BREWERY HISTORY

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GERMAN BREWING INDUSTRY - PART II

J.H. PORTER, A. CLARK DOULL, J. TODD, F.E. LORENZ, G. OSGOOD & L.R. BISHOP

ENGELHARDT BREWER, BERLIN

Target: ENGELHARDT BRAUEREI A.G.
Location: Berlin, Danckelmannstrasse, 8.
Type: Brewery.
Date: 13th July, 1946.
Persons Interviewed: Dr. Dietzl - Chairman
Herr Wunsche - General Manager,
Herr Krause - Head Brewer.

A. Raw Materials.

Malt was supplied from the Koetten Maltings in the U.S.S.R. Zone, and a consignment, found to be of excellent quality, actually arrived during our visit. Coloured malt was used to the extent of 5%, this was supplied by Hermann Plotzmann of the West-Harbour, Berlin. The samples examined were of very poor quality. No crystal malt was used.

They had a good reserve of hops sufficient, approximately, for one year's operation. They expressed the opinion that there had been no great decrease in hop production during the war years, although in the past season there had been a considerable reduction due to the Agricultural policy of Military Government in the U.S.A. Zone. A considerable bulk of hops from the 1944 crop, which they had purchased under contract, was still in the hands of the merchants in Bavaria, but could not be brought to Berlin on account of inter-zonal trade restrictions. They understood that the bulk of the 1945) crop had been exported to the United States of America and Belgium. They had also heard that a number of Breweries in the U.S.S.R. Zone had ceased brewing through shortage of hops.

B. Substitutes.

Even before the war, the German brewing trade had been experimenting with alternative sources of carbohydrate and also with saccharin for sweetening purposes. Thus it could not be stated that the introduction of new substitute sources of carbohydrate had resulted from war conditions. Sugar beet residues had been investigated, although only in connection with the production of top fermentation beers i.e. so-called malt beers. Malted wheat had been used during the war period as there had been a surplus of this material in the Berlin area.

C. Plant.

The brewing plant was normal.

They used both aluminium and ebon-lined fermenting vessels and the latter type was definitely preferred. However, they were of the opinion that the vessels installed were too large because with lager beer the best results were obtained when using fermenting vessels of 50-100 hectolitres (30.5 - 61 barrels) capacity. The aluminium vessels were insulated with asphalt and mounted in non-reinforced concrete.

Aluminium vessels were stated to be more durable but the ebon-lined vessels gave a fermentation approximating more closely to that in wooden vessels. The ebon-lined fermenting vessels were relined every two years. Aluminium vessels were cleaned with formaldehyde.

The roof of the fermenting room was painted and then lime-washed; this was preferred to tiling.

D. Containers.

Casks. Small supplies of timber were still available for the repair of their own casks. In Westphalia there was plenty of standing oak. They expressed the hope that supplies of casks on a more generous scale, would become available as soon as restrictions on inter-zonal trading are relaxed.

Germany had always imported oak from the Balkan States, particularly Yugoslavia, and it was not considered likely that there would be any surplus of German oak available for export since home supplies were not sufficient to cover normal German trading requirements.

The main cooperages were in the U.S.A. and British zones. All wooden casks (which were in very short supply) were pitched with Mammut. They had made use of laminated casks during the war but had found them unsatisfactory as the laminations opened up and nests of infection developed in consequence. The laminated casks were also pitched with Mammut.

Although they had used stainless steel casks, they had found them to be too expensive and they had a definite preference for wood. These stainless steel casks were used for malt beers which were pasteurised in cask, allowing 4% space for expansion. These casks were cleaned in the usual manner, but no special steps were taken to examine the interiors. Taps for stainless steel casks were of normal design.

Bottles. Swing-stopper bottles were still in use and no special precautions were taken to ensure thorough cleansing of the swing-stopper. A preference for crowns was expressed.

Clear beer bottles were no longer in use. They preferred green bottles to amber coloured - the amber colour being produced by manganese oxide.

Neither lightweight one-trip bottles nor plastic bottles have been used.

E. Process.

The brewing process was normal. However, as a result of shortages, the hop rate had been reduced from 200 grammes per hectolitre (11.6 ozs. per barrel) to 100 grammes per hectolitre (5.8 ozs. per barrel).

The brewing water which had 19° German hardness (338 parts per million), 80 permanent (142 parts per million) was obtained from their own wells. It was decarbonated and treated with Micropur against infection from broken sewers following aerial attack. Micropur, which is essentially colloidal silver chloride, was supplied by the Katadyn Gesellschaft. Saccharin (4 grammes per hectolitre) was added for sweetening purposes at the beginning of fermentation to their malt beers, which were pasteurised in stainless steel casks at 70°C (158°F) (beer temperature) for one hour.

The brewer was now producing low gravity beers 2% Balling (1008°) for civilians and hospitals. Bottled beer was supplied in one-third litre swing-stopper bottles to hospitals only.

F. By-products.

Spent Grains. In the summer months spent grains were dried and sold as fodder, while in winter they were sold wet. At the present time sales were under the direct control of the Military Government.

Spent Hops. The spent hops were sparged, dried and sold to tobacco firms for shredding and blending with tobacco; a practice which was common even before the war. Anything up to 100% is now used although 60% is more general. Walnut leaves, dried rose leaves and cherry leaves are now also used as tobacco diluents. Before the war, the use of cherry leaves in tobacco was common. Spent hops were also used as a source of cellulose for the manufacture of beer mats.

Yeast. Surplus yeast had been dried and sold for yeast preparations. Today, there is no surplus yeast from the low gravity beers being brewed and new supplies of yeast are drawn from those nearby breweries making higher gravity beers for N.A.A.F.I.

G. Research.

The brewery subscribed on a barrelage basis to the Berlin Brewing School (V.L.B.) and the Government

also supported it by making good any deficits. Individual analyses were undertaken for the Brewery Companies by the V.L.B. for fees on an agreed scale.

H. Economics.

The Winterhuder Brewery - a subsidiary Company - exported principally to the United States of America. From 1933 onwards they received, in common with other trades, a Government Export Subsidy which was provided by a general export levy on the whole of German Industry. They had their own private export representative.

Wage rates were fixed by Government decree in 1932, since when no alterations have been made. The rate paid for a 48 hour week in Berlin and the Ruhr were as follows:-

Skilled men	52 to 75 Reichmarks
Unskilled men	46 to 70 Reichmarks

In other districts the rates were 5 Reichmarks lower per 48 hour week. Foremen and Charge hands received a bonus of 5 Rms. per week; the only change introduced during the war.

Of the total advertising expenditure by brewing companies, 10% was contributed to a collective advertising scheme. For example, during the war, the following slogan was much used:-

"Bier ist mehrwert
Den es hat naehrwert"

of which a literal translation is:-

"Beer is more worth
As it has food worth"

I. General.

This Brewery had suffered a certain amount of bomb damage as a result of which half of the fermenting cellar, as well as the coolers, had been put out of action. The coolers were undergoing repair. The normal output was 120,000 hectolitres per annum (73,000 barrels).

KINDL BREWERY

Target:	Berliner Kindl-Brauerei, A.G.
Location:	Berlin W.10., Bendlerstrasse 7.
Type:	Brewery.
Date:	15th July, 1946.
Persons Interviewed:	Herr Seifert - Head Brewer,
	Herr Raspe - Solicitor.

A. Raw Materials.

They stated that figures for German hop production had not been published during the war, but, assuming that production continued on the 1939 basis, it was considered probable that there would be a surplus available for export. 7,500 cwts had been taken their own stocks by the U.S.S.R.

B. Substitute Raw Materials.

Both beet sugar residues and whey had been used as malt substitutes. Hop concentrate is not used as, with bottom fermentation beers, head formation is adversely affected.

C. Plant.

Brewing Plant. The coolers were of the open type and the wort stood thereon for a period of two hours at a depth of 10", during which time the temperature was reduced to 120°F. (50°C.). The coolers were constructed of copper and were cleaned with sulphuric acid every week. This treatment has one disadvantage, in as much as the surface of the cooler tends to become too smooth, and in consequence trub break may be removed when drawing off the wort. They had no experience of stainless steel coolers, but the opinion was expressed that coolers constructed in this metal would be advantageous.

The fermenting vessels were constructed of stainless steel, aluminium, and ebon-lined concrete. Their preference being in the order given. Both stainless steel and aluminium vessels were insulated by means of jute cloth, in bandage form, impregnated with tar and covered with a sheet of impregnated paper. This was stated to prevent electrolytic action, the incidence of which

could be easily detected by the development on the bottom of empty aluminium fermenting vessels of a white crust on any small pool of water left there. Aluminium fermenting vessels were normally cleaned once a week, but they received special treatment with nitric acid and clay, twice yearly, to eliminate beer-stone.

Malting Plant. The steeps consisted of a series of steel tanks with conical bottoms which were inter-connected so that the grain could be transferred by centrifugal pumps from one tank to another, thus providing adequate aeration. Steeping time was 76 hours at 50°F. (10°C.). The malting floors were square in shape and the air temperature was controlled by brine pipes around the walls near the ceilings, with trays underneath to catch the drip. The surface of the malting floors showed the same marble-like finish as that observed at Herford. This was attributed to the use of very fine sand in the concrete mixture, and subsequent polishing with a steel float during construction. Both floor and Saladin maltings were installed in this brewery, and if the barley was not of first class quality, it was found preferable to work it on the floor system. A battery of some ten Saladin boxes - 90' long and 13' wide - constituted the main maltings. The loading depth for Saladin boxes was 32".

