

PRACTICAL INFORMATION
ON THE
BEST METHOD OF
BREWING FROM SUGAR;

IN WHICH IS GIVEN

THE HISTORY OF THE TRADE FROM 1769, TO THE PRESENT
TIME, WITH AN ACCOUNT OF THE PRICE OF RAW MA-
TERIAL AND THE SELLING PRICE OF BEER.

BY A PRACTICAL BREWER.

Burnley.

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*History of the Trade from 1769, to the present Time,
with an Account of the Raw material, &c.*

Government in their present measure see with the brewer, how necessary it is that every possible means should be employed, to obtain some other article that will make up the deficiency, which, owing to the present scarcity of barley must be experienced in the duties, obtained from the materials now alone permitted to be used in Brewing. The scarcity of barley is shown by

the high price got for the best qualities, namely :—58s. to 60s. p quarter. The average price on the 5th of Feb. 1847, was 55s. 11d ; being 24s. 3d ; dearer than the average of the five succeeding years in the months of November. And no doubt their measure will materially check the immoderate demand which Malsters are compelled to make for their malt, while barley remains at such high prices—this the Manufacturers--the Brewers must bear, as will be shown hereafter. The history of brewing leads us to a time when Brewers had to complain of the *prohibition laws* before—in 1802, as now, the Brewers was compelled to take the *same* price for their beer, in most towns, as they got, when malt was low, at that time, while 1s. 10d. could be got for a quartern loaf of bread, the Brewer was compelled to take his original 4½d. p quart for his beer. And moreover than that, it is an historical fact that the *price* of beer has never *kept pace* with the “price” of the “raw material.” In 1817, Mr. Calvert was asked by the Police Committee of the Honorable House of Commons, why

beer was not so good as formerly—his answer was, and which “decidedly agrees” with the *present times*—that it was owing to the *price of beer* not keeping pace with the price of the raw material, and the *articles of wear and tear*—from 1797 to 1817, porter had advanced 64 p cent, of which government received 16—the Victualler about 11, and the Brewer 37, while the raw material, and the articles of wear and tear, had advanced in the following proportions :---malt, hops, and poor rates £200 per cent. casks, Millwright work, horse, corn, lightage, £100 p cent, labour £60 per cent, horses £183 per cent, harness £140 per cent, hay £85 p cent, coals £53 p cent, ropes £125 per cent, leather pipes £55 per cent, bricks £72 per cent, and Timber £275 per cent. Assessed and other Taxes, most considerable, and he goes on to show that the advance of £37 per cent will not meet the above charges, and considering that porter is a necessary of life amongst the working class of people, and taking the pressure of the times into consideration, the Brewers have been induced to lower the strength, instead of raising

the price, which must have been 7d; or $7\frac{1}{2}$ d. per quart.

In addition to the above, we subjoin the statement of *Mr. Barclay* giving an account of the average price of malt, hops, and duty, for 48 years.

	s. d.	£ s.d.
From 1769 to 1779 malt 31.6 per qr. hops 4.9.8 per cwt.		
„ 1779 „ 1789 „ 33.9 „ „ „ 4.4.3 „ „		
„ 1789 „ 1799 „ 41.8 „ „ „ 5.4.2 „ „		

During this period, the duty was 5s. $7\frac{1}{2}$ d. per barrel, and the price of beer $3\frac{1}{2}$ per quart.

	s. d.	£ s.d.
From 1799 to 1809 malt 69.3 per qr. hops 6.16.7 per cwt.		
„ 1809 to 1817 „ 81.1 „ „ „ 6.1.7 „ „		
„ 1817 „ 86.0 „ „ „ 15.0.0 „ „		
„ 1818 „ 80.0 „ „ „ 30.0.0 „ „		

During this period, or in 1802, the duty rose to 10s. per barrel; beer having risen during the latter periods to $4\frac{1}{2}$ d, 5d, $5\frac{1}{2}$ d, and on account of the failure of two seasons of hops, porter rose to 6d. per quart, hops having risen to £30. and even £33. per cwt. and malt at one time about 1818, to 5s. per qr — after the fall in price of hops and malt, beer fell to its original $4\frac{1}{2}$ d. per quart, and after the duty was taken off it fell to 4d; that price became the ruling value for some time. In our day, in a great many towns, Brewers are compelled to take for both ale and porter of the above quality as low a price as $2\frac{1}{2}$ d. per quart, and with this price they are compelled to be content, attempts have been made in a great many towns to raise the price to 3d. per quart, but in most cases for not longer than a week.—If then the Brewer finds that $2\frac{1}{2}$ d. is all he is to have, he will either be compelled to shut up his brewery or give something with the beer he is sending out. This then is the reason that the Brewer is compelled to turn his attention to sugar.—In this as in a very many other businesses, “practice” overstrides

