mentation, producing one gallon and a half of alcohol from two bushels of the ripe berries. Beet-roots, carrots, and parsnips also yield, by proper process, a considerable quantity of alcohol.

II. Ardent spirits or whiskey from secula or starchy materials. As starch is transformed into a saccharine condition by malting and mashing, and a fermentable wort may be obtained from starchy meal, so may, by like operations, all vegetable substances which consist chiefly of starch become materials for a whiskey distillery. To this class belong all the farinaceous grains, potatoes, and the pods of shell-fruits, as beans, vetches, horse-chestnuts, acorns, etc.

1. Whiskey from corn. All those species of corn which are employed in breweries answer for distilleries; as wheat, rye, barley, and oats, as well as buckwheat and Indian corn. The product of spirits which these different grains afford depends upon the proportion of starch they contain, including the small quantity of
uncrystallizable sugar present in them. According to Hermstædt, 100 pounds of starch should yield 35 pounds of alcohol, or 4.375 gallons imperial; equal to 7.8 gallons of spirits, excise proof.

One hundred pounds of the following grains afford, in spirits of specific gravity 0.9427, containing 45 per cent of absolute alcohol, (= 1½ of British proof,) the following quantities:—Wheat, 40 to 45 pounds of spirits; rye, 36 to 42; barley, 40; oats, 36; buckwheat, 40; Indian corn, 40. The chief difference in these several kinds of corn consists in their different bulks under the same weight—a matter of considerable importance; for, since a bushel of oats weighs little more than the half of a bushel of wheat, it becomes less convenient in use, though it affords a good spirit.

It is deemed preferable to use a mixture of several sorts of grain instead of a single one. For example, wheat with barley and oats, or barley with rye and wheat; for the husks of
the oats diffused through the wheat flour and rye meal keep it open, or porous, when mashed, and thus favor the abstraction of the wort; while the gluten of the wheat tends to convert the starch of the barley and oats into sugar. When the whole of the grain, however, is malted, a much more limpid wort is obtained than from a mixture of malt with raw grain; hence the pure malt is preferable for the ale and porter brewer, while the mixture affords a larger product, at the same cost of materials, to the distiller. When barley is the only grain employed, from one-third to one-sixth of malt is usually mixed with it; but when wheat and rye are also taken, the addition of from one-eighth to one-sixteenth of barley malt is sufficient. Oats are peculiarly proper to be mixed with wheat, to keep the meal open in the mashing.

1. MASHING.—Barley and raw grain are ground to meal by millstones, but malt is merely crushed between rollers. If only one-
tenth or one-eighth of malt be used with ninetenths or seven-eighths of barley, some husks of oats are added to render the mash-mixture more drainable.

When 40 bushels of barley and 20 of malt form one mashing, from 600 to 700 gallons of water, heated to 150° Fahr., are mixed with these 60 bushels in the mash-tun, and carefully incorporated, by much manual labor with wooden oars, or in great concerns by the mechanical apparatus used in the breweries. This agitation must be continued for two or three hours, with the addition, from time to time, of about 400 additional gallons of water, at a temperature of 190°, to counteract the cooling of the materials. But since the discovery of the diastase, as the best heat for saccharifying starch is shown to be not higher than 160° Fahr., it would be far better to mash in a tun, partially, at least, steam incased, whereby we could preserve the temperature at the appropriate degree for generating the greatest quantity of sugar.
If the wort be examined every half hour of the mashing period, it will be found to become progressively sweeter to the taste, thinner in appearance, but denser in reality.

The wort must be drawn off from the grains whenever it has attained its maximum density, which seldom exceeds 150 pounds per barrel; that is \( \frac{360 + 150}{360} = 1.42 \), or 42 per cent. As the corn of the distiller of raw grain has not the same porosity as the brewer’s, the wort cannot be drawn off from the bottom of the tun, but through a series of holes, at the level of the liquor, bored in a pipe stuck in at the corner of the vessel. About one-third only of the water of infusion can thus be drawn off from the pasty mass. More water is therefore poured on at the temperature of 190°, well mixed by agitation for half an hour, then quietly infused for an hour and a half, and finally drawn off as before. Fully 400 gallons of water are used upon this occasion; and nearly as much liquor may be drawn off. Lastly, to extract from the

\[ 14^* \]
grains everything soluble, about 700 gallons of boiling hot water are turned in upon them, thoroughly incorporated, then left quietly to infuse, and drawn off as before. This weak wort is commonly reserved for the first liquor of the next mashing operation, upon a fresh quantity of meal and malt.

