffron. Let it remain a fortnight longer, then strain, and proceed as directed in the receipt for Cremes de Barbades, and a very fine cordial will be produced.

Fine Brandy Shrub.

Take 8 oz. of citric acid; 1 gall. of porter; 3 galls. of raisin wine; 2 qts. of orange-flower water; 7 galls. of good brandy; 5 galls. of water. This will produce 16 galls. First, dissolve the citric acid in the water, then add to it the brandy; next mix the raisin wine, porter, and orange-flower water together; and lastly, mix the whole, and in a week or 10 days it will be ready for drinking and of a very mellow flavor.

Rum Shrub.

Leave out the brandy and porter, and add 1 gall. more raisin wine; 6 lbs. of honey; and 10 galls. of good Savored rum.

Currant Shrub.

Take white currants, when quite ripe, pick them off the stalks, and bruise them, strain out the juice through a cloth, and to 2 qts. of the juice put 2 lbs. of loaf sugar, when it is dissolved add to it 1 gall. of rum, then strain it through a flannel bag that will keep in the jelly, and it will run off clear; then bottle it for use.

Usquebaugh.

Usquebaugh is a strong compound liquor, chiefly taken by way of drum; it is made in the highest perfection at Drogheda, in Ireland. The following are the ingredients, and the proportions in which they are to be used:

Take of best brandy, 1 gall.; raisins, stoned, 1 lb.; cinnamon, cloves, nutmeg, and cardamoms, each 1 oz.

crushed in a mortar; saffron, 1/2 oz., rind of 1 Seville orange, and brown sugar candy, 1 lb. Shake these well every day, for at least 14 days, and it will at the expiration of that time be ready to be fined for use.

Another Method.

Take of nutmegs, cloves, and cinnamon, each 2 oz. of the seeds of anise, caraway, and coriander, each 4 oz.; liquorice-root, sliced, 1/2 lb., bruise the seeds and spices, and put them together with the liquorice, into the still with 11 galls. of proof spirit, and 2 galls. of water; distill with a pretty brisk fire. As soon as the still begins to work, fasten to the nozzle of the worm 2 oz. of English saffron, tied up in a cloth, that the liquor may run through it, and extract all its tincture. When the operation is finished, sweeten with fine sugar. This liqueur may be much improved by the following additions: Digest 4 lbs. of stoned raisins; 3 lbs. of dates; and 2 lbs. of sliced liquoriceroot, in 2 galls. of water for 12 hours. When the liquor is strained off, and has deposited all sediment decant it gently into the vessel containing the usquebaugh.

Ratafia a la Violette.

Take Florentine orris root 2 drachms, archel 1 oz., spirit of wine 4 pts. Digest, strain, and add sugar 4 lbs. Liqueurs are also made by adding Hungary-water, honey-water, eau de Cologne, and several other spirits to an equal quantity of simple syrup, or common capillaire.

Compound Spirits, Or Cordials

General Rules.

The perfection of this grand branch of distillery depends upon the observation of the following general rules, which are easy to be observed and practised: 1. The artist must always be careful to use a well-cleansed spirit, or one freed from its own essential oil; for as a compound cordial is nothing more than a spirit impregnated with the essential oil of the ingredients, it is necessary that the spirit should have deposited its own. 2. Let the time of previous digestion be proportioned to the tenacity of the ingredients, or the ponderosity of their oil. 3. Let the strength of the fire be proportioned to the ponderosity of the oil intended to be raised with the spirit. 4. Let a due proportion of the finest parts of the essential oil be united with the spirit; the grosser and less fragrant parts of the oil not giving the spirit so agreeable a flavor, and at the same time rendering it thick and unsightly. This may in a great measure be effected by leaving out the feints, and making up to proof with fine soft water in their stead.

A careful observation of these four rules will render this extensive part of distillation far more perfect than it is at present. Nor will there be any occasion for the use of burnt alum, white of eggs, isinglass, etc. to fine down the cordial waters, for they will presently be fine, sweet, and pleasant.

To make Aniseed Cordial.

Take aniseed, bruised, 2 lbs, proof spirit 12 1/2 galls.; water, 1 gall. Draw off 10 galls., with a moderate fire. This water should never be reduced below proof, because the large quantity of oil with which it is impregnated will render the goods milky and foul when brought down below proof. But if there is a necessity for doing this, their transparency may be restored by filtration.

Strong Cinnamon Cordial.

Take 8 lbs. of fine cinnamon, bruised; 17 galls of clear rectified spirit, and 2 galls. of water. Put them into the still, and digest them 24 hours with a gentle heat; after which draw off 16 galls. by a pretty strong heat.

Caraway Cordial.

For 20 galls. Take 1 1/2 oz. of oil of caraway, 20 drops of cassia-lignea oil, 5 drops of essence of orange peel, 5 drops of the essence of lemons, 13 galls. of spirits, 1 in 5, and 8 lbs. of loaf sugar. Make it up and fine it down.

Cedrat Cordial.

The cedrat is a species of citron, and very highly esteemed in Italy, where it grows naturally. The fruit is difficult to be procured in this country; but as the essential oil is often imported from Italy it may be made with it as follows: Take of the finest loaf-sugar, powdered, 1/4 lb. Put it into a glass mortar, with 120 drops of the essence of cedrat; rub them together with a glass pestle, and put them into a glass alembic, with a gallon of fine proof spirit and a quart of water. Place the alembic in a bath heat, and draw off 1 gall., or till the feints begin to rise, then dulcify with fine sugar. This is considered the finest cordial yet known; it will therefore be necessary to be particularly careful that the spirit is perfectly clean, and, as much as possible, free from any flavor of its own.

Citron Cordial.

Take of dry yellow rinds of citrons, 3 lbs.; orangepeel, 2 lbs.; nutmegs, bruised, 3/4 lb.; proof spirit, 10 1/2 galls.; water, 1 gall. Digest with a gentle heat, then draw off 10 galls. in a bath heat, and dulcify with fine sugar.

Clove Cordial.

Take of cloves, bruised, 4 lbs.; pimento, or allspice, 1/2 lb.; proof spirit, 16 galls. Digest the mixture 12 hours in a gentle heat, and then draw off 15 galls. with a pretty brisk fire. The water may be colored red, either by a strong tincture of cochineal, alkanet, or corn poppy-flowers. It may be dulcified at pleasure with refined sugar.

Coriander Cordial.

For 3 galls. Take 7 qts. of spirits, 2 lbs. of coriander seed, 1 oz. of caraway seed, 6 drops of the oil of orange, and 2 lbs.; of sugar. Fill up with water. The coriander seed must be bruised and steeped in the spirits for 10 or 12 days, and well stirred 2 or 3 times a any. Fine it the same as gin.

Eau de Bigarade.

Take the outer or yellow part of the peels of 14 bigarades (a kind of orange), 1/2 oz. of nutmegs, 1/4 oz. of mace, 1 gall. of fine proof spirit, and 2 qts. of water. Digest all these together 2 days in a close vessel; after which draw off a gallon with a gentle fire, and dulcify with fine sugar.

Gold Cordial.

Take of the roots of angelica, sliced, 4 lbs.; raisins, stoned, 2 lbs.; coriander seeds, 1/2 lb.; caraway seeds and cinnamon, each 1/2 lb.; cloves, 2 oz.; figs and liquorice root, sliced, each 1 lb.; proof spirit, 11 galls.; water, 2 galls. Digest 2 days, and draw off by a gentle heat, till the feints begin to rise; hanging in a piece of linen, fastened to the mouth of the worm, 1 oz. of English saffron. Then dissolve 8 lbs. of sugar in 3 qts. of rose-water, and add to it the distilled liquor.

The above cordial derives its name from a quantity of leaf gold being formerly added to it; but this is now generally disused.

Lovage Cordial.

For 20 galls. Take of the fresh roots of lovage, valerian, celery, and sweet fennel, each 4 oz.; essential oil of caraway and savin, each 1 oz.; spirit of wine, 1 pt.; proof

spirit, 12 galls.; loaf sugar, 12 lbs.; Steep the roots and seeds in the spirits for 14 days, then dissolve the oils in the spirit of wine, and add them to the undulcified cordial drawn off from the other ingredients; dissolve the sugar in the water for making up, and fine, if necessary, with alum.

Lemon Cordial.

Take of dried lemon-peel 4 lbs., proof spirit, 10 1/2 galls., water 1 gall. Draw off 10 galls. by a gentle fire, and dulcify with fine sugar.

Nectar.

For 20 galls. Take 15 galls. of red ratafia, 1/4 oz. of cassia-oil, and an equal quantity of the oil of caraway seeds. Dissolve in half a pint of spirit of wine, and make up with orange wine, so as to fill up the cask. Sweeten, if wanted, by adding a small lump of sugar in the glass.

Noyeau.

Take 13 galls. of French brandy, 1 in 5, 6 oz. of the best French prunes, 2 oz. of celery, 3 oz. Of the kernels of apricots, nectarines, and peaches, and 1 oz. of bitter almonds, all gently bruised, essence of orange-peel and essence of lemon-peel, of each 2 dwts., 1/2 lb. of loaf-sugar. Let the whole stand ten days or a fortnight; then draw off, and add to the clear noyveau as much rose-water as will make it up to 2 galls.

Orange Cordial.

Take of the yellow part of fresh orange-peel, 5 lbs.; proof spirit, 10 1/2 galls.; water, 2 galls. Draw off 10 galls. with a gentle fire.

Peppermint Cordial.

For 20 galls. Take 13 galls. of rectified spirits, 1 in 5 under hydrometer proof, 12 lbs. of loaf sugar, 1 pint of spirit of wine that will fire gun powder, 15 dwts. (troy) of oil of peppermint, Water as much as will fill up the cask, which should be set up on end after the whole has been well roused, and a cock for drawing off placed in it.

Ratafia.

This a liquor prepared from different kinds of fruits, and is of different colors, according to the fruits made use of. These fruits should be gathered when in their greatest

perfection, and the largest and most beautiful of them chosen for the purpose. The following is the method of making red ratafia, fine and soft: Take of the black-heart cherries, 24 lbs., black cherries, 4 lbs., raspberries and strawberries. each, 3 lbs.; Pick the fruit from their stalks and bruise them, in which state let them continue 12 hours, then press out the juice, and to every pint of it add 1/4 lb. of sugar. When the sugar is dissolved, run the whole through the filtering-bag and add to it 3 quarts of proof spirit. Then take of cinnamon, 4 oz., mace, 4 oz., and cloves, 2 drs. Bruise these spices, put them into an alembic with a gallon of proof spirit and 2 quarts of water, and draw off a gallon with a brisk fire. Add as much of this spicy spirit to the ratafia as will render it agreeable; about 1/4 is the usual proportion.

Dry or Sharp Ratafia.

Take of cherries and gooseberries, each 30 lbs., mulberries, 7 lbs., raspberries, 10 lbs.; Pick all these fruits clean from their stalks, etc., bruise them and let them stand 12 hours, but do not suffer them to ferment. Press out the juice, and to every pint add 3 oz. of sugar. When the sugar is dissolved, run it through the filtering-bag, and to every 5 pints of liquor add 4 pints of proof spirit, together with the same proportion of spirit drawn from spices.

Common Ratafia.

Take of nutmegs, 8 oz., bitter almonds, 10 lbs., Lisbon sugar, 8 lbs., ambergris, 10 grs. Infuse these ingredients three days in 10 galls. of proof spirit and filter it through a flannel bag for use. The nutmegs and bitter almonds must be bruised and the ambergris rubbed with the Lisbon sugar in a marble mortar, before they are infused in the spirit.

Cherry Brandy.

One of the best and most common ways of making cherrybrandy, is to put the cherries (being first clean-picked from the stalks) into a vessel till it be about half full, then fill up with rectified molasses-brandy, which is generally used for this compound; and when they have been infused 16 or 18 days draw off the liquor by degrees, as wanted; when drawn off, fill the vessel a second time nearly to the top, let it stand about a month, and then draw it off as there is occasion. The same cherries may be used a third time by covering them with over-proof brandy and letting it infuse for 6 or 7 weeks; when drawn off for use, as much water must be added as the

brandy was over-proof, and the cherries must be afterwards pressed as long as any liquor remains in them, before being cast away.

When drawn off the second time the liquor will be somewhat inferior to the first, when more sugar, with 1/2 oz. of cinnamon and cloves beaten, may be added to 20 galls. of it; but there should only be half the quantity of cinnamon and cloves in each 20 galls. of the first infusion.

Another Method.

Take 72 lbs. of cherries, half red and half black, mash or squeeze them to pieces with the hands, and add to them 3 galls. of brandy, letting them steep for 24 hours, then put the mashed cherries and liquor into a canvas bag, a little at a time and press it as long as it will run. Sweeten it with loaf sugar and let it stand a month, then bottle it off, putting a lump of sugar into every bottle.

Another. - To every 4 qts. of brandy, put 4 lbs. of red cherries, 2 lbs. of black, 1 qt. of raspberries, with a few cloves, a stick of cinnamon, and a little orange peel; let these stand a month close stopped; then bottle it off, putting a lump of sugar into every bottle.

Black-Cherry Brandy.

Stone 8 lbs. of black cherries and put on them a gallon of brandy. Bruise the stones in a mortar, and then add them to the brandy. Cover them close, and let them stand a month or 6 weeks. Then pour it clear from the sediment and bottle it. Morello cherries, managed in this manner make a fine rich cordial.

Caraway-Brandy.

Steep 1 oz. of caraway-seed and 6 oz. of loaf sugar, in 1 qt. of brandy; let it stand 9 days and then draw it off.

Lemon-Brandy.

Put 5 qts. of water to 1 gall. of brandy; take 2 doz. of lemons, 2 lbs. of the best sugar, and 3 pints of milk. Pare the lemons very thin and lay the peel to steep in the brandy 12 hours. Squeeze the lemons upon the sugar, then put the water to it, and mix all the ingredients together. Boil the milk and pour it in boiling. Let it stand 24 hours and then strain it.

Orange Brandy.

Put the chips of 18 Seville oranges in 3 qts. of brandy, and let them steep a fortnight in a stone bottle close stopped. Boil 2 qts. of spring-water with 1 1/2 lbs. of the finest sugar, nearly an hour very gently. Clarify the water and sugar with the white of an egg, then strain it through a jelly-bag and boil it nearly half away. When it is cold, strain the brandy into the syrup.

Raspberry Brandy.

