

PETER MAULDON - A LIFE IN BREWING

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Few of the UK's now numerous micro-breweries can claim a brewing heritage as lengthy and distinguished as Mauldon's of Sudbury. With a few minor interruptions, members of the Mauldon family have been associated with brewing in the ancient Suffolk borough for the best part of 150 years, and some of them have also served the local community in an official capacity, as well as supplying it with liquid sustenance.

I met Peter Mauldon, who resurrected brewing in Sudbury in 1982, on many occasions when on the road for neighbouring Nethergate Brewery (which I founded and started brewing in 1986) in the late-1980s and the 1990s, and was fascinated by his past brewing activities. Since enforced retirement, I have spent many happy hours with Peter, in a variety of hostelrys, chatting about the past. It became evident to me that his brewing 'journey' saw him come into contact with several brewing industry 'notables', and of special interest to me was the fact that some of the breweries that he worked at had been connected to important figures in the history of brewing. All this equipped him to play a major, but largely unheralded, role in the UK micro-brewing revolution of the late-1970s - and I felt that there was a story to be told. Here is his story and a portrait of the extant Sudbury brewery, which he founded. Since 2005, the present enterprise has operated from a purpose-built brew-house in Church Field Road, on the outskirts of Sudbury, and is now owned and run by Steve and Alison Sims, of whom more anon.

After operating successfully for around a century, the original Mauldon company was sold to Greene King in February 1958, and there was a 24 year hiatus before Peter Mauldon, brewer incarnate, great-great-grandson

of the founder, and a fugitive from the world of corporate brewing, set up his own commercial micro-brewery in the town. After undertaking his brewing pupilage, Peter's long career saw him brewing for the likes of Tamplin & Sons of Brighton, Crowley & Co. of Alton, the Northampton Brewery Company, Watney (Mortlake), and Mann, Crossman & Paulin in Whitechapel. All of these concerns were, or were to become, part of the Watney empire, which was itself eventually swallowed up by Charles Clore's Grand Metropolitan conglomerate.

The Mauldon story starts in 1861,¹ when a certain Anna Maria Mauldon was lessee and licensee of the White Horse, in Ballingdon Street, Sudbury.² As was commonplace in those days, the inn had a brew-house attached, and was self-sufficient for beer. At some time between 1879 and 1881, the family purchased another Sudbury pub, the Bull Inn (Fig. 1), Church Street,³ which also had its own brew-house. *Pigots Directory* lists the licensee of the Bull Inn as Steven Spurgin in 1839, and the Post Office Directory gives the same name in 1869; 1874, and 1879. By 1891, the name had changed to 'Christie E. Mauldon' in the *Post Office Directory*, and by 1900 it is given as 'A.M. Mauldon & Son'.

For a while, the White Horse brewed dark beers, and the Bull specialised in lighter-coloured products. In 1875, the owner of the White Horse decided to sell up, and bids were invited for the property, which was described as containing 'brewery and stores adjoining (to the rear) and six freehold cottages ...' The first bid was £800, but the lot was eventually purchased by Mrs Mauldon for the princely sum of £1,150. Soon afterwards, she formed a partnership with her son, Christie Edwin



Figure 1. The Bull Inn, Church Street, Sudbury.

Mauldon (Fig. 2),⁴ and they acquired seven public houses, known locally as 'Pearson's Round'. Within the next few years, another seven pubs were added to the estate, and a separate brewery was built behind the White Horse to cope with demand. The new plant became known as the 'White Horse Brewery'.⁵

By 1886, the business was trading as 'A.M. Mauldon & Son', and was listed as 'Wine and Spirit Merchants' as well as 'Brewers' (Fig. 3; Fig. 4), and the name persisted until at least 1900, when a disastrous fire, on the 9 May, destroyed the malt-house, tower brew-house, and some offices. As Peaty relates, the offices fronting onto Ballingdon Street were not destroyed in the fire, and 'remain extant, complete with an embossed glass entrance door and rampant white horse logo on a small pediment' (Fig. 5).⁶ That same year, Christie Edwin, who had become an Alderman of the Borough six years earlier, used his influence and managed to get the brewery rebuilt on an even larger scale, and by 1904, they

were employing around twenty people. Relationships between local breweries were obviously fairly harmonious at this time, for the *Bury & Norwich Post* for 27 September 1904 reports:

The employees of Oliver's, the brewers of Sudbury had an outing to London, there were 41 employees, they were accompanied by 40 employees of Ward and Sons of Foxearth. Lunch was taken at Earls Court. Mr D.Ward was in the chair, supported by Mr Leggot and by Mr Barnes, manager of Acton brewery in London, also by Mr H.B.Bailey of the Cambridge brewery and by Mr P.Fuller, the head brewer at Foxearth. 18 employees of Mauldon's brewery at Ballingdon also accompanied them to the Metropolis.

Christie Junior, and John, two of Christie Edwin's nine children (five sons; four daughters), were taken into partnership in 1907, six years before Christie Edwin's death. These two carried on the business until 1945, when Christie had died. John (Peter's father), who had



Figure 2. Christie Edwin Mauldon.

bought Christie Jr. (Peter's uncle) out just before he died, continued to brew, and took his son, John Jnr (also known as 'Jack') into partnership. The company was now trading as 'J.C. Mauldon & Sons' (Fig. 6, Fig. 7), and, when John Snr. died in 1951, ownership then passed to John's son, John Christie Jnr. (17 years Peter's senior and his half-brother) who assumed the position of head brewer, and carried on the business until February 1958 when he sold it to Greene King. In their last year of trading, the White Horse Brewery had 10 employees, brewed ca. 2,000 barrels, and owned 28 licensed houses and an off-licence. The outlets were in Sudbury and the villages around the nearby Essex/Suffolk border. Both brewery and most of the houses were in need of repair, and some were never to be operated by their new owner. Brewing ceased in 1960. As Wilson notes:

When J.C.Mauldon approached Greene King there was from the outset an understanding that neither would the brewery be kept open nor its small number of employees be taken on at Westgate (although in fact at least three were).⁷

It is also recorded that Mauldon had no intention of approaching anyone else until such time as he heard

what figure had been put on his concern. Since Greene King estimated that they 'should reap the advantage of the saving of competition from Mauldons, and as most of the houses are in our area there would be little additional cost for delivery'. Accordingly, a price of £46,100 plus stock evaluation was agreed.

Ian Peaty relates that: 'At the time of closure the range of beers consisted of sixteen, with six Milds, three Strong Ales, Porter and two Stouts, and four bottled beers, IPA, Extra Stout, Porter and Strong XXXX, in reputed quarts'.⁸ He also relates that, after selling the brewery to Greene King, John C. Mauldon worked for that company as an area manager until retirement. Over their years of trading, Mauldon's had won a number of prestigious medals, notably for their Pale Ale (Fig. 8).

Peter reckons that the Second World War did J.C. Mauldon & Son no favours at all. By the end of hostilities, there was still no electricity - everything being 'run' by a steam engine, and lighting was from gas. 'Half-brother John introduced electricity, refrigeration, and a small bottling plant. Bottling appeared to be the future then'.

It was always anticipated that Peter Mauldon would go into the brewery, as his father had done, but with the latter's early death, when Peter was 13, the running of the business passed to his half-brother John, and a seamless progression into the family firm was no longer possible. Nevertheless, Mauldon had grown up in the brewery environment, and became familiar with the everyday workings from a very early age: 'I knew what mash tuns and steam engines were all about by the age of eight', he told me.

