

# The State of the Flavor Industry More Than 50 Years Ago

By G. N. Revie, Fries & Fries, division of Mallinckrodt (UK) Ltd.

*Bill Littlejohn, my old arch rival, G. R. A. Short and I were contemporaries although I did not know Bill Littlejohn until about 1954 when he was firmly established as the editor of the Perfumery and Essential Oil Record, after that the three of us grew up together. At that time he was slightly biased towards perfumery but over the years this changed. There was always a mystique about perfumes whereas flavourists were known as Flavour Chemists—the inference being that flavours were not an entity in their own right. There was some justification for this because in my early days there were no such things as Flavours and, in fact, they were like Topsy and just grew.*

Mr. G. N. Revie, Technical Director of Fries & Fries, division of Mallinckrodt (UK) Ltd., was the lecturer at the British Society of Flavourists Bill Littlejohn Memorial Medallion Lecture in November 1980 in England.

In 1928 an advertisement appeared in the *London Daily Telegraph* asking for a young chemist able to produce laboratory size batches of confectionery. Having at that time spent five years in the analytical and development labs. of J. S. Fry & Sons, the world renowned chocolate manufacturers, and having by that time acquired a good overall appreciation of many aspects of the chocolate and confectionery world, and full of enthusiasm, I replied to the advertisement which was a box number. The reply came back from A. Boake Robert & Co. Ltd. Manufacturing Chemists of Stratford, in the East End of London. My only knowledge of these people had been in seeing syphons of liquid sulphur dioxide on University shelves. Boake Roberts, I found later, was closely associated with the brewing industry, and that accounted for the sulphur dioxide which was used as the preservative for beer.

The story of A. Boake Roberts is of some interest. A. Boake went from Ireland to London to prepare

sulphur dioxide which he had found was a preservative for beer. From what was said when I joined the company, this started as a 'stick and bucket' process. The business flourished and Boake sent back to Ireland with a request to his old friend Roberts, who was a pharmacist, to come and help. The entree to the brewery trade with SO<sub>2</sub> compounds (potassium meta bisulphite was, in fact, the end product), suggested the possibility of making burnt sugar colouring for beers. The drifting of the brewery industry into the soft drink trade in turn created a demand for satisfactory flavours for, particularly, lemonade.

I was interviewed at Boake Roberts by F. G. Pentecost. A. Boake Roberts had a worldwide reputation for soft drink flavours and won many international gold medals for their Trufruit Lemon Extract, but they had very little success with flavours for the confectionery industry. There was one exception, Boake Roberts produced amyl acetate. The most popular hard-boiled sweets in the early 1900s were pear drops, in which the flavour was amyl acetate. A special grade was made named amyl acetate C.G.S. (Confectionery Grade Special) and this ability to make amyl acetate had far reaching repercussions. The wings of the First World War aeroplanes were covered in fabric which was, in turn, coated with 'dope.' This was cellulose acetate dissolved in amyl acetate and this being one of the few companies which had experience of the manufacture of amyl acetate, Boake Roberts became the main supplier to the government and has grown to be one of the leading fine chemical manufacturers.

The honours for confectionery flavours went to W. J. Bush who had acquired from the pharmaceutical industry, G. R. A. Short, a year before I joined Boake Roberts. F. G. Pentecost, in his wisdom, had decided that it was necessary to understand the confectionery trade if flavours were to be sold, and it was my first job to test all the existing flavours in hard boiled sweets and fondant to find what was going wrong. We all know now that a good lemonade flavour is not a good confectionery flavour, but at that time it was quite a surprise. Having established that the existing range of flavours were no good, it became necessary to compound flavours which were satisfactory.