The total malting period in the box was eight days as compared with a total of nine days on the malting floor, and during the first sixty hours the barley was left without turning, and with larger Saladin boxes the period of non-turning was extended. It was stated that if the dimensions of the boxes were excessive, the modification proved to be less satisfactory.

Pneumatic plant was used for the movement of grain, both barley and malt, but care had to be exercised to avoid excessive pressures which had been found to cause damage to the germinative power of the barley. This observation applies equally to the loading of the malting floors or Saladin boxes with newly steeped barley.

The malt kilns installed by Topf of Erfurt consisted of a series of vertical rectangular columns 11" wide, having wedge-wire type walls and intervening air spaces between the columns. The green malt was fed in & the top of the kiln where it was withered in the first of four sections. The malt then gravitated through the remaining three lower sections where it was dried and cured, eventually emerging as finished malt at the bottom of the vertical columns. The kiln was designed not only to save fuel and space, but also to avoid the necessity for turning. The drying was achieved by means of hot air from a 60 h.p. Fan. No adjustment was made for the decreasing volume of the malt during drying. The inlet air temperature was 187°F. (86°C.) and the finished malt had an average moisture content of 3.2%. Only light malts were made on this kiln. Using 11 columns the output per 24 hours was 800 cwts of malt.

D. Containers.

Casks. Their preference was for wooden casks made from Yugoslavian oak. German oak was not suitable for cask manufacture as it was too porous on account of its rapid growth. They had of necessity to make use of laminated casks even before the war, and approximately 30% of the casks they used during the war were laminated. These were manufactured by Muller of Leipzig. The earlier types were completely sheathed in iron, but it was found that they showed signs of deterioration during the first year of service. Later types were hoped only, but deterioration set in even earlier. Experience had shown that laminated casks had to be pitched twice in order to secure good adhesion, and that internal laminations made of beech did not take the pitch so well as oak. It was also observed that approximately one-third of the laminated casks developed a surface growth of white mould externally which was very slimy in character. This was not eliminated successfully by the normal cask washing plant and consequently necessitated hand washing.

Generally speaking stainless steel casks were too expensive, although they were used for malt beers which were bulk pasteurised. They were not so easy to handle as wooden casks on account of their cylindrical construction.

Bottles. They had no knowledge of the use of plastic materials for bottle manufacture.

E. Process.

Malt beers in bottle were pasteurised at 147°F. (64°C.) for 45 minutes. The pasteurisers for bottled beers were

of the spray-type but they did not provide 100% sterilisation at these temperatures. If sterilisation is essential, then they would suggest a temperature of 156°F. (69°C.) for 75 minutes. The disadvantage of such a method was that the bready, or pasteurisation, taste became too pronounced. Draught beers were pasteurised in bulk and then filled into stainless steel casks which had previously been sterilised with sulphur-dioxide. They expressed the opinion that there was a great future in the German Breweries for the Paraflow type of pasteuriser. They had no knowledge of methods to determine the efficiency of pasteurisation, such as enzyme tests.

F. By-products.

Spent grains were disposed of wet for fodder, and spent hops were dried and sold to tobacco factories.

G. General.

The Brauerhund, or Brewers' Society, in Germany had been active before the war but was disbanded. it was reported that the Society was being resuscitated in Bavaria.

SCHULTHEISS - PATZENHOFER BREWERY, BERLIN.

Target: Schultheiss-Patzenhofer Brauerei A.G.
Location: Berlin, Kaiserallee.
Type: Brewery.
Date: 16th July, 1946.
Persons Interviewed: Dr. Scheuble - Managing Director,
Herr Enderle - Technical Director.

A. Raw Materials.

Hops. As the result of a special survey just completed, they were able to give full and exact details of the hop position. The hop acreages under cultivation in 1935/1945 were as follows:-

U.S. Zone	1935	7,710 hectares	(19,000 acres)
	1945	4,122 "	(10.000 ")
French Zone	1935	2,332 hectares	(6,000 acres)
	19450	763 "	(1,900 ")

A table giving full details was provided and is given as Report No. 14.

Of the 1945 crop, some 90% was exported to the U.S.A., Belgium, Holland and South America. The price paid by the U.S.A. was 130$ (Dollars) for Hallertau hops. Some 14,000 cwts of the 1945 crop were sent from the U.S. Zone to the British Zone to provide hops for the beers brewed for the British occupying troops. They were of the opinion that under normal circumstances there would be an available surplus for export.

B. Plant.

Brewing Plant. High pressure water-tube type boilers with super-heaters were in use. Mash filters were used to save space and secure a quicker run-off.

The coppers were of standard German design and operated at atmospheric pressure and the exhaust steam on these vessels was used for heating up the brewing liquor. They were all equipped with Salzmann vacuum valves to prevent collapse.

Various devices have been used for reducing steam pressure to the level required in the brew house. Formerly when lower copper pressures were general, the Salzmann valve was almost universally used. This operated on the principle of the mercury column, set to correspond to the steam pressure required, and was very reliable in operation, but had the great disadvantage that if the steam valve on the brew house supply line was suddenly opened, the whole column of mercury could be blown out of the apparatus by the resulting knock. Apart from this, the valve took up considerable space and required an appreciable height, and in consequence it could not be accommodated in every brew house. During the 1914-1918 War, mercury was in short supply, and as a result, new devices had been introduced. In the past few years, the Schultheiss plant had gradually discarded Salzmann valves in favour of membrane and oil valves. The membrane valves were supplied by Albert Lob of Dusseldorf and M. Spuhr & Co. of Essen. These valves permit of very exact adjustment and have proved most reliable in use. Furthermore, they were of simple construction, inexpensive, and easy to install. They may be used for all outputs. The oil

valves were built by MAN Maschinenfabrik, Augsburg Nuremberg A.G. of Augsburg and Nuremberg as well as Askania Werken of Berlin - Friedenau. They were more precise in action than membrane valves. The oil valve operates by virtue of a pump discharging a stream of oil which develops the necessary impulse to control the outlet pressure of the steam. They were relatively expensive and mainly used where high outputs were required. They used deep coolers equipped with copper cooling coils, in which the wort stood to a depth of 44" in place of the conventional type of flat cooler. A satisfactory deposition of Trub (Break) was secured. The upper half of the refrigerator coils were supplied with mains water and the lower half with brine. They had made use of stainless steel refrigerators, but did not consider them satisfactory owing to the low heat conductivity of the stainless steel itself. The counter current chiller operating on the Paraflow principle had been used and found to be satisfactory. It was made by Holstein and Keppert. Generally speaking, they consider aluminium to be more advantageous than stainless steel for fermenters if only for the simple reason that there is no limit to the size. Further, they can be made to any shape desired and as a result, the space available is utilised to the best advantage. They considered that the maximum practical size for stainless steel fermenting vessels was 350 hectolitres (214 barrels). They stressed the importance, when placing contracts for fermenting vessels, for the entire work, i.e. both plant and building construction, to be carried out by one firm. They themselves made an invariable rule of doing this, thus ensuring where the responsibility lay in the event of mistakes arising. Asphalt should be applied to the external surface of aluminium fermenting vessels prior to the application of an 8" layer of cork insulation in the form of slabs which is then covered with asphalt and the whole structure sheathed in concrete. Vessels so treated were still in good condition after 30 year service. With stainless steel fermenting vessels only 4" of cork insulation was necessary, otherwise the construction was the same. Aluminium storage tanks which could be conveniently emptied in one day have been found entirely satisfactory and the normal maximum capacity was 500 hectolitres (306 barrels).

The cask cellar floor was asphalted, but on the cask runways 'V' chequered-iron plates were fitted, these being mounted on legs extending through the asphalt.
Bottling Plant. In the bottling stores, bottle washing was carried out on Novissima or Saxo Washers. The bottles were not subjected to any special sterilising process after washing. Boxes of finished bottled beers were carried to the loading banks direct by roller conveyors.

Malting Plant. The malt floors had the same marble-like finish which had already been observed in other German maltings. These floors were laid by Pittel and Brausewetter of Brno. The maltings were air-conditioned by direct expansion.

They had no knowledge of any new floor turners, and themselves use the Maffei-Kraus machines. The turner they had installed could turn 1,000 cwts. per day and was considered to be highly satisfactory as it turned, washed, loaded, spread and cleared the floors. The turner was equipped with hardened and tempered spring steel lines which allowed for slight irregularity in the surface of the malting floor.

They had no knowledge of hop kilns.

C. Containers.

Casks. By tradition, and in consequence of reliability in use, wooden casks were preferred, and, furthermore, the final product had a better flavour and the beer temperature was more constant.

They had not experienced any difficulty when using German oak for wooden casks, but, on the other hand, they always insisted, when placing orders, that the wood to be used in the construction of the casks should be seasoned for four to five years. They expressed the opinion that, at the present time, considerable numbers of wine casks were being made in the U.S. and French Zones but no seasoned timber was thought to be available in the British Zone. Apart from plywood, they knew of no other substitute materials having been used for casks. Laminated casks were not popular as they peeled and did not take pitch regularly. The inner and outer layers of these casks were of oak, and beech was used for the interior layers. The quality of the cementing material for binding the layers together had improved greatly during the war years. They had no knowledge of laminated casks being completely sheathed in metal. All the ones they had in use themselves were merely hooped. They too expressed the opinion that

laminated- casks could only be regarded as being in the experimental stages of development.

Stainless steel casks, which were only in the experimental stage, were considered to be too expensive and had the very great disadvantage of lacking heat insulating properties. Aluminium casks were regarded as being too fragile, and had the additional disadvantage of requiring a special internal lacquer. (Schild Kroeteniack - supplied by Rosenzweig and Hraumann of Kassel).

