THE BREWER:

A FAMILIAR TREATISE

ON

THE ART OF BREWING,

WITH DIRECTIONS FOR THE SELECTION OF MALT AND HOPS, &c., &c.:

INSTRUCTIONS FOR MAKING

CIDER AND BRITISH WINES:

ALSO,

A DESCRIPTION OF THE NEW AND IMPROVED

BREWING SACCHAROMETER AND SLIDE RULE,

WITH

FULL INSTRUCTIONS FOR THEIR USE.

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INTRODUCTION

TO THE

ART OF BREWING.

ALE or BEER is a fermented liquor, obtained from the infusion of malt and hops. This liquor, the natural substitute for wine in such countries as could not produce the grape, was, it seems, originally made in Egypt, the first planted kingdom after the dispersion at Babel, which was supposed unable to produce grapes; and, as subsequent colonies penetrated further west, they found, or thought they found, in those countries, the same defect, and supplied it in a similar manner.

Thus the inhabitants of Spain and France, and the Aborigines of Britain, all used an infusion of barley for their ordinary drink, and it was called by the various names of Cælia and Ceria in the

first country, Cerevisia in the second, and Curmi in the last; all literally signifying, *strong water*. "The several nations," says Pliny, "who inhabit the west of Europe, have a liquor with which they intoxicate themselves, made of corn and water. The manner of making this liquor is somewhat different in Gaul, Spain, and other countries, and called by many various names; but its nature and properties are everywhere the same. The people of Spain in particular brew this liquor so well, that it will keep good a long time. So exquisite is the cunning of mankind in gratifying their vicious appetites, that they have thus invented a method to make water itself intoxicate." The mode employed by the ancient Britons in preparing their beer is thus described by Isidorus:—

"The grain is steeped in water, and made to germinate, by which its spirits are excited, and set at liberty; it is then dried, and grinded; after which it is infused in a certain quantity of water, which, being fermented, becomes a pleasant, warming, strengthening, and intoxicating liquor." Wheat, oats, and millet, were the grains most commonly used in manufacturing this beer. Anciently, the Welsh and Scots had also two kinds of ale, called Common Ale and Spiced Ale, and their value was thus ascertained by law:—"If a

farmer have no mead, he shall pay two casks of spiced ale, or four casks of common ale, for one cask of mead." Even common ale was, at that period, an article of luxury among these people, and was accessible only to the opulent. Wine appears, at that time, to have been quite unknown to the kings of Wales, as it is not so much as once mentioned in their laws, though Giraldus Cambrensis, who flourished about a century after the Conquest, informs us, that there was a vineyard in his time at Maenarper, near Pembroke, in South Wales. Ale was a favourite liquor with the Anglo-Saxons and Danes, and it has continued to be the national beverage from their times down to the present. This much of the early history of Brewing must suffice.

"An inscrutable wisdom," says Stockhardt, "has given to the seed the power of germinating in moist air, and of growing up into a plant, which puts forth leaves, flowers, and fruit, and then perishes and disappears. Germination, growth, flowering, fructification, and decay, are the principal stages of existence through which plants have to pass. When they have produced seed—that is, new bodies capable of life—they have fulfilled their destiny, and their course then tends downwards to decay. Whether they live only one

short summer, or survive hundreds of years, the general principle remains essentially the same."

The Divine agency which effects these changes, and calls forth the phenomena of life in the vegetable world, is, in its essence, wholly unknown to us. A particular name, vital power, has indeed been given to it, but from this we derive no clearer conception or understanding of it. Its operations are conducted in such a mysterious manner, that it is not probable that the vague speculations of the inquiring mind on this point will ever lead to bright or clear ideas here below. That only which it produces, and that from which it was produced, are comprehensible to our senses.

There are two ways by which we may gain a partial insight into the mysterious workshop of vegetable life:—first, that of observation, which, by the aid of the microscope especially, has led to a very accurate knowledge of the structure of plants, and of the changes which their separate parts undergo during their growth; secondly, that of chemical experiment, by which the constituents of plants, their food, and some of the transformations of matter occurring during the growth of the vegetables, have been discovered.

There are generated in plants during their growth various independent substances, which, in

many cases, we can distinguish from each other even by their aspect and taste. Grapes, carrots, and many other fruits and roots, have a sweet taste; they contain *sugar*. The branches and leaves of the grape vine have a sour taste; they contain an *acid salt*. Those of the wormwood have a bitter taste; they contain a peculiar *bitter principle*. The latter emit also a strong odour, which proceeds from *volatile oil*. In the seeds of the different species of grain, and the tubers of the potato, we find a mealy substance, *starch;* in the seeds of the rape, and of the flax plant, a viscous juice, *fat oil*. From the cherry and plum-trees exudes a mucilaginous substance, which is soluble in water; from the firs and pines, a similar substance, but which is insoluble in water; the former we call *gum*, the latter *pitch*. The magnificent colours of flowers proceed from a *colouring matter;* the noxious effects of poisonous plants, from *vegetable bases*, &c.

The elements of which all plants are composed are carbon, hydrogen, oxygen, and nitrogen, and from these few elements, the four main pillars of the vegetable world, with the addition of small portions of sulphur, phosphorus, and inorganic salts, does the Creative Power produce the countless multitude of plants which cover our earth.

The substances into which these elements resolve themselves are chiefly vegetable tissue, albumen, gum, sugar, starch, mucus, fats, chlorophyll, some acids, &c., colouring and extractive matter, resins, volatile oils, &c.

Vegetable tissue constitutes the solid parts of plants; it imparts to them form and strength. It is to the vegetable, what bones and skin are to the animal system; it forms the vessels and cells of plants, through which the sap circulates, and in which the other substances are formed, developed, and matured.

The active agents in awakening the vital force in plants, are heat and moisture.

The constituent properties of plants undergo considerable changes in the process of vegetation; unripe grapes taste sour, ripe ones sweet—the acid of the grapes having been changed during the ripening into sugar. Barley to the taste is mealy, but if suffered to germinate it becomes sweet—a large portion of its starch being converted into sugar. Transformations which nature thus effects slowly, art is able to accomplish more rapidly, and in manifold combinations.

Albumen is a substance common to plants, though it varies much in quantity and appearance; it constitutes their milky and nutrient properties,

and is three times as abundant in ripe barley as in unripe.

Gum is a clammy substance not formed in all vegetables—for instance, in barley or malt—though it is a chief nutrient in many: it abides largely in coffee.

Sugar, in its liquid state as saccharum, may be regarded as the blood, or supporter of life in plants; it decreases considerably in the ripening of seeds, while their starch is considerably increased. As saccharum is the most essential property of wort, its conversion and preservation is of the first moment.

Starch, the most abundant constituent of ripe grain, is analogous to gum as albumen is to gluten; it may be regarded as the tendons and solvent sinews of plants, and is stored up so that the water of vegetation does not easily dissolve it. It is capable of supplying food to the young plant, and yet continues to increase till the plant has reached its maximum growth. This substance in grain is converted into sugar in the process of germination, and this change is effected by the power of a principle called Diastase, generated during the action of germination.

This shews the necessity of malting grain, without which no diastatic power can be evoked,

and no conversion of the starch into sugar effected. Such, however, is the power of diastase when once evoked, that one part is sufficient to render soluble two thousand parts of starch, and convert them into sugar.

Mucus or Farina is the fleshy and perishable substance of plants, and is second to albumen alone in the nutritious properties it contains. Most fruits contain mucilage, which is combined with the sugar or with the oil. It is found abundant in wheat, and consists of the most nutritious parts of various kinds of pulse and tubers.

Fat or fat Oils are the unctuous and thick flowing parts of plants. They occur in small quantities in almost all plants, even in those in which we should not expect to find any; such as different kinds of corn, grasses, &c. They are insoluble in water, and will float thereon; being of less specific gravity, and non-volatile.

Chlorophyll is a substance widely diffused, as it is the colouring matter of all plants possessing a green colour. It is a mixture of wax and other matters not well known. It is not soluble in water; for if it were, the water would become green in flowing over our meadows. It is generated only with the co-operation of light, and in

the maturity or decay of plants is converted into leaf-yellow, or leaf-red, probably by a process of oxidation.

Vegetable Acid is chiefly found in unripe fruit, and is generated during the growth of plants. It may, however, be artificially produced from non-acid vegetable substances, as acetic acid from alcohol—formic and oxalic acid from sugar, &c.

The Colouring and Extractive matter in plants, is that which gives to almost every plant certain peculiar properties, upon which the colour, effect, and taste of such plant depend; imparting to flowers, their endless variety of rich and inimitable colours; and to plants, those special, sweet, pungent, bitter, acrid, and narcotic tastes, and those medicinal effects they possess.

Resins are the juices of plants, which exude either spontaneously or through incisions in the bark made for the purpose. They are tasteless and inodorous, unless they retain some volatile oil. They do not easily decay; are insoluble in water, but soluble in alcohol or oils.

Volatile Oil is one of the constituents of odorous plants; but how diffused and diluted in many plants, may be inferred from the fact, that not one quarter of an ounce is contained in one hun-

dred pounds of rose leaves, or orange flowers. It is chiefly found in the flowers and seeds; sometimes in the stalks and leaves, and more rarely in the roots. Some plants contain several kinds of volatile oils—as, for example, the orange tree: the leaves containing one kind; the blossom, another; and the rind of the fruit, a third kind.

Let us now institute an inquiry into the constituents of Barley and Malt, and rapidly glance at the nature of the process by which the conversion is effected.

Prout, in his analysis of Barley, presents us with the following result:—

	Barley.	
	Unmalted.	Malted.
Starch	32	56
Saccharum or sugar	5	15
Fibre or farina	55	12
Mucilage	4	15
Gluten	3	1
Bitter and Extractive	$\frac{1}{100}$	$\frac{1}{100}$

The constituents of barley appear to consist of sugar, starch, mucilage, gluten, fibre or farina, and a small quantity of extractive matter. These, by a process of vegetation called malting, are made to change their proportions, and yield a pro-

duct more nutritious, and available to the purpose of the Brewer.

Barley intended for malting should have laid in the stack, sweating, for at least two or three months. It should exhibit no inequalities, either in colour or size, and appear of a bright colour, with a thin, clean, and wrinkled husk, closely adhering to a plump, round, and well-fed kernel, which, when broken, appears white, chalky, and sweet. It is then steeped in water for a space of time ranging, according to temperature and season, from 40 to 68 hours; fed with a plentiful supply of liquor, and ordinarily a change within that period. It is then drained, and thrown into a frame called a couch, where it lies full six-and-twenty hours, to generate heat by the process of fermentation, which then commences. The heat is then checked by the grain being spread thinner on the floor; and germination is ordinarily stimulated after the sixth day by a supply of water. The moisture, and a temperate atmosphere, cause the grain to swell, decompose, and evolve heat; the radicle shoots forth, and ministers food from the moist exterior, and from the atmosphere to the base of the plumula, and the grain emits an agreeable scent. The acrospire also swells, and shoots under the husk, and in a few days the end

of the farinaceous matter whence the root issues becomes friable and sweet. Germination and saccharization continue until about the fourteenth day, when the moisture of the grain is so far reduced, and the particles are so thoroughly disturbed, and their cohesion so broken, that they become as meal; when, to check waste and preserve sweetness, the grain is subjected to heat upon a kiln, and evaporated to dryness.

The malt produced is sweet and mucilaginous, because the conversion of the starch into dextrine and sugar continues during germination, until further progress is arrested by drying. Should the germinated barley be allowed to continue growing, as it does in the open fields, all the starch would gradually vanish from the grain, and would pass, in the form of dextrine and sugar, into the juice of the young plant, as is obvious from the sweet taste of such plant, and from its mucilaginous feeling when rubbed between the fingers.

Mr. Tizard, the eminent brewers' engineer, has devised a process for converting grain into malt, which, according to his account, effects a great saving of time, labour, and space, and produces the finest article yet manufactured. This apparatus consists of a large upright cylinder, in which is fixed a series of wire trays provided with

machinery for turning and sprinkling, steam pipes, plunge and vacuum pumps, pressure gauges, thermometers, &c.

This one vessel performs the whole operation of malting, and the space it occupies is inconsiderable. Grain having been let into each diaphragm or tray from a barrel store at the top, the opening of the cylinder is closed, and the apparatus made air tight. Steam is then passed through tubes lying under the bottom of each tray, by which heat is imparted to the barley, and the sweating process of ordinary malting produced. The vacuum pumps are now set in motion; the disengaged vapour is removed, and a partial vacuum formed. The grain thus dried, and freed from the pressure of the atmosphere, is made to imbibe steep water under very favourable circumstances. After sufficient saturation, the corn is allowed to germinate; the carbonic acid gas evolved is constantly removed by pumps; sprinkling is kept up at intervals, while the temperature is carefully regulated throughout.

To dry the vegetated grain, steam is again transmitted through the tubes, and when the grain has attained a heat of about 100° Fah. in the cylinder, the vacuum pumps are employed to expel the vapour which floats above it. A partial

vacuum being thus preserved, the grain in drying retains its plumpness, and the palest and richest malt is finally obtained.

Malt bears the name of Pale, Porter or Black, Brown, and Blown, according to manufacture and colour.

Pale malt is that which has been submitted to a slow drying on the kiln, ordinarily occupying three to four days. A slow degree of drying temperature not only improves the colour, but increases the sugar, and renders it more valuable.

Porter, or, as it is sometimes called, Black or Patent malt, is manufactured by a process similar to roasting coffee in cylinders, at a heat of 370° to 405° Fah. It is used chiefly in colouring porter, being recognised as a lawful ingredient for the purpose. Great variety obtains in this article, both in quality and colour. An inferior sort is made of very light barley, or of such as has very slightly vegetated; the maltster's object being to preserve as much as possible the form and substance of the grain. Such an article should never be purchased, for being composed of carbonized matter it is insoluble in water, and both the flavour and colour it imparts are alike poor and deficient.

Porter malt, to be proper, should be made from

good barley thoroughly malted, and exhibit a sound interior, of a uniform dark chocolate colour; each corn should be separate, and as near as possible of its original size and shape. In this state it contains a large quantity of soluble colouring matter of a superior kind, composed of burnt saccharine and mucilage, which impart an agreeable flavour and odour, as well as colour, to the beer with which it is mixed.

Brown malt differs in its preparation from Pale only in the drying on the kiln, which operation is finished at a brisk heat, obtained from beech, or birch, or some other wood, while the grain is laid an even thickness of about two inches, and occasionally sprinkled with water.

Blown malt is another variety of Brown. The vegetated is laid in a moist condition about half an inch thick upon a wire kiln, and kept constantly turned, while exposed to an ardent heat produced from fern, straw, or wood. The grain by this process suddenly expands its husk, and acquires an unnatural size, which gives to it its name of Blown malt.

This fictitious malt was, on the introduction of the Saccharometer, found to yield a deficient produce, as compared with Pale, of from 18 to 25 per cent., and the best Brown of from 15 to 20 per

cent. These discoveries, combined with the high price of hops in certain seasons, led to the furtive introduction of many illicit substitutes, several of which are in a high degree poisonous, and the employment of which cannot be too strongly condemned. Spanish liquorice root, both in the powder and in the juice, and black resin, were used to impart flavour, as well as colour. Molasses, raw grain, and sugar, took the place of malt. Gentian, or bitterwort root, marsh trefoil, and quassia, all became substitutes for hops, with alum to clarify it. A sensation of warmth was produced by capsicum; sometimes, by salt of steel, and sometimes by copperas: though the two last were employed, the former to produce a "retentive head," the latter to tinge it brown, by its affinity for oxygen. Fictitious strength was imparted by the coculus indicus, and the bitter bean of St. Ignatius. Tobacco and nux-vomica (rank narcotic poisons) were introduced with the same object.

Some of these ingredients are so inimical to animal life, that a few grains are sufficient to produce death, and when imbibed cannot fail to produce excruciating head-aches, nausea, and distressing sickness.

Besides these, they used honey, as a preserva-

tive, and saccharine sweet; carraway and coriander seeds, as stimulants; jalap, as an effervescent, and corrective of acidity; while ginger, grains of Paradise, orange-peel, and long pepper, were boiled with the wort in the copper. Hartshorn shavings also were boiled in the best "London Ale," to fine it; and marble dust, egg and oyster shells, were put into the ale as anti-acids, when lime was not native in the water. Opium was used to induce drunken sleep; sub-carbonates of soda, magnesia, and potassa, to correct acidity; and sulphate of lime, to prevent fretting.

It is a relief to close this precious category of homicidal quackery—this laboratory of, for the most part, deadly poisons, none of which no respectable Victualler would dare to touch—by insisting on a fact, now well attested, that a judicious combination of malt and hops, submitted to a careful mash, and fermented on principles hereinafter explained, will produce, without any foreign appliances whatsoever, a healthy, bright, and exhilarating drink, gently stimulating the digestive organs of the dyspeptic, and gratefully nourishing the strength of the robust.

Let us now turn to

THE ART OF BREWING.

Perhaps there is no art, which, from its extensive use amongst us,—from its ministering so largely to the every-day comforts and necessities of life,—from the careful manipulation it exacts, and the application of science it demands, should receive a larger share of thought and attention,—and especially from those whose profession and business it is to apply it.

The mere mixing and stirring of malt with heated water may be called mashing; the exposure of the wort to atmospheric action, may be termed, cooling; and its spontaneous, or excited changes, fermentation; while the true principles of the art remain uncultivated and unapplied. Mere routine may suffice with most brewers, though the result in many instances may be doleful; but the intelligent brewer will extend his observations. He will take into consideration the erection of suitable premises and utensils, the use of proper materials, and the mode of working them; and will ever bear in mind, that he has to regulate processes of so delicate and precarious a character, as to require his utmost vigilance,

and the application of all his science and experience.

The Brewery, in its construction, should have respect to economy of labour, as well as to the quantity and quality of produce. The supply of water, when a tank is used, should be situated above the brewery, and exposed to atmospheric action.

The liquor copper (which ought to be made of copper metal) should command the mash tun, and have a pipe of sufficient diameter projecting from the bottom, through the brick-work, on a higher level than the top of the mash tun, and a noseless tap fixed to its extremity.

The hopper, or ground malt binn, should be so fixed above the mash tun, as readily, on drawing the slide, to shoot its contents therein.

The mash tun should have a false-bottom, made of several pieces, closely perforated with small gimlet holes, and a hoop should be nailed within, about two inches from the bottom, to support it. Three taps should be placed in the bottom, at an equal distance from each other, and in the form of a triangle, but not driven so as to protrude above the surface. A stage should be erected round it, so that the person employed in mashing might conveniently perform that operation.

The wort copper (which ought also to be made of copper metal, as a saving of fuel and eventually of outlay will, owing to its thinness and durability, be thereby realised) should be placed at a lower elevation, to receive the wort as it runs from the mash tun, in which position it will serve as an under-back, and save the labour of pumping up.

From the bottom should project, through the brick-work, a pipe, terminated by a noseless tap, having a piece of canvas attached to its mouth about a foot long, to break the force of the worts as they issue into the hop back.

The hop back should be so situated as to receive the wort and hops discharged from the copper. This utensil, like the mash tun, should be furnished with a false-bottom, through which the worts might descend clear on to the true bottom, and thence by plug-taps to the coolers.

The coolers should extend from a level somewhat below the hop back, and have a slight inclination, so that at the time of drawing off they might thoroughly empty themselves, leaving only the deposited sediment behind. They should be provided with sluices, to admit the wort at pleasure from one to another. The refrigerator should be so placed as to operate on the wort in its way

to the gyle-tun, which last should be so situated as to command the cleansing casks, as they lie side by side on the stands or stillions in the cellar, or store-room.

The size of your vessels must be regulated by the amount of your brewings, and the extent of your business. It is safer, however, to have them too large than too small; and as a general rule, the coppers and mash tun should contain about four barrels of liquor for every quarter of malt used. Your coppers, mash and gyle-tuns, should be accurately gauged; and for this purpose, provide for each utensil a flat rod, and mark thereon the height to which the water rises on the introduction of every thirty-six gallons or barrel measure into it. Floating gauges are best adapted for the coppers, as they indicate the quantity of wort or liquor they contain at any time.

As the fermentative process can be better and more successfully conducted, where a uniform and low temperature prevails, it is very desirable, that the fermenting-room should be situated as low down as locality and circumstances will admit.

It has been thought, and indeed proved, that an equable temperature of 52°, attainable only at depths varying from twenty to one hundred yards below the surface of our soil, is productive of the

most perfect fermentation, and would in every instance lead to the most successful results. The expense, however, and inconvenience of effecting such excavations, must render the recommendation impracticable, and therefore valueless. Such a depth, however, might easily be attained for our fermenting-rooms as would screen them from those excessive variations to which the temperature of our climate is liable. Damp cellars have by many been preferred to dry ones, on the ground that they are not only cooler, but cause less loss to the beer, by evaporation.

Great and weighty objections have been urged against coolers constructed of wood; as, from their alternate expansion and contraction, under the influence of heat, moisture, &c., the fibres of the wood alternately expand and contract; thus pulverising their own albumen, and grinding away their more solid substances. The loosened particles either float out of their cells, or exude therefrom, and are swept away by the cleansing broom. The gap thus formed soon becomes deeper and wider, affording easy ingress to the vegetable moisture, until the whole plank is saturated with principles that decay with greater rapidity than the albumen it displaces. The ligneous substance is in its turn decomposed and removed, and makes way for new matter, the pores of the wood acting as so

many fermenting vessels in every stage of progress from the vinous to the putrefactive.

During this work of destruction, the worts are absorbed and wasted, and become so permanently impregnated with acidity, that they not only irrecoverably lose their flavour, but a poison is communicated to them by these unsuspected acetous and putrefactive ferments, which after treatment can neither remove nor correct.

Cast-iron is perhaps the least objectionable material for the construction of these utensils; but precaution should be taken, previous to bolting the pieces, to boil each segment in a dense saccharine liquid for the space of fifteen hours, or so. This process would so overlay the pores of the metal, and render them impervious to atmospheric moisture, that, provided the vessels were swept down and dried, when the last wort was run off, and not washed with cold water until a few minutes before the first wort of the succeeding operation was turned out of the copper to cool upon them, no danger of rust or oxydation need be apprehended.

A further guarantee against deteriorating from these causes would be obtained by coating the iron with zinc in a molten state.

Mash tuns, fermenting tuns, false-bottoms, and

mashing machines, have been made of this material. As much of the success of the operator will depend upon the quality of the materials used, he must have a care to their judicious selection.