Take a pint of water and 2 qts. of brandy, and put them into a pitcher large enough to hold them and 4 pints of raspberries. Put in 1/2 lb. of loaf sugar and let it remain for a week close covered. Then take a piece of flannel with a piece of holland over it, and let it run through by degrees. It may be racked into other bottles a week after and then it will be perfectly fine.

Another Method

Raspberry brandy is infused nearly after the same manner as cherry brandy, and drawn off with about the same addition of brandy to what is drawn off from the first, second and third infusion, and dulcified accordingly; first making it of a bright deep color, omitting cinnamon and cloves in the first, but not in the second and third infusion. The second infusion will be somewhat paler than the first, and must be heightened in color by adding cherry brandy, about 1 qt., with 10 or more galls. of raspberry brandy; and the third infusion will require more cherry brandy to color it. It may be flavored with the juice of the elderberry.

Whiskey Cordial.

Take of cinnamon, ginger, and coriander-seed, each 3 oz., mace, cloves, and cubeb, each 1 1/2 oz. Add 11 galls. of proof spirit and 2 galls. of water, and distill; now tie up 5 oz. of English saffron; raisins (stoned), 4 1/2 lbs., dates, 3 lbs.; liquorice root, 2 lbs. Let these stand 12 hours in 2 galls. of water; strain, and add it to the above. Dulcify the whole with fine sugar.

Factitious Liquors.

Much of the wine and spirits sold is factitious. In some cases the ingredients added are not inferior in their character; in others alcohol is replaced by poisonous bodies, some imitations containing absolutely no alcohol. The receipts given below are among the least injurious, although none are recommended.

Neutral Spirits

Or sweet liquor, is made by filtering ordinary whiskey through bone-black, and afterwards through wood charcoal, to deprive it of all fusel oil, and other odorous matter.

Flavoring Materials.

These are acetic, butyric ethers, acetate of the oxyde of amyl (see CONFECTIONARY for Flavoring Extracts), sweet spirit of nitre, oil of bitter almonds, oil of cognac, light oil of wine, the various essential oils, tincture of benzoin, citric, tartaric, and sulphuric acid.

Nut kernels, mucilage of various kinds, slippery elm, almond oil, green tea, and sugar are used to give the appearance of age.

Coculus indicus, Guinea pepper, mustard, horse radish, pellitory, are used to give pungency and intoxicating qualities.

Catechu, green tea, logwood, oak bark, etc., to give astringency and color.

Caramel and burned sugar to give color.

To Detect Adulterations.

The quantity of alcohol is determined by the hydrometer (see SPECIFIC GRAVITY). Should the liquor be much below proof, and still possess decidedly intoxicating qualities, coculus indicus is to be suspected, but no good test for this substance is known. If, when the liquor be swallowed, it produces a burning sensation at the back of the throat, it is adulterated with pepper, etc.

The flavoring ethers may be separated by distillation, but as some of them exist in true wines and spirits, this cannot decide that the liquor is factitious.

If the liquor be cautiously evaporated to dryness, in a porcelain capsule, the extract will contain most of the adulterations, which can often be detected by the taste and smell.

If nitrate of baryta gives a precipitate with any spirit, the presence of acid artificially added may be suspected. This is not true of wines.

To detect fusel oil, put some fused chloride of calcium, broken into small pieces, into a glass; pour over it the suspected liquor, cover it with a glass plate, and let it stand aside for a short time. If fusel oil be present it will at once manifest itself by its smell. The smaller the quantity of fusel oil the longer must it stand before examination.

To Determine the Quantity of Alcohol in Wine, Beer, etc.

Distill carefully a small quantity of the liquid until from 1/2 to 3/4 have passed over, then add water enough to the distillate to make it up to its original bulk, put the mixture in a well-stopped bottle and shake well; let it stand aside for a day or two; its specific gravity may be then taken with the hydrometer, or specific gravity bottle.

To Determine the Strength of Spirits.

The simplest method and that generally adopted, is by the hydrometer. It consists of a cylinder, with a weighted bulb below to make it float upright, and a graduated stem. If it float with the bottom of the stem at the surface of pure water at 60° Fahr., it will sink deeper in a lighter liquid. The instrument of Tralles is so graduated as to indicate the percentage by volume of absolute alcohol in any mixture of alcohol and water. If the spirit be not at the temperature of 60°, it should be brought to that degree, or the temperature tested and allowance made by a table which is found in the chemical works. In introducing the instrument, care should be taken to avoid wetting the stem, as this would give a higher percentage than the truth. To convert volume percentage into that by weight multiply the number of degrees on Tralles' scale by 0.794, and divide by the specific gravity of the liquid under trim. In case the Tralles' instrument is not at hand, take the specific gravity of the liquid by any of the methods given under that head. By means of tables to be found in the chemical works, the percentage of alcohol may be determined.

To Procure the Oil of Wine.

This oil should be distilled from the thick lees of French wines, because of the flavor, and when procured must be kept ready for use. It must be mixed with the purest spirits of wine, such as alcohol, by which means it may be preserved a long time. The bottle should be shaken before the oil is used.

When the flavor of the brandy is well imitated by a proper portion of the essential oil, and the whole reduced into one nature, yet other difficulties still exist, which are, the color, the softness, and the proof. The proof may be effected by using a spirit above proof, which after being mixed with the oil may be let down to any strength with water. The softness will be attained by getting a spirit that has been distilled by a slow fire; and the color may be regulated by the use of brandy coloring.

Preparation of Rum Ether.

Take black oxide of manganese, and sulphuric acid, each 12 lbs.; alcohol, 26 lbs., strong acetic acid, 10 lbs.

The ether above prepared is the body to which rum owes its peculiar flavor; it is also used in making cheap brandy.

Artificial Fruit Essences.

The pineapple flavor is butyrate of ethyloxyde, or butyric ether; apple, valerianate of amyloxyde; quince, pelargonate of ethyloxyde; jargonelle pear, acetate of amyloxyde; ordinary pear, acetate of amyloxyde, with acetate of ethyloxyde; melon flavor, cocinate of ethyloxyde. Other flavors are made by using these in various proportions and different degrees of dilution with alcohol.

To make Butyric Acid.

Dissolve 6 lbs. of sugar and 1/2 oz. of tartaric acid in 26 lbs. of water. Let the solution stand for several days, add 8 oz. of putrid cheese, 3 lbs. skimmed and curdled sour milk, and 3 lbs. of levigated chalk. The mixture should be kept in a warm place, say 92° Fahr., and stirred from time to time. In about 6 weeks the sugar will have given rise to butyric acid, which unites with the lime of the chalk.

To separate the butyric acid, add hydrochloric (muriatic) acid and distill. It is well to neutralize the distillate with carbonate of soda and re-distill. Then saturate the distillate with fused chloride of calcium and redistill.

To make Butyric Ether.

Take 8 oz. of butyric acid, 6 oz. alcohol, and 2 oz. of sulphuric acid. Distill in a glass retort. The distillate may be re-distilled over chloride of calcium.

This is the pineapple oil. It is used to flavor syrup, creams, fruit-drops, and cheap brandy. It requires to be diluted with deodorized alcohol, in order to develop the true flavor.

To make Oil of Quince.

Pelargonic ether is made from oil of rue by treating with double its volume of dilute nitric acid, heating the mixture until it begins to boil. After some time two layers are seen. The lower one is separated with a pipette, and freed from nitric acid by evaporation in a chloride of zinc bath, it is then filtered mixed with deodorized alcohol, and digested at a gentle heat until the fruity odor is noticed.

This ether seems identical with the ethereal oil of wine, which gives the bouquet. It is sometimes sold as oil of Cognac.

Jargonelle Pear Oil

Is made from heavy fusel oil, that which comes over last in distillation. To purify the fusel oil wash with soda and water, and distill between 254° and 284° Fahr. Of this take 1 lb., glacial acetic acid, 1 lb.; sulphuric acid, 1/2 lb. Digest for some hours at 254° Fahr. The ether separates upon the addition of water, and is purified by washing with soda and water. Mixed with 1-30th of acetic ether, and 7 parts of deodorized alcohol, it gives the essence of pears.

Apple Oil.

Mix cautiously 1 part of fusel oil, 3 parts of sulphuric acid, and 2 parts of water. Dissolve 2 1/2 parts of bichromate of potash in 4 1/2 parts of water; introduce this into a large tubulated retort, and gradually add the former liquid, so that the boiling continues very slowly. The distillate, which is principally valerianic acid, is saturated with carbonate of soda, and evaporated to dryness. Take of the valerianate of soda, thus formed, 1 1/2 parts; fusel oil, 1 part; sulphuric acid, 1 part mix cautiously, heat by a water bath, and mix with water; the impure valerianate of amyloxyde will separate. It is washed several times with water, then with a solution of carbonate of soda, and finally with water. This is dissolved in from 6 to 8 parts of water.

To Improve the Flavor of Fruit Essences.

Add to the essence made by dissolving the oil in 6 or 8 parts of deodorized alcohol a small quantity of tartaric or citric acid. This will develop the flavor, and, when used in confectionary, imitate more closely the taste of the fruit.

Bead for Liquors.

Ether, 1 lb.; strong alcohol, 2 qts. Keep in a wellstopped bottle.

Jamaica Rum

Neutral spirits, 4 galls.; Jamaica rum, 1 gall.; sulphuric acid, 1/2 oz.; acetic ether, 4 oz.; burnt sugar coloring, 8 oz.

Pineapple Rum.

Neutral spirits, 4 galls.; honey, 5 pts.; water, to dissolve, 5 qts.; Jamaica rum, 1 gall.; sulphuric acid, 1 oz.; butyric ether, 2 oz.; tincture of cochineal, 3 oz.; burnt sugar, 2 oz.

Gin, Aromatic Schiedam Schnapps.

Neutral spirits, 4 galls.; water, 4 pts., to dissolve honey, 4 pts.; oil of juniper, 15 drops, dissolved in nitric ether, 1 oz.

Curacoa.

Common whiskey, 5 galls.; fresh orange-peel 4 lbs.; oil of bitter almonds, oil of cassia, of each 1 dr.; oil of lemon, 2 drs.; oil of cinnamon, 50 drops; water, 5 qts., to dissolve refined sugar, 16 lbs.; tincture of cochineal, 1/2 a pt., burnt sugar 3 oz.; allow the above to digest for 5 days, the whole of the oils should be dissolved in 1/2 a glass of alcohol, and mix well.

Brandies.

Cognac Brandy.

Neutral spirits, 4 galls.; 1/2 a gall. of honey dissolved in water, 2 pts.; Jamaica rum, 1 gall.; catechu, 1/2 oz.; butyric ether, 1 oz. Mix.

Sarzerac Brandy.

Neutral spirits, 4 galls.; 3 pts. of water to dissolve honey, 4 pts.; rum, 3 qts.; porter, 3 pts.; infusion of almonds, 1/2 a pt.; oil of wine, 1 oz.; sugar coloring, 4 oz., cochineal tincture, 1 oz.; then add the alcoholic solution of starch, 3 pts., and mix. This starch solution is made by infusing 1 qt. of wheat or rice flour in 1 1/2 galls. of equal parts of clean spirit and water for 24 hours.

Cherry Brandy.

Neutral spirits, 4 galls.; refined sugar, 5 lbs.; water, to dissolve, 1 gall., catechu, 1 oz., infusion of bitter almonds, 1/2 a pt.; cloves, cassia, of each 1/2 oz.; these are to be well bruised before adding tartaric acid, 4 oz., dissolved in 1 pt. of water; honey, 1 qt., dissolved in 1 pt. of water; 4 drops of oil of wintergreen, dissolved in 1 oz. of acetic ether, then color with 1 pt. of the tincture of cochineal; burnt sugar, 1 oz.

Peach Brandy.

Neutral spirits, 4 galls.; 3 pts. of honey, dissolved in 2 pts. of water; mix infusion of bitter almonds, 1 pt.; sulphuric acid, 80 drops; porter, 1 pt., tincture of saffron, 1/2 a pt.: and flavor with oil of pears, 1 oz., dissolved in 2 oz. of alcohol, and acetic ether, 1/2 oz.

Old Apple Brandy.

Neutral spirits, 4 galls.; decoction of tea, 1 pt.; alcoholic solution of starch, 3 qts., sulphuric acid 1/2 oz.; this is flavored with the oil of apples, 1 oz. dissolved in alcohol, 2 oz., color with 4 oz. of sugar coloring; valerianate of amylic oxide is the chemical name for apple oil.

Whiskeys.

Irish Whiskey.

Neutral spirits, 4 galls.; refined sugar, 3 lbs., in water, 4 qts.; creasote, 4 drops; color with 4 oz. of burnt sugar.

Scotch Whiskey.

Neutral spirits, 4 galls.; alcoholic solution of starch, 1 gall.; creasote, 5 drops; cochineal tincture, 4 wineglassfuls; burnt sugar coloring, 1/4 pt.

Old Bourbon Whiskey.

Neutral spirits, 4 galls.; refined sugar, 3 lbs.; dissolved in water, 3 qts.; decoction of tea, 1 pt.; 3 drops of oil of wintergreen, dissolved in 1 oz. of alcohol; color with tincture of cochineal, 2 oz.; burnt sugar, 3 oz.

Monongahela Whiskey.

Neutral spirits, 4 galls.; honey, 3 pts., dissolved in water, 1 gall.; alcoholic solution of starch, 1 gall.; rum, 1/2 a gall.; nitric ether, 1/2 an ounce; this is to be colored to suit fancy.

Anisette de Bordeaux

Whiskey, 2 galls.; 5 lbs. of refined sugar; water, to dissolve, 1 1/2 galls.; 1 dr. oil of aniseed, dissolved in 1 oz. of alcohol, or well rubbed up in dry sugar, and added; if this is for white anisette, fine with 1/2 oz. of powdered alum; if it is for rose or pink anisette, color to suit taste.

Common rectified whiskey will answer in the above formula, or in any other in which a powerful aromatic is found necessary.

Maraschino.

Proof whiskey, 3 galls.; 6 qts. of water, to dissolve, sugar, 12 lbs.; oil of bergamot, and oil of cloves, of each, 1 dr.; oil of cinnamon, 5 drops; 2 oz. of nutmegs, bruised, 1 lb. of orange-peel, 3 oz. of bitter almonds, bruised; oil of lemon, 1 dr.; dissolve the oil in alcohol; color with cochineal and burnt sugar.

Sherry.

