BREWING! HAVE THINGS CHANGED SO MUCH?

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Even 50 years ago our colleagues were talking about brewing in the past and what it might be in the future. I thought many of the young people who are coming into the industry today might be interested in what our predecessors thought today might be like. Some of us “old timers” can relate to this article published over 50 years ago.

AMERICAN BREWING OPERATIONS PAST AND FUTURE

The following Paper Was Delivered by Gustave L. Geob at a Technical Session of District New York

The title of this talk is so vast in scope that only the high spots can be touched upon. Much of what will be said may not be new to many of you.

The history of any industry not only is interesting but also very instructive for those who have not lived it. They say that “Practice Makes Perfect.” This is only true if the mistakes of the past have been corrected, so as to avoid them in the future.

The history of brewing during the past 50 years is of great interest and importance to all of us, particularly our younger generation who are to follow in our footsteps. If they will take a lesson from past errors, such as readily be avoided in the future. It will mean signal success to them in their chosen profession and bring further advances in the technique and science of brewing.

A hundred years ago the largest brewery in existence would indeed be a small one today. Although ale production was most common, that of lager beer was just starting. In those days most ales were all-malt. Cane sugar, usually unrefined, or a syrup thereof was employed by some of the ale brewers especially for their heavy stock ales and stouts.

Seventy-five years ago nearly all of the lager beers in the United States were all-malt. Even at that time the trend of the American beer drinkers was towards a pale beer of the “Pilsner” type, as compared with dark beers of the “Munich” or “Bavarian” type. This trend could be understood easily because the American lager beer drinkers consumed the beer mainly as a thirst quencher and mild stimulant - not so much as a food beverage. Preference also was given to beers that were less satiating in character and more drinkable to the consumer, the introduction of rice as a malt adjunct resulted about 75 years ago. At this time I merely want to make mention that our American types of barley malts averaged a protein content of 12 to 13%, almost 50% higher than that of the European malts.

The employment of rice spread rapidly among larger brewers throughout our country. Soon thereafter, dry millers corn-grits were offered as a cheaper material. Refined Grits - a pure edible cornstarch - was introduced into the American brewing industry around 1898.

Corn-sugars and corn-syrups were offered to the brewing industry as early as around 1880 but with no marked success. It was not until 55 years ago that the use of corn-sugar - mostly for preparing Sugar Kraeusen - became general. Its employment not only helped the brewer to obtain paler beers but imparted a finer hop aroma or hop bouquet. This, together with a slightly sweeter taste of the finished beer, made the product prepared with Sugar Kraeusen very popular in many localities. Later on with the advent of pasteurized bottle beers, those finished with Sugar Kraeusen proved of decidedly better stability, both as to clarity and shelf life.

The employment of corn-sugar proved a boon for the ale brewer. It readily allowed him to obtain the desirable high attenuation of his product. It also helped towards imparting the vinous character so highly desired.

Seventy-five years ago our lager beers usually reflected the experience and ideas of the individual master brewers. In those days many of the latter were the owners of the brewery. In consequence, lager beers varied greatly in different locations. These variations became less and less pronounced as sales increased and as brewing science progressed. From individualistic types of beers that varied widely in general character it soon came to pass that brewmasters recognized successful products and then applied their efforts to produce even better ones.

The statement can safely be made that the latest trend of American beers and ales has been towards even paler colors and of high attenuation. The public now a days objects to too much bitterness. This means less hops and the beers and ales are milder and more sweetish to the palate. Undoubtedly, this was brought about mainly upon demand of the large number of women that have become beer drinkers in recent years.

It will not be surprising if this trend becomes even more pronounced in the future, especially in view of the tremendous increase in the sales of the many kinds of carbonated, sweet flavored beverages during the last ten years. In these days of merchandising, advertising and high pressure sales efforts, the likes...
and dislikes of “John Q. Public” must be watched very closely at all times.

