S.T. Ferment Co. Ltd. and the Model Brewery, Norbury, London

Geoffrey Dye

The interesting story of Messrs Johnson and Hare, their Model Brewery at Fairview Road, Norbury, London and their links with Thomas Hamilton Fox's brewery at Farnborough, Kent started in the early years of the 20th century. Mr Grove Johnson, a chemist, isolated a new species of yeast that resisted destruction at temperatures in excess of 180°F. This yeast, *Saccharomyces Thermantitonum* (the heat resister), an unusual oval shape, were discovered on eucalyptus leaves and occurred in compact masses enveloped in a membranous substance. Experiments showed the yeast bottom fermented, settled down to a compact mass requiring no pressing and had an optimum fermenting temperature of between 80 and 110°F., a considerably higher fermenting temperature than normal ale yeast. This ability to withstand such high temperatures meant that the wort could be directly sent from the copper into closed fermenting vessels without the need of a cooler and yeast pitched at 120°F. This process was considered particularly suitable for use in hot climates and for producing low alcoholic beers by arresting fermentation by lowering the temperature when the desired attenuation was reached. Grove Johnson and his partner, Percy Richard Hare, registered the patent for the yeast on 4 May 1903 (see Appendix).

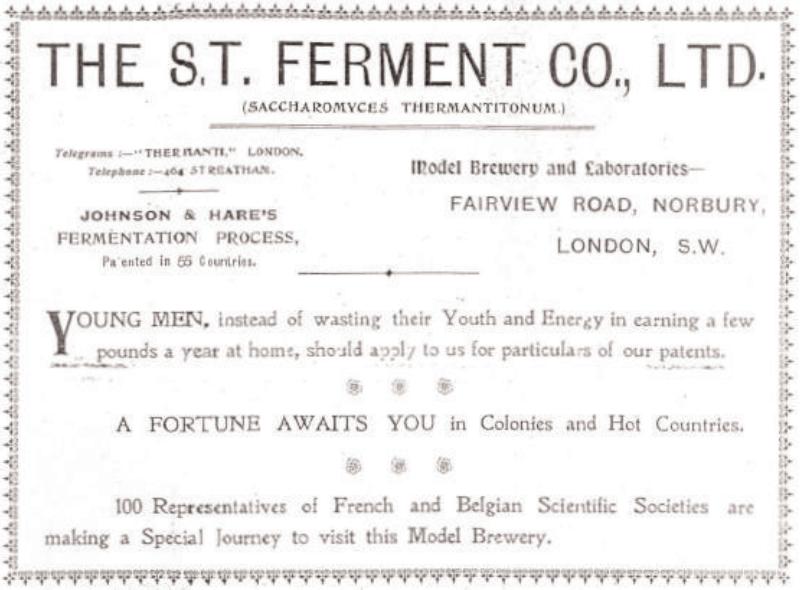
Although Johnson and Hare came from Bromley in Kent it was the Henley-on-Thames brewers Brakespear's whom they persuaded to test brew some beer in the December of 1903. Eighteen months later, in June 1905, this bottled brew was found to be perfectly sound and in excellent state. However, despite the original fermentation proceeding extraordinarily quickly, the beer took a long time to come into condition. Worts of 1050 degrees gravity were reduced to 1010 degrees in 20-24 hours and a 1055 degree brew on Monday was bottled brilliant on the Wednesday following. Initial trial brews were also undertaken at Trumans and Robinsons of Burton on Trent, yet it was Thomas Hamilton Fox, owner of the Fox Brothers Brewery of Farnborough, Kent, who embraced the new process.

Early in 1905 an American steel glass-lined vessel was erected in which as much as five barrels could be fermented. Ordinary worts of the day's brewing were used with ST yeast pitched. Some of the resulting stout was purchased by a work-

ing men's club, along with other supplies, and the results were very encouraging. The men said it was the best stout they had ever had in the club and wished they could always obtain it. A second test was carried out and some of the beer was delivered on two occasions to one of their houses where there were no complaints. There were, however, a number of drawbacks to the process, one being that the yeast thrived better when the wort contained maize, rice or cane sugar.