Bottles. Under normal conditions there should be a surplus of bottles available for export, subject to the bottle-making plants in the U.S.S.R. Zone being capable of producing at pre-war rates. All bottles in the Berlin area were manufactured to a standard specification, and all breweries had agreed to, and actually did, dispense with lettering, thus eliminating the necessity for sorting. Brown bottles were preferred. In the home trade they used one-third litre bottles with swing-stoppers, and for the export trade two-third litre bottles with crowns. In spite of severe shortage of glass bottles throughout the war, plastic bottles had not been taken into use.

Crates. Bottle cases were constructed of wood and designed with low sides which only protected the lower half of the bottles, so that the bottom of the case rested on the closures of the bottles in the case beneath when stacked. They had calculated that total costs were less than when using high-sided cases, in spite of the fact that they had increased breakages.

D. Process.

Malting Process. Barley was normally received with a moisture content of 15% to 16%, and the handling of it was entirely mechanical. When received the barley was screened into two types - i.e. large grain and small grain. Barleys were stored four to six weeks before malting wherever possible. In the event of stored barley developing weevil, it was steeped immediately. Well water at a temperature of 50° to 52°F. (10 to 11°C.) was used for steeping barley. They aerated in the steep for 15 to 20 minutes every six hours at a pressure of 30 lbs. per sq. in. The steep water was changed every 24 hours, and, when the steep water was finally run off, barley was left in the steep to drain for eight hours. There were no additions to the steep water, and aeration was provided by a series of plain tubes arranged in three tiers. They did not believe in pumping over.

Floor malts were considered to be definitely superior to box malts although the latter were cheaper to produce. They had no torrifying plant for malt. When taken from the kilns, the malts had a moisture content of 3.5%, and when taken from the malt bins an average of 5%. Prior to storage the malts were aircooled, and when possible were stored four to six weeks before use. The malts were screened into bins through machines of conventional design, and supplied by Steinecker of Freising and M.I.A.G., of Brunswick. When it was necessary to use freshly-made malt, the malt-mills were adjusted to suit the lower moisture content of the new malt.

Bottling Process. Export beers were pasteurised and had for all practical purposes an indefinite life in bottle. In an effort to eliminate, as far as possible, non-biological haze, the grist for export beers contained up to 20 of rice, or, alternatively, 20% of rice and 5% of maize. They used total immersion pasteurisers of their own design and construction. The total cycle was one of two hours and fifty minutes, the beer by then having dropped to a temperature of 104°F. (40°C). Pasteurisation was effected by holding for 60 minutes at 149 to 154°F. (65 to 68°C). These export beers were double pulp filtered, followed by a final filtration through a Seitz using "E.K." Sheets. All home trade beers were issued in swing-stopper bottles, and all export beers in crowns. An allowance of ± 5% was the normal filling tolerance, calculated on the brimful capacity of the bottle. The home trade beers were not pasteurised and had a life of 21 to 24 days in bottle.

It was estimated that losses in running down the beers to the bottling store tanks and thence to the loading bank, excluding pasteurisation losses, were l½% to 2%. Pasteurisation losses were reckoned as a further 1%, giving a total loss of 2½ to 3% for export beers. Transport losses of l% gave a grand total of 3½% to 4%.

E. By-products.

Spent grains were sold wet for fodder purposes, otherwise they were dried with hot air. Spent hops were sold during the war period to tobacco companies, but prior to the war had been sold for manure. They had no knowl-

edge of published works on the manurial value of spent hops. They were relieved of their surplus yeast by a, subsidiary company which created a semi-finished product for sale to the manufacturers of food or fodder yeast.

F. General.

This Combine controlled 16 Breweries, of which four were in Berlin. The other 12 were in the U.S.S.R. Zone. Of the four Berlin Breweries, one operated for the U.S.A., one for the British Authorities, and the remaining two for civilians.

In the U.S.S.R. Sector beers could be brewed up to 6%, and in the other Sectors up to 2% for civilians. In the U.S.S.R. Sector cards were issued to individuals in accordance with the class of their employment, authorising the purchase of beer at 2, 3 or 6%.

The comparative beer duties were as follows:

Percentage	Pre-War Rate	Wartime Rate
2% Beer	13 R.m. per hectolitre. (approx. 21/- per Brl.)	35 R.m. per hectolitre. (approx. 57/- per Brl.)
3% do.	13 R.m. per hectolitre. (approx. 21/- per Brl.)	75 R.m. per hectolitre. (approx. 123/- per Brl.)
6% do.	13 R.m. per hectolitre. (approx. 21/- per Brl.)	118 R.m. per hectolitre. (approx.193/- per Brl.)

The home trade bottled beers were sold either direct through their own ordering office, or through distributors. There were no local prohibitions on sales direct to the private consumer. The minimum order accepted by the Company for bottled beer was 10 bottles. In pre-war days the bottle deposit was 10 Rpg, and during and since the war this figure had increased to 20 Rpg.

HERFORD BREWERY

Target: Herforderbierbrauerei "Felsenkeller" A.G.
Location: Herford.
Type: Brewery.
Date: llth July, 1946.
Persons Interviewed: Herr Uekermann - Proprietor.
Herr Lowenberg - Head Brewer.

A.Raw Materials.

At this brewery a small reserve of hops was still available, but, generally speaking, stocks were said to be very low or exhausted in most German breweries. Considerable quantities of the 1945 Bavarian hop crop were exported to the U.S.A.

B.Substitute Materials.

During the war, as supplies of barley became ever shorter, whey and beet sugar residues were used. Whey was still being used for civilian beer.

C. Plant.

Brewing Plant. The power house was equipped with both steam and diesel engines, but these were not of sufficient capacity to render the brewery completely independent of outside sources of electric power. In this connection they normally reckoned to provide 50% of their requirements. Two ammonia compressors - one large for summer use and the other smaller for winter use - were installed in addition to an ice producing plant with which they made their own ice for the supply of ice for the cooling of casks during rail transport to their public house cellars.

The brew house was of normal German design.

In the coppers, rotating chains were mounted on spindles to prevent burning of the bottom. The coppers were heated by both direct coal firing and steam. The coolers, supported on adjustable jacks, were of the flat open design constructed of iron and housed in an excellent cooler room. The windows of this room were fitted with amber glass to prevent the action of harmful light-rays

on the wort. The control gear on the window louvres was both robust and ingenious, and easy to operate. The walls and ceiling of the cooler room were oil painted, while the ceiling and upper walls received an additional coat of lime-wash on top of the paint. This form of treatment prevented mould formation despite the steamy atmosphere, and we were impressed by the obvious effectiveness of this method.

Three types of fermenting vessels were in use - aluminium, glass-lined, and stainless steel. Their wooden vessels were no longer in use. Herr Ukermann stated that he preferred aluminium fermenting vessels for the somewhat inadequate reason that they always had some value as scrap. Herr Loewenberg expressed preference for stainless steel fermenting vessels on account of their low maintenance costs. The aluminium fermenting vessels were cleaned with a paste of nitric acid and kieselguhr, which was plastered on, left for two days, and then washed off. Glass-lined tanks were, in their opinion, too easily damaged. When installing aluminium and stainless steel fermenting vessels, they were fabricated in situ from metal sheets, and then externally insulated with linen impregnated with pitch or bitumin. The insulation was held in position with wire and the whole set in concrete 11" thick. Mounting in this manner has the considerable advantage that a much lighter gauge metal can be used, thus reducing the cost. Attemperators were suspended clear of the vessels to prevent galvanic and electrolytic couples. The name of the contractor who supplied the aluminium and stainless steel fermenting vessels could not be ascertained.

The storage tanks ranged up to 400 hectolitres (245 brls.) in size, and were of standard glass-lined construction. Larger sizes of tanks were not recommended as their use resulted in irregularities of gas content in the beer.

Cask washing and pitching were quite standard, the plant being rather ancient and old-fashioned. The racking machines were also normal. The floor in the beer cellar consisted of cast iron plates set in concrete, and was stated to be very durable.

Only some 4% of the beers were normally bottled, and the bottling plant was nondescript.

Malting Plant. The barley was stored on open floors without aeration, and usually reached them with a moisture content of 15 to 18%. If turning was necessary it was done by hand. In attempting to malt winter barley soon after harvest they had encountered dormancy troubles. They would not consider using the same bins for storing barley as were used for malt. The barley steeps were cylindrical with conical bottoms, constructed in iron, and were designed for aeration. In addition, the airflow during aeration secured the circulation of both water and barley. The steep is for 60 hours at 50°F. with an 8 hour change.

The malting floor had an excellent surface, with a very high polish, but no information as to the composition of the cement was available. It was stated that the malting floor was carried on a ferro-concrete base, on which was laid 22" of clay followed by a surface of cement. The floor examined was actually laid in 1896, and was still in excellent condition. The finish could only be described as marble-like. Wear resistance appeared to be very good, and indeed, this, combined with the fine finish, had obvious advantages from the malting standpoint. The malting floor which was almost square, was air-conditioned, and a feature worthy of note was the herringbone system of air ducting which ensured even temperatures throughout the floor. Green malt was transferred to the malt kiln pneumatically After the summer rest period, the suction pipes of the pneumatic system were cleaned by the passage of dry barley.

