

## The United Kingdom Glass Container Industry

14. Redfearn is engaged solely in the manufacture and supply of glass containers. Although Rockware and United Glass also manufacture other related products the main business of both of these companies is also the manufacture and supply of glass containers. Our inquiries have therefore been concerned with the glass container industry.

### The manufacturing process

15. The first fully automatic glass bottle-making machine was produced in the United States by Michael Owens in 1903. Automatic machines have since been increasingly used to produce glass containers required in large numbers and are now used by the United Kingdom industry to produce all types of glass containers.

16. The manufacturing process begins with the mixing of the raw materials in a batch plant. The materials are then fed into a furnace where they are heated to about 1500° Centigrade to form liquid glass which is fed as gobs into the moulds of a forming machine. When the container has been formed it travels through a long annealing chamber, or lehr, which cools the container at a controlled rate to minimise the internal stresses in the material. At what is called the 'cold end' of the production line the containers are inspected and packaged.

17. The raw materials from which glass is produced are almost entirely indigenous. Rather more than half by weight consists of sand, the other main constituents being soda ash and limestone. In addition, a batch usually contains a proportion of waste glass known as 'cullet' which reduces the temperature at which the mix melts to form glass. Among the other raw materials employed may be a small amount of 'decolouriser' used to produce colourless, or 'white flint', containers. The manufacture of white flint glass requires sand of a low iron content. Other colours of glass are produced by using sand of a higher iron content and by the addition of certain chemicals in the batch.

18. With the exception of soda ash, where the Alkali Division of Imperial Chemical Industries Limited is the only United Kingdom supplier, the industry purchases its raw materials from a number of sources. Sand of the necessary quality can be obtained from a number of sources and at least one container manufacturer owns its own quarry. There are also various suppliers of limestone. The industry does not expect any difficulties in obtaining adequate supplies of all the raw materials needed although considerable difficulties were caused in 1974 when an industrial dispute reduced supplies of soda ash.

19. The batch is fed into the furnace by a conveyor. Furnaces are now usually fired by natural gas or by oil, although some can be fuelled by either and some furnaces, especially those of a smaller size, are fuelled by electricity. Modern

furnaces are significantly larger than those constructed some years ago and have higher efficiency in the use of fuel. Improvements in the quality of refractory materials have increased the life of furnaces and so reduced capital costs per tonne of glass melted<sup>1</sup>.

20. A large furnace can serve a number of forming machines producing containers of the same colour. The molten glass leaves the furnace by the forehearth and drops in gobs (approximately sausage-shaped pieces of molten glass cut by shears to the weight required to produce the bottle) into the moulds of the forming machine. The larger machines currently used in United Kingdom glass container factories are mostly of the individual section type produced by the Emhart Corporation of the United States (Emhart). In this machine each mould is stationary and successive gobs are fed to different moulds on the machine. In some machines (double-gob) two gobs are produced at the same time and fed to parallel moulds on the machine; it is similarly possible to have triple-gob machines with almost correspondingly higher output. Eight is the largest number of sections on any machines currently in use in the United Kingdom. 8-section double-gob machines are available with either 4½in, 5½in or 6½in distance between the centre of the moulds on each section. There is also available a triple-gob machine with centre distances of 4½in between the moulds. The greater centre distance between the moulds permits the production of large containers by the double-gob process. 10-section double-gob machines are available in either 4½in centre distance or 6½in centre distance design. At least one will be installed in the United Kingdom in 1979.

21. The inspection of containers after they have left the Lehr is of considerable importance for high-speed lines at filling plants where costly disruptions can be caused by faulty bottles. They are checked for flaws in the material, height, capacity and other critical dimensions. Automatic inspection devices are being increasingly used for this work but sorters are still necessary on such lines to check against certain visual defects. Containers found to be defective are discarded and melted down in the furnace as cullet.

22. At the end of the production line the containers are packed. On most of the faster and some of the slower production lines there are machines which place containers on standard-size pallets that are then mechanically shrink-wrapped. Where customers prefer to have their glass containers packed in their own cartons or fibreboard cases these may be packed manually or mechanically. Because of the nature of the production process and seasonal factors many containers are not delivered to the customer immediately but are stored in the manufacturer's warehouse.

