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The Process of Making Alcohol.

One of the constituents of all kinds of grain is starch, and by the process of fermentation this starch is converted first into sugar, and then into alcohol. These chemical transformations take place only when the grain is immersed in warm water, consequently alcohol is always made in a mixture with water. When the alcohol is to be consumed in the form of ale or beer, it is not necessary to separate it from the water with which it is mingled, but for innumerable uses in the arts this separation is essential, and it is effected by the process of distillation. As alcohol is transformed into vapor at the temperature of 176°, while water remains at this temperature in a liquid state, it is only necessary to heat the mixed liquids to 176°, when the alcohol rises in vapor, and the water is left behind. The vessel in which the liquids are heated is closed by an air-tight cover, and from this cover a pipe is led and coiled through a cask of cold water; as the alcoholic vapor enters this cold pipe it is condensed to the liquid form. This process of evaporating and condensing a liquid is called distillation; the apparatus is called a still, and the coiled pipe is the "worm of the still."

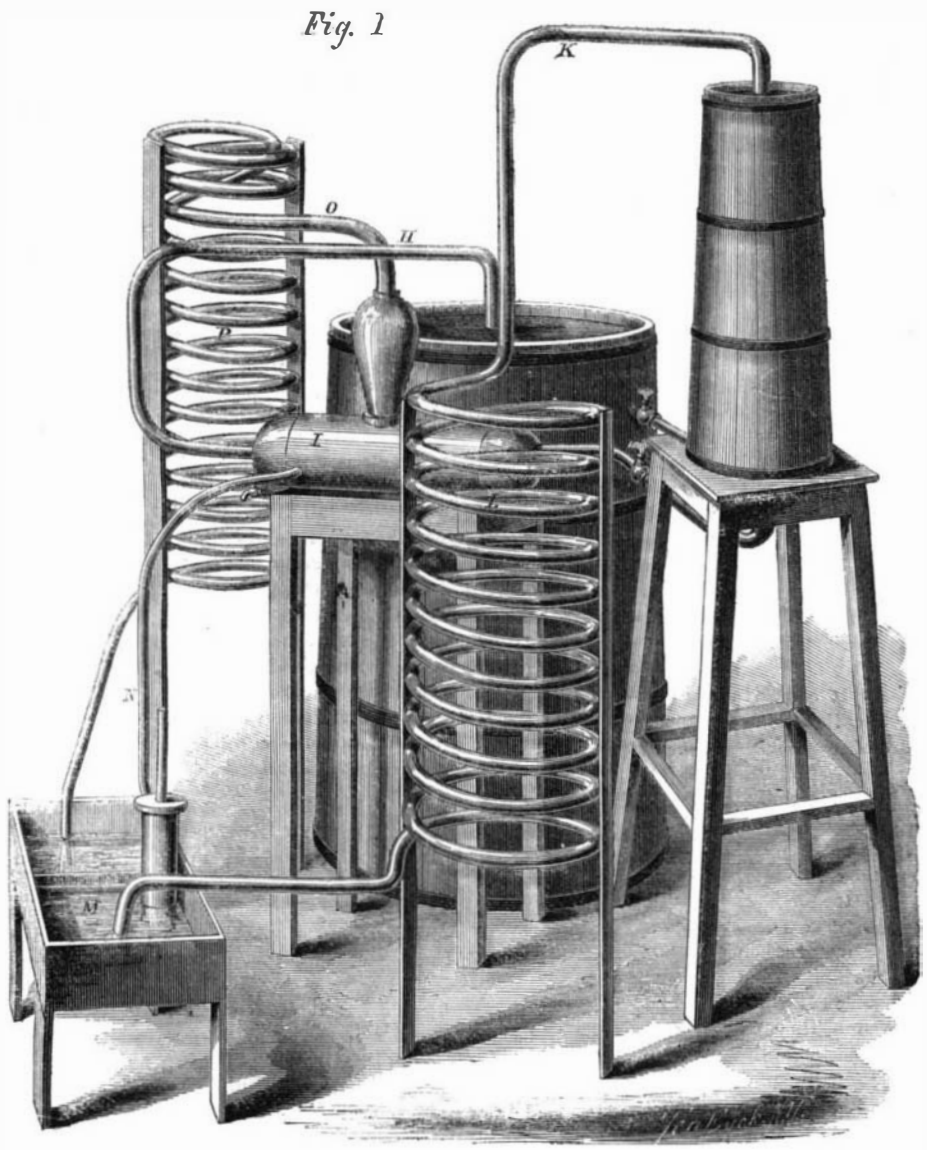
It is not possible by this process to completely separate the alcohol and water, for, though water is wholly converted into steam only at the temperature of 212°, it is partially volatile at lower temperatures, and a portion of it is consequently carried over with the alcohol.

