THE MONOPOLIES
AND RESTRICTIVE PRACTICES
COMMISSION

Report on the Supply of Certain Industrial and Medical Gases

Presented to Parliament in pursuance of
Section 9 of the Monopolies and Restrictive Practices
(Inquiry and Control) Act, 1948

Ordered by The House of Commons *to be Printed*
20th December 1956

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PRINCIPAL ABBREVIATIONS USED IN THE REPORT

B.I.G.	British Industrial Gases Ltd.
BIS	British Industrial Solvents Ltd.
B.O.C.	The British Oxygen Co. Ltd. and its subsidiaries in the United Kingdom except where otherwise indicated by the context.
British Petroleum ...	The British Petroleum Co. Ltd.
BP Trading	BP Trading Ltd.
D.A.	Dissolved Acetylene.
Eagle Oil & Shipping	Eagle Oil & Shipping Co. Ltd.
Esso	Esso Petroleum Co. Ltd.
I.C.I.	Imperial Chemical Industries Ltd.
I.G. (S.)	Industrial Gases (Scotland) Ltd.
N/A	Not available.
Odda...	Odda Smelteverk A/S.
p.s.i.	per square inch.
Saturn	Saturn Industrial Gases Ltd.
SCOW	The Steel Company of Wales Ltd.
Shell Petroleum ...	The Shell Petroleum Co. Ltd.
" Shell " Refining & Marketing	" Shell " Refining & Marketing Co. Ltd.

REPORT ON THE SUPPLY OF CERTAIN INDUSTRIAL AND MEDICAL GASES

Introduction

(i) The following report on the supply of certain industrial and medical gases, namely oxygen, dissolved acetylene and propane, in the United Kingdom is submitted in compliance with Section 2 (1) of the Monopolies and Restrictive Practices (Inquiry and Control) Act, 1948. The reference, which was received from the Board of Trade on 1st February, 1954, is reproduced in Appendix 1.

(ii) The report is made by a Group of members of the Commission formally constituted on 12th October, 1954, under Section 2 (2) of the Monopolies and Restrictive Practices Commission Act, 1953.

(iii) There is no trade association dealing with the production and supply of these gases. The individual producers and suppliers from whom we have received evidence include The British Oxygen Co. Ltd. (B.O.C.)*, the principal producer and supplier of oxygen and dissolved acetylene and one of the principal distributors of propane, and its subsidiaries British Industrial Gases Ltd. (B.I.G.) and Industrial Gases (Scotland) Ltd. (I.G. (S.)); Saturn Industrial Gases Ltd. (Saturn), which produces and supplies oxygen and dissolved acetylene in certain limited areas and distributes propane; Imperial Chemical Industries Ltd. (I.C.I.), Esso Petroleum Co. Ltd. (Esso), The Shell Petroleum Co. Ltd. (Shell Petroleum)† and BP Trading Ltd. (BP Trading)‡ which both produce and supply propane; and Eagle Oil & Shipping Co. Ltd. (Eagle Oil & Shipping), which supplies propane. The propane supplied by the last three named is marketed on their behalf by Shell-Mex & B.P. Ltd. (Shell-Mex & B.P.), which also gave evidence. In addition we received evidence from a few companies which supply one or more of the three gases in relatively small quantities. Members of the Commission and staff visited a number of factories.

(iv) We also received evidence from the trade associations covering the principal users of the gases and from a number of individual users, including Government Departments as well as commercial users. From some of these we took oral evidence after we had considered their written submissions. A list of our principal sources of evidence is given in Appendix 2.

(v) In June, 1955, representatives of B.O.C., of Esso and of Shell Petroleum, BP Trading, Eagle Oil & Shipping, and Shell-Mex & B.P. attended separate meetings to clarify outstanding matters of fact, and early in July, 1955, there were similar meetings with representatives of I.C.I. and of Saturn. In October, 1955, after we had informed B.O.C. of our provisional conclusion that the conditions of the Act§ prevailed in respect of the supply of the gases, we had a hearing with B.O.C. at which the company was represented by Counsel. The purpose of this hearing was to give B.O.C. an opportunity

* Except where otherwise indicated by the context, the contraction "B.O.C." is used in the report to cover the parent company and its subsidiaries in the United Kingdom.

† At the end of 1955, The Shell Petroleum Co. Ltd. took over the production and trading activities of "Shell" Refining & Marketing Co. Ltd. ("Shell" Refining & Marketing), see paragraph 93.

‡ At the end of 1954, BP Trading Ltd. took over the production and trading activities of The British Petroleum Co. Ltd. (British Petroleum), see paragraphs 95 and 96.

§ Throughout this report references to "the Act" are to the 1948 Act and not to the amending Act of 1953.

of discussing with us whether the "conditions" or any of the "things done" operated against the public interest or might be expected to do so.

(vi) We wish to record our appreciation of the assistance given us by B.O.C., Saturn, I.C.I., Esso, Shell Petroleum, BP Trading, Eagle Oil & Shipping, Shell-Mex & B.P., the users' trade associations and all others who provided the information we required in our investigation. As some of the information we received relates to confidential business affairs, we have been careful not to disclose it in the report unless it was essential for a proper understanding of the issues.

CHAPTER 1: THE GASES

Oxygen

1. Oxygen is supplied commercially in three forms: as a compressed gas in cylinders, as a liquid at a low temperature in insulated transport tanks, and as a gas by direct pipeline from producers' to users' premises.

2. The principal source of the commercial product is the atmosphere, and the current processes for its extraction all take advantage of the fact that nitrogen and oxygen, the two principal constituents of air, boil at different temperatures and can accordingly be separated by fractional distillation. A brief account of the process is given in Appendix 3. Of the standard plants now commonly used, the medium to large-sized plants produce liquid oxygen while the smallest plants are usually designed to produce gaseous oxygen. The very largest plants, the "tonnage" plants which are now being developed, and are so called because of their large capacity ranging from 50 tons a day to 400 tons a day or more, are designed primarily to supply gaseous oxygen direct to the point of use. No tonnage plant is yet in full operation in the United Kingdom. A small amount of oxygen is derived from the electrolysis of water as a by-product of hydrogen production.

3. Liquid oxygen is supplied in insulated transport tanks. As oxygen is almost always used as a gas, consumers who take liquid oxygen require both evaporator vessels to receive the liquid and convert it into gas and internal pipelines to take the gas to the consuming points.

4. Oxygen supplied as a gas, whether by pipeline from producers' works or in cylinders, is taken direct from a plant producing gaseous oxygen or from an evaporator which turns liquid oxygen into gas. For supply in cylinders, the gas is passed through a compressing unit. Compressed oxygen in cylinders of varying sizes is the portable form of the gas and, in general, cylinders are moved to consuming points as required. Some consumers have batteries or "manifolds" of large cylinders from which the gas is piped to consuming points. Under Government regulations cylinders must be periodically tested, and there are British Standard Specifications for the types of valves and colour of cylinders.

Dissolved Acetylene

5. Acetylene (C_2H_2) is a gas under normal conditions. Dissolved acetylene is the portable form of acetylene gas. It is manufactured in two stages. In the first, acetylene gas is produced by the interaction of calcium carbide and water and is dried and purified. This process is a simple one; the main problem is the removal and disposal of the lime sludge. In the second stage the gas is pumped under pressure into cylinders, each of which contains a porous mass and a solvent. It is in these cylinders that acetylene is supplied to customers. The solvent used in this country is acetone. There are several alternative porous masses in use: kapok, a mixture of kieselguhr and charcoal, and a cement type (monolithic) solid porous block. Here again, there are British Standard Specifications for types of valves and colour of cylinders. The supply of the raw material, calcium carbide, and of the solvent acetone, is described briefly in Chapter 5.

6. Acetylene under pressure is explosive, and the manufacture of dissolved acetylene is subject to certain statutory regulations. A licence is required from the local licensing authority under the Petroleum (Consolidation) Act, 1928, before calcium carbide in quantities over 28 lbs., may be kept or used on any premises, and the authority may impose conditions to ensure safety

in storage and in acetylene production. Under a Home Office Order (S.R.O. 1919, No. 809) made under the Explosives Act, 1875, H.M. Inspectors of Explosives must approve the premises on which acetylene compression is carried out, and be given facilities to inspect apparatus and methods. The same Order lays down requirements for the strength of cylinders, the maximum pressures at which they may be filled, conditions for their testing, the amount and porosity of the filling, and the amount and nature of the solvent. Samples of the porous filling and drawings of the type of cylinders used have to be deposited with the Home Office and approval obtained. Each cylinder has to be thoroughly examined at intervals of twelve months. Records have to be kept showing the date of each charging, the dates when any solvent has been added, and the date of each examination with the result and the name of the examiner. Firms first issuing a cylinder must also record the tare weight (including porous substance and solvent), the nature of the solvent and the maximum pressure allowed. Each charged cylinder must bear a label giving the last charging date, the name of the charging firm, the address of the charging station, and the maximum pressure allowed. A similar Order operates in Northern Ireland. As with oxygen, some consumers have dissolved acetylene cylinder manifolds from which the gas is piped to consuming points.

Propane

7. Propane (C_3H_8) is a gas under normal conditions but liquefies under pressure at normal temperatures. It is supplied as a liquid in cylinders.

8. Propane is produced commercially in this country by two different processes, and in each it is essentially a by-product. In the first, it is produced in the course of various refining and "cracking" processes by which motor spirit and other oil products are manufactured from imported crude oil. Only a very small proportion of the propane so produced is separated and marketed: the bulk of it, along with the other unseparated gases comprising the refinery "tail-gas" stream, is used as fuel in the refinery furnaces. Separation is effected by processes of distillation and purification. Finally, the propane is compressed to a liquid and is pumped under pressure into storage vessels or cylinders. Commercial propane as supplied by the oil refineries contains varying amounts of propylene (C_3H_6) or other related hydrocarbon gases. In the second process, propane is produced in the course of the production of petrol by the hydrogenation of creosote obtained from gas works and coke ovens. Not all the propane so produced, which is almost the pure chemical substance, is separated and marketed.

9. Cylinders for propane are of two types: the heavy seamless type used for oxygen and dissolved acetylene, and a lighter welded type. Here again, some consumers have propane cylinder manifolds from which the gas is piped to consuming points.

The Uses of the Gases

10. Oxygen by itself is used for breathing purposes in medical and surgical practice and in high flying, mountain climbing, mines rescue and underwater operations. As an industrial gas by itself, it has minor uses, for example, for testing aircraft systems and as a refrigerant in certain engineering processes, but the important and developing uses are in steel making and in chemical synthesis. So far, development has been most marked in the iron and steel industry. The British Iron and Steel Research Association has summarised the present extent of the uses of oxygen in

the British iron and steel industry as follows : enrichment of air in furnaces (experimental) ; desiliconisation or pre-refining (developing) ; as blast in Bessemer converters (developing) ; decarburisation in open hearth furnaces (developing) ; decarburisation in electric arc furnaces (extensive) ; deseaming (extensive). A short explanation of these terms is given in Appendix 4.

11. Dissolved acetylene by itself is used nowadays only for lighting and on a very limited scale, chiefly for the lighting of lighthouses, lightships and buoys. Propane by itself is used in the manufacture of certain petroleum chemicals and as " bottled gas " for cooking and, to a lesser extent, for heating and lighting. For petroleum chemicals, the chemically pure product is required but for the other purposes, a mixture of propane and propylene or other related gases is used and is generally regarded as an alternative to or substitute for butane, the more widely used bottled gas.

12. The commonest industrial use of oxygen in combination with other gases is with acetylene for welding and cutting and with propane for cutting, both operations being used extensively in shipbuilding and in all branches of the engineering industry and, to a lesser extent, in many other industries. The cutting operations performed by the oxy-acetylene or oxy-propane flame are many and varied, and there are machines for profile cutting, bevelling and other special processes. The principal use of propane is in oxy-propane cutting, particularly scrap cutting. It is also used with oxygen for metal spraying. It is generally unsuitable for ferrous welding, but has limited uses in certain non-ferrous welding operations. Oxygen is used with acetylene or propane in cold deseaming and scarfing. Dissolved acetylene is sometimes used for pre-heating in hot deseaming but normally the operation is performed by oxygen alone. Coal gas is also used with oxygen for cutting and for cold deseaming.

Government Responsibilities

13. The Board of Trade is the Government Department concerned generally with matters relating to the production of oxygen and dissolved acetylene and the Ministry of Fuel and Power with matters relating to propane. The Board of Trade also controls the importation, under licence, of calcium carbide, the raw material for dissolved acetylene production. The Ministry of Health and the corresponding Department in Northern Ireland are responsible for matters concerning medical oxygen. The Home Office and the corresponding Departments in Scotland and Northern Ireland are responsible for the administration of the safety regulations relating to the production of dissolved acetylene and the testing of cylinders containing oxygen, dissolved acetylene and propane.

CHAPTER 2: PRESENT PRODUCERS AND SUPPLIERS

14. All the oxygen, dissolved acetylene and propane supplied in the United Kingdom is of home production. The producers and suppliers are introduced briefly in this chapter.

The British Oxygen Company Ltd.

15. B.O.C. is, and has been for the past seventy years or more, the principal producer and supplier of oxygen. It is also the principal producer and supplier of dissolved acetylene. It is one of the principal suppliers of propane, but does not produce it. B.O.C. supplies oxygen in all the three ways described in the previous chapter; as a gas in cylinders, as a gas by pipeline to customers' works, and as a liquid in transport tanks. The bulk of its sales of all three gases is made at delivered prices which apply to all but the remoter areas where demand is small or scattered. The history of the company, its present structure and organisation, and its prices, costs and profits are examined in detail in subsequent chapters, as also are similar matters relating to Saturn and the propane producers.

Saturn Industrial Gases Ltd.

16. Apart from B.O.C. the only firm which produces and supplies both oxygen and dissolved acetylene is Saturn, which supplies these gases mainly in the North East of England where its works are situated. Oxygen is supplied only as a gas: in cylinders or by pipeline to customers' works. Saturn is a principal supplier of propane which it distributes in all parts of the United Kingdom except Wales: it does not produce propane. All three gases are supplied at delivered prices.

The Propane Producers

17. There are four producers of propane: Imperial Chemical Industries Ltd., which produces propane from its creosote hydrogenation plant as a by-product in the production of petrol; and Esso Petroleum Co. Ltd., the Shell Petroleum Co. Ltd. and BP Trading Ltd., all of which produce propane in the course of various oil refining processes. The propane produced by the last two named is marketed by their subsidiary and agent, Shell-Mex & B.P. Ltd., for the account of these companies and also of a third and associated company, Eagle Oil & Shipping Co. Ltd.

Supply by the Propane Producers

18. Until October, 1954, Shell-Mex & B.P. bought propane from I.C.I. which it resold to B.O.C., together with propane produced by its associated companies. Since that date, B.O.C. has bought propane direct from I.C.I. as well as from Shell-Mex & B.P. which remains its largest supplier. Saturn obtains most of its supplies from Esso. From time to time some propane is supplied by one producer to another, either for resale or for use in refining processes, and small amounts are sold direct by producers to other users.

Other Suppliers

19. The only producer and supplier of oxygen in addition to B.O.C. and Saturn is Lea & Son (Runcorn) Ltd., a small family business which produces and supplies cylinder oxygen and supplies dissolved acetylene bought from

B.O.C. for resale. A few firms produce oxygen electrolytically as a by-product. None of them supply oxygen direct to users, the oxygen being generally blown to atmosphere, but B.O.C. has contracts with British Oil & Cake Mills Ltd., Howards of Ilford Ltd., The Southern Oil Co. Ltd. and Lever Brothers, Port Sunlight, Ltd. for the purchase of the electrolytic oxygen these firms produce. This oxygen B.O.C. compresses on site and supplies in the ordinary way. B.O.C. has told us that none of these contracts precludes surplus oxygen being sold to other buyers. The only firm which both produces and supplies dissolved acetylene in addition to B.O.C. and Saturn is The Gas Accumulator Co. (United Kingdom) Ltd., Brentford, which produces and supplies the gas chiefly in connection with its principal business of the manufacture and supply of marine lighting apparatus. Dalgleish Brothers, Nottingham, supply locally small quantities of oxygen and dissolved acetylene obtained from Saturn. Kingston Chemicals Ltd., Hull, which manufactures and distributes anaesthetic gases, with depots in Manchester Glasgow and Birmingham, supplies, principally to dentists, medical oxygen which it obtains from B.O.C. or Saturn. Retail chemists up and down the country stock B.O.C.'s medical oxygen for supply to nursing homes and for domiciliary patients. Lee-Midgley, Whitehead & Co. Ltd., Sheffield, sells for industrial purposes propane obtained from Esso, and Calor Gas (Distributing) Co. Ltd., London, W.1, sells a small amount of propane as "bottled gas" for fuel purposes in addition to its main trade in butane.

Sales of Oxygen and Dissolved Acetylene: 1953 and 1954

20. The following table sets out the total quantities of oxygen and dissolved acetylene supplied in the United Kingdom in 1953 and in 1954, analysed by suppliers:

Supplier	Oxygen				Dissolved Acetylene			
	1953		1954		1953		1954	
	'000 cubic feet	per cent.	'000 cubic feet	per cent.	'000 cubic feet	per cent.	'000 cubic fete	per cent.
B.O.C. ...	4,907,922	96·1	5,371,871	96·2	444,342	92·1	461,873	92·2
B.I.G. ... I.G. (S.) ...	118,358	2·3	129,831	2·3	30,814	6·4	31,886	6·4
Total B.O.C. Group	5,026,280	98·4	5,501,702	98·5	475,156	98·5	493,759	98·6
Saturn ...	74,882	1·5	77,304	1·4	4,771	1·0	4,587	0·9
Others ...	4,840	0·1	4,424	0·1	2,379	0·5	2,515	0·5
Total ...	5,106,002	100·0	5,583,430	100·0	482,306	100·0	500,861	100·0

(Sales by B.O.C. include small amounts of electrolytically produced oxygen purchased from the four firms mentioned in paragraph 19.)

Sales of Propane in 1953, 1954 and 1955

21. The following tables set out the total quantities of propane supplied in the United Kingdom in 1953, 1954 and 1955 (*a*) by the producers and (*b*) by the distributors:

TABLE I

	1953			1954			1955		
	Sales of own production	All Sales	All sales as percentage of total supplied in the U.K.	Sales of own production	All Sales	All sales as percentage of total supplied in the U.K.	Sales of own production	All Sales	All sales as percentage of total supplied in the U.K.
Producers	Tons (i)	Tons (ii)	(iii)	Tons (i)	Tons (ii)	(iii)	Tons (i)	Tons (ii)	(iii)
Esso	2,459	2,541	36·1	2,575	2,809	33·3	2,708	3,070	36·2
I.C.I.	2,943	2,943	41·9	3,050	3,050	36·1	2,814	2,814	33·2
"Shell" Refining & Marketing (Shell Petroleum)* ...	586	1,535	21·8	1,452	2,237	26·5	1,410	2,062	24·3
British Petroleum (BP Trading)* ...	1,044	1,888	26·8	1,368	2,145	25·4	1,546	2,482	29·3
Eagle Oil & Shipping* ...	—	716	10·2	—	813	9·6	—	662	7·8
Total supplied in the United Kingdom ...	7,032			8,445			8,478		

Note: The figures of all sales for each producer given in columns (ii) include, except those for I.C.I., amounts bought from other producers for resale, so that the percentage figures shown in column (iii) total more than 100 per cent. of the totals supplied in the United Kingdom.

* Propane supplied by these companies is marketed by Shell-Mex & B.P. (see paragraph 17).

TABLE II

	1953		1954		1955	
	All Sales	All sales as percentage of total supplied	All Sales	All sales as percentage of total supplied	All Sales	All sales as percentage of total supplied
Distributors	Tons		Tons		Tons	
B.O.C.	3,753	57·8	4,258	57·7	4,620	57·8
B.I.G. & I.G. (S.) ...	50	0·8	82	1·1	118	1·5
B.O.C. Group ...	3,803	58·6	4,340	58·8	4,738	59·3
Saturn	2,501	38·4	2,646	35·9	2,814	35·2
Others	193	3·0	392	5·3	443	5·5
Total Supplied ...	6,497	100·0	7,378	100·0	7,995	100·0

(Where distributors have given figures in lbs. these have been converted into tons on the basis of 2,200 lbs.=1 ton, which is the practice adopted by B.O.C.)

Note: Differences between the totals supplied at Table I and Table II are largely accounted for by sales made by producers direct to users.

CHAPTER 3: THE HISTORY OF THE SUPPLY OF THE GASES IN THE UNITED KINGDOM

22. Oxygen was first supplied commercially in the United Kingdom in about 1886, dissolved acetylene in about 1910, and propane in 1935. B.O.C. has been the principal supplier of oxygen from the beginning and of dissolved acetylene from 1930, and a principal distributor of propane since 1943. The greater part of this chapter is accordingly concerned with the development of B.O.C. Accounts of other producers are included in, as far as practicable, chronological order.

The Supply of Oxygen to 1914

23. In the nineteenth century, oxygen was produced by a number of laboratory processes but the first important step towards large scale manufacture occurred in the early 1880's, when the brothers Arthur and Leon Brin invented a process for the production of oxygen of up to 94 per cent. purity by heating barium monoxide to form the dioxide and then raising the temperature to 1600°F when oxygen was released and the monoxide regenerated.

24. At that time the principal uses of oxygen were for medical and laboratory purposes, for the oxy-hydrogen blowpipe used in platinum working, and for the limelight lamp. In 1886, Brin's Oxygen Co. Ltd., later to change its name to The British Oxygen Co. Ltd., was formed by a family named Sharp who brought in the brothers Brin and others to acquire and operate the rights in the Brin patents; licences under these patents were granted to three companies, The Birmingham Oxygen Co. Ltd., The Manchester Oxygen Co. Ltd., and The Scotch & Irish Oxygen Co. Ltd. All the Brin patents had expired by 1905. The Brin Company's business does not seem to have prospered at first, partly, it seems, on account of technical difficulties presented by the new process and partly owing to lack of demand, and in 1899 about half of the capital of £125,000 was written off.

25. Meanwhile, Carl von Linde in Germany, C. E. Tripler in America, W. Hampson in England, and Georges Claude in France, had been working on new but similar processes for the production of oxygen by the fractional distillation of liquid air. The most important was perhaps the Linde process which made it possible to produce high purity oxygen on a larger scale than before and led to new developments in its applications. In 1885, Carl von Linde's company, the Gesellschaft für Lindes Eismaschinen A.G. of Wiesbaden, which was to become the principal German manufacturer and supplier of industrial gases and gas plant and is now known generally as "Linde of Germany", formed Linde British Refrigeration Co. Ltd., which by 1890 had ice factories and freezing stores in Birmingham, London and Grimsby. In October, 1905, the Brin Company finally acquired the full rights in three Hampson patents relating to the liquefaction and separation of air, and in December of the same year it alleged the infringement of these patents by Linde British Refrigeration, but did not take the matter to court. In 1906, the Brin Company acquired the rights in the Linde patents for the United Kingdom and certain other countries in return for a cash payment and the allocation of one-quarter of the Brin Company's issued preference and ordinary shares to the German and English Linde companies. The Brin Company then changed its name to The British Oxygen Co. Ltd. Linde British Refrigeration continued its normal operations in the refrigeration field and some ten years later changed its name to Lightfoot Refrigeration Co. Ltd. This latter company, which now has no

German connections, is still trading and operating ice and cold stores. Carl von Linde became a director of B.O.C. and served until 1914.

26. In 1906, La Société L'Air Liquide, an important French company concerned with the manufacture and supply of industrial gases, formed British Liquid Air Ltd. to work the Claude patents in the United Kingdom. In the same year, B.O.C. warned British Liquid Air that it would treat the manufacture of oxygen or liquid air by the Claude process as an infringement of the Hampson and Linde patents. In 1907 British Liquid Air brought an action against B.O.C. to restrain it from threats, and B.O.C. brought a cross-action for infringement. B.O.C. won on appeal to the Court of Appeal and this judgment was upheld by the House of Lords.* Two years later, as a result of personal negotiations between Carl von Linde and L'Air Liquide, British Liquid Air came to terms with B.O.C., and the latter acquired the Claude patents for the United Kingdom for the sum of £5,000. L'Air Liquide and B.O.C. agreed upon an exchange of technical information and mutually established territorial spheres of interest abroad. The Brin process was completely superseded by the new air separation processes, and B.O.C., as holder of the British patents for these processes, was for some years, apart from The Knowles Oxygen Co. Ltd., practically the only supplier of oxygen in the United Kingdom. The Birmingham Oxygen Company had been wound up in 1896, and the Manchester Oxygen Company in 1899, and the Scotch & Irish Oxygen Company was wound up in 1909, the assets in each case being acquired by B.O.C.

27. In 1914, B.O.C. acquired the oxygen interests of the Knowles Oxygen Co. Ltd. This company founded in 1909 by A. E. Knowles, a former manager of the Birmingham Oxygen Company, produced oxygen by the electrolytic process from plants at Wolverhampton and adjacent to the works of Lever Brothers at Bromborough, and supplied compressed oxygen in both districts. The plant at Bromborough also supplied hydrogen to Lever Brothers. In 1913, B.O.C.s Board minutes recorded that a report on an important meeting with the Knowles Company was considered and a summary of the Knowles Company's position and prices was studied. Shortly afterwards B.O.C. cancelled a patent licence relating to hand blow pipes which it had granted to the Knowles Company in 1910. By an agreement of 27th February, 1914, Associated Enterprises Ltd., a wholly-owned subsidiary of Lever Brothers, acquired the whole of the issued share capital of the Knowles Company in exchange for 38,816 15 per cent. £1 Cumulative Preference shares in Lever Brothers. The directors of the Knowles Company estimated the capital invested in their business, on original cost, as £130,000 made up of freehold land and buildings, plant, machinery and cylinders. On 27th March, 1914, B.O.C.'s Board minutes recorded that the company's capital would be increased by £75,000 of which £50,000 would be allotted to Lever Brothers in payment for the transfer of the Knowles Company's Wolverhampton undertaking, and the business in compressed oxygen at Bromborough, and that Lever Brothers would be entitled to nominate two directors to the Board of B.O.C. By an agreement of 31st December, 1914, between B.O.C. and the Knowles Company, then a wholly-owned subsidiary of Associated Enterprises, B.O.C. acquired the whole of the assets other than the production plant at Bromborough, but including the compressing plant and cylinders of the Knowles Company, for 46,000 fully paid up ordinary shares in B.O.C. and a small cash payment. It was provided that Mr. Knowles should not engage in the business of the manufacture of oxygen

* British Liquid Air Co. Ltd. *v.* British Oxygen Co. Ltd.
British Oxygen Co. Ltd. *v.* British Liquid Air Co. Ltd. } 25 R.P.C. 218, 577.
Ibid., 26 R.P.C. 509.

in competition with B.O.C. for a period of ten years, except as provided in a further agreement. This further agreement between B.O.C. and Lever Brothers allowed the latter company to subscribe for 4,000 shares in B.O.C. and to nominate two directors to the Board of B.O.C. for as long as it held 50,000 shares (that is, 46,000 obtained by the first agreement and 4,000 by the second). At the beginning of 1933, Associated Enterprises owned about £200,000 Ordinary Stock of B.O.C., including the 50,000 shares acquired under the agreement of 31st December, 1914. At various dates in 1933, all but £53,490 of the holding was disposed of on the Stock Exchange, and the remainder was sold to Metal Industries Ltd. in January, 1934. Lever Brothers' right to nominate two directors to the Board of B.O.C. ended in February, 1934, since when no Lever Brothers nominated directors have served on the Board of B.O.C.