general reasoning, and "facts demonstrated" supersede speculation.* Much is said in the daily and weekly papers about what proportion of sugar is equal to a quarter of malt, and generally their data is from some eminent Distiller, or other advertising quack. What the Distiller must have is not what the Brewer requires—the one requires *spirit* and the other *rich* saccharine fulness with brilliancy. Raw grain is what a Distiller must have more than any other article, because of the gluten which it contains—an indispensable principle when a complete *low* attenuation is to be affected, as with the Manufacturer of spirits, and which speaks for itself when we consider that one quarter of *raw* barley will give after distillation 18 gallons of spirit, malt only 16 gallons, sugar short of 11 gallons—less and less as the quantity of gluten becomes extinct, yet after all that spirit produced from raw grain is not so

*The Author grounds his information on a practical employment of sugar in 1808.

rich as that from malt, nor that from malt as that from sugar.—From this it will be seen that if the distiller gains in quantity he will loose in quality, and therefore, he is compelled to use malt or sugar to a certain extent, so that his spirits may not sell worse than others.

With the Brewer less gluten is required for his purpose, he should be content with his attenuation only attaining *9* lbs. gravity per Dring and Fage's Saccharometer, and *22½* lbs. per Dicus—the very position where the yeast is changing from that of negative electricity to that of the positive—the point where a new acid will be formed; yes, that acid which is a Brewer's greatest enemy if allowed to proceed and increased by carrying out the attenuation too low.

Continuing the above, every Brewer will be perfectly satisfied if he can obtain an extract from malt, that will reach *84 lbs per quarter, or 63 lbs per*
Load per Dring and Fage's Saccharometer; and

if so, it is quite clear that instead of 180 or even 140lbs. of Sugar, as stated by the papers, and would be called *practical Brewers*, being equal to one quarter of malt, he has found that *87 1/2* lbs is equal to that quantity, and even more ; for in sugar there will be discovered a far greater quantity of saccharum required by the Brewer—not the Distiller, than in the same weight of *Malt extract*. For according to Professor Dr. Ure, malt extract of 1.231 specific gravity, or 83.16lbs. Dring and Fage, contains *but one half* of its weight of *solid pure saccharum*, as shown in the following table.

Specific Gravity of Wort, at 60° F.	Original Gravity per Long's Sacc.	Sugar in 100 parts by weight.
1.3260	117.360	66.666
1.2310	83.160	50.000
1.1340	48.240	31.250
1.1110	39.960	26.316
1.0905	32.580	21.740
1.0395	14.220	10.000

Malt sugars, as well as all *starch* sugars, will decompose to a lower degree of attenuation or thinness to the taste, than will cane sugar; in short, it is the character of cane Sugar to maintain a greater proportion of its full rich saccharum properties, after you have attained your proper attenuation, and it is by far more likely on that account to answer the Brewer's purpose better than all malt, for less will do.

Its advantages will be seen still further, by giving one more experimental fact—cane sugar in its state of evaporated dryness, is better than if it was in a liquid state for the Brewer's purpose; for when it is again combined with water, although it shows at the same time a considerable condensation in volume, it also shows an increase in specific gravity of from 1.1166 to 1.216, or 41.98 to 77.76 lbs. gravity.

It will not be out of place here to give a few of the general chemical characteristics of sugars, before we proceed to the detail of the instructions.

Sugar is the sweet constituents of vegetable and animal products, of it there are two principal species; the first which occurs in the sugar cane, the beet-root, and the maple, crystallize in oblique four-sided prisms, terminated by two-sided summits; it has a sweetening power which may be represented by 100; and in circumpolarization, it bends the luminous rays to the right. The second occurs ready formed in ripe grapes, and other fruits, it is also produced by treating common or malt starch, with diastase, or sulphuric acid. This species forms cauliflower concretions, but not true crystals; it has a sweetening power which may be represented by 60, and in circumpolarization it bends the rays to the left. weak sugars are such as contain an inferior proportion of *carbon* in their compositions. The best refined Jamaica sugar contains 42.85 parts of carbon per cent, East India best sugar 41.9 parts; East India raw sugar in a thoroughly dry state but of low quality, 40.88, Sugar from starch 36.2. Pure cane sugars are unchangeable in the air, even when dissolved in a great

quantity of water, if the solution be kept covered up, and in the dark, but with a very small addition of gluten, the solution soon begins to ferment like all other vegetable extracts.

