MANUFACTURE AND USES OF STARCH.

[Concluded from page 167.]

If, instead of employing very minute quantities of acids mixed with water and starch, a large quantity is employed, the starches are not only transformed into gums, but converted into the kind of sugar which exists in grapes and other fruits. In the latter case, however, the starch undergoes not a mere molecular change, but a chemical transformation. On the continent of Europe large quantities of this peculiar sugar are employed in the preparation of beer and other beverages. This grape sugar is made as follows:—

About 100 parts of farina are added gradually to 33 of water containing one part of sulphuric acid, and then boiled for 40 minutes, when the farina is converted into grape sugar. When it is transformed into sugar a little chalk is added to destroy any free acid that may remain; this falls to the bottom in the form of sulphate of lime. The saccharine solution is then poured off and evaporated to a proper consistency. After cooling and standing for several days, solid masses of sugar, very similar in appearance to honey, are obtained. If, instead of continuing the boiling action of the acid upon the starch until it is fully converted into sugar, this action is stopped just as soon as it gives a purple color, when a little iodine is added, then by removing the acid by the use of chalk, as has been described, and evaporating the solution, a translucent soluble matter resembling dextrine is the product. That starch could be converted into dextrine has been long known, but it is only since 1833 that chemists have been aware how this conversion was effected. In that year Messrs. Payen and Persoz, of Paris, succeeded in extracting, with alcohol, from a solution of malt, the curious ferment which caused that change, and they gave it the name of *diastaste*. To leave no doubt that this is the agent which converts starch into sugar, they found that by mixing one part of this azotized substance with 2,000 parts of farina, and a sufficient quantity of water, the farina was completely converted, first into dextrine, then into sugar, at a temperature of 150° Fah. But whenever the temperature was raised to 200° or 212° Fah., this conversion was completely prevented. As a law of chemistry, therefore, brewers must not raise the heat of their mash-tubs above 150°, under the penalty of inflicting loss upon their own interests.

CORN STARCH.

This being an exclusive American manufacture, we find nothing said about it in Dr. Calvert's lecture; we will therefore supply the omission with a brief description of the process. As corn contains considerable oil, it must be treated somewhat differently from wheat. It is therefore first soaked in the vats in a warm alkaline solution. Some manufacturers never permit fermentation to take place in soaking, to facilitate the separation of the starchy from the fibrous elements, while others allow fermentation to take place, as in the wheat starch manufacture. After this is properly effected (which requires from eight to fourteen days), the corn is ground between common grist millstones; from these it passes to rotary screens where it is washed with a stream of water, when the starch flows out through the meshes, and the grain hulls are left behind. The water containing the starch is then pumped into settling cisterns, and some dilute caustic alkali is added and all thoroughly stirred. The alkali causes the fibrous particles of the corn to separate from the starch and settle to the bottom. The starch liquid is then drawn off by siphons, into perforated wooden boxes lined with cotton cloth, from which the water gradually flows out and leaves the starch behind. Settling raffles (a series of inclined, narrow boxes connected with one another) are also used, and by the liquid running over an extensive rippling surface in these, more starch is thus deposited, upon the same principle that streams, in running over pebbly bottoms, deposit more mud and impurities than when flowing smoothly along. It is very remarkable that in the settling cisterns the starch exhibits polar attraction, that is, it gathers in bunches, as metallic oxyds aggregate in the act of crystallization; the localities being called "spheres of attraction."

There are vast quantities of starch manufactured in this country, but some of it is of very inferior quality. This is owing to the want of skill in the manufacturers. Good starch should not only be of a clear white appearance, but should so stiffen muslins that they will possess considerable elasticity. A linen collar, for example, when stiffened with good starch, will not, when folded over, crack and exhibit brittleness, but will exhibit a retractive force and endeavor to assume its original form. A great many manufacturers of corn starch, while they have succeeded in obtaining a product of a good appearance, have not succeeded in making it of a good stiff and elastic quality. There exists a prejudice against corn starch in the minds of bleachers, calico-printers, and cotton manufacturers who use large quantities of it; they believe it is not suitable for their purposes. There are some manufacturers who can make good corn starch, and the time may come when wheat starch will be as scarce as that made from rice, which is now only manufactured for dressing fine lace.

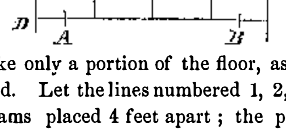
About ten years ago there was a great excitement caused by the supposed large profits obtained in the manufacture of all kinds of starch, and as a consequence a great number of companies were formed in various parts of the country; and starch factories sprung up like mushrooms. But owing to the want of skill and experience on the part of those chosen to conduct them, the greater number, of them soon failed, and one of them (in Buffalo, N. Y.) which for the building and machinery cost over $100,000, was sold a few weeks since for $15,000. To conduct the starch manufacture profitably, about 23 pounds should be obtained from a bushel of grain, but owing to a want of knowledge of the fermenting process, many manufacturers fall a very long way below this produce. They permit vinous fermentation to take the place of the acetous, and considerable of the starch is thus converted into dextrine and passes off as waste. It requires a very critical knowledge of fermentation to conduct the corn starch manufacture successfully.

IRON BEAMS FOR DRILL ROOMS.

MESSRS. EDITORS:—I have just read, with considerable interest, and in at least two particulars, considerable satisfaction, the article published on page 121 of the present volume of the SCIENTIFIC AMERICAN, on the "Strength of Wrought Iron Beams." In your opening remarks I fully concur; and the conclusion to which you come (that different authors have guessed too much) I fear is but too true.