The Supply of Dissolved Acetylene to 1914

28. Acetylene was discovered by Edmund Davy in 1836 by the decomposition of a fused mass containing potassium carbide with water. Calcium carbide was first made in 1862 by F. Wohler who then obtained acetylene from it. In 1892, T. L. Willson, a Canadian electrical engineer, and H. Moissan in France discovered almost simultaneously that calcium carbide could be made by fusing lime and carbon in the electric furnace. The commercial manufacture of calcium carbide for acetylene production began in 1895. Acetylene was used widely for lighting, and attempts were made to use it as a substitute for hydrogen in industrial applications. These attempts were severely hampered by the explosive properties of acetylene under pressure, and its use under pressure greater than 100 inches of water was prohibited by law. The marked solubility of acetylene in acetone was observed by Claude and Hess in 1897, and successful attempts to compress it safely in the presence of acetone and a porous filling revived interest in the use of the gas for industrial purposes. Until about 1890, forge welding had been the traditional and only method of welding. The next twenty years saw the development first of electric "Thermit" welding, and then of oxy-acetylene welding. By using a specially constructed blowpipe an oxy-acetylene flame was produced which was far hotter than the oxy-hydrogen flame and could be used for the direct autogenous welding of metals and for many other metallurgical processes, including cutting. At the same time a rapidly developing business grew up in the preparation and use of dissolved acetylene for lighting motor cars, railway carriages, lighthouses, buoys and yachts, while low-pressure acetylene generators continued to be used for house lighting systems.

29. The production of dissolved acetylene in the United Kingdom which made possible these industrial applications was originally developed by A-L Meteorlite Ltd., a company associated with The Allen-Liversidge Portable Acetylene Co. Ltd., and The Allen Co. Ltd., both of which were concerned in the manufacture and marketing of acetylene generators for household and other lighting and for oxy-acetylene welding. A-L Meteorlite Ltd. held an important patent for the use of kapok as a porous filling for cylinders, and produced and sold dissolved acetylene in seamless cylinders of its own manufacture, principally for oxy-acetylene welding.

Oxygen and Dissolved Acetylene in the First World War

30. The demands of the metal using and fabricating industries in the first world war gave a great impetus to the use of oxygen and dissolved acetylene as welding and cutting gases and to the development of B.O.C.,

with its monopoly of the supply of oxygen, and the Allen-Liversidge companies, with their acetylene generator and dissolved acetylene interests. The companies co-operated closely on the sale of their respective and inter-dependent products. In 1914, B.O.C. owned eleven factories and by 1916, the actual oxygen output of these factories averaged 3 million cubic feet a week, practically all of which was used for munitions, the chief demand being for oxy-acetylene welding and cutting at steel works and shipyards. Demand continued to increase rapidly and by 1917 reached nearly 6 million cubic feet a week. According to the official History of the Ministry of Munitions the output of bombs and the repair of ships were seriously affected by the shortage of oxygen, the factors limiting the supply being shortages of cylinders and labour rather than inadequate oxygen plant capacity. Two or three small new sources of supply were developed to meet the increasing demand, including Liquid Air & Rescue Syndicate Ltd. with small works at Willesden, but the only source which was utilised to any extent besides B.O.C. was the Royal Aircraft Factory at Farnborough where oxygen was produced as a by-product in the manufacture of hydrogen.

Oxygen and Dissolved Acetylene in the Inter-War Years and the Growth of B.O.C.

31. The history of the supply of oxygen in the inter-war years was marked by continued expansion in the industrial uses of oxygen and dissolved acetylene, the development of the new and highly important Heylandt processes for the production, storage and transport of liquid oxygen, and the acquisition by B.O.C. of further oxygen and dissolved acetylene concerns and interests, including the control of the Heylandt patents in the United Kingdom. The following is a list of the suppliers of oxygen, dissolved acetylene, and oxygen plant acquired by B.O.C. and the firms which disposed of their oxygen plants or interests to B.O.C. between 1896 and the present time:

(*a*) firms whose primary business was the supply of oxygen and/or dissolved acetylene, and which were acquired by B.O.C.:

1896 The Birmingham Oxygen Co. Ltd.
1899 The Manchester Oxygen Co. Ltd.
1906 Linde British Refrigeration Co. Ltd.
1909 The Scotch & Irish Oxygen Co. Ltd.
1909 British Liquid Air Ltd.
1914 The Knowles Oxygen Co. Ltd.
1930 Allen-Liversidge Ltd.
1932 Oxygen Industries Ltd. (a subsidiary of Metal Industries Ltd.).
1934 British Industrial Gases Ltd.
1934 Hydrogen, Oxygen & Plant Co. Ltd.

(*b*) firms whose primary business was the supply of oxygen plants (including "customer" plants*) and which were acquired by B.O.C.:

1929 Liquid Air Ltd.
1934 Oxhycarbon Ltd.

* The term used by plant manufacturers for plants for supply to customers who wish to produce their own oxygen.

(*c*) firms which produced oxygen primarily for their own use but sold the surplus and which disposed of their oxygen plants and interests to B.O.C.:

1928 The Plymouth Oxygen Co. Ltd.

1934 Edgar J. Rees Ltd.

1944 Thos. W. Ward Ltd.

(*d*) firms which produced oxygen solely for their own use and which disposed of their oxygen plants to B.O.C. or closed down their plants by agreement with B.O.C.:

1928 The Caledon Shipbuilding & Engineering Co. Ltd.

1930 The Steel Supply Co. Ltd.

1930 George Cohen Sons & Co. Ltd.

1935 G. A. Harvey & Co. (London) Ltd.

1939 The Hughes Bolckow Shipbreaking Co. Ltd.

Acquisition by B.O.C. of Suppliers of Oxygen and/or Dissolved Acetylene

32. The acquisition by B.O.C. of the Birmingham Oxygen Company, the Manchester Oxygen Company and the Scotch & Irish Oxygen Company, the oxygen interests of Linde British Refrigeration Company (with the Linde patents) and British Liquid Air (with the Claude patents), and the Knowles Oxygen Company (electrolytic oxygen) has been mentioned in paragraph 27. The next supplier to enter the industry was Hydrogen, Oxygen & Plant Co. Ltd., which was founded in 1919 to manufacture and supply oxygen and other gases. The company had combined oxygen and dissolved acetylene works at Cardiff and at Jarrow. From 1924, the company had agreements with both B.O.C. and Allen-Liversidge under which it ceased to manufacture oxygen and dissolved acetylene, its customers being supplied by B.O.C. and Allen-Liversidge on a commission basis. In 1934, B.O.C. acquired the whole of the share capital on the basis of an exchange of eleven B.O.C. ordinary shares for fifty Hydrogen, Oxygen & Plant Company shares. The commission arrangement continued until 1939, when the Hydrogen, Oxygen & Plant Company ceased to trade. In 1940 the company was wound up.

33. The Allen-Liversidge interests were acquired by B.O.C. in 1930. In 1917, the Allen-Liversidge Portable Acetylene Company had absorbed the Allen Company and the A-L Meteorlite Company, and changed its name to Allen-Liversidge Ltd. The nominal capital had increased from £20,000 on formation in 1910 to £100,000 by 1919, when a prospectus recorded that the use of dissolved acetylene had extended rapidly, that the demand for it during the war had exceeded the company's capacity to supply, and that it would be necessary to increase the number of the company's stations. The prospectus claimed that the kapok patent filling had proved of " enormous commercial as well as technical benefit in cheapening costs and increasing portability ". A prospectus of 1921 recorded the acquisition of The Dissolved Acetylene Co. Ltd. and of Imperial Light Ltd., and noted that by this amalgamation, Allen-Liversidge, whose manufactures were largely protected by patents and trade marks, became the sole manufacturer of dissolved acetylene in the United Kingdom. The co-operation between Allen-Liversidge and B.O.C. built up during the first world war had continued, and in 1928, a formal agreement was concluded between the two companies, providing for even closer co-operation in the manufacture and marketing of their respective products. In 1930, Allen-Liversidge amalgamated with B.O.C. under an agreement whereby all the

net assets of Allen-Liversidge were purchased by B.O.C. for £550,000. Three of the directors of Allen-Liversidge joined the Board of B.O.C. Allen-Liversidge was converted into a private company and was wound up in 1933.

34. The next take-over of a supplier of oxygen included the acquisition for the United Kingdom of the Heylandt patents relating to methods of production, storage, transport, and delivery of liquid oxygen. This acquisition was to revolutionise the pattern of B.O.C.'s oxygen production and distribution and to encourage the large-scale use of oxygen in industry. The Heylandt processes had been first introduced into the United Kingdom by The Alloa Shipbreaking Co., Ltd. This company (which later changed its name to Metal Industries Ltd.) was set up in 1922, principally to carry on business as ship breakers, builders and repairers. It first obtained its oxygen supplies from B.O.C. but between 1924 and 1927 set up four gaseous oxygen plants, two purchased from Liquid Air Ltd. (see paragraph 38) and two from Messer G.m.b.H. of Frankfurt (see paragraph 40). Oxygen surplus to its own needs was sold first through Liquid Air Ltd., and later, direct to customers. A director of the company visiting Germany to buy plant saw the Heylandt liquid oxygen process in operation. The company saw its potentialities, and by an agreement of 1929 with Aktiengesellschaft für Industriegasverwertung (A.F.I.), the German patent holders, Metal Industries was granted licences to use the process in the United Kingdom in return for a payment of £15,000 and a royalty at the rate of 1s. a 1,000 cubic feet. Metal Industries realised the importance and potentialities of the development of liquid oxygen, linked with a policy of large production units, low cost of production, low transport charges and costs and the consequential low selling prices, and it set up a subsidiary, Oxygen Industries Ltd., to work the process and to supply oxygen commercially. Plants were installed first at Rotherham and later at Aston, Birmingham. Between March and July, 1930, A.F.I. asserted that liquid oxygen plant installed at B.O.C.'s Edmonton works infringed the Heylandt patents of which Oxygen Industries were the licensees. B.O.C. thereupon issued a writ claiming an injunction restraining A.F.I. from making threats. In March, 1931, and before the threats action came before the Court, A.F.I. began an action against B.O.C. for infringement of patents. B.O.C. counter-claimed for revocation of the patents.

35. The claim and counter-claim came on for trial in July, 1932, and judgment was reserved.* The threats action had still not been heard. Shortly after the reservation of judgment, discussions began between the directors of B.O.C. and Metal Industries, and an agreement was reached on 29th September, 1932, under which the actions were stayed, Oxygen Industries was wound up, and B.O.C. was assigned twenty-three Heylandt patents and acquired the business of Oxygen Industries and Metal Industries in oxygen, acetylene, carbide, and cutting equipment, together with their oxygen plants except at two sites supplying Metal Industries' own requirements. Both Metal Industries and Oxygen Industries and their directors individually covenanted not to engage in any oxygen, acetylene or gas and cutting apparatus business for a period of twenty-five years. In return, three directors of Metal Industries named in the agreement were elected to the Board of B.O.C., and Metal Industries obtained 325,000 B.O.C. ordinary £1 shares, with an option (which was exercised) of a further 100,000 at par within five

* The British Oxygen Co. Ltd. *v.* Aktiengesellschaft für Industriegasverwertung m.b.H., 48 R.P.C. 130: 49 R.P.C. 121. These references are to interlocutory proceedings. The hearing of the case does not seem to have been reported and the account given above is based on B.O.C.'s records.

years and a payment of £5,000. A special meeting of B.O.C. shareholders approved the agreement in the following month. Of the Heylandt patents acquired by B.O.C., ten related to the production and thirteen to the storage, transport and distribution of liquid oxygen. All had expired by 1946.

36. The total annual output of the liquid oxygen plants at Rotherham and Aston in 1931 is thought to have been about 23 million cubic feet and to have been rising rapidly. The whole of the production from these plants was sold to customers outside the Metal Industries group. B.O.C.'s total oxygen sales for 1931 amounted to 319 million cubic feet. By 1947, Metal Industries had ceased to produce oxygen even for its own needs, though it has continued to operate acetylene generators.

37. Another competitor to enter the oxygen/dissolved acetylene field was Charles H. Bingham, owner of a carbide importing and merchanting business later acquired by B.O.C. In 1925, Bingham floated Industrial Gases Ltd., later British Industrial Gases Ltd., to carry on the business of the manufacture and supply of industrial gases and ancillary appliances. The company is reputed to have had American backing from the beginning, and in 1932 an American firm, the Keith Dunham Company, held a substantial block of the shares. B.O.C. Board minutes of 1933 record that "the subject of the competition was regarded as vital"; and in 1934 B.O.C. acquired the whole of the issued share capital of British Industrial Gases from a representative of Union Carbide and Carbon Corporation of the U.S.A. for about £210,000, of which the sum of £98,839 represented the value of the net assets. This representative had purchased it very shortly before from the Keith Dunham Company, which had by then obtained control of the company, and the shares were transferred direct from the Keith Dunham Company to nominees of B.O.C. At the time of the take-over, British Industrial Gases was operating oxygen gas plants of standard type, not covered by any patents or patent rights, at Liverpool, Manchester and Hackney, with a total annual output of 25 million cubic feet, and dissolved acetylene works at Manchester and Hackney with a total annual output of 10 million cubic feet. The company had shown trading losses since 1931. B.O.C.'s sales of gaseous oxygen and dissolved acetylene for the year 1933 were 413 million and 55 million cubic feet respectively. In 1938 Industrial Gases (Scotland) Ltd. was set up as a subsidiary of British Industrial Gases. The connection between B.O.C. and these companies was not publicly revealed until 1955, and the two companies were operated as ostensible competitors of B.O.C. in the Liverpool, Manchester, Hackney and Glasgow areas where their works are situated. Trading profits were earned by British Industrial Gases from 1935 onwards.

Suppliers of "Customer" and Other Plants

38. Reference has been made in paragraph 30 to small supplies of oxygen becoming available in the first world war from Liquid Air & Rescue Syndicate Ltd. This company was formed in 1913 to acquire from H. Simoniz & Co. certain patents relating to liquid air respiratory apparatus and, according to a prospectus, to develop the use of liquid air which the company hoped to supply to consumers at a profit of 200 per cent. In 1921, the name of the company was changed to Liquid Air Ltd. Its principal business was the sale of gaseous oxygen plants, principally of Heylandt or Messer manufacture, to customers who wished to produce their own supplies of oxygen. Some of these customers produced more oxygen than they required and had arrangements with Liquid Air for the sale of the surplus. A prospectus issued in 1923 inviting additional capital stated that plans included the expansion of the sales of oxygen plants to large consumers and the manufacture and sale of oxy-acetylene cutting and welding appliances and the establishment of oxygen

plants in areas that were badly served, thus eliminating the existing heavy freight charges. It was stated that the average market price of oxygen was 37s. 6d. a 1,000 cubic feet ex-works compared with the cost of 13s. 5d. a 1,000 cubic feet at plants installed by the company, and figures were given to show the large element of freight charges—one-third to one-half—in current market prices. It was claimed that large consumers could save from 50 to 75 per cent. on their costs by installing plant at their works. Shares in the company were taken up by a number of industrial companies, including Peter Brotherhood Ltd., Thos. W. Ward Ltd., The Hughes Bolckow Shipbreaking Co. Ltd., The Ocean Steamship Co. Ltd., Cammell Laird Ltd. and George Cohen Sons & Co. Ltd., some of which appear to have purchased plants for their own use. The profit for 1925 was £8,340 compared with £34 in 1920.

39. Early in 1925, B.O.C. succeeded in an action* brought against Liquid Air Ltd. for infringement of copyright in a letter written by B.O.C. to a customer, Tanks & Drums Ltd. B.O.C. had offered certain favourable terms for oxygen supplies to Tanks & Drums Ltd. on the understanding that the latter would take no part in Liquid Air's plans to erect an oxygen plant at Bradford. Liquid Air procured copies of the correspondence and sent them to a firm of stockbrokers. In B.O.C.'s Board minutes of 1929 there is reference to a suspicion that an understanding might develop between Charles H. Bingham (see paragraph 37) and Liquid Air, and B.O.C. offered the latter £25,000 or an exchange of shares to go out of business. The offer was declined. Meanwhile, Liquid Air's profits had been falling, and it ascribed its losses to the continued general depression in the engineering industries with increasingly intensive competition in the oxygen market. Later in the same year, agreement was reached for the taking over of Liquid Air by B.O.C., and 21,071 B.O.C. shares were exchanged for 84,284 Liquid Air shares. In 1930, the name of the company was changed to Liquid Oxygen Co. Ltd., and no trading has been carried on since. Further reference to the acquisition of Liquid Air is made in Chapter 5.

40. Reference has been made in paragraph 34 to plants of Messer manufacture purchased by Metal Industries and in paragraph 38 to plants of Messer manufacture sold by Liquid Air. In 1927, a private company, Oxhycarbon Ltd., was formed by Messer G.m.b.H. of Frankfurt, to carry on the business of the manufacture and supply of plant and appliances in the United Kingdom in connection with any patents held by the company. In 1934, B.O.C. purchased the Messer interests in Oxhycarbon, and an agreement was concluded whereby Messer undertook not to make, sell or supply oxygen or nitrogen plants or welding or cutting equipment within the United Kingdom and Eire except through Oxhycarbon which was appointed Messer's agent. In 1935 the whole of the shareholding in Oxhycarbon was held for B.O.C. by nominees, and the connection between the companies was not publicly disclosed until 1955.

Suppliers of Oxygen Surplus to their Own Requirements

41. Until the nineteen-thirties, B.O.C. sold little oxygen in the South West of England and South Wales, and had no oxygen works in these areas. Three independent manufacturers making oxygen primarily for their own or their associates' consumption had surplus oxygen which they supplied to buyers in these parts of the country. In 1926, The Plymouth Oxygen Co. Ltd. was formed to take over the business of the manufacture of oxygen carried on by The Plymouth & Devonport Shipbreaking Co. Ltd. In 1930, the Plymouth Oxygen Company sold the whole of its undertaking to B.O.C. as a going concern for the sum of £6,000. Edgar J. Rees Ltd., a firm of scrap metal

* 1925 Ch. 383.

merchants in South Wales, manufactured oxygen for scrap cutting and sold any gas that was surplus to its own requirements. By an agreement of 1934, B.O.C. purchased the tenancy, plant and goodwill of the Rees Company's oxygen business for £8,000, which amount was satisfied by the allocation of 3,265 B.O.C. ordinary shares which, at the request of the Rees Company, were allotted to nominees. The managing director of the Rees Company undertook to keep out of the oxygen business for a period of twenty years. The Rees Company undertook to purchase the whole of its oxygen requirements from B.O.C. for a period of ten years at a price of 20s. a 1,000 cubic feet delivered for the first five years, and thereafter at a price which was to be 5 per cent. lower than the current price charged by B.O.C. to any customer in the same district taking approximately the same quantity.

42. The third of these firms, Thos. W. Ward Ltd. (T. W. Ward), produced and supplied oxygen in a number of areas, including Cornwall. The acquisition of its oxygen interests, which was not affected until 1944, secured for B.O.C. a large and important customer and also put an end to a source of competition which, as B.O.C.'s records show, had caused anxiety to B.O.C. for a long time. As this is the most recent of B.O.C.'s oxygen acquisitions, we deal with it in some detail. T. W. Ward had begun to install oxygen plants in 1922 for the purpose of ensuring regular supplies to its shipbreaking and main scrap manipulating works, and by 1944 it possessed sixteen plants, mostly of Heylandt or Messer manufacture, with a total scheduled annual capacity of about 110 million cubic feet. The plants produced more than T. W. Ward required and the surplus, the amount of which varied according to conditions in the scrap industry, was sold to outside firms. Customers varied from small garages to large steel works and collieries in Yorkshire, Derbyshire and Staffordshire. While T. W. Ward was selling oxygen, it was also purchasing some oxygen from B.O.C. for use on various demolition sites away from the yards where its own oxygen plants were situated. From 1934 there was a sharing agreement between T. W. Ward and B.O.C. whereby the former supplied a part of Cornwall exclusively from its plant at Hayle. Dissolved acetylene and cutting equipment for the area were supplied by B.O.C. and distributed by T. W. Ward from Hayle. At that time, B.O.C. had no plant nearer than Plymouth. There was no general agreement on selling prices between T. W. Ward and B.O.C., but there appear to have been some local agreements on prices for individual customers, particularly during the war.

43. In 1938, B.O.C. offered T. W. Ward £2,500 to cease the manufacture and sale of oxygen, and the sale of dissolved acetylene, in Cornwall. T. W. Ward regarded the offer as inadequate and indicated that an acceptable figure would be nearer £5,000. A B.O.C. Board minute of 29th September, 1938, records that it was considered advisable to maintain the past friendly relations with T. W. Ward, and it was suggested that further discussions should take place with a view to coming to an arrangement whereby T. W. Ward would refrain from manufacturing and selling oxygen in this country. Nothing came of these discussions, however, for in 1940, the position throughout the country with regard to the arrangement concerning T. W. Ward's share of the oxygen business was reviewed by the Board of B.O.C. and it was decided in view of the small amount of business that no alteration should be contemplated. From 1939 onwards, T. W. Ward had been unable to obtain spare parts for its German oxygen plants and there were continual breakdowns. A B.O.C. Board minute of 26th November, 1942, records that it had been learned that T. W. Ward had been inquiring in the U.S.A. for oxygen plants, and in reply to a suggestion that B.O.C.

should supply all the oxygen required by T. W. Ward in return for a complete shut down of its plant, the Board was informed that discussions on those lines had been taking place but that agreement could not be reached. A Board minute of 8th December, 1943, records that "it was reported that there had been a meeting with Mr. Ward at which he had suggested that the Company might take over T. W. Ward's oxygen interests on certain terms. It was considered that the price was much too high to be worthy of consideration, and it was thought that the approach was the result of the recent reductions by the Company in Oxygen prices. It was agreed that there should be a further meeting to discuss the proposal on the basis of £20,000, to include plant, cylinders to become the property of B.O.C., and that Oxygen supplies for T. W. Ward's own consumption should be somewhat higher priced than as suggested by Mr. Ward. It was agreed that, in the event of failure to come to terms, B.O.C.'s policy of reducing prices without agreement with T. W. Ward Ltd. should be continued." In the following month the Board considered "that failing any agreement with Wards in regard to the purchase of their Oxygen interests, it would be desirable to cancel out all previous arrangements with them, including the arrangement whereby they were allowed an exclusive right to sell oxygen, D/A [dissolved acetylene] and apparatus in a portion of Cornwall." T. W. Ward put forward strong objections to these proposals. However, in July, 1944, an agreement was concluded whereby T. W. Ward sold its oxygen business for the sum of £52,000 which represented £11,307 for sundry plant and machinery, £15,137 for 7,425 cylinders and £25,556 for goodwill. It was provided in the agreement that T. W. Ward should purchase all its oxygen requirements from B.O.C. on advantageous terms for a period of ten years and should not be concerned with the manufacture or sale of oxygen or dissolved acetylene in the United Kingdom in that period. Despite the difficulties over the plant, T. W. Ward's sales of oxygen had risen from about 24 million cubic feet in 1939 to about 40 million cubic feet in 1944. In the eleven financial years prior to the take-over, sales averaged 26 million cubic feet or about 23·7 per cent. of the estimated production capacity of T. W. Ward's oxygen plants. By way of comparison, B.O.C.'s sales of industrial oxygen for 1943 totalled 2,563 million cubic feet, made up of 1,184 million cubic feet of gas and 1,379 million cubic feet of liquid. Both parties have told us that at the time of the take-over T. W. Ward's 16 plants were obsolete and in poor condition, but B.O.C. has pointed out that the 7,425 cylinders acquired were a valuable asset at a time of shortage.

Producers of Oxygen for their Own Use

44. During the inter-war years B.O.C. also made agreements with five firms which produced oxygen for their own use. At one time The Caledon Shipbuilding & Engineering Co. Ltd. operated at its Dundee shipyard an oxygen plant which had been installed by Liquid Air. In 1928, B.O.C. purchased the plant for £2,775 and built an oxygen compressing station on ground leased from the Caledon Company. In 1930, B.O.C. purchased a German oxygen plant from The Steel Supply Company of Sheffield for £3,126, and undertook to supply that company with oxygen at 12s. 6d. a 1,000 cubic feet for three years. George Cohen Sons & Co. Ltd. (Cohen) operated oxygen plants at Canning Town and Letchworth, principally to supply its own group of companies, any surplus being sold to outside concerns. By an agreement of December, 1930, B.O.C. purchased Cohen's stocks of cylinders, and Cohen undertook to close its Canning Town plant with the further undertaking that in the event of its sale, a condition would be imposed on the purchaser that it should not be used in the United Kingdom. B.O.C. undertook to supply oxygen to Cohen for a period of five

years at a fixed price, and Cohen was permitted to continue to operate its Letchworth plant and to sell the surplus, for which it was to endeavour to obtain the ex-plant price obtained by B.O.C. in the district. By a later agreement of 1935, new prices were fixed and arrangements were made for the closing down of the plant at Letchworth. However, in the early days of the war, Cohen applied to B.O.C. for permission to resume oxygen production at Letchworth. Permission was at once granted, and the plant is still operating. The plant, which is not of a size to supply more than about one quarter of Cohen's oxygen requirements at Letchworth, is a Messer plant supplied by Oxhycarbon in 1928. Cohen manufactures any spare parts required for it. In 1935, G. A. Harvey & Co. (London) Ltd. sold to B.O.C. a plant which it had bought from Messer: B.O.C. undertook to supply the firm with oxygen at a fixed price for a period of five years. The Hughes Bolckow Shipbreaking Co. Ltd., a company under the control of Metal Industries Ltd., disposed of its oxygen plant at Blyth to B.O.C. in 1939.

Agreement with Linde Air Products Company, U.S.A.

45. By the nineteen-thirties, B.O.C. had developed an important business in equipment for use with medical and industrial gases and was taking an increasing interest in the technique of their applications. In 1936 B.O.C. concluded an agreement with Linde Air Products Company, U.S.A. This company, which had been founded by Carl von Linde (see paragraph 25), was taken over by the Government of the U.S.A. in the first World War, and was later acquired by Union Carbide and Carbon Corporation, New York. The 1936 agreement was of considerable importance in view of the developing use of oxygen in steel fabrication. By it, B.O.C. acquired non-assignable and exclusive licences for the United Kingdom and certain other specified territories under three groups of patents; the first related to the deseaming of steel blooms, billets and slabs, the second to electric welding processes, and the third to the production, storage, transport and vaporisation of liquid oxygen. The effects of this agreement and its successor on B.O.C.'s supply of oxygen, plant and equipment are examined in Chapter 5.

The Saturn Oxygen Company Ltd. and B.O.C.