23. The manufacturing process is continuous. During the life of up to seven years furnaces are operated continuously except when they are being repaired. Machine lines operate on a 24 hour basis for seven days a week. There is therefore little scope for varying output to match fluctuations in demand.

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<sup>1</sup>The term 'melted tonne' refers in this report to one tonne (equalling 2,204 lb) of glass produced from a furnace. 'Good tonne' refers to an output of containers of a satisfactory quality weighing one tonne.

Furnace output can be varied to a limited extent; it is possible to run furnaces below rated output but the savings in costs are minimal; equally it is possible to increase furnace output somewhat above the rated level by boosting (ie heating by electricity to supplement the normal heating process). The emptying of furnaces for short periods is impracticable as the refractory material is likely to be damaged in the process. As the forming machines are normally run continuously at as high an efficiency as possible their output cannot be increased to meet abnormally high demand. If the demand should fall, machines can be taken out of production and the rate at which glass is melted in the furnaces reduced accordingly. However, we have been told by one manufacturer that a supplier's initial reaction to a fall in demand would usually be to maintain production and allow stocks to rise to a level he regards as the maximum he can carry (see paragraph 37).

### **Recent history of the industry**

24. In the years between the wars the United Kingdom glass container industry consisted of a large number of small manufacturers, some of which were owned by bottlers. For a large part of this period the industry experienced severe competition from overseas manufacturers. In 1932, at a time when the five largest glass container manufacturers were reported to be working at 60 per cent capacity, a 20 per cent import duty was imposed on glass containers imported from non-Commonwealth countries, and in 1934 this was increased to 25 per cent for most types of glass container.

25. In 1938 an association, the Glass Container Association (the name of which was subsequently changed to the British Bottle Association) was formed by a number of manufacturers and established a system of minimum prices for glass containers. This system continued until the Restrictive Practices Court found it to be against the public interest in 1961. The Association was wound up in the same year.

26. The Glass Manufacturers' Federation, which was established in 1926, is the central organisation representing the glass manufacturing industry (other than flat glass). It is not concerned with prices. Among its current activities on behalf of the glass container industry are its 'Get it in Glass' campaign to promote sales of glass containers and the pilot 'bottle bank' scheme to encourage the collection and re-cycling of used containers.

27. In 1961, when the British Bottle Association's agreement came before the Restrictive Practices Court, there were over 20 manufacturers of glass containers compared with 12 now. There was a contraction in the number of manufacturers during the 1950s and the 1960s when Rockware and United Glass made the acquisitions described in paragraphs 69, 70 and 105, and Redfearn was itself formed by the merger in 1967 of its two constituent companies.

28. The three largest manufacturers are now:

#### *United Glass*

The company had about 27 per cent of the United Kingdom market (by volume) in 1977. It is particularly strong in the wines and spirits sectors and has high

sales in soft drinks containers. It also produces containers for a wide range of other products.

#### *Rockware*

The company's share of the United Kingdom market amounted to about 26 per cent (by volume) in 1977. It is strongest in dairy products, foods and beer and cider, but also produces containers for other uses, including soft drinks and wines and spirits, as well as specialised containers for toiletries and cosmetics, including opal ware.

#### *Redfearn*

The company had about 16 per cent of the home market (by volume) in 1977. It is strongest in the soft drinks, beer and cider and food sectors but also produces for other uses except toiletries and perfumery.

Further information on the companies' market shares of individual product sectors are given in Appendix 2.

29. In 1977 imports accounted for almost 10 per cent of containers sold in the United Kingdom. The balance of about 20 per cent was supplied by other manufacturers, three accounting for most of this amount. The principal companies were:

#### *Albion Bottle Company Limited*

Mainly supplying the soft drinks and food sectors.

#### *Beatson, Clark & Company Limited*

The largest producer of containers for pharmaceuticals.

#### *Canning Town Glass Limited* (a subsidiary of Arthur Bell & Sons Limited, whisky distillers)

Mainly supplying the soft drinks, wines and spirits, dairy products, beers and ciders sectors.

#### *Co-operative Wholesale Society Limited*

Supplying other groups within the CWS and also outside customers, its production being primarily in the milk, food and soft drinks sectors.

