

the ultimate object of his desires. But, fortunately for the general benefit of mankind, one discovery in science seems only to whet the mind for subsequent adventure, and to this happy law of nature we are indebted for the recent investigations on the subject of "diffusion," which have now enabled practical men to apply the principle to manufacturing purposes, and amongst others to that of sugar.

Our country is not so immediately engaged in the extraction of sugar as France and Germany, and our scientific men have not paid so much attention to the subject as the Continental savans. Still, as exists in certain parts of sacchariferous plants, pure and unmixed with other ingredients, but by all the processes until recently at work the saccharine juice was not extracted in its pure state, but mixed with salts and vegetable and other matters, which caused the juice to ferment rapidly, and in addition, made the sugar more difficult of manufacture. The problem, then, of sugar-making was to extract all the sugar contained in plants without the admixture of extraneous matters; and this great question, so important in its bearing on the comfort of the human race, has, so far as can yet be seen, been successfully solved by Herr Robert, of Seelowitz, in Prussian Silesia, by a happy application of the great natural law of "diffusion." Theoretically stated, the principle of "diffusion" is, according to M. Dabrunant, an attractive force (akin to that of gravitation) developed in particles of matter at the moment of their being placed in juxtaposition. The principle appears to have been discovered, though not thoroughly carried out, by our own talented and ill-used Priestley. The allied phenomena of endosmosis and exosmosis were further investigated by Dutrochet, who found that if fluids of unequal density are separated by an animal or vegetable membrane, the denser will attract the less dense through the membrane that divides them; this property he called endosmosis, when the attraction is from the outside to the inside, and exosmosis when it operates from the inside to the outside of the body acted upon. By the endosmometer, an instrument for measuring the rapidity with which fluids of unequal density mix, M. Dutrochet also found that less dense fluids pass with greater rapidity into the more dense than vice versa. These phenomena were still further investigated by Mr. Graham, by means of his instrument, the dialyser, made by stretching parchment paper (to serve as a septum or membrane) over a gutta serena hoop, and pouring the liquid to be dialysed into the dialyser, which was then floated in a dish containing distilled water. By this instrument it was found that substances which diffuse readily are generally crystalline, and hence substances, according to their capability of being diffused, or the reverse, are termed crystalloids or colloids, from colloid, the scientific name for gelatine, which is an uncrystallisable substance. Crystalloids, moreover, have a much greater affinity for water than colloids. Now the great value of the principle of diffusion, as applied to the extraction of sugar-juice, arises from the circumstance that sugar, being a crystalloid, will diffuse with much greater rapidity than uncrystallisable matters, which were mixed with it by the old process of extraction, and which, being colloids, diffuse very slowly if at all.

Diffusion in the factory of Herr Robert gives the most striking results. From the beetroot, so comparatively poor in saccharine matter, 10 per cent. of actual raw sugar is extracted, and the refuse left after manufacture hardly contains the slightest chemical trace of saccharine matter—in other words, all the sugar is extracted. A well-known East Indian manufacturer came to Europe some time since in order to see how the competition of the beet was to be met, and was at once struck by the suitability of diffusion for his purpose. In order fully to recognise the peculiar applicability of this principle to the manufacture of cane sugar, we must bear in mind the principal features in the structure and organization of the plant. A horizontal section of a portion of the sugar cane, which has arrived at the period of its maturity, placed under the microscope, presents the following appearance:—"Its internal structure consists of a series of cells, generally hexagonal in shape, which touch each other in every direction. They are formed by a thin delicate tissue, which encloses them—not laterally merely, but both above and below, so that each is perfectly closed and separate from those adjoining. No communication, by pores or otherwise, can be discovered between them when examined under the highest power. This structure is called the cellular structure; interspersed through it are a number of vessels, running in groups of two, three or four, each of which is enclosed in a sheath of woody fibre; surrounding the whole stem is the cortex or bark, covered with its coating of silica."—(Dr. Evans on the Sugar Cane.) The cells and the vessels are quite distinct in their contents and in their functions; the former contain saccharine matter only, while the latter contain the sap, salts, and other matters necessary for the affluent of the aliment of the plant. By some action of nature, which we are unable to detect, but which is, to a certain extent, re-produced in the novel principle of diffusion, a transposition—in a modified and partial form, it is true—of these two liquids is constantly going on. "During life," says Dr. Evans, in the work quoted above, "there appears to be going on a constant exchange of principles between the contents of the cells and those of the vessels, by means of endosmosis and exosmosis. The cells absorb a portion of the water contained in the sap vessels, by which the crystallisation of their saccharine contents is prevented, and they in return give to the sap a certain amount of their sugar, which increases its richness and nourishing properties." The novel method of extracting the sugar juice by the process of diffusion is, therefore, only an imitation by chemical means of the lesson taught by nature, the main object being to extract the saccharine matter, freed, as far as possible, from any admixture of non-sugar ingredients. The principle is at once apparent, for it is nothing more than the absorption of the crystallisable bodies (the exclusion of other matters). It is true that certain other crystallisable matters contained in the cane are diffused as