The best pure malt is light, because it has been well digested; but should the "cockspur" appear, it will prove weak, having grown too freely. When made of good barley, it exhibits a round, full body, which is easily bruised into a sweet white flour. The skin is very thin, and the meal very sweet and rich to the taste. Sameness in colour, and equality of size, are also good tokens. Hard and flinty malt is to be rejected.

A test in common use, is to put a handful into a glass of cold water, when the flints or unmalted grain will sink to the bottom; those partially made, will dip obliquely in angles of depression corresponding to their imperfection; while the thoroughly malted seeds will swim, and float for several hours, before they absorb sufficient water to precipitate them. Experience will, however, enable the eye, the teeth, and the palate, to determine with some accuracy the quality of malt; though the ultimate and best test of productiveness, is the Saccharometer. By its use you may ascertain the extract it will yield per quarter, and thus readily discover its intrinsic value; and by

adopting the plan of recording your observations, you will at all times know which malt to reject, and which to prefer.

Your record may be kept thus :—

Maltster's Names.	Extract per Quarter, lbs.	Price.
A, B.	82	68s.
C, D.	80	65s.
E, F.	74	62s. 9d.

The importance commercially of employing at all times an instrument of such exquisite sensibility as the Saccharometer, to determine the quality of malt, cannot be too strongly insisted on. To expect a uniform quantum of extract from a given bulk of goods is a dangerous fallacy, greatly aggravated by those differences and fluctuations in the quality of grain which soil and season occasion, and to which each deviation of temperature materially contributes. Of all such changes, however, the Saccharometer will be found the faithful indicator, and its use will enable the Brewer to select the most productive malt—a consideration of great pecuniary importance, we repeat, at all times, but especially in those seasons in which the harvest has been scanty, or exposed to injury by wet or lying in the field. The employment of the Saccharometer is opposed by

many, on the ground of intricacy; but it is hoped that in this advancing age, in which science is everywhere superseding custom and blind routine, such objections will be abandoned, and that the directions for its use, in a subsequent page of this work, will enable every thoughtful Brewer to avail himself successfully of its invaluable aid.

Another indispensable constituent in the manufacture of beer is Hops. This flower has been quaintly but correctly styled, the "Nosegay of the British brewery." Its fine, full, and soft bitter, is used to impart the desired flavour and durability to the wort; and, although the cupidity and art of man have ofttimes made the attempt, they have not yet succeeded in discovering a substitute, at all approximating in its quality, for this precious plant. Indeed, the evidence of experience goes to prove, that all other flowers and herbs are far inferior to the bloom of the hop in its preservative properties, as well as being ranker and coarser in their flavours.

As nothing has been found in the past, so it is unlikely that anything will be discovered in the future, to supersede its fine aromatic flavour, and its warm, stomachic, and cheering bitter; and though in times of scarcity and dearth, such as the failure of two or three general crops would

produce, it might be advantageous, did the law permit, to use chamomile, gentian, and quassia, together with the hops, still, under no other circumstances could any deviation from the recognised and exclusive use of malt and hops be justifiable, either in a pecuniary or moral point of view.

The quality of hops depends upon soil and culture; also, upon picking, drying, bagging, and other contingencies. Those in highest repute are grown in Kent, in the environs of Canterbury: the Farnham hops are likewise much esteemed: they are both distinguished for their strength and flavour. The north-clays, so called from the stiff lands in Nottinghamshire, where they grow, are remarkable for a rankness of taste approaching to nauseousness, which renders them fitter for strong store-beer than for any other. The Worcesters are characterised by their mildness and agreeable flavour, while the Sussex, though highly prized in some districts, are studiously avoided in others, owing to a peculiar and incurable smatch they possess.

Proximity of growth and local tastes will, for the most part, determine the purchaser in his choice; but he should be careful to select such only as are full grown, abundant in seed, thick

leaved, and as ripe as possible. More reliance should be placed on the smell of the hop, than on its colour, as the green tinge, with its yellow coating, is often artificially produced, by burning charcoal, and the fumes of sulphur and saltpetre, in the process of drying.

An experienced man will also reject those "choice portions" which are commonly picked too early, whereby the permanency, and perfection of the natural bitter, are sacrificed to colour and delicacy, in the appearance of the aroma.

When nature has matured the hop, its nectarium or pollen appears in large particles, and of a bright yellow; its seeds hard and brown, with many of the edges of its blossoms also tinged brown; when rubbed, it yields a thick oily matter, emitting a grateful and pungent smell. The period of its maturity has now arrived, and the grower may gather with advantage to himself and his customer.

Preference should always be given, other circumstances being equal, to hops of the latest growth, and of eight to ten months old, as many of their valuable properties dissipate by longer keeping.

The character of the hop should be adapted to the quality and constitution of the beverage—the

palest and mildest for the light fresh ales—the strongest and most aromatic for pale ales of a stronger description. The Farnhams answer well for the imitation of London ales, and for those ales intended for exportation; whilst the darker coloured and more astringent Kents, answer best for store-beer, and porter.

Writers, as well as Brewers, differ widely in their opinions as to the qualities in water best adapted for brewing: some prefer hard, others soft, while a third class are indifferent in their choice, provided it be water.

Competent authorities, however, and the evidence borne by many of our choicest ales (Burton, for instance), incline the balance of opinion in favour of hard spring water, particularly that drawn from wells dug in a chalk soil, and impregnated with saline matter. In such a case, however, higher pitching heats and a higher fermentation are necessary than for soft water, to overcome the obstinacy with which such worts ferment; and the employment of such improved patented utensils and instruments as Tizard's "Mashing Attemperator," and "Hop Converter," is very desirable, to force an extract from the malt, equal in quantity, if so desired, to that produced by rain or snow water.

Although such worts require to be pitched from ten to fifteen degrees higher than those drawn from soft water, in order to effect the same attenuation in the same time, yet are their preservative properties increased thereby, for a larger proportion of saccharine matter remains undeveloped, to improve the fulness and flavour of the ale, and prevents its becoming sour, as other full-bodied ales are apt to become, especially in hot weather.

Having sketched a plan for the erection of the brewery, and prescribed some tests for the selection of the three main brewing constituents—malt, hops, and water; let us now advance a step, and explain their combination in the process of Mashing.

It is necessary that the malt you intend mashing should have been bruised or malted from twenty to forty hours before it is used, so that the heat engendered by the process may have thoroughly escaped from it. It should not be ground or crushed, but subjected to the action of rollers, so placed as to split the husk of the grain, and destroy the cohesion of the meal, without removing it, thus converting the husk into a kind of bag, confining the soluble farina within it, and preventing its escape as flour.

Early next morning, when your mashing liquor

shall have attained a heat of 184°, discharge it into the mash tun, in the proportion of about two barrels for every quarter of malt you employ. When the heat is reduced to 180°, let the malt down from the hopper gradually into it, taking care to mix it well with the liquor.

Respecting the temperature of the mashing liquor, Brewers are not agreed; some are partial to high heats, others to low. The choice must depend, partly upon the character of the water used (for hard waters require lower heats than soft, from the difficulty of making such a rich extract with them, although the reverse might appear to be true), and partly upon the temperature of the malt, and of the surrounding atmosphere.

The variety in the colour and constitution of the malt, will also require an equal variety in the mashing heat; as will also the size of the mash. Experience, aided by the thermometer, will alone enable the Brewer to procure the richest extract, and the largest possible quantity of fermentable matter from the malt. Certain it is, that a sufficient proportion of the essential constituent principles of the grain must be obtained, or the process of fermentation will be unsuccessful.

Two very important principles, sugar and mucilage, exist in malt in nearly equal quantities,

constituting thirty per cent. of the whole. Now of all the principles of malt, sugar is the most soluble, melting between the average heats of cold and boiling water, while the mucilage or farina (containing the gluten or yeasty principle) is soluble at any heat between 160° and 212° Fah. Consequently, if we apply heats that dissolve the sugar, but lock up other parts of the grain, fermentation will be proportionately difficult; and if our heats be so high as to extract too much of the mucilage or farina (containing as it does gluten, the exciting cause of fermentation), that process will proceed so freely as to produce acidity. Our endeavour, therefore, must be to obtain a productive extract, not so rapidly fermentable as to become sour, nor so sluggish as to require much heat and yeast to excite fermentation.

In genial temperatures, and with average waters, the heats of the three mashes may be as follows:—

	Hard water.	Soft water.
1st mash	178	182
2nd ditto	184	188
3rd ditto	188	186

These will have to be varied according to the state of the air, as extreme cold or heat will pro-

duce considerable effects, and need special provisions to meet them. These difficulties, however, the intelligent Brewer will be able to overcome; and, by the result of multiplied experiments, conducted as near as possible under similar circumstances, will soon obtain a knowledge of the proper heats.

When the heats are correctly applied, from 76 lbs. to 84 lbs. of extract per quarter should be obtained from good pale malt; the worts should readily quit the goods, and leave them dry in the mash tun, and should be crowned with a fine frothy head in the underback. The tun should be closed immediately after mashing, to exclude the air.

The liquor should remain on the first mash two hours, and indeed as much longer as the heat will keep from falling below 146°. From one to two hours each will suffice for the second and third mashes.

Mr. Tizard's patented "Mashing Attemperator," to which allusion has been made, is an ingenious contrivance for increasing and maintaining heat in the mash tun. It consists of the ordinary mashing machine, with its shaft, arms, and rakes, made hollow, for the conveyance of steam, or of hot or cold water, at such times and in such quantities as

the operator may desire. These generally circulate whilst the machine is in motion, and thus diffuse an equable heat of any required temperature throughout the mash, without increasing its fluidity. The effect of this machine is said to be, to produce a brilliant and sound wort, to purify and concentrate the extract, and increase it in quantity from ten to fifteen per cent.

It may be set in motion by steam, horse, or any other power, and may be purchased at a cost of £40, for a three-quarter mash tun; and £10 more for each additional quarter, under eight.

The quantity of beer, or the length drawn from good malt, may average, where stout ales are brewed, two barrels to two and a fourth per quarter, at a gravity of 30 lbs. per barrel; and where lighter ales are brewed, the length drawn may be from two and three-fourths to three barrels per quarter, at a gravity of 20 to 23 lbs. per barrel, reserving the third mash for a return wort to be mixed with the first tun on the following day.

This third mash may be reserved for a superior sort of table beer; but if retained for a return wort, it should be used without delay, as it is apt to become sharp by keeping, especially in summer. This rapid change may be retarded by running

the wort into the hop-back, and allowing it to remain upon the spent hops for an hour or two before it passes on to the coolers.

Even after the third mash, the goods retain some portion of matter, and though it be small in quantity (rarely exceeding 5 lbs. per barrel gravity), and poor in quality (as it contains less sugar of malt than an equal weight of the former worts), if it be deemed desirable to extract it, the following method may be employed:—

To every two and a half quarters of malt turn on two barrels of liquor at 198°, and allow the mash to stand half an hour after stirring. Add some spent hops of the day's brewing to the wort in the copper, and let it remain therein all night, with the fire damped. Next morning, discharge it into the hop-back among the hops, and let it remain there some minutes before you turn it upon the coolers. The wort will then be reduced in bulk one-third by evaporation; and this, together with the superior wort received from the hops, will bring up the gravity to 8 or 9 lbs. per barrel, from which a good quality of table beer may be made. This should be pitched as cool as possible, as otherwise a rapid fermentation will set in, and acidity soon follow. No more yeast should be added than is sufficient to cream it over, and save

it. Twelve hours after pitching, it must be cleansed.

Table beer, brewed from fresh malt, must be treated on the principles of the ale process, but regard must be had to a very slight fermentation, else the flavour of the malt will be destroyed.

If the length be divided into two portions, each should be boiled for one hour, exclusive of boiling for gravity. To boil it for a longer time is wasteful and pernicious, both to the extract of the malt and to that of the hop, evaporating the finest particles of both, destroying the glutinous properties of the wort, and thereby impoverishing it.

Not only does much of the fine aroma of the extract pass off, with the watery particles, in the ebullition of boiling, but a considerable portion of the fermentable matter is lost; and much of the air requisite to promote fermentation, especially when the worts are pitched at low heats, is expelled.

The reasons assigned for upholding the practice of long boiling, are not based in truth. Some maintain that it is essential to the transparency; others say, to the permanency of the beer. Both these qualities, however, depend upon the course pursued in the mash tun, and not in the copper.

The Brewer should endeavour to obtain his

standard gravity in the tun, rather than by long boiling in the copper, as the value of the extract is sure to be diminished, and the flavour destroyed, by the dispersion of the essential oils of the malt and hops. Besides, the gravity of the wort does not increase in proportion as the length decreases by evaporation. If a wort of twenty-five barrels be reduced by boiling to twenty barrels, the gain will not be five barrels gravity, but about four barrels, the other being lost by evaporation.

Mr. Tizard, in his able work on the "Theory and Practice of Brewing," recommends dispensing with boiling altogether, when the properties of the malt in the mash tun, and of the hops in the hop-back, can be extracted and the length regulated, as by his patented inventions, and when the worts can be fermented at or below 52°.

The operator having now converted the choicest properties of the malt into a sweet and viscous fluid (whether by patent machinery or otherwise), and imparted to it the desired flavour and durability, has next to bring it into a potable state, and ensure the permanency of its virtue. This is effected by the delicate and interesting process of fermentation, by which a portion of its saccharine is converted into alcohol. Fermentation is the mighty agent, which, by means of heat and mois-

ture, operates upon all animal and vegetable substances, and when uncontrolled gradually reduces them to their first principles, and adapts them to enter in a gaseous state into those fresh combinations which constitute the grand circle of natural operations.

Five or six distinct species of fermentation are spoken of by the Chemist; but of these we shall only consider the Saccharine, Vinous, and Acetous. The produce of the first is sugar; of the second, spirit; and of the third, the oxygenation or acidification of the wort; and these effects are always dependent on the amount of caloric present. How important is it, therefore, to obtain a thorough knowledge of, and complete control over, such a power.

The elements of wort are oxygen, carbon, and hydrogen, in certain proportions and combinations; the attraction of these constituents however is so weak, that a slight power is sufficient to disturb it.

At a proper degree of heat, worts evince an immediate symptom of change in the composition of their sugar and water, and will ferment gradually. As this kind of fermentation is slow and irregular, and its termination indefinite, decomposition would not be completed before the acetous

change took place; yeast is therefore introduced to effect this, for, from its strong tendency to decay, and its very strong affinity for oxygen, it soon destroys the equilibrium, and accelerates the decomposition.

The chief constituents of yeast are vegetable gluten, and a small quantity of aluminous matter. When this ferment is introduced into the wort, it stimulates similar principles therein, and these exciting causes act and re-act upon each until one or both are destroyed. During this action, the temperature of the mass rises, and certain principles are evolved in a gaseous or aeriform state, which combine in a new order. The most abundant of these is oxygen, two parts of which unite with four of carbon, and six of hydrogen in forming alcohol; while four parts of oxygen unite with two of carbon, and form carbonic acid gas. These two substances did not previously exist, but are new products of the decomposition of the sugar. As the principles of malt and hops thus exist in a gaseous state, it follows that should they be permitted to escape, through injudicious fermentation or ill-closed tuns, a ruinous waste will ensue, but if detained they will be converted into spirit, and the exhilarating qualities of the beer augmented, while the bulk is little, if at all, diminished.

Alcohol, or spirit, constitutes the strength of beer, and greatly aids in preserving it; carbonic acid gas gives to it pungency and brilliancy, and resists the putrefactive fermentation; and both these elements of goodness are best preserved by a cool, slow, and perfect fermentation.

To secure a beer of a rich flavour, and of a transparent and preservative character, the gyle should not be pitched in the cold season of the year at a heat above 66° Fah., nor when the weather is temperate above 62°, unless the quantity brewed be small, when a higher heat may be necessary. In summer, the hour before sunrise, being the coolest, will prove the most favourable time.

The strongest kinds of Bavarian beer are usually pitched as low as 50°, and allowed to remain in a cool place; a very slow fermentation then sets in, which takes several weeks, sometimes months, to complete. During this process, the carbonic acid gas is evolved in very small bubbles, and the yeast settles at the bottom of the vessel. This beer is much valued. It contains scarcely a trace of gluten or yeast, and can, therefore, be kept for years without becoming sour: it is, moreover, richer in carbonic acid gas than that obtained by the quicker process, owing to its lower tem-

perature and the more gradual elimination of the gas.

A pure, fresh, energetic, and solid yeast may be classed as one of the most necessary agents of a perfect fermentation.

Worts from hard waters will need, as before stated, pitching at higher heats, and require from 5 lbs. to 6 lbs. of yeast per quarter of malt; those from softer waters, from 3 lbs. to 4 lbs. These quantities should not be introduced at once, but in three or four separate portions, to stimulate fermentation when it appears to flag; none, however, should be added towards the close. The proper season will be indicated by the appearance of the gyle, and the state of gravity as indicated by the Saccharometer. Fermentation may also be materially promoted by rousing up the gyle and beating in the head. The yeasty matter contained therein is brought into action, and its fixed air combines with the beer, and displays itself in a fine mantling briskness, until it be consumed: particles are brought together in various degrees of decomposition, new actions are created, and the viscous matter more readily separated and dissolved. By thus blending the yeasty principles produced by the beer, we can make a smaller quantity of Foreign yeast suffice; and it is a

desirable object never at any time to use more of the latter than is absolutely necessary to effect conversion.

The tun, or back, should be kept closed, and only opened to introduce yeast, or to draw samples to test the attenuation. The tun-room also should be kept closed in cold weather, for, should the beer be checked while being cleansed, it will not become bright.

The degree of attenuation to which the gyle is brought must depend partly on the original gravity of the wort, partly on the season of the year and the temperature of the atmosphere, and partly on the time the beer has to be kept before it is consumed.

Strong worts will bear a greater proportionate attenuation than weak ones, and consequently be stronger and more sparkling; indeed, the more we attenuate without producing perpetual flatness or fixing the yeast, the stronger, finer, and more enduring, will our beer be. The attenuation, however, should be arrested at a point when a sufficient quantity of fermentable matter remains unattenuated to support the natural consumption constantly going on in the beer; and this unattenuated matter should be proportioned to the time we intend keeping the beer. In cold weather,

the gravity must not be attenuated so low as in warm; for a sufficient quantity of matter must be left unattenuated, to afford a supply of carbonic acid gas to bring it round. In summer, the attenuation must be more perfect, to counteract acidity, and the warm weather must be relied on to bring it into condition.

Beer intended for immediate use should also be moderately attenuated; for if we attenuate too low, we deprive it of its natural energy, and it has neither time nor power to recover itself; while, on the other hand, if the attenuation be not low enough, the beer will be heavy, deficient in strength and flavour, and so foul, that no effort will avail to clear it. Fretting will produce exhaustion, and staleness will ensue.

Stout Ales from high gravities, intended for storing, may be attenuated as freely as consistent with the safety of the gyle—say, from 6 lbs. to 5 lbs. per barrel, for the lower any beer is attenuated, the more readily it will incorporate with other beer. Upon the proper regulation of fermentation, therefore, does a favourable result mainly depend. Low attenuations will increase the spirit, but the wort is so thinned thereby, that its character as beer is destroyed; but contrariwise, if fermentation be not carried far

enough, the unconverted saccharine will render the beer sickly and cloying, and spontaneous fermentation will continue briskly till it has become sour. A proper mean should be observed: if a rich and full flavoured ale be wanted, attenuate lightly; if a thin and more highly flavoured ale, attenuate more freely. By a due regard to temperature and season, the cleansing gravities best adapted to produce full, or thin flavoured ale, whether of early or late maturity, may be ascertained; but it must be borne in mind, that when the water is pure and soft, the attenuation will proceed more freely, both before and after cleansing, than when hard water has been used.

In hard water worts, cleansed at 10 lbs. gravity, the density at the time of racking will not have diminished more than 2 lbs. per barrel; while in soft water worts, it will usually be reduced 5 lbs. To assist such hard water worts, increase the proportion of yeast; and while you adhere to the proper cleansing gravity, cleanse such worts while the yeast is being thrown off smartly.

The following cleansing gravities, based on experiments and confirmed by experience, are submitted for adoption in ordinary cases:—

Ale, of 20 lbs. to 26 lbs. per barrel, intended to be drunk after a month or six weeks, when the temperature of the air is—

20°	to 30°,	should be cleansed at	11	lbs. gravity.
30°	„ 40°	„	10	„
40°	„ 50°	„	9	„
50°	„ 60°	„	9	„
60°	„ 70°	„	8	„
70°	„ 80°	„	8	„

Worts of a greater density than 26 lbs. will bear a lower cleansing gravity of 1 lb. to 2 lbs.

It has been already observed, that ales of high gravity, intended for keeping, should be attenuated low, so as to secure a proper degree of strength, of softness, and transparency, for it will have time to get round, and yet that a sufficient quantity of fermentable matter must be left unattenuated, to supply the gradual decomposition going on; and that the quantity must be proportioned to the time the beer has to be kept. If it have to remain in store

6	months, it may	be cleansed at	8	lbs. gravity
9	„	„	10	„
12	„	„	11	„
15	„	„	12	„

It were vain to prescribe any time for continuing fermentation, for one gyle may, from various causes, be ready to cleanse before another, yet ordinarily the requisite attenuation will be reached

in less than three days. In temperate weather, it will occupy twelve hours more. As soon, however, as the gyle has attained the desired point, it should be cleansed immediately, as injury will ensue if allowed to remain in the tun one hour longer. Soon after it has been removed into the cleansing casks, the beer will begin to ferment, and work over into the stillions. This it will freely do for the first eight or nine hours; and care must be taken to fill up the casks, hour by hour, with the beer which has run over: as fermentation subsides they will only require to be filled up occasionally.

It is important to allow beer to flatten, after it has ceased working. This is accomplished by leaving the casks open, when the small floating particles of yeast part with their fixed air, lose their buoyancy, and sink to the bottom. Seven or eight days in winter is usually sufficient for this purpose; but in summer, an intermediate racking may be necessary, to check the fermentation induced by the heat. The beer having thus deposited its remaining yeast will not be liable to fret. In this state it must be racked, free of its lees, into clean casks, to each of which twelve or more gallons of fine old ale may be added, then removed to the cellar, kept there perfectly air-

tight, and the bungs frequently examined. As, however, it will soon acquire briskness, the vent-pegs must be loosened, when the pressure on the casks appears great.

The more briskness it acquires the brighter will the beer be; and in a few weeks, according to temperature and attenuation, it will have acquired a luscious flavour and brilliant transparency—sparkling in the glass like the finest bottled ale.

In this condition it may be sent into consumption, and will prove alike creditable to the Brewer, and an agreeable beverage to the consumer.