46. In 1936, a private company, The Saturn Oxygen Company Ltd., which under its present name Saturn Industrial Gases Ltd., is the only other producer and supplier of both oxygen and dissolved acetylene now operating in the United Kingdom, was formed to carry on the business of the manufacture and supply of industrial gases and related apparatus. The founder was Mr. Sidney Allen, a partner in a firm of accountants and a director of a finance company, J. C. im Thurn & Sons Ltd. Saturn's first object was to adopt an agreement which had been entered into between the Commercial Gas Improvement Company of Cleveland, Ohio, the Gas Industries Company of Pittsburg, and Mr. Allen whereby the latter had acquired certain patent rights and other assets from the American companies. The original intention seems to have been to supply imported American propane as well as to manufacture and supply oxygen, but this was abandoned at an early stage, and the Commercial Gas Improvement Company, which had some interest in propane, dropped out. (Saturn did not supply propane until 1944.) The Gas Industries Company was responsible for directing and supervising the erection of the oxygen plants which Saturn was to operate, and the construction was carried out by a small manufacturing company set up for the purpose and then dissolved. Oxygen production was started at Thornaby-on-Tees in 1937, at Glasgow in 1938 and at Sunderland in 1939. In choosing these sites Saturn was influenced partly by the heavy industrial demand in

these areas and partly by local contacts including, in the North East area, contacts with certain distributors of propane. Dissolved acetylene production was started a little later than that of oxygen, beginning at Sunderland towards the end of 1938 and at Glasgow in the spring of 1939. In September, 1938, B.O.C.'s Board minutes record the existence of competition in the Newcastle and Glasgow areas and, two months later, they record the fact that its selling prices in those areas were lower, owing to competition. As already mentioned in paragraph 37, B.O.C. had in the same year set up a new company, Industrial Gases (Scotland) Ltd., as a subsidiary of British Industrial Gases Ltd., to operate in Scotland. Industrial Gases (Scotland) began to produce oxygen and dissolved acetylene in 1939. In that year its average prices for compressed oxygen and dissolved acetylene (excluding cylinder rentals) were, respectively, 21s. 9d. and 94s. 9d. a 1,000 cubic feet as against B.O.C.'s average prices in the country as a whole of 22s. 2d. and 96s. 3d. and British Industrial Gases' average prices of 25s. 7d. and 86s. 3d.

The Supply of Propane to 1939

47. Propane and related hydrocarbon gases, derived both from natural gas and from the "cracking" of petroleum, were first put to industrial and domestic use in the U.S.A. and Canada where the present consumption of these gases for fuel purposes greatly exceeds that of coal gas. Propane was introduced into the United Kingdom by a small private company, Pyrogas Ltd., set up in 1935 by American interests to promote the importation of the gas from the U.S.A., and to exploit a compound additive for its improvement as a cutting gas, which had been patented by an American, Mr. S. H. White. Saturn's original project to supply propane as well as to manufacture oxygen seems to have centred on the acquisition of this company's interests. In 1936, another company, New Process Gases Ltd., was formed by Mr. White and Mr. Eric Lee-Midgley of Sheffield to market propane imported from the U.S.A. In 1938, the American founders of Pyrogas Ltd. formed British Cutting Gases Ltd. which in the following year became associated with New Process Gases by an exchange of shares. Pyrogas Ltd. was wound up in 1942.

48. In 1936, the first production of propane in the United Kingdom began at the Llandarcy refinery operated by a wholly-owned subsidiary of the Anglo-Persian Oil Company (now British Petroleum). This propane was first marketed in 1937 by Shell-Mex & B.P. for industrial purposes. The Anglo-American Oil Company (now Esso) began propane production at Fawley in 1939, and supplied New Process Gases and British Cutting Gases which thereupon ceased to import propane.

49. In 1938, propane was mentioned in "Heads of Agreement" initialled by Shell-Mex & B.P. and I.C.I., which applied principally to butane sold for cooking, heating and lighting, but incidentally affected propane which I.C.I. was not then producing. These Heads of Agreement fixed quotas and confined sales to specified agents, and reflected a productive capacity in excess of the then existing demand and market potential. The butane supplied by the parties was allowed to contain up to 10 per cent. of propane but when propane was supplied by the parties for any purpose other than outdoor lighting, namely for industrial uses (e.g. as a cutting gas), then such supplies were wholly outside the agreement.

The Supply of Oxygen and Dissolved Acetylene in the Second World War

50. The pre-war consumption of oxygen was at the rate of approximately 20 million cubic feet a week and the total capacity was approximately 28

million a week*. The demand rose comparatively slowly in the first eighteen months of the war, and the increase was adequately met by five new liquid oxygen plants installed by B.O.C. before the end of 1940. Demand thereafter increased more rapidly and shortages became acute in the spring of 1941. Lease/lend requisitions were made for three Linde Air Products liquid oxygen plants and for ten thousand 200 cubic feet cylinders, but in the meantime oxygen shortages continued to be serious. All possible Government assistance was given for the provision of spare parts, storage tanks and cylinders. B.O.C. was pressed to bring additional plants into operation in 1942. The lease/lend plants did not get into operation until November, 1943, and then not at full capacity, and demand reached 59 million cubic feet a week at the end of the year. A publicity campaign was initiated by the Ministry of Supply, larger consumers were encouraged to have liquid oxygen evaporators installed, and attempts were made to improve cylinder turn round. The peak of demand of 64·4 million cubic feet a week was reached in March and April, 1945. Special arrangements for oxygen supplies were made in connection with the invasion of Europe and portable plants were used on the Continent. In the event, all the operational demands of the Services were met in full. There were similar cylinder and labour shortages in connection with dissolved acetylene supplies but the main problem was the shortage of calcium carbide, which is dealt with in Chapter 5.

51. In all these activities B.O.C. played a leading and co-operative role. The Ministry of Aircraft Production, however, in March, 1944, had to issue a direction to obtain from B.O.C. information required for a cost investigation. The three lease/lend Linde Air Products plants, which had originally been intended to serve as stand-bys in the ownership of the Ministry of Supply for operation by B.O.C., had in the event to be operated continuously. B.O.C. erected and operated these plants as agents for the Ministry under an agreement dated 17th April, 1943, under which B.O.C. had the right subsequently to purchase the plants at a specified figure. The plants were disposed of to B.O.C. on 1st April, 1944, for a payment of £171,000.

B.O.C. and Saturn

52. In January, 1940, B.O.C. adopted for the first time a national basis for its oxygen and dissolved acetylene prices. Schedules were brought into operation which excluded the very large customers and did not apply to the two areas, Scotland and North-East England, where there was competition from Saturn. A B.O.C. internal memorandum dated 26th August, 1940, gave percentage figures of the trade Saturn handled in these two areas and of its sales to the more important customers, from which it appears that some of the larger users dealt with both companies and that in some cases prices were uniform. In the North-East area, where the average realised price was said to be very low, there was a special list of prices applicable to shipyards and large engineering firms. The memorandum suggested that while it would not be advisable to reduce prices to any of these firms in opposition to Saturn because of the possible repercussions amongst firms who were loyal to B.O.C., small price reductions might be offered to a few customers, who were rather isolated and whose purchases in the aggregate came to over 100,000 cubic feet of oxygen a month, with a view to securing the whole of their business. The memorandum drew attention to the inadvisability of offering price reductions to individual shipyards in the Glasgow area. Reference was made to one firm which purchased 42,000 cubic feet a month of oxygen from Saturn at 15s. a 1,000 cubic feet and a similar quantity from B.O.C. at 15s. 6d. a 1,000 cubic feet. It was pointed out that

* For comparison with consumption in the first World War, see paragraph 30.

B.O.C. could not reduce the price without prejudicing itself with other shipyards loyal to B.O.C., many of which were purchasing greater quantities than 42,000 cubic feet a month at 15s. 6d. or more. It was proposed that prices for oxygen and dissolved acetylene in Glasgow should be, respectively, 5s. and 9s. a 1,000 cubic feet less than the English schedule and that when these prices did not hold the business, the subsidiary company, Industrial Gases (Scotland) Ltd., should "step in and cut further". It was thought that these measures would curtail Saturn's activities in the North-East area and "definitely restrict the operations of our opponents" in Scotland. The Board approved the proposals. By a wartime mutual aid arrangement sponsored by the Board of Trade, B.O.C. from time to time sold oxygen to Saturn in Glasgow and in North-East England, and purchased some oxygen from Saturn in the latter area. Some similar sales were made in the post-war years.

53. In 1941 and 1942 discussions took place between B.O.C. and Saturn on a B.O.C. proposal for the sale of Saturn's share capital and assets to B.O.C.'s dormant subsidiary, Liquid Oxygen Ltd. J.C. im Thurn & Sons Ltd., the majority shareholder in Saturn, was in favour of the proposed sale. However, Saturn's agreement with the Gas Industries Company, Pittsburgh, placed certain restrictions on Saturn in regard to the transfer of its plants to a competitor. B.O.C.'s offer was conditional on the approval of the Gas Industries Company to the transfer of Saturn's plants or on the conclusion of some other "satisfactory" arrangement. B.O.C.'s records show that, in its view, its conditions were not satisfied, and the offer was withdrawn on this ground.

The Supply of Propane in the Second World War

54. As explained in paragraph 48, in 1939 supplies of propane were available from the Fawley refinery of the Anglo-American Oil Company (now Esso) and from the Llandarcy refinery of Anglo-Persian (now British Petroleum), and were marketed respectively by New Process Gases and British Cutting Gases, and by Shell-Mex & B.P. The Llandarcy refinery ceased propane production in 1941. In June, 1940, I.C.I. began propane production from its creosote hydrogenation plant at Billingham, but decided not to engage in distribution, preferring to leave it to a specialist in this field. On 13th August, 1941, I.C.I. and Shell-Mex & B.P. concluded a Propane Agreement (reproduced in Appendix 5), retrospective to November, 1940, to regulate the sale in the United Kingdom and Eire of propane for industrial purposes other than oil refining. This agreement fixed quotas on a different basis from that of the butane agreement of 1938 (paragraph 49), and bound I.C.I. to sell propane for industrial purposes only through Shell-Mex & B.P. The price to be paid to I.C.I. was to be based on Shell-Mex & B.P.'s average selling prices. The quota provisions were meaningless while Shell-Mex & B.P. had no source of supply of its own, and were never operated. In October, 1942, by agreement with the Ministry of Fuel and Power and the Petroleum Board, Esso ceased refinery operations at Fawley. Esso arranged through Shell-Mex & B.P., who were I.C.I.'s sole selling agents for propane, that British Cutting Gases and New Process Gases should obtain their supplies from I.C.I. In 1943, additional and substantial supplies of propane became available from the Ministry of Aircraft Production's new refinery at Heysham. The Ministry of Supply, which then had a general responsibility for the production and distribution of propane for industrial purposes, appointed B.O.C. as the distributor and selling agent for Heysham propane, and B.O.C. thus entered the propane market for the first time. For some time the Ministry had been encouraging the use of propane for cutting in place of dissolved acetylene on account of the shortage of calcium carbide and the

demand for dissolved acetylene, and had pressed the distributors to improve their arrangements. As the outcome of these discussions and at the request of the Ministry, Shell-Mex & B.P. agreed to hand over to B.O.C. from 1st July, 1943, the marketing of I.C.I. propane which it was supplying under the Shell trade name "Propagas" in Shell-Mex & B.P.'s cylinders. Esso's customers, British Cutting Gases and New Process Gases, however, wished to continue trading as independent distributors, and Esso safeguarded their position in the new scheme by arranging with Shell-Mex & B.P. for the latter's agreement with B.O.C. to provide for the continuation of supplies from I.C.I. to these two small distributors. Shortly afterwards, British Cutting Gases also began to draw supplies from Heysham.

55. In 1944, Saturn, already established as a supplier of oxygen and dissolved acetylene in North-East England and the Glasgow area, added propane to its range of sales by acquiring the whole of the issued share capital in British Cutting Gases Ltd., New Process Gases Ltd., Autogenous Gases Ltd., and Augas Northern Ltd. The vendors of British Cutting Gases undertook not to re-enter the propane business within a period of five years. The four companies continued to trade. The propane marketed by the first two named was sold under the trade name "Pyrogas"; that marketed by the last two named contained chemical additives and was sold under the trade name "Super-Pyrogas". The companies also marketed equipment for use with industrial gases and had depots outside the range of Saturn's oxygen and dissolved acetylene activities.

The Post-War Years

The British Oxygen Company Ltd.

56. B.O.C.'s total oxygen sales dropped from the war-time peak of 2,936 million cubic feet in the year 1944 to 2,428 million in 1947 and thereafter rose progressively to 5,372 million cubic feet in 1954 compared with 901 million cubic feet in 1938. Similarly, dissolved acetylene sales dropped from the war-time peak of 315 million cubic feet in the year 1944 to 262 million in 1947, and thereafter rose to 462 million cubic feet in 1954 compared with 125 million cubic feet in 1938. In 1953, 11 customers were receiving gaseous oxygen by direct pipeline from B.O.C.'s works compared with one in 1938, and 657 customers in 1953 had liquid oxygen installations on their premises compared with 168 in 1938. B.O.C.'s propane sales rose from 1,009 tons in 1943 to 2,783 tons in 1945, and to 4,258 tons in 1954. B.O.C.'s Board minutes of the war-time period show that the company, while co-operating with the Government in its policy of encouraging the use of propane, was sensitive to the encroachment of propane on its dissolved acetylene market. Resolutions were also recorded in 1945, 1946, 1949 and 1951 on the desirability of the company securing control of the distribution and sale of propane to the industrial market or of investigating the possibilities of doing so, and in 1953 the increase in sales of propane to the detriment of dissolved acetylene sales was noted. It was also noted that whilst the profit realised on propane was comparatively small, a satisfactory return was obtained from dissolved acetylene. It was stated that there were potential surplus supplies of propane and that strong competition had to be faced. B.O.C.'s present policy in regard to the sale of propane is dealt with in paragraph 209.

57. In the immediate post-war years, experiments undertaken on the Continent and in America into the large-scale use of oxygen in various new processes in steel manufacture aroused considerable interest in the iron and steel industry in this country. For these processes oxygen is required in large

quantity and does not need to be of high purity. In 1947, B.O.C. agreed to co-operate with the British Iron and Steel Research Association and certain steel companies on research into the uses of oxygen in steel production, and in 1948 it subscribed £15,000 towards the cost of experiments which went on for some years. The impact of these developments on B.O.C.'s policy in regard to the supply of oxygen plant is examined in Chapter 5.

58. In 1949 and 1950 the Ministry of Supply gave some consideration to the installation of an air separation plant (not a tonnage plant) to produce nitrogen at the Kenfig carbide factory* which British Industrial Solvents Ltd. was operating as the Ministry's agent, and to supply the oxyen which the plant would also produce to the Abbey Works of the Steel Company of Wales. B.O.C. was among the tenderers for the plant, and it also submitted an alternative scheme under which it would build a works mid-way between Kenfig and the Abbey Works which would supply the two gases by direct pipelines. This alternative scheme was eventually accepted by the Ministry, and an agreement between B.O.C., British Industrial Solvents and the Steel Company of Wales, covering a period of ten years, was concluded on 10th May, 1951. B.O.C.'s first price quotation was reduced in the course of the negotiations and the oxygen prices that were finally agreed were the lowest then charged by B.O.C. to any customer. The price arrangements embodied in the agreement are set out in Appendix 6. The basic price for oxygen was 9s. a 1,000 cubic feet with rebates for quantity so arranged that they also took account of the amount of nitrogen supplied from the same plant to British Industrial Solvents. Any nitrogen produced over and above the requirements of British Industrial Solvents had to be blown to atmosphere, and the scale of the rebates for oxygen ensured that the Steel Company of Wales's credit was reduced by any quantities of nitrogen so wasted. B.O.C. has told us that the cost of the pipeline to the Abbey Works was borne by the Steel Company of Wales.

Saturn Industrial Gases Ltd.

59. In 1947, Saturn purchased the share capital of British Gas & Torch Co. Ltd., and began the manufacture of welding and cutting equipment. In 1948, there were again tentative discussions, initiated by B.O.C., about the sale of Saturn's business to B.O.C. but nothing came of them. Saturn has told us that the uneconomic prices which it had to quote in order to sell its oxygen in Glasgow, allied with some oxygen plant breakdowns, led it to withdraw its oxygen and dissolved acetylene business from Glasgow in 1949. The oxygen plants were transferred to Sunderland where they were needed as stand-bys, and the Glasgow premises and the dissolved acetylene plant were offered and sold to B.O.C. In the same year, Saturn purchased the share capital of Rainville Engineering Co. Ltd., manufacturers of fractional horse-power motors. On 30th December, 1953, Saturn changed its name from the Saturn Oxygen Co. to Saturn Industrial Gases Ltd. and took over the activities of its subsidiaries, British Cutting Gases, New Process Gases, Autogenous Gases and Augas Northern. These companies have since been dormant. Rainville Engineering Company absorbed British Gas & Torch Company; it and H. G. Sanders & Son Ltd., manufacturers of metal extrusions and pressings, a company acquired by Saturn in 1955, are Saturn's only active subsidiaries.

The Propane Producers

60. The refinery at Fawley resumed propane production in 1946. In the same year, propane production ceased at the Ministry of Aircraft Production's

* An account of the setting up of this factory is given in paragraph 141.

refinery at Heysham and in 1948, the refinery was acquired by "Shell" Refining & Marketing. In 1951, in anticipation of the resumption of propane production at the Llandarcy refinery, Shell-Mex & B. P. and I.C.I. reviewed the market sharing arrangements in the Propane Agreement of 1941 (paragraph 54). The parties eventually decided that the agreement was no longer suitable and that they would regard themselves as completely free either to make a fresh agreement or to proceed independently. Since then, there have been no propane market sharing arrangements between Shell-Mex & B.P. and I.C.I. I.C.I. continued to sell propane for cutting gas purposes through Shell-Mex & B.P. until October, 1954, when the arrangement was discontinued, and I.C.I. began to supply B.O.C. and other distributors direct. The distributors had for some years been in direct communication with I.C.I. about the quantities which they wished to collect from Billingham. Shell-Mex & B.P. continued to supply propane for industrial purposes to B.O.C. but resumed its own distribution of propane for other purposes. In 1953, propane production began at the Stanlow refinery of "Shell" Refining & Marketing.

CHAPTER 4 : THE PRESENT ACTIVITIES OF THE PRODUCERS AND SUPPLIERS AND THE EVIDENCE OF USERS

Part I : The British Oxygen Company Ltd.

Structure of the Company

61. The greater part of the B.O.C. Group's trade in industrial and medical gases has until recently been conducted in the name of the parent company, the rest being conducted by the two subsidiary companies, British Industrial Gases Ltd. and its subsidiary, Industrial Gases (Scotland) Ltd. As from 1st October, 1955, the parent company's trading operations in industrial and medical gases and equipment have been transferred to a newly-formed subsidiary, British Oxygen Gases Ltd. This, and other changes made at the same time, have been designed to "complete the segregation of the home operational activity under appropriate Subsidiary Companies" leaving the parent company "free to concentrate attention on the promotion of development and the general guidance of the activities of all Operating Units at home and overseas".

62. At 30th September, 1955, the consolidated balance sheet of the B.O.C. Group showed its net assets to be £35m., of which £2m. represented the interest of outside shareholders in subsidiary companies and £1m. was monies raised by subsidiary companies on loans and debentures. The issued capital at that time consisted of £2½m. of preference stock and over £11m. of ordinary stock: and in May, 1956, the ordinary stock was increased to £17m. by using part of the amount standing to the credit of a share premium reserve in order to issue bonus shares (which were subsequently converted to stock). Particulars of the issued capital and the dividends paid by B.O.C. from 1938 to the present time are given in Appendix 7. At 1st April, 1956, £1m. of the ordinary stock was held mainly by nominees of Metal Industries Ltd. Recently, the Chairman of B.O.C. was also Chairman of Metal Industries, but the companies now have no directors in common. At 30th September, 1955, the issued share capital of British Industrial Gases Ltd. was £125,000 of which £124,995 was held by nominees of B.O.C. The issued share capital of Industrial Gases (Scotland) Ltd. was £20,000 of which £19,997 was held by British Industrial Gases Ltd. These two companies had a common directorate holding the remaining shares in each case. A complete list of B.O.C.'s subsidiary and associated companies is given in Appendix 8. B.O.C.'s interests in the United Kingdom comprise the manufacture and supply of industrial and medical gases and equipment; the manufacture and supply of gas producing plant; the manufacture and supply of "Sparklets" syphons and bulbs and die castings; the manufacture and supply of electrodes and electric welding plant; and the manufacture and supply of chemicals. In 1954, sales of the gases covered by this inquiry amounted to about £9½m. made up as follows: oxygen £5,478,000, dissolved acetylene £3,678,000 and propane £294,000. This represented about two-thirds of B.O.C.'s total turnover in the United Kingdom. Apart from its United Kingdom activities B.O.C. has between 40 and 45 per cent. of its resources employed overseas through subsidiary and associated companies, mainly supplying gases and other products similar to those sold in this country.

63. In 1954, B.O.C. had a Board of eight directors. Most matters were dealt with by the Executive, which consisted of the two Managing Directors, and the Finance, Commercial and Research Directors. From 1st October, 1955, two additional Executive Directors were appointed, making the Board a total of ten directors. B.O.C.'s gases business in the United Kingdom is organised in eight districts, namely:—London (Wembley), London (Green-

wich), Western, Midlands, Lancashire, Yorkshire, North-East and Scotland (with Northern Ireland). There are four senior officers in each district,—the District Manager, and responsible to him, the District Engineer, the District Accountant and the District Sales Manager. They have their own discussions at district level but matters of major policy are referred to the head office in London. Each district contains a number of oxygen works, compressing stations, dissolved acetylene works, and depots, and production and distribution is organised so that every district is self-contained in its normal day-to-day running. Where the need arises, liquid oxygen is transported from one district to another both for supply as liquid and for conversion to compressed gas in cylinders.

64. British Industrial Gases and Industrial Gases (Scotland), which supply gases in parts of London, Liverpool, Manchester and Glasgow only, are organised separately and their activities are examined in paragraphs 79 to 81.

Oxygen: Production

65. The location of B.O.C.'s oxygen works and compressing stations is shown in Appendix 9. The great bulk of the oxygen is now produced by liquid oxygen plants which vary in capacity from 2 to 6 million cubic feet a week. Although B.O.C. held the Heylandt liquid oxygen patents from 1932, it is only since 1951 that it has constructed its own liquid oxygen plants entirely from parts of its own and its sub-contractors' manufacture. Prior to 1951, it imported its liquid oxygen plants from Heylandt or, during the war and immediately after, from Linde Air Products. There are still a few small gas plants in operation, but most of the gaseous oxygen supplied in cylinders is produced by evaporating liquid oxygen, either at works or at compressing stations. B.O.C.'s subsidiary, British Oxygen Engineering Ltd., is responsible for the manufacture and installation of the oxygen plants, though certain parts of the plants are purchased from sub-contractors. B.O.C. holds some 18 patents relating to the production, storage and transport of liquid oxygen, and under an agreement made in 1951 with the Union Carbide and Carbon Corporation, New York, and described in paragraph 121, is licensed to use another 28 patents belonging to Union Carbide's Division, Linde Air Products. The licences are not exclusive to B.O.C. B.O.C. has told us that "none of the patents is of controlling importance in the production, storage and transport of oxygen. They refer more to detailed improvements and refinements." B.O.C. says that it has never been asked to grant licences under its own patents.

66. B.O.C. obtains a small proportion of the oxygen which it supplies (just over 1 per cent. in 1954) from four chemical manufacturers who produce it as a by-product of the electrolytic production of hydrogen (see paragraph 19).

Industrial Oxygen: Distribution

67. As we have explained, B.O.C. supplies oxygen as a gas by pipeline, as a liquid in tanks, and as a compressed gas in cylinders. The two former methods together accounted for about 75 per cent. by volume and about 50 per cent. by value of its oxygen sales in 1954. B.O.C. supplies all its liquid oxygen and over 98 per cent. of its compressed oxygen to customers' premises at delivered prices. In certain areas outside B.O.C.'s delivery boundary and where demand is small and scattered, customers collect their supplies from depots in those areas, and pay a surcharge of 10s. a 1,000 cubic feet above the delivered prices towards the cost of running the depot. B.O.C. undertakes the laying of direct pipelines from its works to the

premises of those customers who receive gaseous oxygen by direct pipeline. It also undertakes the installation on customers' premises of the evaporators and internal pipelines required for liquid oxygen, and the pipelines and apparatus required for cylinder manifolds. B.O.C. retains the ownership of this equipment, which is normally installed and lent free to industrial concerns taking not less than 10,000 cubic feet of oxygen a week. A rental is charged to Government Departments and to customers taking less than 10,000 cubic feet a week or wanting installations for short periods. Customers with equipment on free loan normally provide the tackle and unskilled labour for the original installation and look after the day-to-day maintenance; B.O.C. provides the erectors and periodical inspection.

68. Oxygen cylinders are in sizes ranging between 10 cubic feet and 2,000 cubic feet, and most of B.O.C.'s business is done in the 200 cubic feet size. Except for a number of cylinders belonging to Government Departments, British Railways and a few other customers, B.O.C. owns the cylinders in which it supplies compressed oxygen. B.O.C. owns about half a million oxygen cylinders. It is common practice for the district sales managers to allocate to all customers "floats" of cylinders based on consumption, and only to supply full cylinders against empty ones. As a further inducement to secure the prompt return of empty cylinders, B.O.C. charges rent on those retained for more than one month: the rates are 6d. a week for oxygen cylinders and 1s. a week for dissolved acetylene cylinders.

Medical Oxygen: Distribution

69. Medical oxygen is required by the British Pharmacopaeia to be of a purity of 98 per cent. This standard is, in fact, more than satisfied by B.O.C.'s industrial oxygen, liquid and gaseous, which is all of a purity of at least 99·5 per cent. and there is therefore no difference between "industrial" oxygen and "medical" oxygen at the production stage. However, special precautions against contamination are taken in the filling and handling of medical oxygen cylinders, and in addition, gaseous oxygen used for high flying is specially dried.

70. Medical oxygen is produced at most of B.O.C.'s main oxygen works and compressing stations, and also at three producing nothing but medical gases, and stocks of cylinders are held at works and depots. The distribution of medical oxygen is organised separately from distribution to industry: for most parts of the country, delivery is made in B.O.C.'s own vans.

71. Most medical oxygen is supplied in cylinders of which there are five sizes. B.O.C. owns almost all the cylinders in which it supplies medical oxygen, and the bulk is supplied direct to hospitals. The local managers commonly allocate "floats" of cylinders to hospitals and apply the full for empty rule, but no rent is charged on overdue cylinders. About 150 hospitals have internal pipelines fed by cylinder manifolds, and this equipment was in most cases installed by B.O.C. and purchased outright by the hospital. Supplies are also made to local authorities, to Service Departments and to some 2,250 chemist "stockists" for distribution to nursing homes and for domiciliary patients or to hospitals in emergency. B.O.C. operates a day and night medical oxygen service, and it regards the chemists who act as stockists as part of the service, or supplementary to it. B.O.C. does not own the cylinders in which it supplies gaseous oxygen for high flying to Government Departments, aircraft manufacturers and airlines; it maintains the cylinders and makes a charge for this service. At present, five hospitals are equipped with evaporators to take liquid oxygen; the evaporators are installed and maintained by B.O.C. free of charge. The bulk of B.O.C.'s

supplies of liquid oxygen classed as "medical" (33 million cubic feet out of 34 million in 1953) is supplied to the Air Ministry for high flying.