Brewing has developed into one of our major industries. If progress in sales is to continue we must be alert to make such changes in our beers and ales that the public demands. Needless to say, the beers and ales of recent years are drastically different from those brewed 100 years ago. But they still maintain the prestige of lager beers and ales as beverages. It will be most interesting to see the further new changes that I believe will take place during the next 25 years, especially as competition from other types of beverages becomes more acute.

BREWING MATERIALS

No radical improvements have been made in the quality of the basic brewing materials such as Malt, Hops, Rice and the various types of corn-products including corn-sugars and syrups during the past 50 years.

Malt:

The quality of the malting barley primarily fixes the quality of the malt. Here in the U.S. we are committed to the use of malt made from 6-rowed barley grown so extensively in the Middle West. 30 to 40 years ago any malt made from 2-rowed barley of the 6-rowed Bay Brewing barley was considered poorly suited for brewing, especially bottle beer. I have seen and used excellent malts prepared from the Bay Brewing type of barley. Haennchen barley malt – a 2-rowed variety – has been gaining popularity to such an extent in the last few years that the still limited amount grown each year falls far short of the demand.

The late government curtailment of 7% of malt used for brewing has undoubtedly often brought forth the thought to many brewmasters of how profitable it would now be if we had malts with a laboratory yield of 78-80%, dry basis, instead of only 72%.

Argentine solved their barley problem some years ago. The brewing and malting interests with a concerted effort selected a European 2-rowed barley for cultivation in their country, after making the necessary preliminary tests as to which type of 2-rowed barley grew best on Argentine soil and climactic conditions. The selected variety was then grown for seed distribution. Practically all of the Argentine malt now is made from barley of identical pedigree.

Samples and analysis of Argentine malt that I have seen in recent years usually gave a laboratory yield of 78 to 81%, dry basis. The protein content about 11%. The diastatic power 105 to 120° Lintner. The husk is about the same thickness as that of Haennchen malt. Uniformity in the size of the berries is almost perfect.

Our lesson from this war surely is such that we should strive to obtain malts of much higher yield in the future. Argentine proved that it can be done.

Hops:

It is a moot question whether today’s hops are better than those used by brewers 50 years ago. The war has established one thing, viz, that our American hops are of good enough quality for our American beers and ales.

Malt-adjuncts:

Malt-adjuncts, such as rice, corn grits, cornflakes, refined grits and the various types of corn-sugars and corn-syrups, have not undergone radical changes in quality as compared to those used 50 years ago.

A new sugar – Dextrose – has come into the field. Its employment has increased steadily during the past 10 years. Such Dextrose represents a highly refined product, is white in color and crystalline in appearance. It is odorless and absolutely free from any taste excepting that of sweetness. Its employment as compared with chipped corn sugars imparts a finer bouquet and aroma to the finished ales and beers and a distinct improvement in the taste.

GENERAL EQUIPMENT

For years nearly all breweries erected were of the so-called "gravity" type. Many represented a monument of architecture, no so much to the owner as to the architect who designed and built it castle-like upwards into the sky.

I know of two breweries built shortly after Repeal, for capacities of about 150,000 barrels annually, where the brewhouse was only three stories high and all of the cellars on one floor.

Both of these plants have more than doubled their output during these past ten years. In one plant another brewhouse unit had to be installed. The other equipped originally with a mash-filter merely made a larger number of brews per week. For cellars, both added and equipped another story. Their plant operating conditions are as economical and simple as can be found in any brewery that I know of. There is no doubt in my mind that future breweries will be erected along these lines wherever feasible.

Malt-Mills:

As far as brewhouse equipment is concerned, the greatest advancement undoubtedly was made with malt mills. Compared to the old 2-roller mills in common use 50 or more years ago, our new 4, 5 and 6-roller mills allow as nearly perfect grinding of the malt as probably ever will be accomplished. The only objection that be voiced against the modern malt mills is their very high perifery speed. This causes considerable shredding or tearing of the malt husks to the detriment of a rapid running off of the wort when it is drained off through the false bottom of the mash or Lauter-tub. Maybe a suitable type hammer mill or crushing device will be perfected that merely flattens out the malt kernel without shredding or tearing the husk.