well as the sugars, but they are also extracted by the present processes, and they are easily eliminated in manufacture, and after all only form, according to Dr. Leary, 29 per cent. of the weight of the cane, while the sugar forms 18.36. It was the uncrystallisable matter which caused the fermentation and acidity, and worked so much mischief by the old process of extraction, and this would be left in the refuse by diffusion.

The principle of diffusion is thus applied to the sugar cane. The fresh cane is cut into thin slices, and a certain portion is put into closed iron vessels, called extractors, of which there are six arranged in what is called a battery. Into the first of these, No. 1, pure water, slightly warmed, is admitted by means of a stopcock from a cistern placed at some height above the "extractors." The liquid is allowed to rest half an hour, and then passed on to the next extractor, and so on to the last, from which it is passed on to the factory. It is found that when pure water is applied in the first vessel the quantity of a saccharine matter extracted from the cane is small, but when passed into the next the proportion becomes larger, and so on till it reaches the last, where all the sugar is extracted at the first operation. This fully bears out M. Dutrochet's statement that a less dense liquid will pass more rapidly into a more dense liquid than vice versa.

The specification of the patent is numbered 594 27th February, 1866, and is taken out by Mr. William Edward Gedge, for Mr. Frederick James Vivian Minchin, of Aska, Madras Presidency, India. The well-known excellence of the Aska sugar, made on the old plan, is a sufficient guarantee that the invention has found favor in thoroughly practical eyes, and we believe by the time of the great Paris Exhibition of this year that it will have been fully tested; and that samples of the sugars made by this beautifully simple process will be shown. We confess that we entertain sanguine hopes of the success of diffusion, as applied to the sugar cane from the experimental trials already made, but of course until the invention has been thoroughly tried, its commercial results remain open to question. The process of diffusion claims a distinct superiority over all other processes, in its capacity for extracting a much larger amount of juice than has heretofore been obtained by ordinary processes. It is confidently asserted that at least as much as 15 per cent. of saccharine matter can be obtained. In the next place, the expenses attending the extraction of the juice are about 50 per cent. less, and the cost of the machinery is about 40 per cent. less; thirdly, the machinery is comparatively simple and inexpensive in its management, and finally, the process excels not only in its simplicity and regularity, but the juice can be delivered to the factory diluted with but 15 per cent. of water. Diffusion is also said to be peculiarly applicable to the extraction of sugar from the sorghum and the maize.

Usury Laws abolished in Massachusetts.

The new interest law, making it lawful to contract to pay any rate of interest in the state of Massachusetts is a step in the right direction. The following is the text of the law:—

Sec. 1. When there is no agreement for a different rate of interest of money, the same shall continue to be at the rate of \$8 upon \$100 for a year, and at the same rate for a greater or less sum, and for a longer or shorter time.

Sec. 2. It shall be lawful to contract to pay or reserve discount at any rate, and to contract for payment and receipt of any rate of interest, provided, however, that no greater interest than six per centum per annum shall be recovered in any action except when the agreement to pay such greater rate of interest is in writing.

Sec. 3. Sections 3, 4 and 5 of Chapter 53 of the General Statutes, and all acts and parts of acts inconsistent herewith, are hereby repealed.

Sec. 4. This act shall not affect any existing contract or action pending, or existing right of action, and shall take effect on the first day of July next.

FREE TRADE MEETING AT GLENMORRIS.—A public meeting of the farmers of South Downshire called by Daniel Anderson, Esq., Reeve of the Township, in compliance with a numerously signed requisition, to consider the question of free trade, was held in the Township Hall, Glenmorris, on Friday, the 8th March, 1867.

Daniel Anderson, Esq., was called to the chair, and Mr. G. Fleming appointed Secretary.

It was moved by Mr. Chittenden, and seconded by Mr. Hiram Capron,—"That in view of the abolition of the Reciprocity Treaty, and the Confederation of the North American Provinces, it is imperative that such a system of commercial policy should be adopted as shall best advance our common interests."—Carried.

It was moved by Mr. Chittenden, and seconded by Mr. Daniel O'Neil,—"That it is for the interest of the Confederation that such policy shall approximate to the system of political economy which is bearing such magnificent fruits in the mother country, namely, that of free trade."—Carried.