On 27 June 1905 Johnson and Hare invited several members of the brewing trade to a lecture and the *Brewing Trade Review* of 1 August reported several drawbacks to process, the main one being flavour. The yeast acted best when there was a very large proportion of raw grain which always produces a marked taste which was not appreciated by English beer drinkers. Furthermore, the high temperatures of fermentation were not beneficial to delicate hop flavours. This was probably why Fox's stout was popular, it had a low hop content compared to Pale Ale, its flavours being masked by the chocolate malts.

On 15 July 1905 the *Brewers' Journal* reported that the process was about to be adopted in South Africa and Brazil and a year later the following advertisement was place by Johnson and Hare in the *Brewers' Gazette* (Fig. 1).


THE S.T. FERMENT CO., LTD.

(SACCHAROMYCES THERMANTITONUM.)

Telegrams :—"THERMANTI," LONDON.
Telephone :—464 STRATHAN.

JOHNSON & HARE'S
FERMENTATION PROCESS,
Patented in 55 Countries.

Model Brewery and Laboratories—
FAIRVIEW ROAD, NORBURY,
LONDON, S.W.

YOUNG MEN, instead of wasting their Youth and Energy in earning a few pounds a year at home, should apply to us for particulars of our patents.

A FORTUNE AWAITS YOU in Colonies and Hot Countries.

100 Representatives of French and Belgian Scientific Societies are making a Special Journey to visit this Model Brewery.

Figure 1. Advert from the Brewers' Gazette*, 5 July 1906.*

They began promoting the process more widely and in October 1905 ST Ferment Co Ltd booked a stand at the Brewer's Exhibition with samples of several kinds of beer produced at the Farnborough brewery.

In the 1 May 1906 issue of the *Brewing Trade Review* there was a full report on the new brewery. The plant consisted of a hot liquor tank, mash tun and open copper on a high level with enclosed glass-lined fermenting vessels below. A large laboratory was provided on the same level as the plant. I viewed the premises in late 2009 and the interior remains unaltered (except, of course, that the plant has been removed) and the laboratory is now an office. As can be seen from figures 2 to 7 the premises are still recognisable. Entry from the road is via a very steep staircase to the first floor. On the right is a room (the laboratory) and carrying on the room in front is the main brewing room. Down more steps, on the ground floor, is the fermenting room (no photographs available). This floor was also for storing and racking. For those travelling on a train the old brewery can be seen just after leaving Norbury station on the way towards Clapham Junction on the left hand side. It can also be seen from the front of Fairfield Road. The report says it takes 18 hours for a

