

North of England Section.

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(1909.)

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Ardwick Cooperage,
Manchester.

MEETING HELD AT THE MIDLAND HOTEL, MANCHESTER,
ON FRIDAY, FEBRUARY 12TH, 1909.

Mr. ALBERT E. TAYLOR in the Chair.

The following paper was read and discussed :—

Lager Beers.

By JAMES GRANT, F.I.C., F.C.S. (Head of the Manchester
School of Brewing).

THE word "Lager," derived directly from the German, was the name originally given to the Bavarian beers. It is now applied to most of the beers brewed by the decoction system which have been stored in the cold or lager cellars. The beer was formerly brewed in the late autumn or early winter and stored till the following spring and summer.

Examination shows that the best lager beers contain a low proportion of hops, but at the same time possess a high extract and alcohol content. In composition they are very complex, containing water approximately 90 per cent., alcohol, carbon dioxide, reducing

sugars, dextrins, glycerin, tannins, resinous bodies, nitrogenous matters—chiefly peptones and amides, potash, soda, magnesia and lime salts—mainly as phosphates, sulphates, and chlorides, silica, traces of fats, acetic or volatile acidity and lactic or fixed acidity.

In addition to the ordinary lager beers there are a considerable number of other beers which may be described as popular beverages, not only on the Continent of Europe, but also in the United States of America, Canada, and other parts of the world, especially where the German has settled and carried with him his liking for the beers of his Fatherland.

The chief of these are :—

Schenk or Winter Beer.

A quickly fermented beer decocted in winter for immediate consumption. It usually comes into condition in from three to seven weeks, and like our own mild and running beers is not extremely stable. These beers are brewed at a gravity of 10·5° to 12·0° Balling (or 15·21 to 17·45 lb. Long, or specific gravity of 1042·5 to 1048·8). The present gravity is about 1010 to 1012. The alcohol content is about 3·0 to 3·5 per cent. by weight; the extract about 5·2 to 5·7 per cent.; and the acidity calculated as lactic acid, 0·142 to 0·162 per cent. In Bohemia the Schenk beers are often spoken of as Abzug beers.

Bock Beers.

These some twenty or more years ago occupied an intermediate position between the ordinary lagers and the Schenk or Winter beers, being brewed for spring use only and extra strong, hence the names Doppelt or Märzen. At the present time, a number of varieties of Bocks or strong beers are specially brewed for the export trade at gravities of from 14·5° to 18·0° B. (or 21·33 to 26·78 lb. L., or 1059·3 to 1074·5 specific gravity). Their present gravity is often over 1020. Alcohol content between 4·53 and 6·30 per cent. by weight. Extract between 6·89 and 7·80 per cent. Acidity as lactic acid, 0·152 and 0·180 per cent.

In Berlin, the Bocks other than the export ones are known as Abzug beers.

The White Beers or Weizen Biere.

These are very pale-coloured beers, moderately clear, decidedly acid in flavour, and very rich in carbon dioxide gas, which causes them to foam strongly when poured.

They vary enormously in the raw materials used for their production, and in composition according to the particular locality in which brewed. Thus the most famous or Berlin Weiss beer is prepared from two parts of wheat and one part of barley malt to form the grist, water containing gypsum and chlorides, and hops at the rate of three-quarters of a pound per hundred pounds weight of grist.

The original gravity varies from 10·0° to 12·0° B. (or 14·48 to 17·45 lb. L., or 1040·4 to 1048·8 specific gravity).

The present gravity varies from 1009 to 1014·8. Alcohol content varies from 0·94 to 3·55 per cent. by weight (with an average of 2·75 per cent.). Extract varies from 3·35 to 7·28 per cent. (with an average of 4·80 per cent.). Acidity as lactic acid, from 0·149 to 0·578 per cent. (with an average of 0·392 per cent.). Carbon dioxide from 0·251 to 0·320 per cent. Ordinary lager averages about 0·21 per cent. of CO₂.