With the proportion of malt, raw grain, and water above prescribed, the infusion first drawn off may have a strength = 20 per cent. = specific gravity 1·082, or 73 pounds per barrel; the second of 50 pounds per barrel, or 14 per cent.; and the two together would have a strength of 61·2 pounds per barrel = 17 per cent., or specific gravity 1·070. From experiments carefully made, upon a considerable scale, it appears that no more than four-fifths of the soluble saccharo-starchy matter of the worts is decomposed, in the best regulated fermentations of the distiller from raw grain. For every 2 pounds so decomposed, 1 pound of alcohol, specific gravity 0·825, is generated;
and as every gallon of spirits of the specific gravity of 0.909 contains 4.6 pounds of such alcohol, it will take twice 4.6, or 9.2 pounds of saccharine matter to produce the said gallon. To these 9.2 pounds, truly transmuted in the process, we must add one-fifth, or 1.84 pounds, which will raise to 11.04 the amount of solid matter employed in producing a gallon of the above spirits.

2. As the imperfect saccharine infusion obtained from raw grain is much more acescent than the rich sugary solution got from malt in the breweries, the distiller must use every precaution to cool his worts as quickly as possible, and to keep them clear from any acetous taint. As the worts cool, a quantity of starchy matter is precipitated, but it is all carefully swept along into the fermenting tun, and undoubtedly contributes to increase the production of alcohol. During the winter and temperate months, when the distilleries are most actively at work, the temperature at which the worts are set is usu-
ally about 70° Fahr. When much farinaceous deposit is present, the heat may be only 65°; because, in this case, a slow fermentation seems to favor the conversion of that starch into sugar. In some German distilleries a little chalk is mixed with the worts to check acidity.

3. **The Fermentation.**—The yeast added to the worts as a ferment ought to be the best top barm of the porter breweries. About one gallon of it is requisite for every two bushels of meal and wort worked up in the mashing process; and of this quantity only a certain proportion is introduced at the beginning, the remainder being added by degrees on the second and third days. Should the fermentation flag, a little more may be added on the fourth or fifth day, and the contents of the tun may be roused by an agitator. About eight or nine gallons may be introduced four days in succession to the quantity of worts extracted from 60 bushels of the farinaceous materials; or the third day's dose may be intermitted, and joined
to the fourth on the subsequent days. As regards the periods for administering the yeast, distillers should be governed very much by the appearance of the fermentation. This process continues from nine to twelve, or even fourteen days, according to circumstances, the tuns being left quite open during the first five days, but being covered moderately close afterwards to favor the full impregnation of the liquor with carbonic acid as a fermenting agent. In consequence of the great attenuation of the wort by the generation of so much alcohol, no good body of yeast continues to float on the surface, and what is formed is beat down into the liquor on purpose to promote the fermentation. The temperature of the wash gradually increases till toward the end of the fourth day, when it attains its maximum height of about 25° above the pitch of 55° or 60°, at which it may have been set. The time of the greatest elevation of temperature, as well as its amount, depends conjointly upon the quality of the yeast, the
nature of the saccharo-starchy matter, and the state of the weather. It is highly probable that the electrical condition of the atmosphere exercises a considerable influence upon fermentation, as thunder-storms possess the power to sour vinous fluids. The diminution of the density of the wort is carefully watched by the distiller. This attenuation, as he calls it, is owing partly to the decomposition of the sugar, which communicated its gravity to the solution, and partly to the introduction of the lighter alcoholic particles. Were all the saccharo-starchy matter resolved into gaseous compounds, the wort would become water; but since a part of it remains undecomposed, and a portion of alcohol is produced at the expense of the decomposed part, the degree of attenuation becomes a somewhat complicated problem in a theoretical point of view; the density due to the residuary sugar being masked and counteracted by the spirit evolved. Could the alcohol be drawn off as it is formed, the attenuation
would probably become greater, because the alcohol checks the fermentative action, and eventually stops it, before all the saccharum is decomposed.

The maximum quantity of proof-spirits obtained on the great scale, at any time, from raw grain mixed with from one-fourth to one-eighth of malt, seems to be twenty-two gallons per quarter.

Bezelius says that there are distillers who are guilty of putting a little arsenious acid into the still; that the spirits contain, pretty frequently, traces of arsenic, which may be detected by adding to them a little muriatic acid, then evaporating off the alcohol, and passing a current of sulphureted hydrogen gas through the residuary liquid, which will give it the characteristic orpiment yellow tinge, arsenic being present. No arsenic is ever used in this country.

When damaged grain has been mashed in making whiskey, a peculiar oily substance
makes its appearance in it. On approaching the nostrils to such whiskey slightly heated, this volatile matter irritates the pituary membrane and the eyes powerfully. Such whiskey, intoxicates more powerfully than pure alcohol of equal strength, and produces even temporary frenzy, with subsequent sickness and disordered functions. This oil may be extracted from diluted alcohol by agitating it with an unctious oil, and then distilling the oil along with water. At the end of three or four months, this volatile matter disappears in a great measure, even when the spirits which contain it are inclosed in well-corked bottles, obviously from its undergoing a spontaneous decomposition.