Should it continue flat more than a reasonable time after racking, it proves that it has attenuated too freely after cleansing, and steps must be taken to retard the attenuation in future, either by cleansing sooner, by using less yeast, or by pitching the worts in the tun a little cooler, and thus ensuring a slower fermentation.

In hot weather, a mixture of old beer tends to check the fermentation of the new, by fining and flattening it; while by the spirit it imparts, it checks fretting, and counteracts acidity, and thus assists in preserving it.

This method of flattening is to be preferred to frequent rackings, as the latter must prove injurious to any fermented liquor, not only by expell-

ing the carbonic acid gas and ether, but by exposing the liquor to atmospheric air and its dangerous oxygen. A sufficiency of stock beer should at all times be kept for flavouring your best ale, for if you attenuate to give the character of age, the flavour will be materially reduced thereby.

In preparing stock beer, the density will of course depend on the cost of materials, and the price it should realise: it ought seldom, however, to be under 30 lbs., nor above 38 lbs. per barrel. The worts will be best pitched at a cool temperature of about 60°; all surplus caloric above 72° should, if possible, be extracted, and the attenuation may be carried to from 5 lbs. to 4 lbs. per barrel.

Beer, brewed and vatted entire in the months of March or April, will probably be fit for consumption in the following spring; but that brewed in October may need two seasons to bring it into condition, but then it will be of superior quality. Beer brewed at the fall of the year might be racked at the beginning of April, with 2 lbs. of new hops to the barrel, to check the fermentation which is apt to be excited by the heat of summer.

A stock of old beer may always be maintained by adopting one of the two following plans:— When a vat has acquired some age, start half the

contents into another vat, and immediately fill up both with new beer; or from a vat fit for consumption, rack one-fifth of its contents, fill with the new gyle, and let this drawing and re-filling be repeated every four or six months. If the new beer be introduced through the lower tap, it will secure a more perfect incorporation with the old, and the assimilation will thereby be greatly accelerated. Where the practice of replenishment can be conveniently carried out, the quality of the beer may be kept uniform; an achievement of no small moment, for such is the power of contagion, that a good stock of old beers may thus be kept on hand for a constancy, at a great saving of storage room, time, and capital. The ripeness of a vat of beer may be hastened, by throwing into it the spent hops from two or three gyles, immediately after each brewing: these have a tendency to fine it and mellow it. Finings of some sort are admitted to be necessary, especially for new beer, and where it has to be brought early into consumption, and time cannot be allowed it to fine itself. Should the spent hops injected not produce the desired brightness, it will be necessary to prevent a further decomposition of the turbid particles by employing a precipitant, whose affinity for the glutinous particles is greater than that exerted by any other principle in contact. Such is found in

isinglass, a substance manufactured from the sounds of the sturgeon, as also from the skins, tails, and fins, of other fish, and thence sometimes called "fish glue." It is used in a liquefied state; and the usual method employed in dissolving it, is to steep it in sour beer, such as returns, or in beer brewed and acetified for the purpose. Distilled acetic acid is sometimes used as a solvent, for which its purity and power adapt it, but it is costly, and therefore not extensively employed. No more acid should be used than will effectually cut the isinglass; for the smaller the quantity of acid, the better will the beer fine with it. When dissolved, it should be strained through a fine hair-sieve, and a sufficient quantity of fresh table beer be added to thin it. The inferior descriptions of isinglass require stronger acids than the best sorts, and are much longer in dissolving; the acid often disappears before the common glass is half cut. In such a case the liquid should be poured off, and a sharper acid applied, the mixture often stirred, and kept as close as possible. The quantity requisite will depend upon its consistence, and upon the amount of floating matter it has to engage in the beer. A pint and a half to the barrel will ordinarily be found sufficient.

Some ales are too stubborn to submit to isinglass, and can only be clarified by alum, or some other prohibited ingredient.

The contents of a vat are always stalest at the top—a proof that the decay of beer is more rapid where most exposed. A pint or two of olive oil, poured on the surface about the middle of April, will prove a useful shield to exclude the oxygen, and prevent decline.

We may here refer to a malady to which beer insufficiently attenuated is peculiarly exposed: this disease is technically termed "the Rope." The mucilage and undecomposed gluten such beer contains, have a strong affinity for oxygen, and unite with it in a new constitution, exhibiting this viscid and oily effect. One of the two following methods may be adopted to remedy this evil:—Into the mass pour one-fourth of new wort, at such a heat as will raise the temperature of the whole to about 68°; add thereto 1 lb. of fresh yeast, and 1 oz. of cream of tartar, per barrel; rouse well together, and keep pretty close: soon fermentation will set in, which will decompose the rope by abstracting the excess of oxygen, and restoring the necessary carbon. Or, into every twenty barrels of the diseased beer, introduce from 6 lbs. to 8 lbs. of bruised mustard-seed in a liquefied state, and rouse it well: some days after, spread on the surface 10 lbs. to 12 lbs. of good hops, previously steeped in hot liquor, and in eight or ten days pour over the whole a couple

gallons of finings. This will soon fit it for admixture with a better article, intended for immediate use. The Brewer who is possessed of these old beers, and is guided by the principles laid down for brewing the mild, will be able to command trade in hot weather, while others are sending out a sour and stale drink. Secure the air-tightness of your vats, and use only the best malt, and the choicest and strongest hops; for, though skill may sometimes counteract the ill effects produced by bad malt, it cannot wholly obviate them: bad malt will always be followed by deficiency in flavour and in briskness, and by a tendency to acidity. Be also liberal in the use of materials; weak beer is destitute of every good quality. Liberality is the surest road to success. Extensive business, and quick returns, even when profits are small, is esteemed the wisest course. The Brewer who reckons on large profits, and will have them, soon learns by experience that he cannot compete with his neighbour, who is determined to do business on an extended but liberal scale; for though the profits of the latter are not great, yet their number and extent guarantee a steady, if not a rapid, augmentation of capital, while the trade expenses under either system are about equal.

As order is essential to improvement and suc-

cess, some such method as the following should be adopted of recording each day's observations:—

February 1st, 1855.

	Barrels.		Density.	Extractive Matter.
1st Wort	12·5	×	31·6	395· lbs.
2nd ditto	14·75	×	20·8	306·8 ,,
3rd ditto	9·25	×	9·2	85·1 ,,
Table ditto	9·5	×	5·2	49·4 ,,

	Barrels.	Extractive Matter.
1st Wort	12·5	395·
2nd ditto	14·75	306·8
3rd ditto	9·25	85·1
	36·5)	786·9 (21·5 average
		730 [density.
		569
		365
		2040
		1825
		215

	Extractive Matter.
1st Wort . .	395· lbs.
2nd ditto . .	306·8 ,,
3rd ditto . .	85·1 ,,
Table ditto . .	49·4 ,,
Quarters of Malt .	10) 836·3
Extract per Quarter .	83·6

These memoranda should then be transferred from the slate to the Journal, where also the progressive state of the gyle in every stage of its attenuation should be noted, as follows:—

Date.	Quarters of Malt.	Lbs. of Hops.	Temp. of Air.	Barrels of Liquor.	Temp. of Liquor.	Hours on Mash.	Barrels of Wort.	Density of Wort.	Temp. of Wort.	Extract.	Time boiled.	Length.	Final density.	Extract per Quarter.	Lbs. of Yeast.	Attenuation. 1st day.	2nd day.	3rd day.	4th day.	Temp. of Tun.	Temp. of Air.	Barrels of Ale.	Barrels of Table.	Observations.
Brought forward	60	360	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	168	34	Racked with 9 gallons old ale per barrel.
February 1st	10	60	42	18	182	2	12½	31·6	142	395·	2½	..	..	..	..	..	..	..	..	..	..			
				16	188	1½	14½	20·8	146	306·8	1													
				10	186	1½	9¾	9·2	148	85·1	1													Feb. 15. With the aid of finings, beer became perfectly bright ten days after racked.
				44			42½	36½	21·5	786·9	2½	30	24·4	83·6										
Table	..	..	..	8	198		9½	5·2		49·4		6	8·0											Much admired.
e. 9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	62	44	Roused		
February 2, *m.* 6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	24·1	..	..	..	64	42	ditto		
e. 8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23·2	..	..	..	65	45	ditto		
,, 3, *m.* 7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	19·2	..	..	66	46	ditto		
e. 6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16·8	..	..	66	44	ditto		
,, 4, *m.* 6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	14·5	..	68	48	ditto		
e. 5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13·2	..	68	48	ditto		
,, 5, *m.* 7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11·8	68	44	ditto		
noon	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11·0	70	48			
e. 4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10·4	70	48	29½	6	
Carried forward	70	420																				197½	40	

INDIA PALE BITTER ALE.

This beverage, so highly recommended by the Faculty for its digestive and invigorating properties, has become, from its extensive demand, a profitable branch of business.

Bitter Ale differs from other ale only in the quantity and proportion of material employed in its production; that prepared for the home market is, however, less bitter and spirituous than that which is prepared for exportation to India. The spirit of hop, which enters largely as a constituent in this beer, has ascribed to it several valuable qualities,—the following among others:—that it is cordial and warm, aperitive, digestive, diuretic, stomachic, and sudorific. It certainly acts as a tonic and anti-spasmodic; and its aromatic bitter restores the depraved appetite, corrects unwholesome nutriment, promotes digestion, and increases the nutritive virtue of all food united with it.

The malt employed should be of first-rate quality, of the lightest possible colour, and thoroughly dried. The hops of the palest growth; those known as the Farnhams, Golding's, or the very best East Kents, are to be preferred; about 18 lbs. per quarter of malt are needed for the

home, and 23 lbs. for the foreign, market. Mash as for other ales, drawing a length of about three barrels per quarter for the home, and full that for the export, trade. It would be advantageous to steep the hops for nine hours in water of any temperature between 142° and 172°, when such a heat can be conveniently sustained, as the extract would be much improved thereby. Hops absorb a considerable quantity of raw wort, averaging a barrel to every 60 lbs. used. This wort they retain after the operation of mashing is closed, together with much of their original bitter: they may, therefore, be employed profitably in brewing porter next day, as the absence of aroma in the half-spent hops will not be so much missed in that beverage as in any other; and, in such a case, half or a third only of the usual quantity of new hops will suffice for the brewing. You should guard against leaving these partially-spent hops in the hop-back all night, or even more than four hours, before their bitter is extracted for future use; because within that period a partial decomposition sets in, by which the quality of the bitter is deteriorated in proportion to the time they are exposed to the air. It is best to boil them moderately in each of the after worts. The fermentation should be slow and gradual; and to secure

this, the gyle must be pitched at a low heat—say, when the brewing waters are soft, at from 55° to 62°; when hard, some degrees higher: but here is ample scope for judgment and experience, as temperature and season will severally call for their exercise. A portion of the yeast may be mixed with the wort as it flows into the tun, and other portions occasionally added afterwards. The heat of the gyle should not be suffered to increase more than 3° or 4°, during the first fifty hours, by which time the saccharometer should indicate a diminished gravity, of some 8 lbs. or 9 lbs. As soon as the saccharometer indicates a 7-lb. gravity in the gyle, and the temperature stands about 66°, a third or more of the yeasty head may be removed; another portion when the gravity is reduced to 5 lbs.; and when reduced to 4 lbs. gravity, it may be skimmed close; repeating the operation whenever the light head thickens. It should then be allowed to cool and clarify for two or three days, at the end of which it will be found fit for vatting. If racked into store casks, 2 lbs. of the best and fullest flavoured hops per barrel should be added, and the casks rolled over every day, that the liquor may impregnate the hops, and extract their flavour. Cane vents may be used with advantage, after fermentation is partially complete.

PORTER.

The credit of introducing this beverage, so much esteemed, especially in the metropolis, is attributable to an ingenious Brewer named Harwood, who contrived, about the year 1731, to combine the flavours of what was then called "half-and-half" and "three threads," into a production which he denominated "entire butt." As the consumption was great, especially among porters, it thence obtained, say some, the name of Porter. Others assert, that the name was given to it from the practice introduced by Harwood, of having his beer ported, or carried round to the houses of his customers in pewter pots on racks; his pot-boys crying 'Porter,' to denote they were present, as they knocked at the doors. The inhabitants of London regard this liquor as a necessary part of their food, and prefer it to any other beverage. Whether London Porter is entitled to the praises bestowed upon it by its admirers, is not for us to determine; its nutritious qualities have been much vaunted, and doubtless have been, and still are, much overrated. Its chief distinction lies in its peculiarly agreeable flavour, aided by its flushing, mantling effervescence: these characteristic qualities are produced by hops of a peculiar quality, and malts

prepared and dried by a peculiar process, assisted by a peculiar method of conducting the fermentation.

The observations offered on pages 18, 19, on the manufacture of Brown and Porter Malts, will not need to be repeated or enlarged upon here.

Sweetness and mealiness are criteria of the value of Pale Malt; but they apply not to these Brown or Porter Malts. Of the latter we can form no judgment, but by the aid of the saccharometer: with its assistance, however, we may arrive at a satisfactory result, provided the mashing heats be judiciously regulated and applied, according to the degree of colour the malt possesses. It has been found, that the average extract from pale malt is about 80 lbs. per quarter; while brown malt yields an average of about 62 lbs. only. This deficiency is a very material one, being at the rate of 22 per cent. The difference in the density of worts drawn from this malt Brewers seek to remedy, by lessening the quantity of brown, and increasing the pale, relying upon the use of Black or Patent Malt to give it the desired complexion. It is important, however, to maintain a due proportion of brown malt, as black malt communicates no flavour or character to the beer; and neither the pale nor black can excite that

astringent sensation on the palate, produced by the brown. Amber Malt is likewise employed with advantage, it more nearly resembling the pale malt in its produce, while it can be more largely introduced than the pale, without affecting the colour, or injuring the quality or flavour of the porter.

It is not easy to determine the most profitable proportions in which grists may be made up. The saccharometer will always enable us to ascertain the density of the produce, and experience will decide what proportions yield the richest extract, with the finest flavour and deepest colour.

The following proportions, or slight modifications thereof, will be found useful in practice. They are regulated on the scale of a twenty quarters brewing :—

Pale.	Brown.	Amber.	Black.	Quantity.
12	7	..	1	20
18	..	..	2	20
..	..	19	1	20
9	5	5	1	20
11½	6	2	½	20

As a rule, the malt of whatever kind should be sound, and well dried, and the hops strong and thick blossomed, rich in condition, dull in colour, and sufficiently matured in their growth. A

species of the hop called the Humulus Germanicus, grown in Kent, is well adapted for porter brewing, for it requires some months to mellow it; and its soft, full, and peculiar bitter, is enhanced by keeping. All hops are improved by eight or ten months' age, for when new they do not yield their bitter apart from harsh and disagreeable extracts. Eight lbs. or 9 lbs. of good hops per quarter of malt, will suffice for porter intended for home consumption; 10 lbs. or 11 lbs., for exportation.

Indispensable qualities of good porter are fulness, potency, and flavour; and in these it differs from well-brewed ale, which is thin, spirituous, and vinous. We may here be permitted again to refer to the importance of using only that black malt which is made of good barley, thoroughly malted, and possessing a sound inside, of a uniform, dark, chocolate colour; thus malted, it contains not only a larger quantity of colouring matter, but it is rendered more soluble by the saccharising power of germination. It consists chiefly of burnt saccharine and mucilage, which impart an agreeable odour to the beer, and maintain its colour with tenacity; but the ill-malted and inferior sort is worse than useless, creating numberless obstacles in the mashing process. The difficulty with which it is managed, and the

impediments it presents in its admixture with other malts, led to the suggestion of setting apart a vessel expressly for the purpose of mashing this patent malt in, and adding its produce to the wort in the underback, the copper, or the hop-back, as the judgment of the operator may dictate. In such a case, it becomes necessary to remove the produce by means of taps, placed one above the other in the side of the vessel, as the extract will not perforate its own sediment. The mashings may be repeated, and the process continued as long as any colour can be obtained. This kind of extract may then be concentrated by boiling, cooled down, and vatted; and in this way several weeks' stock may be kept on hand, in good condition, without any danger of its decomposition.

London Porter has a density of from 20 lbs. to 24 lbs. per barrel; and ordinary Stout, for home consumption, from 25 lbs. to 28 lbs. per barrel; when stronger, it is usually exported, or sent into the country. The mode of extracting Porter Wort does not differ from that recommended in brewing ale, except that additional mashing may be requisite to reduce the pasty consistency and insoluble parts of the high-dried corn, especially of the black malt, when the latter is mixed in the tun. The mashing-heat in the tun should be

low, in proportion to the heat the malt has sustained on the kiln: low heats will yield brighter extracts, and *vice versâ*. But the heat should never be so low as to bring off a grey, mealy extract from the pale malt, as such would interfere with its durability. If you have to mash thrice, take the heats 158°, 176°, and 188°; and if four times, 158°, 164°, 180°, and 190°.

Some of the London Brewers are in favour of long boilings; but from the principles laid down, it will be seen that long boilings do not add to the keeping properties of the wort, nor does the density increase in proportion to its evaporation. Fulness and body are two of the most agreeable qualities of porter; these depend upon the gluten in the wort, and this substance is destroyed by long boiling. Porter, therefore, ought not to be boiled any longer time than ale—that is, from one hour to one hour and a half for each wort, exclusive of boiling for gravity. One chief object Brewers propose to themselves in boiling so long, is to extract all the bitter from the hops; but this may be best attained by steeping them several hours in water, between 142° and 172°, as recommended for bitter ale. The general method of proceeding in fermenting porter, differs from the cool and gradual process so essential to preserve the sweet

flavour and richness of ale. Porter owes much of its tart and astringent flavour to a high, rapid fermentation, which carries down the density, without diminishing the high flavour drawn from the materials. This rapid process also suits the extract of brown malt, which, being less dense than that from pale, cannot support a vigorous fermentation, and the yeast being more rapidly thrown off, leaves the beer clear and durable. The pitching temperature should be taken between 64° and 68°, except in summer, when it may be taken as low as possible; the heat of the gyle should be curbed between 74° and 78°, and the attenuation not carried below 12 lbs. or 11 lbs. before it is cleansed. The fermentation in the tun will ordinarily be concluded in about forty-eight hours. The cleansing casks must be filled up occasionally, though moderately, as the beer will work off freely. When 7 lbs. or 6 lbs. gravity are left unattenuated, it may, if fine, be vatted in a large body, to improve and mellow it. Should the gyle, after it is vatted, exhibit a disposition to fret, leave the manhole open for a few days; if the disorder do not abate, throw into it the spent hops from one or two gyles, which will usually check it. A stock of old porter, sufficient for staling twelve months' consumption, should be

kept on hand. It should have undergone the same attenuation as keeping beers, and been fined from the yeast before starting. This sound and superior porter should be mixed in the proportion of one-third with all sent out; it will produce a beverage of uniform strength, having the flavour of age, fine in summer, and full of tone in winter. The proper proportion must depend, however, in a great measure upon the taste of your customers, as no specific rule can be of universal application. It will in all cases be advisable to mix it yourself. Never send out Mild Porter entire, as the admixture, if done by others, may spoil the article, and the fault be charged upon your management. Considerable loss by absorption and evaporation takes place in the store, according to the time occupied in storing: the use of wooden vats greatly aggravates this evil; and the smaller the vat, the greater the waste. A vat containing fifty barrels will, in an ordinary store, lose about two gallons yearly; while one containing five hundred gallons will not, in the same time, show a deficiency of more than five gallons. Much of this loss may be obviated by providing each vat with a small valve opening outwardly, and loaded, on the principle of a safety valve, with a weight of 1 lb. to every square inch. The best cellars are those

that are slightly humid, as dry cellars are found to evaporate full fifty per cent. more of the spirituous content of their stores than those which are damp. They should be dug as deep as local circumstances will admit.

Porter, brewed for exportation, has a density of from 25 lbs. to 32 lbs. per barrel, with 10 lbs. or 11 lbs. of hops per quarter of malt. Prior to shipment, it ought to be vatted ten or twelve months; and as the motion of the ship and the heat are apt to set it at work again, it is necessary to flatten it before the final racking, by leaving the manhole of the vat open for three or four weeks. To guard against premature acidity after its arrival at the place of its destination, all matter tending to its turbidity should be precipitated by finings, and it should not be racked until it has become perfectly bright. Cane plugs, owing to their porosity, or those made from a peculiar red oak nearly as porous, afford additional security to the casks on their transit, by allowing some of the generated gas to escape.

In conclusion, let me urge upon every Brewer the importance of making himself thoroughly acquainted with the laws which affect the delicate chemical process which he has to control; let the saccharometer and the thermometer be his indis-

pensable monitor and guide in the application of those principles, and success will not fail to crown his enlightened and well-sustained efforts.

METHOD OF RECOVERING DAMAGED MALT.

When malt has absorbed moisture, the husk becomes tough, the farina yellow, putrid, and offensive; such malt can never produce sound beer. A considerable improvement, however, may be effected in it, by mixing the mass thoroughly with chloride of lime, so that every grain may be enveloped by it. In this condition it should lie upon the floor for two or three days, if thinly spread; but if heaped, eight or ten hours will suffice. The lime, from its strong affinity for water, will extract the moisture, together with the noxious vapours it has generated, and will neutralise all prevailing acidity.

The same result may be obtained, although more slowly, by intimately blending the grain with powdered charcoal, and allowing them to remain some weeks in contact. The malt should then be gently dried upon the kiln, screened twice or thrice, and brewed immediately, mixed with three-fourths of sound malt. There is still danger of its corrupting the whole mash; the safer course, therefore, is to colour it brown or black for porter malt, in which state it is less liable to injure.

WASHING AND PURIFYING CASKS.

It is of the very first moment that the casks you purpose racking in be sweet and sound, otherwise your labour is lost, your beer will assuredly spoil, and become unfit for use. Casks that are not kept long on ullage, but speedily re-filled, need only to be rinsed with boiling water, or, when the necessary apparatus is provided, by steam and liquor taps; but such as have become foul through neglect, or through the putrescence of the vegetable matter they contain, require some more searching power—such as charcoal, sulphuric acid, chloride of lime, or brimstone burnt by match, or on a chaffing dish of coals within the cask. When the evil is not removed by any of these means, the cask should be unheaded, scraped, and the foul parts pared away. A moderate stinker may, however, be rendered perfectly sweet by introducing into it a few gallons of sweet grounds, some ounces of chloride of lime, and a small quantity of sulphuric acid, filling up with boiling water, bunging tight, and agitating the whole in different positions occasionally for a few days. A method said to be more effectual than any of the preceding, is to introduce hot air by means of an apparatus patented by Messrs.