As no answer has been given to the question published on page 74 of your journal, I have concluded to try it, with the formula which you say "is preferable for all purposes." The question had reference to a room filled with soldiers, in motion; while the given figures (on page 74) allow "a space of 3 feet between the ranks, and 2 feet *between each man*. I hold that marching with "lock step," as some soldiers call it, the space occupied by each does not exceed 1 by 2 feet; making 70 lbs. per square foot, allowing 140 lbs. for each man—a trifle over the 66 lbs. per square foot stated (on page 121) to be the "weight of a crowd of persons standing on their feet."

By the aid of a few lines (see diagram). and not a great many figures, we obtain the following:—



We will take only a portion of the floor, as less figures will be needed. Let the lines numbered 1, 2, 3, 4 and 5 represent beams placed 4 feet apart; the points A and B being central between 1 and 2, and 4 and 5, the distance from A to B will consequently be 12 feet. The length (or distance) between supports (from C to D) is 17 feet. Then $12\times17=204$ square feet$\times70$ lbs. per square foot, for the soldiers$=14,280$ lbs.$\times4$, for "momentum on the floor per second, marching at the rate of 3 miles per hour" (rather slow, in imitating a retreat)$=57,120$ lbs. Weight of arching, concrete, &c., 75 lbs. per square foot$\times204=15,300+57,120=72,420$ lbs., which is the total weight to be supported by the three beams, Nos. 2, 3 and 4. By the formula on page 74, the "breaking weight" of each beam, "with the load uniformly distributed," is 42,254, which $\times3=126,762$. We now have as the result; breaking weight$=126,762$ lbs.; load, 72,420 lbs.; or, in other words, a load of 9,039 lbs. more than half the ultimate strength of the beam; laying aside the "dangerous vibratory motion which accumulates the tensile strain."

As you say you "will not let the subject sleep hereafter," will you, or some other friend of science, answer the following question: would it be prudent and perfectly safe to use—as a drill room—a floor, &c., as described on page 74 of your journal, with beams 4 feet apart?

New York, March 7, 1860. INQUIRER.

Another correspondent sends us the following on this subject:—

MESSRS. EDITORS:—I wish to know why it is proposed to use 9-inch beams in the floor of drill room, as they might as well be made of the brick and concrete work—13 inches. I always like to give as much depth to beams as the floor and space will permit, as the strain is less and the stability greater according as the depth is increased—two very important points in a drill room. I could show very serious objections to the use of 9-inch beams for such a purpose. I gave a rule for calculating the strain in beams at the middle, which was published in Vol. XIV. (old series) of the SCIENTIFIC AMERICAN. It is this:—When the load is concentrated on the middle then multiply its weight by $\frac{1}{4}$ of the span, and divide the product by the depth of the beam, and the quotient will be the horizontal strain in each of the (upper and lower) chords. When the load is uniform, take $\frac{1}{2}$ of it, and proceed with it as with the first. This is the same as calculating the power of a bent lever, and I have proved its truth by actual trial. Or thus:—Let the span be represented by S, weight by W, depth by d, and horizontal strain by H. Then $W\times\frac{1}{4}S\div d=H$. I do not offer this as new, but I regard it as the most simple, and I know it to be true. This gives the strain in the *middle* of the beam; and I stated in the above-mentioned volume that it is *nothing* at the *ends* of the upper chord, when it is straight and parallel with the lower chord. If the makers of such should be required to give the pressure at different points between the middle and ends of a straight chord, they would find reasons for abandoning such forms. B. S.

Baltimore, Md., March 1, 1860.

We are of opinion that it would not be prudent to use a drill room having its beams constructed and arranged as described. They should be capable of standing five times the amount of strain to which they will be usually subjected. Unless they are well constructed, iron beams are exceedingly treacherous when subjected to vibrating action. We have seen bars of the very best quality of steel broken by striking a few rapid blows with them upon an anvil, while a bar of hickory of the same length and thickness, and subjected to the same vibrations, was not the least affected in its strength. Crystallization (and consequent brittleness) was produced in the steel with a rapidity that surprised us. In the broken surfaces the progress of the crystallization from the outside to the center was very clearly defined.

SMALL-POX—GAS A DISINFECTANT.—In St. Johns, New Brunswick, there are many cases of small-pox under treatment, but there is no house in the city where gas is burned, of the ordinary consumption, in which the disease has yet found lodgment. The gas, it is supposed, is a powerful disinfectant, and hence there is no contagion within the circle of its influence. Is is stated that a person burning gas may contract the disease abroad and take it home with him, but it will not be communicated to any other member of his family.

[We copy the above paragraph, which is going the rounds of the papers, for the purpose of disputing the inference that gas will protect people from the small-pox. There is a person in our office who contracted this disease in a room where gas was burned very freely; the disease is also very prevalent in the city of Glasgow, where gas is very largely consumed. Small-pox is doubtless uncommon among that class of people who burn gas in our cities, because they generally have sufficient intelligence and forethought to attend to the vaccination of their families, and its ravages are almost wholly confined to that improvident class who make no provision against the small-pox, or anything else in the future, and who live by the light of burning fluid.

ORANGE COUNTY MILK.---New York City is dependent upon the adjacent agricultural districts for its supply of milk, and a vast amount of it is required for daily use. The above-named county had been distinguished for many years for its excellent butter; but since the facilities offered by railroads permit of the sweet milk being carried from a considerable distance daily, little butter is now made in comparison with the make of former years. Last year there were no less than 5,359,839 gallons collected at nine stations in Orange county, and sent down to the city on the Erie Railroad.