After starting at Boake Roberts I had to sign a contract which would be a joke today. The provisions laid

down were so extreme that very little of it would be binding in law today. This Contract is an historical document and gives a very good insight into the so-called 'good old days'. To quote from the first couple of paragraphs:

"Agreement made this sixteenth day of November 1928 between A. Boake Roberts & Company Limited of Stratford in the County of Essex by Edmund Johnson Boake and Frederick Maurice Roberts, two Directors thereof, the said A. Boake Roberts & Company Limited being hereinafter called the Company, which expression includes its successors and Assignees in its business of manufacturing chemist on the one part and G. Neil Revie, Analytical Chemist, hereafter called the Employee of the other part. Whereby the Company agrees to engage the employee and the employee agrees to serve the Company as Analytical and Research Chemist or in such other capacity as from time to time is mutually agreed on the following terms and conditions. The employee's salary shall be at the rate of £175 per annum payable by monthly instalments, increased by a further £25 per annum at the expiration of the first six months, if in the opinion of the Directors his services are satisfactory. Further increases to be made from time to time at the discretion of the Directors. . . ."

This is the beginning of a three page document.

The protective clothing in the plant was interesting. It consisted of a clean sugar bag tied on with string, wooden clogs and an iron holder cap. We lab. people wore white coats which we paid for and which we laundered at home.

In those days there were certainly not more than 50 fine chemicals which were known to be satisfactory for flavours, but there was a wide range of natural resins and extracts and this was where the expertise of G.R.A. Short from Bush, put Bush in a very strong position.

We very soon produced a successful raspberry flavour with amyl acetate, ionone orris extract and otto of rose—I cannot tell you the quantities because I know the same flavour was certainly being sold in 1962 and maybe still is.

You will appreciate the problem of making flavours with less than 50 fine chemicals available, when you realise that today's GRAS List names about 1500. There were of course no regulations to worry about with flavour ingredients. Coumarin was very widely used and we quite happily included chloroform in a raspberry flavour. I have also heard that nitro benzene was used in an almond flavour in the U.S. and we made and sold large quantities of emulsions using Teepol as the emulsifying agent.

With colours we had quite a thing going. A textile colour manufacturer supplied samples of colours and if the arsenic and lead contents were below 5 parts per million, they were mixed with salt and sold as food colours. Many of the colours, particularly Rhodamine

B, are no longer permitted and certainly never should have been. Requests for new flavours went on but we were, in those days, always behind Bush and Polak & Schwartz except for soft drink flavours. The whole aspect of the flavour industry was changing from the early thirties. Apart from the ingredients which were used, the techniques were changing. Ethanol was already becoming an expensive solvent and diacetyl was introduced, isopropyl alcohol was starting to be used but the quality was so poor it was not until special grades were made that it became a viable solvent. Emulsions too were starting to arrive and what to me has been, in retrospect, a landmark, was the birth in 1930 of spray-dried flavours.

There had been many attempts to produce stable flavours in powdered form, but they were all gimmicky and did not succeed. There were two I remember which had merit—one by Oehm and Bayer in Germany, which entailed adsorbing essential oils on light magnesium carbonate, and the other, which I feel should have survived, by General Foods in the U.S.A., which entailed making an over-flavoured jelly slab and drying it completely and then pulverising the brittle slab.

Strangely, spray-dried flavours when they did arrive, were not as a result of search for powdered flavours. It happened that we had a spray-dryer which, although very primitive by today's standards, was being used successfully to dry burnt sugar caramel, and as it was June and raspberries were being processed, we decided to see if we could spray-dry raspberry juice. The juice alone did not dry, but mixing it with liquid glucose made it a very good spray-dried product. It was interesting enough to carry on with the experiments.

We made it a practice to add 10% ethanol to the juice to preserve it. This became an expensive method because as far as we knew, we were drying off all the high duty alcohol. We replaced the ethyl alcohol with isopropyl alcohol which, as I have said before, was much lower quality than the present day material. The juice/glucose mixture dried well, but was completely spoilt by the strong flavour of the isopropyl alcohol. We realised we had found what we considered a complete contradiction. Why had we dried off water but left behind isopropyl alcohol which had a much lower boiling point and was completely miscible with water? We stopped worrying about spray-drying fruit juice and tried drying mixtures with amyl acetate and all the esters we could find, and then all the essential oils. It seemed that by spray-drying we could retain almost anything except water.