Sudbury-born Peter was educated at Culford School, and, in his own words: 'It took me some time to adapt to the "regime" at school, but, once I did I loved the experience ... it gave me the confidence to succeed'. After he left school in 1956, aged 18, Peter's mother organised a two-year brewing pupilage for him at McMullen & Sons in Hertford (at a consideration of £100 per annum). Such arrangements were commonplace at the time, and the pupilage was basically a way of acquiring brewing skills by being 'articled' to a head brewer in exchange for an appropriate remuneration (which would invariably be retained by said gentleman). The standard of tuition received by the trainee



Figure 3. Dray outside the Ballingdon Street offices.



Figure 4. 'Strong Ale' en route to Australia.



Figure 5. The offices; Ballingdon Street, Sudbury.

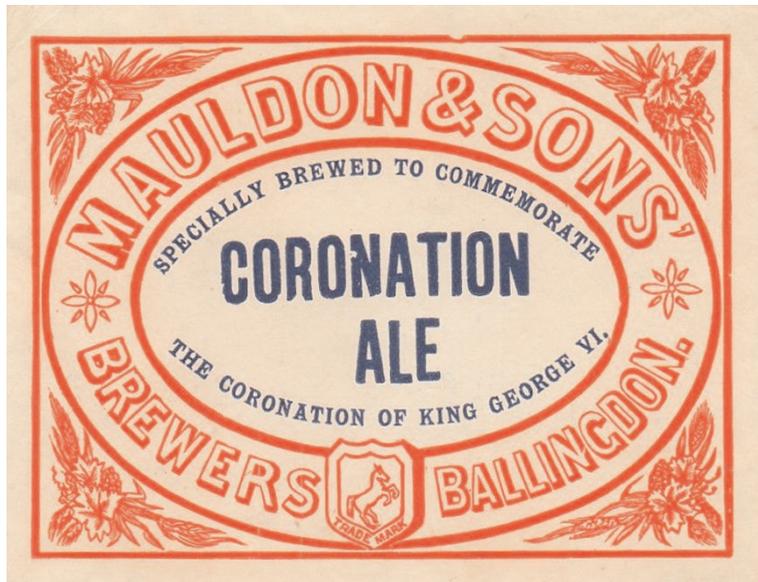


Figure 6. 'Mauldon & Sons'.

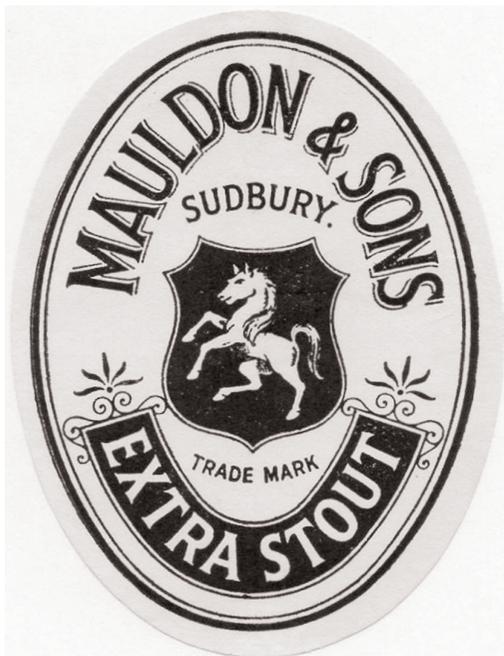


Figure 7. White Horse logo.



Figure 8. 'Medal Winner'.

was extremely variable, and largely dependent upon the conscientiousness of the tutor.

Back then, McMullen's head brewer was A.E. Nichols, who, in Peter's words 'was a thorough gentleman who had fought in the 1914-18 war ... he was very fair and made a real effort to train me properly'. McMullen's were then brewing around 500 barrels per week, and Nichols would lay down a weekly schedule designed to cover all aspects of brewing (including malting). In addition, Peter was given day-release to study A-levels (maths, physics and chemistry) at nearby Hatfield Technical College (now the University of Hertfordshire).

The stint in Hertford was immediately followed by National Service, which, for Peter at least, was mostly concerned with matters electronic; servicing radio transmitters and the like. He admits to be tempted to sign on full-time, but the lure of the mash-tun proved too strong. On returning to civvy street, Peter wrote to the redoubtable Jenkyn Harrington Griffiths,⁸ who was general secretary of the Incorporated Brewers' Guild from 1954-1986, and the reply contained details of around 20 vacancies in the industry. The one which caught Peter's

eye was for a fourth brewer at Tamplin & Sons' Phoenix Brewery in Brighton, and, after a successful interview, he started at the Waterloo Street brewery in 1961, at the grand sum of £750 per annum.⁹

The brewery, founded in 1821, owned around 400 pubs and was producing 3-3,500 barrels weekly at that time. It had been bought by Watney Mann in 1953 who would eventually close it in October 1973. In Brighton, Peter renewed acquaintances with Alistair Heeley, who was third brewer, and who had been a pupil brewer with him at McMullens. Peter vividly remembers the two of them standing on the brewery roof one evening, looking out to sea, and thinking that 'this was as near to heaven as they were likely to get'. Another memorable occasion was when, out of the blue one evening, Heeley declared that his ambition was to be head brewer at Greene King. In fact, Alistair, who has remained a life-long friend, finished his career as head brewer at Greene King's Bury St Edmunds brewery - only a handful of miles from where Peter would eventually end his career.

Mashing-in at Tamplin & Sons was timed for 5am. In the summer months the brewing staff would often be on

the beach and swimming by 7am after which head brewer, Alfred Gough, would buy them all breakfast at a local hostelry. Tamplin's main rivals in Brighton were Kemp Town Brewery in Seymour Road (who had been acquired by Charrington & Co. Ltd. in 1954),¹⁰ and these two concerns, together with Harvey & Son and Beard & Co. of Lewes (where Tamplin & Sons owned a malting), had long been the cornerstones of the 'Sussex Brewers' Association', and Peter can recall many happy group 'meetings' on, and around, the south coast.

Nothing lasts forever, and, after a time, it was suggested that Peter should endeavour to 'enhance his career' within the Watney empire, and, ever eager to listen to sound advice, he duly moved to Crowley & Co's Brewery in Alton, Hampshire.¹¹ In its day, Alton was an important brewing centre, something that was partly attributable to the local water, which had similarities to that from Burton-on-Trent, and partly due to the town's proximity to good Hampshire barley, and renowned Farnham hops. Alton's brewers were thus particularly celebrated for their pale ales, which became something of a vogue in London during the 19th century.

Crowley's had a traditional tower brew-house, were brewing around 2,000 barrels weekly, and had 248 public houses, when Peter was taken on. He was interviewed by the then Head Brewer, Stephen Clark, who also had connections with William Cooper & Co. Ltd.'s brewery in Southampton (acquired by Watney, Combe, Reid & Co. Ltd. in 1943, and previously owned by the Garton family). Peter came as third brewer, and was a replacement for A.H. Button - who had just relocated to The Brewing Industry Research Foundation (BIRF) at Lyttel Hall, Surrey.¹² Mauldon was to come across Button again, for he later joined Watney Mann Ltd's Mortlake Brewery. Number two brewer at Crowley's then was Owen Morris, who was to serve on the Council of the Incorporated Brewers' Guild for 24 years.

Clark was a highly innovative character, and during the Second World War had been involved in the building of a couple of the floating breweries that were to prove so sustaining for British troops. One of the main problems when brewing top-fermented ales on the high seas was the loss incurred by spillages from open fermentation vessels. Steve overcame this particular problem by using inverted (conical bottom uppermost) Nathan-type tanks with the tip of the cone removed. Tanks were

equipped with a yeast overflow system which was not unlike part of the Burton Union apparatus. Such an arrangement prevented undue beer loss during fermentation at sea. Similar ingenuity was needed when Cooper's brewhouse in Southampton was bombed and fermentation capacity was wiped out; Steve's answer was to covert some of his bottled-beer tanks and use them upside down as fermenters. Because of vessel size, this arrangement necessitated beer being fermented at double gravity, and liquored back. Brewing ceased at Cooper's in 1950, but bottling continued for several years - with beer (all under the 'Watney Mann' label) being brewed at Crowley's and tankered down to Southampton. By coincidence, the production director at Cooper's, while Peter was at Alton, was a first cousin of his ('young Christie', as he called him - even though he was almost 20 years his senior).