#### *Gregg & Company (Knottingley) Limited*

Supplying mainly the food and pharmaceutical sectors.

#### *Lax & Shaw Limited* (a subsidiary of Associated British Foods Limited).

Supplying the spirits, soft drinks, food, medical and household sectors.

#### *Lewis & Towers Limited*

Supplying bottles mainly for pharmaceuticals, laboratory chemicals and agro-chemicals.

### **Economics of the industry**

30. The industry has become progressively more capital intensive in recent years. At each stage of production labour input per unit of output has fallen as a result of the introduction of new, more productive plant. At present over-

all labour costs, in production, stocking and distribution account for about 30 per cent of sales revenue compared with 20 per cent for raw materials and about 14 per cent for furnace fuel. A comparison of paragraphs 38 and 50 shows the average number of units produced per employee increased from 377,000 in 1973 to 400,000 in 1976.

31. As a result of advancing technology in furnace design, forming machines, lehrs, and inspection and packaging machinery the minimum economic size of a new one-furnace plant for mass-producing glass containers has been estimated by one manufacturer at a daily melting capacity of 300 tonnes (some 4 per cent of current United Kingdom capacity). Such a plant, it is estimated, would cost about £15 million to put up on a green field site and would have to operate at about 85 per cent capacity to break even.

32. The large United Kingdom producers can obtain considerable savings from economies of scale throughout the manufacturing process.

33. An increase in the size of furnaces can lead to a reduction in the amount of fuel consumed per tonne of glass melted provided the furnace can be operated at something approaching maximum capacity.

34. Appendix 3 shows the higher rates of output of the eight-section double- and triple-gob machines and ten-section machines (see paragraph 20) which may make them capable of producing containers at significantly lower unit costs. However, to make it economic to install the larger, faster machines it is necessary to use them on production runs of adequate length. The cost of time lost in setting up the production of a container on such a machine and the subsequent running-in time to attain optimum production of 'good containers' has to be spread over a longer period than for a slower machine.

35. With the greater output from a larger, faster machine it may become more economic to introduce automatic inspection and packaging equipment giving rise to further savings.

36. The advantage of a reduction in unit costs to be gained from the installation of large furnaces and large forming machines has to be balanced against certain disadvantages. The first is a reduction in flexibility. A furnace and all the machines it serves can produce only one colour of glass at a time. To have an adequate length of run the large, faster machine must produce greater numbers of each container than a small machine. In order to provide greater flexibility a manufacturer will therefore also have a number of smaller machines and smaller furnaces. A second disadvantage is that any disruption to production in a larger plant may have more serious consequences in reducing supplies to customers. A third disadvantage is that large production runs may entail the manufacturer holding larger stocks (to meet customers' needs until the next production run of the container) than if he ran shorter and more frequent runs on smaller machines. These considerations lead manufacturers to adopt their own mix of furnaces and machines to meet the needs of their customers as flexibly and as efficiently as possible.

37. The level of stocks of containers held by the industry is of significance in considering the economics of manufacture. By allowing the level of stocks to fluctuate with changes in demand (letting them increase when demand is low and drawing on them to meet peak requirements) it is possible to maintain a more even level of production which is suited to the manufacturing processes of the industry (see paragraph 23). Manufacturers are however constrained in the size of stocks that they can hold by the costs of financing them and of storage (see paragraphs 77, 125 and 151).

### Labour

38. With the installation of more productive machinery, there has been a decline in the numbers employed in the industry:

<i>Year</i>	<i>Estimated average number of employees (excluding management and office staff)</i>
1973	17,859
1974	15,912
1975	14,151
1976	15,611

*Source:* Glass Manufacturers' Federation.

The reduction was greatest in 1974 and 1975 when, after a period of high demand, there was a slackening of home demand. A number of manufacturers then instituted voluntary redundancy and early retirement schemes.

39. The workers in the industry are represented by a number of trades unions (those recognised by the three largest manufacturers are set out in paragraphs 81, 129 and 155).

