Ullage and Spillage

by J.Random

As with many of my articles this one was prompted by a conversation in a bar; more accurately, a recurring conversation whenever a brewer produces a cask of lager, pilsner or bock. It typically goes something like this. The brewer apologizes for serving lager in a cask. I point out keg technology has not been around as long as lager brewing. The brewer thinks "beer geek!" and goes to find somebody less opinionated to talk to. Finally I decided to find out the facts (or at least the iFacts) and write them up so all CAMRA BC members can be equally annoying to brewers.

The story starts with decline of what we now call home-brewing and brew-pubs and the growth of larger breweries during the industrial revolution. Transport and storage of beer at a distance from where it was produced meant the need for longer shelf life and greater stability. Sales of beer to a wider audience and competition with other brewers required consistency of flavour. One batch of bad beer could result in loss of market share. These factors lead to experiments with pasteurization and filtering.

Although we immediately think of milk, the French scientist Lois Pasteur was investigating spoilage of beer when he found rod-shaped bacteria alongside round yeast cells in a drop of bad beer under the microscope. Boiling was known to ruin the flavour and drive off alcohol. In 1862, Pasteur found the harmful bacteria were killed at a temperature well below $100^{o}C$ if the temperature was maintained long enough. Unfortunately, this also killed the yeast needed to create carbonation during secondary fermentation. Artificial carbonation was therefore required.

Filtering beer to remove yeast and spoilage bacteria also requires artificial carbonation (though I have heard of the odd cask being krausened and primed after filtering). According to Probrewer. com, the first beer filter was presented at a brewing exhibition in Munich in1880 by German engineer Lorenz Adelbert Enzinger. Filtering was rapidly introduced for bottled beer which had previously been naturally bottle conditioned. This required collection of CO_2 from fermentation and its

Never mind the baby drinking beer ... see what that man in the middle is leaning on? Yes, the firkin proof.

reintroduction to the beer, after filtering prior to bottling Breweryhistory.com states chilled, filtered, re-carbonated bottled beer was available in the USA from 1897. Filtration and/or pasteurization had to await development of convenient methods of pressurizing, transporting and storing CO2.

It seems that the first person to artificially carbonate water was English clergyman and scientist, Joseph Priestley who was fascinated by the properties of the gas given off by fermenting beer. In 1767, Priestley hung a container of water above a fermentation tank at a brewery in Leeds. It absorbed CO_2 producing a pleasant flavour. A practical method of mass producing soda water was not developed until the 1800s, by a Hungarian. Thankfully, he did not apply this to beer otherwise the world today might be drinking pale, bland, fizzy, cold, Hungarian beer. Pressurized gas cylinders were developed in Germany around 1886 but German brewers were not the first to serve draft beer under pressure. That dubious

honour, according to Welding and Gases Today, goes to Anheuser-Busch who demonstrated the process at the 1902 St Louis Fair. According to Wikipedia, pressurized CO_2 was introduced in the United Kingdom in 1936 by Watney's to carbonate and serve their experimental pasteurized beer Watney's Red Barrel (pause while ex-pats cringe and take a few seconds to recover their equilibrium). However, this method of serving beer was not widespread until the 1950s and did not virtually eclipse cask-conditioned beer until the 1970s, spurring the formation of CAMRA.

Before the advent of artificial carbonation, draft lager-style beers must have been naturally conditioned. The high degree of carbonation that we associate with lagers probably developed during the long periods of maturation (lagering) at cool temperatures used in central Europe to avoid brewing in summer when fruit flies made spoilage more likely. The carbonation would have become even more apparent when the casks were removed from cool conditions and delivered to where they would be served. As the temperature goes up, less CO_2 can stay in solution. Lagering has apparently been common practice since the middle ages and considerably pre-dates the introduction of bottom-fermenting yeasts. *Saccaromyces pastorianus*, formerly known as *Saccaromyces carlsbergensis*, was identified by Christian Hansen, a Danish brewing technologist in 1883 though it was in use before this.

Lagering was originally done in caves. In Bavaria, these might have been in the foothills of the Alps. In other parts of Europe, caves and cellars would have been kept cold using ice cut from lakes and rivers during the winter. I wonder how cold that beer would have been by the time September rolled around. An experimental refrigeration system was demonstrated by William Cullen in Scotland in 1748, but the first effective machine was developed by an American, Jacob Perkins in 1834. This process was not widely adopted by the brewing industry for beer storage until the mid 1800s. The technology required to produce a compact refrigerator for the brewing industry was developed in 1875 by German scientist Carl von Linde, a friend of Gabriel Sedlmeyr of the Spatenbrau brewery. However it was not made safe enough for widespread use until 1895. This enabled beer to be routinely served cold without the barman having a long walk to the cellar, or to the Alps.

The obvious conclusion from these timelines is prior to 1900, draft lagers were not always filtered, pasteurized, artificially carbonated and served so cold you can't taste them. So brewers: don't apologize for serving lager from a cask on the bar. You are honouring an ancient tradition that just experienced a mere 100 year hiatus.

The moral of this story is clearly that scientists should be kept as far away from beer as possible.

What? §