The formula for common sugar is $C^{24} H^{22} O^{11}$. for starch sugar $C^{24} H^{28} O^{11}$. M. Peligot, found that common sugar was the only one which combined with the alkalis without suffering change. Sugar of *starch* and all other known sugars, at first, combine with the alkalis, and are gradually destroyed, giving rise to two distinct products, according to the circumstances of the mixture of these bodies. Lime dissolved in a solution of *starch sugar*, gradually loses its caustic properties, and is saturated by an acid formed by its influence. On heating the solution of starch sugar and an alkali, a more rapid action is observable; the mixture becomes *coloured*, and a *brownish black acid* is formed, having some resemblance to *ulmic acid*, but is quite distinct from it. Its composition is represented by the formula

$C^{48} H^{20} O^{10}$. This acid is readily obtained with fused *starch* sugar, and a concentrated solution of potash: the action is rapid when the colour has become intense, water is added, and the acid is precipitated by hydrochloric acid, this acid differs from sugar only in being minus water for $C^{48} H^{42} O^{24}$. Anhydroses sugar becomes $C^{48} H^{30} O^{18}$. the first acid by losing $6H_2O$; then $C^{48} H^{30} O^{18}$. becomes $C^{48} H^{16} O^8$. Japonic acid by losing $7H_2O$. sugar, thus loses water successively even in the midst of water.

This remarkable transformation is well characterized with starch sugar, and analogous sugars. When the sugar and alkali are not in contact with water, the phenomena of decomposition no longer occurs; an alkaline saccharate is obtained in which the sugar possesses its usual properties. The action of heat upon sugar, when properly managed, yields very simple results; at about 410° Fah. water is only obtained and a black product remains, which is entirely soluble in water,

which he names *caramel* when purified by alcohol a tasteless substance is obtained which does not ferment. Its composition is very simple, C^{48} . H^{56} . O^{18} . and it differs only from sugar in losing a part of its water. Common and starch sugars treated in this way, both yield the same substance.

From these experiments it will be seen, that the best way of making what the French call *caramel*, and what in English we call *essentia binæ*, or burnt sugar colouring for porter, will be best effected by combining with sugar an alkali—the common mode of preparing it as illustrated by the last experiment leaves it short of that fine quality and full flavour required for porter.

On referring further back to that part of the chemical character of sugar, in which experiment has shown that different sugars possess different quantities of *carbon*, it will be seen by a chemist what amount of intensity each description will possess, and what tendency

each will have to run itself to a low degree of decomposition, when the gluten of malt is added, and from that he will have to make his calculation, so to ascertain what more will be required to meet that loss—not a real loss, but loss in fulness from the too low attenuation. This he will find by taking the difference of proportions in carbon that exists in the best cane-sugar over that of starch-sugar, that difference will be found to be a *sixteenth*, but so that your beers may feel to possess a little of the fulness and flavour of sugar. I add *one sixth of 84 lbs to 84 lbs*, the generally allowed extract from *one quarter of Malt per Dring and Sage's or Long's saccharometer on 210 lbs dices* to produce a beer above equal in quantity and quality to that produced from a quarter of malt.

Having ascertained that *98 lbs* of the best brown Jamaica sugar is more than equal to one quarter of malt, we are brought to that position where it will be necessary

to give that information to the reader which will be most beneficial and requisite to effect a perfect manufactory of sugar into ale and porter. In the first place, the best proportions are found by repeated trials, and daily practice, to be

an equal quantity
of malt to an equal quantity
of sugar, or in other words, with every quarter of malt

90 lbs. of sugar must be used, and 90 lbs. of sugar being equal to one quarter of malt—together these will be equal to two quarters of malt, and so of the rest—with every six bushel load of malt

70 lbs. of sugar and these together will be equal to two loads of malt.

It is requested that the attention of the Brewer be directed to the best mode of combining the sugar with the malt extract, or perhaps that mode which will best suit the construction of his plant, The plans to be recommended, are, you will have to make the same quantity of malt extract, as if you used 10 loads or

quarters, should you only use a load or quarter of malt. The same remarks apply to the use of hops. Although I say you will have to make the same length from one quarter or load of malt, as if you were about to brew from 10 loads or quarters,—I do not mean you to run all that quantity of water through your goods, for that would be extreme foolishness, and a serious injury to the brewing—every Brewer who is a chemist must know, that to run his lengths too low will be an injury to the beer, on account of its then containing too much oxygen; an enemy to a sound fermentation. I am not writing a treatise on brewing generally, or I should have to go into a very lengthened explanation, for there is “nothing so certain” as that the *WHOLE character of the beer is HERE given*. If a proper menstrum be employed, a proper extract will be obtained, and you will have a bright, rich, sound and very sweet wort, and from it a full brilliant beer; on the other hand, and I may refer to an extract from the *same malt*, and perhaps from the very next brewing—if the heat of the