Peter was at Alton for three years, and then moved to the old Phipps & Co. brewery, 122, Bridge Street, Northampton in a 'swap' which saw Pat Heron move in the opposite direction. The Phipps site was one of two that Watney Mann owned in the town; the Northampton Brewery Co. Ltd. site, also in Bridge Street (No. 116), being the other. These two large breweries had merged in 1957 to form 'Phipps Northampton Brewery Co. Ltd.' (PNBC), and the enlarged firm was bought by Watney Mann Ltd. in 1960, with 1,171 tied houses. In 1964, the name was shortened to 'Phipps' Brewery Ltd.', and, four years later, to 'Watney Mann (Midlands)', a move that coincided with the cessation of traditional ale brewing.¹³ When Peter arrived as number three brewer, the Phipps plant was turning out around 10,000 barrels weekly (the adjacent NBC brewery was brewing around half that volume), and so this was a far larger brew-house for him to contend with. Although the two breweries were all part of the same conglomerate, there was a world of difference between the two of them, in terms of equipment and protocol. The old Phipps brew-house had received little in the way of modernisation, and was, in many ways, a wonderful piece of industrial archaeology. Fermentation, for example was by the 'dropping system', whereby newly-fermenting (24 hour-old) beer would be removed, by gravity, from a copper or stainless fermenting vessel, and introduced into a slate square below - where fermentation would be completed. Much of the other brewing equipment was, even by the standards of those days, somewhat antiquated. The NBC plant, on the other

hand, had been subjected to various modernisation projects (stainless steel kettles, etc.), but the whole brewery was, in Peter's words 'somewhat of a mess; a veritable mixture of old and new'. The NBC brew-house had three mash-tuns, and a Steele's masher fixed to one of them had the remarkable capacity to restrict the grist flow as the valve was opened up! This was an early candidate for the Mauldon 'must do' list, and the third brewer's RAF training proved highly useful, since the masher had been wired up incorrectly.

Despite being part of the same company, the sample rooms in both the Phipps and NBC breweries were strictly off-limits to brewers from the 'other place', but Peter was able to circumvent this problem, and was one of the first to be able to use both amenities with impunity; 'mainly because I was an outsider', he relates. Such was the intense rivalry and adherence to etiquette in those olden times. Under the Watney Mann regime, the Phipps site was the 'South' brewery and that of the old Northampton Brewery Co. was 'North'. Noel W. ('Dusty') Miller was head brewer at 'North', while Leslie Milner performed the same task at 'South'. 'Miller was much more ambitious than Milner', Peter told me, 'and gradually became more powerful'. In 1972, Miller transferred to the new Carlsberg plant and brewed there until 1975, when he took the position of head brewer at G. Ruddle & Co. Ltd., Langham, Leicestershire.

Although brewing on the Bridge Street sites was profitable the PNBC breweries were to be closed over the period 1973-74, and their subsequent demolition would leave the site clear for the construction of a brand new plant capable of satisfying the growing demand for lager. A new business was formed and the project required an initial £12m, investment being jointly financed jointly by Watney Mann (49%) and Carlsberg of Copenhagen (51%). Beers from the latter had been imported into the UK since 1868, and had latterly been supplied in the Northampton area by Phipps.

One beer that Mauldon vividly remembers from his Northampton days is 'Stein Lager' (Fig. 9), which had been brewed at the old Phipps site since the mid-1960s. The brewery had a small (ca. 30 barrel) mash tun which was 'used for experimental beers', and so the small output was all bottled. As Peter says: 'It was top-fermented, and was a poor attempt at a lager'. It died an



Figure 9. 'Stein Lager'.

early death when Carlsberg started to supply Watney Mann pubs in 1969. Well known Northampton beers, such as 'Stingo', had ceased to be brewed by Mauldon's time there.

Beer was brewed on the Bridge Street site under the Watney and Manns labels until 26 May, 1974. In their heyday, Phipps and NBC beers were noted for their higher than average hop levels. Having said that, Peter told me that, in his day, the Artesian bore liquor used was 'rather high in Na⁺, which gave poor hop utilisation...this made the beer quite soft'. He also added: 'Red Barrel was brewed at the North brewery in the "Draught Red Barrel" (DRB) plant, where it was also kegged'. The South brewery closed in January 1973, while the new Carlsberg plant was being built on marshy land behind it. Those staff to be retained started to move to the new distribution centre at nearby Duston, which had easy access to the M1.

When at Northampton Mauldon shared a room with W.B.M. ('Bill') Urquhart, who assumed the position of head brewer there in 1972, when Miller left, and the two became great friends. Bill was to oversee the last days of brewing at the Phipps site. With the changing brew-



Figure 10. Litchborough Brewing Company.

ing scene, Watney Mann was unsure about the future of their Northampton operation, and Bill was asked to produce a feasibility study into two options: i) demolishing the existing breweries on Bridge Street and erecting a new, purpose-built, mega-brewery capable of supplying the entire Watney Mann estate across the whole of southern England; ii) selling off the site and establishing a small depot to serve the local monopoly in

Northamptonshire and surrounding area. They decided in favour of the latter, and so the writing was on the wall for many of the brewing staff.

Most employees were given options as to their futures, with Peter being offered the position of head brewer's position at Mortlake, in return for him overseeing the running down of Northampton and the transfer of some staff to the proposed Carlsberg mega-plant; an offer he couldn't refuse. Urquhart, on the other hand, was to be made redundant, something that came as a great shock to Peter, because in all of his time in the industry, he had never witnessed such a thing happening to a close friend.

Around two years before the closures in Northampton, Peter got actively involved in revenue budgeting, which covered everything from raw materials to transport. Unbeknown to him at the time, this experience was to prove invaluable for his final brewing venture. As Peter said:

I got lumbered with co-ordinating all budgets on site, and, as a result, I found that the biggest cost was labour - everything else costing peanuts ... I worked out that, if you could sell twelve barrels/week you could break even (even at Northampton!) ... there WAS money to be made in brewing if one ran a sound ship...I then said to Bill that I reckoned that, someday soon, someone was going to get some old equipment together and start brewing.

With nothing to lose, Urquhart then pestered Peter for more production figures, and, within no time, told him: 'I'm going to have a go'. He had purchased an old pub, with outbuildings, from Watney Mann in Litchborough, Northamptonshire, and, because Watney Mann was somewhat embarrassed about making him redundant, they gave him the pick of any stainless steel equipment that he might need for his venture. So, the resourceful Urquhart, with the help of a neighbour, engineer Frank Kenna (who was to become a partner in 1978), cobbled together the Litchborough Brewery (Fig. 10), which started brewing in 1974. The story of how a five barrel brew-house emerged when Urquhart and Kenna (Fig. 11) gathered together a miscellany of cellar tanks, gas bottles, and an old washing machine motor, is the stuff legends are made of. This was Britain's first new commercial micro-brewery: a totally different enterprise to the Miner's Arms, Priddy, Somerset, which was a brew-



Figure 11. Bill Urquhart (left) and Frank Kenna at the brewery.