Cider, 10 galls.; bitter almonds, 4 oz.; honey, 1 gall.; mustard, 4 oz. Boil for 30 minutes, and strain, then add spirits of orris-root, 1/2 a pt.; essence of cassia, 2 oz.; and rum, 3 qts.

Port Wine

Claret, 100 galls., honey, strained, 12 galls.; red tartar, 1 lb.; powdered catechu, 12 oz.; wheat flour, made into a paste, 1 pt.; neutral spirits, 12 galls.; 2 oz. each of bruised ginger and cassia, 1 pt. of tincture of orrisroot, and color with alkanet-root, or dissolve 16 oz. bruised cochineal in 1 gall. of the above spirit, and 1 pt. of burnt sugar; this will produce the desired shade of purple. For giving artificial strength, use tincture-grains of paradise, and the decoction of strong tea, in quantities to suit the palate.

If this is not perfectly transparent, fine with milk or isinglass.

Madeira Wine.

Water 12 galls.; honey, 1 gall.; clean spirits 5 qts.; hops, 5 oz.; bitter almonds, 3 oz. Boil for 25 minutes and allow it to ferment by the addition of 1 qt. of yeast, allow the fermentation to continue until the liquor tastes pleasantly acid, then fine with milk, and add 3 qts. of rum and 4 oz. of mustard. Allow it to stand for a few days; the mustard should be inclosed in a thin piece of muslin and be suspended in the wine.

Imitation Claret.

Boiled cider, 6 galls.; spirits, 2 galls.; clear water, 5 galls.; catechu, powdered, 2 oz. Color with red beets and tincture logwood to suit taste. When this is not sufficiently acid, add from 1 to 2 drops of sulphuric acid to the gallon, to suit taste.

Cheap Champagne.

Water, 50 galls.; honey, 2 galls.; bruised ginger, 5 oz.; ground mustard, 5 oz. Boil the mass for 30 minutes, and when quite cool add a quart of yeast. Ferment for 10 or 14 days, first add 6 oz. of bitter almonds, bruised; spirits and grains of Paradise tincture, to suit convenience. The more spirit the Champagne possesses the greater will be its body. For coloring, use cochineal 1/2 oz. to 50 galls. The cheapest coloring is red beets sliced, and added to the mass during fermentation. Five or 6 common-sized beets will color 50 galls. The best of this coloring will not compare with cochineal. A fine aroma is given to the champagne by adding 5 drops of spirits of orris, or 3 drops of essence of wintergreen, or essence of vanilla 4 drops; or dissolve 5 grs. of ambergris in 1/2 glass of pure alcohol, the alcohol should be kept hot for 1/2 an hour; this, when dissolved, should be added to 50 galls. of Champagne.

8.1 Essential Oils.

General Directions.

The quantity of volatile oil yielded by a plant will depend upon the part employed, the season, and the period of growth. The drier the season and the warmer the climate, the richer are the plants in oils. They should be gathered, as a general rule, immediately after blossoming, and distilled, if possible, while fresh.

It is better to macerate the plants for one day before distilling. Roots, barks, etc., should be coarsely powdered. Parts which yield no oil, as the stems of mint, sage, etc., should be detached.

The larger the quantity operated on the better; the quantity of water should be sufficient to thoroughly cover the plant; too much water causes loss by dissolving a portion of the oil. When the plants are abundant the distillate should be returned to a fresh portion of the plant in a retort. It is a good plan to use the water of a previous distillation for the same plant, as it is already saturated with the oil.

If the oil is heavier than water, use a saturated solution of salt. If lighter, the Florentine receiver.

Solutions for the Water-bath.

Various salts dissolved in water materially raise the boiling point, and thus afford the means of obtaining a steady temperature at different degrees above 212°. The following are some of the most useful: A saturated solution of nitrate of soda boils at 246; Rochelle salts at 240°;

nitre at 238°; muriate of soda at 224°; sulphate of magnesia at 222°.

Oil of Aniseed.

One lb. of the seeds will yield 2 drs. It is congealed, except in warm weather; this oil is carminative and poisonous to pigeons, if rubbed on their bills or head.

Oil of Ben, or Behen,

Is obtained by expression from the seeds of *Mohringa aptera*. It is insipid, inodorous, and does not become rancid. It is used in perfumery. Hazel-nut oil is sometimes substituted for it.

Birch Oil.

Obtained by distilling 20 parts of birch bark and 1 of *ledum palustre*, crammed in layers into an earthen pot, with a handful of tripoli between each layer; the mouth of the pot is closed with a perforated oak plug, and being inverted, it is luted to the mouth of another pot sunk in the ground, the pot being then surrounded with fire, a brown empyreumatic oil distills per descensum into the lower jar; an 8 gall. pot, properly filled, yields about 2 lbs. or 2 1/2 lbs. of oil. In Siberia it is prepared without the *ledum*. This oil is liquid when fresh, but grows thick in time. It is used in Russia for currying leather, to which it gives a very peculiar smell, much disliked by insects.

Oil of Gum-benzoin.

Obtained by distilling the residuum left after making flowers of benjamin, by a strong fire. It is used instead of birch oil in making an imitation of Russia leather.

Cajeput Oil.

This is obtained from the leaves, which are imported from the East Indies, generally in large copper flasks; it is cooler than that of peppermint, but smells of turpentine. It is used externally in rheumatism.

Oil of Caraway.

This is obtained from the seeds; it is carminative; 2 lbs. will yield more than 1 oz. and 4 cwt. 83 oz.

Oil of Cloves.

This is obtained from a spice of that name; it is very heavy, acrimonious, and supposed to contain some part of the resin of the clove. One lb. of cloves will yield from 1 1/2 to 2 1/2 oz.; 7 1/2 lbs. will yield 1 lb. of oil. It is also expressed from the cloves when ripe. Muller, by digesting 1/2 oz. of cloves in ether, and then mixing it with water, obtained 7 scruples of oil, greenish yellow, swimming upon water. Oil of cloves is imported from the spice islands; it is stimulant, and added to purgative pills to prevent griping; it is externally applied to aching teeth.

Oil of Cassia.

This is a common oil of cinnamon, and is obtained from the bark of inferior cinnamon, imported under the name of cassia. One lb. will yield from 1 to 1 1/2 drs. It is stimulant and stomachic. Another oil is obtained from cassia buds.

Oil of Chamomile.

This is obtained from the flowers, and is stomachic. One lb. will yield a dr.; 82 lbs. will yield from 13 to 18 drs. It is of a fine blue, even if distilled in glass vessels.

Oil of Cinnamon.

This is obtained from the fresh bark, which is imported from Ceylon. De Guignes says the cinnamon from Cochin China is so full of essential oil that it may be pressed out by the fingers.

Essence of Cedrat.

This is obtained from the flowers of the citron tree; it is amber-colored and slightly fragrant; 60 lbs. yield 1 oz. It is also obtained from the yellow part of citron-peel; it is colorless, very thin and fragrant. The second oil is obtained by the distillation of the yellow part of citron-peel, and is greenish; 100 citrons will yield 1 oz. of the white essence, and 1/2 oz. of this. It is likewise obtained from the yellow part of citron-peel by expression between two glass plates; also, from the cake left on squeezing citron-peel, by distillation with water. It is thick.

Common Essence of Cedrat.

This is obtained from the faeces left in the casks of citron-juice; clear, fragrant, greenish, 50 lbs. of faeces will yield, by distillation, 3 lbs. of essence.

Oil of Calamus.

The rhizome of the acorus calamus, or swell flag, yields about 1 per cent. of oil. It is carminative, but little used. It is also employed in perfumery.

Oil of Cedar.

Obtained by distillation; is sometimes used in perfumery.

Camphor.

This is obtained from the roots and shoots of the laurus camphora and laurus cinnamomum, as also the capura curundu, by distillation with water. This crude camphor is refined by sublimation with one-sixteenth of its weight of lime in a very gentle heat.

Camphor from Essential Oils.

Obtained from the oils of the labiate plants by a careful distillation, without addition of 1/3 of the oil; the residuum will be found to contain crystals of camphor, on separating which and re-distilling the remaining oil 2 or 3 times, the whole of the camphor may be obtained. Oil of rosemary or of sweet marjoram yields about 1 oz. of camphor from 10 of oil; of the sage 1 oz. from 8, and of lavender 1 oz. from 4, or even less of oil; that from oil of marjoram is not volatile, and although it takes fire, it soon goes out. This resin, like the others from essential oils, may be obtained in a larger proportion if the oil is kept in slightly stopped bottles in a cool place.

Dippel's Oil.

Obtained from hatshorn, distilled without addition, rectifying the oil, either by a slow distillation in a retort, etc., no bigger than is necessary and saving only the first portion that comes over, or with water in a common still; it is very fine and thin, and must be kept in an opaque vessel or in a drawer, or dark place, as it is quickly discolored by light. It is antispasmodic, anodyne, and diaphoretic, taken in doses from 10 to 30 drops, in water.

Oil of Bitter Almonds

Is obtained by the distillation of the crushed kernels, at the same time hydrocyanic acid is formed and passes over with the oil. The crude oil is therefore poisonous. It is sometimes used in medicine for the hydrocyanic acid which it contains but is uncertain. It is used in perfumery and confectionery. When cakes are flavored with it the hydrocyanic acid can do little or no mischief, as it is driven off by the heat employed.

Artificial Oil of Bitter Almonds

Is made by action on true benzole (not that distilled from petroleum) of fuming nitric acid or a mixture of equal parts of ordinary nitric and sulphuric acids. It is of a yellowish color; is poisonous; is used for making aniline (see COAL TAR COLORS), and in perfumery. Its chemical name is nitro-benzole; it is sold as "Essence of Mirban." By heating benzoate of ammonia, an oily liquid having exactly the bitter almond smell, is obtained. It is not used. It is known in chemistry as benzonitrile.

Oil of Geranium,

From the leaves of the Pelargonium odoratissimum, is used in perfumery. It is adulterated with ginger-grass oil. It is used to adulterate attar of roses.

Artificial Oil of Geranium

May be obtained by distilling benzoate of copper. It has not come into practical use. Its chemical name is benzoxyl.

Krumholz' Oil.

Obtained by distillation from Hungarian balsam. It is distinguished from oil of turpentine, which is commonly sold for it, by its golden color, agreeable odor, and acid oiliness of taste.

Foreign Oil of Lavender.

This is the true oil of spike, and is obtained from the flowers and seeds of broad leaved lavender, and more commonly those of French lavender, stoechas, with a quick fire. It is sweet-scented but the oil of the narrow-leaved lavender, or English oil, is by far the finest.

Essence of Lavender.

The oil of the flowers of lavender is rendered more delicate in its odor by age, but to prevent its becoming glutinous by keeping, which it is very apt to do, draw it over in a water-bath, with a small quantity of alcohol, which is termed the essence, and which, after being kept closely corked for about 7 years, possesses a peculiarly fine delicate odor of lavender, entirely free from empyreuma.

Oil of Lemon

Is obtained by expression and distillation. It is used in confectionery and perfumery. When old it acquires the taste and smell of turpentine.

Oil of lemon-grass.

Antropogon nargus, is a grass which grows in India, Ceylon, and the Moluccas. The oil is extensively used in perfumery.

Oil of Marjoram,

Origeat marjorana, is used in perfumery. The dried herb yields about 10 per cent. of oil.

Oil of Meadow Sweet.

The Spiraea ulmaria is sometimes used as a stimulant and in perfumery.

Artificial Oil of Meadow Sweet

Is made by distilling salicin, a crystalline, bitter principle, obtained from the leaves and young bark of the willow, with bichromate of potassa.

Oil of Mint.

Obtained from the dried plant. Six lbs. of fresh leaves will yield 3 1/2 drs.; and 4 lbs. dried will yield 1 1/2 oz. It is stimulant, carminative, and antispasmodic.

Essence of Neroli.

Obtained from the flowers of the orange tree. Six cwt. of flowers will yield only 1 oz. of oil. Petits grains is an inferior oil of neroli obtained in the same manner, but less care being taken in the selection of the flowers. Another essence is obtained from orange-peel, and is very fragrant. A third essence is obtained from unripe oranges, and is of a gold color.

Oil of Nutmegs.

Obtained from that spice; it is liquid, and of a pale yellow, a sebaceous insipid matter swims upon the water in the still.

Oil of Patchouly.

Obtained by distillation from the Pogastemon patchouli, a plant grown extensively in India and China. One cwt. of the herb yields about 28 oz. of essential oil. It is used in perfumery.

Oil of Peppermint.

Obtained from the dried plant. Four lbs. of the fresh herb will yield 3 drs. In general it requires rectification to render it bright and fine. It is stimulant and carminative.

Oil of Pennyroyal.

Obtained from the herb when in flower. Three lbs. will yield 6 drs. Emmenagogue.

Oil of Pimento.

Obtained from allspice. One oz. will yield 30 drops. It is stimulant.

Oil of Rhodium.

Obtained from the true lignum rhodium. Eighty lbs. will yield 9 drs., and in very resinous old wood 80 lbs. will yield 2 oz. It is light yellowish but grows red by keeping. Another oil is obtained from the root of rose-wort, rhodiola rosea; it is yellowish, and has the smell and taste of that from the true lignum rhodium. One lb. will yield a drachm.

The True Riga Balsam.

Obtained from the shoots of the Apherousti pine, pinus cembra, previously bruised and macerated for a month in water. It is pellucid, very liquid, whitish, and has the smell and taste of oil of juniper.

Butter of Roses.

Obtained from the flowers of damask roses; white, solid, separating slowly from the rosewater. It has little scent of its own, and is used to dilute the scent of musk, civet and ambergris. One cwt. of roses will yield from 1/2 an oz. to an oz.

Oil of Rosemary.

Obtained from the flowering tops; it is sweet scented. One cwt. will yield 8 oz.; 1 lb. of dry leaves will yield from 1 to 3 drs.; 70 lbs. of fresh leaves will yield 5 oz.

Oil of Rue.

Obtained from the dried plant; it is carminative and antispasmodic. Ten lbs. of leaves will yield from 2 to 4 drs.; 4 lbs. in flower will yield 1 dr.; and 60 lbs. will yield 2 1/2 oz.; 72 lbs. with the seeds, will yield 3 oz.

Oil of Sassafras.

Obtained from the sassafras root. Twenty-four lbs. will yield 9 oz.; 30 lbs. will yield 7 oz. and 1 dr.; and 3 lbs. will yield 2 oz.

Oil of Sandal Wood.