When acetic ether is added to well purified or clean spirits, such as the distillers call silent whiskey, it gives it somewhat the flavor of brandy. For this purpose also, the spirits are rectified from bruised prunes, or the lees of the Cognac distilleries, whereby they ac-
quire additional flavor. The astringent taste of old brandy is imitated by the introduction of a little catechu into the British spirits. Burned sugar is employed as the coloring in these imitations.

The quantity of spirits obtained from other vegetable substances depends upon the skill and manner in which the different processes are conducted.

Potatoes may yield from 16 to 22 pounds measure of spirits, from every 100 pounds of potatoes; or about 1½ gallons.

Horse-chestnuts yield 34 pounds of spirits, containing 36 per cent. of absolute alcohol.

After the first distillation of whiskey or pure spirits is finished, our next object is to deprive or free the distilled liquors, before mentioned, from all the impurities which may have passed over in the first distillation. For this purpose they must undergo the process of

Rectification, which consists in passing the spirits through well burned, and properly pul-
verized charcoal, distributed through a series of cylindrical casks, placed so that the liquor may run evenly through the charcoal and other material, care having been taken in properly mixing the raw whiskey and water; otherwise the water would pass through first, from the fact of the high wines containing such a quantity of oil as to render them much lighter than the water, which, unless thoroughly mixed, would remain on top.

Any number of casks may be used; each one must have a double bottom, the false one being perforated with conical or round holes about one-half inch in diameter, and placed a few inches above the true. Upon this perforated bottom, a layer of clean chopped straw, or cleanly carded cotton, or a woolen blanket is laid, and over the straw, woolen blanket, or cotton, a stratum of clean gravel, the size of large peas; on the gravel place six inches of coal, then one-half peck of barley malt, then fill up to within one and a half feet of the top,
with coal; then a woolen blanket, covered with another layer of gravel; then fill up to within eight inches of the top with coal. You may thus have any number of casks, the contents all passing by a tin tube, furnished with funnels under each respective cask, into one common receiver.

The better plan is, to have two series of casks, one above the other; a mixer placed over the upper series of casks, the raw whiskey passing slowly, by means of a faucet and pipes, into the upper series of casks; passing from the upper series, through faucets, into the lower series, and through the lower series of casks into a common receiver; the whole to be so regulated as to run slowly and evenly through the rectifiers, passing into the receiver in the same volume as out of the mixer; by so doing, the coal remains good for a long time, saving both trouble and expense.

When two series of casks or rectifiers are used, the upper rectifiers may be filled entirely with coal (after having placed a woolen blan-
ket over the perforated bottom, and a layer of pebbles or gravel,) to within ten inches of the top. All the casks are to be kept closely covered, thereby preventing evaporation. The coal from the top of the lower rectifiers may be removed to the depth of eight inches every six months, and from the top of the upper rectifiers, once every three months, and replaced by fresh coal; the upper rectifiers requiring more frequent renewals, owing to the larger accumulation of verdigris and other impurities.

Always use the best coal the market affords, and keep your rectifiers in constant use, or the coal will become unfit for use. To pack upper-spirit rectifiers, follow the directions for upper-whiskey rectifiers.

To pack lower-spirit rectifiers, use about one peck of lime, in place of the barley malt, and proceed as for lower-whiskey rectifiers.

When spirits are very crude, or impure, it has been found necessary to pass them through six or eight successive series of rectifiers before they were deprived of their rank flavor.
VINEGAR.

VINEGAR (VINAIGRE, French; ESSIG, Germ.;) is a sour liquid, the product of the acetous fermentation. All liquids which are susceptible of vinous fermentation, may be made to yield vinegar. Sugar and water, infusions of malt, wine, and cider, and saccharine vegetable juices, when subjected to the action of a ferment, and exposed to air and the proper temperature, may be converted into vinegar.

Vinegar is an ancient liquor. It is mentioned in the book of Numbers, nearly 1500 years before Christ. Hippocrates employed it medicinally. Hannibal is said to have softened the rocks by fire and vinegar, in his famous passage over the Alps.

15* (173)
As before mentioned, different liquors are employed in the manufacture of vinegar. In the United States, cider is generally made use of. In Great Britain, the vinegar of commerce is obtained from an infusion of malt, or a mixture of malt and raw barley. In France and wine countries, it is made from inferior wines.

Malt vinegar is prepared from malt, or a mixture of malt and raw barley, which is mashed as in the common process of brewing, and when cooled is put into large fermenting tuns, thoroughly mixed with the proper quantity of yeast, and allowed to ferment for five or six days; it is afterwards placed in vessels of smaller capacity, and kept in rooms heated by a stove to the proper temperature, until the acetoous fermentation is completed. It is then introduced into large tuns with false bottoms, on which are placed a quantity of the refuse of raisins, and other fruit called rape, which had before served for making wines. One of the tuns is filled with vinegar, (from the
smaller vessels, in which it had last been put,) a second tun is only three-fourths filled—in the latter, the fermentation takes place more rapidly than the former—a portion of the vinegar is conveyed from one to the other, at regular intervals, until the process is completed, and the vinegar ready for sale.