### Technology

40. Technological developments are of importance in the industry. These affect all processes of production, including for example the automatic batch-mixing equipment feeding the furnaces, technology in furnace design and construction, electronic machine timing, mould-coatings and developments in automatic inspection and packaging equipment. Improvements in the manufacturing processes have, for example, allowed a reduction in the weight of milk bottles from 18 oz of the pre-war bottle to a current figure of 12 oz, with the increasing use of a 9 oz bottle. This has helped to reduce the effect of inflation on the price of this bottle and also gives advantages in its use.

41. Each of the major United Kingdom manufacturers has its own research and development department. Each also acquires technology developed by other manufacturers. In the case of United Glass this is secured under a general technical assistance agreement with Owens-Illinois Inc of the United States. Rockware and Redfearn make specific arrangements with individual manufacturers.

42. Applied research work is carried out for the United Kingdom industry by its own association, the British Glass Industry Research Association. This is situated next to Sheffield University whose Department of Glass Technology (dating from 1916) co-operates with the glass industry in both education and in research.

### **The demand for glass containers**

43. Nearly all the glass containers made by the companies which are the subject of this inquiry are sold to customers who then pack or bottle their own products in them. The demand for glass containers, therefore, is ultimately related to the demands for these products.

44. Alternative forms of packaging are also used for many products, but wine, spirits, and certain processed foods, eg pickles, are packaged almost entirely in glass. Most milk is delivered in glass bottles. However, other forms of packaging, in particular cans or plastics, are also used for beer, soft drinks, foods, toiletries and household goods. These latter product groups account for over half the number of glass containers produced.

45. Many factors influence the choice of packaging materials: physical suitability of the container, consumer acceptance, the relative price of raw materials and the cost of using (and installing) alternative filling lines. In recent years cans have been widely used for packing beers and soft drinks. One of the glass container manufacturers has estimated that of packaged drinks (ie excluding draught, bulk and catering sales) sold in 1976, 28 per cent of beers and ciders and 22 per cent of minerals were in cans. The remainder (72 per cent and 78 per cent) were packed in glass but since a proportion of these were returnable bottles the proportion of glass containers to cans bought by the drinks' manufacturers was substantially lower; in 1976 purchases of glass containers were estimated to account for 16 per cent of containers purchased for beers and 46 per cent of those purchased for soft drinks. Whilst there are indications that the relative costs of production have moved in favour of glass containers compared with cans, once a packer has installed a can-filling line he would have to install a separate filling line to enable him to switch to glass containers.

46. Seasonal variations in demand for products packed in glass lead to corresponding variations in demand for many types of glass containers. There is a strong pre-Christmas demand for wines and spirits, followed by lower sales in January. Demand for beer and cider increases before Christmas and also in the summer. Soft drinks consumption peaks in the summer. Seasonal variations in demand for processed foods in general are smaller, but there is a steep dip in demand in the holiday months of July and August and a peak in February and March. Apart from this general pattern of demand unexpected changes may occur because of, for example, unusual weather or a change, or anticipated change, in excise duty or VAT.

47. Although the importance packers give to price, quality, security of supply and service varies according to circumstances, security of supply ranks high. If they cannot obtain containers they cannot sell their products and may even have to close down a plant temporarily. Because of this many of the larger packers have two or three suppliers.

48. Consideration has been given in some overseas countries to the cost of containers (especially non-returnable bottles and cans) in terms of the resources necessary to manufacture and dispose of them.

49. In the United Kingdom a Government working party is at present investigating the environmental and economic impacts of returnable and non-returnable beverage containers to consider whether any action should be taken to alter the present market share of the two systems. If as a result any regulatory legislation were enacted, it might affect the level of demand for glass and other forms of packaging.

50. The level of the demand of the home market for glass containers has varied significantly in recent years. The following table shows production by United Kingdom manufacturers, their sales (in units and by value) and imports and exports for the years 1972-77:

United Kingdom market for Glass Containers 1972-77						
	1972	1973	1974	1975	1976 (53 weeks)	1977
<b>(a) Millions of Units</b>						
Production by UK Manufacturers(*)	6,437	6,731	6,702	6,238	6,369	6,869
Total sales by UK producers (†)	6,501	7,148	6,459	6,200	6,546	6,548
Plus imports (‡)	234	361	1,249(¶)	563	427	665
Minus exports (§)	263	400	374	313	306	354
<b>Total UK sales</b>	<b>6,472</b>	<b>7,109</b>	<b>7,334</b>	<b>6,450</b>	<b>6,667</b>	<b>6,859</b>
<b>Imports as percentage of total UK sales</b>	<b>3.6%</b>	<b>5.1%</b>	<b>17.0%</b>	<b>8.7%</b>	<b>6.4%</b>	<b>9.7%</b>
<b>(b) Value (£ millions)</b>						
Total sales by UK producers (†)	107.40	122.61	137.40	175.36	220.62	267.43
Plus imports (‡)	3.98	6.70	44.07(¶)	18.01	15.20	30.68
Minus exports (§)	4.73	6.06	6.47	8.80	12.22	14.86
<b>Total UK sales</b>	<b>106.65</b>	<b>123.25</b>	<b>175.00</b>	<b>184.57</b>	<b>223.60</b>	<b>283.25</b>
<b>Imports as percentage of total UK sales</b>	<b>3.7%</b>	<b>5.4%</b>	<b>25.2%</b>	<b>9.8%</b>	<b>6.8%</b>	<b>10.8%</b>

\*Source: Glass Manufacturers' Federation.

†The total sales figures given by the Glass Manufacturers Federation and used above differ slightly from Business Monitor figures because of the different coverage and accounting dates used.

‡Customs & Excise figures for imports (used above) include tubular glass containers, but it is understood that such imports are small.

§Export figures are taken from Customs & Excise sources, and include exports of tubular glass containers. The figures provided by the Glass Manufacturers' Federation of direct exports of containers (see paragraph 57) do not include tubular containers. Using these figures would give a marginally higher figure for the size of the United Kingdom market.

¶The Glass Manufacturers' Federation estimates imports (including tubular glass containers) in 1974 to be about 950 million units valued at £33.8 million.

51. The above table shows that in unit terms home sales by United Kingdom producers were about the same level in 1977 as they were in 1972 although domestic demand had grown by nearly 6 per cent<sup>1</sup>. The difference is accounted for by a growth in imports. In 1973 United Kingdom producers sold about 9 per cent more containers than they did in 1977 and exports marginally exceeded

<sup>1</sup>There is some evidence that over the period the average size of container increased, indicating that although unit sales were similar the industry was providing packaging for a greater quantity of its customers' products (see tables in paragraphs 86, 92, and 160).

imports in units, though not in value. In 1974 domestic demand was slightly higher but manufacturers' sales were markedly lower and the share of imports in the domestic market rose to 17 per cent. In 1975 and 1976 United Kingdom demand fell away significantly and import penetration subsided from its peak in 1974. 1977 saw some increase in domestic demand but it was accounted for by a growth in imports which accounted for a share of nearly 10 per cent of the domestic market.

52. Reduced sales by United Kingdom manufacturers in 1974 and the marked increase in imports resulted from a number of factors. Manufacturers' stocks were generally low at the end of 1973 as a result of a good summer and buoyant consumer spending encouraged by tax reductions on soft drinks and alcoholic drinks. The industry was prevented from replenishing stocks by a shortage of soda ash in 1974. To try to ensure continuity of supply many customers turned to overseas (mainly Continental) suppliers. The prices were, we understand, often much higher than those of United Kingdom manufacturers and long-term orders had to be placed, some of which ran into 1975. However, imports in 1976 were not reduced to the level of 1972. Partly because of liquidity problems, there were generally insufficient stocks in the United Kingdom to meet customers' demands in full during the hot summer of 1976 and a number of customers turned to the Continent for part of their supplies. There were fears of further shortages in early 1977 as a result of increased demand and some customers again turned to the Continent for part of their supplies. We have been told that the 1977 prices were often similar to those of United Kingdom manufacturers, and this has been attributed by some manufacturers largely to overcapacity in the Continental industry.

53. Whereas before 1973 imports were largely confined to small or specialised ware, mainly for toiletries and perfumery, the shortages in 1974 (see paragraph 52) resulted in imports of standard containers. For example, 61 per cent of imports by value and 53 per cent by units were for beer, cider, wine and spirits, compared with 15 per cent and 14 per cent respectively in 1972.