There are three kinds of sandal or santal wood, the white, yellow and red. The yellow is most used in perfumery. One cwt. of the wood will yield nearly 30 oz. of otto.

Oil of Spearmint.

Mentha viridis, is used in medicine as a carminative, and in perfumery.

Oil of Tar.

Obtained by distilling tar. It is highly valued by painters, varnishers, etc., on account of its drying qualities; it soon thickens of itself, almost to a balsam. The pyroligneous acid that comes over with it is useful for many purposes.

Oil of Thyme.

Obtained from the plant; 2 cwt. fresh will yield 5 1/2 oz.; 3 1/2 lbs., dried, will yield 1/2 a dr. It is stimulant and caustic; and used in toothache, applied to the tooth.

Oil of Tongva.

Obtained from the tongva, or tonka bean. Dipterix odorata is sometimes used in perfumery. The bean contains also a camphor-like body and benzoic acid.

Oil of Turpentine.

Distilled in Europe, from common turpentine, with the addition of about 6 times as much water; but in America, where the operation is carried on upon a very large scale, no water is added, and its accidental presence is even dreaded, lest it should produce a disruption of the stilling apparatus.

To Rectify Oil of Turpentine.

Pour 3 parts of turpentine into a glass retort, capable of containing double the quantity of matter subjected to the experiment. Place this retort on a sand-bath, and having adapted to it a receiver 5 or 6 times as large, cement with paste made of flour and water, some bands of paper over the place where the 2 vessels are joined. If the receiver is not tabulated, make a small hole with a pin in the bands of connected paper, to leave a free communication between the exterior and interior of the receiver; then place over the retort a dome of baked earth, and maintain the fire in such a manner as to make the essence and the water boil.

The receiver will become filled with abundance of vapors, composed of water and ethereous essence, which will condense the more readily if all the radiating heat of the furnace be intercepted by a plate of copper, or piece of board placed between the furnace and the receiver. When the mass of oil subjected to experiment has decreased nearly twothirds, the distillation must be stopped. Then leave the product at rest to facilitate the separation of the ethereous oil, which is afterwards separated from the water, on which it floats, by means of a glass funnel, the beak of which is stopped by the finger.

This ethereous oil is often milky, or merely nebulous, by the interposition of some aqueous parts, from which it may be separated by a few days' rest. The essence, thus prepared, possesses a great degree of mobility, and is exceedingly limpid.

Another Method.

The apparatus employed in the preceding process may be used in the present case. Fill the retort with essence, and as the receiver is tubalated, apply to the tubular a small square of paper moistened with saliva, to afford a free passage to the vapors. Graduate the fire in such a manner as to carry on distillation very slowly, until a little more than 1/2 the oil contained in the retort is obtained. Separate from the product, a very small quantity of exceedingly acid and reddish water, which passes at the same time as the ethereous essence; by these means the operation is much shortened. The oil of turpentine which remains in the retort is highly colored, and thicker than the primitive essence. It may be used for extending fat, varnish, or for coarse oil painting.

Balsam of Turpentine, or Dutch-drops.

Obtained by distilling oil of turpentine in a glass retort, till a red balsam is left.

Or, by distilling resin and separating the oils as they come over; first a white oil, then yellow, lastly a thick red oil, which is the balsam. It is stimulant and diuretic.

Essence of Vitivert

Is obtained by distillation of the kus-kus, the rhizome of an East Indian grass. Used in perfumery.

Oil of Wintergreen,

From the leaves of the gaultheria procumbens, is stimulant and carminative. Used in medicine, confectionary and perfumery.

Oil of Wormwood.

Obtained from the herb; stomachic; 25 lbs. of green wormwood will yield from 6 to 10 drs. of oil; 4 lbs. of dry will yield 1 oz.; and 18 lbs. only 1 1/2 troy oz.

Adulterations of Volatile Oils.

The most common are resinous matters, fixed oils, the cheaper volatile oils, and alcohol.

Resinous and fatty matters are left behind when the oil is evaporated; the latter communicate a greasy stain to paper which does not disappear with a gentle heat, and are comparatively insoluble in alcohol. Both are left behind when the oil is mixed with water and distilled.

The cheaper volatile oils are detected by the smell and taste, and specific gravity. Oil of turpentine (often used) may be detected by it being undissolved when the oil is treated with 4 times its volume of alcohol of a specific gravity of 0.84. Oil of geranium in oil of rose (a very common adulteration) is detected by sulphuric acid, which develops an unpleasant odor if the geranium oil be present, but has no effect upon pure oil of rose.

Alcohol is largely used in adulteration. Take some small pieces fused chloride of calcium in the bottom of a test tube, add the oil to be examined, and heat gently to 212° Fahr. If much alcohol be present the chloride of calcium will be dissolved, if only a small quantity the fragments will fall together and form a pasty mass at the bottom of the tube.

8.2 Waters

Preservation of Flowers for Distillation.

Rub 3 lb. of rose leaves for 2 or 3 minutes with 1 lb. of common salt. The flowers being bruised by the friction of the grains of salt, form a paste which is to be put into an earthen jar, or into a water-tight barrel. The same process is to be repeated until the vessel is filled, so that all the roses may be equally salted. The vessel is then to be shut up and kept in a cool place until wanted.

For distillation, this aromatic paste is, at any season, to be put into the body of the still with twice its weight of water; and when heat is applied, or essential water, is to be obtained in the common way. Both the oil and water are in this way produced in greater quantity than by using the leaves without the salt; besides, the preserved paste will keep its flavor and strength unimpaired for several years.

Other flowers, capable of affording essential oils, may also be treated in the above-mentioned way, with economy and advantage; as there is thereby no occasion to carry on a hurried process in the heat of summer, when these are in perfection.

General Rules for the Distillation of Simple Water.

1. Plants and their parts ought to be fresh gathered. When they are directed fresh, such only must be employed; but some are allowed to be used dry, as being easily procurable in this state at all times of the year, though rather more elegant waters might be obtained from them whilst green.
2. Having bruised the subjects a little, pour thereon thrice its quantity of spring-water. This quantity is to be diminished or increased according as the plants are more or less juicy than ordinary. When fresh and juicy herbs are to be distilled, thrice their weight of water will be sufficient, but dry ones require a much larger quantity. In general there should be so much water, that after all intended to be distilled has come over, there may be liquor enough to prevent the matter from burning to the still.
3. Formerly, some vegetables were slightly fermented with the addition of yeast, previous to the distillation.
4. If any drops of oil swim on the surface of the water, they are to be carefully taken off.
5. That the waters may be kept the better, about onetwentieth part of their weight of proof spirit may be added to each after they are distilled.

Stills for Simple Waters.

The instruments chiefly used in the distillation of simple waters are of two kinds, commonly called the hot still, or

alembic, and the cold still. The waters drawn by the cold still from plants are much more fragrant, and more fully impregnated with their virtues, than those drawn by the hot still or alembic.

The method is this: A pewter body is suspended in the body of the alembic, and the head of the still fitted to the pewter body; into this body the ingredients to be distilled are put, the alembic filled with water, the still-head luted to the pewter body, and the nose luted to the worm of the refrigerator or worm. The same intention will be answered by putting the ingredients into a glass alembic and placing it in a bath heat, or *balneum marae*.

The cold still is much the best adapted to draw off the virtues of simples which are valued for their fine flavor when green, which is subject to be lost in drying, for when we want to extract from plants a spirit so light and volatile as not to subsist in open air any longer than while the plant continues in its growth, it is certainly the best method to remove the plant from its native soil into some proper instrument where, as it dies these volatile parts can be collected and preserved. And such an instrument is what we call the cold still, where the drying of the plant or flower is only forwarded by a moderate warmth, and all that rises is collected and preserved.

Expeditious Method of Distilling Simple Waters.

Tie a piece of muslin or gauze over a glazed earthen pot, whose month is just large enough to receive the bottom of a warming-pan; on this cloth lay the herb clipped; then place upon them the warming-pan with live coals in it, to cause heat just warm enough to prevent burning; by which means, as the steam issuing out of the herb cannot mount upwards, by reason of the bottom of the pan just fitting the brim of the vessel below it, it must necessarily descend and collect into water at the bottom of the receiver, and that strongly impregnated with the essential oil and the salt of the vegetable thus distilled; which, if wanted to make spirituous or compound water, is easily done by simply adding some good spirits or French brandy to it, which will keep good for a long time, and be much better than if the spirits had passed through a still, which must of necessity waste some of their strength. Care should be taken not to let the fire be too strong lest it scorch the plants; and to be made of charcoal, for continuance and better regulation, which must be managed by lifting up and laying down the lid, as wanted to increase or decrease the degrees of heat. The deeper the earthen pan, the cooler the season, and the less fire at first (afterwards to be gradually raised), in the greater perfection will the distilled water be obtained.

As the more movable or volatile parts of vegetables are the aqueous, the oily, the gummy, the resinous, and the saline, these are to be expected in the waters of this process; the heat here employed being so great as to burst the vessels of the plants, some of which contain so large a quantity of oil that it may be seen swimming on the surface of the water.

Although a small quantity only of distilled waters can be obtained at a time by this confined operation, yet it compensates in strength what is deficient in quantity. Such liquors, if well corked up from the air, will keep a good long time, especially if about a twentieth part of any spirits be added, in order to preserve the same more effectually.

To make Rosemary Water.

As the method of performing the operation by the cold still is the very same, whatever plant or flower is used, the following instance of procuring a water from rosemary will be abundantly sufficient to instruct the young practitioner in the manner of conducting the process in all cases whatever.

Take rosemary fresh gathered in its perfection, with the morning dew upon it and lay it lightly and unbruised upon the plate or bottom of the still; cover the plate with its conical head, and apply a glass receiver to the nose of it. Make a small fire of charcoal under the plate, continuing it as long as any liquor comes over into the receiver.

When nothing more comes over, take off the still head and remove the plant, putting fresh in its stead, and proceed as before; continue to repeat the operation successively, till a sufficient quantity of water is procured. Let this distilled water be kept at rest in clean bottles close stopped, for some days in a cold place; by this means it will become limpid, and powerfully impregnated with the taste and smell of the plant.

Simple Alexeterial Waters.

Take of spearmint leaves, fresh, 1 1/2 lbs.; wormwood tops, fresh, angelica leaves, fresh, each 1 lb.; water, as much as is sufficient to prevent burning. Draw off by distillation 3 galls. Or take of elder-flowers moderately dried, 2 lbs.; angelica leaves, fresh gathered, 1 lb.; water, a sufficient quantity. Distill off 3 galls.

Simple Pennyroyal Water.

Take of pennyroyal leaves, dry, 1 1/2 lbs.; water as much as will prevent burning. Draw off by distillation 1 gall.

Simple Spearmint Water.

Take of spearmint leaves, fresh, any quantity; water, 3 times as much. Distill as long as the liquor which comes over has a considerable taste or smell of the mint. Or, take spearmint leaves, dried, 1 1/2 lbs., water as much as is sufficient to prevent burning. Draw off by distillation 1 gall.

Cinnamon Water.

Take of bruised cinnamon, 1 lb.; water, 2 galls. Simmer in a still for 1/2 an hour, put what comes over into the still again; when cold strain through flannel.

Eau Sans-Pareil.

Take 2 galls. of fine old honey-water, put it into a still capable of holding 4 galls., and add the thinly pared rinds of 6 or 8 fresh citrons, neither green nor mellow ripe. Then add 60 or 70 drops of fine Roman bergamot; and, having luted the apparatus well, let the whole digest in a moderate heat for 24 hours. Draw off, by a water-bath heat, about 1 gall.

Jessamine Water.

Take 6 lbs. of the white sweet almond cakes from which jessamine oil has been made abroad; beat and sift them to a fine powder, and put to it as much fresh oil of jessamine as will be required to make it into a stiff paste. Let this paste be dissolved in about 6 qts. of spring-water, which has been previously well boiled, and left until it has become about half cold. Stir and mix the whole well together, and when the oil and water have been well combined, let the whole stand until the powder has fallen to the bottom of the vessel. Now pour the liquid off gently, and filter it through cotton, in a large tin funnel, into the glass bottle in which it is to be kept for use. The powder or sediment which has been left at the bottom of the vessel, when dried by the heat of the sun, answers very well for making almond paste for the hands.

Jamaica Pepper Water.

Jamaica pepper is the fruit of a tall tree growing in the mountainous parts of Jamaica, where it is much cultivated because of the great profit arising from the cured fruit, sent in large quantities annually into Europe. Take of Jamaica pepper, 1/2 lb.; water, 2 1/2 galls.; draw off 1 gall. with a pretty brisk fire. The oil of this fruit is very ponderous, and therefore this water is made in an alembic.

Myrtle Water.

Infuse 8 or 10 lbs. of the cuttings of green myrtle in nearly 20 galls. of rain or river water, and add thereto a pint of fresh yeast, after it has stood for 24 hours. At the end of another day and night, put the whole into a still, with 1 lb. of bay-salt. Draw off the whole of the water, and next day infuse more myrtle leaves as before, and distill again. Repeat the same a third time.

Orange-flower Water.

Take 2 lbs. of orange flowers, and 24 qts. of water, and draw over 3 pts. Or, take 12 lbs. of orange flowers, and 16 qts. of water, and draw over 15 qts.

Orange-peel Water.

Take of the outward yellow rind of Seville oranges, 4 oz.; water, 3 1/2 galls., draw off 1 gall. by the alembic, with a brisk fire.

Peppermint Water.

Take of the herb of peppermint, dried, 1 1/2 lbs.; water, as much as is sufficient to prevent burning. Distill off a gallon. This has been known to allay sickness when nothing else would succeed, and is used in flatulent colics. A wineglassful may be taken, and often repeated.

Another. - Take of oil of peppermint, 1 lb.; water, a sufficient quantity. Draw off 30 galls. This is stimulant and carminative, and covers disagreeable flavors.

Portugal and Angel Waters.

Take 1 pt. of orange-flower water, 1 pt. of rose water, and 1/2 pt. of myrtle-water; to these put a 1/2 oz. of distilled spirit of musk, and an ounce of spirit of ambergris. Shake the whole well together, and the process will be finished.

Rose-water.

Take of the leaves of fresh damask-roses with the heels cut off, 6 lbs., water, as much as to prevent burning. Distill off a gallon. The distilled water should be drawn from dried herbs, because the fresh cannot be got at all times in the year. Whenever the fresh are used the weights must be increased; but whether the fresh or dry are made use of, it is left to the judgment of the operator to vary the weight, according as the plants are in greater or less perfection, owing to the season in which they grew, or were collected.

