Notes on pressure fermentation

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During World War II the fermenting room at Coopers Brewery, Southampton, received a direct hit which put it completely out of action, but left the brewhouse (wort production) and bottling store tanks intact.

The Head Brewer at the time was Mr Stephen Clarke; a single-minded man of great determination who took the view that a small matter like this should not interfere with production and decided to use some of the bottling store tanks as vessels in which to ferment his beer. As these tanks were totally enclosed vertical cylinders it was obvious that the traditional method of yeast recovery from the fermenting beer, i.e. by manual removal from an open top vessel, could not be used. He therefore developed a principle of completely filling a tank with wort to which yeast had been added, connecting a pipe from the top of that vessel to the top of a smaller adjacent one, and allowing the yeast which rises during fermentation to flow along this pipe and be collected in the smaller vessel, hereafter referred to as a yeast back.

The first yeast rising during fermentation carries with it a certain amount of unpleasant bitter material which it was desirable to dispose of together with a certain amount of partially fermented wort. It was found that these two separated in the yeast back, the bitter yeast going to the top and the beer to the bottom. This beer was then returned to the fermenting vessel and the bitter yeast washed away to drain. This happened about a third of the way through fermentation. During the rest of fermentation, the further yeast rising was also collected in the yeast back and again the beer carried over with it 'topped back' to the fermentation vessel.

At the end of fermentation one then had a fermenting vessel almost full of beer (there was inevitably some loss) and a yeast back containing the yeast crop, all of it in an atmosphere of carbon dioxide because all the air had been dispelled early in fermentation and the whole system protected from accidental infection from the surrounding air. The beer could then be removed for further processing before going to either cask or bottle and the yeast could then either be left in the yeast back or transferred to a cold store, depending upon the length of time it was required to store it before further use.

Figure 1. Alton's two major breweries, Courage's top left and Watney, Combe, Reid & Co.'s - formely Crowley & Co. - bottom right.

This system worked to everybody's satisfaction at the time and allowed the brewery to continue production at a time when the demand for beer was both great and clamorous.

Shortly after this system had proved to be a going concern, the Admiralty approached the Brewers' Society to see if it was possible to build a brewery on board ship, to be used as an amenity for ships in the Far East. The traditional method of fermentation was manifestly unsuitable, a relatively shallow open-topped fermenting vessel would soon lose its contents with the movement of the ship. S.T. Clarke was approached to see if he believed his system would be suitable and indeed it was. One ship was fitted out using malt extract as a basis for the wort and it had a short commission life in the Far East.

Towards the end of the war, S.T. Clarke and one or two colleagues, joined forces with Adlams of Bristol, brewery engineers, and took out a patent on the pressure fermentation system with a view to developing it for general use.

The first specially designed plant was installed at Crowley & Co., Alton, being substantially the same as the prototype at Southampton. The one exception was that the yeast back was raised above the level of the fermenting vessel to allow the beer to be topped back under gravity. There were two vessels so installed, each of about 75 barrels capacity, and much basic development work was done with them.

In 1952 four more pressure fermentation vessels were installed and in use until the brewery closed in August 1970. Each were of 150 barrels making a total capacity of 600 barrels and represented a high proportion of the brewery's output. They were constructed of concrete and lined with an inert material known as ebon, whereas all previous vessels had been of mild steel glass lined. Rectangular in shape with a shallow pyramid top, the CO_2 was collected from the yeast back vessel above and passed through one of two silica gell dryers to remove moisture. It was then stored in eleven mild steel receivers at 200 lbs per square inch and reduced to 35 P.S.I. for use in bottling.

To my knowledge, no other pressure fermentation vessels were installed other

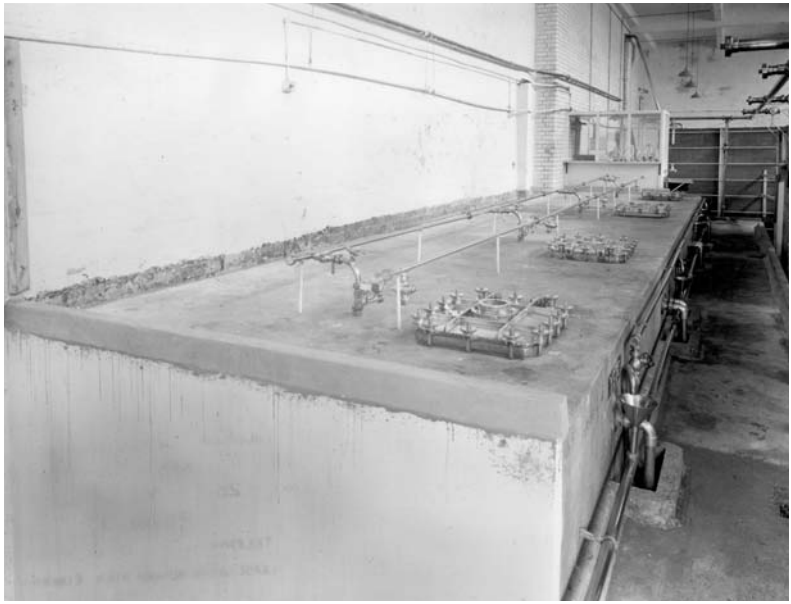

Figure 2. The top of the vessels.