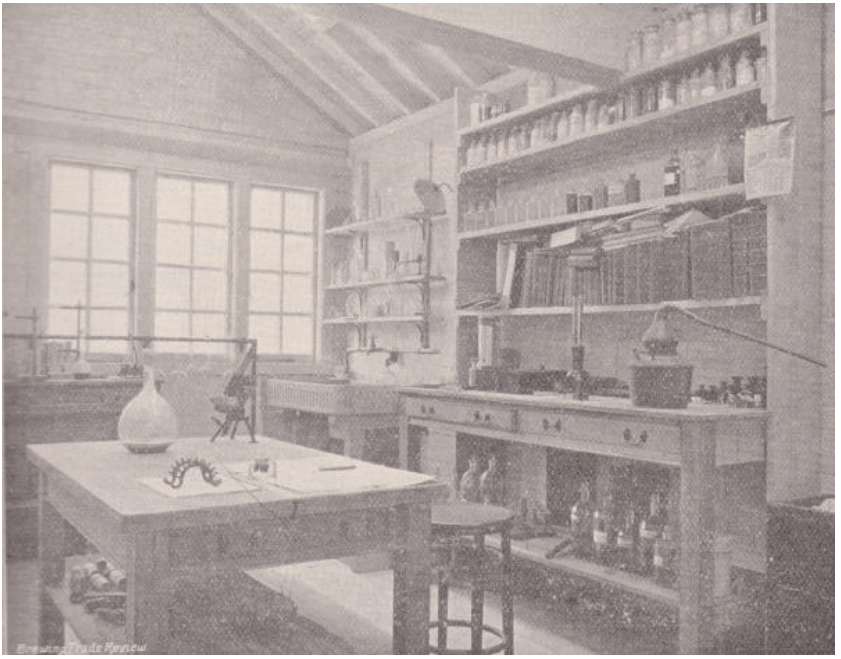


Figure 2. The laboratory from the Brewing Trade Review*, 1 May 1906.*

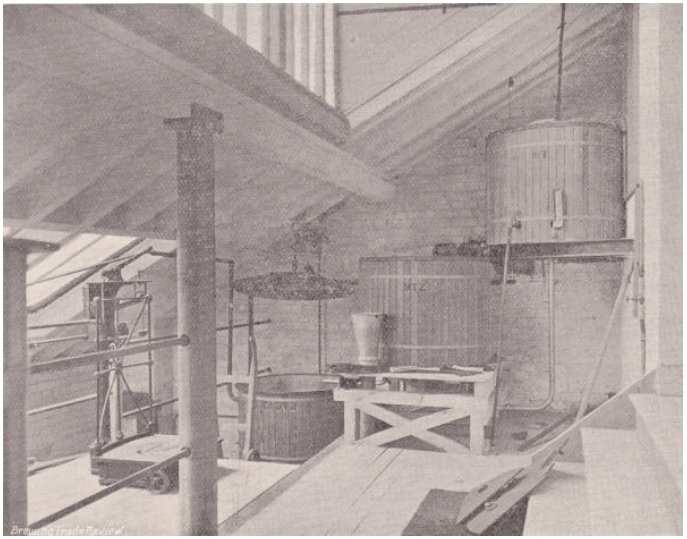


Figure 3. Brewing plant from the Brewing Trade Review*, 1 May 1906.*

Figure 4. The brewing plant room, late 2009. Photo by the author.

Figure 5. The Model Brewery from the Brewing Trade Review*, 1 May 1906.*

Figure 6. View of the former Model Brewery taken from the Norbury - Clapham train, late 2009. Photo by the author.

Figure 7. The front of the former brewery, late 2009. Photo by the author.

fermentation to complete with the yeast settling to a putty-like solid mass at the bottom of the beer which is left practically bright. It may be bottled at once. Thus a beer mashed at 6am one morning is ready to drink at 6pm the following evening. It was reported that it 'has a flavour of its own in many respects' due to the lager type yeast. The piece also stated that a company was to be formed to brew an English lager with the ferment, but the aim generally would be to brew light, palatable beers in hot countries where refrigeration was difficult.

On 1 July 1906 the *Brewing Trade Review* again reported, this time on a demonstration that was given of the process on 31 May at the Model Brewery when many brewers were given the chance to see and taste the light beers brewed.

The business changed in 1907 when the ST Ferment Company was wound up voluntarily and merged with The British Beer Brewers Ltd. (founded in 1902). In February 1908 a new company was established, the British Beer Breweries (Far Eastern) Syndicate Ltd., registered with £10,000 in £I shares to acquire the parent firm. This company had a licence to use, purchase, import and brew from ST yeast in Burma, Singapore. Straits Settlement., Federated Malay States, Java, Siam, Hong Kong and 300 miles to the west of Hong Kong in China States. The first Directors were TH Fox, (Fox's Farnborough Brewery), WHA Barnes and Dr Harold Johnson DSc FCS with a

London office at 24 Coleman Street, EC. A year later Mr De Serin joined the board and it was agreed they would receive no payments or dividends until the company returned its first profits.

In 1908 Grove Johnson wrote and self-published The *Students Manual of Yeast Culture* which obtained a poor review from the Institute of Brewing. It was clear from the book that yeast cultures like *Saccharomyces Thermantitonum* had proved to be unsuitable for English stock beers. However, this did not put a stop to overseas brewing.