Small Snail Water.

Take of balm, mint, hart's tongue, ground ivy, flowers of the dead nettle, mallow-flowers, elderflowers, each a handful; snails freed from their shells, and whites of eggs, each 4 oz.; nutmegs, 3 oz.; milk, 1 gall. Distill in a waterbath to dryness.

Strawberry Water.

Take of the bruised fruit, 20 lbs.; water a sufficient quantity. Draw off 23 galls.; this water is very fragrant.

Common Distilled Water.

Take of water, 10 galls. Distill. Throw away the first 3 gall. and draw off 4 galls., which keep in glass or stoneware. Distilled water is used in making medicine preparations when the salts contained in common water would decompose them.

Compound Distilled Waters.*General Rules for the Distillation of Spirituous Waters.*

1. The plants and their parts ought to be moderately and newly dried, except such as are ordered to be fresh gathered.
2. After the ingredients have been steeped in the spirit for the time prescribed, add as much water as will be sufficient to prevent a burnt flavor, or rather more.
3. The liquor which comes over first in the distillation is by some kept by itself, under the title of spirit; and the other runnings, which prove milky, are fined down by art. But it is preferable to mix all the runnings together, without fining them, that the waters may possess the virtues of the plant entire.
4. In the distillation of these waters, the genuine brandy obtained from wine is directed. Where this is not to be procured take, instead of that proof spirit, half its quantity of a well rectified spirit, prepared from any other fermented liquors. In this steep the ingredients, and then add spring-water enough both to make up the quantity ordered to be drawn off, and to prevent burning.

Bergamot Water.

Take of fine old French brandy 2 galls., or 1 gall. of highly rectified spirit of wine, and 1 gall. of spring-water. Put to the brandy, or diluted spirits 3 oz., or more, of true Roman oil of bergamot, whose parts have been previously well divided by trituration with lump-sugar, in a glass

mortar, Now distill by a water heat, and draw off 6 qts. only. By this operation a most excellent bergamot water will be produced, which will remain good for 20 years.

Original Receipt for Hungary Water.

The original receipt for preparing this invaluable lotion is written in letters of gold in the hand-writing of Elizabeth, queen of Hungary. Take of aqua vitae, four times distilled, 3 parts, the tops and flowers of rosemary, 2 parts. To be put together in a close-stopped vessel, And allowed to stand in a warm place during 50 hours, then to be distilled in an alembic, and of this, once every week, 1 dr. to be taken in the morning, either in the food or drink, and every morning the face and the diseased limb to be washed with it.

French Hungary Water.

The French Hungary water is made wholly from a wine spirit, and from rosemary flowers alone which about Montpellier (the place from whence this commodity comes) grow in great plenty and perfection. The fragrancy of these flowers is so great as to render the waters made from them more excellent and valuable than anything of the kind made in England.

Best Hungary Water.

Take 30 galls. of spirit of wine; put to it, in a large still, 6 large bunches of fine green rosemary, when the flowers are white and in full bloom, 1 lb. of lavender flowers, and 4 oz. of true English oil of rosemary. The rosemary-leaves and flowers must be stripped from all their wood and green twigs. When the whole has been in a state of digestion for 24 hours, distill as before drawing off about 25 or 26 galls., but no more. When distilled, stop it closely in a copper vessel, and keep it undisturbed for about a month.

Aqua Mellis, or the King's Honey-water. First Distillation.

Take 28 lbs. of coriander seeds, ground small in the starch-mill; 28 common bunches of sweet marjoram in flower, dried and stripped from the twigs; 1 lb. of calamus aromaticus; 1 lb. of yellow saunders; and 1 lb. of orange and lemon peel. Let the 3 last be separately beaten into gross powder. Mix the above ingredients, and put them into a 60 gall. copper still, and add to them 20 galls. of proof spirit, and the same quantity of rain or spring-water. Lute well all the junctures of the apparatus, and leave the ingredients in this state, without fire,

for 48 hours. At the end of this time begin to distill by a very gentle heat, lest the flowers and seeds, which are very light, should rise suddenly in the still-head, stop up the worm, and endanger the whole work.

Increase the fire after the first half hour, and keep it regular till the termination of the process. Draw off about 26 or 27 galls., or continue so long as the spirit will burn by the application of a lighted paper to a small quantity of it in a saucer. Next day, when the still is perfectly cold, let it be well cleaned out. The ingredients should be immediately dried in the sun, otherwise they will become mouldy. When there is a considerable quantity from 3 or 4 makings it ought to be ground in a mill, and finely sifted. They will be found to be of great use in the making of ordinary brown wash-balls, and, with some additions of brown powders for the hair.

Second Distillation.

Now return the spirits drawn off into the still and add 10 or 12 galls. of water; then put in the following ingredients, bruised and mixed: 14 oz. of nutmegs, 4 oz. of gloves, 12 oz. of cinnamon bark, 8 oz. of pimento, and 40 oz. of cassia-lignum. These are to be separately broken or bruised in an iron mortar, until they are about the size of small peas. If there be any dust, it must be sifted from them before they are used; then take 40 oz. of storax, 40 oz. of gum Benjamin, 44 oz. of labdanum, and 40 venelios.

Break and bruise the above also, but make as little dust as possible. Put the dust from these and the foregoing, together, into a coarse muslin bag, which is to be hung in the still, so that the liquor, during distillation, may extract all its virtues. The whole are then to remain in the liquor in a cold state, for 48 hours, attention being still paid to luting and stopping close, as before. At the end of this time kindle the fire, and work off (slowly at first) until 26 galls. are distilled. Mix all the different runnings together in a copper vessel, kept for this purpose only.

Having drawn off, in this second distillation, 26 galls., mix together 10 oz. of spirit of musk, 10 oz. of spirit of ambergris, 1/2 oz. of true oil of lavender, 1/2 oz. of essence of bergamot, and 1/2 oz. of oil of rhodium. Now add to it in a copper vessel that will hold 40 galls., 6 galls. of orange-flower water, and 8 galls. of rose-water, recently made. When properly mixed, put all these into the copper vessel, and stir the whole well together. Add to all these a quart of milk, which has stood for a night, and which has had the cream taken clearly off; then agitate and mix the whole well together, and stop the vessel up close, until the time when it is to be used.

The jar ought to have a lock-cock soldered into it, to prevent accidents. This should be placed full two inches from the bottom, in order that the milk and other impurities may fall to the bottom.

If this honey-water be made in the spring, and if the weather be fair, it will be quite fined down in the course of a month, that is, if it be not opened or disturbed. When, by drawing off a little in a glass, the milk, etc., have fallen down to the bottom, draw the whole off into clean and wellseasoned stone or glass bottles, or into another copper jar. This composition ought never to be drawn off in rainy or cloudy weather, for then the milk is apt to rise. In warm weather it should be kept cool, and in winter as warm as possible. When distilled in the winter the jars ought to be warmed, or otherwise the honey water will not be fined for 5 or 6 months.

This honey-water may keep 30 years.

The ingredients from the second distillation are of much greater value than those from the first, and therefore require more care in the drying. These are of great use for the best sort of gross powders, for sweet bags, etc.; and, if made into a fine powder, may be made use of with great success, in the best sort of brown perfumed balls.

The same powder, with fresh ingredients, makes excellent pastils, to burn; and may be further used in making spirit of Benjamin.

Compound Spirit of Juniper.

Take of juniper-berries, well bruised, 1 lb.; caraway seeds, and sweet fennel seeds, each, bruised 1 1/2 oz.; diluted alcohol, 1 gall. Macerate for two days, and having added as much water as will prevent empyreuma, draw off, by distillation, 1 gall.

Lavender Spirit.

Take 14 lbs. of lavender flowers, 10 1/2 galls. of rectified spirit of wine, and 1 gall. of water, draw off 10 gall. by a gentle fire; or, which is much better, by a sand bath heat.

Lavender water.

Take 30 galls. of the best wine spirit, pour it into a copper still, placed in a hot-water bath, over a clear but steady fire; put to it 6 lbs. of the largest and freshest lavender flowers, after having separated them from all stalks and green leaves, which give the lavender water a woody and faint smell. Put no water into the still, close all the junctures well, and let the spirits and flowers stand in a state of digestion for 24 hours, and then, with a gentle fire, draw off 25 or, at most, 26 galls. only, which, as

soon as distilled, are to be poured into a copper vessel for keeping. Wooden vessels and cans are to be avoided, as the best parts of the oil and of the spirits will be absorbed by them, and consequently lost. When the distillation is over draw out, or quench the fire, and let the remaining spirits and flowers continue in the still until the next day. When the above quantity of 25 or 26 galls. has stood for 4 or 5 days, put to it 10 oz. of true English oil of lavender. Mix the whole well in the jar, by drawing out 1 or 2 galls., and then returning them. Repeat this 10 or 12 times, then stop the vessel up close, and do not disturb it for a month at least.

Lavender-water of the Second Order.

To the 4 or 5 galls. of the spirits, and the lavender flowers left in the still, after the distillation mentioned in the last article, add 15 galls. of common proof spirit, 9 or 10 galls. of spring-water, 3 lbs. of lavender flowers, and 4 oz. of oil of lavender, intimately mixed with loaf sugar, by powdering it in a glass mortar. Digest the whole, and draw off 25 galls., proceeding in every respect as before, except that, in this case, no oil is to be added, for, as there is so much water present, the addition of oil would be apt to turn the whole quantity muddy, or of a bluish or opaque color, which it cannot be easily freed from, without a second distillation.

Lavender-water for immediate use.

Mix with 1 gall. of proof spirit, 1 1/4 oz. of true English oil of lavender, which is all that will properly combine with the spirit, without injuring the color, by rendering it muddy. When the spirit and the oil are properly mixed, they are to be put into glass bottles, which are to be well stopped and ought to be shaken before used.

Perfumed Lavender-water,

Distill by a gentle heat in a sand or water bath, or mix and shake frequently, during 14 days, the following ingredients: 1 oz. of foreign oil of lavender, 1/2 oz. of English lavender, 1/2 oz. of essence of ambergris, and 1 gall. of rectified spirit of wine.

Lemon-water.

The peel of the lemon, the part used in making this water, is a very grateful bitter aromatic and, on that account, very serviceable in repairing and strengthening the stomach. Take of dried lemon-peel, 4 lbs.; proof spirit, 10 1/2 gall., and 1 gall. of water. Draw off 10 galls. by a gentle fire.

Spirit of Peppermint.

Take of the herb of peppermint, dried, 1 1/2 lbs.; proof spirit, 1 gall.; water, sufficient to prevent burning. Distill off 1 gall.

Compound Gentian-water.

Take of gentian root, sliced, 3 lbs.; leaves and flowers of the lesser centaury, each 8 oz.; infuse the whole in 6 qts. of proof spirit and 1 qt. of water; and draw off the water till the feints begin to rise.

Spirit of Scurvy-Grass.

Take of scurvy-grass, fresh gathered and bruised, 15 lbs.; horseradish-root, 6 lbs.; rectified spirit of wine, 1 gall.; and water, 3 pts. Digest the whole in a close vessel 2 days, and draw off 1 gall. with a gentle fire.

Antiscorbutic Water.

Take of the leaves of water-cresses, garden and sea scurvy-grass, and brook-lime, each 20 handfuls; of pine-tops, germander, horehound, and the lesser centaury, each 16 handfuls; of the roots of bryony and sharp-pointed dock, each 6 lbs.; of mustard-seed, 1 1/2 lbs. Digest the whole in 10 galls. of proof spirit, and 2 galls. of water, and draw off by a gentle fire.

8.3 Vinegar And Acid Liquors.*Vinegar. (Impure Dilute Acetic Acid.)*

Vinegar is made by the oxidation of alcohol, either directly or through the medium of a ferment, or by the distillation of wood; the latter is known as pyroligneous acid. Any substance capable of fermentation or any containing alcohol is suitable for making vinegar. It is made in the slow way from wine, cider, beer, sugar, or honey and water, whiskey and water juice of plants and vegetables; in the quick way from a spirit prepared for the purpose.

Slow Method of Making Vinegar.

This is the process usually adopted in the small scale. The "wash," as any weak alcoholic liquor is called, should be weak, from 5 to 10 per cent. of alcohol is best; too strong a liquor will ferment very slowly; the strength is best judged by the taste. The temperature should be

from 74° to 86 Fahr. Sour beer, wine, or cider are better than good liquors. The addition of sugar, honey, or other sweet matter with a view of strengthening the vinegar is not to be recommended, as it renders the vinegar liable to spoil. Ordinary fermented liquors are quite alcoholic enough.

The best ferment is vinegar, an old cask in which good vinegar has been kept is the best to ferment in. Other ferments are used, as bread soaked in brewer's yeast, sour dough, dough of wheat and rye flour soaked in cream of tartar and vinegar, all these are used in small quantity, a few ounces to a barrel of wash. Vinegar made with them is more apt to spoil. The more ferment present the quicker the process.

The wash is put into the cask, which is best painted black in order to absorb the sun's rays when the weather is cool; the bung is left out, the bung-hole covered with a piece of slate, and in about 4 weeks the acetification is complete. The lower the temperature the slower the change.

To Purify Vinegar.

After all the mothers are deposited, draw it off into a vessel filled with beech-shavings, and let it stand in a cool place until clear. Vinegar is apt to be infested with flies (*Musca cellaris*), and eels (*Vibrio aceti*). These may be killed by passing it through a coiled tube dipped in boiling water.

Vinegar (especially when weak) if exposed to the air becomes thick or mothery, and deposits a mucilaginous substance; the vinegar becomes weak and mouldy as this change goes on.

When vinegar is barrelled, a pint of spirits should be added to each barrel to secure its keeping. It should be kept in a cool place.

Varieties of Vinegar.

Wine Vinegar, made from wine, contains citric and tartaric acid, and a small portion of acetic ether, which communicates an agreeable flavor. It is imitated by adding acetic ether and coloring matter to vinegar made from whiskey.

Cider Vinegar (which includes all fruit vinegars) contains malic acid.

Malt, or Corn Vinegar, made from weak worts, contains phosphates of lime and magnesia, gum, and extractive matter.

Wood Vinegar or pyroligneous acid, when crude, contains tar and wood spirit.

Adulterations of Vinegar.