The malt kiln was a double floor circular one with floors 8' apart and equipped with a mechanical turner on each floor. The turners were driven from a vertical shaft. The kiln floors were constructed of normal wedge-wire material, and were carried on H girders let into the walls at the periphery. The H girders carried strips of flat iron approximately 2" by 3/16", standing on edge and set at 6" centres, and at right angles to the twists in the 3 foot wide wedge-wire flooring mats. As a result, a very open floor was obtained, giving a maximum uninterrupted passage for the hot air.

Very thin lengths of flat iron, partially cut at right angles to its length and at 6" intervals, were used as spacing ties for the main supporting flat-irons which rested every 6" in each slot, thus locking and preventing the supporting flat-irons from getting out of line and failing to carry the weight of the wire floor adequately and equally. This construction was thought to be very much superior to that commonly used in the United Kingdom.

The malt storage plant was excellent, having been completed in 1939 by Topf of Erfurt, and was in consequence one of the most up to date in Germany. The malt bins were constructed of iron sheets bolted together. This was stated to prevent distortion which might occur if they were rivetted. The whole battery of 16 bins, with a total storage capacity of 1,000 tons, was supported on concrete floats and pillars in line and entirely independent of the main structure of the building. This method of mounting has the advantage that the strengthening of existing buildings when installing new storage bins was rendered superfluous. The bins were rectangular with hopper bottoms. The malt was sucked into the bins and each bin was equipped with a separate extractor gear leading into the main trunk. The malt was drawn out of the bins by suction from below and a top air pressure of 7½lbs. per square inch was applied to assist. The extraction was controlled from a very elaborate electric control panel situated some distance away from the bins. It was thus possible to blend a grist from eight bins, drawing from each bin successively, in an order and in amounts previously determined and set on the control apparatus. The malt ran into an automatic weigher and thence into the polishing plant and mill. This electric controlling gear is worthy of further investigation, and it is recommended that an expert on electrical gear should be sent to examine it.

The malt mill room was equipped with a Topf polishing and dust extraction plant and a standard Beck six roller malt mill. The design of this polisher was excellent, and it is recommended that as detailed drawings were not available, arrangements should be made for the making of drawings on the spot. Some l% of extraneous matter was removed in the polishing and dust extraction unit. The malt was screened both into storage bins and also when transferred to the malt mill. Transfer from the storage bins to the malt mill was pneumatic.

D. Containers.

They expressed a preference for wooden casks but supplies of home grown timber were not available for new casks. Stainless steel casks were very expensive, and, in their opinion, easily damaged in transit. They used some l% of stainless steel casks for a malt beer, bulk-pasteurised. These stainless steel casks were supplied with golden-gate fittings.

It was stated that cask capacities were stencilled on the ends of casks by Government Authority, and that the casks were regauged every two years.

E. General.

The normal output of this brewery was 250,000 hectolitres (153,000 brls.) per annum and, at the moment, they were brewing for both N.A.A.F.I. and civilians. The present output was 125,000 hectolitres (76,000 brle.) per annum.

The N.A.A.F.I, beer was 8%, i.e. 1032°, and could be classified as a normal lager. It had a definite trub (tannin protein) flavour, and, considering the standard of the working conditions, could not be classified as good. It seemed likely that it was consumed much too new for a beer produced by a bottom fermentation yeast in a lager brewery, and this may very well account for the unpleasant trub flavour. Head capacity and head retention of the beer were good. The civilian beer was a non-fermented - ½% beverage - i.e. 1002° original gravity - it was manufactured from whey and spent hops left over from the N.A.A.F.I. beer. It had a colour similar to normal beer, a rather pleasant hop flavour, and carried a surprisingly good head. The normal life in bottle was stated to be three weeks.

BAVARIA AND ST. PAULI BREWERY

Target: Bavaria und St. Pauli Brauerei A.G.
Location: Hamburg, Taubenstrasse.l.
Type: Brewery
Date : 18th July, 1946
Person Interviewed: Dr. Linderlann - Director.

A.Raw Materials.

Hops. At the moment they were using 1944 Bavarian hops the quality of which had been spoilt by exposure to sunlight. They also had a small supply of 1942 Bavarian hops which were of better quality. Cold storage they considered to be essential for the successful keeping of hops. Hops in cloth could be kept satisfactorily for two years, and in tins for five years. If possible, new hops should be in cold store within two months of harvesting.

The lingering bitter flavour now apparent on the palate of their own and other beers, was caused by the poor quality of hops available. This was demonstrated by comparing two beers - one brewed with badly stored Bavarian hops, and the other with good Bohemian hops. Whereas the former was rough, the latter was a smooth, round beer which could only be described as delightful.

B. Plant.

Their brew house was a fine installation, and the coppers were re-ported to be the largest in Germany. The installation could only be described as magnificent, both walls and floor being tiled. The plant was of copper, highly polished, end the height of the room was approximately 40 ft.

Mash filters were originally used, but with the improvement in the design of the Lauterbottich their had been discontinued. At the moment, due to plant destruction, the mash filters were being renovated for use again. The low pressure coppers were supplied by Spielvogel of Nordhausen, who was reported to be re-opening his premises in the British Zone.

Owing to shortage of space they could not use flat coolers entirely, but preferred to do so. Pure air was very necessary when operating with flat coolers, but, on the other hand, they were strongly averse to the use of air purification plant as it was so dependent on the efficiency and conscientiousness of the operator. They regarded pure air plants as potential sources of serious infection, and this was particularly so at the present time when the class of labour available left so much to be desired. The great advantage of the flat cooler is the relatively sharp cooling rate achieved, which improved the product. High oxygen absorption was also advantageous. On their cooler the wort stood to a depth of 6" to 8" for 45 minutes. They drew from the top of the wort first by means of a floating outlet.

For the best results, flat coolers should be made in copper, but they had to be heavily reinforced to prevent buckling. Cooler bottoms, even if rivetted, should be dead smooth. This type of cooler-was supplied by Siemens of Stuttgart, and a concern in Apolda - the name of which was not known. They considered that copper coolers had longer life, were more easily cleaned, and made a better job of cooling because of their higher heat conductivity than coolers made in iron. Paraflow coolers were thought to be satisfactory when brewing from malts made from fully ripe barley and working in conjunction with a flat cooler on which aeration was thorough. They had no practical experience of stainless steel fermenting vessels, but they knew of a number of installations which were quite satisfactory in operation. The idea of using stainless steel was excellent, but the disadvantage was the very high cost. They used plain iron fermenting vessels, lined with Tremonit, Ferronit or the standard glass lining. Some aluminium fermenting vessels were also installed. Their order of preference was glass-lined, plain iron with Ferronit or Tremonit lining, and lastly aluminium. Their chief objection to the use of aluminium was the development of electrolytic currents which, of course, resulted in pitting. The glass-lined fermenting vessels were cleaned by swilling down and scrubbing out when empty. After scrubbing they were painted with freshly made lime-wash, and then washed off after two hours: this effectively prevented the formation of beer stone. Repairs to glass-lined fermenting vessels and storage tanks were effected by rubbing down and applying a special paint supplied by the makers Their own installation had been supplied by Thalewerke, situated in the Harz district, and Schwelm of Westphalia. This method of repair had been found to be quite satisfactory. To prevent damage when cleaning the fermenting vessels, the workmen were provided with rubber boots, ladders were rubber shod top and bottom, and the buckets were also suitably protected. The thermometers used in these vessels were fitted with wooden floats to prevent damage if they were dropped. The largest glass-lined fermenting vessels they had in use were of a capacity of 230 hectolitres (140 brls.)

Storage tanks could be either of glass-lined or aluminium construction. They preferred the former, and their tanks were of one piece construction when of small capacity, and of ring construction when of large capacity.

Bottling Plant. The bottling store mains were made of copper, unlagged, and were not emptied at meal breaks. They had never had any trouble with metallic hazes. Only 30 ft. of mains were used between the filter and the filling machine. The pipes were not dismantled for cleaning but brushed through, the elbow pipes being cleaned with Sorbo balls.

Normal commercial detergents were used in the bottle washer without the addition of caustic soda or soda. The bottling plant was subjected to special cleaning once a week. A 1% formaldehyde solution was circulated, the first runnings going to waste so that the circulation was effected with full strength solution. The pumping round continued for two hours, after which it was necessary to rinse through thoroughly with water. The racking plant was treated in a similar manner.

C. Containers.

They definitely preferred oak casks, and had no practical experience of aluminium or stainless steel casks. The normal life of their oak casks was 15 to 20 years, and with smaller sizes 25 to 50 years. They preferred Slavonic oak to German oak, as the latter was more porous and required 4 to 5 years seasoning. They had received certain supplies of oak for their casks from the U.K., and U.S.S.R. Zones. They did not consider it likely that there would be any surplus oak for export from Germany if home trade requirements were to be satisfied. All wooden casks were tested at 67½ lbs, per square inch pressure - i.e. 50% above the normal working pressure of 45 lbs. per square inch. They were tested by complete immersion in water for a period of one minute, the pressure being applied through the bung or tap hole. Both the bung and tap holes were bushed with a much heavier type than those used in this country, and fitted with a finer thread. The bung bush had an iron screwed plug instead of the traditional wooden shive. The bushes were made of wrought or cast iron. A sample was taken. They had of necessity made use of laminated casks. Their life was rarely over five years, and they definitely preferred the traditional oak cask. For bulk export trade they had tried plain steel casks, lacquered, but had not found them to be satisfactory.

D. Process.

Malting Process. Formerly they had operated their own maltings in Mecklenberg, but because of distance which increased the carriage costs and made supervision difficult, they had disposed of them.