The Hamburg, Hanover, Munich, and Viennas closely follow the Berlin figures.

American white beers are brewed from a grist composed of pale ale malt, wheat sometimes, and grits up to 30 per cent. The wheat malts contain more nitrogenous matters and thus increase the foam.

In addition to the Schenks, Bocks, Abzugs, and white beers, are a number of very interesting special beers brewed in various parts of the civilised world, which might well form the subject of another paper.

Amongst them are: The Broyhan of Hanover; Kotbusser and Goslazer Gose of Mid-Germany; Mumme, a thick, sugary, dark beer of Brunswick, which contains about 2 per cent. of alcohol and an extract of 45 per cent.; Döllnitz and burnt Gose, both Central Germany beers of a pale greenish-yellow colour, decocted from barley malt and crushed wheat and maize; Kulmbach beer, a very dark Bavarian type of lager brewed of a very strong wort; the Graetzer beers (which by the way are so far the only Infusion beers mentioned), brewed from one part of barley malt and two parts of smoked malted wheat. These beers are famous for their delicate sour wine-like flavour. In colour they are pale straw.

The Belgian spontaneous fermentation beers are also of interest. The three chief are:—Mars of low gravity, Faro of medium gravity, and Lambik of high gravity. They are brewed from equal parts of barley malt and raw crushed wheat. The beers are very dextrinous and take from two to five years to come into proper condition. They are strongly acid, viz., from 0·87 to 1·16 per cent. as lactic. The alcoholic content varies from 3·5 to 7·00 per cent. by weight.

Our attention must now be directed to the principal subject of this evening's paper: Lager Beers ("Lager Biere"). Of these there are four recognised types:—Bohemian, Vienna, Bavarian, and American. As a general rule, three varieties of each are brewed: Light, Ordinary or Summer Lager, and Export. The exports are all brewed considerably stronger and contain more alcohol. All the types vary a good deal in colour, flavour, palate-fulness, amount of hops, acidity and alcohol. For example:—

1. Bavarian and Munich beers possess a light to dark-brown shade of colour, are lightly hopped, and are characterised by their palate-fulness, sweet taste and malt flavour. Their gravities vary from 12·5° to 15·0° B. in the Light, and from 15·0° to 18·0° B. in the Export beers.

2. The Bohemian are light-yellow, as in the case of the Pilsener, to a peculiar greenish-yellow colour. They taste somewhat sharp, dry and wine-like, but with a prevailing bitter of hops as opposed to the lightly-hopped Bavarians. Their gravities vary from 10·5° to 11·5° B. for the Light, and from 11·0° to 12·8° B. for the Heavy.

3. The Vienna Lagers come somewhere midway between the Bavarian and Bohemian, especially as regards colour, hops, and taste. The gravities vary from 10·5° to 13·5° B. in the Light, and from 13·5° to 15·5° B. for the Heavy and Export beers. The larger amount of the common beer of Vienna is brewed at a gravity of 13·5° B.

4. The American Lagers generally follow the German rather than the Austrian types, yet differ considerably in the many American cities.

Raw Materials.

The raw materials employed consist of malts, chiefly barley, more seldom maize, rice, wheats, especially for Weiss beers, and rye, in addition to sugars and hops. Hops are used in much smaller quantities

than in this country, rarely exceeding 3 to 10 lbs. per quarter of the grist.

In America, both flakes and grits are largely used for bottling beers on account of the lighter colour, greater brilliancy and stability, and lighter body than all-malt lagers. For the dark beers, caramel malt, black malt, roasted malt, roasted maize and ordinary sugar caramel are necessary, besides the pale ale malts. In addition, glucose for Kräusening purposes is employed.