menstrum employed be incorrect but a very few degrees, your extract will taste sickly, or rather bitter and will be less in gravity—this you may also detect in the steam that flies from your wort boiler during boiling, and in the end, your beer will be cloudy, taste thinner, and will not keep. When I use the words “a few degrees of heat,” I do not mean that heat indicated by the thermometer, but the amount of the heat in the whole.

We must again resume our subject, by shewing that there are four modes of combining the sugar with the malt extract. The first is by placing the sugar in a sive, under the taps of the mash tub, and when the taps are set, the wort washes the sugar into the boiler with it. The second is when you have an under-back to your mash tub; throw it in there, and keep rousing and combining it with the wort that runs from the tub through the under-back into the copper. The third is to combine it with the worts as they run from the copper, or in the coolers after turning out, and the fourth is to let so

much of the wort from the coolers into your mixing vessel—square or round, as you think will dissolve the sugar you are employing, and then rouse and mix it completely; in this state allow it to remain until your heat on the coolers and that of the mixture will be together, the one you require. When together, rouse them well until they are properly combined, then proceed as though it had been all malt wort.

It is very necessary that you wet the sugar by degrees, for it will naturally run into lumps. The implement best adapted to combine together the sugar and the malt extract, will be found to be a rake, and one so constructed, that it will turn over as well as mix it efficiently.

Other plans besides those which are here given might be adopted with equally the same success, but of the four the last two in my opinion will be found the least injurious, and if there should be given any particular prefer-

ence to one mode only, the last will best answer the purpose of the Brewer, because by mixing it in the square, there will be no fear of loss by evaporating the fine volatile qualities of the sugar away, the fact of its being boiled once when in the cane-juice, into sugar, removes any further call for an additional boiling, and therefore, it is clear that it is prepared for fermenting purposes, and more particularly when we consider that it is not raw water with which it is combined, but with a boiled malt extract.

Being now prepared for fermentation your best plan will be to adopt your usual quantity of yeast, that which you have found to produce the greatest quantity in return, or in other words, so much as you have found will produce an healthy fermentation—it will be a piece of folly in me to name a quantity for every brewery, when natural laws explain to us, that nearly every brewery will require less or more for the same gravities and barrels.

A good and steady fermentation will be the result and attendant consequence when the proportions which I herein recommend of sugar to malt are employed,—combined also, with the following precautions, that is, when you have attained the proper gravity at which to stop the fermentation, namely:— *96°*—you must then take off all the yeast or barm and continue skimming until it discontinues to throw up, using at the same time that means of refrigeration you may possess, after you have reduced it to as low a heat as it remains in your power to accomplish,—rack it off—bung it down, and send it out,—it will then be superior to all malt beers.



PART SECOND.

In my hurry to get the foregoing pages out of the press, I neglected to state that when sugar is employed instead of malt, there will be found a great deficiency in gravity—no doubt every Brewer will be inclined to think, when he has applied his saccharometer, that sugar will not do, this is not the case, although there is not exhibited a gravity there still remains the same sweetness, the same desired fullness, and the same quality of beer after fermentation, as though all malt had been used. My opinion is, that the addition in gravity, when sugar is used, principally depends upon the presence of a gummy matter that may be found in most cane-sugars, and not so much upon its saccharum.

From the above it will be seen that the instrument now known by the name of Saccharometer is very im-

properly called, it should be styled a Saccharogluto-Gravometer instead of a Saccharometer, because it indicates the amount of gluten contained in the extract, more than the saccharine.

When the best brown West India sugars are employed, your extract will be found to be in some instances ~~no~~ more than 3 lb 5 pounds heavier than the malt extract; when I employ Mauritius sugar, I have generally found about *one half* the quantity I used by the Saccharometer,—other sugars varying some little on one side or the other, but generally when the quantities of sugar and malt are employed according to the directions given at pages 18 and 19, the gravity of common ales will be found to be from 15 ~~to~~ 18 ~~to~~—these as well as the higher gravities I take off at such weights as will leave them when sent out at 9 ~~to~~ and no lower. I have had them even as low as 6 $\frac{1}{2}$ which after being in Barrel, bunged down four days, became very bright and brisk and passed off without

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worth his consideration. In my forth-coming work, it is my intention to illustrate the loss of profit from their improper application; also to give the true system of fermenting in Bentley's system of close stone squares, *adduced* from above twenty different plans adopted by Brewer's of note, and amongst them Bentley's system, most of which will be given, and the true system, secret, or point of success illustrated.