Dissolved Acetylene: Production

72. Dissolved acetylene is manufactured by B.O.C. at the works shown in Appendix 9. B.O.C. owns two patents, one relating to the production of acetylene from carbide in ingot form as cast, the other to a metal flash-back arrestor for use in charging acetylene cylinders. Neither, we are told, is of any particular importance. The plant is assembled or erected by B.O.C.'s engineering subsidiary; most of the components are obtained from outside contractors. The majority of B.O.C.'s cylinders are massed with a mixture of kieselguhr and charcoal. This process is not protected by patent and is not secret.

Dissolved Acetylene: Distribution

73. A number of customers have systems of internal pipelines which are supplied from cylinder manifolds. These are installed by B.O.C. and lent free when consumption is above 5,000 cubic feet a week. In other cases, a rent may be charged or the equipment may be sold to the customer. B.O.C.'s arrangements for the distribution of dissolved acetylene are similar to those for compressed oxygen; most supplies are made to customers' premises at delivered prices and there is a surcharge of 10s. a 1,000 cubic feet on supplies collected from depots in areas outside the delivery boundary. There are five sizes of cylinder, but the bulk of B.O.C.'s business is done in the 200 cubic feet size.

Propane: Sources

74. B.O.C. obtains supplies of propane for distribution and resale from Shell-Mex & B.P. and I.C.I. The propane, already filled into the cylinders in which it will be delivered to customers, is collected by B.O.C.'s own transport from the refineries at Stanlow and Llandarcy, and from I.C.I.'s works at Billingham. B.O.C. does not break bulk and re-pack. A considerable proportion of the propane cylinders used by B.O.C. belongs to Shell-Mex & B.P.: this arrangement dates from 1943 when, as we have already described in Chapter 3, B.O.C. took over the marketing of industrial propane from Shell-Mex & B.P. B.O.C. has no formal agreement with either I.C.I. or Shell-Mex & B.P. guaranteeing its supplies, but we understand that each of these companies would do its best to meet B.O.C.'s requirements as an established customer for propane for cutting purposes. Shell-Mex & B.P. has an understanding with B.O.C. that it will not, without due notice, revive its pre-war trade in the direct distribution of propane for use with oxygen for industrial purposes. B.O.C. pays the same price of £24 a ton for propane to both I.C.I. and Shell-Mex & B.P., with an additional payment to Shell-Mex & B.P. of £11 a ton for propane supplied (whether by I.C.I. or Shell-Mex & B.P.) in the latter's cylinders.

Propane: Distribution

75. B.O.C. owns about one-third of the cylinders it uses for the supply of propane; these are of the heavy solid drawn seamless type obtained from The Chesterfield Tube Co. Ltd. The remainder are those owned by Shell-Mex & B.P., which are of the lighter welded type. B.O.C. distributes propane to its customers either from its works or other stations or direct from the refineries. As in the case of oxygen and dissolved acetylene, the bulk of supplies are made to customers' premises at delivered prices, and customers who collect supplies from a depot in areas outside the delivery boundary pay a surcharge.

Contract Conditions for the Supply of Industrial Gases

76. In 1954, only 1,575 customers out of a total of 99,438 purchased under period contract terms. In general, these contracts are for a period of twelve months, and prices are based on past and estimated consumption. The form of contract used by B.O.C. is reproduced in Appendix 10. It includes the following clause:

> " 8. *Supplies only to be obtained from the Company*
>
> (*a*) The customer shall not during the continuance of this Contract use or obtain any Gas the subject of this Contract other than that obtained from the Company except for any period during which the Company cannot supply the Customer's requirements under this Contract or arrange for a sufficient supply from elsewhere.
>
> (*b*) If through any cause beyond their control the Company cannot supply for the time being the Customer's requirements under this Contract or arrange for a sufficient supply from elsewhere the Customer shall not have any claim for damages against the Company but shall be entitled to make up the deficiency of supply from such other source as may be available until the Company can resume delivery."

77. The evidence obtained from users shows that a number of B.O.C.'s customers also obtain supplies of gases from Saturn or other suppliers and either amend clause 8 or treat it as inapplicable to them. On the other hand, a number take it at its face value as prohibiting purchases from other suppliers: one user has made the point that it is largely meaningless in the absence of other suppliers on the scale of B.O.C.

78. Other conditions, which B.O.C. states are in the interest of safety and to ensure conformity with statutory regulations, relate to the use of cylinders lent by B.O.C. and of those evaporators, pipelines and manifolds which remain B.O.C. property, namely:

(a) " *Loan of Cylinders*

All Cylinders loaned by the Company are, whilst remaining on loan, for the sole use of the Customer, who shall not re-fill or allow to be re-filled any of the said Cylinders or allow them to be used for any purpose other than for storage or transport of Gas or Gases compressed therein by the Company."

(b) " *Supply of Cylinder Manifold Apparatus*

The Customer shall not be entitled to make any use of the Apparatus other than for the purpose for which the Company supplied the Apparatus."

(c) " *Operation of Apparatus* [*Evaporator*]

The Customer shall not be entitled to make any use of the Apparatus except to draw off and use through the Pipeline the evaporated Gas and shall not place or allow anything to be placed therein other than the Liquid supplied by the Company. The Liquid delivered into the Apparatus is for the use of the Customer through the Pipeline only and the Customer shall not use the same for filling portable Cylinders or containers except as authorised by the Company."

The Subsidiary Companies

79. British Industrial Gases Ltd. and its subsidiary, Industrial Gases (Scotland) Ltd., manufacture and supply compressed industrial oxygen and

dissolved acetylene, and supply propane on a small scale in the districts near their works at Hackney, London; Speke, Liverpool; Trafford Park, Manchester; and Hillington, Glasgow. Industrial Gases (Scotland) supplies some gaseous oxygen by pipeline. It also supplies equipment for use with gases. For some of its compressed oxygen supplies, British Industrial Gases draws liquid oxygen from B.O.C. works. The total sales of the reference gases by British Industrial Gases and Industrial Gases (Scotland) amount to about 5 per cent. by value of the total Group sales of these gases in the United Kingdom.

80. B.O.C. has explained to us that co-ordination of the policies of these two subsidiary companies is secured by close co-operation with the parent company. As already stated in paragraph 37, B.O.C.'s relation to them was disclosed for the first time in April, 1955 when B.O.C.'s Annual Report for 1954 was presented, and the companies were listed amongst the other subsidiaries. B.O.C. has told us that the relationship was already an "open secret", that there was free exchange of higher personnel, that the three companies frequently exchanged customers with the latter's full knowledge and consent, and that the companies' lorries were daily in and out of each other's works. It appears from evidence obtained from users that some customers have been fully aware of the connection, others have suspected it, and others have been quite unaware of it.

81. B.O.C. has told us that the prices charged by British Industrial Gases are more or less the same as B.O.C.'s, but that, as British Industrial Gases does not have any very large customers, the range is different, there are fewer categories, and the average price is higher. It appears from our accountants' investigation that in 1953 the average selling price of British Industrial Gases for compressed oxygen was higher than B.O.C.'s while that of Industrial Gases (Scotland) was lower. From the evidence of users who have bought gases both from B.O.C. and its subsidiaries it appears that in some cases prices charged or quoted were uniform or nearly so, and that in others they were different. B.O.C. has informed us that these two subsidiary companies will continue to be operated separately from the parent company.

Part II: Other Suppliers

82. This part of the chapter deals with the present activities of the companies other than B.O.C. which supply one or more of the gases in the reference.

Saturn Industrial Gases Ltd.

83. In paragraph 46 we have described the formation of the Saturn Oxygen Co. Ltd., later Saturn Industrial Gases Ltd., and the principal features of its subsequent development. Saturn is a private company with an authorised share capital of £300,000 of which 260,000 £1 shares have been issued: 209,750 of these shares are held by Imtas Investment Trust Ltd. which acquired the major part of them from J. C. im Thurn & Sons Ltd. in July, 1947. Imtas Investment Trust is controlled by Marmic Investment Trust Ltd. and the present Chairman of Saturn is also Chairman and Managing Director of both these companies.

84. Saturn manufactures oxygen at its works at Sunderland and Thornaby-on-Tees and dissolved acetylene at its works at Sunderland, and supplies the two gases from both works mainly in the North East area. It has one distributor in Nottingham. It distributes propane throughout England and Scotland, but not in Wales. It also supplies equipment used with the gases (some being of its own manufacture), and some carbide.

85. The company's sales of the gases in 1953, 1954 and 1955 are given in the following table:

	1953	1954	1955
	1,000 cubic feet	1,000 cubic feet	1,000 cubic feet
Oxygen	74,882	77,304	74,990
Dissolved Acetylene ...	4,771	4,587	5,131
	tons*	tons*	tons*
Propane	2,501	2,646	2,814

* 1 lb. of liquid propane yields approximately 8·5 cubic feet of gas.

86. Saturn's oxygen plants are not primarily designed to produce liquid oxygen, and gaseous oxygen only is supplied to customers. In 1953, nearly one-third of the total sales was supplied by pipeline. Saturn's present plants are those originally installed by the Gas Industries Company shortly before the war. After the war, the plants were virtually obsolete, and certain reconstruction has since been carried out incorporating parts designed and manufactured by firms other than Gas Industries. From about 1948 onwards, new parts have been obtained from Linde of Germany. Saturn has told us that prior to the conclusion of the B.O.C./Linde of Germany agreement in 1954 (see paragraph 132) it arranged with Linde that it would always be able to obtain its plant direct from that company, no matter what other arrangement might be made in other directions.

87. Saturn collects its propane supplies in cylinders at Esso's Fawley refinery. Most of it, which is sold under the registered trade name "Pyrogas", is transported to depots at Lymington, London, Birmingham, Manchester, Sheffield, Thornaby, Sunderland and Glasgow. From the depots it is distributed to customers either in the same containers or in smaller ones into which it has been "decanted". The remainder is treated at the Lymington depot with compound chemical additives under licence from the patentee Mr. S. H. White (see paragraphs 47 and 55), and is sold as "Super-Pyrogas" through the same channels as "Pyrogas".

Esso Petroleum Company Ltd.

88. Esso, formerly the Anglo-American Oil Company, was founded by the Standard Oil Company in 1888. Esso now has an authorised capital of £30 million of which £25 million has been issued and is owned by the Standard Oil Company (New Jersey). The original activities in the United Kingdom were the importing and marketing of petroleum products. Refining was added in 1937 by the purchase of the Agwi Petroleum Corporation, which operated a small refinery at Fawley. The refinery was subsequently extended, and a second and larger refinery was brought into production at Fawley in 1951.

89. The Fawley refinery produces a wide range of petroleum products, of which the principal is motor spirit. The raw material is crude oil from the Middle East. This is first separated by distillation into various fractions, some of which are subjected to further processing. The cracking of some of the gas oil fractions designed to produce high octane motor spirit produces a number of gases, including propane, as by-products. Some of the propane—about four per cent. of that actually produced—is separated by distillation, condensed and stored. The rest of the propane is burned with other unseparated gases in the refinery furnaces. Fawley propane contains, on average, about 55 per cent. pure propane and 45 per cent. mixed hydrocarbon gases, and the total propane separated in 1953 amounted

to about 0·09 per cent. of the refinery's output. In recent years Esso's separating facilities for propane have been used to capacity, and it has sold as much as it could produce. To meet customers' needs, Esso has on occasion obtained supplies from the other propane producers when its own production has been stopped for plant maintenance. Propane production is about to be transferred to the new refinery, and Esso has told us that as a result its production capacity will be doubled.

90. Esso does not distribute propane, and its customers take their own cylinders and transport to Fawley to collect their supplies. The principal customer is Saturn. Sales for 1953, 1954 and 1955 are given in the following table :

Quantities in tons

Purchaser	1953			1954			1955		
	Esso production	From other suppliers	Total	Esso production	From other suppliers	Total	Esso production	From other suppliers	Total
Saturn	2,328	82	2,410	2,389	173	2,562	2,490	291	2,781
Lee-Midgley, Whitehead & Co. Ltd. ...	130	—	130	184	61	245	199	71	270
L. Light & Co. Ltd. (for laboratory use)	1	—	1	1	—	1	—	—	—
B.O.C.... ...	—	—	—	(*a*)	—	(*a*)	(*a*)	—	(*a*)
British Transport Commission	—	—	—	(*a*)	—	(*a*)	19	—	19
Total	2,459	82	2,541	2,575	234	2,809	2,708	362	3,070

(*a*) represents quantities less than 1 ton.

From October, 1947, to October, 1952, sales to British Cutting Gases (Saturn's subsidiary) were subject to " Heads of Agreement " which included the provision : " Buyers' total requirements of Propane up to a maximum of 2,000 tons per annum. Sellers to be under no obligation in any event to supply more than ninety-five per cent. of their Propane output to Buyers but within this limit undertake to meet Buyers' requirements as above." This agreement was not renewed. Esso does not regard itself as under an obligation to give Saturn first claim on supplies but tells us that, in view of Saturn's position as its biggest customer, it would always give consideration to Saturn's wishes.

91. Esso has left the development of a market for propane as a cutting gas to its distributor customers. When the propane separating facilities at the new refinery come into production, Esso expects that Saturn will take an additional 10 per cent. and that sales to Lee-Midgley, Whitehead, will increase. It has also been considering the possibility of supplying propane in bulk to Gas Boards. It expects in time to find markets to take up the whole of the increased capacity but will not meanwhile produce to the limit.

The Shell Petroleum Company Ltd.
BP Trading Ltd.
Eagle Oil & Shipping Company Ltd.
Shell-Mex & B.P. Ltd.

92. As we have already explained, Shell Petroleum and BP Trading are producers and suppliers of propane; Eagle Oil & Shipping is a supplier of propane; and Shell-Mex & B.P. is the agent and consignee of all three for the marketing of propane.

93. *The Shell Petroleum Company Ltd.* "Shell" Refining & Marketing Co. Ltd., a non-exempt private company, was incorporated in 1915 under the name "Shell" Marketing Co. Ltd., and its principal objects were to manufacture and market petroleum products. It is one of the wholly-owned companies of the Royal Dutch/Shell Group, its ultimate owners being N. V. Koninklijke Nederlandsche Petroleum Maatschappij (the Royal Dutch Shell Company) and the "Shell" Transport & Trading Co. Ltd. In 1921, its marketing activities were transferred to Shell-Mex Ltd., a predecessor of Shell-Mex & B.P. Until 1948, "Shell" Refining & Marketing's refining activities were limited to the manufacture of lubricating oils and special boiling point spirits, but in that year the processing of crude oils became one of the company's principal activities. At the end of 1955 the company's refinery assets and its production and trading activities were transferred to the Shell Petroleum Co. Ltd., another of the wholly-owned companies of the Royal Dutch/Shell Group. "Shell" Refining & Marketing now operates the refineries at Stanlow, Shell Haven and Heysham as manager, on a fixed fee basis.

94. Propane has been produced commercially at Stanlow since 1953: in that year propane production as a percentage of the company's total production was 0·006 per cent. Commercial production at Shell Haven began in September, 1955. Propane/propylene is produced at Stanlow as a by-product in the cracking operations, the propylene content being largely used in the manufacture of chemicals and motor spirit. Propane delivered for marketing contains appreciable but varying quantities of propylene, the current propane content in the marketed product averaging about 86·5 per cent. Propane currently being delivered ex-Shell Haven for marketing is separated from crude oil and contains virtually no propylene. Deliveries of propane ex-Stanlow for marketing increased from 586 tons in 1953 to 1,410 tons in 1955. Subject to the maintenance of the existing refinery programmes and with facilities available or planned it is expected that the total quantities of propane available for marketing from Stanlow and Shell Haven will shortly substantially exceed the 1955 figure.

95. *BP Trading Ltd.* The British Petroleum Company Ltd., formerly Anglo-Iranian Oil Co. Ltd., and Anglo-Persian Oil Co. Ltd. which was formed in 1909, has world-wide activities and many associates. It has an authorised capital of £120 million of which £113,393,752 has been issued. H.M. Government holds 55·9 per cent. of the ordinary stock and The Burmah Oil Co. Ltd. holds 26·5 per cent. In December, 1954, British Petroleum handed over its production and trading activities to a newly formed subsidiary, BP Trading Ltd., and the parent company is now a holding company only. The refineries at Llandarcy in South Wales, Grangemouth and Pumpherston in Scotland and the Isle of Grain in Kent are owned and operated by other wholly-owned subsidiaries of British Petroleum which pays them for the processing of the oil and the manufacture of the various products.

96. Until recently, Llandarcy was the only one of these refineries at which marketable propane was produced. Propane production began there in 1936, stopped during the war, and was resumed in 1951. Propane production at Grangemouth started late in 1955. Productive capacity at both plants is comparatively small and rising demand in these areas is expected to absorb the whole of the available propane in the future so far as can be foreseen. The propane produced at both refineries contains butane and may contain propylene. In 1953, propane production as a percentage of British Petroleum's total production was 0·012 per cent.

97. *Eagle Oil & Shipping Company Ltd.* is a wholly-owned subsidiary of Canadian Eagle Oil Co. Ltd., and was incorporated in 1912 under the name Eagle Oil Transport Co. Ltd., and acquired its present name in 1931. Its principal interests in the United Kingdom are the transporting and marketing of crude oil and refined products. It has some directors in common with "Shell" Refining & Marketing and Shell Petroleum and the companies work in close co-operation. It is not a producer of propane but supplies, in the quota proportions described below, propane purchased from Shell Petroleum.

98. *Shell-Mex & B.P. Ltd.* was incorporated in November, 1931, as the result of a decision to amalgamate the distributing businesses of Shell-Mex Ltd. (a company set up in 1920 by "Shell" Marketing Co. Ltd. and Anglo-Mexican Petroleum Co. Ltd.), British Petroleum Co. Ltd. (then a company owned by Anglo-Persian Oil Co. Ltd.), and Scottish Oil Agency Ltd. Under a number of agreements dated 31st December, 1931, Shell-Mex & B.P. acquired the undertakings and assets of these three companies (other than the refining business of Shell-Mex Ltd.), and was appointed agent and consignee by "Shell" Marketing Co. Ltd., Eagle Oil & Shipping Co. Ltd. and Anglo-Persian Oil Co. Ltd., for the sale and distribution of oil (excluding certain named products) for consumption in the United Kingdom, the Irish Free State, the Isle of Man and the Channel Islands. The present relationship of Shell-Mex & B.P. to its parent companies is shown in Appendix 11. There are at present eleven directors of Shell-Mex & B.P. Of these, four represent the shareholdings of the Shell Companies and Eagle Oil & Shipping and four the shareholdings of British Petroleum (the successor of Anglo-Persian Oil Co. Ltd.) and five Scottish companies. The remaining three directors are executives of Shell-Mex & B.P.

99. The present agency arrangements for the marketing of oil and its products, including propane, by Shell-Mex & B.P. are substantially those of the agency agreement of 31st December, 1931, which is reproduced in Appendix 12. By this agreement, each of the three consigning companies mentioned in paragraph 98 appointed Shell-Mex & B.P. its sole and exclusive agent for the sale and distribution of specified products in the United Kingdom. Shell-Mex & B.P. was given freedom to fix prices, terms and conditions of sale, and provision was made for the commission payable for its services. An "obligation and right" was placed on the consigning companies to supply products according to the percentage quotas specified in a memorandum to the agreement. A few modifications to this agreement have been introduced from time to time since 1931. The principal modifications which are relevant to the supply of propane are:

(*a*) the provision of precise definitions of the products covered by the general term "scheduled oil" to which the agreement applies;

(*b*) recognition of freedom of supply between the consigning companies, between those companies and other members of their groups, and between members of these groups and those of the Standard/Socony group;

(*c*) arrangements for supply outside the agreement by the consigning companies of goods for use as raw materials for chemical synthesis which are of a quality not normally marketed by Shell-Mex & B.P. (special provisions apply to the mutual notification of inquiries for such supply, to participation rights of the consigning companies, and to the sharing of any resulting business); and

(*d*) the exclusion from the agreement of the supply of refinery gas by pipeline unless it is thought probable that the gas, or a constituent fraction of it, is going to be supplied in liquid form in containers, in which case it qualifies as a "scheduled oil" for the purposes of the agreement.

100. Quotas for the various products covered by the agency agreement are varied by negotiation from time to time. The present quotas for propane are:

Shell Petroleum ("Shell" Refining & Marketing)	34·67 per cent.
BP Trading (British Petroleum)	48·00 per cent.
Eagle Oil & Shipping	17·33 per cent.

The companies' representatives have told us that the present propane quotas must be regarded as "to some extent historical and indeed empirical". Shell-Mex & B.P. passes regularly to the consigning companies, in their quota proportions, the proceeds from its sales* on their behalf, and receives commission at an agreed rate designed to cover distribution costs and to allow a small margin of profit. The consigning companies thus obtain the rewards of Shell-Mex & B.P.'s activities directly from sales, and the parent companies indirectly from their investments in Shell-Mex & B.P. Shell-Mex & B.P. tells us that the purpose of these arrangements is to transfer the return on the sales to the parent and consigning companies in a manner which will be most satisfactory in the light of commercial considerations and taxation requirements. The property in the propane supplied by the consigning companies and marketed by Shell-Mex & B.P. passes direct from the consigning companies to B.O.C. and other customers. In the case of propane purchased from concerns such as I.C.I., Shell-Mex & B.P. buys and sells for the account of the consigning companies.

101. Shell-Mex & B.P. delivers propane to a few consumer customers. B.O.C. and other distributor customers take delivery at the refineries. Shell-Mex & B.P.'s sales of propane and their sources of supply for 1953, 1954 and 1955 are given in the following table:

* These sales now consist almost entirely of Shell Petroleum and BP Trading production: propane sold for the account of Eagle Oil & Shipping being purchased by that company from Shell Petroleum. Supplies bought from an outside source by Shell-Mex & B.P. for resale would be acquired by Shell-Mex & B.P. for the accounts of the three consigning companies in their quota proportions, as was done with I.C.I. propane in recent years.

Quantities in tons

Purchaser	1953			1954			1955		
	From Consigning Companies' Refineries	From I.C.I.	Total	From Consigning Companies' Refineries	From I.C.I.	Total	From Consigning Companies' Refineries	From I.C.I.	Total
B.O.C. ..	1,558	2,225	3,813	2,373	1,525	3,898	2,990	—	2,990
Esso ...	19	62	81	115	109	224	303	—	303
Calor Gas (Distributing) Co. Ltd.	—	—	—	222	—	222	237	—	237
Others ...	23	17	40	109	14	123	275	—	275
Total...	1,630	2,304	3,934	2,819	1,648	4,467	3,805	—	3,805

It will be seen that substantial quantities of propane were obtained from I.C.I. in the first two years in pursuance of the arrangement made in 1941 which ended in October, 1954, and that Shell-Mex & B.P.'s principal customer is B.O.C. The "others" include British Railways. Shell-Mex & B.P. considers that the supplies expected from its consigning companies' refineries are sufficient to satisfy the needs of B.O.C. and other customers, and through the recently acquired subsidiary Bottogas Ltd., it is endeavouring to develop a domestic trade in propane through retail dealers for cooking, heating and lighting, and, also in cylinders, a direct trade for large scale cooking and other fuel purposes. Bulk deliveries in road tank waggons, which are still only in the early development stage, have so far been developed by Shell-Mex & B.P. itself to supply large quantities to industry for fuel purposes. As already mentioned in paragraph 74, Shell-Mex and B.P. has an understanding with B.O.C. that it will not itself develop a business in direct sales of propane for use with oxygen for industrial purposes, e.g. as a cutting gas, without giving due notice of its intentions to B.O.C. It does, however, regard itself as free to quote for supplies for industrial purposes to other distributors. Its sales to Esso, under a "mutual aid" arrangement, are for resale to Saturn, which takes delivery at the Llandarcy and Stanlow refineries.

Imperial Chemical Industries Ltd.

102. I.C.I. was formed in 1926. Its present authorised capital is £220 million, of which approximately £176 million has been issued. The United Kingdom manufacturing interests are carried out in thirteen manufacturing Divisions, but propane is produced only in the Billingham Division. In 1953, propane represented 0·033 per cent. of I.C.I.'s total home and overseas sales.

103. It has been explained in Chapter 3 that I.C.I. began propane production in June, 1940, as a by-product from the hydrogenation of creosote for petrol production at Billingham. Here again, not all the propane actually produced is separated and marketed, some of the gas being used for fuel and some for chemical processes. I.C.I. tells us that the amount of propane recoverable varies with the type of petrol being made, that its own needs for the manufacture of chemicals are generally given priority, but that it believes that it has over the years satisfied its customers' needs. Propane

produced from the hydrogenation plant is of a high degree of purity. Supplies are made direct to two oil companies for use in refining operations. To supplement its propane, I.C.I. sometimes adds propylene produced as a by-product from its naphtha cracking plant at Wilton, of which the main product is ethylene. Most of the separated propylene is used for chemical synthesis, and only about 3 per cent. or less of production is added to Billingham propane; the amounts added at any particular time depend on the demand for commercial propane, the current output of the Billingham plant, and I.C.I.'s other uses for propylene, and thus the propylene content of I.C.I.'s commercial propane may vary widely.

104. The greater part of I.C.I.'s propane production is supplied to customers who take delivery at Billingham. I.C.I. has never owned cylinders for the distribution of commercial propane. The pure propane required for oil refining is delivered by I.C.I. to "Shell" Refining & Marketing in cylinders and to Mobil Oil Company Ltd., formerly the Vacuum Oil Company Ltd., in I.C.I.'s own rail tank waggons. Sales in 1953, 1954 and 1955 are given in the following table:

Quantities in tons

Purchaser	1953	1954	1955
B.O.C.	—	364	1,763
Shell-Mex & B.P. Ltd.	2,304	1,648	10
Other Distributors	—	—	78
"Shell" Refining & Marketing Co. Ltd. ...	160	199	128
Mobil Oil Co. Ltd. (formerly Vacuum Oil Co. Ltd.)	479	830	830
Other Consumers	—	9	5
Total	2,943	3,050	2,814

105. I.C.I. has told us that it has informal understandings with B.O.C. and with the oil companies that it will do its best to meet their requirements, estimates of which it receives at the beginning of each year. It would be prepared to supply new customers subject to supplies being available. It has told us that there is a growing market for pure propane in bulk for oil refining and that its sales have increased steadily over the last few years: it does not, however, expect to experience any increased demand for propane for cutting and other industrial processes, and it has neither undertaken any research into such uses, nor tried to develop the market. It has taken part in discussions with British Railways and with Gas Boards about the use of propane as a fuel.