Cookers:

The average cooker in most breweries today can only be termed a crude, clumsy, very noisy piece of apparatus. Over 50 years ago pressure cookers were offered to brewers and installed in a number of the larger plants. They were copied from cookers already in common use for boiling potatoes in German distilleries. Relatively few breweries have pressure cookers today and those that have them seldom boil the cooker-mash under pressure.

With atmospheric-pressure type cookers the starch of rice or corn grits can readily be completely gelatinized. If higher pressures are used, especially over 15 pounds per square inch, there is the danger of forming small amounts of a reversion type starch that resists diastatic action and later causes the formation of an excessive amount of upper dough. This results in slower running-off of the wort and poor extraction of the grains by the water used for sparging.

Too long a time of boiling the cooker mash under atmospheric pressure will give a similar result. I know of an instance where
a brewer with a large cooker tried to economize by making double the amount of cooker-mash. When it was finished, one-half was run into the mash tub for the first brew. The other half was held for 7 or 8 hours for the second brew of the day, at a temperature around 75°. When it was run into the mashtub and mixed with the malt for the second brew, much difficulty was experienced with a slow and incomplete inversion. The real trouble, however, started with the running off of the wort. It took over twice as long to fill the kettle as usual. The excessive amount of upper-dough retarded the flow of the first wort, as well as of the water used for sparging. In consequence, the balling of the last wort running into the kettle still was about 5% and the yield of the brew about 6% lower than average.

The cooker of the future, in my opinion, will be an upright cylindrical vessel made of stainless steel and equipped with a mixing propeller operated at a fairly high speed by a practically silent drive. It must not be overlooked that in most of our present cookers, the live steam injected into the mash has a by far greater mixing action than that of the crude blade stirring device they now have.

**Mashtubs:**

Most breweries still are equipped with the old conventional type mashtub introduced over 50 years ago, namely a round upright tank equipped with a false bottom and a stirring machine that is better suited for removal of the grains than for the thorough mixing of the mash during the mashing operations. In recent years many such stirrers were replaced with the “Aufhæk” machine that can be operated slowly in the grains while running off the wort. A faster flow of wort and better extraction of the grains resulted. The introduction of a separate mash tank and a separate modern Lauter-tub equipped with this new type of stirrer was a distinctly progressive step.

**Mash-filters:**

Mash-filters are bound to come into their own after the war in our larger breweries, viz, those having sales of 200,000 barrels and upward. Smaller breweries eventually will also adopt them — in fact, several used small mash filter successfully during the past decades.

Mash-filters are not new in the American brewing industry. The first was installed for experimental purposes around 1902 in a Chicago brewery. It was a “Meura” machine imported from Belgium.

I had the experience of making about 100 brews with it. We used 5,000 pounds of finely ground malt and 2,000 to 2,500 pounds of grits, rice or cornflakes per brew. About 175 barrels of finished wort of approximately 11.5% Balling was obtained. The mash was prepared in a separate tank and then run into the mash-filter. The time required for running-off of the wort into the kettle averages 1-1/2 hours.

Self-evident, the object of these tests was to determine whether mash-filters were suitable for our American brewing conditions when using malt-adjuncts. Nobody was more amazed than I, when the parties conducting these tests, condemned the mash filter as unsuitable for our American brewing process.

The two main reasons given for this decision were, firstly, because in some of the brews made with cornflakes, rice or corn grits, the last worts flowing into the kettle showed traces of starch. In the case of cornflakes, this was due to an incomplete gelatinization of the starch during the manufacture of the material. With rice and grits, it resulted mainly because the cooker-mash was made in a cooker that was entirely too large so that the vessel was filled to less than 40% of its capacity.

The other principal objection was that of washing the filter-cloths. With no laundering machine available, these cloths had to be placed on a floor, a small amount of soda ash dusted over them and then scoured vigorously with a heavy brush before thoroughly rinsing with hot water.

Although this condemnation of mash-filters was never published officially, it was spread verbally to such an extent that most brewers and brewmasters regarded mash filters a failure. I believe that there are five large breweries at the present time using mash-filters with excellent success.