Malts.—The malts for decoction brewing differ widely from the fine malts used in English breweries. The types of malts are closely followed by the types of beers; thus there are Bavarian, Bohemian, and Vienna malts in the production of which the processes differ considerably. In some cases a "cold sweat" is used which produces a malt giving a larger extract, though one not so stable—as it contains more of the complex albuminoids. In other cases a "hot sweat" is preferred and this gives rather less extract, but of a more stable character. Then for Pilsener beers—one of the Bohemian group—special precautions are needed.

Methods of Brewing.

All lager beers are brewed by one of the several modifications of the decoction system. The more common method is by the "three mash" or "thick mash" (*Dicke-maische*); the one to be described hereafter.

The "Two-mash" Systems.

In the "two-mash" systems less time is required, it seldom exceeding three and a-half to four hours, but less extract is obtained, and that of a poorer quality than from the usual process. With certain of these systems the liquor used is of such a temperature as to give the first initial heat of about 90° to 95° F., or 97° to 104° F., or 122° to 129° F., whereas, in the ordinary "three-mash" cold liquor is invariably employed. From the above it may be seen that what is gained by shortening the time is lost in quality and quantity of extract obtained.

The "Three-mash" System.

According to Thausing, Prior, and others, the three-mash system is conducted somewhat on the following lines:—

The crushed grist is mixed with cold water by an outside masher,

either automatic or power-driven, the quantity of water being from two and a-half to two and three-quarters per quarter of grist. Then boiling water is pumped from the "Kessel," or mash-copper, into the cold mash with the rakes going until a temperature of between 89° to 95° F. is reached.

This is known as the "First temp.," and it is very suitable for the formation of peptones and similar nitrogenous yeast foods. Then between 30 and 40 per cent. of the "thick mash" is run down into the "Kessel" and gradually brought to the boiling point.

If necessary, the goods may be stewed at temperatures of between 145—169° F., to ensure conversion. The chain rakes of the "Kessel" are kept going the whole time to prevent the burning of the mash. When near the boiling point, about 190° to 200° F., the grains rise to the surface, so that there is little further danger.

First Mash.—The first mash is then boiled for periods varying between 15 and 45 minutes. The longer the boil the darker the finished beers and also the better flavour and stability. The mash, in which all the diastase and other enzymes are destroyed, is pumped back into the mash-tun with rakes going, so as to raise the mash to temperatures of about 122° to 129° F.

Second Mash.—Another 30 to 40 per cent. is run down into the Kessel, forming the second mash, which is brought to the boil and the temperature maintained for from 15 to 30 minutes. Where raw grain is used, the previously prepared gelatinised material is mixed with the second mash. The whole is pumped back into the mash-tun, raising the contents to temperatures suitable for diastatic action, viz., about 144—149° F. The pumping should be very carefully regulated, taking approximately 15 to 18 minutes on each occasion.

Third Mash.—So far the mashes have been thick ones, and frequently the third is also thick, but some lager brewers prefer to boil a "lautermaisch," a thin mash which is wort without the grains. This mash is brought to the boil rapidly and kept boiling for 10 or 15 minutes. The quantity run down should be carefully calculated, so that when pumped back into the tun it should raise the contents to as near as possible 167° F. This last operation is known as "the final mashing."

Clarification.—The whole of the goods are then pumped over into the clarifying tun or strainer (Läuterbottich). Rakes are employed in this to properly and evenly settle the grains. After a short "stand on,"

lasting 15 to 45 minutes, the wort is run off into the copper, or "Brau-Kessel," and the grains sparged as in the English system. The time required by this system is about five hours. The total quantity of liquor used is about twice that of the required beer. Of this, from a-half to two-thirds is for mashing and the remainder for sparging.

The objects in mashing are very similar to those at home, but the lager beer brewer obtains from far inferior malts very nearly 5 per cent. more extract, in addition to nitrogenous compounds possessing greater foamy-head keeping properties.

Boiling.—Boiling is carried out either by open fire or steam coppers. Worts are boiled until a good break is obtained, then a portion of the hops is added, and at the end of another hour the remainder; but there are many variations as to time and quantity, as with ourselves. Boiling takes from $1\frac{3}{4}$ to $2\frac{1}{2}$ hours.