The Smaller Suppliers

106. The gases are also supplied by the firms mentioned in paragraph 19: only the more important of these suppliers need be mentioned again here. *Lee-Midgley, Whitehead & Co. Ltd.*, Sheffield, was formed in 1951 by Mr. Eric Lee-Midgley (whose previous interests in propane distribution have been described in paragraphs 47 and 55), and Mr. L. G. Whitehead. The principal business of the company is the distribution of propane and the supply and repair of cutting and other equipment. It operates in an area roughly as far south as Corby and as far north as Halifax, owns its own cylinders and draws its supplies from Esso. Sale of propane in 1953 amounted to 150 tons, in 1954 to 257 tons, and in 1955 to 277 tons. *Lea & Son (Runcorn)* Ltd. has been producing and supplying oxygen at Runcorn since 1899, and supplies oxygen principally for welding and cutting and a small amount for medical purposes. Sales of oxygen of its own production in

recent years have been constant at about 4½ million cubic feet, and sales of dissolved acetylene (bought from B.O.C.) have been constant at about 200,000 cubic feet. *The Gas Accumulator Company (United Kingdom) Ltd.*, Brentford, specialises in the manufacture of automatic marine navigation light apparatus, and produces dissolved acetylene of the standard necessary for use in the apparatus. For economy of production, a constant load is maintained on the plant, and the gas generated in excess of marine requirements is sold for industrial use. Industrial sales in 1953 amounted to 980,873 cubic feet, and in 1954 to 1,143,375 cubic feet. The principal business of *Calor Gas (Distributing) Co. Ltd.*, London, W.1, is the supply of bottled fuel gas for cooking, heating and lighting. The bulk of the gas supplied is butane but supplies are supplemented from time to time with propane obtained from Esso, I.C.I. or Shell-Mex & B.P. Sales of propane in 1953 amounted to 43 tons, in 1954 to 135 tons and in 1955 to 166 tons.

Part III : The Evidence of Users

107. B.O.C. supplied us with the following analysis of its sales of oxygen, dissolved acetylene and propane in 1953 according to type of consumer:

	Oxygen per cent.	*D.A.* per cent.	*Propane* per cent.
Steel Industry—all purposes other than processing	30	8	13
Steel Processing	5	—	—
Shipbuilders and Marine Engineers ...	10	16	20
General Engineers	12	19	12
Electrical Plant Manufacturers ...	3	5	1
Car Manufacturers	4	7	4
Aircraft Manufacturers	1·5	2	—
Scrap Cutting	7	7·5	27
Public Contractors	1	0·5	1
Railways	3	4	3
Coal Board	1·5	2	4
Gas and Electric Authorities	0·5	1	—
Medical Oxygen—Hospitals, etc. ...	2	—	—
Miscellaneous, including Garages ...	18	25·5	11
Government Departments	1·5	2·5	4
	100	100	100

108. We used this analysis as a general guide in selecting users to approach for information and evidence. We invited the principal trade associations concerned to submit evidence if they wished, and consulted them about the selection of representative users. Two associations, the Shipbuilding Conference and the British Constructional Steelwork Association, undertook the task of issuing questionnaires to their members and submitted memoranda based on the returns they received. In addition to industrial users, we approached a number of Government Departments, nationalised industries, local authorities and hospitals. A summarised list of users who gave information and evidence is given in Appendix 2. Users were asked for information about the quantities of the gases purchased and the prices paid in 1953 and the processes for which the gases were used. Their comments were invited on the present arrangements made by the suppliers, including the level of prices. The comments and criticisms mentioned in this chapter were made in response to these inquiries. In all, 469 returns were received of which 285 were submitted direct to us, 70 were collected by the Shipbuilding Conference and 114 were collected by the British Constructional Steelwork Association. The returns covered every category of user, and although we were only able to approach a relatively

low proportion of the smaller users we see no reason to doubt that the returns as a whole provided us with a fair cross-section of user opinion.

109. Of the 285 users whose returns were submitted direct to us, 102 had no comments to offer on the present supply arrangements or the level of prices. One hundred and thirty expressed their general satisfaction, and nearly half of this number expressly commended B.O.C.'s supply arrangements and services. Thirty-four, including 10 hospitals, commented adversely on B.O.C.'s arrangements for the supply of oxygen in cylinders: the difficulties mentioned were the alleged shortage of cylinders, the "full for empty" rule, and the difficulty of obtaining increased supplies. Of the 114 members of the British Constructional Steelwork Association, 62 had no comments to offer on the present supply arrangements or the level of prices. Of the 52 who commented, 23 expressed their general satisfaction and 14 indicated that they obtained excellent service from the suppliers. Thirteen indicated that they experienced difficulties in regard to the supply of oxygen in cylinders and 4 expressed dissatisfaction with the distribution arrangements. The Shipbuilding Conference did not refer directly to a shortage of cylinders but said that "the main difficulty mentioned by several firms is that supplies are often restricted to a 'one full for one empty cylinder' basis". There seems no doubt that at the time the returns were made (in the last three months of 1954 and the first three months of 1955) difficulties over the supply of oxygen in cylinders were fairly widespread, but such evidence as we have suggests that the position has improved since the returns were made: indeed a number of the firms whose returns were submitted direct to us and who commented adversely on B.O.C.'s arrangements subsequently informed us that they were now satisfied with the service. There were no adverse comments on Saturn's supply arrangements or prices amongst the proportionately few returns received from firms who were customers of Saturn, and some of these firms commended the service they received.

110. Forty-four of the users whose returns were sent direct to us commented on prices in the general sense that the absence of competition made it impossible for them to assess the reasonableness or otherwise of B.O.C.'s prices. A smaller number said that prices were reasonable, or seemed to be reasonable, but the majority of those who said they were generally satisfied with the present state of affairs made no specific comment on the level of prices. One company said of Saturn that "we make it a definite policy to support this firm as we well realise what might happen if they went out of existence", and another company which bought both from B.O.C. and Saturn considered that it "owes a good deal to having an alternative source of supply which has had a considerable effect on the price of oxygen, dissolved acetylene and propane". The Shipbuilding Conference stated that "the majority of replies described the present supply arrangements as good, satisfactory or excellent or offered no comment. There are one or two remarks to the effect that in view of B.O.C.'s high profits the gas prices could well be reduced and reference is also made to the absence of competition between suppliers". Thirteen members of the British Constructional Steelwork Association stated that they considered that the prices charged were reasonable and 6 commented in the sense that they considered that the prices charged were on the high side.

111. The largest individual quantities of oxygen are taken by the largest steel firms, and in 1953 six of the biggest users (individual companies or associated groups of companies) together accounted for nearly 24 per cent. of B.O.C.'s total sales of oxygen. The evidence received by us direct included returns from 41 firms in the iron and steel industry (including steel

processing). The evidence of these firms has been included in the preceding analysis, but we give the following separate analysis of their comments since this is the branch of industry consuming most oxygen and further substantial increases in consumption in it are expected. Eleven of the firms had no comments on the present arrangements or the level of prices. Twenty-one said they were generally satisfied and six of these expressly praised B.O.C.'s service. Three mentioned difficulties over the supply of cylinders and the float system. One firm said that the price level seemed reasonable and another that no doubt the prices were equitable; two considered that B.O.C.'s prices were high; one said that it was more or less in B.O.C.'s hands in the matter of price; one said that it had no means of comparing prices; one had a definite policy of buying part of its requirements from Saturn and said that Saturn's prices were lower, and the comment of another firm on the advantages of having an alternative source of supply is quoted in the preceding paragraph.

112. The evidence of the users of propane amongst those who submitted returns suggests that its use may well continue to increase, partly as an alternative to dissolved acetylene in cutting and deseaming, partly in the newer processes such as metal spraying, and partly because of expansion in certain industries that are substantial users of industrial gases. Propane is supplied as a liquid gas under pressure and is sold by weight. We understand that 1 lb. of liquid propane yields approximately 8·5 cubic feet of gas, although the yield may vary slightly from consignment to consignment. In 1953, B.O.C.'s average price for propane was 7·3d. a lb. This works out at a price of 71s. 9d. a 1,000 cubic feet compared with B.O.C.'s average price for dissolved acetylene of 147s. 9d. a 1,000 cubic feet. However, a number of factors require to be taken into account in making any price comparison between propane and dissolved acetylene, including the efficiency of each gas and the quantities of oxygen required for particular operations. Comments on the relative merits of propane and dissolved acetylene, for processes in which the gases are alternatives, varied but the majority of the users who commented considered that propane was cheaper in use than dissolved acetylene, and some of these considered that propane had the additional advantages of being safer and less liable to backfire and of being more easily handled. None of the users said that dissolved acetylene was cheaper but several preferred it for speed. For cleanness of cut, some users preferred dissolved acetylene and some preferred propane. On the relative merits of gas welding and electric welding, the evidence received suggests that the use of electric welding is increasing and tending to replace gas methods for work in thicknesses of more than $\frac{1}{8}$ in. to $\frac{1}{4}$ in. but that gas methods are used almost entirely with the thinner gauges and with non-ferrous metals and cast iron. In the matter of costs, the evidence shows that, in general, the cost of welding is a relatively small item in the final cost and that where gas and electric methods are alternatives, the choice is to a large extent dependent on personal preference.

CHAPTER 5: THE SUPPLY OF PLANT, EQUIPMENT AND RAW MATERIALS

Oxygen Plant and Equipment

113. As will have been seen, an important alternative to the purchase of oxygen for industrial use is the manufacture by the user of his own oxygen. The extent to which this is feasible and economic depends upon a variety of circumstances, but one of the chief factors is the ready availability of suitable plant at an economic price. For a full understanding of the present position in this respect it is necessary to look back at least to the inter-war period and to the steps which were taken to market "customer"* plants in the years after the first war. At the end of the war B.O.C. was virtually the sole supplier of oxygen and few consumers were producing oxygen for their own needs.

114. "Customer" oxygen plants of Messer or Heylandt manufacture were on the market here in the early 1920's, and in 1923 a B.O.C. Board minute records that "it had been claimed that Wards had erected 14 oxygen plants at the most important of their works in order to produce oxygen for metal cutting and that in the aggregate these plants were capable of producing 75,000 cubic feet of oxygen per annum. This was thought to be an exaggeration but it was undeniable that German plants were finding their way into the country in spite of vigorous counter propaganda by B.O.C. The view was expressed that these plants were the outcome of the temporary boom in shipbreaking and that to retain the bulk of that business it would be necessary for B.O.C. to lower the selling price of oxygen and that in fact owing to the exaggerated claims of the German agents and the cheap price of the plants, B.O.C. were continually being compelled to meet their customers in the matter of price in order to hold the trade". This competition came mainly from two firms, Liquid Air Ltd. and Oxhycarbon Ltd., the British subsidiary of Messer.

115. *B.O.C. and Liquid Air Ltd.* Liquid Air Ltd., whose activities we have described in paragraphs 38 to 40, set out in about 1923 to sell "customer" oxygen plants in competition with B.O.C.'s supply of oxygen. By the time that it was taken over by B.O.C. in 1929 Liquid Air had sold about thirty such plants: some were of its own manufacture and others were Messer or Heylandt plants. Some of the plants sold were later acquired from the buyers by B.O.C. There is no record that Liquid Air owned or operated any patents; certainly none were acquired from it by B.O.C.

116. *B.O.C. and Messer (Frankfurt).* The other company which was selling "customer" oxygen plants at about this time or later was Messer. G.m.b.H. of Frankfurt, through its British subsidiary Oxhycarbon Ltd. It is not known precisely how many plants were sold by Oxhycarbon prior to its acquisition by B.O.C. in 1934, but we were interested to learn that British Railways are still operating at Swindon a Messer plant which produces approximately 19 million cubic feet of oxygen a year and which has given satisfactory service since it was installed in 1929†. Since 1934 no Messer plants have been supplied to outside firms through Oxhycarbon, which has since that date held the exclusive agency for the supply of Messer plants in this country. B.O.C. has told us that since 1934 Oxhycarbon has never had

* See footnote to paragraph 31.

† B.O.C. has pointed out to us that British Railways, Swindon, have taken regular supplies of cylinder oxygen from B.O.C. and, in addition, have tank facilities loaned by B.O.C. to take supplies of liquid oxygen when the Messer plant is not working.

a request for one and that there has been virtually no demand for " customer " plants. A plant was supplied to B.O.C. in 1939 for erection at its Rotherham works, and certain delays and difficulties occurred because a part of the plant had to be returned to Germany. A B.O.C. Board minute of 27th July, 1939 recorded, apropos of these delays, that " the question of withholding payment of monies due to Messer & Company pending settlement of this matter was fully discussed and it was resolved that no action be taken which might endanger the Company's control of the sale of oxygen plant in its territories as covered by the German agreements ". Some of the plants sold by Oxhycarbon prior to 1934 were later acquired from the buyers by B.O.C. Nine Messer plants were amongst the sixteen plants acquired by B.O.C. from T. W. Ward in 1944 (see paragraphs 42 and 43), but it is not known whether these were supplied in the first instance by Liquid Air or by Oxhycarbon, or some by each. An agency agreement concluded with Messer in 1950, which is the successor to the agency agreement of 1934, gives Oxhycarbon sole selling rights in the United Kindom and certain other countries for oxygen and nitrogen producing and compressing plants and all other apparatus and equipment manufactured by Messer. B.O.C. has used this agency to market, through Oxhycarbon, light equipment such as regulators, blowpipes and small cutting machines of designs different from those marketed by B.O.C. B.O.C. has told us that Messer is primarily engaged in the manufacture of the smaller types of oxygen plants—not the new tonnage sizes. We understand that Linde of Germany* now has an interest in Messer and a director on its Board.

117. *B.O.C. and Heylandt.* From 1932 until the expiry of the Heylandt patents relating to the production, transport and storage of liquid oxygen, B.O.C. had the exclusive right to sell plant embodying such patented features. The basic Heylandt patents expired before 1939 and, as we have mentioned in paragraph 35, all had expired by 1946. B.O.C. did not sell any plants protected by the Heylandt patents between 1932 and the war. In explanation, it has pointed out to us that liquid oxygen plants are essentially plants for the supplier of oxygen and not for the consumer, who wants oxygen as gas and not as liquid ; and that the only oxygen supplier who appeared on the scene after 1932 (that is, Saturn) was not interested in acquiring Heylandt plants. We understand that in 1928, Linde of Germany acquired an interest in and concluded an agreement with the principal Heylandt company, Aktiengesellschaft für Industriegasverwertung, and that before the war both this company and Heylandt Gesellschaft für Apparatebau, manufacturing plant and evaporators respectively, were absorbed by Linde of Germany.

118. *B.O.C. and L'Air Liquide.* B.O.C. has maintained business relations with L'Air Liquide since its acquisition of the Claude patents in 1909 (paragraph 26). In 1928, the two companies were in close touch over the Heylandt patents relating to the transport of liquid oxygen. Heylandt had proposed that B.O.C. and L'Air Liquide should have an exclusive licence for two years against the payment of 425,000 marks and the right to take material to the value of 400,000 marks, payments to be in the proportion of 29 from B.O.C. to 71 from L'Air Liquide. However, nothing came of the proposal, for as we have described in paragraph 34, the rights in the Heylandt patents were acquired in 1929 by Oxygen Industries. In 1928, L'Air Liquide had proposed a price agreement with B.O.C., but B.O.C. refused to consider the proposal and said it would be prepared to consider the acquisition of L'Air Liquide. Agreements between the two companies were concluded in 1929,

* See paragraph 25.

1930 and 1933 covering a variety of matters, including the following arrangements. B.O.C. was granted an exclusive licence for three years to use the process of L'Air Liquide in the British Empire, excluding Canada, under a royalty arrangement, and B.O.C. agreed to refer to L'Air Liquide any inquiries for oxygen plant to be installed outside this territory. There was an arrangement for the exchange of constructional drawings relating to liquid oxygen plant and for the payment by B.O.C. of £1,000 a year for five years as a contribution towards practical experiments. B.O.C. has told us that it did not have any agreement or understanding with L'Air Liquide restricting the supply of oxygen plant in the United Kingdom. Subsequent negotiations between B.O.C. and L'Air Liquide have related, amongst other matters, to the exchange of technical information.

119. *B.O.C. and Linde Air Products Company, U.S.A.* B.O.C. has been interested in other types of equipment used with oxygen. Reference has been made in paragraph 45 to an important agreement concluded in 1936 and covering a period of fifteen years from 1st January, 1937, between B.O.C. and Linde Air Products Company, U.S.A., which gave B.O.C. non-assignable and exclusive licences for the United Kingdom and certain other countries for three groups of patents. The first group related to the deseaming process, the second to electric welding processes, and the third to the production, storage, transport and vaporisation of liquid oxygen. B.O.C. paid a lump sum of £25,000 on the execution of the agreement and in the twelve years to 1948 a total of £142,766 for royalties, £36,000 for the liquid oxygen licence fees* and £13,716 for expenses in maintaining the patent rights.

120. B.O.C. has told us that the main advantages to it of the agreement "lay more in the deseaming sphere and to a lesser extent in the electric welding sphere" than in the liquid oxygen sphere. With regard to the value of the liquid oxygen patents, B.O.C. has explained to us that liquid oxygen production was still in its infancy in 1936, but the directors saw its tremendous potentialities and consequently were impressed by the progress made by Linde Air Products in that field. "In retrospect, the early Linde Air Products patents in the liquid oxygen field cannot be ranked higher than the current patents which we own and the Linde Air Products patents which we are currently licensed to use." B.O.C.'s licence did not allow it to supply oxygen plants embodying Linde Air Products patents except to its own subsidiaries or to Government Departments. B.O.C. has told us that during the currency of the 1936 agreement it could have offered an equally efficient plant without infringement of the terms of the licence, and that the restrictions on the sale of apparatus embodying the Linde Air Products patents has had no effect on its sales of plant.

121. An agreement concluded in 1949 between B.O.C. and Linde Air Products, which covered a period of ten years, granted B.O.C. a non-exclusive licence under patents relating to the dry generation of acetylene and to contouring (a metal cutting process), and an exclusive non-assignable licence under patents relating to pressure welding, stress relieving and "Heliarc" welding. Two new agreements in succession to the liquid oxygen and deseaming sections of the 1936 agreement were concluded in 1951 between B.O.C. and Union Carbide & Carbon Corporation (through its Division, Linde Air Products Company). One of these agreements granted B.O.C. a

* It appears that Linde Air Products had some obligation to a German company in respect of the liquid oxygen patents and the licence fee of £3,000 per annum was included in the agreement to cover payments by Linde Air Products to this German company. In view of the ultimate destination of some of the money B.O.C. suspended payments to Linde Air Products from September, 1939 until the U.S.A. entered the war.

royalty-free non-assignable non-exclusive licence under a group of patents and patent applications relating to the production, storage and vaporisation of liquid oxygen and contained provisions restricting the sale of apparatus embodying those patents to subsidiaries of B.O.C. and to Government Departments. B.O.C. has told us that the agreement is of indefinite duration. The other agreement concluded in 1951 granted B.O.C. a non-exclusive non-assignable licence under a group of patents relating to inventions, improvements and developments relating to powder cutting, powder descarfing and deseaming metal products by the use of oxygen. B.O.C. was permitted to make, to use and to sell embodiments of the patents and to practise the inventions disclosed in the patents for a period of ten years. Sub-licences were to be granted only to subsidiaries of B.O.C. The royalties payable by B.O.C. under this licence are at the following rates: (*a*) 7½ per cent. of gross receipts from sales of equipment and materials covered by the patent rights; (*b*) 5 per cent. of sales of oxygen for use with equipment and for use in the practice of processes covered by the patent rights, and (*c*) 7½ per cent. of the amount received as rental or licence fees for the use of equipment and practice of processes from purchasers or lessees and/or licensees. B.O.C. has told us that (*b*) applies to sales of oxygen for use with both hot and cold deseaming equipment.

122. B.O.C.'s acquisition of the deseaming licence in 1936 introduced that process into this country, and B.O.C. has told us that "the deseaming process was something new . . . the installation of a mechanical deseaming machine was a great innovation in the steel industry. . . . We recognised its potentialities in the early days because of the benefits it conferred on the steel industry and also the fact that it was the means of increasing the demand for oxygen". Under the 1936 and 1951 agreements B.O.C. has imported and rented to a few steel companies hot deseaming machines on conditions which require that B.O.C. gases only (oxygen and, where required, dissolved acetylene or propane) are used with them. These machines are costly and are made to meet the particular requirements of each customer. B.O.C. has told us that the rental agreements provide for free service and that it is a "matter of mutual convenience that customers using the deseaming process agree to take supplies of gas from the B.O.C. rather than reimbursing us for the service we give by operating on a royalty basis". The first hot deseaming machine to be used in this country was ordered in 1939. In 1954 six machines in all were rented by five steel companies under contracts of from five to seven years duration with extensions in some instances. B.O.C. has told us that a rental is charged for each machine which over the years covers its cost and that the rental does not include anything for the royalty payable to Linde Air Products in respect of oxygen used with the machine. The property in the machine does not pass to the hirer. Hand cold deseaming torches were at first imported by B.O.C. for resale, but B.O.C. now manufactures them for sale and says that there are about 400 in use in steelworks up and down the country. B.O.C. describes the price of the torch as nominal and gives no free service with it. The quantities of B.O.C. oxygen used in the hot and cold deseaming processes in 1954 were 123 million cubic feet and 575 million cubic feet respectively, or, together, 698 million cubic feet which represented about 13 per cent. of B.O.C.'s total sales of 5,246 million cubic feet of industrial oxygen.

123. Deseaming machines and deseaming torches are obtainable in the United Kingdom only from B.O.C., but B.O.C. has told us that there is nothing to prevent other manufacturers from making deseaming appliances so long as the Linde Air Products patents are not infringed, and that to

the best of its knowledge it has never had occasion to issue written or verbal warnings of infringement of current patents. The Managing Director of a firm of manufacturers of cutting and welding equipment, however, told us that "in 1948 we made a prototype deseaming torch which was tested satisfactorily at one or two steel works. The British Oxygen Co. Ltd. then pointed out to us that they considered it infringed certain patents in which they were interested and asked us to discontinue manufacture. As we did not want to risk the possibility of having to fight a patent action we did so. As our other lines have kept us working at full pressure ever since, we have not gone any further into the patent question at the present date". When we asked B.O.C. about this incident, B.O.C. said that its Sales Manager had drawn the attention of the Managing Director of this firm to the fact that he had heard that the firm intended marketing deseaming torches and pointed out that the B.O.C. deseaming torch was covered by Linde Air Products patents. B.O.C. added that there was no threat of any nature; it was just a friendly conversation.

124. *B.O.C. and Siebe Gorman & Company Ltd.* An agreement concluded with this company in 1946 gave it the sole selling rights for B.O.C. underwater cutting equipment and deep-sea diving apparatus. In return, the company agreed (*a*) not to sell oxy-hydrogen cutting equipment other than that supplied by B.O.C.; (*b*) to refer to B.O.C. all users of the equipment for supplies of compressed gases for use with it; (*c*) to refer to B.O.C. all inquiries for industrial oxy-acetylene and oxy-hydrogen welding and cutting equipment and supplies of compressed gases. We understand that the agreement is of little commercial significance.

125. *B.O.C. and the Supply of Tonnage and Standard Size Oxygen Plants.* We have already noted in Chapter 1 the important post-war developments in the new uses of oxygen by the iron and steel industry for which oxygen is required in "tonnage" quantities, that is, large enough to be reckoned in tons. Originally, the terms "tonnage" and "low purity" (or sometimes "medium purity") were used interchangeably in relation to plant but present day tonnage plants are designed to produce high purity or medium purity gaseous oxygen as required. We understand that the change is due in a large measure to Linde of Germany, which before the war had devised the Linde–Fränkl process for the cheap production of medium purity tonnage oxygen and has since made great advances in this field. Linde of Germany has stated in a recent publication*, in a passage devoted to the development of tonnage oxygen, that up to the 1939–45 war an exchange of patents existed between it and L'Air Liquide of Paris and Linde Air Products of New York.

126. For many years, it was B.O.C.'s policy not to supply oxygen plants to other users in the United Kingdom, the only exceptions being Government Departments, and I.C.I. which does not use its oxygen production for cutting and welding. Since the war, however, this policy has been modified in important respects, mainly in connection with tonnage plants. B.O.C.'s Board minutes and memoranda illustrate this development. A B.O.C. Board minute of 31st October, 1945, recorded that "it was agreed, taking all the circumstances into account, that the present policy of confining the manufacture of Oxygen Plants to orders received from specially selected customers should be continued. Specially selected customers comprised those who were located in areas, other than Europe, which could not be supplied from our own Overseas Companies and where Oxygen was required for internal use, and before any order was accepted the position would be

* Fifty Years Linde Oxygen Plants: Gesellschaft für Linde's Eismaschinen A.G.

agreed with other Overseas Subsidiary Companies whose works were nearest to the point at which the new Oxygen Plants were intended to be located. It was noted that certain inquiries had been received from European countries and in those cases, it was decided that the Company should refrain from quoting as it had not previously been our policy to sell in European markets and a continuance of this policy in Europe was the one most unlikely to react to our disadvantage when more settled conditions in that area had been attained." Shortly afterwards, however, on the 5th December, 1945, " it was decided to modify the ruling with regard to European markets, and to leave a decision relative to such inquiries to the Management Committee as circumstances might arise which would make it advisable for the Company to submit tenders ".

127. Shortly after the war B.O.C. began the designing of large scale plants of the Linde–Fränkl type with improvements to reduce power consumption and capital cost. In 1947 it agreed to co-operate with the British Iron and Steel Research Association in a programme of trials carried out at various steel works, and to supply free of charge equipment and gases for initial research and experiments. A B.O.C. Board minute of 22nd October, 1947, recorded that " it was agreed that the policy of the Company should be to retain ownership of any plants eventually installed in steel works, to be operated by the Company, and to sell the Oxygen to the consumers ". In the same year, negotiations were opened for the purchase for experimental purposes of a 20 tons a day Linde–Fränkl plant manufactured by Linde of Germany. The plant was obtained but was never erected, and B.O.C. has told us that the reason was that B.O.C. developed a superior design, which it named the " Rescol–Air " process. On 14th January, 1948, it was recorded that " the development of Low Purity Oxygen was a very important one to the Company in view of the potential danger of other Concerns contemplating the manufacture of Liquid Oxygen and therefore this matter should be given first priority by all concerned to ensure that the Company led the field ".

128. A B.O.C. internal memorandum dated 26th March, 1952, estimated that a single 180 ton/day medium purity gas plant operating in this country could deliver oxygen, with all charges paid, including overheads and depreciation and with a 10 per cent. return on capital, at rather less than 3s. a 1,000 cubic feet. The memorandum went on to state that " it must be clearly understand that where a tonnage gas plant is installed to supply process oxygen for iron and steel making there is no difficulty in arranging that this plant supplies also the 99·5 per cent. oxygen which the steelworks will use for deseaming, cutting, welding, etc., even if the tonnage plant itself is designed to make medium purity oxygen. Thus any large scale installation of tonnage gas plants in this country or in the Commonwealth would have a most serious effect on our existing oxygen business. It is not possible, however, to put the clock back and it has been considered that the best tactics for the Company were to be in the forefront of technical development in this field so as to have a quick appreciation at all times of current trends; to ensure that all potential users had first-class and reliable information and were not misled by those anxious to sell plants; and, as far as any control was possible, to endeavour to control the development as a whole. . . . It has in general been the Company's policy not to build plants for other concerns. Recognising however that we must be abreast of the medium oxygen field the Research and Development department worked out some years ago complete designs for tonnage gas plants to the Linde-Fränkl cycle, prepared mechanical designs and estimated operating and capital costs. This was in order that the Company would be fully equipped to build plants

should the need arise, for itself or for others, and further, so that we could tender against enquiries for such plants."