Having established that almost any fine chemical or essential oil could be retained during spray-drying, it was a short journey to spray-drying complete compounded flavours. It soon became apparent that there were advantages in this approach to flavours. There had been no method of making liquid flavour containing for example equal parts of essential oil and fruit juice. No solvent system would give an homogeneous mixture, but with spray-drying nonmiscible products can be readily incorporated in the same mixture. We

did, however, hit one major problem. All our work had been based on the use of liquid glucose as the carrier and it soon became apparent that this was far too hygroscopic to make a commercial product. My colleague, Fred Wilkinson, quite suddenly came up with the suggestion that we should use gum arabic. What inspired it we were never able to decide but it was used, and still is, and it remains the most perfect carrier for spray-dried flavours of all kinds. Clean gum arabic was not known in those days and we had to work with what was known as rough sorts. These were large lumps which had to be dissolved in boiling water and screened through sackcloth to remove wood, pebbles, etc. and then clarified through a sharples centrifuge to remove the sand. For over 20 years nothing but gum was used for spray-drying flavours. As a matter of interest, the first order for spray-dried flavour was for 14 lbs of Drydex, Blackcurrent Flavour from Alfred Birds which later became a part of General Foods.

In 1932 after having small orders here and there, we received an order for several tonnes of lemon and orange flavour for one season's requirement. This, of course, was beyond our capacity so we just had to build a dryer. There was no way you could go and buy a dryer, and remember, stainless steel was almost unknown. The dryer was, in effect, a large room about 24 feet by 12 by 12; the skeleton was made of 4 x 4

timbers to which were nailed, on the inside, half inch asbestos sheets and to this were nailed sheets of tin plate. We were able to get a large gas ring from the London Gas Company, and a second-hand Sturtevant fan, and a phosphur bronze Shaw Pump with an operational pressure of four thousand pounds to the square inch. The atomising jet was a monometal disc about the size of a five pence coin (or U.S.A. quarter), in which a one ten-thousandth of an inch hole was drilled. When five or six hundred pounds of flavour had been sprayed, the plant was shut down and the operator went into the drying chamber with a shovel and a broom and filled open topped 40 gallon drums with the product and then the plant was started up again.

The skill of the plant operator was in manipulating the hole in the jet with a darning needle to give the right throughput, and bear in mind that this was the foundation on which a huge industry of convenience foods—here and, more important, in the U.S.A.—was built because without spray-dried flavours, powdered soft drinks, Jello etc. would not have been possible. At the same time I must add that if we had not done it, I have no doubt that somebody else would have, and at that time nobody anticipated that a whole new industry was ahead. To illustrate this, we had the greatest difficulty in persuading the Board of Directors that a Journal advertisement—which was to cost

£25—was worthwhile.

By the way, going back to the large unexpected order which we received, the product made was a drink called Oxade. It was a cube about the size of a bath salt cube and made a very good drink. It has surprised me that nobody has resurrected this form of presentation because a vastly superior product could be made today with modern packing and packaging materials.