_Wine vinegar_ is, as before mentioned, obtained from inferior wines; it is placed in casks in a heated room, those casks being preferred which had before been employed for a similar purpose; they are placed in three rows, one above another, each having an opening of about two inches at the top; the temperature of the room must be from 68° to 75° F. The wine intended for vinegar is kept in barrels containing beech shavings, on which the lees are deposited. Twenty-two gallons of vinegar, at the boiling temperature, is put into each vinegar cask; in eight days, two gallons of the wine, drawn off clear, is added, and repeated every eight days, until the casks are
filled. In about fifteen days, the vinegar is formed.

At the end of that time, half the contents only of each cask is drawn off, and again filled by the addition of two gallons of wine as at first; the intervals sometimes between the successive additions are shorter or longer, the variations depending upon the rapidity or progress of the fermentation, which is ascertained by plunging a stave into the cask; if covered with froth when withdrawn, the fermentation is supposed to be going on properly, and accordingly more wine is added.

Wine vinegar is of two kinds, white and red, according as it is prepared from white or red wine.

White-wine vinegar is preferred; it is purer, pleasunter, and keeps better than the red.

Cider vinegar is the kind generally made in this country. The cider is exposed in barrels to the heat of the sun, with the bungs open. The acetic fermentation being generally com-
pleted in from eighteen to twenty-four months. The progress of the fermentation must be watched, and as soon as good vinegar is formed, it should be racked into clean barrels, otherwise the vinegar might be spoiled by taking on the putrefactive fermentation.

The improved German, or quick method of vinegar-making, is, however, far superior to all the old and slow methods formerly in use, and is now being generally adopted. This process greatly enlarges the surface of the liquid exposed to the air, securing thereby the speedy oxidation of the alcohol, or its conversion into acetic acid.

"An oaken tub, somewhat narrower at the bottom than the top, from six to seven feet high and three feet in diameter, is furnished with a well-fitted, grooved, but loose cover. About half a foot from its mouth, the tub has a strong oak or beech hoop fitted to its inside surface, sufficiently firm to support a second cover, also well fitted, but movable. The space under
this second cover is destined to contain the vinous liquor, and in order to bring it very amply into contact with the atmosphere, the following contrivances have been resorted to: this cover is perforated, like a sieve, with small holes of from one to two lines in diameter, and about one and a half inches apart. Through each of these holes, a wick of pack-thread or cotton is drawn, about six inches long, which is prevented from falling through by a knot on its upper end, while its under part hangs free in the lower space. The wicks must be just so thick as to allow of the liquor, poured above the cover, passing through the holes in drops. The edges of the lid must be packed with tow or hemp, to prevent the liquor running down through the interval.

"The whole lower compartment is now to be filled with chips of beech-wood, up to nearly the perforated cover. The liquor, as it trickles through the holes, diffuses itself over the chips, and, sinking slowly, collects at the bottom of the
tub. The chips should be prepared for this purpose, by being repeatedly scalded in boiling water, then dried, and imbued with hot vinegar. The same measures may also be adopted for the tub. To provide for the renewal of the air, the tub is perforated at about a foot from its bottom with eight holes, set equally apart round the circumference, two-thirds of an inch wide, and sloping down, through which the air may enter into this lower compartment, without the trickling liquor being allowed to flow out. In order that the foul air, which has become useless, may escape, four large holes are pierced in the sieve cover, at equal distances asunder, and from the center, whose united areas are rather smaller than the total areas of the holes on the side of the tub. Into these four holes, open glass tubes must be inserted, so as to stand some inches above the cover, and to prevent any of the liquor from running through them. The proper circulation of the air takes place through these draught holes. This air
may afterwards pass off through a hole of two and a half inches diameter, in the uppermost cover, in which a funnel is placed for the supply of liquor, as it is wanted to keep up the percolation.