Cooling.—Filtering and cooling operations require little explanation. In suitable districts open-air coolers placed on the top of the brewery are common enough. Frequently also, in the midst of populous areas, enclosed refrigerators supplied with pure cold air are used in cooling the worts.

Fermentation.

All lager worts are fermented at low temperatures by the so-called bottom yeasts.

For light-coloured worts the pitching temperatures are lower than for dark worts. These vary between 40° and 46° F., while the fermentation often takes from nine to fifteen days.

The quantity of yeast employed also varies with—

- (a) The gravity of the worts;
- (b) The pitching temperature; and
- (c) The size of the vessel.

From about half a kilogram to two-thirds, *i.e.*, about a pound to a pound and a-half is used.

The actual pitching temperatures, however, vary with the locality; thus in Bohemia they are lower and in Bavaria they are higher.

The Gähr or fermentation cellars are kept about 38 — 45° F. When primary fermentation is over the beers are run into the Lager Fässer or store casks, holding from 10 to 70 barrels, at temperatures varying from about 36° to 45° F.

All the new beers contain a quantity of fermentable extract, so that "conditioning" can readily proceed in the Fässer.

The temperature of the lager cellars is anything between 32° and 41° F.

The treatment here depends not only on the type of beer but also on its strength. Some are stored only for a few weeks, others for several months, and some few for over a year. Again, some are "Kräusened," others not. For example, many Bohemian and Vienna beers are not so treated, but shived up soon after the foam of the secondary fermentation disappears. This, however, does not apply to all.

Bavarian beers, which are usually sent out very full-drinking and of a sweetish taste, are not stored so long as similar gravity beers of other districts.

The Lager Fässer are generally filled from several different gyles so as to ensure uniformity. Clarification in the Fässer is assisted by the aid of beechwood chips.

"*Kräusen*."—This is always taken from normally fermenting beers, and it is never used when beers are to be carbonated. Too much has a tendency to render the beers turbid. The quantities used are from one and a-half pints to one and a-half gallons per barrel (36 gallons). The average is 6—10 pints per barrel, but the proper amounts must be regulated by the condition of the beer, the yeast, and the season. *Kräusening*—

- (a) Revives the active fermentation in beers ;
- (b) Makes the beers foam more strongly ;
- (c) Develops much carbon dioxide and a sharp taste ;
- (d) Brings the beers more quickly into condition ;
- (e) Renders the beers less liable to be affected by heat and cold.

When perfectly bright and in good condition the beers are racked off by means of a special filtering and racking machine into the trade casks, viz., hektolitre, half hektolitre, and quarter hektolitre sizes, or twenty-two, eleven, and five and a-half gallons respectively ; or they are directly bottled, most of the work being carried out either in the lager or the Vor Keller.

The beers are despatched from the breweries during the hot season in the cool of the evening or the early morning.

Nothing has been mentioned in this paper about the machinery for a lager plant. This must not be looked upon as an oversight, but as everything is much more complex than in infusion breweries it would have unduly lengthened a long, intricate paper.

The chief hydrometer or saccharometer used in lager brewing is one of the forms of Balling.

I. Ordinary Balling shows the number of parts of cane sugar or malt extract contained in a hundred parts by weight of a solution at a temperature of 17.5° C. or 63.5° F. or 14° R.

Malt extract and cane sugar for this instrument are considered approximately equal.

The actual relation is—

$$\begin{array}{lcl} \text{Malt extract} & : & \text{Cane sugar} = \\ 2.681 & : & 2.597 \end{array}$$

To convert Balling degrees into pounds Long or Brewers' lbs.—

Let B = Balling degrees and S = Brewers' lbs.

$$\text{Then } B = \frac{260 \times S}{360 + S} \quad \text{and} \quad S = \frac{360 \times B}{260 - B}$$

The Excise Standard 1055 or 19.8 Brewers' lbs. = 13.556° B.