54. The three largest manufacturers have imported glass containers for their customers at times when they have been unable to meet their full requirements. Figures in this report of these companies' sales do not include these containers where such sales have been of any significance.

55. Import duties on glass containers from members of the European Economic Community were finally abolished at the end of June 1977. Even with the advent of containers and roll-on roll-off ferries estimates by Rockware and United Glass show that the cost of transport from the Continent to a United Kingdom customer adds from 10 per cent to as much as 30 per cent to the cost (depending on the size of the container) compared with transport from a factory in the United Kingdom.

56. Demand for glass containers depends partly on the likely demand for products sold in such containers and this in turn depends upon the amount of available disposable income in home and export markets as well as other factors such as the taxation carried by the products. Changes in demand are likely to vary significantly between one product sector and another but for the home market as a whole the major manufacturers foresee an increase in demand of the order of 3 per cent per annum (in number of units) over the next three or four years. This figure could be affected by changes in the respective shares of glass and of other forms of packaging, in particular, for example, of glass containers and cans in the beer market, as well as by other basic assumptions such as the market growth for products. The general view appears to be that there is likely to be greater growth in the wines, spirits and soft drinks sectors than the food-stuffs and other non-beverage sectors.

57. Direct exports account for only a small percentage of the sales of United Kingdom glass container manufacturers, although it is understood that there are also some exports made by bottle merchants:

<i>Year</i>	<i>Total sales (million units)</i>	<i>Exports (million units)</i>
1972	6,501	220
1973	7,148	271
1974	6,459	223
1975	6,200	246
1976*	6,546	267
1977	6,548	312

*Source:* Glass Manufacturers' Federation.

\*53 weeks

### **How business is done**

58. Most of the industry's output is sold direct to customers who use it for packing their products. The terms on which business is done do not vary significantly between the three major manufacturers. The normal practice (especially with larger customers) is for the user to indicate the size of his requirements for a period of about a year ahead and the timing of his requirements within this period. The manufacturer then tells the customer what quantity he can supply. The understanding thus arrived at is normally regarded as committing neither party and in the event of the customer not requiring the containers or the manufacturer not supplying them, each party apparently accepts that it has no enforceable rights against the other. We have been told that such arrangements can lead to problems for the manufacturer if the customer does not take up his estimated requirements, for example, in the event of a down-turn in demand for his product, or for the customer if the manufacturer cannot supply, for example, in the event of an overall increase in the demand for his containers. Recently there have been suggestions by one of the container manufacturers for firmer arrangements.

59. Small customers requiring standard glass containers do not usually indicate their long-term requirements but place orders for deliveries as required. The manufacturers have a minimum size for deliveries which is usually a vehicle load.

The smallest users are not usually served directly by the manufacturers but by bottle merchants or wholesalers. The latter buy glass containers from manufacturers, hold stocks and supply in the small quantities required by their customers. Bottle wholesalers are particularly important (together with pharmaceutical wholesalers) in the supply of pharmaceutical bottles to independent pharmacists.

60. The prices charged by the major manufacturers include standard packaging and usually also delivery to the customer's premises. An additional charge is made for non-standard packaging.

61. Although each major manufacturer has an unpublished price list for standard bottles it is the practice for prices, especially to larger customers, to be negotiated individually. Some major manufacturers reduce their prices to larger customers by a discount on their purchases, and also add an additional charge to the orders of very small customers to contribute to the extra unit cost of meeting their small orders.

62. Whether the price is negotiated with the customer or is taken from a price list the charge for delivery by the major manufacturers is standard irrespective of the distance from the factory to the delivery point. One reason for this is apparently that some customers have factories at a number of different locations and require a standard price irrespective of the factory of origin or delivery point. Another is that in planning production it is often necessary for containers to be produced at factories which are not those nearest to the customer and in such cases the customer could not be expected to bear the cost of the extra transport involved.

63. Major glass container manufacturers deliver their products to customers' premises, some using their own vehicles and others outside contractors or a combination of both.

#### **Recycling of used containers**

64. The industry is actively investigating the possibility of extending the recycling of waste glass, and a pilot scheme operated by the Glass Manufacturers' Federation in collecting waste containers in skips, referred to as 'bottle banks' is providing experience of how the process might be operated on a larger scale.