129. In 1951, The Butterley Co. Ltd. of Derby, bridge builders, iron founders and general engineers, entered the oxygen plant field with the conclusion of an agreement with Air Products Inc., U.S.A., which included a licence covering the manufacture and sale of a range of standard size oxygen plants. A later licence related to tonnage plants. In 1952, Stewarts & Lloyds Ltd. showed interest in the installation of a tonnage plant at its Corby Iron and Steel Works. A B.O.C. Board minute of 19th November, 1952, recorded that "if this matter were developed further, whilst everything possible would be done to have such plant under our own control, Stewarts & Lloyds might decide to have their own plant and in such case it would be necessary to tender for the supply of such plant as if the Company did not do so there would be other firms who would be in a position to meet Stewarts & Lloyds requirements". At a general discussion on 18th June, 1953, on the full implications of tonnage oxygen plants, the Board agreed that it was absolutely essential that the company should take all possible steps to secure a major interest in the development of these plants in the United Kingdom and Commonwealth and that Dr. Richard Linde (Linde of Germany) should be invited to send representatives here for talks on the question of closer collaboration.

130. The following B.O.C. Board minute of 30th September, 1953, is of particular interest in illustrating the impact on B.O.C.'s plant policy of Butterley's entry into the plant market and the special attention which B.O.C. gave to its oxygen selling prices as a result of the competition. "The subject of the manufacture and sale of the customer range of High Purity Oxygen Plants was again discussed. Discussion was confined to the range of such plants now being offered in competition. A schedule was tabled summarising approximate costs of producing oxygen by a competitor's range of plants and showing the comparison with our selling prices in the several ranges of consumption, by customers taking compressed or Liquid Oxygen. A point at issue was whether we should enter the customer size plant market and offer such plants to the customers where the customer was determined to install his own plant. It was appreciated that such a course would place upon the Company a responsibility for the efficiency of the plants, for the supply of knowhow and in the event of breakdown, the maintenance of supplies from our own factories—all of which would undermine the Company's business. Various aspects of the matter were stated as each Director expressed his views and whilst [two directors] were opposed to such a departure the [majority of the directors] considered reluctantly that we should, but only as a last resort, offer customer plants. On the further issue as to whether we should manufacture these plants, there were again divergent views but as [one director] indicated that he was hopeful to acquire designs and knowhow from Linde, Germany, and as no immediate necessity arose, it was decided that this whole subject should be deferred until further discussion with Linde had taken place. The Chairman then stated that in view of the competition from customer plants and the details shown in the statement submitted, consideration needed to be given to our Oxygen Selling prices to customers within the range of the customer sized plants. A revised schedule must not be such that an adequate profit will not accrue to the Company. It was agreed in principle that selling prices be examined and it was remitted to the Directors' Executive Committee to consider and recommend such reduction as was felt to be expedient in the light of all the circumstances."

131. A B.O.C. internal memorandum dated 3rd December, 1953, referred to the review of B.O.C.'s policy in regard to the manufacture and supply of tonnage and standard size customer plant at the Board meeting on the 30th September, 1953, and set out to define the position in more detail to assist in the formation of the company's future policy. After setting out the various categories of plant requirements the memorandum continues:

"There would appear to be two alternative policies open to the Company as there does not appear to be any justification for carrying a design and manufacturing organisation whose activities are strictly limited to The B.O.C. internal plant requirements:

(*a*) The purchase of all our own plant requirements from Linde (or some other company) and the establishment of B.O.C. as sole selling agents for the marketing of Linde plants in this country and the Commonwealth if we desire to enter the customer market.

(*b*) The establishment of a limited standard range of tonnage oxygen and high purity oxygen plants for manufacture by B.O.E. [British Oxygen Engineering] selected so that they can cover as far as possible the requirements of the Home Company and our Overseas Associated Companies and cover the normal customer requirements. With this arrangement a link with Linde would be recommended which would ensure the right for the Company to manufacture tonnage and/or high purity plants for customers whose requirements would overlap with our normal gas markets in the metallurgical and allied industries.

In considering the policy advocated in (*b*) it must be emphasized it will not always be possible to maintain standard designs. There will be quite a substantial margin of special development work required by the Government and certain industrial undertakings which will have to be carried out as part of our normal establishment. The existence of standard designs will, however, provide a reliable frame-work from which to establish designs and costs by interpolation.

If we consider the policy laid down under (*a*) it will place the Company in a very difficult situation and encourage the establishment and growth in this country of plant manufacturers. We have, for instance, a large amount of work in hand for the Government Departments which undoubtedly carries a considerable prestige value. If these contracts were not undertaken by B.O.C. they would be placed with Butterley, Petrocarbon*, or other firms. Many of these contracts, due to their security nature, cannot be undertaken by Continental companies, such as Linde. This would result in the establishment in this country, with Government funds, of an efficient oxygen plant manufacturer, the activities of whom we could not limit and ultimately they would expand into our markets.

There are many schemes, of which we are aware, under consideration by the steel companies. Due to the fact that we are established plant manufacturers we automatically come into the picture when their preliminary schemes are developed due to our accepted position and we endeavour to convert these customers to pipeline schemes: the Margam scheme involving the pipelining of oxygen to SCOW and nitrogen to BIS was an example of this technique†. A further phase is now under consideration by SCOW which will call for large supplies of oxygen and nitrogen. Similarly, in Lincolnshire, Appleby–Frodingham and the

* Petrocarbon Developments Ltd. (the successor to Petrocarbon Ltd. which is in voluntary liquidation) designs oil refinery, petroleum chemical and oxygen plant.

† See paragraph 58.

Lincolnshire steel manufacturers have asked us to develop a project under which we would install a centralised plant for pipe-lining gas to three four major consumers. If, due to the fact that we were not established plant manufacturers we did not participate in these schemes it would leave the field open to Butterley and Petrocarbon etc., who are primarily interested in selling plants to customers and not operating them. There would be every encouragement therefore for the large steel manufacturers to install their own plants in preference to The B.O.C. technique of pipelining gas to them. If we were only agents, acting for Linde, and marketing their plants, our standing in the industry would diminish and if we succeeded in selling plants for them and using their plants we should simply be establishing Linde in this country and in the Commonwealth as the leading plant manufacturer to the ultimate detriment of The B.O.C.

There are many other instances where B.O.C., acting as plant manufacturers, will be able to play an effective part in controlling the disposal of surplus oxygen—to quote an example, an outstanding case is the use of tonnage nitrogen in ammonia synthesis. Schemes of this nature require large quantities of nitrogen. If we are able to take the lead in projects of this type it automatically gives us an opportunity of controlling the surplus oxygen which could be used by our competitors to the detriment of our business. The policy of allowing the Company to design and develop its own plants enables us to be in a position to ensure that we have available for the Group the most efficient production and distribution methods. If other companies specialising in the manufacture of oxygen plants and the sale of gas are allowed to achieve a technical lead over B.O.C. it would be possible for them ultimately to enter our markets due to the inefficiency of our existing manufacturing system.

It is therefore recommended that the Company should adopt the policy of establishing a limited number of standard designs which would cover the normal development of the home and overseas business for high purity oxygen and also customer requirements in this field and at the same time develop a range of tonnage oxygen plants which can be used for installation by B.O.C. on their own sites for pipelining gas to customers and ultimately for the sale to customers who intend to install their own plants, although it would always be the Company's policy to prevent this by pipelining gas where an economical scheme can be considered."

As already mentioned in paragraph 127, B.O.C. had started work on the design of tonnage plants soon after the war ended, and the proposals in the above memorandum for the establishment of a range of designs and costs of tonnage and standard size oxygen plants were approved by the Board on 9th December, 1953.

132. By August, 1953, the discussions between B.O.C. and Linde of Germany mentioned in paragraphs 129 and 130 revolved round a proposal to form a joint selling company in this country: B.O.C.'s "primary object was to secure adequate entry into the tonnage plant market", and by the summer of 1954, the proposal was well advanced. Meantime, B.O.C., Linde of Germany, L'Air Liquide and Butterley had responded to Stewarts & Lloyds' invitation to tender for a tonnage plant at Corby, and in December, 1954, the contract for a 200 tons a day plant was placed with Butterley. The plant is expected to come into production in the Spring of 1957. In January, 1955, B.O.C., in conjunction with Linde of Germany announced the formation of a new company to be known as British Oxygen Linde Ltd. to handle sales in the United Kingdom and overseas of tonnage plants capable of producing 50 to 350 tons daily. The £20,000 authorised capital of British

Oxygen Linde Ltd. is held in equal proportions by the British and German parents, which are also equally represented on the board of four members.

133. Since 1954 the following tonnage oxygen projects have been put in hand, in addition to Stewarts & Lloyds' plant at Corby. B.O.C. has erected a tonnage oxygen plant of 100 tons a day capacity at Margam to supply oxygen to the Steel Company of Wales. Many of the major components of the plant were obtained from Linde of Germany and modified to conform to B.O.C.'s Rescol design. The plant is expected to come into production before the end of 1956. B.O.C. plans to erect a second plant of 200 tons a day capacity as part of the same project. In September, 1955, B.O.C. announced that it is to erect a new works at Scunthorpe to supply oxygen direct to the individual steel works in the district. The initial installation will consist of a tonnage plant of B.O.C.'s Rescol design of 200 tons a day capacity which is planned to come into production in 1957. In October, 1955, I.C.I. placed a contract with Butterley for the supply of a tonnage oxygen plant of 240 tons a day capacity, to be erected at Billingham and planned to come into production in 1957. Most of the oxygen produced will be used to make synthesis gas for ammonia manufacture. In January, 1956, B.O.C. announced that it will erect a Rescol tonnage oxygen plant of 200 tons a day capacity as part of a new project at Middlesbrough which will supply oxygen to the local steel works and nitrogen to the local chemical works. B.O.C. has told us that it has concluded arrangements with Consett Iron Co. Ltd. and Richard Thomas & Baldwins Ltd. which will involve the erection of tonnage oxygen plants from which B.O.C. will supply oxygen to these two companies. "Shell" Refining & Marketing Co. Ltd. has placed a contract with B.O.C. for the supply of a Rescol tonnage oxygen plant of 240 tons a day capacity to be erected at Shell Haven to supply oxygen for ammonia manufacture, and Shell Chemicals Ltd. has placed a contract with B.O.C. for the supply of a Rescol tonnage plant for erection at Partington for the supply of oxygen for the direct oxidation of ethylene to ethylene oxide. We have seen estimates of production costs at full output for two of the tonnage plants mentioned in this paragraph, one being 2s. 2d. a 1,000 cubic feet and the other 2s. 7½d. a 1,000 cubic feet. We cannot say how far the figures are comparable but we would expect that there would be some variations in costs due to local circumstances.

134. Oxy-acetylene welding equipment, oxy-acetylene and oxy-propane cutting equipment and apparatus ancillary to the use of the gases other than those mentioned in previous paragraphs in this chapter are obtainable from a variety of sources other than B.O.C., and we have made no detailed investigations into their supply.

Cylinders: Compressed Oxygen, Dissolved Acetylene and Propane

135. *Compressed Oxygen and Dissolved Acetylene.* Cylinders of the heavy solid-drawn seamless type for the supply of compressed oxygen and dissolved acetylene are manufactured in the United Kingdom only by the Chesterfield Tube Co. Ltd., which supplies B.O.C., Saturn, Lea & Son (Runcorn), and the Gas Accumulator Company. About two-thirds of the cylinders now in use by Saturn for dissolved acetylene are of foreign manufacture and were obtained before the war when Saturn began the production of dissolved acetylene, but it now buys only from the Chesterfield Tube Company. The latter has told us that apart from the war period it has experienced no difficulties in the supply of skilled labour or raw material and is in a position to meet demands from new customers. The company is in process of installing a modern cylinder plant at a cost of £1¾ million and will in due course be able to meet additional demands from both the home and export

markets. B.O.C. and the Gas Accumulator Company mass their own cylinders; the latter company uses a process belonging to its Swedish parent company. On one occasion, three or four years ago, it massed some cylinders for Saturn, from which it required an undertaking that the massed cylinders should be used only for the supply of dissolved acetylene to customers who required it for cutting and welding. Saturn now has it in mind to mass its own cylinders and has obtained a licence to use a patented process belonging to a German firm.

136. *Propane.* Cylinders used for propane are either of the type used for oxygen and dissolved acetylene manufactured only by the Chesterfield Tube Company or of a lighter welded type manufactured principally by Rubery, Owen & Co. Ltd. and Joseph Sankey & Sons Ltd. Both these companies have said that owing to the shortage of steel plate they have had some difficulty in recent years in meeting the demand for cylinders. We understand that there has recently been some improvement in the supply of steel plate.

Raw Materials

137. *Calcium Carbide.* We have described briefly in Chapter 3 the early manufacture of calcium carbide for acetylene production. This is a matter in which B.O.C. has long been interested. Until the middle of the 1914-1918 war, supplies for the United Kingdom were obtained from Canada and Norway and from a British company in Manchester. Early in 1917, demands for war purposes greatly increased and as foreign supplies were precarious it was decided to develop home production. However, production fell short of the increased demand and it was therefore necessary to continue overseas contracts, principally with the Alby Company of Norway.

138. For many years B.O.C. has had importing and merchanting interests in carbide. In the inter-war years there was no significant production of carbide in the United Kingdom and Norway was the chief source of supply. It appears to be generally accepted* that from about 1910 onwards, there existed a succession of international European calcium carbide syndicates or cartels. B.O.C. has confirmed that such a cartel was formed in 1924 and ceased to operate in 1939. This cartel, which consisted of a number of the firms operating in the principal European carbide-producing and exporting countries, seems to have shared markets and fixed selling prices. Within the United Kingdom there was a Carbide Committee, consisting of representatives of five of the leading firms of carbide merchants, who were also agents for the members of the cartel. This Committee fixed quotas and selling prices in the United Kingdom; it appears to have had some success in obtaining price reductions from its overseas principals and rather less in enforcing its own arrangements in the United Kingdom. Supplies of carbide also came into the United Kingdom on occasion from other than cartel members. B.O.C., as a merchant, was a member of the Carbide Committee and drew most of its requirements of carbide for dissolved acetylene production from Odda Smelteverk of Norway, which was a member of the cartel. With the introduction of the general protective tariff in 1932, calcium carbide became liable to an ad valorem duty of 10 per cent. As a result of trade agreements with Norway and Sweden, the duty was removed in July, 1933, and calcium carbide from all sources has since remained free of duty.

139. B.O.C. made several attempts to get Government support for carbide production in the United Kingdom. In 1935, it formed a subsidiary, The Caledonian Power Co. Ltd., and promoted the Caledonian Power Bill;

* Ervin Hexner: International Cartels, London, 1946. Alfred Plummer: International Combines in Modern Industry, London, 1951.

the project was to construct hydro-electric generating stations in Inverness-shire and to take power from them to operate a carbide factory at Corpach. The Bill was introduced three times and rejected, each time on Second Reading, in March, 1936, March, 1937, and April, 1938. In 1937, B.O.C. submitted a proposal, conditional on the acceptance of the Caledonian scheme, to set up an additional factory run on steam-generated power at Port Talbot in South Wales and pressed for a Government undertaking to protect the proposed new carbide industry by import duties or a "bounty" giving a guaranteed return. This undertaking was not forthcoming. In the summer of 1937, B.O.C. acquired a controlling interest in Odda Smelteverk and, in the following year, the whole of its share capital.

140. Carbide has a number of important uses in addition to the production of acetylene, and Government plans for ensuring and distributing supplies were completed in May, 1939. On the outbreak of war, there was set up the Carbide (Voluntary) Control Committee, consisting of representatives of the leading importers and consumers, and later in the same year the Government decided to start carbide production in the United Kingdom. Carbide continued to be imported from Norway and other European sources and, when these were cut off in 1940, from Canada and in smaller amounts from the U.S.A. and South Africa, but shipping losses made these supplies hazardous.

141. The primary purpose in setting up carbide production in the United Kingdom was the manufacture of acetone, which was required in quantity for a number of essential wartime purposes. It was decided to build carbide and acetone factories on the same site, and that they should be Government property but be built and operated on an agency basis by a commercial firm. Kenfig in South Wales was chosen as the site, and British Industrial Solvents Ltd. (then a subsidiary of The Distillers Co. Ltd.) was chosen as the builder and agent. This company held the British rights for patents belonging to a Canadian company, Shawinigan Chemicals Ltd., on a process for the manufacture of acetone from carbide. Attempts had earlier been made to get some joint arrangement between B.O.C. and British Industrial Solvents for erection and operation but these broke down owing to the Canadian company's refusal to disclose information to B.O.C. In view of the change in the war situation, it was decided in 1940 that acetone deficiencies should be made up by purchases from the U.S.A. (later lease/lend). At the same time, the carbide situation had worsened and the production of carbide in the United Kingdom had become a matter of the highest priority; it was decided therefore to go ahead with the carbide factory at Kenfig and the acetone project was abandoned altogether. The agency agreement with British Industrial Solvents included an option for the purchase or lease of the factory after the war. By a gentlemen's agreement with B.O.C., I.C.I., the Distillers Company and Shawinigan Chemicals Ltd., British Industrial Solvents agreed not to exercise the option unless three out of these four parties agreed to its doing so.

142. The Ministry of Supply had taken over distribution of all imported carbide in 1941, and until the Kenfig factory came into production in 1942, the Ministry used B.O.C. as its agent for the distribution of supplies. The Carbide (Voluntary) Control Committee was wound up in October, 1942, and the firms which were represented on its sub-committee on distribution (which were substantially those merchanting firms, including B.O.C., which had formed the pre-war United Kingdom Carbide Committee described in paragraph 138) formed themselves at the request of the Ministry into The Carbide Distributing Agency Ltd., to act as the Ministry's agent in distributing carbide to small consumers. Carbide for the larger consumers was supplied direct from Kenfig or from such imports as still arrived.

143. For some time after the war B.O.C. seems to have had it in mind to obtain an interest in the Kenfig carbide factory, and from time to time drew the Government's attention to its interest, as a consumer, in the fate of the factory. In December, 1950, B.O.C. received assurances from the Board of Trade that proposals for the handling of Kenfig production on private account would not be put into force without the views of the consumers of carbide being sought and taken into consideration. In the event, the Ministry of Supply leased the factory to the Distillers Company (which had then absorbed its subsidiary, British Industrial Solvents) in September, 1953, after first discussing the proposal at a meeting with B.O.C., I.C.I., and the Carbide Distributing Agency. By then, B.O.C. had come to the conclusion that it did not want the additional financial burden of carbide production, and its representative at the meeting accordingly raised no objection to the proposed lease to the Distillers Company provided his company was given reasonable assurances that it would continue to get its supplies of carbide, and "at the right price". The representatives of I.C.I. and of the Carbide Distributing Agency took a similar line. The Distillers Company gave an undertaking not to introduce any price changes without prior notification to the Ministry of Materials (now Board of Trade) to which Department the general responsibility for carbide production and distribution had been transferred, and said that it was not its intention to vary the existing pattern of distribution. The British Industrial Solvents Division of the Distillers Company now manufactures and sells Kenfig carbide on an ordinary commercial basis. I.C.I., the only other manufacturer of calcium carbide in the United Kingdom, produces solely for its own consumption.

144. B.O.C. now obtains supplies of calcium carbide for consumption in its gases and chemical manufacturing business from the Distillers Company and from Odda Smelteverk. B.O.C., as one of the principal customers of the former, buys carbide for dissolved acetylene production direct and is the only manufacturer of dissolved acetylene to do so. While there is no formal agreement, B.O.C. has explained that there is some understanding that it shall continue to get its supplies of carbide and at a reasonable price. Carbide imported from Odda Smelteverk is cheaper to B.O.C. than supplies from the Distillers Company and is reserved by B.O.C. for its own use.

145. The shareholders of the Carbide Distributing Agency are the eight leading carbide merchants, including B.O.C.; these buy from the Agency at the price the latter has paid the manufacturer, and resell to other merchants on an approved list or direct to users. The various grades of carbide are sold at fixed prices at each stage; the Agency members add a fixed margin and the approved merchants add another fixed margin. Members who sell as merchants take both margins. Both prices and margins are fixed by the Distillers Company. Saturn, the Gas Accumulator Company, and firms which generate acetylene for their own use obtain their supplies of carbide from members of the Agency or approved merchants. We have not found any evidence that any of these users have difficulty in getting supplies. No returns are made of the uses to which carbide is put but it is estimated by the Board of Trade that about one-third of the present total used, which is at the rate of about 160,000 tons a year, is consumed in the production of acetylene for burning and that of this about 80 per cent. reaches the consumer as dissolved acetylene.

146. *Acetone.* Acetone is produced by a number of chemical manufacturers in the United Kingdom. The greater part of the acetone manufactured is used for purposes other than the production of dissolved acetylene, and we have not found any evidence that manufacturers of dissolved acetylene have difficulty in getting supplies.

CHAPTER 6: PRICES, COSTS AND PROFITS

PART I: OXYGEN AND DISSOLVED ACETYLENE

Prices

The British Oxygen Company Ltd.

147. *Industrial Oxygen and Dissolved Acetylene.* B.O.C.'s prices for industrial oxygen and dissolved acetylene are on a national basis and for over 98 per cent. of sales include delivery to customers' premises. Customers who obtain supplies from B.O.C.'s depots as distinct from B.O.C.'s works collect in their own transport and pay a surcharge of 10s. a 1,000 cubic feet above the delivered price towards the cost of running the depot (see paragraphs 67 and 73). There is no published price list. Tables setting out a scale relating prices to six-monthly consumption figures are drawn up for internal use and serve, we are told, as a guide to the staff in negotiating prices. Certain of the largest customers are in a "special" class and get lower prices than those shown on the scale. Contracts with these customers, with the larger customers on the scale, group contracts and national contracts with Government Departments and other bodies are negotiated from B.O.C.'s head office. Contracts for other buyers are negotiated and reviewed annually by the local district officers.

148. The following tables set out the scale prices for industrial oxygen and dissolved acetylene in force during 1953, 1954, 1955, and since 1st January, 1956, and a two-part tariff for tonnage oxygen (see paragraph 133) introduced on 1st February, 1956:

TABLE I: B.O.C. INDUSTRIAL OXYGEN PRICES

Six-monthly consumption	1953	1954	1st May, 1955	15th September, 1955	1st January, 1956
			per 1,000 *cubic feet*		
Liquid	s. d.	s. d.	s. d.	s. d.	s. d.
Less than 500,000 cubic feet... ...	21 0	20 0	20 0	20 6	26 0
From 500,000—1 million cubic feet	20 0	19 0			22 0
,, 1— 2 million cubic feet ...	19 0	18 0	18 0	18 6	19 6
,, 2— 4 ,, ,, ,, ...	17 0	16 0	16 0	16 6	17 0
,, 4— 8 ,, ,, ,, ...	16 0	15 0	15 0	15 6	16 0
,, 8— 12 ,, ,, ,, ...	15 0	14 6	13 6	14 0	14 0
,, 12— 16 ,, ,, ,, ...			13 0	13 6	13 6
16 ,, ,, ,, ...	13 0	12 6			
From 16— 26 ,, ,, ,, ...	Specials		12 0	12 6	12 6
,, 26— 52 ,, ,, ,, ...	,,		11 0	11 6	11 6
,, 52—104 ,, ,, ,, ...	,,		10 0	10 6	10 6
,, 104—208 ,, ,, ,, ...	,,		9 0	9 6	9 6
Compressed					
Less than 20,000 cubic feet	47 0			49 0	
From 6— 20,000 cubic feet ...					49 0
,, 20— 40,000 ,, ,, ...	41 0			43 0	43 0
,, 40— 60,000 ,, ,, ...	36 0			38 0	39 0
,, 60— 90,000 ,, ,, ...	34 0			36 0	37 0
,, 90—120,000 ,, ,, ...	32 0			34 0	35 0
,, 120—160,000 ,, ,, ...	31 0			33 0	34 0
,, 160—200,000 ,, ,, ...	30 0	No	No	31 0	32 0
,, 200—250,000 ,, ,, ...	29 0	change	change	30 0	31 0
,, 250—350,000 ,, ,, ...	28 0			29 0	30 0
,, 350—500,000 ,, ,, ...	27 0			28 0	29 0
,, 500— 1 million cubic feet ...	26 0			27 0	28 0
,, 1— 2 ,, ,, ,, ...	25 0			26 0	27 0
,, 2— 4 ,, ,, ,, ...	Specials			25 0	26 0
,, 4— 6 ,, ,, ,, ...	,,			24 0	25 0
,, 6— 8 ,, ,, ,, ...	,,			23 0	24 0
,, 8—10 ,, ,, ,, ...	,,			22 0	23 0

TABLE II: DISSOLVED ACETYLENE PRICES

Six-monthly consumption	1953	1954	1st May, 1955	15th September, 1955	1st January, 1956
	per 1,000 *cubic feet*				
	s. d.	s. d.	s. d.	s. d.	s. d.
Non-contracted customers	172 6	167 6	160 0	162 6	162 6
Less than 18,000 cubic feet	157 6	152 6	147 6	150 0	150 0
From 18— 30,000 cubic feet... ...	152 6	147 6	142 6	145 0	145 0
,, 30— 45,000 ,, ,, ...	150 0	145 0	140 0	142 6	140 0
,, 45— 60,000 ,, ,, ...	145 0	150 0	135 0	137 6	135 0
,, 60—100,000 ,, ,, ...	142 6	137 6	130 0	132 6	132 6
,, 100—150,000 ,, ,, ...	140 0	135 0	127 6	130 0	130 0
,, 150—300,000 ,, ,, ...	132 6	127 6	125 0	127 6	130 0
300,000 or more cubic feet	127 6	122 6	120 0	122 6	125 0

TABLE III: TONNAGE OXYGEN. TWO-PART TARIFF

PART I. *General Purpose Oxygen*
Price in accordance with ruling industrial Liquid Oxygen. Price Schedule.

PART II. *Tonnage Oxygen*
Flat rate (approximate) ... ... 3s. to 3s. 6d. per 1,000 cubic feet
Additional surcharges:—
(*a*) Freedom from annual forecast ... ... 1d. per 1,000 cubic feet
(*b*) Compression into storage ... ... 1d. per 1,000 cubic feet
(*c*) Rental for storage vessels ... ... £35 per week per vessel

Notes

(i) *General Purpose Oxygen*—used for welding, cutting, deseaming, lancing of furnace tap holes, and comparable applications.

(ii) *Tonnage Oxygen*—used for metallurgical applications in actual steel making.

(iii) *Flat Rate for Tonnage Oxygen*—represents the price of gas delivered into B.O.C. main supply pipeline at utilisation pressure similar to that from a cold evaporator installation.

(iv) *Freedom from Annual Forecast*—B.O.C. reserves the right to make this surcharge if a customer wishes to be freed from forecasting, one year ahead, his annual requirements in the form of a weekly estimate. This surcharge will not apply to any customer who agrees to forecast his annual requirements in accordance with limits specified by B.O.C.

(v) *Compression into Storage*—surcharge covers the additional cost of pumping gas into storage vessels to approximately double the utilisation pressure.