"The temperature of the fermenting compartment is ascertained by means of a thermometer, whose bulb is inserted in a hole through its side, and fastened by a perforated cork. The liquor collected in the under vessel runs off by a siphon, inserted near its bottom, the leg of which turns up to nearly the level of the ventilating air-pipes, before it is bent outward and downward. Thus the liquor will begin to flow out of the under compartment only when it stands in it a little below the sieve cover, and then it will run slowly off at the inclined mouth of the siphon, at a level of about three inches below the lower end of the glass tubes. There is a vessel placed below, upon the ground, to receive it. The tub itself is supported upon a wooden frame,
or a pier of brick work, a foot or eighteen inches high. A tub constructed like the above is called a *graduation vessel,—vinegar generator.* (Essig-bilder.) It is worked in the following way:

"The vinegar-room must be, in the first place, heated to from 100° to 110° Fahr., or till the thermometer in the graduation vessel indicates at least 77°. The heat may then be modified. We now pour through the uppermost cover of the tub a mixture, warmed to 144° Fahr., of 8 parts of proof-spirits, 25 parts of soft water, 15 parts of good vinegar, and as much clear wine or beer. The water should be first heated, and then the vinegar, spirits, and wine or beer may be added to it. Of this mixture, so much should be poured in as is necessary to cover over the second lid two or three inches deep, with the liquor; after which the rest may be poured slowly in as it is wanted."
VINEGAR.

"When the liquor has run for the first time through the graduation vessel, it is not yet sufficiently acidified; but the weak vinegar collected in the exterior receiving cisterns must be a second time, and, if need be, a third time, passed through the graduation tub, in order to convert all the alcohol into acetic acid. In general, we may remark that the stronger the vinous liquor, the more difficult and tedious is its conversion into vinegar, but it is so much the stronger. To lessen this difficulty somewhat, it would be well not to put all the spirits at first into the wash, or mixed liquors, but to add a little more of it at the second and third running, especially when we desire to have very strong vinegar. After the graduation vessel has been some days at work, it is no longer necessary to add vinegar to the mixture of spirits and water, since the sides of the graduation tub, the beech chips, and the pack threads, are all impregnated with the ferment, and supply its place. The mix-
ture must, however, be always maintained at the temperature of 100°.

"Instead of the above mixture of proof-spirits, water and wine, we may employ, according to Dingler, a clear fermented wort of malt, mixed with a little spirits. The perfect vinegar which collects in the receiving cistern may be immediately racked off into the store casks for sale.

"It has been objected to this process, that in consequence of the mixture of saccharine and glutinous materials which are contained in beer or worts, along with the acetous fermentation, there is also partially a vinous fermentation, and much carbonic acid thereby disengaged, so as to obstruct the acetification. This obstruction may be remedied by a freer circulation of air, or by the exposure of quicklime in the chamber. It is a more substantial objection that, from the addition of beer, etc., more lees or dregs are deposited in the graduation tub, whereby a more frequent cleansing of it,
and of the beech chips, with a loss of time and vinegar, becomes necessary. The only mode of obviating this difficulty is, to take well-clarified fermented wash.

"Another evil attendant on the quick process is, the evaporation of the spirituous liquors. Since, in the graduation tub, there is a temperature of 110°, it is impossible to avoid a loss of spirit from the circulation and efflux of the air. The air, indeed, that issues from the top hole in the uppermost cover, might be conducted over an extensive surface of fresh water, where its spirit would be condensed in a great measure. But, after all, this fear of great loss is, I believe, groundless; because the spirit is rapidly acidified by the oxygen of the air, and thereby loses its volatility.

"The supply of the warm wash should be drawn from a cistern placed near the ceiling, where the temperature of the apartment is hottest; and it may be replenished from the partly acetified liquor in the cistern on the floor."
"With this view, two cisterns should be placed above, so that one of them may always contain liquor sufficiently hot, and thus the process will suffer no interruption.

"When malt wash is used for this quick process, the resulting vinegar must be clarified in a tun with beech chips, as above described. In two or three days the impurities will be deposited, and the fine vinegar may be racked off. The following prescription for preparing what he calls malt wine, is given by Dr. Kastner:—

'Eighty pounds of pale barley-malt, and 40 pounds of pale wheat-malt, are to be crushed together. These 120 pounds are to be infused with 150 quarts of water, at the temperature of 122° Fahr., afterwards with 300 quarts of boiling water, and the whole body is to be mashed thoroughly, till all the lumps disappear. It is then to be left at rest in a large covered tub, for two or three hours, to allow the grains to settle down, from which the wort is to be drawn off. When it has fallen to the temperature of 64°
Fahr., 15 pounds of good yeast are to be stirred in, and it must now be left for two or three days to ferment, in a loose-covered tun. When the vinous fermentation has taken place, the clear liquor must be drawn off by a tap-hole, a little above the bottom, so as to leave the lees and scum in the tun.' This malt wine, he adds, may be kept for a long time in close vessels, and is always ready for making quick vinegar.” (Ure.)

Vinegar can be manufactured cheaper by this method than by any of the old systems. By increasing the size of the graduation vessel, both in height and diameter, vinegar is still more rapidly formed, owing to the increased enlargement of the surface of the liquid exposed to the oxygen of the air.
OTHER VINEGARS.

*Raspberry Vinegar.*—Macerate two pounds of fresh raspberries, with a pint of the best vinegar, for fourteen days, and strain; or, to a quart of raspberry juice add two ounces of strong acetic acid, or enough to render it sufficiently acid.