Sulphuric, nitric and muriatic acids, are used to give a false strength; burned sugar and acetic ether to give color and flavor. The latter cannot be considered as injurious. One one-thousandth of mineral acid is allowable, and tends to preserve the vinegar. This would be about four measured ounces to the barrel, or two to the ordinary halfbarrel.

Sulphuric acid is detected by boiling with chloride of calcium; baryta is not admissible as a test for sulphuric acid in vinegar.

Muriatic acid gives a white, curdy precipitate, with a solution of nitrate of silver. This precipitate is soluble in ammonia, and blackens on exposure to light.

Nitric acid is detected by adding muriatic acid. If the solution will dissolve gold leaf, nitric acid is present.

To Strengthen Vinegar.

Freeze it and remove the floe which forms on the surface. The water of the vinegar alone freezes leaving the acetic acid in solution in the remaining water.

To Determine the Strength of Vinegar.

The hydrometer (see SPECIFIC GRAVITY) is not to be much relied on in testing the strength of vinegar. The simplest test is to take a fragment of fine marble, weigh it and suspend it by a thread in a known measure of vinegar until all action ceases and the liquid has no longer a sour taste. Take out the marble, wash and dry it, and note the loss of weight it has sustained. Five-sixths of this is real (hydrated) acetic acid. An ounce of good vinegar should saturate from 30 to 32 grs. of pure and dry carbonate of soda; such vinegar contains about 5 per cent. of anhydrous (absolute) acetic acid. Vinegar above 30 per cent. of real acid will dissolve the essential oils and camphor.

Simple continuous Vinegar Process.

The following household vinegar method is to be recommended as simple, expeditious, and furnishing a constant supply of vinegar with scarcely any trouble, and at trifling cost: Two barrels are procured, one for making, the other for storing the vinegar. Those from which good vinegar has just been drawn are preferable. The storage barrel is kept always in the cellar, the generating one in the cellar or house, according to the season. In this latter barrel a small hole is bored, for the circulation of air,

at the top of one of its heads. The barrels lie on their side, and contain each a wooden faucet. Of course their capacity is regulated by the yearly demand of vinegar.

We will suppose that the generator, filled to the level of the ventilating hole, contains 10 galls.; the manufacture will then be carried on in the following manner: Seven galls. of good vinegar are poured in it, and 3 galls. of a warm alcoholic mixture made in the following manner and added: If common whiskey (50 per cent.) be employed have a small measure of 3 pts. and a large one (a bucket) of 3 galls. If 86 per cent. spirits are used let the small measure be for 2 pts. Put a small measureful of the spirits in the large measure; fill quickly to the mark with boiling water, and pour by a funnel into the generator. Every 2 or 3 weeks 3 galls. of vinegar are withdrawn from the generator, added to the storage barrel, and 3 galls. of alcoholic mixture are placed in the generating barrel as before.

Another method of working the casks consists in half filling the generator with vinegar and adding every week so much of the alcoholic mixture that it fills the barrel in from 8 to 16 weeks, according to the season. Half the vinegar is then added to the storage cask, and the process recommenced in the generator. The warmer the season the more rapid may be the manufacture. - Wetherill on the Manufacture of Vinegar.

Vinegar without a Ferment (Dobereiner's Process), The ferment used in the manufacture of vinegar is not necessary. Alcohol may be oxidized directly by the agency of finely divided platinum (platinum black); 10 per cent. alcohol placed in a close vessel with platinum black is rapidly converted into acetic acid. Dr. Ure estimates that with a box of 12 ft. cube and 6 to 8 oz. of strong platinum, 1 lb. of alcohol daily can be converted into acetic acid, and with from 20 to 30 lbs. we may obtain 300 lbs. of vinegar from the proportionate quantity of spirits. The same platinum black will last for an indefinite time, requiring only to be heated to redness from time to time, to restore it. This method is undoubtedly the most elegant one known of vinegar manufacture, and has been tried on a large scale in Germany. The objection to it is, however, the high cost of the platinum in which a large amount of capital must necessarily be kept looked up.

The continuous Quick Vinegar Process.

This is the method almost universally adopted for manufacturing vinegar on the large scale. Common new whiskey makes excellent vinegar; the fusel oil becoming oxidized during the process, is converted in harmless, agreeable ether. It is diluted so as to form a wash of about 6 per cent. alcohol. Two tubs, or upright casks, are

prepared as follows: A false top and bottom are inserted. In the false top are bored numerous holes one tenth of an inch in diameter and 1 1/2 in. apart, the top is fixed water-tight about 6 to 8 in. from the top of the barrel. At from 8 to 14 in. above the bottom of the tube are bored 1/2 in. air-holes, inclining downwards so that the liquid may not flow out. About 2 in. above the air-holes is placed the false bottom pierced with 1/2 in. or inch holes. The space between the false top and bottom is filled with closely-curved beech-shavings, or charcoal in lumps of the size of a walnut, sifted, washed and dried. The holes in the false top are filled with lamp-wick, and the space below the false bottom provided with a stop-cock, or gooseneck. There is also an inclined hole 6 in. below the false top for the insertion of a thermometer and hour-glass, or wood tubes are inserted into the false top, reaching nearly to the cover of the tub; these act as chimneys. The beech shavings are boiled in vinegar and pressed into their place until within 6 in. of the false top or sieve. Before starting the process the room and tubs are to be kept a day at a temperature of 75° to 80° Fahr.

The shavings at the thermometer hole, and at the lower ventilating holes, are then loosened by means of a stick thrust therein. A wash is now prepared which contains 1-5 vinegar and 4-5 of a 3 per cent. solution of alcohol; this heated to from 75 to 80°, is gradually poured through the hole in the cover of the generator, at the rate of 1 barrel in 24 hours. At the expiration of this time, warm the resulting vinegar if necessary, and having alcohol enough to make the whole quantity taken thus far of 5 per cent. alcoholic strength, pour this through the generators as before. Repeat this operation on the third, and even on the fourth day if necessary. Investigate the temperature of the air escaping from the generator, and when it exceeds that of the wash which is running, it is a sign that the acetification has commenced. When it rises to a point between 98° and 104°, the generators are in a proper condition to commence the regular business of the manufacture; the fermentation has been properly established. We then daily pour through generator No. 1 a wash consisting of a certain quantity of spirits, vinegar, and water heated to a temperature between 75° and 80° Fahr.; and through No. 2 the wash has passed through No. 1, to which has been added more spirits. We draw manufactured vinegar daily from generator No. 2. The vinegar resulting from setting the generators in action, though not prejudicial to health, is of inferior quality and bad flavor, from extractive matter from the shavings and tubs and from the iron cauldron. It may be added in very small quantity to the subsequent vinegar, if it be not thrown away. - Wetherill on the manufacture of Vinegar.

To make Quass.

Mix rye flour and warm water together, and leave it till it has turned sour. This vinegar is much drunk in Russia; it looks thick and unpleasant at first, but becomes agreeable by use.

Distilled Vinegar.

This is obtained from vinegar by distillation, rejecting the fourth or eighth part that comes over first, and avoid its acquiring a burnt flavor.

Distilled vinegar is weaker than the common but is used sometimes in pickles, where its want of color is an advantage.

To Deprive Vinegar and other vegetable Liquids of their Color.

To take away the color of vinegar, a litre of red wine vinegar, cold, is mixed with 45 grammes of bone-charcoal, in a glass vessel. Shake this mixture from time to time, and in 2 or 3 days the color completely disappears. When the process is to be performed in the large way, throw the charcoal into a cask of vinegar, which must be stirred from time to time. The highest colored red wines treated in the same manner become perfectly limpid. Ivory-black possesses the same property as bone-black.

To Prepare the Charcoal.

Fill a crucible with the most compact parts of ox and sheep bones, lute the cover, carefully leaving only a small opening at the top, place the crucible on a forge fire, and heat it gradually till red; when the flame from the oily and gelatinous parts has ceased, diminish the opening and suddenly raise the fire; when cold, reduce the charcoal to fine powder.

To Procure Pyroligneous Acid.

This acid is procured from any kind of green wood (such as cord wood), used for making charcoal; a cord of wood will produce about 80 galls. It is obtained in the following manner: A brisk oven is filled with coal or wood, until it becomes sufficiently hot to heat an oven over it to that degree as to reduce green wood to a charcoal. The upper oven should be closely stopped except a tube at the top to carry off the steam or acid, which tube is passed through water, and the steam thus condensed forms the acid.

To Prepare the same.

Place a large east-iron cylinder, or retort (similar to those used for the production of coal gas), in a furnace, so that it may receive as much heat, all round, as possible. One end of this cylinder must be so constructed as to open and shut, to admit wood, and exclude the air.

Oak, in pieces about 1 foot in length is to be put into the cylinder, which is to be filled as full as possible, without being wedged, and the door must be shut close to exclude air; from the cylinder let a worm run through cold water to condense the acid; by this it is conveyed to a large cask placed on one end, where there is a pipe to carry it from that to 2 or 3 more; thus it is completely secured from flying off in the vaporous state. The fire is now to be raised to a great heat, sufficiently powerful to convert the wood completely into charcoal. When the acid ceases to come over, the fire is to be taken out, and the mass of wood left to cool in the confined state, when it becomes perfect charcoal. In the first cask, tar is chiefly contained with the acid; it precipitates to the bottom and is drawn off by a cock; it is afterwards boiled in an iron boiler to evaporate the acid, before it is fit for use. If the acid is not strong enough, it is put into large square vats about 6 inches deep, for the purpose of making a large surface, to evaporate a part of the water contained in the acid, more especially by a slow heat. These vats are bedded on sand upon the top of a brick stove, where a gentle heat is applied; thus it may be procured in a pretty strong state.

This acid is a liquid of the color of white wine, possesses a strong acid and slightly astringent taste, combined with an empyreumatic smell. When allowed to remain in a state of rest for 8 or 10 days, tar of a black color subsides, and the acid is then comparatively transparent. To purify it further, it undergoes the process of distillation by which it is freed from a still greater portion of the tar, with which it is combined, and is thus rendered still more transparent. But through the process of distillation be repeated without end it will never be freed from the volatile oil with which it is combined, and which is the cause of empyreuma constantly attending it. In short, it contains the same properties for the preservation of animal matters from putrefaction as smoking them by wood does, which is practiced at present by the most barbarous nations, and which has been handed down from the remotest ages of antiquity.

Glacial Acetic Acid (Ice Vinegar).

To 83 lbs. of fused acetate of soda add 100 lbs. of sulphuric acid and distill. Place the distillate in ice at 50° Fahr., it will become solid. Allow it to drain. It is the monohydrated acid.

Oil of Vitriol.

The strongest or Nordhausen or fuming acid is made by distilling green vitriol at a red heat. The residue is colcothar or crocus martis. It is used for dissolving indigo and other purposes where an acid of great strength is required. The ordinary sulphuric acid is made by causing vapors of sulphurous acid (from burning sulphur), nitric acid and water, to combine in a leaden chamber. The weak acid is concentrated in leaden pans, and afterwards in a platinum still.

Nitric Acid.

Or aqua fortis, may be made by distilling at a gentle heat in a glass retort, equal weights of saltpetre (nitrate of potassa), and sulphuric acid. The receiver should be kept cooled by a cloth dipped in water. To obtain it pure it must be redistilled over nitrate of silver.

Hydrochloric Acid,

Or muriatic acid (marine acid, spirit of salt). Take 3 parts common salt, 5 of oil of vitriol, and 6 of water. Mix the oil of vitriol with 2 parts of water in a thin glass vessel, and allow the mixture to cool. Put the salt into a glass retort connected with a receiver containing the remaining 3 parts of water. Pour the mixture of sulphuric acid and water upon the salt, and distill with a gentle heat. To purify it, mix with an equal volume of water, and distill over chloride of barium.

Chlorine Water.

Pass a current of chlorine gas, made by the action of commercial muriatic acid upon black oxide of manganese, into a bottle half filled with water, shaking occasionally. Water will absorb twice its volume of this gas, acquires thereby a yellowish color, and the peculiar smell of chlorine. It is used in medicine and to bleach linen, take out fruit marks, etc. It should be kept in the dark, or in a bottle covered with blue paper.

Sulphurous Acid Water

Is made as above, using sulphurous acid instead of chlorine. This gas may be prepared by the action of sulphuric acid upon copper, charcoal, or sulphur. Water absorbs 50 volumes of the gas. The solution is used for bleaching purposes, in medicine, and to check fermentation.

Test Liquors, Test Papers, Etc.

Distilled water only should be used in these preparations. In preparing the papers the liquid should be placed in an earthenware plate or dish, and the paper carefully immersed in it so as to be uniformly wetted then dried out of the reach of acid, ammoniacal, or other vapors likely to affect it; and afterwards kept in bottles, jars, or cases.

Brazil Paper.

Dip paper in a strong decoction of Brazil wood and dry it. [It is rendered purple or violet by alkalies; generally yellow by acids.]

Cabbage Paper.

Make a strong infusion of red cabbage leaves, strain it, and evaporate it by a gentle heat till considerably reduced. Then dip the paper in it and dry it in the air. [This paper is of a grayish color; alkalies change it to green, acids to red. It is a very delicate test; if rendered slightly green by an alkali, carbonic acid will restore the color.]

Dahlia Paper.

From the petals of violet-dahlias, as cabbage paper.

Elderberry Paper.

This is merely paper stained with the juice of the berries. Its blue color is changed to red by acids, and to green by alkalies.

Indigo Paper.

Immerse paper in sulphate of indigo, wash it with water rendered slightly alkaline, then with pure water, and dry it in the air.

Iodide of Potassium and Starch Paper.

Mix starch paste with solution of iodide of potassium, and moisten bibulous paper with it. [It becomes blue when exposed to ozone. Chlorine has the same effect.]

Lead Paper.

Paper dipped in a solution of acetate of lead. [When moistened it detects sulphuretted hydrogen, which renders it black.]

Blue Litmus Paper.

Bruise 1 oz. of litmus in a mortar, and add boiling water; triturate together, put them in a flask and add boiling water to make up to half a pint; when cool strain it, and dip paper in it. More color may be extracted from the litmus by hot water, but the liquid will require to be concentrated by evaporation. [Acids change the color to red, but it does not become green with alkalies.]

Red Litmus Paper.

As the last, adding to the strained infusion few drops of nitric acid, or of pure acetic acid.

Rose Paper.

Make a strong infusion of the petals of the red rose, and dip unsized paper in it. [Dipped in an alkaline solution so weak as not to affect turmeric paper, it assumes a bright green color.]