(vi) *Storage Vessels*—these vessels will be standardised at 40,000 cubic feet capacity, and will be installed in customer's works on a rental basis. The number of vessels to be installed will depend upon individual customer's requirements.

The above applies to pipeline supplies from B.O.C. tonnage plants *only*.

In deciding the scale appropriate to a customer consideration is given to actual consumption in the previous year combined with estimated future demand. From a number of examples examined by us it seems that, generally, in recent years customers who have paid prices differing from the scale prices corresponding to their actual consumption paid less than they would have done under the scale. We came across a very few cases where customers appear to have paid more than the scale price corresponding to their actual consumption.

149. A recent extension of the liquid oxygen scale (see Table I, paragraph 148) has taken in some but not all of the customers who were formerly in the "special" class. The "special" class is now confined to three categories of customer: those to whom oxygen is supplied by pipeline, those whose consumption of liquid oxygen is exceptionally large, and a few with whom B.O.C. has long-standing arrangements. The following

are three examples from the special class. (*a*) The price arrangements for supplies of oxygen to the Steel Company of Wales at its Abbey Works at Margam stem from the agreement concluded between B.O.C., British Industrial Solvents and the Steel Company of Wales in 1951 (see paragraph 58 and Appendix 6). The Steel Company of Wales has told us that the ratio of the quantities of oxygen taken by it to the quantities of nitrogen taken by the Kenfig Works of British Industrial Solvents (now absorbed into the Distillers Company) did not work out as anticipated, and that the provision in the agreement whereby its credit was reduced by the amount of nitrogen not taken up by British Industrial Solvents was modified. It was agreed that as British Industrial Solvents had not taken up the nitrogen it was to the advantage of the Steel Company of Wales to purchase nitrogen under the scale and blow it to atmosphere. This meant that the scale operated fully in respect of oxygen and in consequence the rebate in 1953 for the quantity of 120 million cubic feet of oxygen supplied by pipeline on the basic price payable of 9s. 0d. a 1,000 cubic feet resulted in a price paid of 6s. 5d. a 1,000 cubic feet, which was the lowest price charged by B.O.C. to any customer for liquid or pipeline oxygen. (*b*) Prices to T. W. Ward are governed by an agreement of 2nd February, 1953 which provides that liquid oxygen, compressed oxygen and dissolved acetylene shall be supplied by B.O.C. for three years at 11s. 6d., 18s. 0d. and 122s. 6d. respectively a 1,000 cubic feet After this period the prices are to be mutually agreed having regard to variation in costs and provided that the prices charged to the Ward company shall not exceed the lowest price charged to the scrap iron, scrap steel, demolition and shipbreaking industries apart from any special prices which may be charged by B.O.C. to Metal Industries Ltd. by reason of their internal arrangements. The price of 18s. 0d. a 1,000 cubic feet charged under this agreement for approximately 13·5 million cubic feet of compressed oxygen supplied in 1953 was the lowest charged to any customer for compressed oxygen in that year. The quantities of liquid and compressed oxygen and dissolved acetylene purchased in 1953 would, in any event, have put T. W. Ward in the "special" class for all three. This agreement is, in part, in succession to the agreement of 1944 described in paragraph 43, and contains a similar undertaking by T. W. Ward not to be concerned in the manufacture or sale of oxygen or dissolved acetylene in the United Kingdom and Northern Ireland. (*c*) The price of 19s. 0d. a 1,000 cubic feet charged to Metal Industries for 443,000 cubic feet of compressed oxygen supplied in 1953 compares with the scale price of 29s. 0d. a 1,000 cubic feet for a similar quantity. The price of 115s. 0d. a 1,000 cubic feet charged for dissolved acetylene for a heavy demand of 2·33 million cubic feet at one of Metal Industries' works was the lowest charged to any customer for dissolved acetylene in 1953. The price charged to Metal Industries for 42 million cubic feet of liquid oxygen supplied in 1953 was 10s. 0d. a 1,000 cubic feet.

150. B.O.C. has no fixed basis for the "group contracts" which it has with a number of companies and their subsidiary or associated companies, and also with a few groups of companies which are not so related. The initiative in negotiating such contracts has been taken by the customers and not by B.O.C. Some of the group contracts prescribe different prices for different participants. In others, there is a uniform price for all the participants, and we are told that the price is then fixed mainly in relation to the largest sale per annum to any one consumer in the group. B.O.C. has told us that among the groups with which it has contracts are Associated Portland Cement Manufacturers Ltd. (15 members), Chloride Purchasing Co. Ltd. (35 members) and The Tilling Association Ltd. (35 members). The

following are a few examples of the terms of certain group contracts which have been brought to our notice in the evidence submitted by users. A group contract negotiated by Colvilles Ltd. of Glasgow, first introduced in 1937, gives the benefit of low uniform prices to 14 companies forming the Colvilles Group and to 16 other companies in which Colvilles Ltd. had some financial interest. Colvilles Ltd. has told us that the reason for this group purchasing arrangement was "the inducement of reduced price". The group contract negotiated by T. W. Ward Ltd. in 1953 provided for a lower price for oxygen for the parent company than for the other companies in the Ward Group. The United Steel Companies Ltd. does not receive uniform prices throughout its Group although it negotiates a single contract to cover the requirements of the Group.

151. B.O.C. also has contracts with the Admiralty, the Ministry of Supply (which negotiates an "umbrella" contract for most of the other Government Departments), the nationalised industries, and certain other public bodies. In 1946 and 1953 the Ministry of Supply examined the costs of B.O.C. in respect of all gases bought by the Ministry from the company and used the information so obtained as a guide in determining contract prices at those dates. Contract prices are periodically reconsidered by the Ministry by reference both to information given by B.O.C. and to published statistical data as to changes in costs since the date of the last costing inquiry. The Ministry has told us that the prices approved were on the basis of providing a rate of profit in the region of 10 per cent. on capital employed, which we understand is the rate allowed on many Government contracts.

152. *Medical Oxygen.* Prices for medical oxygen cover delivery to hospitals in most parts of the United Kingdom. A delivery charge is made only for supplies to the Shetlands, the Outer Hebrides and the Channel Islands, or when B.O.C. is asked to send supplies by passenger train or special conveyance. For the guidance of staff negotiating prices with hospitals, B.O.C. issues a list of prices which is not shown to customers. Prices for hospitals are negotiated by the local district officers, who refer to B.O.C.'s head office in exceptional circumstances. Periodically, the quantities consumed and the price paid by hospitals are examined centrally by B.O.C.

153. The Air Ministry, which in 1953 took 33 million cubic feet of liquid medical oxygen for high flying purposes, paid 11s. 0d. a 1,000 cubic feet. The two hospitals which together took the remaining 1 million cubic feet of liquid medical oxygen sold in 1953 paid 31s. 0d. a 1,000 cubic feet. The following table sets out the prices charged to hospitals, oxygen tent renters, chemists, dentists, etc., for compressed oxygen in 1954.

B.O.C. COMPRESSED MEDICAL OXYGEN: PRICES PER CYLINDER

Customer	Cylinder sizes				
	240 cubic feet	180 cubic feet	120 cubic feet	48 cubic feet	24 cubic feet
	s. d.	s. d.	s. d.	s. d.	s. d.
Hospitals:					
Class 1	8 6	6 9	5 0	3 1	2 7
Class 2	9 0	7 2	5 3	3 7	3 1
Class 3	9 9	7 9	6 0	4 6	3 4
Class 4	11 3	9 3	7 0	5 0	3 8
Oxygen tent renters	9 0	7 2	5 3	3 7	3 1
Chemists	11 3	9 3	7 0	5 0	3 8
Dentists, anaesthetists, etc. ...	—	13 9	—	—	—

B.O.C. has given us the following explanation of its classification of hospitals: "Class 1—prices apply to all teaching hospitals and to the very largest users who take regular deliveries of oxygen in large cylinders. Class 2—prices apply to the vast majority of hospitals who take regular weekly or fortnightly supplies of oxygen in quantity. Class 3—prices apply to hospitals who only order at irregular intervals and these are generally of the small cottage hospital types. Class 4—prices apply to those hospitals, very small in number, which take occasional deliveries of very small quantities."

154. It has been a tradition of B.O.C. to give the best terms to teaching hospitals, but, owing partly to recent changes under the National Health Service, Class 1 does not now in fact include all the teaching hospitals. As will be seen, the ranges of oxygen consumption in each class are not specified precisely and the evidence obtained from hospitals has shown that the criteria are not always consistently applied. B.O.C. agrees that there are some anomalies and says that "the ideal would be that we shall to-day have four classes, 1, 2, 3 and 4, based on four quantities but this would mean that certain hospitals would require to bear an advance in price while others might get a reduction. Again, until the hospitals have settled down under their re-organisation scheme, it is difficult to apply a fixed scale of prices based on quantities." B.O.C. has told us that there will "in all probability be a re-arrangement of prices" when the hospitals have settled down. We understand that a suggestion made by B.O.C. to the Ministry of Health in 1949 for a national uniform price was not pursued because it would have raised prices to some hospitals.

155. Certain hospitals under the same Board of Governors or Management Committee pay uniform prices. B.O.C. says that "we do not advocate group contracts for medical gases. Where a group supply officer particularly desires such a contract we agree to his request." The Ministry of Health has told us that the arrangements for the purchase of oxygen are a matter of local administration and that they vary considerably from one Hospitals Group to another.

The Basis of Prices

156. B.O.C. tells us that "we operate on the basis of average cost of all our works and on the basis of average price. We do not have a costing for each step in the scale of prices. We have endeavoured on several occasions to assess the actual costs for each step but the circumstances vary so much—transport for example—that it is almost impossible to arrive at an equitable cost basis for each step. With the detailed costs at each works plus our detailed Transport, Office and Selling Expenses, we are in a position from our commercial experience and practice to frame our price list in varying scales which are based on quantities purchased." With regard to the general price level B.O.C. has said that its main objective has been to maintain low prices with moderate profits and thereby to expand use and sales, and that the profit figure achieved over the last three years is roughly what it has aimed at. B.O.C. does not expect medical oxygen to yield any particular rate of profit, and indeed losses have been incurred on these sales in recent years (see paragraph 165).

157. In the course of our costing investigation it appeared that quarterly accounts and statistics are prepared in great detail, giving (*a*) for each factory, the average unit production cost in respect of each product, (*b*) for each district, the average unit delivered cost (excluding certain overheads), average realised price and profit at that stage for each product, and (*c*) for the company as a whole, the total and unit figures of cost, sales and profit for

each product. General overheads at district and head office level and central expenditure, such as research costs, are allocated in respect of each product pro rata to all other costs. This information is not, however, used by B.O.C. to form the basis of costing the steps in the price scales.

Sales, Costs and Profits

158. We have examined the sales, costs and profits of the business of B.O.C. and its two subsidiary companies in oxygen and dissolved acetylene for 1939, 1952, 1953 and 1954, and in propane for 1952, 1953 and 1954, and we summarise the results in the following tables*. Costs include all normal production and selling expenses, including depreciation at the rates allowed for Inland Revenue purposes (ignoring initial allowances), such depreciation being calculated by reference to original costs. We have also computed the amount of capital employed in respect of the gases concerned. For this purpose we have, in the absence of any generally accepted alternative method, included fixed assets at their original cost less depreciation to date at Inland Revenue wear and tear rates, and this we refer to as basis A. It has been represented to us by B.O.C. that in computing capital employed fixed assets should be included at "replacement values", and that profits should be calculated after providing for depreciation on these higher values. We have been given alternative figures by the company which have been arrived at by the application of indices to our calculations of the written down value of fixed assets and the charges for depreciation, in order to express them in terms of estimated current replacement values. This we refer to as basis B. The results of our inquiries may be summarised as follows:

B.O.C. GROUP RESULTS

	Sales	Costs	Profit (Basis A)	Profit Percentage on Cost
	£'000	£'000	£'000	Per Cent.
1939				
Industrial liquid oxygen†	242	151	91	60
Industrial compressed oxygen	840	596	244	41
Medical oxygen	N/A	N/A	N/A	N/A
Total oxygen	1,082	747	335	45
Dissolved acetylene	779	524	255	49
Propane	—	—	—	—
All Reference Products	1,861	1,271	590	46
1952				
Industrial liquid oxygen*	2,137	1,622	515	32
Industrial compressed oxygen	2,557	1,978	579	29
Medical oxygen	276	312	− 36	− 12
Total oxygen	4,970	3,912	1,058	27
Dissolved acetylene	3,344	2,762	582	21
Propane	235	213	22	10
All Reference Products	8,549	6,887	1,662	24

* The year 1954 was the latest for which figures were available when we made a detailed examination. We have, however, since seen the published accounts of B.O.C. incorporating the results of the parent company for the 9 months and the subsidiary companies for the 12 months ended 30th September, 1955. These figures include the results of home and overseas companies and relate to both industrial gases and other products. When the figures of the previous year are adjusted to make them comparable with the revised trading periods of 1955 the overall profit in the latest year is slightly higher than during the corresponding period of 1954.

† Includes gaseous oxygen supplied by pipeline.

B.O.C. GROUP RESULTS—*continued*

	Sales	Costs	Profit (Basis A)	Profit Percentage on Cost
	£'000	£'000	£'000	Per Cent.
1953				
Industrial liquid oxygen*	2,412	1,857	555	30
Industrial compressed oxygen	2,554	1,954	600	31
Medical oxygen	308	345	− 37	− 11
Total oxygen	5,274	4,156	1,118	27
Dissolved acetylene	3,656	2,856	800	28
Propane	262	240	22	9
All Reference Products	9,192	7,252	1,940	27
1954				
Industrial liquid oxygen*	2,554	2,030	524	26
Industrial compressed oxygen	2,597	2,009	588	29
Medical oxygen	327	369	− 42	− 11
Total oxygen	5,478	4,408	1,070	24
Dissolved acetylene	3,678	2,904	774	27
Propane	294	252	42	17
All Reference Products	9,450	7,564	1,886	25

* Includes gaseous oxygen supplied by pipeline.

RESULTS FOR EACH COMPANY WITHIN THE GROUP

	B.O.C.	B.I.G.	I.G.(S.)	Group Total
1939				
Sales £'000	1,745	116	(*a*)	1,861
Costs £'000	1,187	84	(*a*)	1,271
Profit £'000	558	32	(*a*)	590
Profit (percentage on cost)	47%	38%	(*a*)	46%
Profit (percentage on capital)	25%	N/A	(*a*)	N/A
1952				
Sales £'000	8,140	313	96	8,549
Costs £'000	6,589	228	70	6,887
Profit £'000	1,551	85	26	1,662
Profit (percentage on cost)	24%	37%	37%	24%
Profit (percentage on capital) (basis A) ...	23%	67%	52%	24%
(basis B) ...	16%	44%	44%	16½%
1953				
Sales £'000	8,742	346	104	9,192
Costs £'000	6,936	243	73	7,252
Profit £'000	1,806	103	31	1,940
Profit (percentage on cost)	26%	43%	42%	27%
Profit (percentage on capital) (basis A) ...	22½%	76%	65%	23½%
(basis B) ...	16%	51%	51%	16½%
1954				
Sales £'000	8,975	365	110	9,450
Costs £'000	7,221	266	77	7,564
Profit £'000	1,754	99	33	1,886
Profit (percentage on cost)	24%	37%	43%	25%
Profit (percentage on capital) (basis A) ...	22%	71%	72%	23%
(basis B) ...	16%	49%	57%	16½%

(*a*) not in full production.

159. It will be seen that the profit rates as a percentage on costs of B.I.G. appear to have remained approximately at the pre-war level, whereas those of B.O.C. are substantially lower. The subsidiary companies do not produce liquid or medical oxygen; their prices for compressed oxygen appear to be comparable with B.O.C.'s for the smaller customers with whom they do most of their business. B.I.G. also obtains at cost a certain amount of liquid oxygen from B.O.C. for conversion to compressed oxygen. The remaining paragraphs of this section are concerned with B.O.C.'s results only.

160. *Industrial Oxygen: Prices and Profits.* The following tables summarise the trading results for liquid and compressed industrial oxygen in the years covered by our costing investigation:

	Industrial Liquid Oxygen*			
	1939	1952	1953	1954
Sales				
Value	£242,327	£2,137,303	£2,412,126	£2,553,923
Volume (1,000 cubic feet)	340,895	2,979,339	3,407,641	3,837,320
Average per 1,000 cubic feet	14s. 3d.	14s. 4d.	14s. 2d.	13s. 4d.
Cost				
Total	£151,268	£1,622,229	£1,856,990	£2,030,225
Average per 1,000 cubic feet	8s. 11d.	10s. 11d.	10s. 11d.	10s. 7d.
Profit				
Total	£91,059	£515,074	£555,136	£523,698
Average per 1,000 cubic feet	5s. 4d.	3s. 5d.	3s. 3d.	2s. 9d.
As percentage on cost	60·2%	31·8%	29·9%	25·8%

* Includes gaseous oxygen supplied by pipeline.

	Industrial Compressed Oxygen			
	1939	1952	1953	1954
Sales (including rentals)				
Value	£789,806	£2,366,858	£2,351,078	£2,376,211
Volume (1,000 cubic feet)	693,340	1,413,333	1,394,308	1,408,953
Average per 1,000 cubic feet	22s. 9d.	33s. 6d.	33s. 9d.	33s. 9d.
Cost				
Total	£559,903	£1,840,038	£1,803,159	£1,842,756
Average per 1,000 cubic feet	16s. 2d.	26s. 0d.	25s. 11d.	26s. 2d.
Profit				
Total	£229,903	£526,820	£547,919	£533,455
Average per 1,000 cubic feet	6s. 7d.	7s. 6d.	7s. 10d.	7s. 7d.
As percentage on cost	41·1%	28·6%	30·4%	28·9%

The most striking features are the great increase in the volume of liquid oxygen, which is now eleven times the pre-war output, and the low increase (20 per cent.) in average production costs of it in relation to the general level of cost increases since 1939. The much larger output and the more effective use of capacity have kept costs down. Selling prices of liquid oxygen have not been increased to absorb all the higher costs, and in 1954 were actually a little below the 1939 average and the profit per unit is now

much less than pre-war. Sales by volume of compressed oxygen are about double those of 1939, costs have increased by about 60 per cent., and, though selling prices and the profit per unit are somewhat higher, the rate of profit has fallen.

161. *The Range of Prices.* As already explained, the costings kept by B.O.C. are not used to evaluate their price scale which, we note, is very wide. B.O.C. has emphasised that greater transport expenses are incurred in supplying the smaller customers and that there are not the same transport expenses in the case of pipeline supplies. The following figures have been supplied by B.O.C. in respect of pipeline and liquid oxygen supplies in 1953 :

	The Steel Company of Wales (see paragraph 149)	All other Pipeline	Total Pipeline	Liquid Oxygen	Total (see paragraph 160)
Volume (million cubic feet) ...	120	294	414	2,994	3,408
Average realised price per 1,000 cubic feet	6s. 5d.	12s. 1d.	10s. 5d.	14s. 8d.	14s. 2d.
Average cost per 1,000 cubic feet	5s. 10d.*	9s. 5d.	8s. 10d.	11s. 2d.	10s. 11d.
Average profit per 1,000 cubic feet	7d.	2s. 8d.	1s. 7d.	3s. 6d.	3s. 3d.

* After crediting 1s. 6d. a 1,000 cubic feet realised on the sale of nitrogen produced at the same time.

162. We have looked at the separate results for the different districts into which B.O.C. divides its figures, and in comparing the average realised price of one district with another we find that the price level for liquid oxygen bears a marked relationship to the volume sold, with the sole exception of the Western district, where the Steel Company of Wales is a customer. This same relationship is not, however, in evidence in respect of compressed oxygen. Here, the North-Eastern district has the lowest average realised price and the smallest average sales value. B.O.C. denies that this average realised price has any connection with competition from Saturn and explains that in this district a relatively small number of customers take relatively large quantities. B.O.C. tells us that its national prices apply in this district as elsewhere.

163. *Works Costs.* We have examined the figures for unit costs for 1952 and 1953 of eleven of the fourteen factories producing liquid oxygen and thirty of the thirty-six factories compressing oxygen†. For liquid oxygen the average costs for the two-year period as between factories ranged from 5s. 2d. to 7s. 1d. a 1,000 cubic feet, the weighted average being 5s. 11d. For liquid oxygen the cost of electricity amounts to about one-half of the total works cost, and B.O.C. has separate agreements with the Area Electricity Boards as to the prices to be paid for electricity for each of its main liquid oxygen factories. The amount of electricity required for the production of 1,000 cubic feet of oxygen varies between factories, being influenced by the type, size, age and condition of the plant, the level of output and the resulting load factors, and the local atmospheric pressure. Although there are also variations in other costs, in general the variations in cost between factories are fairly closely related to levels of output.

164. In the case of compressed oxygen the costs ranged from 11s. 7d. to 19s. 0d. a 1,000 cubic feet (with one exceptionally at 24s. 9d.), the weighted

† The remaining factories were producing only small quantities (if any) of these gases for industrial purposes, or were in production for only part of the period.

average being 15s. 0d. The variation in costs is not consistently related to level of output. The factories compressing their own oxygen, whether produced primarily as a gas or liquid, are generally at or below the average cost, while those using liquid obtained from another factory are above the average partly because of the transport cost involved in transferring the liquid oxygen from one place to another. However, the lowest cost factory is one which obtains part of its oxygen as liquid but has a large business in supplying oxygen by pipeline to a nearby customer, while the highest cost factory is a comparatively new one with a small output and consequently high overheads. The use of bought-in electrolytic oxygen appears to result in low costs to some of the factories using it.

165. *Medical Oxygen (Liquid and Compressed): Prices and Profits.* The following table summarises the relevant trading results for medical oxygen:

	1939	1952	1953	1954
Sales				
Value	£50,771	£276,485	£307,710	£327,506
Volume (1,000 cubic feet) ...	12,706	82,194	105,973	125,598
Average per 1,000 cubic feet ...	79s. 11d.	67s. 3d.	58s. 1d.	52s. 2d.
Cost				
Total	N/A	£312,732	£344,705	£369,242
Average per 1,000 cubic feet ...	N/A	76s. 1d.	65s. 1d.	58s. 10d.
Loss				
Total	N/A	£36,247	£36,995	£41,736
Average per 1,000 cubic feet ...	N/A	8s. 10d.	7s. 0d.	6s. 8d.
As percentage on cost	N/A	11·6%	10·7%	11·3%

(As from July, 1953, " high flying oxygen " has been included with medical oxygen.)

The average price of medical oxygen in 1939, which was for compressed oxygen only, was high compared with 1938 and 1940, but the 1953 average price of 64s. 4d. a 1,000 cubic feet for compressed oxygen was only a little higher than the 1940 average price of 58s. 6d. (see Appendix 13). It is because liquid oxygen (mainly for high flying purposes) forms an increasing proportion of the total sales of medical oxygen that the average realised price is declining. In 1953, the average selling price of 64s. 4d. a 1,000 cubic feet for medical compressed oxygen was substantially higher than the average selling price of 33s. 9d. a 1,000 cubic feet for industrial compressed oxygen but the average selling price of 11s. 6d. a 1,000 cubic feet for medical liquid oxygen (31s. 0d. to hospitals and 11s. 0d. to the Air Ministry for high flying purposes*) was lower than the average selling price of 14s. 2d. a 1,000 cubic feet for industrial liquid oxygen.

166. *Costs.* As we have explained, medical oxygen is the same product as industrial oxygen and requires no further processing. Greater care from the hygienic point of view is, however, required. In 1953 about half the medical compressed oxygen was produced, in comparatively small quantities, at factories predominantly engaged on compression for industrial uses, and the other half at three factories exclusively engaged in producing medical gases. B.O.C. does not ascertain the actual works costs for medical oxygen production at the former but estimates that its works cost per unit is double that for industrial compressed oxygen at each factory. The costs of medical oxygen at the three medical gases works in 1953 compared with the average costs of industrial compressed oxygen were as follows:

* B.O.C. has pointed out that the price differential is mainly due to the difference in quantities taken (see paragraph 153).

	Compressed Oxygen (1,000 cubic feet)	
	Industrial	Medical
	s. d.	s. d.
Production (including inward transport of liquid, where necessary) ...	7 6	8 8
Cylinder Filling, Handling, Maintenance and Depreciation ...	4 11	26 7
Works overheads	2 0	6 7
Works Cost	14 5	41 10
Outward Transport and Delivery	6 0	16 8
General Overheads and Selling Expenses (pro rata on above) ...	5 6	13 11
Total Cost	25 11	72 5

The striking difference between the costs of cylinder filling and handling for medical and industrial compressed oxygen appears to be due to the smaller sizes of cylinder used for the former, and the higher general overheads and selling expenses arise from the fact that they are arbitrarily allocated pro rata to other costs. The average cost of all medical oxygen in 1953 was calculated to be 65s. 1d. a 1,000 cubic feet. As, however, part of the total cost was determined on arbitrary bases as described above, the trading results set out in the Table in paragraph 165 must be treated with considerable reserve. Nevertheless, the figures for the works where costs are available suggest that at least some loss is being incurred on the sale of medical oxygen.

167. *Dissolved Acetylene: Prices and Profits.* The following table summarises the relevant trading results:

	1939	1952	1953	1954
Sales (including rentals)				
Value	£712,135	£3,125,408	£3,413,423	£3,430,457
Volume (1,000 cubic feet) ...	140,535	431,864	444,342	461,873
Average per 1,000 cubic feet ...	101s. 4d.	144s. 9d.	153s. 7d.	148s. 6d.
Cost				
Total	£475,341	£2,601,133	£2,694,358	£2,733,719
Average per 1,000 cubic feet ...	67s. 8d.	120s. 6d.	121s. 3d.	118s. 4d.
Profit				
Total	£236,794	£524,275	£719,065	£696,738
Average per 1,000 cubic feet ...	33s. 8d.	24s. 3d.	32s. 4d.	30s. 2d.
As percentage on cost	49·8%	20·2%	26·7%	25·5%

Sales by volume have trebled since 1939, and costs and selling prices have increased, respectively, by nearly 80 per cent. and nearly 50 per cent. As in the case of industrial oxygen the full cost increases have not always been recovered in the higher selling prices, and profits as a percentage on cost show a considerable reduction on the pre-war level.

168. *Works Costs.* We have examined the costs for 1952 and 1953 of the fifteen factories producing dissolved acetylene. Taking the two years together the weighted average cost a 1,000 cubic feet for all factories was 95s. 0d.; costs for individual factories ranged from 88s. 0d. to 99s. 11d. The average quarterly costs of carbide for all factories taken together varied from 57s. 1d.

to 66s. 10d. a 1,000 cubic feet of dissolved acetylene over the eight quarters examined. The average price paid for carbide was £31 2s. 0d. a ton* in 1952 and £33 17s. 9d. in 1953. Total purchases were about 36,000 tons in each year of which 40 tons in 1952 and 2,000 in 1953 came from Odda Smelteverk. Supplies from Odda increased to about 10,000 tons in 1954. Although the variations in the total works cost as between factories are not clearly associated with differences in level of output there are indications that costs other than for carbide vary to some extent with level of output.

Industrial Liquid and Compressed Oxygen and Dissolved Acetylene : District Prices, Costs and Profits

169. The average realised selling prices, total costs (excluding general overheads) and the profits earned expressed as a percentage on costs, for each of B.O.C.'s eight districts in 1953, are set out in Appendix 14.