Davison and Symington, rinsing the casks with beer of the quality they are to be filled with. All new casks need seasoning by one or other of the foregoing processes, and, as a precautionary measure, should be filled two or three times with inferior beer, before the best ales are racked into them.

BOTTLING.

Ascertain that your ale or porter is in a fit condition before you bottle it. If it be mellow and fine, and but slightly saccharine, it will do, if previously flattened; but should it exhibit briskness, it is a sign that it is still too active to be bottled with safety. If your bottles have been used before, rinse with small shot, or with what is a better cleanser still, small nails. Provide corks that are not worm eaten, but solid and close. Fill up the bottles within two inches of the top, and leave them open for twenty-four hours; then cork them tight, and lay them on their sides in sand, covered with saw dust. When the beer is up and drinkable, the air bubbles will ascend to the top, and may be seen on holding the bottle to the light. Should a breakage be discovered in the binns, the bottles must immediately be set standing on their ends.

DIRECTIONS FOR MANAGING A BREWING OF TWO QUARTERS OF MALT.

As the writer knows from observations on an extended scale, that by far the larger number of licensed Brewers mash less than three quarters of malt at one time, and that they are for the most part unprovided with many of those costly, though invaluable appliances, to which reference has been made in the former part of this work, he proposes, for their guidance, to trace a two-quarter brewing from its commencement to its close.

We must assume, however, that, as Brewers by profession, each man conducts and controls his operations by means of the thermometer and saccharometer. Without the aid of the former instrument, it is impossible for him to regulate the heat of the liquor necessary to penetrate the malt, dissolve the farina, and extract the substance. The most distressing results will follow: by too high a heat he will lock up much of the malt, causing it to run into balls, or lumps of glutinous paste, hard on the surface, but dry within. This evil cannot be remedied, as no subsequent mash will penetrate these lumps, and a loss of one-third of the malt will in consequence be sustained. On the other hand, by too low a heat he will bring

off a grey, mealy extract, in which farina and other fermentable matters are suspended and imperfectly dissolved. Besides, it is equally impossible to determine but by the thermometer the heat at which the worts should be set to ferment; to depend for the mashing heat upon the reflection of your face in the water, and in the pitching heat upon the touch, is to risk your property, your reputation, and your business, on the shifting sand: the temperature of the air, and the variable warmth of the body, may lead, as they often do, to erroneous conclusions, the consequences of which will frustrate every expectation of a successful fermentation. Equally indispensable is the Saccharometer, or "Brewer's Compass" as it is called, in ascertaining the value of the material and extract you obtain; and in enabling you to conduct the fermentation, and to check it at the proper stage by cleansing and subsequent rackages. Since the invention of these instruments, brewing has become a science, and continues no longer a mere mechanical operation, which any illiterate man may be entrusted to perform.

I will not again enter upon the tests, nor describe the properties which will enable you to select the best materials. For information on this head, I must refer you to the former part of this work;

but will here observe, that a bushel of good malt is estimated to possess saccharine properties equal to 24 lbs. to 25 lbs. of the best Jamaica sugar, and should weigh from 40 lbs. to 44 lbs. avoirdupois. The malt should be uniformly crushed, and not ground, as it will then release the wort into the underback in a much finer state than if ground, and the flavour of the wort be improved. This operation should have been performed thirty-six hours, if practicable, before it is used, as it will then have parted with the heat generated by grinding, and have softened down, be better disposed to imbibe the liquor, and yield a larger produce. It will likewise ferment more freely, and arrive sooner at maturity. It may not be out of place here to notice an opinion commonly entertained, that good ale cannot be brewed from a small quantity of malt. This is untrue, except where the quantity is so small as to prevent the proper temperature from being kept up: by steadily applying the principles herein explained and developed, no Brewer need doubt to produce an article which will repay his toil in manufacturing it. Malt contains salts and oils: the former excite fermentation, while the latter retard it; so much of the oil, therefore, should be extracted as will counteract the excitement of the salts, and the

proportion will depend upon the state and colour of the malt, the strength of the wort, and the time intended to keep it: high heats will extract the oils, low heats the salts.

Two quarters of malt should yield four barrels or one hundred and forty-four gallons of good ale; and one barrel and a firkin, or forty-five gallons, of excellent table beer; or, if the ale and table beer worts are mixed together, five barrels and a fourth of weaker ale. When the water in the copper is brought to nearly boiling point, one hundred and thirty-four gallons are turned into the mash tun, with as much cold water as will reduce the heat to 178°. We shall assume, that ten gallons of cold water are added, which will bring up the whole to one hundred and forty-four gallons: equal to nine gallons per bushel of malt. One person must now gradually let down the malt from the hopper into the liquor, while another is employed in mixing them thoroughly together. This mashing operation will occupy full half an hour, as every lump must be completely broken, and reduced to an equal consistency. Now place the cover on the tun, and over it throw the empty malt sacks, and a blanket to retain the steam, and keep the mash hot. Refill

your copper with water, to get hot for a second mash, or rather sparge. After the mash tun has remained covered for the space of nearly two hours, turn on the three taps partially, and run the wort into a pail placed in the underback. As soon as it runs perfectly clear the pail is removed, and the wort allowed to run direct into the underback; while the contents of the pail are returned into the mash tun, and the taps turned on by degrees, for the freer passage of the wort into the underback. If the wort run quite clear, and form a transparent, frothy head, some inches high, the proper mashing heat has been chosen; if this head be turbid, and tinged with red, it is a sign that the liquor was too hot; but if it descend frothless and dead, it is proof that the liquor was too cold. The heat of the wort, at the time it is thus discharged into the underback, should not be under 144°. Remove the cover of your mash tun, and, before the wort sinks below the surface of the grain, shower over it, through a coarsely perforated watering pot, at slight intervals, about one hundred and twenty-eight gallons of liquor, heated to about 188°. This process, termed sparging, is to be preferred to a second mash. The operation itself is greatly facilitated by employing a

proper sparging machine, of a simple and inexpensive construction, which will soon repay its cost by its economy of labour. From this first running, ninety-six gallons of wort, at a gravity we suppose of 26 lbs. per barrel, are drawn off before the taps are turned; and ninety-eight gallons more, at a gravity of about 22 lbs. per barrel, are subsequently drawn from the spargings, which together amount to one hundred and ninety-four gallons of an average gravity of 24 lbs. per barrel. This quantity will be reduced fully one-fourth by the process of boiling, by absorption of the hops, and evaporation in cooling, and will eventually measure little more than the one hundred and forty-four gallons required; but while it will thus have decreased in quantity, it will have proportionably increased in gravity, and will prove, if properly fermented, a stout and good-bodied keeping ale.

Meanwhile, the copper has been refilled, the water boiled, and, when cooled to a temperature of 198°, forty gallons is sparged on the grains for the table beer wort, and allowed to remain on the mash for the space of one hour and a quarter. Before the copper is empty, the fire is damped, and the whole of the ale worts from the under-

back turned into it as quickly as possible, with 8 lbs. of the best hops: the fire is rekindled, made to burn briskly, and the wort to boil as quickly as possible, and kept so boiling, that it may the sooner break, and fine itself. After it has thus boiled for thirty or forty minutes, the wort will probably be broken, and much of the goodness of the hops extracted: the remaining 8 lbs. of hops are now introduced, and the boiling continued for thirty minutes more. By this mode of dividing the hops, an aromatic flavour is imparted to the ale which greatly improves it, while the hops are more valuable for the table beer wort. The boiling being finished, and the fire damped, the wort is run off upon the cooler through a large hair sieve, but is well stirred in the copper while running, to prevent the hops from subsiding at the bottom. In the meantime, about seventy gallons of the table beer wort, at a gravity of about 6 lbs. to the barrel, has been run into the underback, and is with the hops quickly turned into the copper, and the fire renewed. This wort is then made to boil quickly for the space of one hour, and turned off on the coolers in the ordinary way; or, as it is very desirable to increase the gravity of so weak a wort, it is allowed

to remain all night in the copper, with the fire damped, which will further decrease the bulk by evaporation to from forty-eight to forty-four gallons, according to the means employed.

Let us pause a moment, to consider what has been advanced: it has been stated, that 1 lb. of good Jamaica sugar, thoroughly dissolved in one gallon of water, will indicate by the saccharometer a gravity of 14 lbs. per barrel; also, that one bushel of malt is as valuable to the Brewer as 25 lbs. of sugar. In two quarters of malt, therefore, he possesses saccharine matter equal to 400 lbs. of sugar. Now, the first mash, in which we employed nine gallons of water to every bushel of malt, may not quite extract one-half of this saccharum; we have supposed, therefore, the ninety-six gallons, drawn off the first running, to have a gravity of 26 lbs. per barrel, and to have extracted 194 lbs. of the 400 lbs.; we have then supposed the ninety-eight gallons of the second running to indicate a gravity of 22 lbs., and to have extracted 156 lbs. more. There remains, therefore, only 50 lbs. of saccharine on the goods for the table beer wort; and were it possible to extract the whole by this mash, they would give to the seventy gallons drawn off a gravity of

10 lbs. per barrel; but as this is not possible, and as 20 lbs. will probably be left with the grains after the operation is concluded, their gravity, instead of 10 lbs., will be 6 lbs. only: now, as this quality of wort is very weak and poor, and contains a much smaller quantity of the sugar of malt than an equal weight of either of the previous runnings, it may be necessary to raise it to 9 lbs. or 10 lbs. by the process of evaporation described, which will reduce the bulk to about forty-four gallons.

Our operation was conducted thus: we turned into the mash tun one hundred and thirty-four gallons of water nearly boiling, and added, say ten gallons of cold water, to reduce the heat to 178°, being one hundred and forty-four gallons in all; we then turned into it the two quarters of malt, each bushel of which absorbed full three gallons of water (forty-eight gallons), leaving only ninety-six gallons free, which is all that could have been drawn off the first mash, had we run the goods dry before sparging; and as the goods will continue to retain this quantity in the subsequent worts, we can reckon on drawing off the same number of gallons only, as of water sparged on. The sparging commenced as soon as we turned

the taps for the first wort to run, and continued until we had drawn off ninety-six gallons; the quantity of liquor sparged on during that period was one hundred and twenty-eight gallons, which remained on the mash after the taps were turned off. The taps being again opened, ninety-eight gallons were drawn off from the one hundred and twenty-eight, thus leaving thirty gallons on the mash; forty gallons of liquor was then sparged on, to make up the seventy gallons required for the table wort.

Before we pass on, it may not be amiss to observe, that the lbs. of saccharum extracted are ascertained by the following proportions, viz.: as 14, the gravity of 1 lb. of sugar mixed with one gallon of water, is to the gravity of the wort, so are the gallons drawn off to the lbs. required.

Gravity of 1 lb. of Sugar to 1 Gallon of Water.		Gravity of Wort.		Gallons drawn.		Lbs. of Saccharum extracted.
14	:	26	::	96	:	194
14	:	22	::	98	:	156
14	:	6	::	70	:	30
Remaining with the grains						20
Total						400

The mean gravity of the ale worts is also arrived at in the following manner:—

	First Wort.	Second Wort.
	96	98
	26	22
	576	196
	192	196
Galls.		
96	2496	2156
98	2156	
194)	4652 (	23·9 called 24 lbs.
	388	
	770	
	582	
	1880	
	1746	
	134	

A pint and a half of good brewer's yeast will be wanted to ferment the table wort, which must be cleansed at the end of twelve hours; one gallon of good yeast will suffice to ferment the ale wort. Two quarts of the yeast are dissolved and mixed with two gallons of ale wort, at a temperature of 87°; and when fermentation has commenced in this portion, another gallon of wort is added; and just before the worts are cooled down to the pro-

per temperature, which should be as low as possible in warm weather, 62° in mild weather, and 74° in very cold weather, this ferment is poured over the surface of the fermenting tun, the worts let down upon it, and well incorporated. The other two quarts of yeast are added as occasion may require, to stimulate the fermentation, though care must be taken not to over stimulate, as fermentation should be very gradual, especially at first. The slight white cream which floats next morning on the surface, is mixed up with the mass; a sample is then drawn, and examined by the thermometer and saccharometer, when a slight increase of heat will appear, attended with a decrease of gravity. Towards evening, should fermentation be languid, a small portion of the remaining yeast is added, and well mixed. The second day, should the cauliflower head appear with patches of dark brown yeast on its surface, it must be carefully removed, lest it incorporate, and impart a bitter and unpleasant flavour to the ale; the cream is then mixed with the mass, and a sample taken out, and examined by the thermometer and saccharometer, when a further decrease of heat and increase of gravity will be detected. The gyle is then allowed to remain undisturbed as long as its foamy head continues to retain a light

white colour; but should a head be formed of a uniform dark brown colour, exhibiting a tendency to sink, it is skimmed off; and if the gyle have not reached the degree of attenuation required, which, according to the temperature of the air from 20° to 70°, should range from 14 lbs. to 7 lbs. per barrel (the more matter being left unattenuated the colder the weather is at the time of cleansing), it is in such a case again roused up, and skimmed every two hours, until this point is reached.

The directions I have before given respecting casking, storing, &c., I will not here repeat; but conclude this treatise on Ale brewing, by assuring the operator, that if he conducts his processes by the rules herein laid down, he will find his reward in the uniform production of a drink superior in quality, and cheaper in manufacture, than can possibly be obtained by the casual "rule of thumb" method, which has satisfied many of his forerunners so long, and to which many of his compeers still cling, to their incalculable loss and shame.

CIDER BREWING.

Although Cider brewing in England is chiefly restricted to the apple-growing counties, and is an art totally distinct in itself from that of the ale brewer, a few observations respecting it will certainly not be out of place here.

Cider is a pleasant acid fluid, not possessing the spirit and body of some of our ales, but allaying thirst more effectually, and exerting slightly aperient properties. It is produced by the fermentation of the expressed juice of the apple. The quality of this popular beverage depends on the kind of fruit employed, on its condition at grinding, on the manner of grinding and pressing it, and on the method of conducting the requisite fermentation. Those varieties of apples which are esteemed the best for the purpose, have a light ground, with red streaks on the sunny-side. Mr. Knight asserts, that "when the rind and pulp are green, the cider will always be thin, weak, and colourless; but when these are deeply tinged with yellow, it will, however manufactured, or in whatsoever soil the fruit may have grown, almost always possess colour, and either strength

or richness." A tough and fibrous pulp, smart acid flavour, and an aromatic scent, are also characteristics of a good cider apple. The fruit should be gathered ripe, as it then possesses a larger supply of juice, and of a richer quality: when in this state of maturity, the limbs of the trees should, on some dry day, be slightly shaken, and partly disburdened of their golden store: thus taking such apples only as are ripe, and leaving the unripe ones on the trees, until they have acquired a due degree of maturity, when they may be gathered in the same way. Mr. Knight says, that the strongest and most highly flavoured cider which has been obtained from the apple, was produced from fruit growing on a shallow loam, on a limestone basis; and most writers on the subject are agreed, that calcareous earth should form a component part of the soil of a cider orchard. It is important that each kind of apple be manufactured separately, or at least those kinds only should be mixed which ripen about the same time: the yellow, or yellow mixed with red, should, therefore, be carefully separated from the green, and placed in heaps a few inches thick, under cover if possible, and with free access of air. Here they undergo a species of fermentation, which renders them mellow; and when this ob-

ject is attained, and the decayed fruit removed, they are in a fit state for grinding. By thus collecting in heaps fruits of similar quality and equal ripeness, the saccharine fermentation is more equably and consistently perfected, and the produce is more abundant and valuable.

Each sort of apple should be ground separately, or such sorts together as are equally ripe; but experienced makers assert, that fine cider, of various flavour and strength, is obtained from the same orchard, the liquors being mixed together after they are made. The fruit should be reduced by grinding to an uniform consistence, in which the rinds and kernels are scarcely distinguishable; this should be done slowly, and with free access of air. The quantity of food to feed the mill will depend upon the size and extent of the apparatus. A difference of treatment in its state of "pomace," or "pommage," as it is now called, obtains among makers: some removing it immediately to the press to extract the juice; others allowing it to remain a day or two in the vats, until fermentation has extracted the flavour of the rinds and kernels, and imparted a rich red colour to the juice. Knight ascertained by experiments, that by exposing the reduced pulp to the operation of the atmosphere for a few hours, the specific gravity of the

juice increased from 36 to 67; and from the experiment being repeated in a closed vessel with atmospheric air, he ascertained the accession to be oxygen, which, according to Lavoisier, constitutes 64 per cent. of sugar. In furtherance of this plan, he recommends, that "the fruit should at first be ground and pressed imperfectly; that the pulp be then exposed for twenty-four hours to the air, spread thin, and turned once or twice to facilitate the absorption of oxygen; that it be then ground again, and the expressed juice be added to it before it is again pressed."

It is best to observe a middle course; and soon after the saccharometer has detected a loss of gravity in the "must," or unfermented juice, which, according to circumstances, will take place within twelve and twenty hours' time, to remove it to the press, where a square cake or cheese is formed of it. This is done by spreading layers of the pulp between reeds, or clean straw; or upon hair cloths, laid in succession one upon the other. From nine to fourteen layers are thus placed upon the square frame of the press, and a stout board is laid on the top; the straw is then lowered, and a slight pressure applied, which is increased as the cakes or cheeses become dryer, and until the juice or must is entirely expressed. This operation is

completed by a long lever and windlass. The juice is then strained through a coarse hair sieve, and removed into casks to ferment: it is now a turbid and unwholesome fluid, consisting of sugar, mucilage, essential oil, colouring matter, acid, and water. As the first of these only can produce alcohol, one might reasonably suppose, that the sweetest apples would produce the strongest cider; this, however, is not the fact, as the juice of those apples has a strong tendency to the acetous fermentation, which must be carefully guarded against, as no subsequent effort will avail to arrest it.

When the juice is thoroughly extracted, the cakes are usually thrown away; but in scanty seasons they are sometimes laid by, and re-ground with water, and the washings thence obtained made available for family use.

The vinous fermentation commences and terminates at different periods, according to the quality and condition of the fruit and the state of the weather. Fermentation should not be conducted with too much heat, or the process will be too rapid: a temperature of 45°, more or less, will enable the vinous fermentation to proceed with regularity and completeness. When the ebullition caused by fermentation has ceased, and a

thick crust has collected on the surface, the liquor will be clear and of a vinous flavour; at this stage, the clear liquid should be racked into open vessels, kept cool for a day or two, and returned into casks previously sulphured. This fuming of the casks with burning sulphur is termed "stumming," and is used as a precaution to prevent excessive fermentation. It is performed in the following manner:—the cask having been scalded and dried, and a few gallons of cider put in, a piece of rag, two inches broad and some inches long, saturated with sulphur, is lighted and suspended through the bung-hole; the bung-hole is then stopped, and the cask well rolled, so as to incorporate the sulphurous acid with the cider. The sediment remaining after racking, may be strained through filtering bags, and be mixed with inferior cider; it is sometimes employed in checking irregular fermentation, which it does by precipitating the gross lees, and leaving the cider clear and vinous. When, by careful management, a proper vinous fermentation has been secured, the cider will exact but little more attention than filling up the casks each fortnight, to supply the waste caused by silent fermentation; but if scum again collect on the surface, it must immediately be racked off, as it would produce bad effects if suffered to sink.

Towards the end of February, if it prove bright and quiet, it is fit for its final racking, which should always take place on a bright day: but if on trial it appear cloudy and foul, it should be fined down with isinglass; and two pounds of loaf sugar, to each hogshead, may with advantage be added to it.

Soon after this spring racking, but not till then, the casks may be gradually stopped, and the bungs after a few days tightened. In the month of April, it will probably be ready for bottling, which operation should be performed on a cool and dry day. The bottles should be filled to within two inches of the top, left unstopped till next day, then tightly corked, secured with string or wire, and finally waxed. Their condition in the binn must occasionally be ascertained. Should a breakage be discovered they must immediately be set on end; when ripe, air bubbles may be seen ascending towards the cork, on holding up the bottle to the light.

BRITISH WINES.

As I do not intend entering largely in the present treatise on the manufacture of Wines from native fruits, although the subject is one deserving a large share of attention, upon both economical and sanitary grounds, I shall endeavour to be as concise as consistent with perspicuity, and usefulness.

We must admit, at the outset, that wines produced from grapes are superior to all others in purity, strength, and flavour, and will ever be the standard to which we must seek to conform those made from other fruits. The juice of the grape when newly expressed, and before it has begun to ferment, is called "must,"—in common language, sweet wine; it is turbid, having an agreeable and saccharine taste; it is also very laxative, and when drunk too freely, or by persons disposed to diarrhœa, is apt to occasion dangerous illness: it is somewhat less fluid than water, and becomes almost of a pitchy thickness when evaporated.

When the must is pressed from the grapes, and put into a proper vessel and place, with a tempe-

rature between 55° and 60°, very sensible effects are produced in it, in a shorter or longer time, according to the nature of the liquor, and the exposure of the place. It then swells, and becomes so rarefied, that it frequently overflows the vessel containing it, if this be nearly full; an intestine motion is excited among its parts, accompanied by a hissing noise, and evident ebullition: the bubbles rise to the surface, and a quantity of carbonic acid gas is disengaged at the same time; the skins, stones, and other grosser matters of the grape, are buoyed up by the particles of disengaged air that adhere to their surface, are variously agitated, and are raised in form of a scum, or soft and spongy crust, that covers the whole liquor.

During the fermentation, this crust is frequently raised and broken by the air disengaged from the liquor which forces its way through it; afterwards, the crust subsides, and becomes entire as before. The effects continue while the fermentation is brisk, and at last gradually cease; then the crust, being no longer supported, falls in pieces to the bottom of the liquor. At this time, all sensible fermentation is arrested by putting the wine into close vessels, and carrying them into a cellar or other cool place, and depositing them there.

After this first operation, an interval of repose takes place, which is indicated by the cessation of the sensible effects of the spirituous fermentation. If we examine the wine produced by this first fermentation, we shall find that it differs entirely and essentially from the juice of the grape before fermentation: its sweet and saccharine taste is changed into one that is very different, though still agreeable, and somewhat spirituous and poignant; it retains no longer the laxative quality of the must, but affects the head, and occasions, as is well known, inebriation. And, finally, if it be distilled, it yields, instead of the insipid water obtained from the must, a volatile, spirituous, and inflammable liquor, called spirit of wine, or alcohol.