Manganese Paper.

Dip paper in a solution of sulphate of manganese. [It becomes black in an ozonized atmosphere.]

Rhubarb Paper.

Dip paper in a strong infusion of rhubarb, and dry it. [Alkalies render it brown. It is not, like turmeric paper, affected by boracic acid.]

Starch Paper.

This is merely paper imbued with starch paste. Cotton cord is sometimes used instead of paper. [As a test for iodine, which turns it blue.]

Turmeric Paper.

Boil 1 oz. of coarsely powdered turmeric-root in 1/2 a pint of water for 1/2 an hour, and strain; dip paper in the liquid and dry it. [It is rendered brown by alkalies, and also by boracic acid and borates.]

8.4 Artificial Waters

The following afford approximate imitations of those waters. The earthy salts, with salts of iron, should be dissolved together in the smallest quantity of water. The other ingredients to be dissolved in the larger portion of the water, and the solution impregnated with gas. The first solution may be then added, or be previously introduced into the bottles. The salts, unless otherwise stated, are to be crystallized.

Baden Water.

Chloride of magnesium, 2 grs.; chloride of calcium, 40 grs.; sesquichloride of iron, 1/4 gr. (or 3 minims of the tincture); common salt, 30 grs.; sulphate of soda, 10 grs.; carbonate of soda, 1 gr.; water, 1 pt.; carbonic acid gas, 5 volumes.

Carlsbad Water.

Chloride of calcium, 8 grs.; tincture of chloride of iron, 1 drop; sulphate of soda, 50 grs.; carbonate of soda, 8 grs.; carbonated water, 1 pt.

Eger.

Carbonate of soda, 5 grs., sulphate of soda, 4 scruples; chloride of sodium, 10 grs., sulphate of magnesia, 3 grs.; chloride of calcium, 5 grs.; carbonated waters, 1 pt. Or it may be made without the apparatus, thus: - Bicarbonate of soda, 30 grs.; chloride of sodium, 8 grs., sulphate of magnesia, 3 grs.; water, 1 pt. Dissolve, and add a scruple of dry bisulphate of soda, and close the bottle immediately.

Ems.

Carbonate of soda, 2 scruples; sulphate of potash, 1 gr.; sulphate of magnesia, 5 grs.; common salt, 10 grs.; chloride of calcium, 3 grs.; carbonated water, 1 pt.

Pullna Water.

Sulphate of soda, 4 drs.; sulphate of magnesia, 4 drs.; chloride of lime, 15 grs.; chloride of magnesium (dry), 1 scruple; common salt, 1 scruple; bicarbonate of soda, 10 grs.; water slightly carbonated, 1 pt. One of the most active of the purgative saline waters.

Pullna Water, without the Machine.

Bicarbonate of soda, 50 grs.; sulphate of magnesia, 4 drs.; sulphate of soda, 3 drs.; common salt, 1 scruple. Dissolve in a pint of water; add, lastly, 2 scruples of bisulphate of soda, and close the bottle immediately.

Salts for Making Pullna Water.

Dry bicarbonate of soda, 1 oz.; dried sulphate of soda, 2 oz.; dried sulphate of magnesia, 1 1/2 oz.; dry common salt, 2 drs.; dry tartaric acid, 3/4 oz. (or rather, dry bisulphate of soda, 1 oz.).

Seidlitz Water.

This is usually imitated by strongly aerating a solution of 2 drs. of sulphate of magnesia in a pint of water. It is also made with 4, 6, and 8 drs. of the salts to a pint of water.

Seidlitz Powder.

The common Seidlitz powders do not resemble the water. A closer imitation would be made by using effloresced sulphate of magnesia instead of the potassio-tartrate of soda. A still more exact compound will be the following: - Effloresced sulphate of magnesia, 2 oz.; bicarbonate of soda, 1/2 oz.; dry bisulphate of soda, 1/2 oz. Mix and keep in a close bottle.

Seltzer Water.

Chloride of calcium and chloride of magnesium of each 4 grs. Dissolve these in a small quantity of water, and add it to a similar solution of 8 grs. bicarbonate of soda, 20 grs. common salt, and 2 grs. of phosphate of soda. Mix, and add a solution of 1/4 of a gr. of sulphate of iron. Put the mixed solution into a 20-oz. bottle, and fill up with aerated water. But much of the Seltzer water sold is said to be nothing more than simple carbonated water. An imitation of Seltzer water is also made by putting into a stone Seltzer bottle, filled with water, 2 drs. bicarbonate of soda, and 2 drs. of citrate acid in crystals, corking the bottle immediately. Soda powders are sometimes sold as Seltzer powders.

Vichy Water.

Bicarbonate of soda, 1 dr.; common salt, 2 grs.; sulphate of soda, 8 grs.; sulphate of magnesia, 3 grs. tincture of chloride of iron, 2 drops: aerated water, 1 pt. Dorvault directs 75 grs. of bicarbonate of soda, 4 grs. of chloride of sodium, one fifth of a gr. sulphate of iron, 10 grs. sulphate of soda, 3 grs. sulphate of magnesia, to 1 pt. of water. By adding 45 grs. (or less) of citric acid an effervescing water is obtained.

M. Soubeiran, relying on the analysis of Longchamps, imitates Vichy water by the following combination: - Bicarbonate of soda, 135 grs.; chloride of sodium, 2 1/2 grs.; cryst. chloride of calcium, 2 grs.; sulphate of soda, 11 1/2 grs.; sulphate of magnesia, 3 3/4 grs.; tartrate of iron and potash, 1/8 gr., water, 2 and one-tenth pts. (1 litre); carbonic acid, 305 cubic inches (5 litres). Dissolve the salts of soda and iron in part of the water dissolve and add the sulphate of magnesia, and then the chloride of calcium in the remaining water. Charge now with the carbonic acid gas under pressure.

Vichy Salts.

Bicarbonate of soda, 1 1/2 oz.; common salt, 15 grs.; effloresced sulphate of soda, 1 dr.; effloresced sulphate of magnesia, 1 scruple; dry tartarized sulphate of iron, 1 gr.; dry tartaric acid, 1 oz. (or dry bisulphate of soda, 1 oz.). Mix the powders, previously dried, and keep them in a close bottle.

Sulphuretted Waters.*Simple Sulphuretted Water.*

Pass sulphuretted hydrogen into cold water (previously deprived of air by boiling, and cooled in a closed vessel), till it ceases to be absorbed.

Aix-la-Chapelle Water.

Bicarbonate of soda, 12 grs.; common salt, 25 grs.; chloride of calcium, 3 grs.; sulphate of soda, 8 grs.; simple sulphuretted water, 2 1/2 oz.; water slightly carbonated, 17 1/2 oz.

Bareges Water.

Crystallized hydrosulphate of soda, crystallized carbonate of soda, and common salt, of each 2 1/2 grs.; water (freed from air), 1 pt. A stronger solution for adding to baths is thus made: - Crystallized hydrosulphate of soda, crystallized carbonate of soda, and common salt, of each 2 oz.; water, 10 oz. Dissolve. To be added to a common bath at the time of using.

Naples Water.

Crystallized carbonate of soda, 15 grs.; fluid magnesia, 1 oz.; simple sulphuretted water, 2 oz.; aerated water, 16 oz. Introduce the sulphuretted water into the bottle last.

Harrowgate Water.

Common salt, 100 grs.; chloride of calcium, 10 grs.; chloride of magnesium, 6 grs.; bicarbonate of soda, 2 grs.; water, 18 1/2 oz. Dissolve, and add simple sulphuretted water, 1 1/2 oz.

Chalybeate Waters*Simple Chalybeate Water.*

Water freed from air by boiling, 1 pt.; sulphate of iron, 1/2 gr.

Aerated Chalybeate Water.

Sulphate of iron, 1 gr.; carbonate of soda; 4 grs.; water deprived of air, and charged with carbonic acid gas, 1 pt. Dr. Pereira recommends 10 grs. each of sulphate of iron and bicarbonate of soda to be taken in a bottle of ordinary soda water. This is equivalent to 4 grs. of carbonate of iron.

Brighton Chalybeate.

Sulphate of iron, common salt, chloride of calcium, of each 2 grs.; carbonate of soda, 3 grs.; carbonated water, 1 pt.

Bussang, Forges, Provins,

And other similar waters, may be imitated by dissolving from 1/2 to 2/3 of a gr. of sulphate of iron, 2 or 3 gr. of carbonate of soda, 1 gr. of sulphate of magnesia, and 1 of common salt, in a pint of aerated water.

Mont d'Or Water.

Bicarbonate of soda, 70 grs.; sulphate of iron 2/3 gr.; common salt, 12 grs.; sulphate of soda, 1/2 gr.; chloride of calcium, 4 grs.; chloride of magnesium, 2 grs.; aerated water, 1 pt.

Passy Water,

Sulphate of iron, 2 grs.; chloride of sodium, 3 grs.; carbonate of soda, 4 grs.; chloride of magnesium, 2 grs.; aerated water, 1 pt.

Pyrmont Water,

Sulphate of magnesia, 20 grs.; chloride of magnesium, 4 grs.; common salt, 2 grs.; bicarbonate of soda, 16 grs.; sulphate of iron, 2 grs.; Carrara water, 1 pt.

Portable Lemonade.

Take of tartaric acid, 1/2 oz.; loaf sugar, 3 oz.; essence of lemon, 1/2 dr. Powder the tartaric acid and the sugar very fine, in a marble or wedgewood mortar (observe never to use a metal one), mix them together, and pour the essence of lemon upon them, by a few drops at a time, stirring the mixture after each addition, till the whole is added; then mix them thoroughly, and divide it into 12 equal parts, wrapping each up separately in a piece of white paper. When wanted for use, it is only necessary to dissolve it in a tumbler of cold water, and fine lemonade will be obtained, containing the flavor of the juice and peel of the lemon, and ready sweetened.

8.5 Fixed Oils.

To make Oil of Sweet Almonds.

It is usually made from bitter almonds for cheapness, or from old Jordan almonds, by heat, the oil from which soon grows rank, while that from fresh Barbary almonds, drawn cold, will keep good for some time. The almonds are sometimes blanched by dipping in boiling water, or by soaking some hours in cold water, so as to part with their skin easily, but are more usually ground to a paste, which is put into canvas bags, and pressed between iron plates in a screw press, or by means of a wedge, 1 cwt. of bitter almonds, unblanched, produces 46 lbs. of oil; the cake pays for pressing.

Nut Oil

Is obtained from the kernel of the hazelnut, and is very fine. As it will keep better than that of almonds, it has been proposed to be substituted for that oil. It is drunk with tea in China, probably in lieu of cream, and is used by painters, as a superior vehicle for their colors.

Oil of Mace.

Is obtained from nutmegs by the press. It is buttery, having the smell and color of mace, but grows paler and harder by age; 2 lbs. of nutmegs in Europe will yield 6 oz. of this oil.

True Oil of Mace by Expression.

This oil is red, remains always liquid or soft, has a strong smell of mace, subacid taste, and is imported in jars or bottles, the lower part being rather thicker than the top; 1 1/2 lbs. of mace will yield in Europe 1 1/2 oz. troy of oil.

Olive, Salad, or Sweet Oil.

This is the most agreeable of all the oils; it is demulcent, emollient, gently laxative, and is also used as an emetic with warm water; dose, 1 oz. troy, or a large spoonful; also externally, when warm, to the bites of serpents, and, when cold, to tumors and dropsies. Rank oil is best for plasters, but fresh oil makes the best hard soap.

Castor Oil

Is made by pressing the beans, cold or slightly warmed. It may be rendered colorless and odorless by filtering through animal charcoal and magnesia. It is soluble in strong alcohol, and is used as the basis of many hair oils. (See PERFUMERY.)

Oil of Croton.

This oil is extracted from Molucca grains, or purging nuts. In its chemical qualities it agrees with castor oil, but is considerably more active, as a single drop, when the oil is genuine, is a powerful cathartic.

Rape Oil.

This is made from rape-seed. It dries slowly and makes but a softish soap, fit for ointments. The mucilage it contains may be got rid of, in a great measure, by adding 1/2 ounce of oil of vitriol to 2 pts. of the oil.

To Purify Rape Oil.

The following is a simple method of rendering rape oil equal to spermaceti oil, for the purposes of illumination:

Begin by washing the oil with spring-water; which is effected by agitating the oil violently with a sixth part of the water. This separates the particles of the oil, and mixes those of the water intimately with them. After this operation it looks like the yolk of eggs beat up. In less than 48 hours they separate completely, the oil swimming at the top, the water, with all feculent and extraneous particles, subsiding to the bottom. This may be very much improved, by substituting sea water in the place of fresh-water.

By the process of washing the oil does not lose a hundredth part. The experiment can at all times be made in a glass decanter, or in a churn, with a cock at the bottom, the water to come up very near to the cock, by which all the oil can be drawn off, after it has deposited its impurities.

Another Method.

To 100 parts of oil add 1 1/2 or 2 of concentrated sulphuric acid, and mix the whole well by agitation; when the oil will become turbid, and of a blackish-green color. In about three-quarters of an hour the coloring matter will begin to collect in clots; the agitation should then be discontinued, and clean water, twice the weight of the sulphuric acid, be added. To mix the water with the oil and acid, a further agitation of half an hour will be requisite. The mass may, afterwards, be left to clarify for 8

days, at the end of which time 3 separate fluids will be perceived in the vessel; the upper is the clear oil, the next is the sulphuric acid and water, and the lowest a black mud or fecula. Let the oil then be separated by a syphon from the acid and water, and filtrated through cotton or wool. It will be nearly without color, smell, or taste, and will burn clearly and quietly to the last drop.

To Purify Vegetable Oil.

To 100 lbs. of oil add 25 oz. of alum, and mix, dissolved in 9 lbs. of boiling water. After stirring it about half an hour, add 15 oz. of nitric acid, still continuing to stir it. Let it stand 48 hours, when the fine oil will swim on the surface, and then draw it off. Such oil is used all over the Continent, and an equal quantity yields double the light of whale and fish-oil without its offensive odor.

To make Pumpkin Oil.

From the seeds of the pumpkin, which are generally thrown away, an abundance of an excellent oil may be extracted. When peeled they yield much more oil than an equal quantity of flax. This oil burns well, gives a lively light, lasts longer than other oils, and emits very little smoke. It has been used on the Continent for frying fish, etc. The cake remaining after the extraction of the oil may be given to cattle, who eat it with avidity.