It was noted in the *Brewing Trade Review* that in February 1908 plant at the Shubra Brewery, Egypt was now installed and brewing would commence in the middle of the month. Later, in September, a new brewery opened in Entally, on the outskirts of Calcutta, and three years later the Madras Brewery opened, again on the city's outskirts, and employed RW Prosser, formerly of the Bennetts Brewing Syndicate, Newfoundland, as Head Brewer.

In the same year, 1911, Dr Harold Johnson visited the Calcutta establishment. The brewery was housed in a large converted bungalow, previously the country house of a wealthy Indian. It consisted of one immense room with two smaller rooms of equal size at either end, one with a barred window, and the whole structure rested on four foot brick arches. Inside was a mash tun, copper, refrigerator. several fermenting vessels and a chilling plant for bottled beers. Facing the bungalow, surrounded by shrubs, was a large pond tank which provided a year-round supply of cool water for the refrigerator and ammonia condenser - it never rose above 90°F even in the hottest weather. Filtered brewing water was supplied by the Calcutta municipality from the Hoogly River, a distributary of the Ganges, which contained a percentage of sea water.

Labour in the brewery was all native, with the exception of an Anglo-Indian assistant who had engineering knowledge, and the pay was 10 rupees per man per month. One of the staff kept a one eye fighting ram and matches would be arranged and bets taken on the results of fights with other animals.

The brewing method was as follows:- Three quarters of the malted barley raw grain was first mashed in a quantity of lukewarm water. Mash temperature was raised to about 170° by the addition of boiling water and subsequently cooled to 150°. The remaining 25% of the malt was added and after being stirred the mash was left to stand for about two hours. After boiling and filtration in the hop back the wort was pumped up to a small vertical refrigerator on the brewery roof. This initially stood in the open air and was later housed in a small shed. As the wort reached the tray of the refrigerator (probably similar to the external Briggs copper type at Elgoods brewery, Cambridgeshire) long thick filaments, resembling hemp or silk, formed at an

incredible speed and measuring up to one foot long and one eighth inches thick. Despite the pipes being scoured inside after each brew it was clear that this was due to organisms carried in the air, but it was soon realised that the filaments were arrested the moment the yeast got to work. Fermentation with ST proceeds rapidly. Malt mashed at 6am in Calcutta could be consumed as a bright sparkling cold beer at 2pm the following day. Under most favourable conditions a wort of 1042 gravity would decrease to 1011 in about 18 hours.

Fresh yeast was sent over from the UK to prevent infection, something prone to light gravity bottled beers after 3-6 weeks storage. Frequently beers had a most disagreeable yeast bite, a flaw attributed to allowing a fall in temperature during fermentation and the yeast receiving a check. Pitching temperatures varied between 82 and 105ºF. As soon as attenuation had reached the desired point beers were chilled, filtered and racked into casks or bottles. Saccharomyces Thermantitonum is sluggish within a few degrees of its limit and this is the time to filter for cask racking. Dr Harold Johnson stated that the real fault with ST yeast was that it did not produce a sufficiently bitter beer for many tastes and 25% more hops were required, usually added late in the boil or during fermentation.

During Dr Harold Johnson's visit to India Grove Johnson was settling in Australia after having seemingly emigrated there around 1910. By November 1916 he was employed by Tooth & Co. Ltd. as an analytical chemist at their Kent Brewery, Sydney and the next year he published *The Australian Brewing Student's Manual*.

With the advent of newer and cheaper refrigeration technology the ST system appeared to die a natural death. No dates can be found for the cessation of brewing at Norbury, but it was probably about 1907 when the ST Ferment Co. was wound up.

Any members with further information on ST please contact me so I can update this history.