There is also mingled with the alcohol another ingredient which for some purposes it is desirable to remove. This is properly an ether, though it is called by some chemists and by most distillers an essential oil, which gives the peculiar flavor to the different kinds of spirit; one oil being produced from sugar and giving the flavor to rum; another from corn and giving the flavor to corn whisky; another from rye and giving the flavor to rye whisky—each kind of spirit deriving its flavor from its peculiar ether. It so happens that charcoal has the property of absorbing all of these ethers (the quantity of which bears a very small proportion to that of the spirits), and consequently they are eliminated by simply leaching the spirits through charcoal. This process is called rectifying.

In practice, it is customary for distillers in the grain-growing regions of the West to manufacture an article called "high wines," which is alcohol mingled with considerable water and with ethers. This article is sold to refiners—located in New York and other places—who re-distill it to separate it from a portion of the water, and leach it through charred bone-dust to eliminate the essential oil.

Many efforts have been made to obtain alcohol sufficiently pure for use in the arts by improvements in the first distillation, in order to save the expense of re-distilling and rectifying, as well as the cost of transporting the large quantity of water contained in high wines. Though enormous amounts of money have been expended in these efforts, they have been heretofore unsuccessful; but we now have the satisfaction of illustrating an apparatus invented by a practical distiller, who says that he has had it in operation at his distillery in Springfield, Ills., for more than a month, and that he obtains in the place of high wines an article of alcohol which is pronounced by the dealers of this city superior to the ordinary re-distilled and rectified alcohol. These great results are obtained by the introduction of a simple apparatus, which the inventor calls an extractor, by which the wines are re-distilled by dry heat instead of by throwing steam among them as in the ordinary process.

Fig. 1



HOWLETT'S IMPROVEMENT IN DISTILLING.

Fig. 1 of the engraving is a perspective view of the whole still, including the extractor, and Fig. 2 is a vertical section of the still vat.

A is a large wooden vat, 24 feet in hight and 8 feet in diameter at the base, divided by two horizontal diaphragms into three compartments, one above another. The alcohol, mingled with the meal from which it has been extracted and with the water employed in the process, is introduced in successive charges into the upper compartment, B; each charge occupying about one-third of the capacity of the compartment. The compartments, C and D, contain charges which have been let into them from above. Into the lower compartment, D, steam is introduced by the pipe, E, leading from a steam boiler. This steam passes through the beer in the compartment, D, evaporating and carrying with it any alcohol which may remain in this beer. It then passes up through the pipes, F and G, in the direction indicated by the arrows, into the second compartment, C, passing through the beer in this compartment, and carrying forward a portion of its alcohol into the upper compartment, B. Here it encounters the fresh beer, taking out a portion of its alcohol, and, thus strengthened, passes out of the pipe, H, at the top of the vat, through the pipes in the extractor, I, into the lower end of the doubler, J, which contains a charge of lees left from a previous distillation. These lees still hold a portion of alcohol by which the spirit is strengthened as it passes through them, and it is led from the top of the doubler by the pipe, K, to the worm, L, where it is condensed and runs down into the vat, M; being mingled with oil and water, constituting it the first wines.

These first wines are now thrown by Mr. Howlett into his extractor, to separate the alcohol from the essential oil and from a sufficient portion of the water to bring it to the strength of commercial alcohol, suitable for shipment to foreign markets.

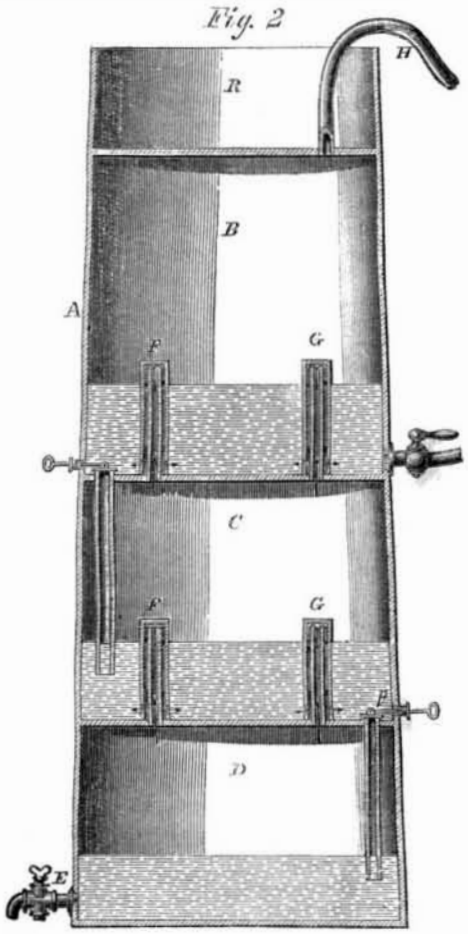
By means of a pump driven by the steam engine of the works the first wines are forced up through the pipe, N, into the extractor, I, where the liquid surrounds the pipes through which hot vapors pass, as has been described. Here the alcohol is evaporated, and the vapor passes upward through the ascending coil, O, where most of the water which has been

evaporated with it is condensed and trickles back into the extractor, while the vapor of alcohol continues onward and is condensed in the descending worm, P, when it is ready to be barreled.