pub.¹⁴ The UK ‘micro-brewing revolution’ had started. Originally, Bill, who, in a long career, had brewed at other Watney breweries in Ely and Norwich, wanted Peter to go into the venture with him, but the lure of a prime job in London won the day, and Peter duly decamped to Mortlake. In hindsight, this was just as well because the business was really only capable of supporting one family. Litchborough ‘Northamptonshire Bitter’ was received with great acclaim, and Urquhart was soon brewing more than he had bargained for. Fortunately, he was able to inveigle his wife and, occasionally, his daughter to help him when necessary. He did, however, face a major problem; because of Watney Mann’s dominance in Northamptonshire there was a dearth of hand-pumps. Most of Urquhart’s output, therefore, was in keg. Northamptonshire Bitter had its roots in the Phipps Pale Ale recipe, which was suitably

scaled-down for a small brew length. Eventually several of Litchborough’s free trade outlets acquired hand-pumps so that traditional draught beer could be supplied to them. Litchborough’s first customer was Farthingstone Golf Club, where Bill was a member.¹⁵

Local businessman John Heaverman (Fig. 12) was often at hand to help Bill when the situation demanded, and he would take over the brewery in 1979, when its founder wished to retire. Because of demand, Urquhart had wanted to expand the brewery at a different site in Litchborough, but could not get permission from his local authority - so he decided to sell. Shortly after purchase, Heaverman moved the business to an industrial estate in Daventry, Northamptonshire, and four years later it was sold to drinks wholesalers Liddingtons of Rugby; the brewery closing in 1986.

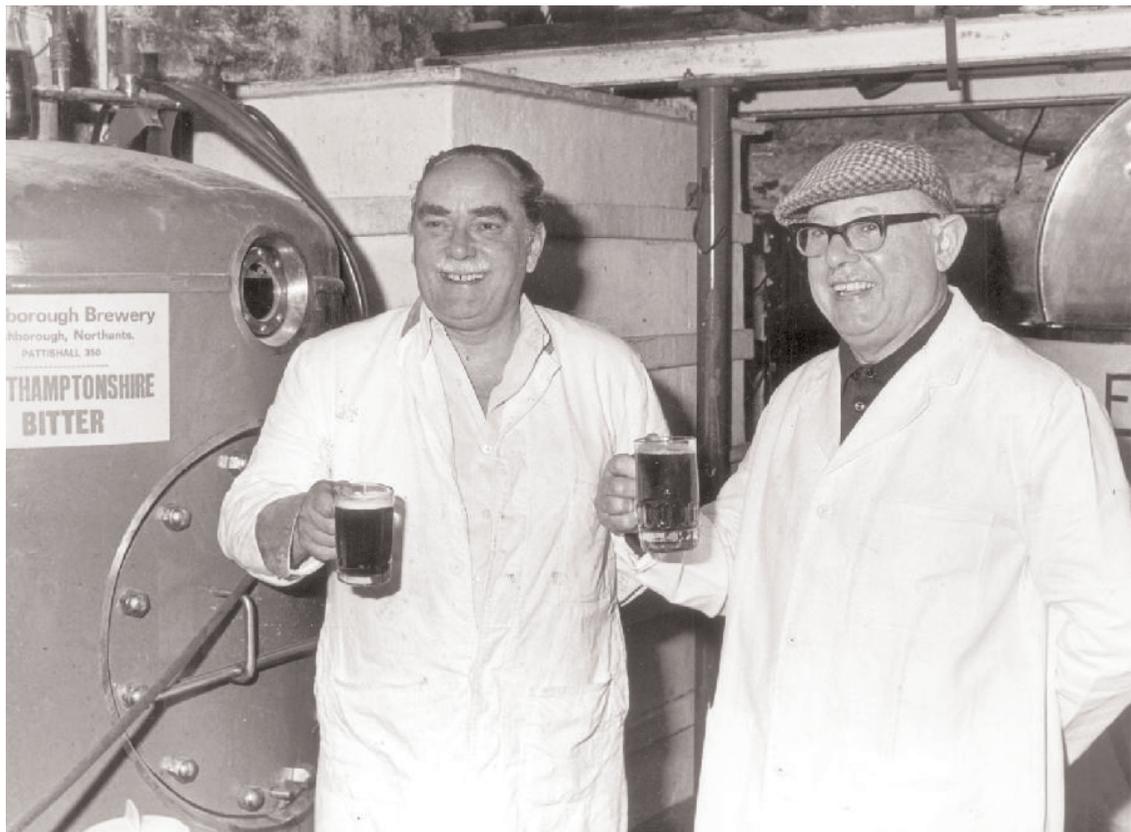


Figure 12. John Heaverman (left) and Bill Urquhart.

As well as running his brewery, Urquhart acted as a consultant to several of the new breweries being set up in the late 1970s and early '80s, but he took on his most intriguing project after he had sold Litchborough in 1980 and was just starting to enjoy retirement. He received a call from the Foreign Office indicating that there were logistic problems associated with supplying beer to the island dependency of St Helena. 'We thought that they might brew their own beer' was the gist of the call, with the proviso that 'the brewery be as labour-intensive as possible'. Bill went out to St. Helena to suss out the feasibility of it all and told the Foreign Office to go ahead. Peter acted as an intermediary and gathered the necessary equipment together in Bristol ready for transportation. For the next three years, Bill spent several months a year in the South Atlantic assembling a brewery and training local operatives. After a couple of years in operation a bottling plant was deemed necessary, and the two ex-Northampton brewers duly obliged,

although, by this time Peter had embarked upon his brewing venture in Sudbury. The St Helena undertaking lasted for several years.

Mauldon started at Mortlake in 1973, where he succeeded Peter Barrow as head brewer at a plant that was then producing around 20,000 weekly barrels, all brewery conditioned (keg and cellar tank). Bottling then was carried out at a modern plant at the old Isleworth Brewery site; 120 barrel batches of beer being tankered from Mortlake. In effect, the site was the centre of the Watney empire, especially with regard to the fact that the company's Central Research Laboratory (CRL) was on the site. There were, in fact, two laboratories at Mortlake; one for the everyday brewery requirements and one for fundamental brewing research, the latter being under the charge of that eminent brewing scientist, Dr Laurence R. Bishop. Mauldon's office was only a stone's throw away from the great man, 'but my role never demanded

that we had to speak professionally; we inhabited very different worlds - mine managerial and his technically innovative'. Bishop was Watney Mann's chief chemist, and was sufficiently influential in the company that he had direct access to the Board, most notably Simon Coombe and Sandars Watney. His reputation led to Anderson penning: 'Suffice it to say that Bishop has a strong claim to being regarded as the premier brewing scientist of this [20th] century - regardless of nationality'.¹⁶ Bishop's career in brewing research is so outstanding that it is worth looking at some of the landmarks.

Cambridge-educated Bishop (1903-1988) (Fig. 13), who secured a double first in the Natural Science Tripos at Trinity College, records that

in 1926 the Institute of Brewing [IOB] published a small advertisement in *Nature* for a scientist to study the nitrogen compounds of barley. I had the honour to be appointed to that post and the nitrogen compounds of barley, malt, wort and beer have been an outstanding concern of mine ever since.¹⁷

For this early work, conducted in 1927, Bishop was stationed at Rothamsted Experimental Station, Hertfordshire, where he was involved with barley evaluation, and 'developed an acute interest with all agricultural problems connected with barley'. In particular, he was interested in why barley nitrogen content was high one year and low in another, and 'what controlled yields and how far could they be controlled'. As Bishop said:

The data for such studies were there at Rothamsted - from the hundred year old classical experiments on Hoosfield and from the Woburn plots, while, in addition, there was much further information from the then current Institute of Brewing nationwide series of barley manuring trials. These had been inspired and organized by the perspicacious and energetic director of Rothamsted at that time - Sir John Russell.