Sources

Ray Anderson - personal communication
Brewers Gazette - various
Brewers Journal - various
Brewery Trade Reviews - various
Ray Farleigh - various
Brewery History - Moynihan, P. (1988) 'A Fox's Tale'. No. 54, November. pp.3-11.
Institute of Brewers Journal

Appendix

PATENT

No. 10,093, AD 1903

Date of Application, 4th May, 1903 - Accepted, 24th Mar., 1904

COMPLETE SPECIFICATION

"Improvements relating to the Fermentation of Liquids"

We, GROVE JOHNSON, "Honours" Certificate City and Guilds of London Institute for Brewing Technology, and PERCY RICHARD HARE both of 8, Hawes Road, Bromley, in the County of Kent, Analytical Chemists, do hereby declare the nature of this invention and in what manner the same is to be performed, to .be particularly described and ascertained in and by the following statement:-

This invention relates to the fermentation of liquids with the aid of a ferment which we have isolated and termed "Saccharomyces Thermantitonum" (the heat resister); the objects being to effect economy in the carrying out of the process of fermentation, to expedite such process and to improve the condition and keeping qualities of the liquids.

The ferment hereinbefore referred to and which constitutes the essential feature of our invention was discovered whilst experimenting with a view to ascertaining the fermenting properties of eucalyptus leaves; the said ferment being obtained by immersing the leaves of the eucalyptus plant in a saccharine solution. Observations taken while thus under treatment disclosed the fact that fermentation was taking place. Microscopical examination of the mixture and the subjecting the same to various tests and experimental trials resulted in the determining of a hitherto unrecognised organism eminently adapted to promote alcoholic fermentation.

The characteristic features whereby the said ferment may be recognised are as follows::- The cells, if magnified by a one-fifteenth objective, appear somewhat smaller than Sacch Cerevisiae and oval rather than round. The cells are rarely in a state of dissociation, but are usually observable in compact masses hanging together closely by means of a membranous substance and this will be the more apparent if a few cells (or a few granules consisting of an agglomeration of cells) be exposed for some hours in a quantity of water maintained, for example, at a temperature of 120° Fahr. The compact granules spread out into skinny flocculent particles, somewhat resembling cobweb, in which the cells are seen to be enmeshed. This membranous substance or web containing cells in their embryonic state is, moreover, observable by the naked eye; as, for example, when a bottle charged with fermented wort containing the said ferment was allowed to stand, with a view to the mature cells settling or becoming deposited, observation disclosed the aforesaid membranous substance in which the embryotic or immature cells were seen in a state of suspension. These floating particles were found arranged at different altitudes according as the cells became developed; the

tendency of the mature cells being always to .subside. The said ferment sustains a temperature of 170° Fahr. without destruction, but it is undesirable to maintain this temperature for too long a period. The character of the ferment in resisting destruction at this temperature facilitates the cleansing of impure cultures by repeated washings with hot water; disease ferments, for the greater part, dying at. 131° Fahr. The result of the said repeated washings (the ferment having been allowed to settle into a compact mass, which occurs in about 15 minutes, after being briskly agitated in clear water) is a greyish, gelatinous, though granulated, substance, somewhat similar in composition and consistency to the soft roe of a herring.

The hereinbefore described ferment is capable of inciting alcoholic fermentation within a wide range of temperature; the temperatures most favourable to the action of the said ferment being between 80° and 110° Fahr. The action is, however,. difficult and slow if the temperature fall below 50° Fahr. or rise above 131° Fahr. It has been found in practice, moreover, that, if the process be carried out under pressure, the action of the ferment in saccharine solutions below 55° Fahr. is accelerated.

During fermentation, the ferment rises in flocculent masses from the bottom of the vessel (it is a bottom ferment) apparently with the assistance of the carbon-dioxide generated. As the gas is liberated upon the surface of the liquid, the ferment descends again ; the alternating movement continuing until fermentation ceases. The ferment, whilst performing its function, rarely renders the fermenting liquid turbid, as usually happens in the case of ordinary yeasts. On the contrary, it has somewhat the appearance of "finings" suspended in a more or less clear super-natant liquor.

At the close of fermentation, the ferment falls to the bottom of the liquid and, in a short space of time, settles in a firm and compact mass, resembling, in consistency, yeast from a brewer yeast press. This mass will also appear to somewhat resemble common yeasts respecting colour but after repeated washings in hot water it will regain the beforementioned characteristic grey colour.