II. Brix or corrected Balling or Balling-Brix is a saccharometer which was designed by Brix to overcome the error caused by the contraction of cane sugar when dissolved in water.

III. The Kaiser-Balling is of the same form as the Balling, but is graduated in halves, quarters, etc., per cent. instead of in tenths.

The composition of lager beers generally and also those met with in the Manchester area.

Average composition only—

	Water.	CO ₂ .	Alcohol by weight.	Extract.	Acidity as lactic.	Ash.
Ordinary lager...	90.000	0.196	3.890	5.794	0.151	0.305
Carlsberg " ...	90.000	0.193	4.270	5.286	0.140	0.309
Export " ...	80.000	0.209	4.410	6.292	0.161	0.321

Analyses of some of the Lagers found in Manchester.

Data.	Bottled.			Draught beers.			Bottled.			Bottled.		Allsopp's Pale Ale (English) (1901).
	Allsopp's (Light).			Cosmos (Light).			Spaten (Dark).			Möller's.		
	(1)	(2)	(3)	(3)	(4)	(5)	Tennent's (Glasgow).	Jeffrey's (Edin- boro').	Red label (Light).	Green label (Dark).	(7)	
Original gravity	1044·00	1050·00	1052·00	1053·00	1044·00	1046·00	1052·00	1046·00	1052·00	1042·00	1052·00	1082·00
Present gravity	1012·30	1016·90	1013·90	1020·70	1010·00	1011·80	1011·30	1011·80	1011·30	1015·60	1015·60	1009·00
Alcohol by weight	3·53	3·87	4·17	3·55	3·72	3·75	4·39	3·75	4·39	2·91	2·91	5·44
Alcohol by volume	4·41	4·86	5·24	4·46	4·67	4·70	5·50	4·70	5·50	3·69	3·69	6·76
Proof spirit by volume	7·74	8·47	9·14	7·79	8·16	8·23	9·62	8·23	9·62	6·39	6·39	11·88
Extract, total solids	4·41	5·96	5·07	7·31	4·19	4·45	5·14	4·45	5·14	5·45	5·45	4·71
Specific rotatory power	110·30	100·90	122·90	112·20	117·80	125·1	115·70	125·1	115·70	131·50	131·50	0·31
Ash in 100 c.c.	0·270	0·278	0·21	0·20	0·203	0·180	0·178	0·180	0·178	0·153	0·153	0·31
Ash as percentage of total solids	6·11	4·67	4·14	2·71	4·84	4·04	3·50	4·04	3·50	2·81	2·81	
Copper reducing as maltose (grams per 100 c.c.)	1·06	1·17	1·375	2·072	1·018	1·252	1·216	1·252	1·216	1·417	1·417	
Acidity (per cent.) calculated as acetic acid (volatile)	0·057	0·059	0·062	0·066	0·084	0·060	0·066	0·060	0·066	0·038	0·038	
Acidity (per cent.) calculated as lactic acid (fixed)	0·085	0·088	0·093	0·099	0·126	0·090	0·090	0·090	0·090	0·057	0·057	

The average ash of a German lager containing 0.306 per cent., according to Dr. König, consists of:—

K ₂ O.	Na ₂ O.	MgO.	CaO.	Fe ₂ O ₃ .	P ₂ O ₅ .	SO ₃ .	SiO ₂ .	Cl.
33.79	8.95	6.34	2.78	0.48	31.47	3.52	9.39	2.96 = 99.68

In conclusion, I wish to acknowledge my indebtedness to my colleague, Mr. F. G. Richards, for having undertaken the whole of the analytical work recorded on pp. 384 and 385. Without his assistance the very useful analyses could not have been submitted to you.

DISCUSSION.