The findings of this pioneering work were published in a comprehensive ten-year *Report*.¹⁸ Again, Bishop tells us:

Previous advice had forbidden nitrogenous fertilizer as inevitably bound to increase nitrogenous content and lower quality; but one of the essential findings of this Report was that, correctly used, nitrogenous fertilizers could be of benefit to yield, without damage to quality. [He goes on] Russell



Figure 13. Dr Laurence.R. Bishop.

successfully promulgated the findings of the Institute experiments in the years before the war, and it is my strong conviction that the increased barley yields were of great benefit to this Industry and to this country. Especially was this so when the country was plunged into war, and the massive barley imports suddenly stopped - leaving us to starve or survive on home-grown supplies.

The continuous barley long term trial experiment at Hoosfield, Rothamsted commenced in 1852 and was organised and run by John Bennet Lawes (1814-1900) and Joseph Henry Gilbert (1817-1901), both of who were noted agricultural scientists who were later to be knighted. The Lawes family owned Rothamsted Manor and John founded an experimental farm at his home which would eventually become Rothamsted Experimental Station - the oldest agricultural research facility in the world. The first barley to be grown in the 'continuous' experiment was 'Chevalier' (1852-1880) and, in 1873, the *Journal of the Royal Agricultural Society* published the results of 20 years of experimentation with this variety.¹⁹

Sir John Russell had a special interest in barley growing and instigated the first trials for the Institute of

Brewing's 'Barley Advisory Committee' (renamed the 'Barley Committee' in 1920). During his 'Rothamsted period', Bishop conducted his work on 'prediction of extract', and continued with barley matters, such as carbohydrate and nitrogen composition,²⁰ until the research emphasis changed in 1934 when he was transferred, along with most of the Institute's research, to the School of Malting & Brewing at Birmingham University.²¹ This was an attempt to centralise research, rather than have it conducted in disparate establishments.²² Although still publishing results of researches on barley and malt, he developed a new interest in yeast and fermentation. Bishop was to spend 12 years in Birmingham, during which time he worked with several eminent brewing scientists, including professors R.S.W. Thorne, R.H. Hopkins, and C. Rainbow. His fermentation work at Birmingham was wide-ranging and included: assimilable carbohydrate; assimilable nitrogen; essential minerals, and vitamins.²³

His first zymological work was on 'sticking fermentation' (then called 'yeast weakness'), which was usually attributed to nitrogen deficiency, or, sometimes, vitamin deficiency ('bios').²⁴ Research showed that 'normal' worts normally contained sufficient nitrogen and vitamin levels, but that some brewery worts can be deficient in minerals - although no conclusions were able to be reached before Bishop moved on. In 1946, he took the position of chief chemist at Watney Combe Reid & Co., Ltd., Stag Brewery, Pimlico, London, succeeding the redoubtable Julian Baker who had been in position since 1900.²⁵ Thus, remarkably, Watney Combe Reid had only two chief chemists for the first 70 years of the twentieth century. When the Stag Brewery closed in April 1959, Bishop relocated to the Mortlake site - which also had the name 'Stag Brewery' transferred from Pimlico.

Work on the role of minerals in brewery fermentations carried on after he went to Pimlico, although he found things very different:

At Watneys I was somewhat nonplussed when I found that tests had to be made in 700 barrel (1,000 hectolitre) vessels. Fortunately, these tests were remarkably successful and by 1951 Mr Cory and I were fully convinced that brewery worts can be deficient in minerals for yeast nutrition. Furthermore, we were convinced that my original observations had been correct and this deficiency was

overwhelmingly that of one element, required only in fractions of a part per million - zinc.²⁶

Bishop went on to intimate that trace amounts of zinc are required for the integrity of some yeast enzymes 'such as alcohol dehydrogenase'. The yeast requirement for zinc has been since elucidated, but of subsequent work Bishop avers:

... none, I think, has had a more dramatic result than our first large-scale test in 1951 in two 700-barrel vessels, where the stimulated fermentation gave a yeast head some eight feet higher than that of the control, and this is the result of the addition of only three quarters of a part per million zinc. Incidentally, yeast is so avid for zinc that, at the end of primary fermentation, all traces are removed from beer.

Bishop was remarkably outward-looking in an era when the British brewing industry was rather introspective. In this respect, with the encouragement of European brewing scientists, he established the European Brewery Convention (EBC) Analysis Committee as the primary co-ordinating and regulatory body for analytical methods in Europe. While he was chairman of that body (he was also chairman of the IOB's Analysis Committee) many 'standard' methods and test procedures were adopted. He was also responsible for developing equipment, such as the EBC colour discs and EBC mill.²⁷ Also, during his time, a method for the analysis of beer bitterness became the first to be agreed internationally.²⁸ In the IOB *Centenary* booklet, the following compliment was paid:

A study of any comprehensive index will bring forth the name Bishop as one active in matters brewing from Analytical Methods to Zinc in Fermentation - with mid-alphabet peaks at Malting and Nitrogen. All brewing problems have been grist to the mill - including the EBC mill itself, and as a participant at EBC Congresses and Committees he can have few rivals.²⁹

Later, Ray Anderson was to write:

Laurence Bishop was to go on to become one of the most versatile, accomplished, and influential research scientists ever associated with brewing in Britain in a career which stretched over fifty years.³⁰

One of Bishop's major contributions to the Mortlake brewery was to investigate a problem which was rife in

London breweries at that time; cask ale spoilage due to the bacterium *Zymomonas*. Casks were mostly metal by now, and Bishop's solution was to chill, filter, and carbonate draught beer prior to filling, and this certainly eradicated the problem. As Peter said: 'From here, there is only a short step to keg beer'. Within no time, 100% of Mortlake beer was chilled and filtered, and this method of production soon spread to other Watney Mann breweries.

It was also when at Mortlake that Bishop turned his attention to hops ('I found hops an exhilarating study'), in particular the fact that 'lupulin grains contain all that is of benefit to brewers and offer great advantages in the separated state'. This being the case, he devised a method of separating them.³¹ The patented method involved separating the grains by rubbing them off in a disc pin mill and then 'washing' them out in an air stream through a centrifugal sifter.³² Grains thus separated are then comminuted by grinding in a colloid mill, and this 'concentrated form of lupulin' can be used to bitter beer either directly in the copper or in a pre-boiling stage. It was shown that in an aqueous extraction process of this lupulin preparation, almost quantitative pure and separate fractions of the alpha- and beta-acids can be obtained. From these, the alpha-acids can then be isomerised nearly quantitatively and the beta-acids can be oxidised to give a 50% yield of hulupones. The latter are added to the kettle, while the isomerised α -acids can be added as post-fermentation bittering. It was postulated that α -acids extraction is about 95% efficient and that the conversion to iso-humulones is around 90% efficient.

Regarding aroma, it was claimed that the aqueous extraction process 'has been found to leave the hop aroma in the extracted lupulin material in an unadulterated condition, except that it has been freed from fatty acid and vegetable odours'. Later, Bishop published proposals for the efficient and economical use of hops in brewing.³³

Of all his contributions to brewing science, Bishop is most widely known for his pioneering work on continuous fermentation; his classic paper appearing in *Journal of the Institute of Brewing* in 1970.³⁴ He commenced his interest in the subject as far back as 1925,³⁵ and maintained that serious work into the subject might have commenced some 30 years earlier than it did, but that 'conditions in the industry were not favourable for

developing it further'. The initial pilot plant at Mortlake was capable of producing 1,000 gallons per week, and the first trial brew on it was mild ale, which was surreptitiously introduced into the regular trade. There being no adverse comments from mild drinkers,³⁶ a number of other beer styles were brewed on the apparatus, and the resultant beers were found to be highly acceptable, in fact, large volumes of continuously-fermented beer went out into trade, without adverse comment.³⁷ This prompted Watney Mann to build a full-scale continuous brewhouse at Mortlake. Bishop's remit was that the plant should be able to cope with the production of a variety of beers, of widely differing OG. This it was able to do, and, as a result, Watney Mann installed similar plants in three of their other breweries. As Bishop reported in his seminal 1970 paper:

The system has been installed in four breweries which have at present a total maximum output of 20,000 barrels per week. It has proved flexible in operation. Its use is considered amply justified both on the grounds of economics and maintenance of high beer quality.³⁸

The plant comprised a safe wort storage facility; a means of wort sterilisation, and a wort oxygenation column. The latter was critical in effecting the correct level of wort oxygenation (too much and too little are both deleterious). The main part of the plant consists of two stirred fermentation tanks, and these are followed by a specially-designed yeast settling vessel (consisting of a cylindrical upper part and a conical bottom). As Bishop stated: 'In this type of continuous fermentation plant the basic control is the relationship between the wort supply rate and the fermentation temperature'.³⁹

Other types of top-fermented beer were successfully trialled, including 'Stingo', a beer that took nine months to produce by traditional methods. Apart from the time factor, the production methods used led to significant losses - thus making Stingo a very expensive beer. Bishop found that he could produce an acceptable version of this beer in two days, and the continuous method gave him a useful control of final sweetness. Bishop concluded that:

I am not aware that any other version of the continuous fermentation process has been claimed as capable of fermenting satisfactorily really strong beer (1080-1090° OG), but in our experience it is the only method for producing

strong beer which is either economic or satisfactory, and it is the only method we have used in recent years.⁴⁰

As for lager, trials were ongoing when Bishop published in 1970, but he maintains that: 'Our experience is that very satisfactory lager can be produced in this way'.

Other notable Bishop achievements during his Watney days were in the fields of: pure yeast propagation; mashing;⁴¹ carbon dioxide collection; dosing and regeneration of the brewing aid PVPP;⁴² formulation of yeast food; formulation of detergents and disinfectants for brewery and pub use;⁴³ lacquering copper mains; control of air (oxygen) pick-up by beer during packaging, and a tangential mixing device for dispersing liquor treatment prior to brewing, thus helping to ensure the control of beer pH.

Lesser known, was his work on continuous wort production, which did not proceed past the experimental stage. Through the efforts of Bishop's team, Watney Mann became, arguably, the most technically-oriented of all UK brewers - certainly the most innovative. To me, Bishop's work can be regarded as the apotheosis of late-20th British century brewing research and much of his work is summarised in his Horace Brown Memorial Lecture.⁴⁴

The well-documented drawbacks of continuous fermentation, and a change in drinking behaviour, meant that by the time Peter arrived at Mortlake, the three-vessel plant was not being used in a revenue-earning capacity, but was being used for storing recovered beer. The brewery itself was antiquated, but a new one was being built (on, what was, the bowling green). All beer was brewery-conditioned - mostly in keg, but some in cellar tank ('there wasn't a cask in the place'), but, by the time that the new brewery opened, CAMRA came into existence and had begun to influence the draught beer trade. The Board in London began to take note, and, before long, Chairman, Robin Soames, called Mauldon in to discuss the possibility of brewing cask-conditioned beer once more.⁴⁵ Firstly, Peter had to explain exactly what 'cask-conditioned' was and that the appropriate containers would have to be purchased. After a while, Soames said: 'Right; we'll go ahead', and a bemused head brewer went away to inform his team about the about-turn in policy. None of his staff knew anything about 'live' beer, and a large percentage of subsequent 10.30 meet-

ings were used to impart the relevant information. Subsequently, the brewing staff was informed by Soames that no casks were to be purchased, and that they would have to, somehow, use the existing keg stock. Once the astonishment had receded, Peter and his brewing staff devised a mechanism that would allow 'live' beer to be drawn from a keg. The system involved 'blowing-out' the base of the keg to give a 'rounded' bottom, and inserting a modified spear into the top. A small weir was inserted at the concave base of the keg, and yeast would settle underneath its upper edge, thus allowing clear beer to be drawn up through the spear, which had a modification at the upper end to allow air to replace the beer being drawn off. The use of these converted kegs spread to other breweries in the Watney group. Another innovation at Mortlake during Peter's reign there was the use of phenol-formaldehyde resin as a means of haze-proofing beer.⁴⁶ A major problem that had to be resolved during the Mauldon years was a massive fire in the new brewery being built at Mortlake on the old bowling green. The buildings were in three blocks; brew-house, fermentation block and processing. The brew-house and processing had been commissioned, and the fermentation block was nearing completion when a spark from a welding torch caused a major fire. For a while the smoke stopped flights in and out of Heathrow and caused major disruption to production. With the new fermentation suite temporarily unavailable, wort was pumped from the new brew-house to the old fermentation facility, and the resultant green beer was passed back to the new processing block. Fortunately, all pipe-work was paid for by insurance.

Peter managed to achieve a brewing landmark while at Mortlake in the 1970s when he approved what was probably the first £1 million duty cheque in the UK; he also brewed 'Red Barrel', the *bête noire* of CAMRA. Also while at the Stag Brewery, he picked up a copy of *The Times* one day and in it found a picture of Bill Urquhart standing next to the famous 'Watney wall' - with a caption saying 'What We Want is Bill's'.

After six years at Mortlake, Soames asked Peter whether he would go to the old Mann, Crossman & Paulin Albion Brewery in London's Whitechapel Road, as production manager. His remit was to sort out problems within the bottling plant - which was one of the largest in Europe (at one time, it was home to the largest Guinness bottling operation in Europe). 'The Mann's



Figure 14. Mauldon's Brewery in early 1982. From left to right: Peter Mauldon, Steve Birch, Sara McGarr, Derek Compson and Jane Mauldon.

brewery was quite traditional, and, even though it had brewed ca. 20,000 barrels weekly, there was plenty of spare capacity', he averred. The problems were duly solved, but the move was badly timed because the whole plant was about to be approved for closure. In fact, brewing had ceased in 1979, but kegging and bottling continued; the kegging plant packaging around 10,000 barrels of tankered-in beer weekly. Peter reckons that, when he was there, it was the most modern bottling plant in the world, but this was to prove his last Watney assignment.

Mauldon finished at Whitechapel Road in 1982 after three years, and when it became obvious that he was being earmarked by 'Grand Met' for a move up to Manchester to oversee the closure of Wilson's brewery, he couldn't face the prospect of being involved in more brewery carnage. Instead, he negotiated suitable redun-

dancy terms, and with the success of some of the new micro-breweries, decided to start his own venture.

In fact, the success of Urquhart's Litchborough venture persuaded several other 'refugees' from the shrinking UK brewing industry to try their hand at something similar, and the rest, as they say, is history. By the early 1980s, the British drinking public's interest in traditional beers had been rekindled, and in early 1982, Peter, together with wife Jane, and trusted ex-colleague Derek Compson, acquired an industrial unit in Sudbury. One early problem was that of the very name of the brewery. Remember, the name 'Mauldon' had been sold to Greene King in the 1950s, and using it again could prove difficult. Fortunately, Peter's half-brother John worked for the Bury St. Edmunds brewers and he approached the relevant department. The gist of the reply from Bury was: 'We wish you all the very best

with your new venture; by having more choice, we'll sell more beer ... there's enough room for all of us'. Peter originally wanted to use the site of his family's old White Horse brewery, but this proved impossible, so he trundled round a few other locations - including that of G.E. Cook & Sons Ltd., Tidings Hill brewery, Halstead, Essex.⁴⁷ Mauldon entered into lengthy negotiations with Richard Cook, but could not come to an agreement. In the end, an industrial unit in Addison Road, Sudbury was leased (and later purchased).