Pasteur has shown that a maintained temper-ature of 140° Fahr. is sufficient to kill alcoholic ferments but our said ferment, after being submitted in a saccharine solution to a temperature of 142° Fahr. for six hours, commenced to perform its functions after a period of repose of eight hours in the same solution reduced to a temperature of 105° Fahr.

After several hours heating at 140° Fahr. the ferment loses its gelatinous appearance and takes the form of a coarse grey powder which may lie dormant for two or more days. Upon the resuscitation of the ferment it again gradually assumes its flocculent condition and ultimately reverts to all its normal characteristics.

The power of the said ferment in inverting cane sugar is very marked as may be readily demonstrated, for example, by digesting a solution of pure crystallized cane sugar with

some of the ferment in a water bath maintained at 140° Fahr. In about an hour's time, distinct inversion will have commenced which may be proved by resorting to the test of Fehling's solution.

We may here mention that no deterioration of the ferment has been observed in fermenting pure solutions of uninverted cane sugar. For example, a litre of a solution of pure crystallized cane sugar of a specific gravity of 1.050 containing 25 grammes of the said ferment and a litre of a solution of lævulose saccharum of a like gravity containing a like amount of ferment were set to work in a water bath maintained at 100° Fahr. Except for the fact that the cane sugar occupied three hours longer than the lævulose to accomplish complete fermentation, *viz*. 14 hours, instead of 11 hours as in the case of the inverted sugar, there was no apparent difference to be observed. Each solution yielded approximately 40 grammes of ferment and microscopical examination revealed no "collapse" of the cells from the cane sugar solution. The fermented product should be withdrawn from the presence of the ferment and conveyed to closed vessels as soon as convenient after fermentation is complete; a period of repose being necessary to allow of the deposition of immature cells: This period will. probably vary very little in'- practice from that ordinarily required after fermentation by ordinary yeasts, but possibly a alight reduction in the time will be experienced.

Having explained the characteristic differences between the ferment and the saccharomyces hitherto known and employed; it may be useful to state some of the advantages resulting from the use of the ferment.

Brewers, according to present practice (regulated, obviously, by the conditions under which alcoholic fermentation by yeast is accomplished) are compelled to use large areas of coolers, refrigerators or like appliances, entailing cost of water or of pumping, waste of time, .labour, and of valuable space, with the contingent risk of putrefaction or adulteration during exposure. These objections are obviated by carefully observing the following rules in connection with the use of the hereinbefore described ferment:-

The wort is to be conveyed, without loss of time, from the hop-back, as hot and bright as possible, to the fermenting vessel. Preferably, this should be done without the intermediate use of settling tanks and the like, providing always that the wort runs bright ; the great object being to avoid exposure and loss of temperature, thus jeopardizing sterility.

The fermentation is conducted in covered vessels preferably constructed of metal provided with manholes, such cocks as may readily suggest themselves, pressure valves. for permitting the escape of excess of carbon-dioxide, and attemperators, or same suitable construction of "jacket", to control the temperature.

The wort should be introduced .into the fermenting vessel as hot as possible, say, for example, 180° Fahr. Although we have found the temperature (180° Fahr.) here referred to desirable with a view to effecting perfect

sterilisation, it will probably be unnecessary. in practice to collect the wort at such temperature. Having introduced the wort, the manhole should immediately be closed. The temperature should then be allowed to fall, either spontaneously, or, if time be an object, with the assistance of the attemperator or

"jacket", to 120° Fahr., the ferment .being then introduced through the manhole and well "roused" in, after which the, manhole should be closed. Fermentation will commence immediately and proceed with Increased vigour as the temperature falls to 105° Fahr.

Should there be a tendency for the temperature to fall below 95° Fahr. before fermentation is complete (although this is unlikely to happen with large volumes of, liquid) hot water or steam should be passed into the "jacket" or attemperators for the purpose of maintaining the requisite temperature.

The precise quantity of ferment necessary for accomplishing complete fermentation within the time limit regulated by the temperature falling from 120° Fahr. to 90° Fahr. is ascertainable only by experience. Any excess by weight of the ferment as compared with ordinary yeast will not, however, be injurious as, according to our experience, no flavour resembling "yeast bite," is imparted under, normal conditions.