Although wines have been made from the fruits of this country for centuries back, they have never established a reputation in public esteem. This is doubtless owing to the fact, that in eleven cases out of twelve they are nothing better than ill-fermented compounds of sugar, juice, and spirit, conveying no strength to the system, but injuriously affecting the functions of the digestive organs. These results are attributable to the inexpert and clumsy manner of making them, and not to the impossibility of manufacturing a wine which shall act as a gentle stimulant, and a kind promoter of

health. When domestic wines are fabricated with care, and the fermentative process completed according to nature and art, the wholesomeness of the product is certainly equal to those wines imported from the great vine districts, and assuredly far more so than a great quantity sold in this country under the name of Foreign Port and Sherry.

The price of Foreign wines, and the extensive and shameful adulterations to which they are commonly subjected, render it important that a wine should be introduced, well fermented, genuine, cheap, and wholesome; accessible, as respects cost, by all, and easily manufactured by any careful operator.

The fruits most valuable to the maker of British wines are those which are richest in sugar and in fermentable extract, or natural leaven, as both these principles concur in producing its spirituosity, and, therefore, the more of these ingredients they contain, the stronger will the wine produced from them be. Most of the fruits we are about to treat of contain the following principles, viz.:—sugar, malic acid, vegetable albumen, tartar, sweet principle, oxalate of potash, colouring matter, flavour, tannin, and water. These ingredients vary very much in their proportions in different fruits; thus,

the oxalate of potash is a salt of very rare occurrence, a trace of it only being discoverable in some fruits; whilst tartaric and malic acid are common nearly to all; and mucilage, or extractive matter, so essential to produce in the wine its vinous character, is common to all. The diversity in the quality of fruits, is occasioned by the different proportions in which these ingredients combine in them. We shall briefly advert to each.

Sugar is a crystallisable substance, and is extracted from the sweet principle of vegetable juices by chemical means; the more abundant this ingredient is, the more spirituous will be the wine produced from it.

Malic acid is a saline substance, abounding in our native fruits, especially in the apple. It constitutes the leading distinction between wine and cider; but when in excess, is always prejudicial to the former.

Vegetable albumen, or extractive matter, is an azotised substance, and is the body capable of inducing fermentation, and of producing that change in sugar which resolves it into alcohol, and carbonic acid gas.

Tartar is an indispensable ingredient in the manufacture of all genuine wines, and where a deficiency exists, as in the juices of our native

fruits, it is necessary to supply it artificially, in order to improve the quality of the produce, by increasing the quantity of spirit the sugar is capable of yielding. It exists in a larger proportion in the grape than in any other fruit, and it is this that renders it fitter for wine making than any other. It undergoes a change during fermentation, and part of it is deposited as a hard, grey, or red crust in the casks, or bottles. It is obtained in large quantities from the wine countries, where it is deposited from wines in the casks, as a white or reddish crust, and is known by the name of "argol," or crude tartar. When this is purified from colouring matter by re-crystallisation, we obtain a white tartar (purified tartar), the power of which is well known under the name of "cream of tartar."

The sweet principle is distinguished by the difficulty with which it is crystallised, and its tendency to ferment on the addition of water.

Oxalate of potassa is a salt of rare occurrence: it is formed by the vital process in some fruits; it is found abundantly in the leaves of the wood-sorrel, from which it is obtained by evaporation and crystallisation, in white, sparingly soluble crystals, in which form it is commonly used for removing ink-spots from linen.

Colouring matter does not exist in many of our fruits. It is often communicated to our wines by adventitious ingredients, such as elderberry juice, which serves to produce various tints of red; and burnt sugar, various tints of yellow.

Flavour, according to Leibig, depends upon a peculiar volatile substance of an oily nature. It cannot be detected previous to fermentation, but is formed, during that process, from fruits containing a large proportion of tartaric acid.

Tannin is that principle which imparts to wine that astringent and rough character so recognisable in Port wines. The damson and the sloe, among our fruits, contain large proportions of this ingredient.

Lastly, Water exists in large proportions in most fruits; and, however insignificant a product it may appear, it is nevertheless of vast importance. When the quantity in the fruit subject to fermentation is deficient, it must be supplemented, else that process will be maintained with difficulty, and the product will be a sweet, half-fermented wine, like those of some Foreign countries.

Fermentation, by which these principles are modified, or resolved into other bodies, is divided into primary or active, and secondary or insensible. Primary, or active fermentation, takes place when

the elements necessary for conducting that process, viz. an active acid matter and saccharum, are in solution and in immediate contact, and the temperature from 50° to 80°. These ingredients then resolve themselves into alcohol and carbonic acid, and further decomposition is arrested. The secondary, or insensible fermentation, is a continuation of the former, and takes place when the wine is in the cask. Care should be taken to keep the level of the must as near the bung-hole as possible, so that the ferment may flow out; and a covering should be placed over it so that the air may, as much as possible, be excluded; and when the wine decreases through loss of heat, or other cause, it should be made up. On the judicious management of this process, the quality and permanency of the wine mainly depends. This is also the time to add anything intended to flavour or colour the wine, as it now enters into permanent combination with it, which is technically termed "fletting in." When spirit of any sort is added, care should be taken not to add so much as will check fermentation altogether. As long as the vinous or insensible fermentation progresses, and alcohol continues to be formed, the wine is gaining in quality; and the more perfectly the atmospheric air is excluded, the less liable is the wine to run

into the acetous fermentation. When the insensible fermentation has continued to the desired length, it is checked by drawing off the wine from the lees, a process termed racking; and, to prevent a new fermentation, the cask, previously well rinsed, is sulphured, by burning in it a sulphured match, by which the oxygen of the air is consumed, and sulphuric acid gas generated; but this preventive must be moderately used, as the wine is apt to acquire, and retain for some time, a taste of the sulphur. This done, the wine is immediately transferred to the exhausted cask, otherwise it will be speedily refilled with common atmospheric air. This plan is commonly adopted to prevent acetous fermentation, and often practised by Vintners when wine is drunk on draught or from the tap. The clarification of the wine is effected spontaneously by time and repose: a deposit is formed at the bottom and sides of the cask, composed of bitartrate of potash, gluten, yeast, and colouring matter. This precipitate is apt to injure the quality of the wine, owing to its susceptibility of being mixed with it by agitation and change of temperature, thereby rendering it turbid, and producing a new fermentation. To prevent this the wine should be drawn off at different periods,

and the lees carefully separated and put into a fresh cask.

Several artificial precipitants are used for clearing wines—such as isinglass, made from fish or from bones; whites of egg, powdered gum, sugar candy, calcined flints reduced to powder; alabaster pulverised, but not calcined; brown paper, &c. Fish or bone isinglass put into the liquid combines quickly with the tannin and dross, and by this union becomes heavier than the wine; spreading through the liquor, it forms a sediment, and, sinking to the bottom, carries with it all floating particles, discolourations, and undissolved tartar. Wines without tannin cannot be cleared with isinglass, as, wanting it, the isinglass dissolves in the liquid, and makes it more ropy, consequently less easily cleared than before the introduction of the glass. Though the wine should contain a large portion of tannin, no larger proportion of isinglass should be used than experience has taught is sufficient to clear with. Bone isinglass, or jelly made from hartshorn shavings, is considered very effective. It acts in the same way as fish isinglass, and combines principally with the tannin. It clears wine equally well as the whites of eggs, precipitating the floating particles as abundantly as they do, with this advan-

tage, that the lees are more compact, and occupy less space, and consequently leave more liquid clear. It is also very cheap.

The whites of eggs combine with the tannin, but much sooner with the alcohol. It is best to clear wines devoid of tannin with eggs, otherwise the bad particles, which prevent transparency, are not dispersed quick enough. Immense quantities of eggs are used by foreigners annually in clearing their wines. In the city of Bordeaux alone, fifteen millions are each year devoted to that purpose. They are preferred for clearing red wines, but the common isinglass for white wines: the latter, however, produces greater transparency.

Little use is made, and, therefore, little experience had, of either gum or sugar candy as clarifiers; they are only used when the substances above-mentioned are not readily obtained.

When calcined flints, or alabaster, are employed, they only produce a mechanical change, being incapable of dissolving. A pint of either is put into a cask of wine, and well stirred with a scourge. After diffusing itself through the liquid, it begins to descend, and carries with it all impurities held in suspension. Many persons affirm, that sand has the same effect, but it appears

that sand sinks too rapidly to produce perfect clearness.

When brown paper is used, an entire sheet is plaited up, and introduced through the bung-hole; it spreads over the surface of the liquid; a second is put in as soon as the first is unfolded; and so on. These sheets only clear the extent of liquid they cover, and would answer pretty well, if one could be sure that the whole of the wine was strained by them; filtration, however, is known to diminish the strength of the wine, and injure its quality.

To prepare three pints of finings for clearing light-coloured wines, take two drachms of the whitest and most transparent isinglass, beat it well with a mallet on a block to make it unfold easily; tear the leaves into the smallest possible pieces, that they may dissolve easily and quickly; put them into an earthen dish, with as much wine as will cover them, and place the dish near the fire, or in a warm room. In six or seven hours, the isinglass will have absorbed the wine, when you must add more. After infusing twenty-four hours, it will be sufficiently diluted to form a jelly; add to it three parts of a pint of wine, luke-warm; knead it well with your hands to break the little pieces not entirely dissolved; strain it through

a clear linen cloth, and squeeze it to extract the jelly; beat it well with a birch twig for half an hour, and add wine till it measures three pints. One pint of this size is sufficient to clear a cask of eighteen gallons. When you are in haste, you may dilute it more quickly by making it boil until it is quite melted; it must, however, be cold when used.

To clear an eighteen gallon cask of red-coloured wine, draw out half a gallon therefrom, and, in a pint of this wine, mix the white of three fresh eggs; beat the mixture well with a whip made of osier or birch twigs, put it into the cask at the bung-hole, and stir up the liquid well with the cleft stick, or the scourge, taking care not to disturb and incorporate the sediment; then pour in the remainder of the wine, and stir the liquid on all sides for two or three minutes; fill up the cask, removing the moss, and chasing away the air bubbles from the bung-hole; replace the bung, wrapped up in a new piece of cloth or paper; after six or seven days' repose, the wine will be clear, and fit for bottling; but no harm will ensue by allowing it to lie longer. New-made wine should be disturbed as little as possible, as insensible fermentation is always awakened by its removal.

Wines ripen much better in large than in small bodies; this led, on the continent, to the construction of tuns of an enormous size, as that of Heidelberg, which was thirty feet in length by twenty in depth, and was one among several of almost equal capacity. In these, wines are preserved for centuries—always improving; but it is essential to keep the vessels always full, either by replacing each quantity drawn off with newer wine of similar growth, or by throwing in washed pebbles, to fill up the void. In the last century, for want of such a precaution, the residue of a cask at Strasburg, bearing date "Anno Dom. 1472," was found to have become thick and sour.

When wines have attained their maturity in the wood, they are usually drawn off into bottles. This operation should be performed in fine weather, and, by preference, during the months of March or October. The bottles should be perfectly clean; the corks sound, and as elastic as possible, so that, when driven beyond the narrow part of the neck, they might expand, and perfectly exclude the air; and, to further this object, the neck of each bottle might be dipped in melted wax. They should be kept in a cool and dry place.

Among our native fruits, those best adapted for

wine making, are the gooseberry, the white, black and red currant, mulberry, elderberry, blackberry, raspberry, strawberry, cranberry, cherries, grape, ripe and half ripe; rhubarb stalks, the damson, and the sloe. Some roots are also used, such as parsnip, beet, &c.; and also flowers and leaves, as cowslips, elder-flowers, balm, &c. Of these, the gooseberry and the currant are in most general use: when employed in their green state, they produce a brisk and sparkling wine, somewhat resembling champagne. Ripe currants, when properly managed, make an excellent wine, not inferior to gooseberry. The abundance and cheapness of the elderberry, and its capacity for making an excellent red wine, recommend it to particular notice. It contains a large proportion of extractive matter, which is the chief ingredient required to produce a free and full fermentation; but it is deficient, in a great measure, of acid and sugar, which two principles it is necessary to supply artificially to the must. From the strawberry and raspberry wines of an agreeable quality, both dry and sweet, can be produced, but the flavour of the fruits is generally lost in the process. It is possible, however, to retain much of their piquancy and fragrancy, by infusing the fruit during fermentation. From our grapes, both

ripe and unripe, a wine may be obtained nearly resembling Foreign; but they are deficient in sugar, which has to be added to the must. Of all our domestic fruits, none perhaps are better adapted to the use of the wine-maker than the stalk of the rhubarb plant, the pure juice of which abounds in acid and fermenting principles, both of which are indispensable to his art; and though it contain but little of the saccharine or colouring principles, he has these always at command, and may supply them artificially in any proportion he may please.

The orange and lemon, although not native fruits, are much used for domestic wines: they contain a quantity of uncombined acid, differing little from the tartar of the grape, and we might from hence expect that their produce would be of good quality; they are, however, deficient in extractive matter, or leaven, and, on this account, are incapable of being converted into wine, even with the aid of sugar, unless yeast or some other leaven be added; and as it is impossible to supply the yeast of beer in sufficient quantity to perfect the fermentation of the fluid without spoiling the flavour, these wines usually are imperfect and sweet. Raisins are also extensively employed, and, when properly managed, they produce a full, tasteless,

vinous fluid, to which any required flavour may be imparted.

A chief aim in the manufacture of our wines, is to prepare a must, constituted of ingredients similar in degree and kind to that produced from the grape. Almost all our fruits are deficient in the saccharine principle, and in tartaric acid, two essential ingredients in wine making; while malic acid exists in too large a proportion, deteriorating the quality of the wine, and making it more nearly resemble cider and perry. These obstacles must be met, first, by diluting the juice of the fruit, so that a given quantity thereof shall contain no more malic acid than an equal quantity of grape juice; and, secondly, by supplying the deficient principles, sugar and tartar, in the proportions necessary to resemble it. I will now proceed, therefore, to lay down some simple and efficacious principles to guide the operator in determining the value of the juice and sugar, and enable him with confidence to conduct the process to a successful result.

As the Brewer's principal study is to exhaust all the fermentable matter which his malt contains, so the Wine Maker's object must be, to extract all the goodness from the fruit he uses. He has also, whatever may be the character or quantity

of the wine he makes, to convert into spirit the sugar of the fruit, as well as the raw sugar added to bring the must, or juice of the fruit, up to a proper standard. Now, the specific gravity of the pure juice, and of the sugar, and their consequent value, together with the changes which they undergo in the progress of attenuation through fermentation, can alone be ascertained by the saccharometer, and hence the indispensable necessity of such an instrument in every stage of the operation. Indeed, without its aid, it is next to impossible to make wine of any description. It is used, first, to ascertain the specific gravity of the pure juice in lbs. weight per barrel; secondly, of the pure juice, with water; and, thirdly, of the mixture of juice, water, and sugar; so as to bring up the must to the intended standard, and thus obtain a uniform produce. Subjoined is a table of the specific gravities of the pure juice of some of our native fruits adapted for wine making; also, of the pure juice of oranges, lemons, and Foreign grapes; with the specific gravity of the liquid extract from raisins, parsnips, honey, sugar, and malt, when a pound of each of these has been steeped into, or incorporated with, one gallon of water, at the temperature of 60°.

Pure Juice of	Average gravity in good years.
Green Gooseberries (two-thirds ripe)	20·6
Currants, White	21·
Ditto, Red	22·
Ditto, Black	21·
Mulberries	22·6
Elderberries	21·8
Ripe Grape ("Sweetwater")	26·8
Ditto, half ripe ditto	17·4
Oranges	18·6
Lemons	14·4
Foreign Grapes	26·2
Rhubarb	6·
Raisins (1 lb. steeped in 1 gal. water 21 days)	6·8
Parsnips (5 lbs. boiled in ditto 2 hours)	5·8
Honey (1 lb. mixed in ditto)	12·
Sugar (1 lb. Jamaica ditto)	13·8
Malt (1 lb. ditto)	9·4

The standard gravity which experience has fixed for making a generous and strong wine is 46·, except for champagne wine, when 42· will do. Assuming the standard, therefore, to be 46·, and that the juice of the fruit, in a good year, should indicate a gravity of 21·, and be further reduced by water to 10·5; the deficiency 35·5 would have to be made up by sugar. In warm and dry

seasons, when the fruit is very good, two-thirds of water will be a fair proportion to add, to one-third of juice; in less favourable seasons, equal quantities of juice and water may be used; but in bad years, when the juice is thin, and the gravity low, more of the juice and less of the water must be employed. It is best, however, always to err on the safe side, for the stronger the juice is, the better will the fermentation be; owing to the presence of a greater quantity of fermentable extract or natural leaven which it contains. Suppose the fruit of a good year to yield juice of a gravity of 22°, by adding an equal quantity of water as of juice, we shall reduce the gravity to 11°. Now let us fix upon this gravity, 11°, as our juice standard at all times, and in unfavourable seasons proportion our dilutions accordingly. Having reduced to this point, it will now be necessary to make up the mixed juice and water to our "must" standard gravity, 46°, by the addition of sugar; and as every pound of sugar yields a gravity of nearly 14° per gallon of water, it follows, that in order to make up the 35 deficient degrees, we must add 2½ lbs. for every gallon of must prepared. Having ascertained by the saccharometer that the must has attained a gravity of 46°, we have now to promote fermentation by heat,

and frequent agitation; and to note the progress of attenuation occasionally, until it has reached the desired point. When these processes have been properly managed, it will be found unnecessary to add spirits to the wine, as it will keep better, and be far more wholesome, without than with them.

A very excellent aid to, or cheap substitute for sugar, will be found in malt wort of the first running: the wine, moreover, will possess more softness of flavour, and spirituosity, than if made from sugar only. Malaga raisins form another excellent basis, and are extensively used by manufacturers of home-made, and adulterators of foreign wines. The extract of raisins is chiefly employed in making such wines as ginger, cowslip, elderberry, beet, and parsnip; as they contain but little of the natural leaven so necessary to fermentation; while raisins possess it in a high degree, and will ferment spontaneously. If sugar is used with such, instead of raisins, an artificial leaven must be employed. Perhaps a combination of sugar, malt, and raisins, would answer best in the manufacture of our British wines, and improve alike their strength and flavour. When an artificial yeast is wanted, argol or crude tartar may be advantageously employed. This substance, which,

as we have noticed before, grape wine deposits during fermentation as a thick crust in the inside of a cask, possesses much of that natural leaven which our musts lack; communicates to them an agreeable acid, and proves a most valuable ferment where needed. The artificial means of arresting or checking fermentation, are racking and fining; but when these have failed in restoring thick and turbid wine to that brilliancy and purity so essential to its permanence and value, the cask, when empty, should be filled with the vapour of sulphur by the process already described, and the wine returned thereto: this should be repeated as often as may be found necessary.

Wines may be classified, according to the predominance of certain ingredients, into sweet, sparkling, or effervescing; dry and light; generous and strong. Sweet wines are those in which the fermentative process has been incomplete, and the leaven insufficient to convert the whole of the sugar into wine. In this class the far larger number of our home-made wines may be included, owing to the imperfect and unskilful manipulation they undergo. Sparkling and effervescing wines are chiefly produced from fruits in an unripe state; they are bottled before the fermentation is complete, which leaves much of the sugar unde-

composed, and confines the carbonic acid gas generated by fermentation. This gas on opening the cork is liberated, and rises to the top, causing that effervescence so observable in gooseberry wine, champagne, &c. Dry and light wines are those in which the saccharine principle has been entirely decomposed during fermentation into alcohol, and carbonic acid gas, as in grape, hock, &c. Generous and strong wines are those which are both dry in their quality, and strong in their nature, and contain more of the alcoholic principle than any of the forementioned.

The practice—would that it were less common—of adding spirit in large quantities to home-made wines, cannot, we repeat, too highly be condemned. It imparts neither vinosity nor flavour to the wine, nor preserves it from the acetous fermentation which it is intended to correct; on the contrary, its tendency is to destroy the briskness of these wines, diminish their wholesome character, and increase their cost. The uncombined alcohol acts on the organs of the body, precisely as though it were mixed with an equivalent quantity of water, so that disorders of the liver, and the diseases attendant on spirit drinking, more commonly follow the use of wines to which spirit has been thus added, than ever attend even immoderate

indulgence in genuine wines. It has been observed that intoxication is a vice of rare occurrence in the wine-producing countries, and this can only be accounted for on the principle that, when alcohol forms an integral portion of good sound wine, the free acids, which are present in it, hinder the spirit from acting prejudicially; tartaric acid, the one most common in good wine, exerts the greatest power in this respect. When spirit is added to wine of a thin and poor quality, it renders it more liable to acetous fermentation, and eventually destroys its colouring principle; when mixed, however, it should be done while the process of fermentation is still going on, though not in sufficient quantity to arrest it altogether; or it may be added during the insensible fermentation in the cask, as, at this juncture, a portion of the spirit will enter into permanent union with the wine, and thus obviate the injury it would otherwise occasion. Finally, there is no branch of practical chemistry more interesting than the preparation of wine, nor any that will more agreeably reward enlightened and painstaking efforts.

GOOSEBERRY WINE (CHAMPAGNE).

To fill a kilderkin or eighteen-gallon cask, and a two-gallon cask to supply deficiency arising

from racking the larger cask, fermentation, &c.—

Procure thirty-two gallons of gooseberries (two-thirds ripe); bruise a gallon at a time with a small wooden block or mallet, so that every berry may be broken; and remove the bruised fruit into a thirty-six gallon fermenting cask, adding two pints and a half of pure water to each gallon of fruit, until the whole is in. When the thirty-two gallons of berries, and ten gallons of water, are in the tun, mix them thoroughly together, and examine the juice with the saccharometer. You will probably find the gravity about 7°, which note down. Cover your cask over until the morning, stir up the mass afresh, and again apply the instrument, and record result. Allow the water to remain upon the bruised fruit as long as the gravity continues to increase, because fermentation has not yet commenced; but soon after fermentation has been detected by a decrease in gravity, the skins must be removed. This operation is performed by first emptying the fermenting cask, and then returning into it the liquor strained through a sieve, squeezing the skins with the hands, and throwing them into another tub, and pouring over them a gallon and a half of water, which is also strained. Should this not yield twenty gallons of liquor, add to and strain through the skins, as much water as will

make up that quantity. Now ascertain the gravity with the view of proportioning the sugar requisite to raise the must to 42°, our standard gravity for this wine. We will suppose the gravity of the liquor to have been reduced to 6° by the water added to the skins; the difference, 36°, will have therefore to be made up with sugar; and, if every pound of good sugar raises the gravity of a gallon of water 14 degrees, we shall require nearly 52 lbs. of the finest Bengal or Corsepore sugar for twenty gallons of must, or about 2½ lbs. to each gallon. 5 lbs. of honey, boiled in a gallon of water for twenty minutes, and well skimmed, would greatly improve the must. The sugar will augment the liquor, about a gallon for every 16 lbs. added; but this increase will not much more than make up for losses by fermentation and evaporation in the early stages of the process. Unrefined sugar is at all times preferable to the refined, where a pale colour is not needed, as it contains more of the fermenting principle, and, moreover, is less costly. Having now prepared and collected your must together, place the head on the top of the fermenting cask, with a blanket thrown over it; rouse it several times during the first day—morning and evening of each day afterwards; note the gravity each visit, until the

attenuation has reached 33 degrees, when it must be strained through a sieve into the kilderkin, and into the two-gallon cask. These should be placed obliquely on a stand, with dishes underneath to receive the ejected scum. The remainder of the must is kept to fill the casks up with—every three hours, during the first day, and from time to time afterwards. At the end of five or six days, when fermentation has become somewhat languid, the casks are lightly bunged down; and a gimlet hole is made near the bung-hole of each, into which a spile is loosely introduced; and when there is no longer any danger of excessive expansion, the spiles are permanently tightened. The bung-holes should be made sufficiently large to admit the saccharometer to test the gravity, without drawing any of the wine from the cask. This test should be applied twice a week. Great care must be used to secure a regular fermentation: should it proceed too rapidly, recourse must be had to racking and sulphuring the casks; if too slowly, the mass must be well agitated, either by rolling the cask to and fro several times, or by stirring it with a cleft stick.