It was moved by Mr. Chittenden, seconded by Mr. Hiram Capron,—"That this meeting desires to record the opinion that protective duties are unjust in principle and mischievous in practice, that they rob the consumer under the hypocritical pretence of guarding his interests."—Carried.

It was moved by Mr. Chittenden, seconded by Mr. Hiram Capron,—"That it is expedient to form an association to aid in resisting the unjust demands made by certain classes, namely, that the financial legislation of the country shall be such as to afford these special advantages at the expense of the mass of the people; an insinuation of which was obtained during

the last session of Parliament, when the Government were compelled to abandon part of their policy in consenting to impose a duty of fifteen per cent. on agricultural implements, and that, too, at the time when the farmers of Canada had just been deprived of the advantage of free access to the American market."—Carried.—*Brantford Expositor.*

THE NEW YORK WOOL TARIFF IN THE UNITED STATES.—The effect of the increased duties placed on foreign wool, has been already to drive trade away from the United States. The *New York Economist* says:—

"A ship which was loaded at Melbourne, with wool for this port directly, before the tariff was passed, will, it is expected, be immediately ordered to Havre on its arrival here, instead of being offered in this market. There is a cargo of Buenos Ayres wool now here on shipboard, which the owners are making arrangements to have shipped to England. Most of the wool now in bond here is being held with a view to a disposal in the same manner."

It also states in its report of the wool market:

"The activity which characterized the market last week has not extended to this. The market for woolsens did not respond to the passage of the tariff in the manner which many expected. It is true that there is more confidence, more firmness and expectation, but as yet little has been realized. Goods could be sold very readily at former rates, but it is exceedingly difficult to obtain any material advance, and as a consequence, the wool market has been quiet, although firm, and if we say that wool is 2c. per lb. better than it was before the passing of the tariff, it is all that it will warrant. But as we have frequently said, all the tariffs in the world cannot manufacture a demand, and this is now being realized, and so little confidence have manufacturers that the demand will be seriously increased by the passage of the tariff, that none have yet increased the hours of labor at least none of those who have been running short time, and as it is almost impossible to obtain an advance on the price of woolsens which would pay the cost of manufacturing, and equally impossible to go down the price of wool, manufacturers are now seriously considering the alternative of either a reduction of wages or of an entire stoppage of machinery. This is a sorry comment upon the tariff and protection. We suppose that the laborer was included in the question; but in place of an advance of wages, as the laborer might have expected if the protection theory was sound a reduction was contemplated. It is true we have a slight advance in wool, we wish it was more. We should be glad to see an advance of wool and of labor arising from true grounds, an active demand, but that demand is still lacking. The large failure in Providence last week, has not improved things this week. It is true this was not a woolen establishment, but it has weakened confidence in manufacturers generally, and there is no doubt but wool dealers could sell more wool than they now do if they would give the indiscriminate credit they did a year ago. This want of confidence stendies business at the present time, and we think it is well for all concerned that such is the state of things, or we should certainly have in a very short time one of the most disastrous crashes that ever visited the business of this country."

PORK PACKING IN THE WEST.—The following table shows the number of Hogs packed in Milwaukee, Chicago and Cincinnati, for twelve seasons:

Seasons.	Milwaukee.	Chicago.	Cincinnati.
1855-6	40,000	80,380	405,896
1856-7	18,000	74,000	344,512
1857-8	10,000	99,282	446,677
1858-9	32,091	185,000	582,906
1859-60	61,687	197,918	431,499
1860-1	60,129	221,335	439,760
1861-2	99,461	244,118	474,167
1862-3	182,374	270,264	608,457
1863-4	141,091	204,658	370,022
1864-5	167,29	750,147	850,000
1865-6	87,853	501,462	854,079
1866-7	133,370	635,732	462,610

—*Milwaukee Journal of Commerce.*

IRON MANUFACTURES.—At the last regular meeting of the American Iron and Steel Association, the following table was presented, giving a complete statement of the iron manufactured in the United States during the past year:

	Tons of
Pig Iron of all kinds.	2,600 lbs.
Rails, new and re-rolled.	339,956
Iron advanced beyond blooms, slabs and loaves but not beyond bars.	339,764
Bars and Rods made from iron on which a duty of \$3 has been paid.	184,761
Blooms, slabs and loaves.	23,078
Band, hoop and sheet, all sizes.	14,616
Plate iron, all sizes.	142,829
Rivets, nuts, washers and bolts.	57,771
Cut nails and spikes.	29,281
Castings for bridges and other permanent structures.	124,853
Castings exceeding 10 lbs. in weight.	3,309
Stoves and hollow ware.	346,643
Iron advanced beyond blooms, slabs, etc., the duty to which it was liable in the form of blooms, slabs, etc., not having been paid.	82,005
Wrought railroad chairs, etc.	18,855
	27,693