*Raspberry Vinegar.*—Bruised ripe raspberries and white-wine vinegar, of each 2 quarts; macerate twenty-four hours, press, strain, and to each quart add 2 pounds of white sugar; boil, skim, cool, and to each quart add 4 ounces of brandy.

*Camp Vinegar.*—Take 12 chopped anchovies, 2 cloves of garlic, minced, 1 drachm of Cayenne,
2 ounces of soy, 4 ounces of walnut catchup, and a pint of the best vinegar; digest for a month, and strain.

_Camp Vinegar._—Vinegar a quart, walnut catchup a pint, mushroom catchup 3 tablespoonsful, garlic 4 heads, Cayenne ½ ounce, soy 2 tablespoonsful, port wine 2 glasses, 3 anchovies, and a tablespoonful of salt; put them into a bottle, shake daily for a month, and decant.

_Tarragon Vinegar._—Put fresh tarragon leaves into a stone jar, and pour on them a sufficient quantity of the best wine vinegar to cover them. Set the jar in a warm place for fourteen days; then strain through a jelly-bag.

_Curry Vinegar._—Infuse 12 ounces of curry powder in a gallon of vinegar, near the fire for five days. Used as a flavoring.

_Seville Orange-peel Vinegar._—Seville Orange-peel ½ pound, vinegar 1 gallon; leave stand fourteen days, and strain.
Ginger Vinegar.—Bruised ginger-root 1/2 pound, vinegar 3 quarts; macerate for fourteen days; strain.

French Raspberry Vinegar.—Take 6 quarts raspberries, mash them, press out the juice; to each pint of the juice add one half pound of white sugar, and a half pint of the best cider-vinegar, first, however, mixing the juice and the vinegar, and giving them a boil in a kettle; after boiling add the sugar gradually, with a beaten white of egg to every two pounds; and boil and skim it till the scum ceases to rise. When cool, bottle and cork tightly. To use it, pour out half a tumblerful and fill it with iced-water.

Argol Vinegar.—White argol or cream of tartar 1/2 pound, boiling water 4 gallons; dissolve, cool, add 1/4 gallon proof-spirits, and keep it lightly covered in a warm place.

German Family Vinegar.—Soft water 15 gallons, brown sugar 4 pounds, cream of tartar
½ pound, corn-spirit 2 gallons; mix, keep it lightly covered, in a warm temperature.

Sugar Vinegar.—Boil 10 gallons of water for ten minutes with a quart of bran, run it into a tub through funnels, and put into it 12 pounds of coarse brown sugar, and when cooled to 70°, add a quart of yeast at three different times. Let it work for four days, then take off the yeast, and run the liquor into a clean tub. Fill the tub nearly with the liquor, leaving room for 2 pounds of bruised crab-apples, and 1 pound of raisins. If it ferments, add a little reserved liquor, or water, boiled with sugar, till the fermentation ceases. Then place the cask upon a plank fronting the sun in summer, and near the fire in winter. Put into it 1 ounce of isinglass, well beaten up with a quart of old vinegar; cover the bunghole with a piece of hop-bag, (fastened to the edge of the hole by pitch,) and lay a tile over it. Leave it in this state until it becomes fit for use.
Chilli Vinegar.—To 1 quart of the best vinegar add 100 English chillies, cut or bruised, (or \frac{1}{4} pound Cayenne pepper;) digest for fourteen days.

Horse-radish Vinegar.—To 3 ounces of the scraped root, 1 ounce of minced shallots, and 1 drachm of Cayenne pepper, add a quart of vinegar; let stand for fourteen days.
BITTERS.

BITTERS are very much used at the present time as additions to spirituous and vinous liquors, as likewise also for the purpose of giving strength and vigor to the body; and, when repeated at proper intervals, a permanent healthy tone is induced. *Bitter extractive* appears to be the active tonic principle,—found in a great variety of vegetable productions; which, as a general thing, are combined in certain proportions, with aromatics, rendering their infusions and tinctures more pleasant, though at the same time more stimulating. Dr. Paris says: "We are ourselves conscious of the invigorating effects of slight bitters upon our stomach; and their presence in malt (or vinous) liquors, not only tends to diminish the noxious effects of such (192)
potations, by counteracting the indirect debility which they are liable to occasion, but even to render them, when taken in moderation, promoters of digestion. The custom of infusing bitter herbs in vinous drinks is very ancient and universal; the *poculum absinthiatum* was regarded in remote ages as a wholesome beverage, and the wormwood was supposed to act as an antidote against drunkenness. The Swiss peasant cheers himself amid the frigid solitude of his glaciers, with a spirit distilled from *gentian*, the extreme bitterness of which is relished with a glee that is quite unintelligible to a more cultivated taste."