Mr. C. F. HYDE said that, according to Mr. Grant, the average acidity in the foreign lagers was 0.3 per cent., and some of them contained 0.5 per cent. He should like to know how the acidity was determined—what was the indicator and method employed. He also observed that the extracts were stated to be 5 per cent. more than English extracts. He had always had the impression that in lager beers on the decoction system the extracts were considerably lower than English. This view was strengthened by the fact that most of the German and American malts contained a fair percentage of moisture—up to 5 or 7 per cent. They did not seem to pay much attention to moisture in the malt so long as it was good, and on the decoction system of mashing they did not consider the moisture of any importance whatever. If these malts contained on the average 3 per cent. more moisture than English malts, one would have thought this would have brought the extract down three or four pounds per quarter.

Mr. GRANT repeated the comparative figures, and proceeded to point out that, with the single exception of the white beers, there was in the figures nothing unusual. Those who had been in Berlin would probably have noticed that some of the white beers had a rather acid taste. In Berlin he had drunk beers some of which were of normal acidity, and others excessively so. If they compared white beers in the South of Germany with the North German beers they would find that the former had a strongly acid flavour. In the experiments he had made the substance used for determining the acidity was a standard alkali—caustic soda. Ammonia was not used, as it could not be relied upon to maintain its strength at laboratory temperatures. As to decoction mashing, it was generally recognised that with this

system, by gelatinising the starch more completely than on the English system, they got an extract very nearly approaching an average of 5 per cent. over an extract, say, in even a high-grade English malt. With regard to moisture, he knew that within the last few years the Germans, the Danes, and the Dutch—he did not know much about the Belgians and the French—had taken a great deal more care about the moisture, as they had found—as brewers in England so well knew—that if the malts were allowed to become excessively moist or slack, the quality of the decocted beer was affected.

The CHAIRMAN enquired if the author would explain more fully what was meant by the cold and hot sweat “system” in the preparation of malt.

Mr. GRANT replied that it was a term given to one portion of the malting process on the flooring system. Although we had the pneumatic system from the Continent, it was recognised that pneumatic malts were not in any way equal to the ordinary floor malts, and therefore a very large proportion of the malt used was prepared on the old flooring system. After the steeping (the preliminaries were much the same as in England) the malts were not allowed to “couch” in the ordinary sense that we couched them; but they were put out rather thickly, and at this stage they began to sweat. In the case of cold sweating, the temperature did not exceed 70° or 72° F., but in the case of a hot sweat, the temperature went up to over 80° F. This, however, was only at one stage, and it did not last very long. The barleyes were then spread out and grown pretty much in the normal way.

The CHAIRMAN enquired how long flakes and grits had been allowed to be used in the production of lager beer? He was under the impression that every substitute was prohibited, and that the wort of lager beer could only be produced from malt.

Mr. GRANT replied that he could not say how long, but it was well understood that in Bavaria—and especially in Munich—no substitutes of any kind were allowed. But in a proportion of white beers, in various parts of Germany, apart from Bavaria, both grits and flakes were used.

Mr. G. JONES asked if the author had experimented with bottled or draught lager beers. In one case Mr. Grant spoke of a racking gravity of 20° out of an original gravity of about 45°. He would like to know

what would be the effect of putting such a beer into bottle. Did they rely on the pasteurisation to minimise possible trouble, English bottlers would be chary of bottling such a beer.

Mr. GRANT said that most of the beers examined were bottled beers, but in no case had he got the original gravity down below 1042, and in no instance was there any deposit worth mentioning. They were all singularly free and quite bright; there was nothing that would cause turbidity in the beers.

Mr. H. MARRIOTT said that he understood that in the Berlin white beer there were two parts of wheat and one of barley. Was the wheat used as a raw grain, or was it prepared in any way? Also, he would like to know what extract would be obtained from the wheat, and what would be the result in the finished beers?