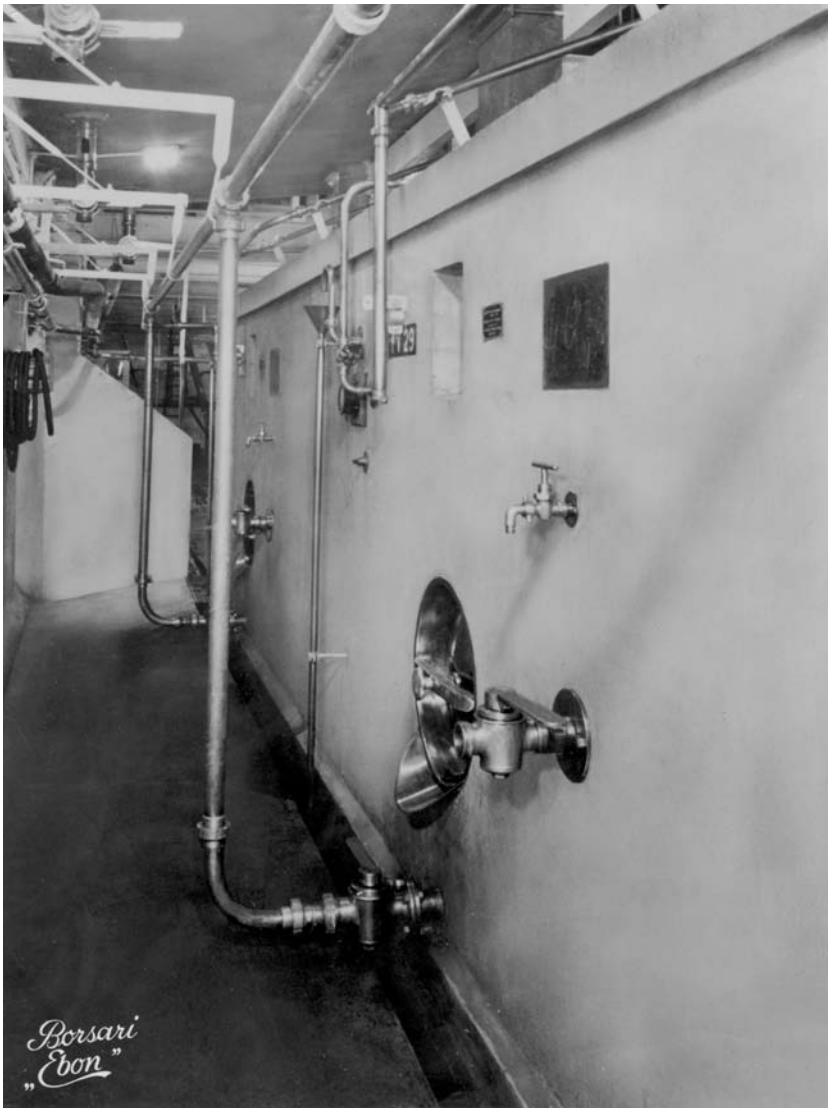

Figure 3. The ebon-lined Borsari fermentation vessel.

than a small one associated with the laboratory at Mortlake and designed for experimental work only.

The advantages of the system were fivefold. Firstly, before use, the vessel and the yeast back and associated pipes could be sterilised, after which there was little or no chance of accidental infection as there would be in open vessels. Secondly, the CO_2 produced by fermentation could be collected in greater quantities and much more simply than by the traditional methods. Thirdly, the beer at the end of fermentation and during its settling period lost less CO_2 and therefore passed to the next stage of processing more fully conditioned. Fourthly, the early rising bitter yeast heads could be easily removed and, fifthly, at the time of installation at Alton, the concrete vessels represented a lower capital cost per fermentable barrel than alternative systems, but the running costs were approximately the same.

There were two major disadvantages. Firstly, the system was being developed at a time when everybody was searching for better fermentation systems generally and was competing very strongly with continuous fermentation which was, at that time, considered to show great promise. Secondly, if losses were to be kept low, it was essential to have a yeast which gave adequate fermentation in the fermenting vessel, but separated out readily in the yeast back so that a bottom layer of clear beer could be topped back. In practice and with the knowledge of yeast husbandry available at the time, this was never fully achieved and there was a tendency to have either an excessively high residual yeast content in the beer in fermentation vessel or an unacceptable amount of beer associated with the yeast in the yeast back.

At the same time as pressure fermentation was being developed an alternative method was under investigation, not only in this country but also in Australia and other parts of the world. One of the reasons why pressure fermentation was not pursued was a general feeling that the continuous type offered better prospects, particularly on vessel utilisation and therefore running costs. This has now proved to be a false assumption and although some continuous plants are still in operation, it is very doubtful if any more will be installed unless a technological breakthrough occurs. Again, one of the main reasons for this is the same as pressure fermentation, namely yeast husbandry. More research requires to be done on yeast behaviour.

If any members know of the whereabouts of any continuous fermenting systems the author would be keen to hear from you.