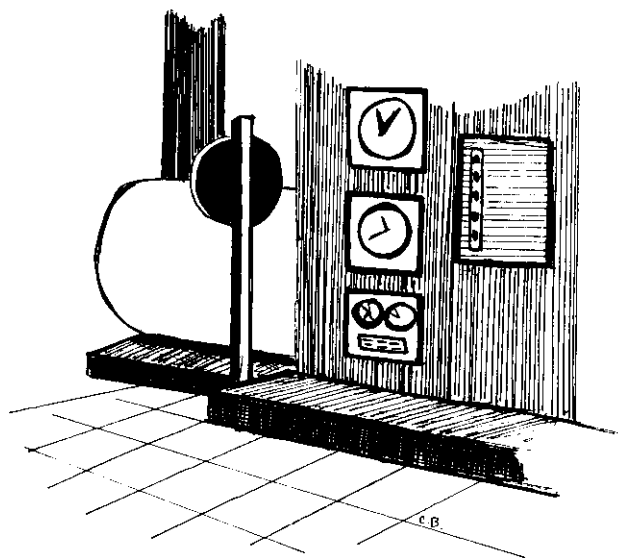
Before I finish with spray-dried flavours, I will add one small point, and ask one small question. Spray-dried flavours are fifty years old this year—born in July 1930—and still nobody has explained how it is possible to spray-dry a mixture of gum solution, water, soluble material like diacetyl, which has a boiling point considerably lower than that of water, yet, during the spray-drying, the water goes but the diacetyl is left behind. It may be that one must not think of spray-drying as an evaporation problem but rather as a solvent extraction process in which the solvent is hot air, or it may be that the initial impact of the hot air flashes off the diacetyl and forms an adsorbing matrix which readsorbs the diacetyl vapour in the air in the same way that activated carbon would do.

I have mentioned the high quality of soft drinks flavours which existed in the 1930s and you may be interested in the manufacturing processes involved. These flavours were based on ethanol as solvent which rules them out today on grounds of cost, because unlike almost all of our overseas competitors, all alcoholic essences are based on full duty paid alcohol. One wonders how much longer this practice will persist. In the U.S.A. ethanol is almost the cheapest solvent available for flavour work.

Essential oils used, lemon in particular, were selected with extreme care and only Sicilian lemon oil of the very highest quality was used. The other main ingredient was peel extract. Making this was an interesting operation. Lemons and oranges were purchased at the London auctions and delivered to Stratford. Here they were peeled by a team of Cockney ladies. This peeling was useful operation . . . for about 30 of them, which was almost a family gathering. One family of peelers in fact, consisted of four generations. They were all true Cockneys who did pea picking, hop picking, strawberry picking, and at the end of the year they came to us for fruit peeling. They came every year until the War, when they dispersed and, in any case, the fruit was no longer available. They sat round in a circle peeling a very thin layer of the peel. They were paid piece work—one shilling (5 p or 10 cents) per case of 300 oranges. The first year I was in control, I had a strike on my hands. A strike meeting was held under the Railway Arch in Carpenters Road, in a demand for 1/1d. per case, that is 5½p (or 11 cents). I put the case before the Directors and it was agreed after much discussion to pay. Some of the quicker workers were able to make £1.50 a week which perhaps was not too bad, when a plant worker was getting £2.50 a week which included Saturday mornings. It was a pathetic situation in the thirties and although there was no such thing as time and a

half for overtime on Saturdays, I once had a man literally with tears in his eyes asking for Saturday overtime.

The peel from the fruit was dried in a Sirocco Tea Dryer—that is a hot air dryer, until it was brittle but not discoloured. The peel could be stored for years without spoilage in tin-lined cases. The peel was ground to a coarse powder and macerated at the rate of ten pounds of peel to one gallon of alcohol for about six months. The extract was then pressed out on hydraulic presses working up to five thousand pounds per square inch. This extract with the very high grade lemon oil used was the basis for what was perhaps the best lemon essence ever made.



When the War came there were inevitably shortages—all our formulae had to be revised and we added the letters “W.T.F.”—War Time Formula—to all our standard lines. In many cases it was surprising how high a quality we were able to maintain. Very early it was realised that flavouring was a matter of national importance and personnel were given reserved occupation status. The importation of essential oils and other ingredients, was permitted. This was a necessity because at one point the only basic materials for the food manufacturer, were wheat flour, fat, and sugar. Wheat flour, fat, sugar and flavour was the basis of all baked goods, of course, but it was also the background of blancmanges, ice cream, custard and quite a variety of fancy goods.