In the month of September, when it has attenuated to about 14 degrees, it is fined with a quarter of an ounce of isinglass, dissolved in a

pint of the wine; then racked into a sulphured cask, into which two bottles of British brandy have been emptied, and well agitated. The racking is repeated towards the end of November, without the sulphuring, fining, or brandy; and the deficiency again made up from the small cask; the lees from the large cask replacing the clear wine drawn from the small one. Soon after the second racking, or, at latest, before the month of April following, if the wine be clear and bright, it should be bottled; but for this operation, as also that of racking, a clear, dry day, and cold weather, should always be selected. The bottles should be well corked, and securely wired: during the winter months they are laid flat upon their sides; but from April to October, are set upright on their ends.

CURRANT WINE (WHITE).

To make eighteen gallons of this wine, and two gallons more to fill up with—

Provide twenty-five gallons of fruit, picked on a warm, dry day, dead ripe—for the riper the fruit, the less sugar will be required to bring up the must. Separate the stalks from the fruit; squeeze the latter lightly in small portions with the hand, and add two gallons of water to it; boil this for fifteen minutes, and strain through a

sieve, mixing two gallons more of water to the husks, to extract the remaining good; which strain, as before.

Three weeks previous to this, you have steeped 64 lbs. of Malaga raisins in twelve gallons of water; the extract of which is now strained, and added to the juice of the currants. Should the mixture not measure twenty gallons, make up the deficiency from water strained through the raisin husks; note the gravity, and make the must up to 46° by the addition of loaf sugar. 1 lb. of pulverised or ground argol is then thoroughly mixed up with the whole. This will ferment readily, especially in warm weather. Samples of the must, after the head is broken into it, are taken out daily, and noted, until gravity has decreased to from 33° to 31°, when it is casked, as described. It is always desirable to wash out the casks with boiling water, and put in the wine while the casks are warm, in order to invigorate languid fermentation: for if this be not complete, the wine will have a sweet and mawkish taste. If spirits of any kind be added, this should be done when the gravity is about 29°, and by the time the attenuation has reached 14°, its flavour will be delicious. This wine should be kept in wood until November twelve months following, when it will prove a rich, mellow, and sparkling wine.

CURRANT WINE (RED).

To make eighteen gallons of this wine, and two gallons more to supply deficiencies—

Eighteen gallons of white and nine gallons of red currants are required. Bruise the fruit by degrees into the fermenting cask, and when finished examine a portion by the saccharometer, and note the gravity. Allow the mass to remain until a decrease in gravity is observed, then strain the juice, and add two gallons of water to the husks, which strain likewise. Measure the pure juice, and weigh a sample, to ascertain what quantity of water has to be added to it. Should the gravity be 22°, which it will be in a dry season, add the same quantity of water as of juice, to reduce it to our standard 11°, or less water if the fruit be inferior. Then bring this gravity 11° up to our must gravity 46°, by the addition of either moist or lump sugar, in the proportion of 2½ lbs. to each gallon of must, or 50 lbs. to the whole, more or less, as the saccharometer shall determine. Break half a pound of argol, previously dissolved in heated must, into the fermenting tun, to assist fermentation. Should it flag, however, draw out two gallons of the wine, and place the measure containing it in water at boiling heat, and allow

it to remain there until the wine ceases to rise in temperature; return it into the cask, and mix it well with the other portion: then place the cask in a warm room, and keep it perfectly full. Should the wine still appear languid, you must rouse up the lees and yeasty portions which have subsided to the bottom, and incorporate them again with the wine. The subsequent operations are conducted as in the case of white currant wine.

CURRANT WINE (BLACK).

To make eighteen gallons of this wine, and two gallons extra to fill up with—

Employ twenty-six gallons of black currants. The manipulation of this wine in other respects much resembles that of red currants. The juice is reduced by water to our standard gravity 11°, and the mixture then raised to 46°, by the addition of either moist or loaf sugar. For instructions, therefore, refer to currant wine (red).

BLACK CURRANT, TO IMITATE CONSTANTIA.

This wine is made by mixing two measures of fruit to one of water, which are boiled for ten minutes, and strained. When cooled down to the temperature of 95°, the whole is measured, and the gravity ascertained. The gravity is then

brought up to 46· with lump sugar; 1 lb. of ground argol and a pint of good fresh yeast are introduced into the must, when the temperature has reached 84°, and well incorporated with it. The must is attenuated to 19· only, instead of 14·, as in the other currant wines. This wine greatly improves in the wood, and should be kept two or three years before it is bottled.

MULBERRY WINE.

To make eighteen gallons of this wine, and two gallons extra to supply deficiencies—

Use twelve gallons of berries, perfectly ripe, and slightly bruised, to ten gallons of water. Allow the water to remain on the berries for two days, stirring them well night and morning during that time. Then strain, and measure the juice into the fermenting cask. ' Pour two gallons of water on the refuse, to make up if necessary the quantity to twenty gallons; ascertain the gravity; dissolve 1 lb. of tartar in half a gallon of the must, and mix it well into the mass. Make up the gravity to the standard 46·, by the addition of sugar, and conduct the after process as in the case of currant wine.

ELDER WINE, FROM THE FLOWERS.

To make eighteen gallons of this wine, and two gallons extra to fill up with—

Half a bushel of elder flowers must be collected, at the time they shake easily off the trees.

Three weeks, more or less, previous to this, 80 lbs. of Valentia or Malaga raisins are stalked, bruised, and steeped in sixteen gallons of water. As soon as the saccharometer detects a decrease of gravity, they are squeezed, the liquor strained, and four gallons more water thrown on the skins to wash them, and the strained liquor added to the former quantity. Into this extract, which will probably now measure twenty gallons, or must be made so to do, the flowers are infused, the gravity noted, and made up with refined sugar to 50°. This wine will need an artificial ferment, though not so much as when raisins are not used, as they contain an abundance of natural leaven, so conducive to spontaneous fermentation. A gill of good Brewer's yeast will suffice, and is, together with 1 lb. of white argol (previously dissolved in two quarts of heated must), well mixed with the fermenting mass. The temperature of the extract should now be about 78°, and the tun placed in a room, the temperature of which ought

not to be lower than 55°, and then covered. The head must be broken in every night and morning, and the gravity noted, until it is reduced to 32°. The must is then strained from the flowers into a cask, previously washed out with boiling water, and the juice of two dozen oranges added to it. This wine should be kept in the wood for twelve or eighteen months before it is bottled.

ELDER WINE, FROM THE BERRIES.

To make eighteen gallons of this wine, and two gallons extra to supply deficiencies—

Fifteen gallons of dry ripe berries are needed. They are picked clean from the green stalks, bruised with the hand, or between two heavy boards, slightly pressed, and left in that condition twenty-four hours. Next day, they are boiled for fifteen minutes. The juice is then strained through a sieve, and the skins pressed, and twelve gallons of water are poured on the refuse to extract the remaining good. After remaining in steep an hour they are again strained and pressed, and the liquor added to the pure juice. It should now measure about twenty-five gallons at a gravity of 11°, or thereabouts; this is noted, and sugar is added to raise the must to 46°; 4 oz. of allspice, and 4 oz. of good ground ginger enclosed in a bag, are now

introduced, and the whole boiled and well-skimmed for half an hour. It is then strained while hot into the fermenting cask. It should now measure about twenty-two gallons, but if deficient, water, at a temperature of 95°, must be added to make it up. When cooled down to 84°, half a pound of crude tartar, previously dissolved in a quart of the must, is, together with half a pint of good fresh Brewer's yeast, broken into it. The gravity is now taken and noted—it will probably be found to have increased from boiling, and the evaporation of the aqueous particles consequent thereon. The head formed by fermentation is daily broken into the must, and the whole well roused up. Every means must be employed to sustain fermentation, as this wine, like all others whose fruit is boiled, requires more excitement by artificial stimulants, than such as are made from unboiled fruit, as much of the natural leaven is weakened or destroyed by the boiling process. For this reason, additional ferments may sometimes be necessary. When the saccharometer shews an attenuation of 35°, it is casked; and fermentation stimulated, till it is reduced to 21°. To secure this attenuation, the wine should be placed in a warm room, and if it be necessary to revive fermentation, a portion of the must should

be drawn, heated, and returned into the cask, and the lees incorporated by agitation with the wine. This wine, like the former, should be kept a year or more in the wood before it is bottled.

GRAPE WINE (RIPE).

To make eighteen gallons of this wine, and two gallons extra to fill up with—

160 lbs. of sweet and mature grapes will probably be needed. Those ripened in this country may, in a warm and dry season, yield a juice whose gravity will be 28°; this should be reduced by the addition of water to 19°, the standard gravity for this wine. To produce this gravity, one gallon of water will be required for every 20 lbs. of grapes. The grapes are carefully picked from the stalks, slightly bruised, and six gallons of water poured upon them; the mass is then well agitated, the gravity noted, and the fermenting cask covered. Next day the rousing is repeated, and the gravity tested, when an increase thereof will appear. This is renewed, morning and evening, until the gravity begins to decrease. The extraction being now complete, the liquor is drawn off from the husks, and two gallons more of water are thrown upon them to rid them of any remaining good—strained, and added to the liquor. The quantity

should now measure about twenty gallons, at a gravity of 19°. Sugar, of which all our native fruits are deficient, is then added to bring up the must to our standard gravity 46°. The fermentation of this wine is conducted as in the case of former wines; only, that if it be intended for sweet wine, it is arrested by racking, when the gravity is 14°—if for dry wine, when it is reduced to 7°. This wine should be kept in cask two years, and examined every three months, and all losses made up with spirits, mixed with a small portion of sugar and water.

GRAPE WINE (UNRIPE).

It frequently happens in this country that grapes do not ripen in the open air, owing either to the nature of the vine, or the character of the season; it is desirable, therefore, to learn how to apply the crude fruit to a profitable use. Now grapes in the several stages of immaturity will, according to the proportions used, make wines resembling champagne, hock, moselle, and grave, and of a flavour so genuine, that good judges will not be able to distinguish them from the foreign wines. Some judgment, however, is necessary in proportioning the fruit to the water, for it would be as unwise as it is inexpedient to lay down here posi-

tive rules to meet the constantly varying degrees of maturity in which the grapes will be used. As a principle, however, we may determine, that the more immature the grape, the less will be the quantity required for the must; when half ripe, an equal proportion of juice and water will produce a wine resembling champagne; but for hock, a much larger proportion will be requisite, as well as a longer continuance in the cask. The skins may either be subjected to fermentation or not, the quality of the wine will differ as either process is used. Having decided on your proportion of fruit, the must is then raised to our standard 46°, by the addition of sugar, and the same course pursued in its subsequent treatment as with the ripe grape.

RHUBARB WINE (CHAMPAGNE).

To make eighteen gallons of this wine, and two gallons extra to supply losses, &c.—

91 lbs. of fresh stalks are well bruised, and the pure juice drawn off into the fermenting cask: fourteen gallons of water, heated to 88°, are now poured over the pressed pulp, being at the rate of 6½ lbs. of stalks to each gallon of water. The liquor is allowed to remain on the pulp twelve

hours; then strained, and added to the pure juice. As 13 lbs. of prime rhubarb stalks will yield a gallon of juice, we may expect to extract from this quantity of stalks seven gallons of pure juice, at a gravity of about 6°. This mixture should now measure twenty-one gallons, at a gravity of 2 lbs. per barrel. This must be made up to the standard 46° with sugar and honey; and as the difference is 44°, and each pound of sugar raises the gravity per gallon 14°, we will require nearly 3 lbs. of sugar, and $\frac{1}{4}$ lb. of honey per gallon; that is, 61 lbs. of East Indian sugar and $5\frac{1}{2}$ lbs. of honey for the whole. Half a pound of tartaric acid, previously dissolved in a small portion of the heated liquid, is now added, and the whole mixed well together. The must is then placed in a warm room, roused twice a day, and examined, and when attenuated to 38°, it is cleansed into casks, which are to be filled up as the wine ejects its impurities. After the fourth day the casks are partially bunged down, and the examination made weekly through the bung-hole; and when it has further attenuated to about 15°, it is racked, and treated in all respects like champagne made from unripe gooseberries. (See page 117.)

RHUBARB WINE (HOCK).

To make eighteen gallons of this wine, and two gallons more to fill up with—

130 lbs. of fresh stalks are well bruised, and the juice which has escaped is put aside into the fermenting cask. Over the pulp ten gallons of water, heated to 88°, are thrown, being at the rate of one gallon for every 13 lbs. of fruit. The water is allowed to remain on the pulp twelve hours, then strained, and added to the juice in the fermenting cask. The liquor should now measure about twenty gallons at a gravity of about 3°. This has to be made up to 50°, the standard for this wine, by the addition of 67 lbs. of the best Corsepore or Dobah sugar, with half a pound of tartaric acid, previously dissolved in a little heated wine. The must is then removed to a warm room, and well roused twice a day, and when, on examination, it is found to have attenuated down to 33°, it is casked. The examinations are continued weekly, and when the saccharometer denotes a gravity of 25°, the cask is bunged down until the month of November, when the gravity should be about 12°. Should it, however, have attenuated lower before that time, it must be racked into a sulphured cask, as directed

for other wines. Half a gallon of Bucellas wine and two gallons of the finest old Devonshire cider may be added, and well incorporated with it; and a week after this addition it may be fined; and after five or six days' rest, if it prove bright, it may be bottled.

ORANGE WINE.

To make eighteen gallons of this wine, and two gallons more to supply losses, &c.—

Three weeks before the oranges are used, 54 lbs. of Malaga raisins are stalked, bruised, and steeped in fifteen gallons of spring water. Two gallons more are thrown on the stalks, and the washings strained and added to the raisins. When fermentation has extracted all the valuable properties of the raisins, they are pressed, and two gallons more of water is strained through them. Two-thirds of the contents of an orange chest are now purchased—each orange is divided, and the juice expressed with a lemon squeezer into a separate vessel. The orange juice is then strained into the raisin extract, the quantity measured, and the gravity ascertained. There should now be about twenty gallons of the liquid compound; but, if deficient, water heated to 180° is thrown upon the orange skins; cooled down to 95°,

strained, and added in the required proportion. The gravity is now brought up to 46 lbs. per barrel: 1 lb. of white argol, previously dissolved in half a gallon of the extract, together with three parts of a pint of fresh Brewer's yeast, are now well mixed with it; the cask placed in a room the temperature of which is not less than 56°, and closely covered. Next morning, the whole mass is roused up, the gravity ascertained and noted, and should fermentation appear languid, a quarter of a pint more yeast is added. Morning and evening the must is roused and examined, and, in the course of seven or eight days, when the attenuation has reached 35', it is removed into warm casks, previously washed out with boiling water, and saturated with the contents of two bottles of British brandy, well shaken in them. Should fermentation continue sluggish some hours after cleansing, a quarter of a pint more yeast is mixed with half a gallon of the must heated to 86°, and introduced into the casks about an hour after, and well roused up; but should it ferment too rapidly, the usual means of racking and sulphuring must be resorted to. When the wine has been reduced by a regular fermentation to about 13', it is fined, the bung tightened, and an air-hole made near the bung, into which a spile is

loosely introduced. Should froth issue out of the air-hole, it must again be racked into a sulphured cask, and fined; and this treatment must be repeated until fermentation has subsided, when the cask should be filled up with brandy, and the bung and spile tightened down. This wine should remain in the wood until the Spring following: but it will prove more brilliant and vinous, if suffered to remain until the ensuing Autumn. If the fermentation has been perfected, it will be found very delicious, and may rank among the choicest of our home-made wines.

RAISIN WINE (SWEET).

To make eighteen gallons of this wine, and two gallons extra to supply deficiencies—

Provide 120 lbs. of the best Malaga or Valentia raisins. They are imported in mats, containing about 56 lbs. each. Pick the fruit carefully from the stalks, and bruise it in the fermenting cask. Pour over the fruit fifteen gallons of water, heated to 92°, and wash the stalks with two gallons more, which add thereto. Stir up the mixture, and place it in a room to ferment, the temperature of which is kept at a uniform heat of about 56°. The operation of stirring and bruising the fruit should be repeated twice or thrice per day, more or less, for

three weeks, and the gravity ascertained and noted. After it has attained its maximum gravity, which will be about 35°, it will begin to attenuate, and when fermentation has reduced it to 31°, the liquid is strained and squeezed from the raisins, and then returned into the fermenting cask; four gallons of water are thrown upon the refuse, allowed to remain twelve hours thereon, strained, and added to the previous quantity. 6 oz. of tartaric acid and 3 oz. of salt, dissolved in a little hot water, and put into half a gallon of the must, are now well mixed with the mass; which should now measure full twenty gallons. The standard for this wine is 50°: the difference, therefore, between the highest gravity 35°, and 50°, has to be made up with sugar; and, as we have seen that each pound of sugar raises the gravity per gallon 14°, it follows, that we shall need rather more than 1 lb. of sugar to each gallon of must; or about 22 lbs. to raise the whole to that standard. The process of rousing the must, and examining it, should now be performed morning and evening of each day, and when the gravity has fallen to about 35°, it should be cleansed into the casks for final fermentation. A colour resembling sherry may be imparted to this wine by adding 12 lbs.

of Smyrna raisins to the first infusion. For after treatment, see Orange Wine, p. 134.

RAISIN WINE (DRY).

To make eighteen gallons of this wine, and two gallons extra to fill up with—

This wine requires 8 lbs. of raisins to each gallon of water, and therefore 160 lbs. for the whole. The fruit must be stalked and steeped as before described. No sugar need be added to the must; but 5 lbs. of honey, previously boiled in the liquor in which the stalks have been washed, and well skimmed, will greatly improve the flavour. The process of management will be the same as with the Sweet Raisin Wine, except that the gravity must be attenuated to 25· before cleansing. Proper attention and frequent rousings may secure this object; but should they fail, portions of the wine must occasionally be heated to 98°, and well mixed with the mass. The attenuation also must be carried further than with sweet wine; instead of 13·, it is to be reduced to 7·. Two gallons of Madeira added to this or the former wine at the time of racking, will give to it a character resembling Lisbon wine, and thereby greatly improve its quality, though it will somewhat add to its cost.

RAISIN WINE (MADEIRA).

To make eighteen gallons of this imitation, and two gallons extra to supply losses, &c.—

72 lbs. of Malaga raisins are stalked and bruised, and eight gallons of water, heated to 92°, poured upon the fruit. The stalks are washed with one gallon of water, which is strained and added. The infusion is then placed in a warm room, stirred, and bruised twice a day for three weeks, more or less; a sample examined daily by the saccharometer, and the gravity noted; and when fermentation has attained its maximum, or after it has reduced the gravity three or four pounds on the instrument, the liquor is separated from the fruit, and three gallons of water are thrown upon the skins, and allowed to remain upon them for twelve hours, then strained, and added to the rest. Now, procure thirteen gallons of ale wort of the first running, at a gravity of about 35°, and before it has cooled below 92° turn it into the copper, together with 16 lbs. of moist sugar. Boil this wort for forty minutes, and skim off all impurities as they arise, both before and after boiling. Into a gallon and a half of this wort at boiling heat put 2 lbs of bruised argol, and, when dissolved, turn it into the body of the

wort. When this malt wort has cooled down to 62°, it is added to the raisin extract; and together may measure twenty-one gallons, at a gravity of about 46·; or failing this, it must be made up to that standard. For after management, see Orange Wine, p. 134. If intended for sweet wine, the final gravity, before bottling, must be 13·; but if for a dry wine, 7·. Yeast may be necessary when fermentation becomes languid: in such a case, raise the temperature of one gallon of the must to 85°, and add three or four spoonfuls of yeast to it, and, when expanded, break it into the body in the fermenting cask.

DAMSON WINE.

To make eighteen gallons of this wine, and two gallons extra to supply deficiencies—

Twelve gallons of damsons are squeezed, so as to leave no plum entire; but with so much care as not to break the stones of the fruit, lest the kernels should communicate their flavour to the wine. On the mashed fruit six gallons of water are then poured. 72 lbs. of raisins, steeped three weeks previously in fourteen gallons of water, are now strained, and the extract added to the bruised damsons and water. The mixture is allowed to remain twenty or thirty hours, during which time

it is roused three or four times. The liquor is then strained, and the damsons squeezed; and if the quantity do not measure twenty gallons, the deficiency is made up by straining water through the pressed fruit. The gravity is now taken and noted, and made up with sugar to the standard 46°. 1¼ lb. of crude tartar, dissolved in half a gallon of heated must, is, when cooled to 98°, mixed up with the mass. The must is agitated twice daily and examined, and when the gravity has attenuated to 25° (which, owing to the abundant natural leaven in these ingredients, it will freely do), it is casked, and treated afterwards, in all respects, as raisin wine. If a deeper colour be required, the damsons are allowed to remain unstrained forty hours instead of twenty.

MEAD.