On the subject of malting they expressed the view that experienced brewers preferred floor malts especially for export beers, as they were better modified. It was agreed that box malts, if the malting process had been correctly controlled, were also good, but nevertheless, floor malts were still regarded as being more reliable. Whilst no concrete evidence was brought forward in support of this contention, their experiences over a period showed that they got better results from floor malts, and they had fewer complaints from customers when brewing from floor malts than when brewing with box malts.

Brewing Process. The home trade worts were boiled in low pressure coppers, the temperature being raised from 212 to 220°F. (100 to 104.5°C.). The first fifteen minutes boil was open, after which the coppers were closed and the temperature taken up to 220°F. (104.5°C.) where it was held for 20 minutes. If this temperature was maintained too long, the flavour of the resultant beer was too bitter, hence the restriction on the pressure boil to 20 minutes. The copper was then opened and the temperature let down to 212°F. (100°C.). Open boiling proceeded for a further 45 minutes to get rid of ethereal oils. They were of the opinion that by pressure boiling they obtained a better extraction of the hop bitter resins, a better reaction between wort proteins and tannins, producing a better break and a more stable beer with a smooth flavour. They also thought that the initial boil at 212°F. (100°C.) assisted in securing complete saccharification. The best flavour extraction from the hops was given by the pressure boil. They also believed that thorough saturation with oxygen when on the coolers was best ensured by a vigorous low pressure boil. The cooler break was, of course, assisted by this oxygen absorption. One third of the hops were added at the start of charging the copper, and the balance when fully charged.

Export beers were brewed by the three mash system with an open boil for 2½ hours. When available, 5 to 7% of rice was added to the grist for export beers. At a later stage export beers were also primed. The hops were sparged with hot liquor at 113°F. (45°C.). Hot liquor was preferred to cold liquor, as the latter gave a coarse flavour. When hopping at 240 grammes per hectolitre (13.8 oz. per brl., they would use 2 to 3 hectolitres of sparge liquor for a 100 hectolitre length (equivalent to the use of 44 to 46 gallons of liquor to sparge 86.25 lbs of hops). At present the hop rate for NAAFI 8% beer (1032°O.G., had been raised to 350 grammes

per hectolitre (20.2 oz. per brl.) which was regarded as excessive. For their normal 9.3% beer (1037°O.G.) they had used 270 grammes per hectolitre (15.6 oz. per brl.), preferably of Czeckoslovakian origin. The 12% beers (l048°O.G.) brewed in pre-war days were hopped at 240 grammes per hectolitre (13.8 oz. per brl.). During the war some brewers had re-boiled spent hops with the next brew, but this gave a raw taste and there was little doubt that some of the trub would have been re-absorbed. They themselves had disposed of their spent hops during the war for use in the upholstery trade as stuffing.

The hop flavour of the English type beers now being brewed with a high hop rate was of a different character from that of a Lager beer, and this was also considered to be so when making comparisons between normal English and Lager beers. Bitterness of an unpleasant character may be caused either by the quality of the hops, or, alternatively, by pasteurisation. They held the same views with regard to the relationship of calcium sulphate content and hop flavour as we do in this country. They had no experience of Irish Moss, as the use of such adjuncts was prohibited by German law.

Protein stabilisation for their export beers was effected in one of two ways. A concentrated solution of tannin was made-up in water and diluted with beer. This was added to the beer in storage tanks at the rate of 5 to 7 grammes per hectolitre (2.9 to 4.0 oz, per 10 brls.) three to five weeks prior to bottling. The addition was made through the bung hole in the case of wooden storage casks, and through the air tap with storage tanks. Thorough mixing was essential. Shortly before filtering pepsin was added at the rate of 4 to 6 rammes per hectolitre (2.3 to 3.5 oz. per 10 brls.). The object of this addition was to make quite sure that no further albuminous precipitates could develop. Some brewers add gelatine at the rate of 5 to 7 grammes per hectolitre (2.9 to 4.0 oz. per 10 brls.) approximately 10 days after the tannin addition in order to precipitate any excess tannin. This gelatine addition was not considered absolutely essential. For really satisfactory results the temperature in the storage cellar should be brought down to 34°F, (1°C.) during the last weeks of storage. An adequate degree of acidity was also necessary.

In recent times the Protex process had also been used for protein stabilisation. One kilogramme of Deglutan (aluminium silicate) was mixed to a thick paste with 15 litres of beer freed of carbon dioxide (2.20 lbs. Deglutan to 3.30 gallons beer). The Deglutan must be added very slowly to the beer, constantly stirring. After 24 hours it may be used for treating the main bulk of beer in the storage tank. Deglutan was added at the rate of 60 to 80 grammes (dry weight) per hectolitre (3.5 to 4.6 oz. per brl.). This treatment should be carried out 5 to 10 days before bottling. This rest period was necessary for the complete precipitation of the albumin, but on the other hand, the maximum of 10 days should not be exceeded as there was a danger that the albumin might be re-absorbed. The storage cellar used for beers treated by this system should be taken down to 30°F. (-1°C.). This was of great importance. In the following filtration it was necessary to use a freshly packed filter, washed through with ice-cold water prior to filtration. The filter should be in a filter room at the lowest possible temperature and, if it was possible, the filter should be packed in ice. Under no circumstances should the beer be allowed to warm up appreciably during the filtration process. Beers treated in this manner will remain stable, as far as protein or albumin precipitation is concerned, for years.

Filtration was effected through standard double Enzinger Pulp Filters. Before breaking the filters they washed back with cold water to eliminate the main turbidities, and followed this with a back-wash of warm water not exceeding a temperature of 113°F. (45°C.) so as to avoid damaging the rubber washers. The filter was then drained and broken and the pulp loaded into the washer whilst still warm. All dirt was washed off with water in the normal manner and the temperature was then gradually raised to 185 to 194 °F (85 to 90°C.), taking great care not to exceed the higher limit. This temperature was maintained for one hour, after which the pulp was cooled with cold water, strained off and made up into new cakes. Chemicals were not used as the temperatures specified, combined with the hot back-wash prior to breaking up the filter, ensured elimination of hop resins and the destruction of yeasts. If the pulp was discoloured after constant use, it could be bleached with calcium hypochlorite. The cakes were made up at 45 lbs, per square inch pressure. The filter frames were cleaned with special brushes.

Before the war their light beer had been brewed at 12½ to 13% (1050 - 1052°O.G.) and had had an alcohol con-

tent of 3½. The dark beer was of similar composition but did not have such a high hop rate. No crystal malt was used in the production of this beer. Malt beer has been brewed at 13% (1052°O.G.) and matured normally, and had an alcohol content of 3½ to 4%. Prior to filtration they added malt extract to bring the beer up to an equivalent of 18% beer (1072°O.G.), and then filtered and pasteurised. The export dark beer was made from Munich malt, and they also used crystal malt. To provide additional sweetness to the finished product, they used malt extract of their own manufacture at racking or bottling.

Bottling Process. Bottle beers had been pasteurised, and they stressed the necessity for attaining maximum temperature slowly. Cooling down with light beers should be achieved as rapidly as possible. The cycles for their Home Trade beers were as follows:-

Beer Type	Pasteurising Temperature	Climbing period	Holding Period	Cooling Period
Pale	154-158°F. (68-70°C.)	1 hour	45 mins.	25 mins.
Dark	154-158°F. (68-70°C.)	1 hour	30 mins.	Air cooling
Malt	154-158°F. (68-70°C.)	1 hour	1 hour	Air cooling

The light beers were stored in cold store at 37 to 39°F. (3 to 4°C.).

E. Research.

They were subscribers to the V.L.B. but, as they had their own laboratory, they made little use of it except for detailed water analyses or a complete biological survey of their whole plant. No research was carried out in their laboratory which was concerned essentially with the checking of materials and processes. At the moment it was engaged on investigating the possibility of using soya beans as an alternative source of carbohydrate owing to the current shortage of raw materials.

F. General.

This brewery was damaged by aerial attack on eighteen occasions, sixteen of them being classified as heavy. In one attack fifteen bombs - said to be not less than 1,000 lbs. each, were dropped on the brewery. In spite of these numerous attacks, brewing was never interrupted for more than nine days. Dr. Lindemann is an enthusiastic and most competent brewer.

BILL BREWERY

Target: Bill Brauerei A.G.
Location: Hamburg, Bullenhuserdamm 73-75.
Type: Brewery.
Date: 18th July, 1946.
Persons Interviewed: Herr Jung - Technical Manager
Herr Steinecker - Commercial Manager.

A. Raw Materials.

Hops. They had some 1200 to 1400 cwts of Hallertau Hops in stock which would see them through till next spring at the present rate of brewing. A free issue of hops was received from N.A.A.F.I. for use in beer for troops. A similar free issue of malt was also made. The hops now in use were not of good quality having been damaged by water following aerial attack whilst still in the hands of merchants in Bavaria. They preferred, if available, Saaz, Tettnanger and Spalt hops. The hops were cold stored in 2 cwt cloth-lined tins. These tins were the property of the hop merchants to whom they paid rent for them. After withdrawal from cold store, they reckoned that the hops should keep satisfactorily for six months in the cloth lining, provided that they had been well pressed prior to cold storage.

They did no malting themselves, but had their own silos for the storage of purchased malt. During the war period they had been compelled to buy all their malt from German sources.

B. Plant.

Brewing Plant. Fermenting vessels in use were ebon-lined concrete, and both the erection and lining were

executed by Rostock and Barlocher. They pointed out that the main danger with concrete vessels was the possibility of hair cracks developing, a danger accentuated in their own case by the fact that the brewery was built on piles. With good subsoil and solid foundations this type of vessel should give perfectly satisfactory results.