The unfortunate decision of 40 years ago undoubtedly retarded the introduction of mash-filters for these many years. Had it been favorable there would be more mash filters installed in breweries today than mashtubs and Lauter-tubs.

Let us consider a practical example of the advantages of mash-filters. One of our large breweries where mash filters were installed some years ago fill their kettle with about 600 barrels of wort in 2 to 2-1/2 hours after inversion of the mash had been completed. Due to the use of finely ground malt, the malt yield is 3 to 5% higher than when employing the coarsely ground malt in the usual old-fashioned mashtub or the newer Lauter-tub. The yield of rice and corn grits is not materially higher, but if these materials are ground to meal form, it undoubtedly can be brought to within 1% of the laboratory yield. In other words, the total yield obtained from the materials in brewing practice will be within 1% or even less, of that found in the laboratory. This means a gain of 2.0 to 3.0%, an economy well worth striving for and one that means a big saving in a large brewery.

As soon as the kettle has been filled, the grains are emptied from the mash-filters in 25 to 30 minutes. Freshly washed cloths can be inserted immediately and the filter is then ready for the next mash. At least six brews can be handled every 24 hours in a mash filter. The washing of the cloths is a simple matter now a days when using a modern laundering machine.

**Brew Kettles:**

The old steam jacketed, pear-shaped copper kettle still predominates in most breweries and will be used until it must be replaced with a new one. The newer kettles now being installed are wide and comparatively shallow. The wort is heated by means of a steam coil, some of which can be rotated. In my opinion, a stationary coil is adequate.

Some years ago pressure copper kettles were installed in a few breweries, and tried out. The results were unfavorable, mainly because the wort darkened in color and acquired too much bitterness.

As an average, the method of boiling the wort and addition of hops in the kettle still is the same as it has been for the past 100 years. The fact that the American brewer now a days uses only about 50% of that of hops per brew than was employed 30 to 40 years ago probably is the reason why no change in this respect has been made in recent years.

**Hop Separators:**

The hop-jack still is in most common use for the separation of the hops from the wort. Its cost of installation is relatively low. Besides removing the hops a filtration of the hop wort also is effected.
Several different types of hop separators have been introduced in recent years. Their main advantage is a very rapid removal of the hops from the wort. When such are used, it has been found advantageous to run the wort into a suitable tank so that most of the particles of protein and hop resins can settle out before the wort passes to the cooler.

In my opinion, the application of a suitable centrifuge will eventually solve the question of hop separation and at the same time filter the wort before it passes to the cooler.

**Wort Coolers:**

The “Baudelot” type wort cooler reigned supreme for many years. Several modified forms have been designed of late. Some of them were enclosed in a housing so that sterilized air could be introduced during the cooling operations.

The enclosed pipe-type of wort cooler was introduced over 40 years ago with satisfactory results. The question of aeration had to be studied but was solved quite easily.

A most efficient and modern type of wort cooler installed in several breweries is the so called “Plate” cooler which is very much similar in appearance to a filter press with chambers arranged for the flow of wort and others for the cooling media – usually water and brine. The flow of the wort is at high speed so that the surfaces of the metal automatically remain clean. Self-evident, the cooling water and the brine must be supplied in adequate amounts to that of the wort.

**Wort Filtration:**

Filtration of the cooler wort was introduced about 5 years ago. Since then it has been adopted by a number of master brewers. The advantages are many. Loss of extract is decreased and the clear wort allows for better fermentations and much faster clarification of the beer during the storage and finishing periods.

The filtration of the cooled wort also effects the removal of certain hop resins that impart a harsh, bitter taste to the finished beer – in fact, this was the main reason why wort filtration was introduced in several of the breweries.

**Handling and Storage of Brewing Materials:**

My comments about brewhouses would be incomplete without mention of the handling and storage of the basic brewing materials. Malt has always received consideration but the storage of malt adjuncts such as rice, grits and refined grits seldom was given thought excepting in large plants. Shipments of the latter usually were lined up for arrival so that as little storage space and handling as possible was needed. During the past two years, brewers had to buy malt-adjuncts whenever there was an opportunity of obtaining them. In consequence, every possible space was piled with bags. Frequently, outside storage was rented.