To make eighteen gallons of this wholesome and delicious wine, and two gallons extra to fill up with—

Honey, in the proportion of 2½ lbs. for every gallon of water, is employed. 60 lbs. of honey are mixed with fourteen gallons of water and the whites of ten eggs, and the impurities of the honey are removed. It is then put into the copper, and heated by a brisk fire to 186°, when the

heat is allowed gradually to decrease. It is well skimmed during the process, and after the scum ceases to rise it is removed into the fermenting cask. Ten gallons more water are put into the copper to remove the honey clinging to it, and when heated to 95° are likewise removed to the fermenting cask. 1 lb. of tartaric acid, dissolved in a little boiling water, is now added, and when cooled to about 86°, the quantity (which should now prove about twenty gallons) is measured, and the gravity ascertained. Sugar is now added to bring up the must to 46°, the standard gravity for this wine. A pint of good fresh yeast, previously mixed with three quarts of the must at 85°, is now thoroughly broken into the mass; the cask is then covered up, and kept in a warm room. Should it be thought desirable to impart a pink colour to this wine, this may now be done, by infusing into the must 10 lbs. of beet-root, cut thin, and allowing it to remain till the time of casking, when the wine will be strained from it. Every morning the head is broken in, and the must examined; and when the gravity has attenuated to 33°, the casks that are to contain the wort are washed out with boiling water, and filled with the must while they are warm. Every possible means are now used to encourage fermentation; the casks

are filled up several times a day for the first few days, and the lees stirred up: and twice a week afterwards for the first month. Should this fail to keep up the requisite fermentation, a gallon of the wine is drawn from the cask, and heated to about 86°; it is then mixed with the yeasty content of the dishes placed under the casks; and when expanded is returned into the casks, and the whole well roused up. After two or three months, fermentation will subside, and the gravity fall to 18°. The casks may then be bunged down, and a spile-hole made near the bung, and left open for a few days. If this wine is made in March, the warmth of the weather will materially aid the fermentation. In February or March following it is racked into two nine gallon casks, which have been previously washed with cold water, and slightly sulphured, and half a gallon of strong spirit well agitated in each, previous to the racking, and mixed in equal proportion with the wine. The deficiency, if any, caused by loss of lees, is made up from the two gallon cask, and the lees put into the small cask. Half a pint of finings is now put into each nine gallon cask, and well mixed. The bungs are then tightened, and the spiles left out for a few days. This wine should be kept in the wood two or three years, and when ascertained to be bright, the wine from one cask

may be bottled, and the other kept till wanted, as it ripens faster in the cask than it does in bottle.

PARSNIP WINE.

To make eighteens gallons of this wine, and two gallons extra to supply losses, &c.—

5 lbs. of this root, well scraped and washed, and cut into slices half an inch thick, are used to every gallon of water. As this wine has to be boiled, we shall need one-third more liquor to meet the waste. Boil, therefore, 150 lbs. of parsnips with thirty gallons of water for two hours, then strain the liquor as clear as possible without bruising the parsnips; ascertain the quantity, which should measure about twenty gallons, and the gravity, which will probably be about 6°; and add sugar, till you bring up the must to the standard gravity of 46°. As the difference to be made up is 40°, this sum divided by 14 shows, that nearly 3 lbs. of sugar will be needed per gallon of must, or 56 lbs. for the whole. 2 lbs. of pounded argol, dissolved in a gallon of must at 198°, and a pint of good fresh Brewer's yeast, mixed with the argol and must when the heat has declined to 84°, are, when expanded, mixed up with the wort at 84°. The fermenting cask is

then covered, and kept warm; the head broken each morning, and the must examined, until the gravity is reduced to 33°; when the frothy head is skimmed off and kept for future use. To secure fermentation after racking, a quarter of a pint of yeast is mixed with a quart of the must at 90°, and, when expanded, is broken into the skimmed mass; the casks are washed out with boiling water, and the must is agitated, and put into them while they are warm. If fermentation still appear languid, half a pint of the skimmings is mixed with a small portion of the surplus must heated to 95°, and stirred in. The after management of this wine resembles that of the former wine, except that, at the first racking, two bottles only of rectified spirits are used to wash the casks with; and a gallon of British brandy may be employed to fill up with.

MALT WINE (MALAGA).

To make eighteen gallons of this imitation, and two gallons extra to supply deficiencies—

Two bushels and a half of pale malt are mashed in thirty gallons of water heated to 180°; and, after the infusion has remained undisturbed for two hours, eighteen gallons of wort are drawn off, and the tap then turned off. Ten gallons of water,

at a heat of 192°, is now spread lightly over the mash with a hand bowl, and allowed to remain thereon for the space of a quarter of an hour; the tap again turned on, and ten gallons more wort run off, making in all twenty-eight gallons of wort. The goods in the mash tun are subjected to a second mash, which is made into table beer, according to directions given; but with the first extraction we have now only to do. These twenty-eight gallons of wort are turned into the copper, with 42 lbs. of East India sugar to raise the gravity to 46°. This compound is then boiled for forty minutes, and well skimmed, both before and after boiling; it is now drawn off the copper, strained, measured, and examined. There should now be about twenty-two gallons, at a gravity between 46° and 48°. 2 lbs. of argol, previously dissolved in a gallon of must at boiling point, and a pint of good Brewer's yeast added to it, are, when cooled down to 72°, well worked in with the wort at 82°. The fermenting cask is closely covered, and kept in a warm room; and the head produced by fermentation daily broken in, until fermentation appear on the decline. When reduced in gravity to 33°, the casks that are to contain the wort are washed out with boiling water, and filled with the wort while they are warm.

Fermentation is stimulated by agitation and by other means, the casks being kept full, and at the end of seven or eight weeks it will attenuate by a gradual fermentation to 17° or so. When all appearance of fermentation has ceased, the bungs may be driven home, and in the following Spring the wine must be racked, with a gallon of British spirits added. This wine should be kept in the wood for three years, and examined every six months; it will then be found a full, rich, and delicious wine. Fine, bright, and dry days should be selected for both the racking and bottling operations.

GINGER WINE.

To make eighteen gallons of this wine, and two gallons extra to fill up with—

2½ lbs. of the best Jamaica ginger are needed. Twenty-eight gallons of water are turned into the copper, and 70 lbs. of sugar added immediately after; the scum is removed as it rises, and after the liquor has boiled clear, the ginger is introduced, coarsely bruised, and the whole boiled for two hours and a half; then strained, and turned upon coolers. As soon as the copper is empty, six gallons of water is put in with the strained ginger, and the peels of ten lemons and ten bitter

oranges, and boiled for two hours. This also is strained and cooled; and when both together would average 90°, they are turned into the fermenting cask; the quantity measured (which should be about twenty-one gallons), and the gravity ascertained; and should the latter not reach 46°, it must be made up to that standard with sugar; half a pound of tartaric acid, dissolved in a little boiling water, is then mixed up with it, or, what is better still, two quarts of lemon juice. A pint of sound and fresh yeast, previously mixed in half a gallon of must, and expanded, is now incorporated with the mass; the cask covered up and placed in a room of a temperature of about 58°. The after management of this wine is the same as Mead wine, except that, at the first racking, two bottles only of rectified spirits are used to wash the casks with; and a gallon of British brandy may be used to fill up with.

N.B.—Instead of using 70 lbs. of sugar, it will be both advantageous for the wine and profitable to the operator, to use twenty-five gallons of wort, extracted from two bushels of malt, according to the process recommended in Malt wine. These two bushels of malt will be equivalent in their saccharine produce to 40 lbs. of sugar, and will yield wort of a gravity of at least 21°; to make

this wort up, therefore, to the ultimate gravity 46°, only 30 lbs. of sugar will be needed. It is then put into the copper over a brisk fire, and carefully skimmed: the ginger is then added, and the whole boiled for half an hour; then strained into coolers, and treated subsequently as the former wine. A small portion of table beer may be made from the second mash, according to the directions previously given.

GINGER WINE (GREEN).

Ginger root in a green state has, for some years past, been imported from the West Indies, and when it can be procured perfectly fresh and sound, it is to be preferred, on many accounts, for wine-making purposes, to the dried ginger. In the necessary process of bruising, a portion of the dried ginger is pulverized, which on straining passes through the sieve with the liquid, thus causing too much sediment in the wine, and thereby occasioning much waste. A resinous matter also, formed in drying, is dissolved, and renders the wine coarse and turbid; and the natural ferment of the ginger, with its fine fruity aroma, are both destroyed in drying. The only precaution necessary in employing green ginger is, duly to appor-

tion the quantity used, which (to compensate for the moisture it contains) must be at least double the weight of the dry.

To make eighteen gallons, therefore, of this wine, and two gallons extra to supply deficiencies—

7 lbs. of green ginger are thoroughly washed in warm water, and bruised with a mallet; the juice which runs out received into a pail, and laid aside. Twenty gallons of water are now put into the copper, and the bruised ginger added, and boiled for three hours; the liquor is then strained from the ginger, and returned into the copper to be boiled with the sugar. Six gallons of water are now thrown on the bruised and partly exhausted ginger; strained, and added to the liquor in the copper. We have now about twenty gallons of extract in the copper, and to them we add 65 lbs. of sugar (being $3\frac{1}{4}$ lbs. to the gallon), which will increase the volume four gallons, namely, one gallon for every 16 lbs. of sugar. The whole is then well incorporated, and boiled for fifteen minutes, and all impurities skimmed off. It is then strained into coolers, and when reduced to a temperature of 82°, the reserved juice from the bruised ginger is, together with $1\frac{1}{2}$ lb. of white argol, or two-

thirds of a gallon of lemon juice, and three quarters of a pint of good yeast, well mixed with it in the fermenting cask. The quantity should now measure about twenty-one gallons at a gravity of 46·; if the gravity be less, sugar must be added to bring it up; if the quantity fall short, the deficient water must be strained through the skimmings and boiled ginger into the fermenting cask. For subsequent processes refer to Mead Wine, *ante*, p. 141.

N.B.—Raisin extract may be used with advantage in this wine; ten gallons may be obtained by the infusion of 60 lbs. of Malaga raisins, according to the process described for Raisin Wine, *ante*, p. 136. Fifteen gallons of water are now put into the copper, and 44 lbs. of sugar added; this is well stirred, and boiled until all impurities are removed by skimming, when the bruised ginger is introduced, and boiled for three hours. It is now strained, and when cooled down to 82°, the raisin extract, the reserved ginger juice, 1 lb. of argol, and from a quarter to half a pint of yeast, are added to it, in the fermenting cask. The quantity will now measure about twenty-one gallons at a gravity of 46·. Subsequent treatment as stated.

STRAWBERRY WINE.

To make eighteen gallons of this wine, and two gallons extra to supply losses, &c.—

Twelve gallons of these berries, stalked, and carefully squeezed, are well mixed with ten gallons of water, and allowed to remain together for forty hours. The liquor is then strained off, measured, and, if under twenty gallons, the deficiency is made up by water poured upon and strained through the refuse. The gravity is then tested, and the weight of sugar necessary to raise it to 46° added; 3 lbs. of sliced beet-root, now put into the fermenting cask, will impart a deep rose colour to this wine if required. As the flavour of the fruit is dissipated to a great extent during the early stage of fermentation, it may be restored by introducing into the fermenting cask 20 lbs. of strawberries, enclosed in thin muslin, two or three days before the wine is casked. On removing the bag, the juice of its fruit is strained through a sieve into the must. This wine needs no artificial ferment, provided it be placed in a warm room. For after treatment, see Currant Wine.

BRAMBLEBERRY WINE.

To make eighteen gallons of this wine, and two gallons extra to fill up with—

Twelve gallons of the juice of this fruit is mixed with six gallons of water. The blackberries should be very ripe, and picked on a dry day. To this is added the juice of three gallons of sloes, or of sloes and damsons in equal proportions, boiled soft, in three gallons of water. Half a pound of tartar, dissolved in the sloe juice, is likewise added; the gravity ascertained, and made up with sugar to 46°. The after process to be conducted as in the case of Currant Wine.

CHERRY WINE.

To make eighteen gallons of this wine, and two gallons more to supply deficiencies—

Equal quantities of juice and water are needed, namely, ten gallons of each. The cherries should be obtained ripe; they are bruised, but care must be taken not to break the stones. The quantity is measured and the gravity ascertained, and made up to 46° with sugar. In the subsequent stages it is treated as Currant Wine. This wine should

be kept in cask some years. It becomes sparkling with age, but is heavy and flat when new.

COWSLIP WINE.

To make eighteen gallons of this wine, and two gallons more to fill up with—

Two bushels and a half of picked cowslip flowers will be required. Three weeks previous to this, 60 lbs. of Malaga or Valentia raisins are stalked, and infused in fifteen gallons of water at 92°. Two gallons of water are thrown on the stalks, strained, and added. When the first extract is drawn off, four gallons of water at 98° are allowed to remain on the pressed fruit for twenty hours, strained, and added to the previous quantity. The whole should now measure twenty gallons, and be made up with sugar to 46° gravity. The flowers are now added and put into the fermenting cask, together with 6 oz. of tartaric acid dissolved in a little hot water, and a quarter of a pint of yeast, previously expanded in half a gallon of the must at 86°. After management, as Raisin Wine. This wine greatly improves by keeping in the wood.

BALM WINE.

To make eighteen gallons of this wine, and two gallons extra to supply losses, &c.—

Twenty-one gallons of boiling water are poured on twenty-one gallons of balm leaves separated from their stalks; well mixed, and allowed to remain together thirty hours. The liquor is then strained from the leaves, measured, and the gravity taken. It is then made up to gravity 42°, the standard for this wine, by adding 3 lbs. of loaf sugar to each gallon. If properly made, this wine will prove very pleasant and delicious. It greatly improves with keeping.

BIRCH WINE.

To make eighteen gallons of this wine, and two gallons extra to supply deficiencies—

Twenty-six gallons of the sap is drawn from the trees early in March, when it is rising in the trunk. Its fitness for wine making is denoted by its consistency and colour. The usual mode of drawing the sap is to bore holes in the trunk of the trees, and drive in quills, or short pieces of the elder with the pith removed, and then place

vessels under to catch the juice. Each day's sap should be boiled as collected, as it rapidly injures by keeping. It is boiled as long as any scum rises, and carefully skimmed. It is then removed to the fermenting cask, and when cooled down to 88°, it is measured, and the gravity made up to 48°, the standard for this wine. 2 lbs. of argol, previously dissolved in half a gallon of hot must, and a pint of good yeast added and expanded in it, are, when cooled down to 72°, well mixed with the must in the fermenting cask. A vigorous fermentation must be sustained by keeping the cask in a warm room, beating in the head, rousing, and using if necessary small portions of ferments. At the time of racking the casks are sulphured, and wetted thoroughly in the inside with a quart of spirits. For subsequent management, see Ginger Wine.

SPRUCE BEER.

Brown Beer is made by dissolving 15 lbs. of treacle or brown sugar in nine gallons of hot water; 8 oz. of the essence of spruce, and a pint of fresh yeast, are thoroughly incorporated with it when the heat is reduced to 82°. In the Winter season fermentation must be conducted in a warm

room. Should fermentation flag after it is casked, the liquor must be drawn off, the cask washed with warm water, and the beer returned into it. Fermentation will revive after a short time, and when somewhat abated the beer is bottled off and wired. The bottles are laid on their sides until the beer is brisk, and then set on end to prevent their bursting.

White Beer is treated in a similar way, except that loaf sugar is used instead of brown.

GINGER BEER.

This cooling drink is made by pouring four gallons of boiling water upon four ounces of good ginger coarsely bruised. When the liquor has fallen in heat to 86°, it is strained through a linen bag. 5 lbs. of loaf sugar, half an ounce of citric acid, 1 oz. of cream of tartar, and half a pint of good yeast, are now thoroughly mixed with it. For after management, see Spruce Beer.

A DESCRIPTION

OF THE NEW AND IMPROVED

BREWING SACCHAROMETER

AND

SLIDE RULE,

WITH

FULL INSTRUCTIONS FOR THEIR USE.

INTRODUCTION.

WORT, the technical name given by Brewers to an infusion of malt, or a simple solution of sugar from which beer is prepared, is heavier bulk for bulk than water, according to the quantity of solid extractive matter which it holds dissolved. In other words, a given measure of wort will always weigh more than the same measure of water, and such excess of weight will be in proportion to the greater or less amount of saccharine substance present in the wort, an uniform temperature being observed. In the Distiller's process, wort is sometimes reduced, by the continued action of yeast, below the density of water; but in the brewing of beer, fermentation is designedly checked, for obvious reasons, long before so extreme a te-

nuity of the liquid is attained. The relative weight or the "gravity" of wort being a certain index to its degree of saccharine richness, it is highly desirable that the Brewer should possess some ready means of informing himself, with tolerable if not absolute precision, of the value or strength of his wort before it is set to ferment, by the determination of its comparative density, and of subsequently ascertaining in a similar way the extent to which attenuation has proceeded, so as to regulate, at will, the quality of the finished beverage sent by him into consumption. The Saccharometer enables him to make the requisite observation on a sample of wort, at any stage of the brewing process, with sufficient practical exactness, and very little trouble. It is an instrument closely resembling the ordinary Spirit Hydrometer in its form and mode of application, and is fully described in detail on page 11, &c. The term, Saccharometer, compounded of two words which signify respectively sugar, and a measure, would naturally appear to limit the use of this invention to the testing of saccharine liquids alone; but while resorted to principally and almost exclusively for this purpose, it must be understood, that the Saccharometer will in-

dicate anything as well as sugar,—common salt, for instance,—that adds to the specific gravity. The name merely implies a particular property of the instrument, for which it is mainly valued and employed. It is, in fact, a commodious substitute for the Chemist's weighing bottle, or the hydrostatic balance, demanding neither the time, skill, nor the delicate apparatus, indispensable to the successful execution of any of the methods adopted in scientific research, for the accurate determination of the specific gravity of a fluid. By the aid of the Saccharometer and Thermometer, portable in size and easy in manner of use, the Brewer can, at any time, note, not indeed the actual specific gravity of his wort, but a fact directly dependent on the specific gravity, and of much greater service to him, as an indication of the value of the liquid under trial, namely, the "pounds gravity per barrel." This expression we now proceed to explain. When it is said, that a wort is, for example, of "26 lbs. gravity per barrel," it is meant that the weight of a barrel, or 36 imperial gallons of such wort, exceeds the weight of a barrel of pure water by 26 pounds avoirdupois. Similarly, a wort of "30 lbs. gravity per barrel," or more shortly of "30 lbs. gra-

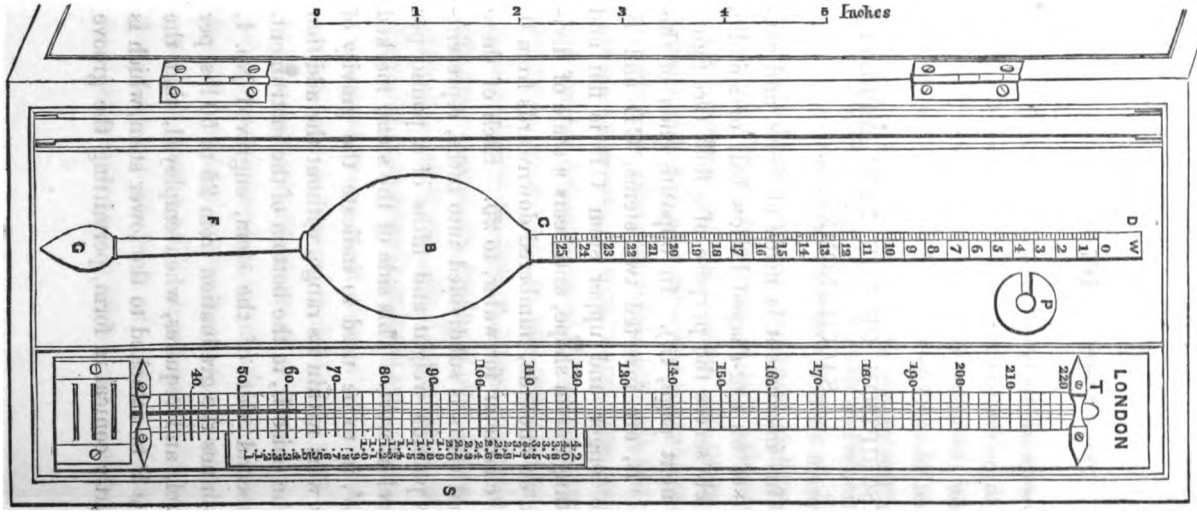
vity," is heavier by 30 pounds than a barrel of water, and so on. That division on the stem of the Saccharometer which floats level, or most nearly level, with the surface of the liquor in the sample jar, corrected for temperature by reference to an Expansion Scale, graduated on the stock of the Thermometer, opposite to a limited number of degrees of heat, or by the use of a Sliding Rule (*see* page 15), indicates, on inspection, the gravity per barrel, as above defined. In immediate relation to the gravity, thus at once discoverable from the instrument, is the amount of "extract," or the "lbs. weight per barrel," as it is called in the language of the Brewer. A wort of 26 lbs. gravity contains 67⅓ pounds of solid saccharine matter dissolved in a barrel of it; again, a wort that marks 30 lbs. gravity on the Saccharometer, holds in solution 78 pounds per barrel of fermentable substance extracted from malt, &c., in the process of mashing. The extract or lbs. weight per barrel, stands therefore in direct proportion to the gravity, and may be deduced from it either by an easy calculation on the data (which correspond very closely with the truth), that gravity per barrel is, to extract per barrel, as 5 to 13, or by consulting a table given at

the end of this book, or by inspection of a line laid down on the Sliding Rule. The difference between "gravity" and "extract" per barrel is owing to the displacement of the liquid particles, occasioned by the solution of saccharine matter in water. Each pound weight of solid extract, dissolved in wort, may be stated to occupy on the average the space of ·0615 parts of a gallon of water at 60° Fah., or to take up 17·063 cubic inches which would otherwise be filled by water. A barrel of distilled water, at 62° Fah., weighs 360 pounds, or 10 pounds per gallon. A barrel of wort of 25 lbs. gravity will, therefore, from what has been already explained, weigh 385 lbs., and will contain 65 lbs. of solid extract, and displace 65 times ·0615 or 4 gallons of water, within one hundredth, subtracting which from 36 gallons, we have, as the composition of the wort in question, 32 gallons of water, weighing 320 lbs. and 65 lbs. of extract, or together 385 lbs.,—a result in perfect agreement with the assumption made above. It also follows from this investigation of the subject, that every pound of gravity per barrel represents, and is equivalent to 2·6 lbs. of extract; for if 25 lbs. gravity correspond to 65 lbs. extract, 1 lb. gravity will indicate 2·6 lbs. ex-

tract; and if any other instance be chosen, a like correspondence will exhibit itself. A practical verification of these statements and inferences may readily be instituted, by evaporating to dryness any convenient measure of a wort of known gravity, and weighing the residue so obtained. A quart of wort of 25 lbs. gravity, from which all the water is driven off by heat, should, according to the Table or the Sliding Rule, leave a residue ·451 parts of a pound in weight, or a little less than $7\frac{1}{4}$ ounces. It must be borne in mind, that all the foregoing expressions of weight and value, refer to wort of the temperature of 50°. If, in any experiment, the sample be not carefully reduced to this degree of heat, a proper correction or allowance must be made by the aid of the expansion scale on the Thermometer or the Slide Rule, as already pointed out.