Beech Nut Oil.

Beech-nuts are not only an excellent food for pigs, but they are known to yield an oil, fit for common purposes, by the usual methods of extraction.

8.6 Animal Oils And Fats

—indexAnimal Oils

Hog's Lard.

This is obtained like the rest of the animal fats, from the raw lard, by chopping it fine, or rather rolling it out, to break the cells in which the fat is lodged, and then melting the fat in a waterbath, or other gentle heat, and straining it while warm. Some boil them in water, but the fats thus obtained are apt to grow rank much sooner than when melted by themselves.

Neat's-foot or Trotter Oil.

Obtained by boiling neat's-feet, tripe, etc. in water. It is a coarse animal oil, very emollient, and much used to soften leather.

To Purify Trotter Oil.

Put 1 qt. of trotter oil into a vessel containing 1 qt. of rose-water, and set them over a fire till the oil melts and mixes with the rose-water. Stir well with a spoon. When properly combined take the vessel from the fire, and let it cool. Now take off the oil with a spoon, and add rose-water as before. When the oil is again separated and cleansed, set it in a cool place. The principal use of trotter oil is for the making of cold cream, in which its qualities exceed those of every other oil.

To Prepare Oil from Yolks of Eggs.

Boil the eggs hard, and after separating the whites break the yolks into 2 or 3 pieces, and roast them in a frying pan till the oil begins to exude, then press these with very great force. Fifty eggs yield about 5 oz. of oil. Old eggs yield the greatest quantity.

Another Method.

Dilute the raw yolks with a large proportion of water, and add spirit of wine to separate the albumen, when the oil will rise on the top after standing some time, and thus may be separated by a funnel.

To Refine Spermaceti.

Spermaceti is usually brought home in casks, and in some cases has so little oil mixed with it as to obtain the denomination of head matter. It is of the consistence of a stiff ointment, of a yellowish color, and not tenacious. Besides the head matter, there is also a quantity of sperm obtained from the oil by filtration. Indeed, in all good spermaceti lamp oil, which is not transparent, particles of the sperm may be seen floating.

Having the head-matter, or filtered sperm, in order to purify it, first put it into hair-cloths, and with an iron plate between each cloth to the number of half a dozen or more, submit it to the action of an iron screw-press, and, as the oil does not separate very readily, it will in general be necessary to let the cakes of sperm be pressed three different times. The third time the cakes will become so dry that they may be broken in small pieces with little trouble, and then put in a furnace containing 1/3 water and 2/3 cake. Let the fire be raised sufficiently under the furnace to melt the cake, which it will do before the

water begins to boil; after which boil the whole together for about 1/2 an hour, taking off during the boiling what scum and other extraneous bodies rise to the top, then let the whole be dipped out into a tub or other coolers. After it is completely cold take off the cake of spermaceti, which will be on the top of the water, and cut it into pieces. Suppose, for example, that the cake weighs 1 cwt., it will be necessary to have a furnace, or rather a movable kettle, where the light is thrown in such a way that the process can be observed. Having taken 1 cwt. of the unrefined spermaceti prepared as above, melt it together with about 3 galls. of water. As soon as it begins to boil add from time to time small portions of the following liquor, say 1/2 pint at a time: Take of the alkaline salt, or potash, 7 lbs.; pour on it 2 galls. of water; let them stand together 24 hours, and from the top dip off the lye as wanted, adding more water occasionally, till the alkali is exhausted. After boiling the spermaceti for about 4 hours, having during the process taken off the scum as it arose, let the kettle be removed from the fire; and after remaining about 1/4 hour, dip off the spermaceti into suitable coolers. This process must in general be repeated 3 times. The third time, if the processes have been properly conducted, the spermaceti will be as clear as crystal; and then, after it is cool, the only thing necessary to make it fit for sale, is to cut it into moderately small pieces, when it will break into that flakey appearance which it has in the shops.

To Sweeten, Purify, and Refine Greenland Whale and Seal Oil.

The oil, in its raw state, is filtered through bags about 41 inches long, with circular mouths extended by a wooden hoop about 15 inches in diameter, fixed thereto. These bags are made of jean lined with flannel, between which jean and powdered charcoal is placed, throughout, to a regular thickness of about 1/2 inch, for the purpose of retaining the glutinous particles of the oil and straining it from impurities; and the bags are quilted, to prevent the charcoal from becoming thicker in one part than another, and to keep the linings more compact. The oil is pumped into a large funnel made of tin, annexed to the pump through a perpendicular pipe, and passed from the funnel into another pipe placed over the bags horizontally, from whence it is introduced into them by cocks. The oil runs from the filteringbags into a cistern about 8 feet long by 4 feet broad, and 4 1/2 deep, made of wood and lined with lead and containing water at the bottom about the depth of 5 or 6 inches, in which are dissolved about 6 oz. of blue vitriol, for the purpose of drawing down the glutinous and offensive particles of the oil which have escaped through the charcoal; and thereby rendering it

clean and free from the unpleasant smell attendant upon the oil in the raw state; and in order to enable the oil thus to run from the bags, they are hung in a frame or rack made like a ladder, with the spokes or rails at sufficient distances to receive the hoop of the bag between two; and such frame or rack is placed in a horizontal position over the cistern. The oil is suffered to run into the cistern until it stands to the depth of about 2 feet in the water, and there to remain for 3 or 4 days, (according to the quality of the oil), and is then drawn off by a cock which is fixed in the cistern a little above the water, into a tub or other vessel, when it will be found to be considerably purified and refined; and the oil after having undergone this operation, may be rendered still more pure by passing a second or third time through similar bags and cisterns. But the oil after such second and third process, is drawn off into and filtered through additional bags made of jean lined with flannel, inclosed in other bags made of jean, doubled, when the process is complete.

Clarifying Coal-Oils.

In a close vessel are placed 100 lbs. of crude coaloil, 25 qts. of water, 1 lb. of chloride of lime, 1 lb. of soda, and 1/2 lb. of oxide of manganese. The mixture is violently agitated, and allowed to rest for 24 hours, when the clear oil is decanted and distilled. The 100 lbs. of coaloil are to be mixed with 25 lbs. of resin-oil; this is one of the principal points in the manipulation; it removes the gummy parts from the oil, and renders them inodorous. The distillation spoken of may terminate the process, or the oils may be distilled before they are defecated and precipitated.

To Bleach and Purify Fixed Oils.

Fish and other fat oils are improved in smell and color by passing hot air or steam through them. Dunn's method is to heat the oil by steam to 170° or 200°, and force a current of air through it, under a chimney, till it is bleached and purified. Mr. Cameron's method of bleaching palm oil is to keep it at 230°, with continual agitation, by passing into it high pressure steam through leaden pipes of 2 inches diameter. Four tons of oil require 10 hours' straining. Palm oil is also bleached by chloride of lime. Take from 7 to 14 lbs. of chloride of lime, triturate in a mortar, adding gradually 12 times the quantity of water, so as to form a smooth cream. Liquefy 112 lbs. of palm oil, remove it from the fire, add the solution of chloride of lime, and stir well with a wooden stirrer. Allow it to cool, and when become solid break it into small fragments, and expose it to the air for 2 or 3 weeks, then put into a cast-iron boiler lined with lead, diluted with 20 parts of water.

Boil with a moderate heat till the oil drops clear from the stirrer; then let it cool. To remove the foetor from fish oils, treat them in the same way (except the exposing to the air), using only 1 lb. of chloride of lime to 112 lbs. of oil. It does not remove the natural smell of the oil.

Calcined magnesia has been used to deprive oils of their rancidity.

Mr. Griseler finds that the addition of a few drops of nitric ether will prevent oils from becoming rancid.

Mr. Watt's patented method of bleaching oil is by chromic acid. For palm oil it is thus used: The oil is heated in a steam vessel, allowed to settle and cool down to 130° Fahr., then removed into wooden vessels, taking care that no water or sediment accompany it. For a ton of palm oil make a saturated solution of 25 lbs. of bichromate of potash; add 8 lbs. of sulphuric acid, and 60 lbs. of muriatic acid (or an equivalent quantity of salt and sulphuric acid). Put the mixture into the oil, and let it be constantly stirred till it becomes of a light-green color. If not sufficiently decolorized, add more of the mixture. Let the oil settle for half an hour, then pump it into a wooden vat, boil it for a few minutes with fresh water, by means of a steam pipe, and let it settle. For linseed, rape and mustard oils a dilute solution of chromic acid is used, with a little muriatic acid; for olive, almond, and castor oils no muriatic acid is required. Fish oils and fats are first boiled in a steam apparatus with a weak soda lye (1/2 lb. of soda for every ton of fat) for half an hour; then 1/2 lb. of sulphuric acid, diluted with 3 lbs. of water, is added, the whole boiled for 16 minutes, and allowed to settle for an hour or more, when the water and sediment are drawn off, and the oil further bleached by a solution of 4 lbs. of bichromate of potash and 2 lbs. of sulphuric acid, properly diluted.

Mr. Davidson treats whale oil first with a solution of tan, next with water and chloride of lime, and lastly with diluted sulphuric acid and warm water. Rape and other seed oils are also refined by means of sulphuric acid and twice as much water. Mr. Gray directs 2 lbs. of oil of vitriol to 112 lbs. of oil. The oil should be carefully washed from the acid and filtered.

Mr. Bancroft's process for refining common olive oil, lard oil, etc., for lubricating purposes, is to agitate them with from 3 1/2 to 8 per cent. of caustic soda lye, of 12 specific gravity. If, on trial of a small quantity, the lye he found to settle clear at the bottom, enough has been added. The oil is allowed to rest for twenty-four hours for the soapy matter to subside: the supernatant oil is then filtered.

Another plan of purifying oils (especially lamp oils) is to agitate them with a strong solution of common salt.

Purification of Castor Oil.

Mix 1000 parts of the oil with 25 parts of animal charcoal, and 10 parts of calcined magnesia, and leave them together for 3 days at a temperature of 68° to 78° Fahr., often stirring or shaking the mixture. The oil is then filtered off, and is found to be limpid, colorless, without taste, and easily soluble in alcohol. It congeals, too, at a lower temperature than before, and is in that respect superior to the ordinary oil.

Oil of Brick,

Used by lapidaries, is made by saturating fragments of brick with oil and distilling at a red heat.

Watchmaker's Oil.

1. Expose the finest porpoise oil to the lowest natural temperature attainable. It will separate into two portions, a thick, solid mass at the bottom, and a thin, oily supernatant liquid. This is to be poured off while at the low temperature named, and is then fit for use.
2. Put into a matrass or glass flask, a portion of any fine oil, with 7 or 8 times its weight of alcohol, and heat the mixture almost to boiling; decant the clear upper stratum of fluid, and suffer it to cool; a solid portion of fatty matter separates, which is to be removed, and then the alcoholic solution evaporated in a retort or basin, until reduced to one-fifth of its bulk. The fluid part of the oil will be deposited. It should be colorless and tasteless, almost free from smell, without action on infusion of litmus, having the consistence of white olive oil, and not easily congealable.
3. Take a white glass bottle of pure olive or almond oil, put into it a coiled strip of lead, and expose it to the sun's rays until a white curdy matter ceases to be deposited.

To Prevent Fats and Oils from becoming Rancid.

Heat the oil or melted fat for a few minutes with powdered slippery-elm bark, in the proportion of 1 dr. of the powder to 1 lb. of fat. The bark shrinks and gradually subsides, after which the fat is poured off. It communicates an odor like that of the hickory-nut. Butter thus treated has been kept unchanged for a year.

Chapter 9

PERFUMERY

Materials used.

The flowers, roots, and woods employed in perfumery are nearly all grown abroad, and even when raised in the United States are seldom used for perfumery.

Essential or volatile oils (p. 289) are obtained by distillation. In the case of delicate perfumes the flowers are macerated in warm oil or cold lard (enfleurage). From this grease the oil may be extracted by alcohol. Sometimes the flowers or other odorous bodies are macerated in alcohol.

Essences are solutions of volatile oils in alcohol. The term tincture is sometimes used to express the same idea.

The dried flowers and rasped woods or roots are used in the manufacture of sachets.

The following substances are obtained from the animal kingdom: -

Musk, a secretion of the Musk deer (*Moschus moschatus*), which inhabits Eastern Asia. There are three varieties. The Tonquin or Chinese is the finer, but is apt to be adulterated.

Civet, a secretion of the Civet cat (*Viverra civeta*), and

Castor, from the beaver (*Castor fiber*), are used in small quantities.

The Essence of Mirbane and flavoring ethers are obtained by the chemist.

Lard, suet, and the fixed oils are used as vehicles.

Alcohol employed in perfumery should be free from all smell of fusel or other oils. Atwood's (patent) alcohol is generally preferred. It is deodorized by distillation over permanganate of potassa.

Deodorizing Alcohol.

1. Spirit of wine, brandy, or alcohol distilled over soap lose their empyreumatic odors and tastes entirely. At

about 215° the soap retains neither alcohol nor wood-spirit.

2. The empyreumatic oil, which remains in combination with the soap which forms the residue of the distillation, is carried off at a higher temperature by the vapor of water, which is formed during a second distillation, the product of which is a soap free from empyreuma, and fit to be used again for similar purposes.

3. The concentration of the alcohol increases in this operation more than when soap is not employed, because this compound retains the water and the alcoholic vapors which pass over are richer.

4. Thirty-three lbs. of soap is enough for 100 galls. of empyreumatic brandy, and direct experiments have shown that under the most favorable circumstances the soap can retain 20 per cent. of empyreumatic oil.

5. The soap employed should contain no potassa; it must be a hard or soda soap, and ought to be completely free from any excess of fat acids or fluids, otherwise it may render the product rancid and impure. Common soap, made with oleine and soda by the manufacture of stearine candles, has satisfied all the conditions in practice.

If this soap is employed, it will be better to add a little soda during the first distillation.

The hard soda-soaps, as exempt as possible from fluid fat acids, remove completely the empyreumatic odor.

J. Maria Farina Cologne.

Benzoin dissolved in alcohol, 4 oz.; essence of lavender, 8 oz.; essence of rosemary, 4 oz.; alcohol at 75°, 325 qts. To this solution add successively neroli, 21 oz.; petit grain, 21 oz.; cedrat, 21 oz.; Portugal, 2 1/2 lbs.; lemon, 2 1/2 lbs.; alcoholic extract of geranium, 2 1/2 lbs. Shake several times; leave 14 days, and bottle.

Fine Cologne Water.