It is self-evident that adequate storage facilities should be provided for malt-adjuncts just as well as for malt. Several large breweries have erected such in recent years and equipped them with the latest types of conveying machinery, thereby achieving both economy and convenience.

As an average, the handling of rice, grits and refined grits in bags costs 3 to 8¢ per bag. It generally is an inconvenient nuisance. Rice still is mainly sold in bags. A number of breweries that are on a railroad siding obtain grits and refined grits in bulk. The material is unloaded manually and passed to the bucket-type elevator that conveys it to the storage bin. Where pneumatic equipment is available, the grits or refined grits are conveyed by the air suction directly to the storage bin.

A number of breweries that are not on a railroad siding use tank trucks equipped with a pneumatic suction device for the handling of malt and malt-adjuncts shipped in bulk. The material is sucked out of the car into the tank on the truck and then hauled to the plant where it is handled according to the conveying machinery available.

One of our very large breweries have a most unique system of handling malt-adjuncts, probably at the lowest cost of any brewery in the United States. The material is loaded into closed hopper cars. These cars are run on a trestle in the railroad yards and spotted over a chute that allows the material to drop into a lighter. A 50,000 pound can can easily be unloaded in about 10 minutes’ time. In one instance, 7 cars of 350,000 pounds were emptied within 47 minutes after the first car was spotted. The lighter was then floated to the water-bay adjoining the plant and the material transferred to their storage bins by air suction.

These closed hopper-cars certainly ought to be adopted by the brewing industry. They are moisture-proof and the material cannot be contaminated in any way while in transit. The interior of the cars can be sand blasted whenever necessary – which is very seldom if they are in constant use. The interior surfaces remain clean and sanitary at all times. Smaller cars hold about 50,000 pounds of grits, and larger ones 65,000 pounds. When used for malt the capacity weight would be about 10 to 15% less.

If a brewery is on a siding and has the usual bucket elevator equipment, it will be a simple matter to insert a short conveyor to drag the material from the hopper outlet to the hopper car to the boot of the elevator.

Much more could be said about the above subject. My experience with the closed hopper-type car during the past 7 years has been most satisfactory. The railroads have an ample supply of such cars to take care of all shipments of materials, both malt and malt-adjuncts, to the brewing industry. Handling of materials in bags really is obsolete and if adequate bin storage for the normal supply of malt and malt-adjuncts is provided the purchase of materials in bulk will result in considerable savings yearly.

As far as brewers’ sugars and syrups are concerned, sugars especially those of the lump type, still will have to be shipped in bags.

Corn-syrups and other brewers’ syrups have been used very extensively during the past two or three years when starchy malt-adjuncts at times were scarce. Such brewers who intend to continue with syrups and who use 100,000 pounds or more per month should install one or more storage tanks of about 15,000 gallons capacity. The syrup can then be bought in tank car quantities at a considerable saving.

These syrup storage tanks should preferably be installed in the basement of the plant. The syrup can then flow out of the tank car through a suitable hose or pipe connection by gravity into the storage tank. If the latter is on the same level as the track or even slightly higher the syrup can be forced out of the tank car with air pressure.

The syrup can then be pumped from the storage tank to a small service tank located higher than the brew-kettle. In most instances this service tank is calibrated in pounds of syrup so that the desired quantity can be run into the kettle whenever it is needed. Large auxiliary tanks usually are not calibrated but equipped with an automatic stop-meter inserted in the pipe
through which the syrup flows to the kettle. This meter can be set at any desired weight and the flow stops automatically when the required amount has passed through.

CONCLUSION

In conclusion, allow me to say that I have attempted to confine my remarks almost entirely to actual production practices. All of us know that the bridge spanning theory and practical operations must be erected on foundations of good judgment and reinforced by experiences gained through actual practice. Only then can progress be achieved.