DESCRIPTION OF THE NEW IMPROVED SACCHAROMETER.

This instrument is made of brass, and consists of an egg-shaped hollow ball or spindle, which serves the purpose of a float (*see* figure on next page, 12). In opposite ends of this ball B, are inserted two stems, CD and F. The longer and upper stem CD is flat and rectangular in shape, and bears a scale of division on one side, numbered downwards from 0, the character for water, to 25. Each of these equal parts is subdivided into fifths, representing pounds weight and fifths of a pound per barrel of wort. This side of the stem, marked O W, is to be used to indicate the gravity of any wort within its range, without the addition of the poise P, to the bottom of the instrument. A second side of the stem, engraved No. 1, continues the graduation from 25 to 50 lbs. per barrel, and requires, when employed, that the poise P be attached to the lower stem, which is lightly conical in form, permitting the groove



NEW IMPROVED SACCHAROMETER

of the poise to be placed on its thinner end, and to be slid down until secured on the stem by the thickness of its other extremity. The loaded bulb G is appended to the instrument with the object of preserving it in a vertical position when floated, and has a vacuity for the reception of little leaden pellets, which it was at one time customary to supply with the Saccharometer, for the purpose of adjusting it to the particular water used in brewing. The necessity and trouble of observing this precaution are now, however, dispensed with, by an original adaptation of the instrument to the mean or average density of several varieties of well and river water.

The Thermometer, T, figured in the drawing, and which is furnished at one cost with the Saccharometer, is necessary for observing the temperature of wort, when its gravity is tested. The heat of a sample must never be greater than 220°, the highest range of this instrument. Indeed, it is advisable, for the sake of accuracy, that the liquor, before immersing the Saccharometer, be suffered to cool to 100°, or below it if convenient. The nearer the temperature is to 50°, the less will the corrected indication of the weight of any wort submitted

to trial, differ from the absolute truth. The scale of allowances for expansion will, however, give a result, at any temperature included in its graduation, devoid of all error in the slightest degree material to the Brewer. This scale, denoted by S in the engraving, extends from 51° to 120°, a range of heats that will be found to apply to the condition of most wort under ordinary circumstances. The numbers indicative of the additions to be made on account of temperature, to the lbs. gravity per barrel, shown by the Saccharometer, being placed on a line with certain degrees of heat on the mercurial scale, catch the eye at the time of inspecting the Thermometer, and save the trouble of reference to a rule. Despatch and simplicity are thus usefully combined. At heats above 120° the Slide Rule must be employed, and indeed generally when precision or cety is desired.

Worts of different densities or strengths vary in their amount of expansion. A wort of 30 lbs. gravity, for example, will not be affected equally with a wort of 60 lbs. gravity, by the same elevation or depression of temperature. One will not dilate or contract in bulk so much as the other, under a similar increase or diminu-

tion of heat. A mean gravity of 20 lbs. has, therefore, been taken for worts; the apparent strength of which may be corrected by reference to the Expansion Scale engraved on the Thermometer Stock. The less the strength of any sample of wort differs from the medium gravity so assumed, the more reliable will be the final indication derived from the use of both instruments. In no case, however, will the error exceed one-fifth of a pound for gravities below the average, and above 20 lbs. the variation will be nearly as inconsiderable. Under the temperature of 100°, the approach to an accurate result is still further ensured; but by the use of the Slide Rule, the real strength of wort can be readily determined at any gravity under 60 lbs. per barrel, and at any degree of temperature not exceeding 150°, with the utmost exactness attainable from any means, other than a set of costly and elaborate Tables, for which few Brewers would be willing to pay, and which are only needed for the purposes of Revenue.

DESCRIPTION OF THE NEW AND IMPROVED SACCHAROMETER SLIDE RULE.

This Rule consists of a Stock, bearing several distinct lines of graduation for brewing purposes, and co-operating with a moveable scale or slide, on one side of which is laid down a temperature scale, and on the other, a double scale of lbs. gravity per barrel. The first, or AB side of the Rule contains the Expansion Scale already adverted to, for rectifying the indications of the Saccharometer, on account of temperature, and a line of comparison, showing the number of lbs. extract per barrel that correspond to any number of pounds gravity per barrel,—a proportion also to be had from the Table given on page 32. The Temperature Scale (so marked) on one face of the slide ranges from 50° to 150°, each degree downwards to 70° being divided into fifths. The degree of

heat of any sample, indicated by the Thermometer, being set on this slide opposite to the gravity shown by the Saccharometer on the line denominated "W. lbs. gravity per barl.," facing 50° on the slide will be found on the stock the real or corrected strength of the wort. The line "W. lbs. gravity per barl." extends from water to 60 lbs. gravity or 156 lbs. extract per barrel, and is divided into fifths throughout the length of its graduation, as is also the line of comparison for extract, which is distinguished as "Extc$^{t.}$ pr. bar$^{l.}$"

The C D side of the Rule exhibits a line of "barrels" on the stock reaching from 15 to 120, and adapted to an appropriate line of "lbs. gravity per barrel" on the slide. By means of this scale a Brewer is enabled to regulate what are technically called his "lengths," and to produce a wort of uniform strength from malt of variable quality. On this side of the Rule is also graduated a line of "Shillings per quarter," devised for showing, by a simple proportion, the value of malt according to the gravity of the wort which it yields. The use of the Rule generally will be better understood from the Examples given further on, than from any lengthened exposition of the prin-

ciples involved in its construction that may be entered into here. We therefore refer the reader to pages 20, 21, for a number of familiar and practical illustrations of the subject.

INSTRUCTIONS FOR USING THE SACCHAROMETER.

Having taken a fair sample of the wort intended for trial, first immerse the Thermometer, and gently stir the liquor with it, observing that its temperature does not exceed 150°. Then dip the Saccharometer into the wort as far as the bottom of the stem, and lifting it up return it gradually into the sample: press it about a division lower than the point at which the instrument appears disposed to become stationary, taking care to avoid disturbing it on the removal of the hand. When at rest, note the division on the stem nearest to the surface of the liquor, and add to it the number which faces the degree of temperature at which the quicksilver stands, read off from the Thermometer, partly raised out of the liquid for that

purpose. Such number or correction added to the indication of the Saccharometer gives the real gravity of the wort. If the Slide Rule be used, observe the heat of the wort by the Thermometer, disregarding the Expansion Scale on the stock, and so adjust the Temperature Scale on the slide, that the degree of heat indicated by the Thermometer shall face the apparent gravity of the wort shown by the Saccharometer on the stock of the Rule; then, opposite to 50° in the slide, will appear the real gravity in lbs. per barrel on the stock.

EXAMPLES.

1.—If the Saccharometer rest in a sample of wort at 23 and two-fifths below, which will be decimally 23 and four-tenths, or 23·4, and the quicksilver in the Thermometer tube stand at 88°, then opposite to 88° appears 1·6 on the Expansion Scale; this added to 23·4, the Saccharometer indication, or the *apparent* gravity, gives 25 lbs. per barrel as the real strength of the sample.

BY THE SLIDE RULE.

Setting temperature 88° on the slide to 23·4 on the stock, opposite 50° on the slide will be found 25 on the stock; a result which completely agrees with the determination by the first method.

2.—Suppose apparent gravity shown by Saccharometer, having the poise attached, to be 44 and three-fifths, or 44·6—the temperature of

the sample being 100°. Facing 100° on Thermometer is 2·4 on Expansion Scale, which added to 44·6, gives as the corrected gravity of the wort 47 lbs. per barrel.

BY THE SLIDE RULE.

Temperature 100° being set to 44·6, opposite 50° on slide appears 47·4 (nearly) as the real gravity. There is a disparity in this case amounting to a little more than one-fifth of a pound per barrel, but the wort chosen is of a gravity considerably higher than the standard or medium, 20 lbs. (*see* pp. 14, 15.)

BY THE SLIDE RULE ONLY, ABOVE 120° TEMPERATURE.

3.—Let the temperature be 146°, and the Saccharometer indication (with poise affixed) 38·8; 146° on Temperature Scale being placed on a line with 38·8, facing 50° on slide may be seen 46·5 (nearly), the true gravity of the sample.

USE OF THE CD SIDE OF SLIDE RULE

FOR THE REGULATION OF

LENGTHS FROM WORT,

AND FOR

ESTIMATING THE VALUE OF MALT.

APPLICATION OF THE RULE TO THE MAKING UP OF LENGTHS.

Premising that the Brewer has proper tables of the capacity of his coppers and fermenting tuns, drawn up in barrels and tenths of a barrel for every inch of their depth, and of his coolers for every tenth of an inch, we proceed to show how by a very simple calculation the average gravity or strength of the several mashes of a brewing may be obtained, and how the quantity of liquor necessary in certain cases to be boiled away, may be determined by reference to the Slide Rule.

Having ascertained and noted separately the gravity and gauge of the produce of the different mashes, multiply the number of barrels of each wort by the proper gravity per barrel, and divide the sum of the products so found, by the total number of barrels—the quotient will represent the average or mean gravity of the several worts.

EXAMPLE.

Suppose the 1st wort of a particular brewing to have measured 13 barrels, and to have indicated a Saccharometer gravity of 34 lbs.; the 2nd wort, 16 barrels and 20 lbs.; and the 3rd wort, 18 barrels and 8 lbs.—the calculation of their average strength will be thus performed:—

	Barrels.		lbs. gravity.	
1st wort	13	at	34	 442
2nd wort	16	at	20	 320
3rd wort	18	at	8	 144
Total..	47			906

47)906(19·3 (nearly).

The average gravity of the three worts is therefore 19·3 lbs. per barrel.

If, in this instance, it was desired that the strength of the collected worts should stand at 20 lbs. per barrel, a certain quantity of water

will have to be boiled away to bring the wort to the requisite degree of concentration. The upper portion of the C D side of the rule may be used with great convenience for finding the amount necessary to be evaporated. Opposite the total number of barrels of wort, 47, on the stock of the rule, place 19·3, the average gravity as computed, on the slide, and in a line with 20, the required weight, on the slide, will appear 45·3 on the stock, which number exhibits the proportion of wort (in barrels) of 20 lbs. gravity contained in the 47 barrels at 19·3 lbs. per barrel., The difference between 47 and 45·3, or 1·7 barrels, gives the water that must be driven off by boiling, in addition to the quantity otherwise requisite, in order to procure a wort of the desired strength. When this is done, instead of 47 barrels of wort averaging 19·3 lbs. per barrel, the Brewer will have 45·3 barrels of 20 lbs. gravity. If the standard strength were fixed at 19 lbs. per barrel, or at a lower gravity by three-tenths of a pound than the average of the worts produced, the quantity otherwise usual to boil away should be reduced by seven-tenths of a barrel, or about 25 gallons, for, in like manner as above, 19·3 on the slide being set to 47 on the stock, facing

19 on the slide will be found 47·7 on the stock; and 47 taken from 47·7, leaves 0·7 of a barrel, the amount by which the evaporation otherwise necessary should be lessened, as the wort obtained is stronger than the gravity fixed upon.

Where the same number of barrels of wort is derived from each mashing, then all that is requisite in calculating the average gravity of the several worts, is to divide the sum of the gravities by the number of mashes.

The practice of boiling a wort for a longer time than is otherwise needed, with the object of bringing it to a higher gravity, is in many respects objectionable, and is seldom if ever resorted to, by Brewers of skill or experience. Mashes should be so regulated as to ensure a wort of the quantity and strength intended. Cases however will occur, where, owing to some unforeseen circumstance—such as a mistake in the quality of the malt—the Brewer is compelled to concentrate his worts by protracted boiling, and here the Saccharometer is his sole reliable guide. To take an instance, let us suppose that in a brewing for porter 11 quarters of malt are employed, from which the Brewer expects a produce of 64 lbs. per quarter; and that 22 lbs.

is the rate per barrel fixed upon for the strength of the worts. We will suppose the first and second worts already gauged, and their gravities cast, thus:—

1st wort	11	barrels at	28 lbs. per barrel	308
2nd wort	12·5	„ at	19 lbs. „	237·5
Total. .	23·5	weight		545·5

The third or last mash in the copper, if its quantity and strength were ascertained, and a proper allowance made for heat*, would now amount, we will suppose, to 15 barrels at 6 lbs. per barrel, or 90 lbs. in the whole. This added to the above totals, would give for the entire extract derived from the goods, 635·5 lbs. or 38·5 barrels at an average gravity of 16·5 lbs. per barrel, a result which thus falls considerably short of the estimated produce, as the 11 quarters of malt employed were expected to yield 64 lbs. per quarter, or 704 lbs. altogether. The wort in the copper must accordingly be reduced in bulk by boiling off a certain number of barrels, and the requisite amount of evaporation may easily be learned by having recourse, as in the former example, to the C D side of the rule;

* One per cent. should be allowed for increase of bulk for every 50 degrees of heat, at which the wort stands above 60°.

16·5 lbs., the average gravity of the two worts already drawn and in the coolers, added to the third wort in the copper, being placed opposite to 38·5, the number of barrels produced at that strength; in a line with 22 lbs., the required gravity, on the slide, will be seen 29 on the stock. This quantity, 29 barrels, is therefore all that the Brewer can obtain from his malt, if he desire to keep up the gravity of his porter to 22 lbs. per barrel, and 23·5 out of the 29 barrels are already in the coolers; so that the 15 barrels of wort in the copper must be reduced by boiling until, when cold, it shall not measure more than the difference between 29 and 23·5 or 5·5 barrels. The operation being finished, the results will stand as under:—

	Barrels.		lbs. gravity.	
1st wort	11	at	28	308
2nd wort	12·5	at	19	237·5
3rd wort	5·5	at	16·4	90·2
	29·0			635·7

29) 635·7 (21·9 gravity
58
55
29
267
261

The gravity of the 29 barrels of wort produced, is thus within one-tenth of a pound of the standard fixed on for the porter—an agreement sufficiently near for every practical end.

USE OF THE RULE IN ESTIMATING THE VALUE OF SAMPLES OF MALT.

The line laid down on the lower part of the stock, and denoted "shillings per quarter," acts in conjunction with a scale of "lbs. gravity per barrel" on the slide above, and is useful as affording an expeditious means of judging of the comparative value of different malts, in proportion to their price per quarter, and the produce obtained in the mash tun, expressed in pounds gravity per barrel. To take an illustration of the use of the rule in this respect, let us refer to the example of a brewing given on page 23. In this case, the Brewer was supposed to expect 47 barrels of wort, at a gravity of 20 lbs. per barrel, from the malt he employed, whereas the resulting strength did not amount to more than 19·3 lbs. per barrel for the same

length of wort. To determine the proportion which the price or value of the malt should bear to its deficiency in quality as above shown, we will suppose it to have cost 59s. per quarter; so adjust the rule that 20 lbs., the expected gravity on the slide, shall face 59, or the cost per quarter, on the lower line of the stock marked D; then opposite to 19·3, or the actual lbs. per barrel on the slide will appear 57 on the stock, as indicative of the proportional worth, in shillings, of the malt per quarter. If, instead of 19·3 lbs. gravity, the malt had yielded a wort of 21 lbs. per barrel, then 20 on slide being set to 59 on stock as before, facing 21 on slide is 62, or the comparative value of the malt to the price charged, in shillings, per quarter. Again, let us suppose in two brewings from the same measure, but different qualities of malt—the first malt, costing 65s. per quarter, to have produced a wort of 18 lbs. average gravity, and the second malt, costing 68s. per quarter, to have produced a wort averaging 21 lbs. per barrel; if the gravity of the wort yielded by either sample of malt be placed opposite to its price, the proportional value of the other sample may be readily found on inspection, thus:—18 lbs., the gravity produced by

the first sample, being set in a line with 65s., its price, facing 21 lbs., the gravity from second sample on the slide is 75s. 6d., the proportional value of the second sample of malt. The second sample of malt is therefore as well worth 75s. 6d., as the first is 65s. per quarter, and it is obvious that any number of samples of malt, differing in quality or price, may be readily compared in like manner.

If the Brewer think it desirable, and will take the pains to operate on small, exactly measured quantities of various malts, such as half a gallon or less, making a proper infusion of each in a close vessel, and trying the gravities carefully with the Saccharometer, as in the case of a brewing on the large scale, he will be enabled, by means of this line on the Slide Rule, to form a correct opinion of the relative saccharine value or goodness of any number of samples of malt, much to his advantage, before deciding on the purchase of his stock. It is necessary to observe, that in conducting experiments for the purpose just indicated, the same measure of water as the malt employed should be used for the several mashes—a quart of water to a quart of malt, &c.,—and the goods allowed to stand a sufficient time previous to straining off the wort.

A close vessel, such as a can with a lid to it, is recommended for making the infusions in, to guard as much as possible against a rapid fall of temperature, and to permit the hot liquor to exercise its full extractive power on the malt—a precaution especially called for in operating with small quantities of materials. It is also advisable to measure the malt in the grain, and to grind it afterwards in a small mill, such as that used for coffee.

N.B.—Before putting up the Saccharometer in its case, the instrument should be gently and carefully wiped dry with a fine cloth, each time that it is used. Attention to this point is particularly requisite, if the Saccharometer be ungilt, as corrosion and consequent lightness are much more readily produced in this class of instruments, than where the protection of a coating of fine gold is afforded against the effects of wear or carelessness in the handling. A bulge or bruise, however apparently slight or unimportant, materially impairs the accuracy of the instrument, rendering its indications untrustworthy, by a change of the original dimensions, until repaired and adjusted by the manufacturer.

TABLE showing the pounds of Solid Extract, or fermentable matter, corresponding to the Gravity per Barrel, as indicated by the Saccharometer.

Gravity per Barrel.	Extract per Barrel.	Gravity per Barrel.	Extract per Barrel.	Gravity per Barrel.	Extract per Barrel.	Gravity per Barrel.	Extract per Barrel.	Gravity per Barrel.	Extract per Barrel.	Gravity per Barrel.	Extract per Barrel.
0.	.0	8.4	21.8	16.8	43.6	25.2	65.5	33.6	87.3	42.	109.2
.2	.5	.6	22.3	17.	44.2	.4	66.0	.8	87.8	.2	109.7
.4	1.0	.8	22.8	.2	44.7	.6	66.5	34.	88.4	.4	110.2
.6	1.5	9.	23.4	.4	45.2	.8	67.0	.2	88.9	.6	110.7
.8	2.0	.2	23.9	.6	45.7	26.	67.6	.4	89.4	.8	111.2
1.	2.6	.4	24.4	.8	46.2	.2	68.1	.6	89.9	43.	111.8
.2	3.1	.6	24.9	18.	46.8	.4	68.6	.8	90.4	.2	112.3
.4	3.6	.8	25.4	.2	47.3	.6	69.1	35.	91.0	.4	112.8
.6	4.1	10.	26.0	.4	47.8	.8	69.6	.2	91.5	.6	113.3
.8	4.6	.2	26.5	.6	48.3	27.	70.2	.4	92.0	.8	113.8
2.	5.2	.4	27.0	.8	48.8	.2	70.7	.6	92.5	44.	114.4
.2	5.7	.6	27.5	19.	49.4	.4	71.2	.8	93.0	.2	114.9
.4	6.2	.8	28.0	.2	49.9	.6	71.7	36.	93.6	.4	115.4
.6	6.7	11.	28.6	.4	50.4	.8	72.2	.2	94.1	.6	115.9
.8	7.2	.2	29.1	.6	50.9	28.	72.8	.4	94.6	.8	116.4
3.	7.8	.4	29.6	.8	51.4	.2	73.3	.6	95.1	45.	117.0
.2	8.3	.6	30.1	20.	52.0	.4	73.8	.8	95.6	.2	117.5
.4	8.8	.8	30.6	.2	52.5	.6	74.3	37.	96.2	.4	118.0
.6	9.3	12.	31.2	.4	53.0	.8	74.8	.2	96.7	.6	118.5
.8	9.8	.2	31.7	.6	53.5	29.	75.4	.4	97.2	.8	119.0
4.	10.4	.4	32.2	.8	54.0	.2	75.9	.6	97.7	46.	119.6
.2	10.9	.6	32.7	21.	54.6	.4	76.4	.8	98.2	.2	120.1
.4	11.4	.8	33.2	.2	55.1	.6	76.9	38.	98.8	.4	120.6
.6	11.9	13.	33.8	.4	55 6	.8	77.4	.2	99.3	.6	121.1
.8	12.4	.2	34.3	.6	56.1	30.	78.0	.4	99.8	.8	121.6
5.	13.0	.4	34.8	.8	56.6	.2	78.5	.6	100.3	47.	122.2
.2	13.5	.6	35.3	22.	57.2	.4	79.0	.8	100.8	.2	122.7
.4	14.0	.8	35.8	.2	57.7	.6	79.5	39.	101.4	.4	123.2
.6	14.5	14.	36.4	.4	58.2	.8	80.0	.2	101.9	.6	123.7
.8	15.0	.2	36.9	.6	58.7	31.	80.6	.4	102.4	.8	124.2
6.	15.6	.4	37.4	.8	59.2	.2	81.1	.6	102.9	48.	124.8
.2	16.1	.6	37.9	23.	59.8	.4	81.6	.8	103.4	.2	125.3
.4	16.6	.8	38.4	.2	60.3	.6	82.1	40.	104.0	.4	125.8
.6	17.1	15.	39.0	.4	60.8	.8	82.6	.2	104.5	.6	126.3
.8	17.6	.2	39.5	.6	61.3	32.	83.2	.4	105.0	.8	126.8
7.	18.2	.4	40.0	.8	61.8	.2	83.7	.6	105.5	49.	127.4
.2	18.7	.6	40.5	24.	62.4	.4	84.2	.8	106.0	.2	127.9
.4	19.2	.8	41.0	.2	62.9	.6	84.7	41.	106.6	.4	128.4
.6	19.7	16.	41.6	.4	63.4	.8	85.2	.2	107.1	.6	128.9
.8	20.2	.2	42.1	.6	63.9	33.	85.8	.4	107.6	.8	129.4
8.	20.8	.4	42.6	.8	64.4	.2	86.3	.6	108.1	50.	130.0
.2	21.3	.6	43.1	25.	65.0	.4	86.8	.8	108.6		
.4	21.8	.8	43.6	.2	65.5	.6	87.3	42.	109.2		
1	2	3	4	5	6	7	8	9	10	11	12

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