Mr. GRANT replied that white beers were prepared, as he had pointed out, from a mixed grist. The Berlin brewers depended on the wheat for foaming properties. The wheat was used in two forms: (1) crushed, and (2) in the malt form and crushed afterwards. Wheat contained anything from about 11 to 15 or 16 per cent. of nitrogenous bodies, of which, perhaps, 2 or 3 per cent. were soluble and the rest might be taken as glutinous. The great value of wheat lay in the peculiar foamy head it gave, and which was such a characteristic of Berlin white beers.

In reply to some remarks made by Dr. A. K. MILLER,

Mr. GRANT said that he would not like to say there were no other acids than lactic and acetic present on account of the introduction of the wheat, although they knew that lactic was the fixed acid of all cereals. But as other substances were introduced through the use of wheat, there was a likelihood of some nitrogenous acids being present also.

Mr. A. H. MORRIS thought that a malt containing 5—7 per cent. of moisture would be difficult to grind. The operation would be more like squeezing than crushing it. Could Mr. Grant say what method was used in Germany to get the malt properly disintegrated? Also, could he say how the growth of the malt compared with English methods, and at what temperature they were dried off? Lastly, he did not know if duty were paid on beer in Germany; but, if so, it would be interesting to know how it compared with the duty in England.

The CHAIRMAN said that in Germany the duty was paid on the malt only, not on the beer, and equalled 3s. 3d. per English barrel.

Mr. GRANT, in reply, said that he had only inspected a few malt floors in Germany, and he had found over there as much variation in the methods of growth as there was in this country. As to crushing, the malt mills were constructed pretty much on the patterns known over here. In some of the mills there were two rolls, and in others four rolls. There were also mills known as the Dresden type, and these were getting rather more common than they were a few years ago. The question of kiln temperature was an important one; but, speaking generally, the temperatures had to be regulated according to the type of malt required. For example, in the case of Pilsener, the temperatures ran up to 175° or 178° F. In other cases, especially where the aim was to produce a full-drinking beer, the temperatures might run, as in the case of Bavarians, to 185° with some malts; others went up to 190° and in a few instances 200°. The duration of the kilning process also varied, but four hours were frequently allowed in the case of Bavarians. But on this point, again, there was as much variation in kilning and curing temperatures in Germany as in this country.

The CHAIRMAN inquired what was meant by "smoked malt." Was it black or amber malt?

Mr. GRANT explained that this was a malt through which the smoke or fumes of wood had passed.

The CHAIRMAN said that they all welcomed Mr. Grant's paper as a contribution to the subject of lager beer production. The idea had, perhaps, occurred to some whether lager beer was likely to become popular and meet with a large sale in this country. He agreed with Mr. Hyde, though he admitted there would always be a small demand for it here, but it would never become a serious rival and competitor of the national beverage. The troublesome and costly system of filtration he considered an objection in the production of lager beer: the beer was depreciated by the process and he felt sure that an improvement in the method of filtration was urgently required. He supposed the use of the filter press was an absolute necessity, but he would like to know if any experiments had been made with the view of doing away with the filter press and throwing down the sediment by the storage of lager beer under pressure. For example, in the manufacture of mineral waters, the carbonic acid gas pressure very quickly threw down any sediment; it would not necessarily mean using such high

pressure for lager beer : a pressure of 30 lb. would be ample, and suitable arrangements could be made to draw off the clear liquor. The production of lager beer as we know it was very expensive : a prominent brewery firm in this country had informed him that they had incurred a capital outlay of over a million pounds in laying down the plant and advertising their brand of lager beer. He, therefore, drew attention to the fact that he had visited small lager beer breweries in Germany similar to the home brewery or public house brewery in this country, where they produced successfully a very good quality of lager without this great outlay, and should they be mistaken and lager beer became a popular beverage here and a rival to their own, he was satisfied that small brewers could and would produce a good quality of lager beer.

Mr. A. H. MORRIS moved a vote of thanks to Mr. Grant for his paper.

Mr. H. MARRIOTT seconded, and the motion, having been heartily carried, was acknowledged by Mr. Grant, and the proceedings then terminated.