It will be seen that the separating process depends upon a nice adjustment of the temperatures. Alcohol boils at 176°, water at 212° and the ethers at a somewhat higher temperature, and the distillation is so managed as to drive off the alcohol with only a small portion of the water and without any of the ether. By the use of dry heat, too, instead of steam, the introduction of water into the spirit is avoided.

To complete our description of the process we will explain briefly the manner in which the waste products are discharged. A valve is made in the lower

Fig. 2



compartment, D, of the tub, A, and after the steam has been passing through the beer in this compartment a sufficient length of time to extract its alcohol, the valve is opened, when the pressure of steam blows out the slops, which are used for feeding hogs or cattle. Then the valve, *g*, is opened and the charge in compartment, C, is allowed to fall into the compartment below. B is emptied in the same manner, and a fresh charge is introduced from the charger, R, above. At the same time the lees from the doubler, J, are drawn into the compartment, B. These lees are the water and ether left in the extractor when the alcohol was evaporated from the first wines, and they contain a portion of alcohol which is taken from them by the action of the steam as they repeatedly encounter it in their passage back to the waste pipe.

Each charge in a still of the size here described yields about 25 gallons of spirits, and a fresh charge is introduced every 15 to 30 minutes.

Application for a patent for this invention has been made through the Scientific American Patent Agency, and further information in relation to it may be obtained by addressing the inventor, P. L. Howlett, at Springfield, Ills.

Shameful Waste in the Army.

An army correspondent of the Philadelphia *Gazette* makes the following record of waste in the Army of the Potomac :—There is food for reflection in the enormous waste of provisions by an army, exceeding by far the consumption of the same number of men at home. A contemplation of the various camping grounds vacated by Burnside's army corps during the present week would present a fair illustration. In all the camps the waste was more or less great; but within my limited view, that of the Ninth New Hampshire Regiment was the greatest. There, in one spot, I saw fresh meat enough to compose a good sized calf, which was not in the least spoiled; several barrels of salt beef and pork, and boxes of crackers which I had not time to count. Many of these were open, and had but a small portion of their contents abstracted. Others were in piles, and had not been opened at all. Thus, while thousands in the army are often hungry, other thousands are wasting the food provided for them in the most disgraceful manner. Where are the Quartermasters? Who are they that permit these things?

America—The Granary of the World.

In his book of travels in the United States, recently published, Mr. Trollope says :—I was at Chicago and at Buffalo in October, 1861. I went down to the granaries, and climbed up into the elevators. I saw the wheat running in rivers from one vessel to another, and from railroad vans up into huge bins on the top stories of the warehouses; for there rivers of food run up hill as easily as they do down. I saw corn measured by the forty-bushel measure with as much ease as we measure an ounce of cheese, and with greater rapidity. I ascertained that the work went on, through the week and Sunday, day and night incessantly; rivers of wheat and rivers of maize ever running. I saw men bathed in corn as they distributed it in its flow. I saw bins by the score laden with wheat, in each of which bins there was space for a comfortable residence. I breathed the flour, and drank the flour, and felt myself to be enveloped in a world of breadstuffs. And then I believed, understood, and brought it home to myself as a fact, that here in the corn lands of Michigan, and amid the bluffs of Wisconsin, and on the high table plains of Minnesota, and the prairies of Illinois, God had prepared the food for the increasing millions of the Eastern World, as also for the coming millions of the Western. I began to know what it was for a country to overflow with milk and honey, to burst with its fruits, and be smothered by its own riches. From St. Paul down the Mississippi, by the shores of Wisconsin and Iowa, by the ports on Lake Pepin, by La Crosse, from which one railway runs eastward, by Prairie du Chien, the terminus of a second, by Dunleith, Fulton, and Rock Island, from which three other lines run eastward, all through that wonderful State of Illinois—the farmer's glory—along the ports of the great lakes, through Michigan, Illinois, Ohio, and further Pennsylvania, up to Buffalo, the great gate of the Western Ceres, the loud cry was this—"How shall we rid ourselves of our corn and wheat?" The result has been the passage of 60,000,000 bushels of breadstuffs through that gate in one year! Let those who are susceptible of statistics ponder that. For those who are not, I can only give this advice: let them go to Buffalo in October and look for themselves.

Potabilization of Sea-water by the Electric Current.