Their storage tanks were horizontal with a capacity of 60 hectolitres (37 brls.) whereas the vertical treatment tanks had a capacity of 162 hectolitres (99 brls.).

C. Containers.

They preferred wood casks although they had been compelled to use laminated casks during the war period. They had used some stainless steel 50 litre containers (11 gallons) supplied by Krupp for bulk export markets. These containers were cylindrical and fabricated from ½" stainless steel sheet.

D. Process.

The wort stood for six hours on flat coolers, before passing to the vertical refrigerators. They considered the use of sterilised air in the cooler rooms essential, and had an elaborate plant installed for this purpose. The home trade beers were fermented at 41 to 49°F. (5 to 9°C.), and the export beers at 41 to 44°F, (5 to 7°C.). The importance of sterile air was again emphasized for the fermenting cellars, which were also equipped with elaborate air conditioning plant. Home trade beers were stored for three months at 34°F. (1°C.) and export beers for eight months at 30°F. (-l°C.). If necessary, both home and export trade beers were Kraeusened in the lager tanks. In earlier practice they brought about protein stabilisation by treating with 4 grammes per hl. (2.3 oz. per 10 brls.) tannin, and 2 grammes per hl. (1.2 oz, per 10 brls.) pepsin or collupulin. In more recent times they had changed over to the use of 6 grammes per hl. (3.5 oz, per 10 brls.) of aluminium silicate in suspension in beer added through a connection at the top of the vertical settling tank. After settling for six to eight days the beers were drawn off and centrifuged into storage tanks. Filtration and bottling followed immediately. They had never used sulphur dioxide preparations. Tannin, when used, was B.P. quality supplied by Merck, and was added in solution in beer. They claimed that this process, together with their methods for attaining biological stability, gave a guaranteed life of two years in bottle. This contention was confirmed by the examination of a three year old beer. This was of the Bock type 18° (1072°O.G.), and was entirely free from deposit or haze and had an excellent full, slightly vinous, flavour. For their export beers they used anything up to 20% of rice in the grist, and used, as far as possible, a low nitrogen barley of Moravian origin for the malt. The malt and the rice were mashed separately, the rice being added to the mash after the albumin rest - i.e. the first stage.

The pre-war export beer had been 14% (1056°O.G.) with a colour of 0.50 on the Brand scale, equivalent to 6.0 Lovibond scale. Practically no dark beers were exported.

Bottling Process. They had two bottle filling units in operation, one being a Seitz sterile filler, and the other a normal filler with pasteuriser. The beers bottled on the Seitz unit were pulp filtered once and finished on a double Seitz filter with "E.K." and "E.K.S." Sheets. The beers bottled on the other unit were subjected to double pulp filtration and then pasteurised. The pasteurising temperature for the larger bottles (two thirds litre) was 149°F. (65°C.) and for the smaller bottles (one third litre) 143°F. (62°C.). They took 75 minutes to attain this temperature, held for 25 minutes, and then cooled to room temperature in 30 minutes. A flame steriliser for crowns was in operation.

Bottled beers for export were in crown bottles, capacity one third or two thirds litres. Their label adhesive was purchased from Sichel under the name of Kaltleim and stood up to ice box conditions. An Anker machine was used for labelling, applying both neck and body labels. The same machine was also used for applying aluminium foil capsules to their special Pilsner type bottled beers.

Wooden export cases were supplied already branded by the case makers, but they themselves applied the shipping marks. Bottles were packed in straw envelopes, but for ships' stores they made use of standard compressed paper packing. The cases were made locally and had a Capacity of 50 two thirds litre bottles (total 7 gallons) or 75 one third litre bottles (total 5.5 gallons).

A certain quantity of beer had been exported in bulk in 50 litre (11 gallons) stainless steel containers. These were pasteurised by total immersion and an expansion space of 4 to 6% was allowed. Such containers were sold on the basis of the standard 50 litre content less an allowance for expansion space. According to the market, they received an export subsidy, varying from 20 to 30%. Their export agents had been Messrs. G. and Q. Stern Ltd. of London. Prices were quoted f.o.b. Hamburg, and the main markets were India, Malaya, West Africa and Columbia.

E. Research.

Although subscribers to the V.L.B., they made relatively little use of this institution, as they had a large modern up-to-date laboratory of their own. The laboratory had been destroyed by aerial attack. Their subscription to the V.L.B. was of the order of Rm. 800 per annum on an output of 300,000 hectolitres (183,000 brls.)

F. General.

At the moment it was reported that there were only four breweries operating in Hamburg. They were working for both N.A.A.F:I. and for civilians. The Bavaria and St. Pauli Brewery was working for N.A.A.F.I., while the Elbschloss and Holstein Breweries supplied civilians.

In view of the capacity of the brewery, the provision of plant, (which was more than adequate) buildings, and laboratories indicated that the profit basis must have been relatively high. It was mentioned that the-salary of their Head Brewer was Rm.12,000 per annum, and that their capital was Rm.2,700,000 on which they made a gross profit of Rn.700,000 prior to assessment for taxation purposes, and paid a dividend of Rm. 500,000.

BECK AND CO.

Target: Beck and Co.
Location: Bremen, Am Deich.
Type: Export Brewery.
Date: 19th July, 1946
Person Interviewed: Herr von Marwede - Director.

A. Raw Materials.

Barley and Malt. Their barleys, which were carefully selected and of low nitrogen content, were purchased in Prague from Bohemian and Moravian sources, and the final selection was made by the brewery from the sample range offered. Malts were made for them on a commission basis in Bohemia and Moravia and were made on the flooring system. They never used box or drum malts.

Hops. They used Bohemian and Bavarian hops exclusively and expressed a preference for the former. Indeed Bavarian hops were only used if Bohemian hops were not available. The proportions of Bohemian and Bavarian hops used in the brewery varied according to the quality of the crop.

B. Containers.

In their opinion wood was the only suitable medium for the making of casks. They had experimented with plain steel casks coated with vitreous enamel, but these had chipped in transit and were regarded as utterly useless as beer containers. Balkan timber was the most suitable material for wooden casks as German oak was too soft and porous. This comment on German oak applied both to Westphalian and Rhineland supplies, although the latter was said to be the better. They had used 50 litre (11 galls) stainless steel casks for bulk to Java. The number in circulation was, however, small, and they were not regarded as satisfactory.

Crown bottles only were used, normally pints having a capacity of 370 ml. (13 fluid ozs) and normal quarts, 680 ml. (24 fluid ozs). For one specific market they also supplied beer in bottles with 780 ccm, capacity 27.5 fluid ozs. They preferred amber bottles, but had been compelled to turn to green as the former became scarce. Wooden export cases were used universally and accommodated 72 pints or 48 quarts. For one particular market they used cases which accommodated 96 pints. The bottles were packed in straw envelopes although on occasion, when straw was not available, compressed paper packing was used. A combination of the two was also used on occasion when the bottles were first placed in straw envelopes and then packed in layers between corrugated compressed paper.

C. Process.

Brewing Process. This brewery was entirely devoted to export, exporting beer from its foundation in 1873, although a Subsidiary Company operated on the Home Market. Their well-known Key Brand Lager was made exclusively from malt, hops and sugar, and never at any time was rice or maize added to the grist. The mashing system was elastic and not tied to any rigid routine. It was usual to decide on the details of the mashing system after examination of the new malts each season. The same remark applied to the fermentation procedure. The hop rate was said to be 34 grammes per hectolitre (2 ozs. per barrel), with no additional hops in the storage tank. (This statement would appear to be incorrect.) At one time they had maintained their own yeast propagation plant, but this was no longer in use and they now obtained their changes of yeast from other breweries. Fermentation was carried out at 44 to 46°F. (7° to 8°C.). The beers were stored for six months at temperatures of 33.8 to 34.7°F. (1 to l½°C.).

Pepsin, collupulin or aluminium silicate were not used for protein stabilisation purposes. B.P. tannin supplied by Merck or Schering-Kahlbaum only was added to the beer in solution, and this at the rate of 6 to 7 grammes per hectolitre (3.5 to 4.0 ozs per 10 barrels). The beer was transferred from the ordinary storage tanks to vertical treatment tanks in which it was rested for two to three weeks after treatment. It was then passed through double pulp filters, bottled, and pasteurised. Asbestos was added to the filter pulp when required.

They used Jagenberg Labellers which applied front, back, and neck labels in one operation. The aluminium foil capsules for the neck were applied by hand. They could not name the supplier of their label adhesive, but said that it stood up to icebox conditions. In view of the fact that von Marwede was principally concerned with the commercial side of the brewery, the details given on the technique of production must be accepted with a certain degree of reserve, as he was obviously not too familiar with the details of the production side.

D. General.

This brewery together with the subsidiary company operating on the Home Market had an output of some 700,000 hectolitres per annum (428,000 barrels). Some 60 to 70% the German beer export trade was in their hands. The main markets were in the Congo, British India, and West Africa, and the peak of export trading was reached in 1927 to 31. In the last-named year 800,000 cases were exported. After the 1931 economic crisis there was a major drop in trade, and by 1939 the trade had fallen to 260,000 cases per annum. Apart from the economic crisis of 1931, the decline in export was further accentuated by the establishment of modern breweries in the export areas. To meet this competition they had built breweries at Singapore, Sourabaya, and Batavia, and had also acquired shares in a brewery in Colombia. In spite of this, however, trade continued to decline.