In conclusion it is necessary to remark, that there remains something yet unexplained— 98 lb. of sugar will produce a better beer, when it displaces a quarter of malt, than it would have been had the quarter of malt been used in its stead—yet at the same time, beer produced from 98 lb. of sugar, would be of a worse quality, than that produced from one quarter of malt, should they *each separately* be converted into beer, and their gravities would be materially different; this then speaks in plain language that a judicious mixture of malt and sugar is all that is required, and such a one

as I have given will answer well, although it will show a deficiency in gravity, and it is this deficiency that yet remains to be explained, in doing that it is necessary to state, that, it is a well known fact with a distiller, that worts from malt or grain cannot be carried beyond a certain point of attenuation, its specific gravity seldom arrives at 1.000, but most commonly stops short of 1.002 or 1.004—molasses .9999.8 below water, and sugar worts from .9900 to .9820 also below water, this leaves in our minds a somewhat complicated problem—the question is, why should not malt or grain wort be carried as *low* in attenuation as that of sugar worts? the answer is, malt produces more spirit at the same point of attenuation than sugar will, therefore, all that a Brewer has to do, is to obtain in his sugar and malt beers, that quantity of spirit he found sufficient in those produced from malt alone, and to attain that end, he will be compelled to go into calculations and therefrom obtain such data as will then enable him to feel that he has not lost that amount in pounds of gravity he first believed. The calculations are as follows :

The probable mean lowest attenuation of malt wort	}	1.0020 Specific gravity.
Do. do of sugar do.		.9820
		<hr/>
		200
		360lb weight of a Bar. [of water.]
		<hr/>
		12000
		600
		<hr/>
		7.2000 or $7\frac{7}{10}$ lb Dring & Fage or Long's saccharometer.

Probable lowest attenuation of malt worts	}	1.0020 Specific gravity.
Do. do. do. of sugar		.9900
		<hr/>
		120
		360lb weight of 36 [gal. of water.]
		<hr/>
		7200
		360
		<hr/>
		4.3200 or $4\frac{3}{10}$ lb per Dring and Fage or Long's saccharometer.

With this data I work as follows: if I should use equal quantities of sugar and malt, I say that my gravities will be from 4.3lb gravity to 7.2lb lower *than malt* extract; and in my attenuations, I should reduce or attenuate to some where between the 4.3lb to 7.2lb per Dring and Fage, lower than I had formerly attenuated my ales, to obtain the same fulness, flavour, or brilliancy, as that produced from all malt. If my original gravity was $22 \frac{1}{2}$ and I obtained from sugar and malt $17 \frac{1}{2}$, I should attenuate it $5 \frac{1}{2}$ lower than my malt worts.

There is one particular characteristic in sugar and malt wort I cannot here overlook, that is their natural desire to attenuate slow—at first, at the rate of 1lb. per day, gradually increasing until it attains its highest state of positive electricity, where its remains stationary for a short time, after that it again begins to decompose less and less in the same ratio until it is stopped—one general rule I wish to impress, is, should fermentation proceed slow, encourage that *slowness*; should it fer-

ment quick, push it on *as quick*, and you will then work with the electrical law that governs all attenuation

In Brewing porter, I should have named that a great amount of gluten is required—in sugar there is but little of that gluten, and as little in brown or patent malt, for in the brown malt the gluten is partially set in converting the starch of the malt into colouring and flavour—in the patent malt, nearly the whole of the gluten will be lost to the Brewer; therefore, you will be compelled to employ a portion of pale malt, always to obtain that which must be in connection with good porter. There is but three secrets in porter brewing, which malt alone cannot produce—they are, a great amount of *full-bodiedness* in the mouth—an *agreeable* flavour, and a full bitter. The best proportions of malt and sugar for porter will be for a twenty quarter brewing— $2\frac{1}{2}$ quarters of patent, $2\frac{1}{2}$ quarters of brown, 8 quarters of pale and the equivalent of 7 quarters of malt in sugar.



The Author intends shortly to publish a COMPLETE work on brewing, in which contrary to the system of Brewing Book MAKERS, he intends making distinct chapters on that part of the process which is the cause of 90 Brewers out of every 100 turning out bad beer instead of good—particularly in the summer months.

W. WADDINGTON, PRINTER.