In *Macmillan's Magazine* for last month is an interesting paper by Dr. Phipson, entitled, "Electricity at Work," in which the author passes in review the useful applications of this wonderful agency. He concludes his paper as follows :—"Reflecting upon the powerful decomposing chemical force with which we are furnished by the electric current, it occurred to me that I might be able to render sea-water potable by decomposing and extracting its salt, by means of a moderately powerful battery. The experiments were made at Ostend a few years ago. My apparatus consisted of three vessels containing sea-water to be operated upon, the two others communicated with the two poles of the battery. The three vessels were connected by two bent U-tubes filled with sea-water. As the only battery I could procure in Ostend was rather weak, I passed the current though the water for about fourteen hours, after which one of the outside vessels had become acid and the other alkaline. The sea-water was then filtered through charcoal, and was nearly drinkable. It would have been, I doubt not, quite potable had the battery employed been more powerful; as it was, I found it difficult to extract the last particles of salt, and the water, after subsequent trials, still presented a slightly brackish taste. I have not had an opportunity of repeating this experiment since, but from the results obtained, I think it probable that sea-water may be rendered potable by means of the electric current."

A Vermont Marble Quarry.

One of the best, though not the largest, of the marble quarries in Vermont is at Sunderland's Falls of Otter Creek, in the town of Rutland. One face of the quarry shows a perpendicular cut of perhaps 100 feet, and the other about half that, and that much below the level; the workmen still going deeper, as the quality of the marble is found to improve. Some of it is almost as fine as Italian statuary marble, and is taken out in blocks of about 100 cubic feet, perfectly solid and free from flaws or blemish. These blocks are cut out by a slow, tedious process of handiwork by men who labor at day wages—at present 90 cents a day. It is found better to pay day wages than job work, as great care is requisite, and all the work must be under the constant supervision of a competent overseer. Powder is only used to open a starting place in the floor of the quarry for a new course of blocks, and great care must be used so as not to injure any of the adjoining marble. The first course is worked out between a natural perpendicular seam, running nearly east and west across the ridge in which the quarry is situated, and the first cut, which is to form one face of the block. Another cut is made parallel about four feet from the first, and cross-cuts about six feet apart; holes are drilled under the bottom and wedges driven in to break up the block from the bed. It is then pried out of its bed and hoisted to the surface by ox power on the sweep of a windlass and a great crane. This process is continued quite across the floor of the quarry, until all that course of blocks are removed, the area lessening a few inches with each course, because the workmen cannot work quite up to the perpendicular side, so that every course that has been taken out shows on the nearly perpendicular face, and when wet, the exact color and dip of strata of each particular description is seen, and forms an interesting geological study.

Railroads in Michigan.

The Detroit *Commercial Advertiser* says :—We have now in actual operation, within the State of Michigan, upwards of one thousand miles of railway, all of which is owned by six companies, viz :—the Michigan Southern and Northern Indiana (having a total length, with branches, of 549 miles), the Michigan Central (284 miles), the Detroit and Milwaukee (188 miles), the Grand Trunk (Detroit branch 57 miles), the Flint and Pere Marquette (35 miles), and the Amboy, Lansing and Traverse Bay (30 miles), making a total of 1,143 miles now in working order. The trunk lines leaving the city of Detroit are, the Michigan Southern, Michigan Central, Detroit and Milwaukee, and Grand Trunk, all of which are doing excellently well. The Michigan Southern road has direct connections with Chicago, St. Louis, Milwaukee, Cincinnati, Toledo, Cleveland, Buffalo, Philadelphia, New York, Washington and Baltimore, besides its numerous branches diverging in all directions from its main line. At Buffalo and Dunkirk it affords a choice of routes to the eastern traveler, and along its whole line affords the most splendid scenery. The Central road is regarded as the great avenue of travel between Chicago and the East, *via* the Great Western and Grand Trunk Railways of Canada, and is a connecting link in the great chain of railways from Portland, Maine, to St. Louis, Missouri. The Detroit and Milwaukee road connects in this city with the Michigan Southern, Great Western, and Grand Trnnk roads, forming the most direct route for Milwaukee and the great Northwest.

Substitute for Apple Sauce.

A lady writer communicates the following bit of information obtained where she "took tea last" :—A dish of what I took to be preserves was passed to me, which upon tasting I was surprised to learn contained no fruit. The ease with which it was prepared and the trifling cost of its materials, not my tasting apparatus, deceived me as it is not usually wont to do. It is emphatically a tiptop substitute for apple sauce, apple butter, tomato preserves, &c. It is prepared as follows :—Moderately boil a pint of molasses from five to twenty minutes, according to its consistency, then add three eggs thoroughly beaten, hastily stirring them in; continue to boil a few minutes longer, and season with nutmeg or lemon.—*Oil Springs Chronicle.*