In the thirties there was a general awakening in the flavour industry. New fine chemicals were being produced and their main function was to contribute to new creations. It was, in those days, unusual to attempt to match a competitor's product, and all the emphasis was on creating new flavours of outstanding merit. It was a major breakthrough when we fortified

lime flavour with terpineol. Diacetyl became a commercial product and revolutionised the butter flavour market. It was possible to make a flavour which really did simulate butter, far better than the reliance on butyric acid ever made possible. Allyl caproate became available and opened up a whole new aspect in pineapple flavours. Polak and Schwartz introduced aldehyde C. 18 and a new approach to coconut flavours was possible. The outstanding contribution was the isolation and use by Firmenich of what is now known as raspberry ketone. This altered the whole approach to raspberry flavours and this, with the introduction of new ionone-like products, opened up a whole new field.

The most exciting time in the flavour industry was probably in the fifties. Pyrazines began to trickle in; mercaptans became important; an extension of the range of lactones opened up a whole new world for the flavourist. In the United States the upsurge was even more dramatic. Work was started on the now famous GRAS List and the close collaboration between the Food and Drug Administration, the Flavor & Extract Manufacturers Association, and the American Society of Flavour Chemists, which was formed in 1955, established flavour making as an important industry and standardised the use of over a thousand fine chemicals.

In the 1950s spray-dried flavours spread to the

United States, in part due to the migration of personnel, and the impact was tremendous. By the mid-sixties, monthly orders for individual flavours for individual customers of several thousand pounds, were not unusual, and today these quantities would be regarded as modest.

Another aspect of the flavour industry has been the rapid and universal introduction of instrumentation, particularly G.L.C. (gas liquid chromatography) techniques. The use of G.L.C. was to a large extent pioneered in the U.S.A. by Jim Broderick, and in the fifties, although we were working in this country along the same lines, the first experiments of which I was aware, used a long glass column which went up through a hole in the ceiling. I have found that the generation gap has been most difficult to bridge in the world of instruments. It was always so, as a young chemist my first experience of pH readings was with a mirror galvanometer set on a table in the middle of the lab with a beam of light focused on a twelve foot scale nailed to the wall. I also remember the distrust when sugar boiling was carried out with thermometers instead of relying on the skill of the sugar boiler to know when a batch was just right for pouring, or when the viscosity of chocolate was measured by an instrument instead of relying on the skilled worker dipping his finger in and deciding how much cocoa butter was necessary to make the right fluidity.

As one gets older it becomes more and more difficult to keep abreast of modern techniques and finally one has to come to terms and decide that the next generation must take over. I often wonder what the situation will be in the next thirty or forty years.

Fifty years ago almost all flavour houses were family businesses. Boake and Roberts were both still members of the Board of A. Boake Roberts & Co. Bush was active in W. J. Bush and Allen was part of Stafford Allen. Schwartz was in charge of Polak & Schwartz in Holland. Boake Roberts was taken over in the late fifties or early sixties by Albright & Wilson who very soon afterwards acquired W. J. Bush and then Stafford Allen, and formed B.B.A. Albright & Wilson more recently became part of a large American Oil Company. Polak & Schwartz joined up with the American Company Van Ameringen, to form I.F.F., and Givaudan is part of the Hoffmann-LaRoche group. Very few family businesses remain and the number is constantly reducing. There are of course advantages, especially when it comes to financing "in depth" research and, in the long term, I am sure better flavours will result.

When I was invited to join Fries & Fries in the U.S. in 1962, it was a progressing family business. About 1970 it was taken over by Mallinckrodt Inc. of St. Louis and more progress has been made in terms of sales in the last 10 years than in many years before that. Traditionally the English have enjoyed being a large fish in a small pond, but the coming of the multi-nationals has made this an untenable position. In some ways it is a pity but, on balance, the advantages—especially in terms of service to customers—have outweighed the disadvantages.