They mentioned the fact that their export trade in British India had been affected when the Madras Presidency went dry in 1937, and mentioned having heard reports that Bombay followed suit in 1939. 80% of the British India business was done in bazaars. Their Agents for British India were C.B. Goss and Co. Ltd. 1, Lloyds Avenue, London. In Malaya they were represented by Stowe and Co. of Penang and Singapore and in Colombia by Cargills and Co. They had done practically no business in Hongkong or the West Indies.

An export subsidy to the extent of 30% was paid to them by the Government, and their effective competition on the export market after 1931 was only possible by virtue of this subsidy. It was entirely absorbed in meeting their expenses and in the last few years before e war their profits were derived almost exclusively from their subsidiary breweries operating in the Far East. The profit rate on the home market trade, for dividend purposes, was 1½ to 2 Rm per hectolitre. Speaking generally, German breweries had built up large reserves in the period 1926 to 1932. In 1922 this Company had a capital of 9,600,000 Rm. with contingent liabilities of 8,000,000 Rm. These liabilities were apparently liquidated in the 1926 to 1932 period. A similar liquidation of such liabilities took place in most German breweries. As a consequence of this the German breweries as a whole were working with a low capital relative to their output capacity. They could thus pay dividends of some 15% to their shareholders and still give good service to the customer. The excellent service given to the public by German breweries would not have been possible but for this state of affairs, and there is no doubt that the

German public received extremely good value for their money.

There had been no statutory increase in the wages paid to workers in the brewery during the war period. Unskilled men were paid at the rate of Rm. 45 per week. Many working class incomes were free from tax which placed unfair burdens on the higher income classes. Von Marwede himself, on what was obviously a quite considerable income, paid 38% income tax which he considered to represent a munificent contribution to the German Exchequer.

HUMBSER BREWERY

Target: Brauerei Humbser A. G.
Location: Fuerth, Schwabacherstrasse. 106
Type: Brewery.
Date: 24th July, 1946
Persons Interviewed: Herr Rosenfeld - Director.
Herr Humbser - Head Brewer.
Herr Hahn - Second Brewer.

A. Raw Materials.

Barleys were bought by the Company in lower Franconia, chiefly from their own customers. The quality often left much to be desired. The position relating to hops was fully set out in Report No. 15.

B. Plant.

Brewing Plant. The tiled brewhouse was erected in 1911 at a cost of 1,000,000 Reichmarks, incorporating four vessels arranged on three stages. It was an outstanding example of brewing engineering, design and forethought as illustrated by the duplication of all wort pump units. Furthermore, unlike any other brewhouse we saw in Germany, the portions under the brewhouse floor exposing the pumps, raking gear and under sides of the brewing vessels, had the same degree of finish - tiled walls and floors, bronze window fittings etc. - as the main brewhouse.

They had both wooden and ebon lined fermenting vessels. They had no practical experience themselves with stainless steel fermenting vessels, although they has heard reports that they were operating very satisfactorily in Sweden. The beer mains throughout the brewery were of copper.

C. Containers.

Casks. No more timber was available for the repair of casks, and they had, therefore, been compelled to knock down old casks to keep the bulk of their newer casks in good repair. Prior to the war they only used branded casks, but had discontinued this practice under present circumstances. They had also, during the war, been compelled to establish a cask register. Records were now maintained showing dispatches and receipts of all casks every month for each customer.

Bottles. Bottles were in very short supply. During the war period they had bottled up to 80% of their normal capacity, but now they only bottled 10% of their capacity. The small quantities of new bottles received were of very bad quality and the loss sustained with any new consignment from receipt of the bottles, through washing and filling machines for the first time, was anything up to 30%. Their present supplies were received from the Amberg Bottle Works. They estimated the current demand for bottles in Bavaria alone at least 50,000,000 bottles per annum. The present allocation was not likely to exceed 450,000 bottles per annum - only sufficient to cover 1% of requirements.

D. Process.

They made their own malt from their own purchased barleys on the flooring system and turning by hand.

At the time of our visit they were brewing low gravity beers of 1.8% (1007°O.G.). This was for civilian consumption. It was necessary to carbonate these beers to obtain an adequate gas content. To maintain their yeast in good condition they were actually brewing at 8% (1032°O.G.) and breaking down with water. Even under this system, however, they were compelled to obtain changes of yeast from an outside source. It was possible, even with the low gravity beers of 2% or under, to obtain an adequate carbon dioxide content by retaining the whole of the yeast in the beer when running down to the storage cellar, but this system had the serious disad-

vantage that no yeast could be recovered for future pitching. They reported that the demand for dark beers was falling off and that sales of this quality only amount to some of the total trade as compared with practically 100% at the beginning of the century. They used Bavarian hops almost exclusively except in seasons when Bohemian hops were much cheaper. When comparing beers brewed from Bohemian and Bavarian hops, they could not find any difference in the flavour. This was due to the sweeter character of Bavarian beers masking any minor differences of hop flavour. Hops were used at the rate of 8.7 to 10.4. oz, per barrel (150 to 180 grammes per hectolitre). The actual hop rate to be used was not decided on analysis but by a physical examination of the hops and on practical brewing tests. The hops were kept in cold store at 35.6°F. to 37.4°F. (2 to 3°C.),the cold store being, in effect, a portion of the fermenting cellar converted for this purpose.

F. Research.

They did not carry on any research themselves were members of both the Berlin and Weihenstephan Institutes.

They had no laboratory, all their work being undertaken by the Public Analyst of Nurnberg who was employed as a consultant by every brewery in the town. In conversation the Head Brewer mentioned that their own laboratory could not cope adequately with hop analysis - which did not agree with the statement made by the Director. It was possible, however, that they had a small laboratory which was used for routine work only.

G. General.

The normal capacity of the brewery was 110,000 brls. (180,000 hectolitres) per annum. The 1945 Production was 24,000 Hrls. (40,000 hectolitres) - i.e., less than the 1888 output, the first year in which the plant was operated. The 1946 output was expected to reach 49,000 Brls. (80,000 hectolitres). Prior to the war their normal beers were 10% to 11% (l040 to 1044°O.G.), the export beer 13% (1052°O..G.) and the Bock beer 18% (1072°O.G.). The current production of civilian beer was 1.8% (1007°O.G.) on which tax was paid at the rate of 35 Rm. per hectolitre. This tax was charged when the beer left the brewery, and was paid to the Government without any addition of local taxation. The output figures were checked by reference to the records of brewing material purchased and in stock. Their present tax bill amounted to 350,000 to 400,000 Rm. per month and was paid on the 25th day of the following month. They made their own sales declaration to the taxation authorities. The selling price of this civilian beer was 74 Rpg, per litre for draught beer, whereas the half litre bottles were sold at 39 Rpg. each.

For the local delivery in Fürth they made use of horse drays, and for delivery in Nurnberg they made use of electric lorries. Petrol lorries were used for the country trade and other towns. The electric lorries had a range of fifty miles with a five ton load, or forty miles with a five ton load plus a three ton trailer. It was noted, by inspection, that these electric trailers were of the four-wheel type as compared with the three-wheel type used in the U.K. Further, they were equipped with Buna synthetic tyres. The opinion was expressed that pre-war Buna was better than natural rubber, but the quality had deteriorated very much during the war.

They owned some 120 public houses prior to the war, sixty of which were lost by aerial attack. Apart from these, certain houses were tied by the granting of mortgages for maximum periods of five years.

Bottle beers were supplied against spot-cash payments made to the drayman. Draught beers were paid for by monthly account. Some customers were paying in advance at present for both bottle and draught beers as they did not wish to hold currency owing to the fear of inflation. They experienced some difficulties when in competition with country breweries on the free market as the country breweries paid lower wages and also paid lower rates of Duty. This circumstance was explained by the fact that in pre-war days Duty was scaled according to output.

Prior to 1914, they had engaged in a certain amount of export trade to U.S.A, and for this market they used purchased Bohemian malts and not the malt of their own manufacture. This trade was not resuscitated after 1918. In Bavaria all beer brewed there and not sold inside the State of Bavaria, was defined as export. During the war brewing operations were finally stopped in December, 1944, through lack of fuel. Brewing was resumed in

September, 1945. The non-allocation of coal to their brewery was due to their unpopularity with Nazi Government officials.

Ancillary materials, such as filter pulp, nails, bungs, bung cloths, etc. were practically unobtainable, and even supplies of carbon dioxide for carbonating the present low gravity beers were only obtained with difficulty. Cement was in very short supply in Bavaria, as only six factories in the whole province still exist, compared with the twenty-six, for example, in the U.S.S.R. Zone.

In Bavaria there were two trade organisations prior to the war, namely the Brauverbund (roughly equivalent to the Brewers' Society) and the Brauwirtschaftsvirbund (Brewing Economic Group). The latter, during the period of shortages both prior to and during the war, was responsible, under the control of the Ministry of Agriculture, for allocations of raw materials. During the war period, legislation of a temporary character was introduced and made effective prohibiting one brewery taking over the customer of another brewery. An exchange of customers system was also operated. Two methods were in general use. In the first case, the parent brewery supplied the malt to the supporting brewery, and the parent brewery invoiced to the customer. In this case the parent brewery made a payment to the supporting brewery at the rate of 6.50 Rm. per hectolitre for the quantities handled. In the second case the supporting brewery supplied the malt and also invoiced the customer. Under such arrangements the supporting brewery credited the parent brewery with 3 Rm. for each hectolitre of beer handled.

Apart from this a complete zoning system was in full operation, under Government supervision, by the end of the war.