The formulæ for bitters are very numerous. We give those which we have found to be the best,—most pleasant; and which have rendered to the consumers the most satisfaction. If a small quantity only is wanted, reduce the quantities of the ingredients in a proportionate ratio; if a large quantity, increase in the same manner.
IMITATION WINE BITTERS.

No. 1.—WINE BITTERS.

8 ounces dried orange-peel.
8 ounces bruised gentian root.
6 ounces unground cinnamon.
2 drachms ginger root.
8 ounces bruised cochineal.
2 gallons proof-spirits.
1½ gallons water.
1 pound loaf-sugar.

Digest for fourteen days; decant the clear liquor, and filter if required.

No. 2.—WINE BITTERS.

½ pound bruised gentian.
½ pound orange-peel.
2 ounces cassia bark.
½ pound lemon-peel.

(194)
BITTERS.

½ pound bruised columbo root.
4 ounces red sanders.
1 pound loaf-sugar.
2 gallons proof-spirits.
1 gallon water.

Digest fourteen days; decant the clear liquor, and filter if required.

No. 3.—WINE BITTERS.

½ pound wild-cherry bark.
2 ounces canella bark.
½ pound red sanders.
1 ounce bruised cardamom seed.
1 pound bruised gentian.
2 gallons pure spirits.
1 gallon water.

Digest fourteen days; decant, and filter if necessary.

No. 4.—WINE BITTERS.

4 pounds orange-peel.
4 pounds bruised gentian root.
6 pounds red sanders.
4 pounds wild-cherry bark.
½ pound cochineal, bruised.
\(\frac{10}{16}\) pound cannella bark.
½ pound bruised cardamom seed.
1 pound Virginia snake-root.
1 pound powdered gum kino.
12 gallons pure proof-spirits.

Digest three or four weeks; draw off as required, filling up from time to time, until the strength is so much exhausted as to require new ingredients. What is drawn off may be reduced with water to the desired strength; adding a little loaf-sugar. A large quantity may be obtained in this manner. The above is a fine receipt, producing a splendid article.

The ingredients may be increased or diminished to please the fancy of the maker; insuring thereby a larger or smaller quantity of bitters.
BRANDY BITTERS.

No. 5.—BRANDY BITTERS.

2 ounces bruised gentian.
2 ounces dried orange-peel.
1 ounce cassia bark.
1 pound loaf-sugar.
2 gallons brandy.

Digest for twelve days, agitating frequently; filter through paper, then add the sugar.

No. 6.—BRANDY BITTERS.

½ pound wild-cherry bark.
½ pound orange peel.
½ pound bruised gentian.
1 ounce canella bark.
1 ounce Virginia snake-root.
2 ounces red sanders.
4 gallons of brandy.

17* (197)
Digest fourteen days, agitating frequently; then draw off the clear liquor, adding 2 pounds loaf-sugar.

No. 7.—BRANDY BITTERS.

½ pound bruised gentian.
1 ounce cinnamon, broken.
1 drachm cloves.
1 ounce red sanders.
½ pound lemon-peel.
2 gallons brandy.

Digest ten days, shaking frequently; decant the clear liquor, and add 1 pound loaf-sugar.
SPIRIT BITTERS.

No. 8.—SPIRIT BITTERS.

4 ounces cinchona bark.
2 ounces canella bark.
4 ounces bruised columbo.
½ pound orange-peel.
1 ounce red sanders.
1 drachm cloves.
2½ gallons pure spirits.

Digest fourteen days, agitating frequently; decant the clear liquor, and add 1 pound loaf-sugar.

No. 9.—SPIRIT BITTERS.

½ pound bruised gentian.
½ pound orange-peel, dried.
1 ounce cassia bark.

(199)
BITTERS.

½ pound wild-cherry bark.
1 ounce bruised cochineal.
1 ounce red sanders.
3 gallons pure spirits.

Digest fourteen days, frequently agitating; decant the clear liquor, and add 2 pounds loaf-sugar.

No. 10.—SPIRIT BITTERS.

½ pound bruised gentian.
½ pound orange-peel.
½ pound wild-cherry bark.
½ pound calamus.
½ pound chamomile blossoms.
½ pound bruised cardamom seed.
½ pound red sanders.
1 ounce canella bark.
½ pound Virginia snake-root.
½ pound columbo root, bruised.
5 gallons spirits.

Digest for fourteen days, frequently shaking; decant the clear liquor, add 2 pounds loaf-sugar.
A few gallons of spirits may then be put over the ingredients, and drawn off in a few weeks, as before.

**No. 11.—SPIRIT BITTERS.**

2 ounces bruised columbo root.  
1 ounce cassia bark.  
1 ounce orange-peel.  
1 ounce red sanders.  
1 gallon spirits.  