From the start, Peter recognised that he was taking a big risk and, therefore, wanted minimal capital expenditure. With uncanny foresight, whilst at Whitechapel, he enquired about the fate of numerous, defunct, one- and five-barrel cellar tanks that were littered about the estate, and was told that 'they are free if collected'. Such items, plus some ex-dairy equipment, formed the basis of the 15 barrel brew-house (Fig. 14). Although there was quite a lot of free trade in the vicinity of Sudbury, much of it was 'tied' by means of brewery loans, and Mauldon's first outlet was Sudbury Squash Club - who were genuinely free. Despite the 'soft loan' problem, with the aid of local CAMRA groups, the brewery managed to build up to 35 barrels per week after 18 months, which as Peter admits gave him 'a reasonable living, but it was very hard work'.

Compson, who had been a brewing chemist at Truman's Brick Lane brewery, and then at Mann's, with Peter, and Peter himself, carried out the manual chores of brewing and delivering, whilst Jane found plenty to do in the office; the 'Mauldon' name was now re-born. As business progressed, more help was needed and Steve Birch, a young local lad, was hired as a general help in the brewery. Derek retired after about five years, and Steve, who had gradually learnt the trade under Peter, progressed to the position of head brewer, one that he still holds today. Sara McGarr then joined the team to give Jane much-needed help with office chores.

Around the turn of the new millennium, Peter felt that it was time to retire, but, since his son, James, who had been an assistant brewer, did not want to take on the responsibility of running the company, there was a possibility that the enterprise might have to be wound up. Fortunately, redemption arrived in the form of Steve Sims, at that time free trade director of Adnams, and someone who Mauldon knew quite well. Steve had been

working for the Southwold brewer for around 18 years, and together with wife Alison, who worked in the brewery accounts office there, had been thinking about running their own business for some time. Being well acquainted with Peter, Steve was well aware of Mauldons products, and with Peter's desire to take a back seat. Mauldon tells me that he would not have sold his business to 'anybody', but was quite happy that his loyal staff would be well looked after under a Sims regime. Peter was especially anxious that the 'Mauldon' name be retained, and this presented no problem for the prospective owners. After a bout of number-crunching, Steve and Alison felt that the time was just right to step into Peter's shoes, and by March 2000, the brewery was theirs. As Steve recalls, 'Adnams could not have been more helpful, they even offered me laboratory facilities'.

The Sims' were determined to expand the business, and trade continued to flourish, and it was soon pretty evident that the Addison Road site could not cope for much longer. Accordingly, a brand-new brew-house was built in just down the road (Fig. 15), the equipment being sourced from Canada and installed by AB, UK Ltd. Brewing at the new site commenced in January 2004. Despite its modernity, the new 30-barrel plant (Fig. 16) is entirely traditional apart from the fermenters, which are upright and enclosed; they are not, however, conicals. The new copper will hold 40 barrels, and it is possible to get 50 barrels out of the mash tun. The FVs can hold 30 barrels. All beer production and manipulation (Figs. 17 & 18), bar bottling, is carried out in the main brew-house area, and there is a refrigerated facility in the brewery yard.

Present weekly output averages out at around 50-60 barrels, although the new kit can accomplish 100 quite easily, when the situation demands. At present, about 95% of output in cask, the remainder being bottled for them at Wolf Brewery, Besthorpe, Norfolk. Best selling beer is the 4.2% ABV 'Silver Adder' closely followed by 'Mole Trap' (3.8%), and the flagship 'Black Adder' (5.3%). Other regular products are: 'Christies Golden' (3.9%); 'Micawber's Mild' (3.5%); 'Suffolk Pride' (4.8%), and 'Blackberry Porter' (4.8%), and these are supplemented with a range of seasonal beers, some of which expand upon the Dickensian theme.

Over the years, Mauldon's have won numerous awards, but in 1991 the brewery achieved the ultimate accolade



Figure 15. The new brewery site in Church Field Road, Sudbury.



Figure 16. The brew-house: Back row; left to right, copper, cold liquor tank and two FVs. Front row; hot liquor tank and mash tun.



Figure 17. Steve Birch getting ready of cask-racking.



Figure 18. Steve Birch taking stock to the cold room.



Figure 19. The Brewery Tap, East Street, Sudbury.

when ‘Black Adder’ was voted CAMRA’s Champion Beer of Great Britain. A fine range of Mauldon’s beers are available from their shop, and in their tied house, the Brewery Tap (ex-Black Horse), East Road, Sudbury (Fig. 19), which opened in 2008, and has experienced a year-on-year increase in trade.

The author wishes to thank Keith Osborne for Figure 10 and BHS Chairman Jeff Sechiari for supplying the other label illustrations in this article. Figure 13 is by courtesy of the Institute of Brewing & Distilling.

References

1. Bristow states ‘This brewery is claimed to have been founded in 1793, probably as a home-brewery inn’. Bristow,

C.R. (1985) *A Directory of Nineteenth and Twentieth Century Suffolk Breweries*. Ipswich: Salient Press.

2. Some records have Ann Maria Mauldon (née Spurgin). She was born in 1828.

3. According to Bristow, one Steven Spurgin, wine and spirit merchant, was at the Bull Inn (‘35 and 36, Church Street, Sudbury’) in 1864, and brewing there was first mentioned in 1868. Spurgin also had a beerhouse at 7, Church Street, Sudbury. By 1885, the concern was listed as ‘exors of Stephen Spurgin’, and A.M. Mauldon & Son had bought the business by 1888. In 1891, the *Post Office Directory* lists ‘Christie E. Mauldon’ as licensee. ‘Stephen Spurgeon’ (sic) was listed as the Bull Inn license in 1823, and the house remained in the family until the Mauldon purchase.

4. Christie Edwin Mauldon, J.P., was born at Coggeshall, Essex, 3 August 1850 and educated in Sudbury, Mistley, and Long Melford. He became a member of the Sudbury Corporation in 1878, and an Alderman in 1894. He was

elected Mayor of Sudbury three times (1893; 1894; 1905), and was Chairman of the Common Lands Trust; Governor of the Court of Guardians, and President of the Sudbury Trader's Association.

5. Barber, N. (2005) *A Century of British Brewers 1890 to 2004*. New Ash Green: Brewery History Society. p.129.

6. Peaty, I.P. (1992) *Essex Brewers and the Malting and Hop Industries of the County*. New Ash Green: Brewery History Society. pp.3-4. Ballingdon Street is in Ballingdon, or more accurately, Ballingdon-cum-Brundon, which, being south-west of the River Stour, is in Essex - hence the inclusion in Peaty's book.

7. Wilson, R.G. (1983) *Greene King: A Business and Family History*. London: Bodley Head.

8.. Anderson, R.G. (2012) *Brewers and Distillers by Profession: A History of the Institute of Brewing and Distilling*. London: The Institute of Brewing & Distilling.

9. I am assured that the promise of a seaside location, and a regular train service to London, were by no means an irrelevancy in his decision-making!

10. Barber, N. (2005) op. cit. p.132.

11. Grey, J.R. (1963) *Crowley's Brewery 1783-1963. A Brief History of Crowley & Co. Ltd., Alton*. London: Watney Mann.

12. Anthony Horace Button became deputy managing director of Grand Metropolitan Brewing and, after retirement from that organisation, was appointed industrial professor of brewing at Heriot Watt in 1989. Peter recalls that 'Of all the people in knew in the Watney empire, Tony went further than anyone else; he had that "air" about him ... In the end, he was responsible for overseeing the company's the closures during the '60s and 70s - and I received "notice" from him over Northampton'. Button embarked upon his brewing career as a pupil brewer at Wm. Butler & Co. Ltd., Wolverhampton. He was responsible for some significant research whilst at BIRF, including: a novel pilot brewery; the effect of barley steep liquor on fermentation, and reduction of effluent from malting. Hudson, J.R., and Button, A.H. (1968) 'A Novel Pilot Brewery', *Journal of the Institute of Brewing*, 74, pp.300-304; Button, A.H., and Hudson, J.R. (1965) 'Effect of barley steep-liquor on fermentation', *Journal of the Institute of Brewing*, 71, pp.321-324; Reynolds, T., Button, A.H., and MacWilliam, I.C. (1966) 'Malting with Production of Minimum Effluent', *Journal of the Institute of Brewing*, 72, pp.282-285.