MUNICH BREWERIES

Target: Various Munich Breweries.
Location: Munich.
Type: Breweries.
Date: 27th July, 1946
Persons Interviewed: Dr. Berchtold - Director,
Inspector Vogel - Manager,
Dr. Hagenmiller - Director,
Herr Lense - Director.

Dr. Berchtold and Inspector Vogel of the Loewenbrauerei, Carl Hagenmiller of the Paulaner Salvator Brauerei, and Carl Lense of the Hofbrauerei, were all interviewed at their private residences. The information obtained in the other breweries already visited during the course of the trip were fully confirmed.

They stated that there had been no progress in brewing under the Nazi regime and that, in actual fact, some regression had occurred. Thus there was nothing original to be seen in the breweries of Munich and district.

WEYERMANN MALTINGS

Target: Malzfabrik M. Weyermann.
Location: Bamberg.
Type: Maltings for Coloured Malts.
Date: 25th July, 1946.
Persons Interviewed: Herr Kalk - Technical Director.
Herr Seitz - Head Maltster.

A. Raw Materials.

The first deliveries of new season's barleys were received during August and September each year. Only the best quality low nitrogen type barleys were used, these being purchased in Lower Franconia. The moisture content was usually below 14%. Low nitrogen barleys were preferred as they gave better saocharification than high nitrogen barleys.

The barley prices were controlled and ranged from Rm. 20.50 to Rm.21.50 per 100 kilos free on rail. The merchants' commission at the rate of 95 Rpg, per 100 kilos was additional to this charge. Pre-war prices were some 1.50/2 Rm. per 100 kilos lower, but the merchants' commission was the same.

B. Process and Plant.

The barleys were screened into hoppers on receipt. At the commencement of the season, barleys could be stored with safety for approximately two months but later in the season storage time rarely exceeded fourteen days. There was no screening of the barley from the hoppers to the steep. The time of steeping varied from

60 to 70 hours. The water was drained off after twenty-four hours and the barley then allowed to rest for 5 to 6 hours. This cycle was repeated by adding water and pumping over to another steep. On completion of the final drain, the barleys then rested for a further twenty-four hours. There was no artificial aeration in the steeps.

The malts known as Cara-Pils, Cara-Hell and Cara-Munch were made from barley germinated for seven days, but the Farbmalz was germinated for 4 to 5 days only. During germination, temperatures were raised from 54.5°F. (l2.5°C.), to 68°F., to 77°F. (20 - 25°C.). This high temperature was used to set up a forcing effect - i.e. to induce more active proteolytic enzyme. These high temperatures were usually attained only in the last twenty-four hours of germination but gave more sugar and amino acids with the object of aiding caramelisation.

Cara-Pils. The green malt in this case was transferred to cylinders and saccharified for 10 to 15 minutes at 140°F. - 149°F. (60 - 65°C.). It was then removed to a normal two floor kiln suitable for either steam or lager kiln heating. The malt was dried for twenty-four hours with the vents open during the, entire period. The colour was 0.12/0.20 Brandt, equivalent to 2/2.5 Lovibond.

Cara-Hell. The green malt in this case was transferred into cylinders and saccharified for 30 to 45 minutes at 140°F. (60°C.), closing the vents when this temperature was attained. It was dried in the same cylinders at 194°F. - 248°F. (90 to 120°C.) for 45 minutes. Colour was 8/10° Lintner No.l scale (4 - 5° Lovibond approx).

Cara-Munch.This malt was processed in exactly the same way as Cara-Hell except that the drying temperature was 302°F. (150°C.) and the colour 17 to 20 Lintner No. l scale (180° - 200° Lovibond approx).

Farmalz. This malt was not saccharified. It was first hand dried either on a kiln or in an ordinary drum at 122°F. - 124°F. (50 - 51°C.) the process taking about 24 hours. The rootlets were removed by screening. The malt was then roasted in spherical drums at 392°F. (200°C.) for two hours, the heating being applied by direct coke firing. Air was sucked in through two 3" suction pipes, the air being heated by the coke fires. A flexible hand sparge pipe could be inserted into the drums through the hollow axis. For a charge of 7.5 cwts. (380 kilos) of malt they add 5.5 to 6.6 gallons (25 to 30 litres) of water during a period of four minutes after one hour's roasting. To put a glaze on the malt, they draw from the spherical drums after drying into a large cylindrical drum with a capacity of 10 tons (10,000 kilos). They then steam for one hour and reduce the temperature to 140° to 176°F. (60 to 80°C.) over a period of three hours by blowing in air heated by steam. The colour was 160 to 1700 Lintner No. 2 scale (1600 - 1700° Lovibond approx).

The cylindrical drums used for drying were of two - capacities - i.e., six hundredweights and fifteen hundredweights respectively. The 6 cwt. drums were supplied by van Guelpen G.m.b.H. of Emmerich, Rhineland, and the 15 cwt. drums by G.W. Barth of Ludwigeberg, and the steaming drum by Freund of Berlin-Charlottenbegg.

The yields were as follows:-

Cara-Pils	74/75%
Cara-Hell	72/74%
Cara-Munch	69/70%
Farbmalz	60/62%

These figures were calculated on weight of screened barley.

C. General.

The four special coloured malt products of this firm can be classified as follows:-

Cara-Pils - light caramel malt for Pilsner type beers.
Cara-Hell - light caramel malt for light beers.
Cara-Munch - caramel malt for dark beers.
Farbmalz - de-bittered caramelised coloured malt.

They were regarded as special malts and should be added at the rate of anything up to 10% of the grist to normal malts with the object of improving the flavour and head retention of the finished beer. The selling prices were as follows:-

Cara-Pils)	
Cara-Hell)	Rm.46.50 per 100 kilos.
Cara-Munch)	
Farbmalz	Rm.50.50 per 100 kilos.

All prices were quoted free on rail and special discounts were granted for contracts. The Cara-Pils, Cara-Hell and Cara-Munch were packed in heavy quality single jute sacks, 165 lbs. (75 kilos) capacity, and the Farbmalz in similar sacks 137 lbs. (62½ kilos) capacity.

It should be noted that Kalk, the Technical Director, could not, or rather would not, give detailed information. Seitz, the Head Maltster, was extremely difficult to understand due to his broad Bavarian accent, and he was obviously under instructions not to show the steaming plant used in the manufacture of debittered black malt.

MANNHEIMER MALTINGS

Target: Mannheimer Malzfabrik A.G.
Location: Mannheim Kafertal.
Type: Maltings for Special Malts.
Date: 29th July, 1946.
Persons Interviewed: Herr van Herwenden - Director,
Herr Nuesselt - Director,

This concern manufactured proteolytic malts, working on the Dixon Patent.

These special malts were blended to the extent of 5% to 10% of the total malt grist in much the same manner as crystal malt was normally blended.

STEINECKER MALTING MACHINERY

Target: Anton Steinecker Malzmaschinenfabrik A.G.
Location: Freising.
Type: Manufacturers of Malting Machinery.
Date: 26th July, 1946.
Person Interviewed: Herr Eau - Secretary.

This concern was manufacturing the Schuster free running green malt turner. Complete detail and assembly drawings were produced and examined, and arrangements made for copies to be evacuated through the normal channels.

The Company did not intend to resume the manufacture of this type of turner in its present form. Should they recommence the manufacture of a malt turner, the design would be very considerably modified.

The premises were adjacent to the railway station and for all practical purposes had been complete destroyed by aerial attack. Reconstruction of the premises was now in progress.

Description of the Schuster Green Malt Turner.

This machine was a mechanical malt turner which had worked with great success in at least five large Continental Maltings and in three famous Breweries. It was driven by electric power, lifting the green malt lying in front of the machine and throwing it out behind. In so doing it mixed and lifted the green malt, dispersing the accumulated $C0_2$ at the same time. It may be used for turning the barley in the couch or for young or old pieces of green malt with equal success. It contained a small fan providing additional air, but the aeration obtained by lifting the malt was usually quite sufficient, and in most cases it was not necessary to use the fan.

The machine was said to cause no damage to the grain and that it could be driven by any reasonably skilled labourer. It turned 1200 to 1500 sq. yds, an hour and required 2 h.p.

The electric current was introduced either by a trolley (similar to trolley buses) or by cables fixed on curtain rings and running on a permanent wire up and down the length of the malt floor.

The turner has one serious disadvantage if applied to United Kingdom floor maltings and that is on account of its inability to throw the grain forward. It can only turn the malt in the same piece of ground. It would therefore be necessary either to re-design the turner for use in the United Kingdom, or to change the existing system by conveying the different floors of green malt to the kiln by mechanical means.

The saving of labour which this turner can secure is said to be very considerable. A particular malting with an output of 35,000 quarters per year had only two men turning on the floors during the daytime, and one man during the night for the entire malting which was stated to be world famous for the quality of its malt.

MALTING PLANT - M.I.A.G. BRUMSWICK.

Target: Muehlen-industrie A.G. "MIAG".
Location: Braunschweig.
Type: Milling and Screening Plant Manufacturers.
Date: 17th July, 1946.
Persons Interviewed: Herr Schmidt - Head of Mill Section,
Herr Heisse - Assistant.Engineer,
Herr Cabes - Head of Silo Section.

This Company is at present engaged on drawing up a new design for an improved six roller Seck Mill. This, it was understood, would be completed within three months of our visit, and plans were promised. At the time of submitting this report no further information has been received.

We inspected plans of aerated silos and pneumatic plants for handling barley, green malt and malt. These plans will be available at the address given on page 119 of this report.

Part III of this report will appear in a later issue of the journal.