Digest for ten days, draw off, and add half a pound of loaf-sugar.

**No. 12.—SPIRIT BITTERS.**

2 ounces bruised gentian.  
2 ounces chamomile blossoms.  
1 drachm cloves.  
1 ounce lemon-peel.  
1 ounce red sanders.  
1½ gallons spirits.

Digest ten days, as before, and decant the clear liquor.
IMITATION LEMON SIRUP.

1. Lemon Sirup.—Citric acid 1½ ounces, sugar 6 pounds, pure soft water 4 quarts; dissolve the sugar in the water with the aid of heat, then add the acid, previously dissolved in a small quantity of water; agitate thoroughly. When cool, bottle. For use, take two tablespoonsful of the sirup in a tumbler, fill with ice-water. A fine summer drink. Color, if desirable.

2. Lemon Sirup, Aromatic.—Same as No. 1, only adding, before bottling, any aromatic tincture or sirup, the flavor of which you desire, using in the same manner as the first. Color, if required.

(202)
IMITATION LEMON SIRUP.

Lemonade, Acidulated.—Juice and thin peel of 1 lemon, citric acid 1 drachm, sugar three ounces, boiling water a quart. It may be varied by substituting for the sugar, sirup of raspberries, strawberries, or other fruits.

French.—Sirup of citric acid 2 ounces, water a quart, spirit of lemon-peel a teaspoonful.

Imperial.—Cream of tartar 1½ drachms, a slice of thin lemon-peel, a lump of sugar; pour on them a quart of boiling water; strain when cold. A cooling drink.

Queen Cup.—Fresh lemon-juice 4 ounces, fresh lemon-peel (thinly peeled) ½ ounce, white sugar 4 ounces, boiling water 3 pints; strain when cold.
ORANGEADE, OR SHERBET.

1.—Juice of 4 oranges, thin peel of 1 orange, lump sugar 4 ounces, boiling water 3 pints.

2.—Juice and peel of 1 large orange, citric acid $\frac{1}{2}$ drachm, sugar 3 ounces, boiling water a quart.

*Efervescing Orangeade, or Sherbet.*—1. Put into a soda-water bottle $\frac{1}{2}$ ounce to 1 ounce of sirup of orange-peel, 30 grains of bicarbonate of potash, 8 ounces of water, and lastly, 40 grains of citric acid in crystals, and cork immediately.

2. Put into each bottle 2 or 3 drachms of sugar, 2 drops of oil of orange-peel, 30 grains of bicarbonate of potash, or 25 grains of bicarbonate of soda; water to fill the bottle, and 40 grains of citric acid as before.

(204)
FORMULÆ.

Formulae for the preparation of the tinctures, essences, etc., used in the different imitations as recommended in this work:—

TINCTURES.

1. Tincture Kino.—Kino in powder 3½ ounces, rectified spirits 2 pints. Macerate for fourteen days, and filter through paper.

2. Tincture Rhatany.—Rhatany, ground, 6 ounces, diluted alcohol 2 pints. Macerate for fourteen days, and filter through paper.

3. Tincture Catechu.—Catechu 3 ounces, diluted alcohol 2 pints. Macerate for fourteen days, express, and filter through paper.

18 (205)

5. *Tincture Cinnamon.*—Cinnamon, bruised, 3 ounces, diluted alcohol 2 pints. Macerate for fourteen days, and filter through paper.


7. *Tincture Cardamom Seed.*—Cardamom, bruised, 4 ounces, diluted alcohol 2 pints. Macerate for fourteen days, and filter through paper.


ESSENCES.

1. *Essence of Lemon.*—Pure oil of lemon 1 ounce, strongest alcohol ½ pint, exterior rind of lemon ½ ounce. Macerate two days, and filter.

2. *Essence of Orange-Peel.*—Orange-peel 3½ ounces, strongest alcohol 2 pints. Macerate fourteen days; filter through paper.


COLOR.

*Beet-Root Color.*—Extract by boiling.

SIMPLE SIRUP.

*Simple Sirup.*—Best white sugar 2 pounds, water a pint. Dissolve the sugar in the water with the aid of heat; remove any scum that may rise; the moment it boils remove, and strain while hot.
COLORING FOR LIQUORS.

Take 4 pounds of best white crushed or lump sugar, put it into a kettle that will hold five quarts, with a half pint of water. Boil it until it is black, then remove it from the fire and cool with water, stirring it as you put in the water. Use, to color liquors from a light amber to a dark brown. For brandies, whiskey, old rye, etc.

*Red Color.*—Beet root, red sanders, or cochineal.

*Port-Wine Color.*—Extract of rhatany.

BEAD FOR LIQUORS.

One ounce of oil of vitriol, and one half ounce of sweet oil, mixed together in a glass bottle. One drop is sufficient for a quart, and in proportion for a larger quantity.

THE END.