13. Barber, N. (2005) op. cit. p.104.

14. Hornsey, I.S. (2003) *A History of Beer and Brewing*. Cambridge: Royal Society of Chemistry. p.681. In 1965, Peter Maxwell Stuart, the 20th Laird of Traquair rediscovered and began to renovate the 18th century brew-house in Traquair

House, Innerleithen, Peebleshire - and the beer started flowing again. A little later, in November 1972, Martin Sykes resuscitated the brewery at his family's Selby Brewery, Yorkshire. The company had been founded in 1894, but ceased brewing in 1954 to concentrate on wholesaling. The next year saw the installation of the first new brewery per se in the UK, when Paul Leyton built a brew-house at the Miner's Arms, Priddy, Somerset. Customers could only buy Leyton's beer by the bottle while having a meal. In 1977, Barry Haslam purchased the business, and relocated it to Westbury-sub-Mendip in 1981. Urquart built the first new commercial brewery.

15. Watney Mann's dominance in Northamptonshire and their proclivity for 'brewery conditioned' beer, meant that were few suitable outlets for cask-conditioned beer; i.e. a dearth of handpumps. Thus, the first Litchborough beers had to be kegged. The 'draught' form in cask was, in fact, cold filtered and dry hopped with a small amount of seeded yeast.

16. Anderson, R.G. (1992) 'The Pattern of Brewing Research: A Personal View of the History of Brewing Chemistry in the British Isles', *Journal of the Institute of Brewing*, 98, pp.85-109.

17. Bishop, L.R. (1971) 'Horace Brown Memorial Lecture: A Conspectus of Brewing Progress', *Journal of the Institute of Brewing*, 77, pp.12-24.

18. Russell, E.J. & Bishop, L.R. (1933) 'Experiments on Barley. Report on the Ten Years of Experiments Under the Institute of Brewing Research Scheme 1922-1931', *Journal of the Institute of Brewing*, 39, p.287.

19. Lawes, J. B., and Gilbert, J.H. (1873) 'Experiments on Barley for Twenty Years in Succession', *Journal of the Royal Agricultural Society*, 9, pp.89-186, 275-374.

20. Bishop, L.R. (1930) 'Statistical Studies of the Analytical Data Accumulated in the Course of the Barley Investigations I.-The Prediction of Extract', *Journal of the Institute of Brewing*, 36, pp.421-434; Bishop, L.R., and Marx, D. (1934) 'Regularities in the Carbohydrate Composition of Barley Grain', *Journal of the Institute of Brewing*, 40, pp.62-74; Bishop, L.R. (1930) 'The Nitrogen Content and "Quality" of Barley', *Journal of the Institute of Brewing*, 36, pp.352-369.

21. After the 1914-18 war, the Institute of Brewing created a new class of 'Research Members' and formed a Research Committee to oversee policy and expenditure. As there was to be no initial expenditure on major capital projects, use had to be made of existing facilities at universities and research institutes. There were three major areas of research to be followed: barley; hops, and timber. Barley research was initially apportioned to Rothamsted; hop work was carried out at the South-Eastern Agricultural College, Wye, and timber at

the Imperial College of Science & Technology, London. After 1923, two new topics were added to the Research Scheme; yeast and pH. Studies on the former were initially carried out at Imperial College, and then at Birmingham University.

22. Anderson, R.G. (1992) op. cit.
23. Bishop, L.R. (1971) op. cit.
24. Bishop, L. R. and Rainbow, C. (1939) 'Bios in Relation to Brewing', *Journal of the Institute of Brewing*. 45, pp.33-47.
25. Julian Levett Baker (1873-1958), a highly respected servant of the Institute of Brewing, started his brewing career in 1900 at Combe's brewery in Long Acre, London and moved to the Stag Brewery, Pimlico in 1903. He was the first chemist to be employed by Watney Combe Reid & Co. Ltd. Among other positions, he served as Editor of the *Journal of the Institute of Brewing*, and of *The Analyst*. Now best remembered for his little tome about the brewing industry in the early 20th century: Baker, J.L. (1905) *The Brewing Industry*. London: Methuen.
26. Bishop, L.R. (1971) op. cit.
27. Bishop, L.R. (1966) 'Tests of the E.B.C. Colour Discs for Wort and Beer', *Journal of the Institute of Brewing*. 72, pp.443-451; Bishop, L.R. (1963) 'The E.B.C. Malt Mill', *Journal of the Institute of Brewing*. 69, pp.228-236.
28. Bishop, L.R. (1967) 'The E.B.C. Scale of Bitterness', *Journal of the Institute of Brewing*. 73, pp.525-527.
29. Institute of Brewing (1986) *Centenary*. London: Institute of Brewing. p.66.
30. Anderson, R.G. (2012) op. cit.
31. For 'lupulin grain' now read 'lupulin gland'. Most of the bulky plant tissue of the hop cone is unwanted by the brewer. It is the lupulin glands, situated at the base of the bracts, which contain all the essential oils and resin acids required for beer aroma and bitterness.
32. 50. US Patent 3,271,162, 6 September 1966; 'Process of Separating Lupulin from Dried Hops'.
33. Bishop, L.R., Whitear, A.L., and Brown, R.G. (1977) 'Proposals for the Efficient and Economical Use of Hops in Brewing', *Journal of the Institute of Brewing*. 83, pp.153-157.
34. Bishop, L.R. (1970) 'A System of Continuous Fermentation', *Journal of the Institute of Brewing*. 76, pp.172-181.
35. Bishop (in *ibid.*) tells us: 'My own personal experience has been such as to lead me to form and to retain confidence in the method as that likely to be widely adopted in the future. This experience with continuous fermentation started in 1925-26 when, as a post-graduate student, I was carrying out research on yeast metabolism and used a continuous fermentation technique in which yeast was held in a thin film of agar and nutrient flowed past it'.
36. It is now difficult to appreciate that it was only as far back as the 1960s that mild ale was the biggest selling beer in the UK (with 'lagers' accounting for only around 2% of trade). Keg bitters and a taste for 'continental-style' beers changed all that.
37. Bishop maintains that he didn't know that, supposedly experimental beer was going out into trade: 'Firstly, mild beer was produced, and after some weeks of careful tasting, it was decided that it would be safe to send some to trade unblended. At this point it was discovered that, for some time, the whole of the output had already been going to trade unblended and without complaints'. Bishop, L.R. (1970) op. cit.
38. *ibid.*
39. *ibid.*
40. Continuous fermentation of beer was attempted prior to the end of the 19th century; see Hornsey, I.S. (2003) op. cit. pp.638-649 for a review.
41. Bishop, L.R., and Spaul, D. M. (1959) 'Factorial Laboratory Malting', *Journal of the Institute of Brewing*. 65, pp.504-507; Bishop, L.R. (1963) 'Objectives and Definitions for Germination and Other Tests for Malting barley', *Journal of the Institute of Brewing*. 69, pp.237-238.
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45. Robin H. Soames joined the Board of Watney Combe Reid & Co. in 1950. He is a direct descendant of Harvey Christian Combe (1752-1818), an English Whig politician who was elected Alderman of the City of London in 1790, and Lord Mayor of London in 1799; Janes, H. (1963) *The Red Barrel*. London: John Murray.
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47. Peaty, I.P. (1992) op. cit. pp.64-66.