If it be desired to obtain perfect fermentation with the improved ferment alone-in a sterile wort-the wort must be collected in the fermenting vessel at a temperature not less than 175° Fahr. the ferment being immediately inserted and the manhole pertaining to the vessel closed. Care must then be taken to reduce the temperature as rapidly as possible, with the means provided, to about 105° Fahr. because as we have already demonstrated length of time and exposure to high temperatures causes the ferment to become dormant varying in extent according to the period it is so exposed.

As hereinbefore described the ferment will work well under pressure of its own gas (CO_2) generated during fermentation. This fact may 'be taken advantage of for racking and '.bottling under pressure. If it be desired to hasten clarification with a view to enabling bright and well aerated beer to be drawn off within a few days of brewing, finings maybe forced at a suitable period, by means of a pump. into the fermenting vessel, the latter being constructed as hereinbefore described. In this process, the employment of the said construction of fermenting vessels would be necessary; although, for ordinary purposes, such vessels are not indispensable to the successful employment of the ferment.

As a result of the employment of the hereinbefore described ferment, the action of yeast pressing and the employment of the product with its crude taste, is rendered unnecessary; the ferment settling spontaneously in a compact mass upon the completion of each fermentation. Moreover, the process of brewing in tropical countries or during periods of high temperature is rendered capable of accomplishment without being subjected to the difficulties and considerable expense incidental to the employment of ice plants rendered necessary

by the use of common yeast. It may with appropriateness, be remarked that the ferment appears to be the organism provided by nature to overcome all the difficulties due to atmospheric temperatures of 80o Fahr. and upwards.

Non-alcoholic beer can be perfectly produced by the employment of the ferment by observing the following rules:- First, worts must be prepared with a view to obtaining the highest possible percentage of non-reducing carbohydrates. As stated above respecting favourable temperature for fermentation, it is merely necessary to reduce the temperature of the fermenting wort to suspend fermentation, the ferment precipitating to the bottom of the vessel, thus allowing the clear beer to be drawn off. This fermented product is then boiled to either eliminate alcohol or to reduce it to the percentage allowed by the Excise. Cooled, filtered and aerated, the result is a non-alcoholic beer of a quality unobtainable by the use of hitherto recognised saccharomyces.

Concentrated beer may be obtained by evaporating the last mentioned preparation by the aid of suitable means, such as steam or water pans ; it being simply necessary, after obtaining the syrup, to again dilute and aerate it, where- upon the condition it assumed before evaporation will be reverted to.

It may here be remarked that the production of non-alcoholic and concentrated non-alcoholic beer, in the manner and of the character above referred to, would be impossible if ordinary yeasts were employed, because suspension of fermentation (if achieved) would not necessitate the immediate separation of the ferment and, if fermenting worts were boiled, containing common yeasts, they would be rendered wholly unpalatable.

The advantages above mentioned respecting the application of our. said ferment to brewing will be similarly appreciable in connection with distilling. In the latter connection, the worts may be fermented at the earliest moment possible after leaving the mash tun and the fermented product conveyed in almost a bright condition to the still. The ferment. reposing in a. compact mass at the bottom of the fermenting vessel may be employed for succeeding operations thereby dispensing with the present necessity of providing new yeast incidental to the destruction of the greater part of the ferment in the still.

Fruit juices and other saccharine solutions may, with advantage, be fermented. with the aid of the hereinbefore described ferment; but it will be obvious that, before fermentation by the said ferment alone can be assured, solutions which bear natural ferments must be raised in temperature in order to annihilate these organisms.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:-

1. The fermentation of liquids substantially as herein described for the purposes specified.
2. The herein described ferment for use in

the fermentation of liquids.

3. The manufacture of fermented liquors, substantially as hereinbefore described for the purposes specified.

4. Fermented liquors manufactures substantially as herein described for the purposes specified.

Dated this 4th day of May, 1903.

HASELTINE, LAKE & Co.,
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