Transport and Delivery Costs

170. The following table sets out the average transport and delivery costs for the years 1952 to 1954 for oxygen (industrial liquid, industrial compressed, and medical) and dissolved acetylene, expressed as percentages of total costs and of production and distribution costs:

	Per cent. of total cost	Per cent. of production and distribution costs
Industrial liquid oxygen	9·3	11·1
Industrial compressed oxygen	23·5	28·3
Medical oxygen (liquid and compressed) ...	25·6	31·0
Dissolved acetylene	10·2	12·3

The percentages for liquid oxygen are lower than for compressed oxygen because liquid oxygen is delivered either in large tank waggons or, after conversion to gas, by direct pipeline. B.O.C. does not evaluate delivery costs for supply by pipeline. For dissolved acetylene, the percentages are lower than for industrial compressed oxygen because nearly one half of the dissolved acetylene cost is for raw materials, including the porous mass and the acetone contained in the cylinders, for which there is no comparable element in the oxygen cost. The average cost of delivery of 1,000 cubic feet of gas in 1953 was 1s. 0d. for industrial liquid oxygen ; 6s. 0d. for industrial compressed oxygen ; 16s. 8d. for medical oxygen (liquid and compressed) and 12s. 0d. for dissolved acetylene.

Saturn Industrial Gases Ltd.

171. As we have explained, the only other important supplier of oxygen and dissolved acetylene is Saturn Industrial Gases Ltd., which distributes oxygen (pipeline and cylinder) and dissolved acetylene mainly in the North-East area. We deal with Saturn's costs and profits on propane in paragraphs 184 to 187.

172. *Prices.* Saturn does not publish a price list. It negotiates selling prices with its customers individually, regard being had to the price charged by B.O.C., to the quantity of gas taken, the rate at which the gas is consumed, and the distance over which it has to be transported. Prices include delivery, and there are no rental charges for cylinders retained over a period.

* B.O.C. informs us that for its accounting purposes 1 ton=2,200 lbs.

Saturn's prices for oxygen and dissolved acetylene are rather lower than B.O.C.'s in the same area for comparable quantities. During 1953 the bulk of Saturn's sales of oxygen (including pipeline supplies) were within the price range of 18s. 0d. to 30s. 0d. a 1,000 cubic feet, with small quantities being sold at prices up to and, in isolated cases, above 50s. 0d. a 1,000 cubic feet. For dissolved acetylene the corresponding figures were from 120s. 0d. to 180s. 0d. for the bulk of the trade, with the remainder up to and, in a few isolated instances, over 230s. 0d. a 1,000 cubic feet.

173. *Costs and Profits.* We have examined the costs and profits of the Saturn Group* in respect of its business in oxygen, dissolved acetylene and propane for 1952 and 1953. Separate cost records for oxygen and dissolved acetylene were kept only up to the works stage, the remaining costs and overheads for these two gases being combined. We have accepted the allocation of costs made between the companies in the Group and the depreciation charged in the Group's accounts which is based on rates similar to those used for Inland Revenue purposes. In computing capital employed fixed assets have been taken at book values.

174. As we have indicated in paragraph 20, Saturn is responsible for $1\frac{1}{2}$ per cent. of the total trade in oxygen and 1 per cent. in dissolved acetylene. We have found that in 1952 and 1953 the profit rate of Saturn, both on cost and on capital employed, for these two gases was much lower than the corresponding figures for B.O.C. (see paragraphs 160 and 168).

PART II: PROPANE

The Propane Producers

175. *Prices.* The prices charged by Esso and I.C.I. and by Shell-Mex & B.P. which acts as agent for Shell Petroleum, B.P. Trading and Eagle Oil & Shipping, are not (with the exception noted in paragraph 178) uniform, and we are assured that there is no agreement, understanding or consultation on price between these companies on supplies to third parties. In general, prices are ex-works, but certain sales made by I.C.I. and Shell-Mex & B.P. are on a delivered basis. The prices now charged by each company to its principal customers appear to be the result of individual negotiations though naturally affected by market conditions, while each company has told us that it takes some account of the fact that propane and butane are largely interchangeable in their uses as liquid petroleum gases, and butane is an important constituent of motor spirit. The following table sets out the average realised prices obtained in 1953, 1954 and 1955 by the three companies:

	1953	1954	1955
		£ per ton	
Esso	22·84	20·70	21·27
I.C.I.	23·30	26·25	26·24
Shell-Mex & B.P.	33·77	28·84	29·44

176. *Esso* tells us that its current prices follow, with some adjustments, those first charged to distributors in 1938. In quoting terms to customers Esso gives regard to the quantities supplied and to whether the propane is for resale or not. A variation of 1d. a gallon in Esso's wholesale price of

* i.e., the Saturn Oxygen Co. Ltd., and its subsidiary companies, British Cutting Gases Ltd., New Process Gases Ltd., Autogenous Gases Ltd., and Augas Northern Ltd.

motor spirit is equivalent to one of 32s. 0d. a ton in the price of propane. The price to Saturn recognises the long haul from Fawley to Saturn's customers; a reduction was made in July, 1950, in response to Saturn's representation that its propane business was becoming uneconomic.

177. *Shell-Mex & B.P.'s* prices for propane supplied to B.O.C. follow, with some adjustments, those fixed in 1943 when Shell-Mex & B.P. became dependent on I.C.I. for propane. These were calculated to yield on the purchase price from I.C.I. a profit of 1d. a pound to Shell-Mex & B.P. Changes in motor spirit prices have not been systematically reflected in the prices charged to B.O.C. for propane but for certain other customers there is an adjustment of 8s. 0d. a ton in butane and propane prices for each ¼d. a gallon on motor spirit. In settling prices for propane, Shell-Mex & B.P. aims to obtain such value for the product as market conditions permit, paying due regard to the minimum returns at the refineries which the consigning companies consider economic and to the recovery of distribution costs. Having regard to the assumed value relationship between motor spirit and butane and butane and propane, the ex-refinery return on propane is based on the ex-refinery return on motor spirit (see paragraph 175).

178. The prices for propane paid by B.O.C. to Shell-Mex & B.P., and as from 1st November, 1954 also to I.C.I., were as follows:

	In B.O.C. cylinders	In Shell-Mex & B.P. cylinders
	per ton £ s. d.	per ton £ s. d.
1952	29 10 0	50 0 0 (Jan. only) 38 10 0
1953	29 10 0	38 10 0
1954	24 0 0	35 0 0

I.C.I. charged Shell-Mex & B.P. £24 a ton from 1st July, 1953, and continued to charge this price to B.O.C. when direct trading began in November, 1954. For the use of cylinders belonging to Shell-Mex & B.P. to carry propane supplied by I.C.I., B.O.C. makes a payment to Shell-Mex & B.P. at the rate of £11 a ton. I.C.I. gives to B.O.C. a monthly statement showing the stocks, receipts and despatches of cylinders handled for B.O.C., and gives to Shell-Mex & B.P. a similar statement of cylinders handled for Shell-Mex & B.P. Prices for propane supplied to Calor Gas (Distributing) Co. Ltd. are negotiated annually. Prices for pure propane are higher than for the ordinary product because of the testing that is necessary in order to ensure that the required standard of purity is achieved.

179. *Costs and Profits.* Shell Petroleum and B.P. Trading keep no separate costings for the various by-products of the refineries. Shell-Mex & B.P. receives commission from the consigning companies at an agreed rate designed to cover distribution costs and to provide a small margin of profit. We have described these arrangements in Chapter 4. Esso and I.C.I. each keep for their internal accounting purposes a propane trading account to which they attribute all costs that can be separately identified with the processing and supply of propane and also a notional cost for the unseparated propane as a by-product of their main refining activities. For the latter figure both companies pay regard to the alternative use of tail gas or unseparated propane as a fuel. Esso relates it to the average market prices of marine fuel, with adjustments for ocean freight and thermal values; I.C.I. to the thermal value of propane as compared with that of fuel oil. When calculated in these ways,

Esso's profits were 78 per cent. on cost in 1953 and 55·6 per cent. in 1954, and I.C.I.'s profits were 28·3 per cent. and 40·6 per cent. on cost respectively. Both companies have stressed the notional character of these calculations. Esso has said that the profit figures have no significance in determining selling prices; and I.C.I. that its main concern is that propane should not yield an amount less than its value to it as fuel. I.C.I. has also pointed out that its selling price for propane is lower than for other hydrocarbons, such as butane and petrol.

The Distributors

The British Oxygen Company Ltd.

180. *Prices.* As in the case of oxygen and dissolved acetylene, B.O.C.'s prices for propane are on a national basis and for the great bulk of sales include delivery to customers' premises; customers who collect supplies from a depot outside the delivery boundary pay a surcharge towards the cost of maintaining the depot. A very few large users are in a "special" category and pay less than 6½d. a pound. Generally the arrangements for negotiating prices for group contracts, and for contracts with Government Departments and public bodies, are similar to those described for oxygen and dissolved acetylene in paragraphs 147, 150 and 151.

181. B.O.C. tells us that its prices for propane have not been increased since it first marketed propane in 1943, and that the basic determining factor is the price charged by the suppliers. B.O.C. is not aware of any case where it is being undersold. The following table shows the scale prices in force:

Group	6 months' sales	pence per lb.
1	less than 500 lbs.	9
2	from 500 to 2,000 lbs.	8
3	„ 2,000 to 5,000 lbs.	7½
4	„ 5,000 to 30,000 lbs.	7
5	over 30,000 lbs.	6½

182. *Costs and Profits.* B.O.C.'s sales, costs and profits on propane in 1952, 1953 and 1954 may be summarised as follows:

	1952	1953	1954
Sales (including rentals)			
Value	£234,331	£257,785	£287,151
Volume (1,000 lbs.)	7,273	8,256	9,368
Average per lb.	7·73d.	7·49d.	7·36d.
Cost			
Total	£212,845	£236,509	£245,445
Average per lb.	7·02d.	6·87d.	6·29d.
Profit			
Total	£21,486	£21,276	£41,706
Average per lb.	0·71d.	0·62d.	1·07d.
As percentage on cost	10·1%	9·0%	17·0%

The increase in profit in 1954 was partly due to a reduction in selling prices made by B.O.C.'s supplier (see paragraph 178). As will be seen from the figures given in paragraph 158, the percentage profit on cost of propane is considerably lower than that on oxygen and dissolved acetylene. It has not been possible to compute the capital employed by B.O.C. in respect

of propane alone, but as the company is only a distributor of this gas the amount of capital employed in relation to costs would be much less than for oxygen and dissolved acetylene. B.O.C. has told us that the profit rate on capital for propane would probably be not less than that on dissolved acetylene, if capital could be calculated separately for the two gases.

Saturn Industrial Gases Ltd.

183. The only other distributor of propane from whom we have obtained information about prices and costs of distribution is Saturn, which distributes propane in most districts except Wales.

184. *Prices.* Saturn tells us that its propane prices are largely determined by B.O.C. competition. As in the case of the other two gases there is no published price list. Prices to individual customers are based on the quantities which are supplied, and the distance the gas has to be transported; prices include delivery and there is no reduction for ex-works sales. The prices charges by the Saturn Group in 1953 for Pyrogas* ranged from 5d. to 8d. a pound for the bulk of the sales, with some customers paying up to 2s. 6d. a pound for small quantities. For Super-Pyrogas* the average price was about 2s. 2d. a pound.

185. Our examination of the figures of the Saturn Group shows that the trading results for propane for 1952 and 1953 were less favourable than those of B.O.C. (see paragraph 182) and that this was particularly so in the latter year.

186. The unsatisfactory results for 1953 are ascribed by Saturn to (*a*) a reduction in price to a large contracted customer from July, 1953; (*b*) a falling-off in the sales of Super-Pyrogas (which is regarded by Saturn as more profitable than Pyrogas); and (*c*) the higher price paid for propane of I.C.I. origin during a shut-down of the Fawley refinery. This offset for a time the benefit of a reduction made by Esso in April, 1953 for propane at Fawley. Saturn thought that there were better results on propane in 1954, in part as a result of the general re-organisation of the affairs of the Group, but because of a merging of accounting records it has not been possible for the company to give us details.

Comparison of B.O.C.'s and Saturn's Costs

187. We have made a comparison of the average costs of B.O.C. and Saturn on their trading in propane and in Pyrogas respectively in 1953. We find that at the works cost stage and also for delivery Saturn's average costs a pound are somewhat the lower, but that this advantage is more than offset by Saturn's higher costs for selling expenses and general overheads. It seems likely that the difference in selling and general overheads costs per unit of the two companies is due, at least in part, to the very much larger turnover of B.O.C., which enables it to spread such costs more widely.

* See paragraph 55.

CHAPTER 7: CONCLUSIONS ON THE CONDITIONS DEFINED IN THE ACT

188. We are required by our terms of reference to report whether the conditions to which the Act applies prevail as respects the supply of each gas in the reference. In the circumstances of this inquiry, the conditions to which the Act applies* prevail if at least one-third of the goods which are supplied in the United Kingdom are supplied (1) by or to any one person (2) by or to any two or more inter-connected bodies corporate or (3) by or to any two or more persons who so conduct their affairs as in any way to prevent or restrict competition in connection with the production or supply of the goods.

Oxygen

189. As is shown in the Table in paragraph 20, in 1953 and 1954 about 96 per cent. of the oxygen supplied in the United Kingdom was supplied by the British Oxygen Co. Ltd. and over 98 per cent. was supplied by the inter-connected bodies corporate which form the B.O.C. Group.

Dissolved Acetylene

190. As is also shown in the same Table, about 92 per cent. of the dissolved acetylene supplied in the United Kingdom was supplied by B.O.C. and over 98 per cent. by the B.O.C. Group.

Propane

191. In relation to propane we think it proper in all the circumstances to treat separately, in accordance with Section 3 (3) of the Act, each of two forms of supply, namely, supply by producers and supply by distributors.

192. *Supply by the Producers.* We have calculated total supplies in the United Kingdom by adding together the sales by the producers of propane of their own production. The relevant figures are set out in Table I, paragraph 21. The total supplied by each company includes any amount bought from other producers for resale so that the percentage figures add up to more than 100 per cent. of the total supplied in the United Kingdom. On the average of the period covered by the Table, 1953, 1954 and 1955, Esso supplied about 35 per cent. of the propane supplied. Through the common marketing agency of Shell-Mex & B.P., "Shell" Refining & Marketing† and British Petroleum,‡ with Eagle Oil & Shipping, supplied just over 60 per cent. and, having regard to the terms of the agency agreement with Shell-Mex & B.P. and to the understanding with B.O.C. referred to in paragraph 101, they so conduct their affairs as to restrict competition in the supply of propane. I.C.I. supplied about 37 per cent. The supplies of propane made *to* the B.O.C. Group amounted to about 58 per cent. of the propane supplied by producers.

193. *Supply by the Distributors.* We have calculated total supplies by distributors in the United Kingdom by adding the sales by the distributors named in Table II, paragraph 21. On this basis over the same period B.O.C. supplied about 58 per cent., the B.O.C. Group about 59 per cent.,

* Section 3 (1), Monopolies and Restrictive Practices (Inquiry and Control) Act, 1948.

† As from 31st December, 1955, "Shell" Refining & Marketing Co. Ltd. has handed over its production and trading activities to Shell Petroleum Co. Ltd. (see paragraph 93).

‡ As from 31st December, 1954, The British Petroleum Co. Ltd. had handed over its production and trading activities to BP Trading Ltd. (see paragraphs 95 and 96).

and Saturn Industrial Gases Ltd. about 36 per cent. of the propane supplied by distributors.

Conclusion

194. We have no reason to believe that there has been any material change in the proportions mentioned in paragraphs 189, 190, 192 and 193 since the years to which the figures set out in these paragraphs relate. The restrictive arrangements mentioned in paragraph 192 are still continuing. We consequently find that the conditions to which the Act applies prevail as respects the supply of each gas in the reference, in the manner and to the extent indicated in the preceding paragraphs.

CHAPTER 8: THE CASE FOR THE PRODUCERS AND SUPPLIERS

Part I: The British Oxygen Company Ltd.

B.O.C.'s Share in the Industry

195. B.O.C. has pointed out that ever since the importance of the use of industrial gases came to be recognised it has specialised in their production. It claims that it has always pursued a policy designed progressively to increase its efficiency and that it is because of its efficiency over the years that it has achieved its present monopoly position. It contends that that position is in no way contrary to the public interest, and indeed that it furthers the public interest for the following reasons: (*a*) B.O.C.'s works are so placed as to cover practically all industrial areas in the United Kingdom and to ensure prompt and economic delivery by B.O.C.'s own transport; (*b*) economy in production, supervision and distribution can best be achieved by bringing the manufacture of oxygen and dissolved acetylene together on the same site and by delivering both together; (*c*) the siting of works, together with B.O.C.'s resources, technical knowledge and experience, enable oxygen and dissolved acetylene to be produced and distributed in such volume and at such prices as will best meet the requirements of the market.

196. B.O.C. submitted to us that this contention was supported by the following special circumstances connected with the industrial and medical gases industry:

(*a*) Plant is very costly and considerable capital is required.

(*b*) Plant must constantly be renewed and brought up to date and this again is costly.

(*c*) So far as cylinder oxygen is concerned the container is approximately twenty times as valuable as its contents.

(*d*) Prompt delivery is extremely important, and this is best given if, like B.O.C., the undertaking has works so situated as to cover all industrial areas and is able to use its own transport and so save cost. B.O.C. is able to avoid duplication of works capacity, transport, plants, management and offices.

(*e*) An unfailing supply of oxygen is essential to many industries, and any interruption can have serious consequences. A temporary shortage or a breakdown in one of B.O.C.'s main producing areas can be overcome by the transport of liquid oxygen from another. By this means, expansion in consumer demand, temporary or permanent, can be met without delay. Moreover, planned maintenance and overhaul of all plants throughout the country can be carried out on a co-ordinated basis without interruption of supplies. Spare capacity is not essential in all producing centres, as standby plant in one district can serve the needs of other districts. If oxygen were supplied by a number of competing concerns each of them would require reserve plant to cope with expansions in demand or breakdowns. The capital investment required under such conditions would of necessity be greatly in excess of that now required, and this would involve a wastage of national resources.

(*f*) Compressed gas manufacture entails the observance of a strict code of safety regulations. B.O.C. continues to pay the closest attention to matters of safety in the interests not only of its works personnel, but also of all users of compressed gases.

Development of B.O.C.'s Monopoly Position

197. B.O.C. has assured us that it has not been the company's policy to secure complete control in the oxygen and dissolved acetylene field by taking over the gas interests of other producers, suppliers and competitors, or otherwise preventing the establishment of effective competition including the production of oxygen for producers' own consumption. The acquisitions listed in paragraph 31 undoubtedly added to B.O.C.'s position in the industry, but their purpose, says B.O.C., was to improve efficiency, to reduce costs, and to enable gases to be produced and distributed at a fair price. Regarding the first category of undertakings acquired (the suppliers of gases), some were acquired to obtain patent rights or know-how to the great benefit of users. Some of the undertakings in this category were in a poor way and approached B.O.C. with a view to being taken over. B.O.C.'s comments on the fact that between 1932 and the war it did not sell any plants protected by the Heylandt patents which it acquired with the exclusive agency for the sale of Heylandt plants through its agreement with Metal Industries have already been noted in paragraph 117. It is in B.O.C.'s view significant that only one supplier, Saturn, entered the industry in the years between 1932 and the war, and that Saturn was not interested in obtaining Heylandt plants: it obtained its gas producing plants from the U.S.A. Regarding the second category of undertakings acquired (the suppliers of oxygen surplus to their own requirements), B.O.C. has commented on two cases. By 1934 the oxygen plant of Edgar J. Rees Ltd. was getting old and out of date, and the company found it was not worthwhile to continue to produce oxygen and willingly entered into an arrangement to take its supplies from B.O.C. The Plymouth Oxygen Co. Ltd. found difficulty in maintaining continuity of supplies, as did other isolated operators of small plants, and when in 1928 B.O.C. was contemplating expanding its network to cover the south-western region, the company willingly sold its plant and business to B.O.C. B.O.C. claims that undertakings in the third category (the producers of oxygen for their own use) were faced with the choice of continuing with unsatisfactory out of date plant, incurring the cost of replacing it or making use of B.O.C.'s supplies and services. In each case, the undertaking chose B.O.C.'s services because it was to its advantage. The fourth category comprises the two undertakings, Liquid Air Ltd. and Oxhycarbon Ltd., which supplied customer oxygen plants. According to B.O.C., Liquid Air had some initial success in selling these oxygen plants but with the growth of the delivery service developed by B.O.C. and Metal Industries, found it difficult to persuade consumers that it was worth while having their own plants. The company got into financial difficulties and approached B.O.C. with a view to being taken over. At the date of acquisition, Liquid Air had losses carried forward for tax purposes of £20,353 and various allowances of £12,345 for which relief had not been granted, making a total of £32,698 to be carried forward. These assets were of interest to B.O.C. which was expanding at that time and, B.O.C. has told us, may have been regarded as a " cheap buy ". Oxhycarbon, a subsidiary of Messer of Frankfurt, had been used prior to 1934 for the sale of the parent company's gaseous oxygen plant and equipment in the United Kingdom, the business done being principally in equipment. B.O.C. desired to carry on the business as before and made the agreement with Messer in 1934 whereby Oxhycarbon became Messer's sole agents in the United Kingdom for all plant and equipment which it had handled before the change in ownership. Messer chose to adopt this method of making its products available in the United Kingdom rather than go to the expense of setting up a new selling organisation. B.O.C. has said that from about 1928, owing to the growing efficiency of direct supplies from the large producers, the trend had been steadily against the

use of plants by consumers, that by 1934 there was virtually no demand for them, and that since then Oxhycarbon has never had a request for a plant. B.O.C. asserts that its acquisition of the two foregoing plant interests and the conclusion of the agreement with Messer in 1950 were not effected with any intention of cornering the oxygen market.

198. B.O.C. claims that the patent rights it acquired in the course of its development were not critical in the sense that they closed the field to others who might have desired to engage in the production of oxygen on a commercial scale. The Linde and Claude patents expired by 1916, leaving the process of oxygen production by the fractionation of liquefied air available to all from that date. The earliest Heylandt patents expired in 1936, and all the more important Heylandt patents had expired by 1943. It has been open to anyone to produce and distribute liquid oxygen for nearly twenty years, and it has been open to anyone to manufacture, use or sell gaseous oxygen plant for the past forty years without risk of patent infringement.

The Supply of Plant and Equipment

199. B.O.C. states that the object of the agreement of 1936 with Linde Air Products, U.S.A. was to make available in the United Kingdom the knowledge that had been developed in the U.S.A., and that the effect of the agreement was to improve and extend the means of applying oxygen over a wide field of industry to the general advantage of consumers. The subsequent agreement of 1951 with Union Carbide & Carbon Corporation relating to liquid oxygen patents merely conferred certain reciprocal licensing rights which are not exclusive to B.O.C. The restrictions in the agreement have had no effect on B.O.C.'s own sales of plant. B.O.C. has pointed out that there is nothing to prevent any manufacturer of equipment, of whom there are many in this country, from competing with the hot deseaming machine manufactured in the U.S.A. by Linde Air Products and supplied by B.O.C. under its non-exclusive licence and the hand deseaming torch now manufactured by B.O.C. under its non-exclusive licence, so long as the Linde Air Products patents are not violated. Of all the equipment supplied by B.O.C. a condition requiring the purchaser to use B.O.C. gas is imposed only in connection with the hot deseaming machine. It is a matter of mutual convenience that a customer using one of these machines agrees to take supplies of gas from B.O.C. rather than to reimburse B.O.C. for the service it gives by operating on a royalty basis. A machine can be bought direct from Linde Air Products free of any such restriction and the purchaser is then free to use whose gas he likes.

200. We are told by B.O.C. that the purpose of the agreement of 1950 between Oxhycarbon and Messer was in direct continuation of the policy mentioned in paragraph 197 in connection with the 1934 agreement between the same parties. B.O.C.'s purpose in concluding the agreement of 1954 (with Linde of Germany) which set up the jointly owned selling company, British Oxygen Linde Ltd., was to place before the firms interested in tonnage plants the most modern installations which would incorporate all the latest developments of both companies.

201. B.O.C. has said that the three stages in the history of oxygen production bear upon the supply of oxygen plant. When gaseous oxygen in cylinders was the main method of supply, small customer plants may in some cases have been economic because of the high cost of supply in cylinders to remote areas. The second stage was reached when liquid oxygen became the main type of supply to large users at much lower cost. Then customer plants became quite uneconomic. The third stage was reached when large undertakings required oxygen in tonnage quantities at one point with a

continuous demand. In such cases, a gas plant working at the point of consumption is economical. Until the advent a few years ago of tonnage oxygen, the economic factors were all against customer plants. B.O.C. claims that it is due to its research and collaboration with industry that the use of oxygen has reached its present volume and importance, and that it is the scale on which oxygen is now required by single consumers as a result of these developments that has made possible and created the present interest in plants capable of supplying these vast quantities. There is no question of B.O.C. finding itself faced with a sudden demand and reversing its policy. B.O.C. has done much to foster the demand for tonnage oxygen and consequently for tonnage plant. The fact that it now offers to supply tonnage plants through British Oxygen Linde Ltd. is not a reversal of policy in regard to the supply of plant. B.O.C.'s policy is that "the supply of gas is the best method"; it "pushes that method until it gets knocked out by a plant proposition", but offers both.

202. B.O.C. tells us that it is not its policy to prevent the sale of plant to anyone and it has taken no steps to prevent such sales. Oxygen plant may be obtained from any of the following suppliers: the Butterley Company, L'Air Liquide of France, Air Products Inc. of U.S.A., British Oxygen Linde Ltd. (half owned by B.O.C.), Messer of Frankfurt (through Oxhycarbon). It follows that B.O.C. could at no time have prevented a customer from obtaining his own plant, even if it had desired to do so. That users prefer to obtain the gases from B.O.C. is claimed to be due to the fact that it is more convenient and economical to do so.

Purchase of Surplus Electrolytic Oxygen

203. The surplus electrolytic oxygen bought from four chemical manufacturers (see paragraphs 19 and 66) is in each case a residual by-product from a hydrogen plant used for an entirely different purpose from that of oxygen manufacture. The quantities available are relatively small and fluctuate with the use to which the hydrogen plant is put at any given moment. B.O.C. has explained its contracts for the purchase of such oxygen on the ground that the chemical manufacturers are naturally anxious to obtain some advantage from this by-product, and has told us that in each case the approach and request to take over the electrolytic oxygen came from the operator of the hydrogen plant to B.O.C. and not vice versa. If a chemical manufacturer tried to sell the gas himself he would not be able to give continuity of service to his customers because his rate of supply would be subject to wide fluctuations, and he would have to incur heavy capital outlay in compressing plant, cylinders, cylinder testing equipment, and also office management and transport costs. B.O.C. claims that for these reasons it is to the advantage of both parties that this casual and irregular source of supply should be absorbed as and when it is available through B.O.C.'s distributing organisation.

Contract Terms

204. B.O.C. justifies the restrictive character of Clause 8 of its standard form of contract (see paragraphs 76 and 77) as a reasonable means of safeguarding its interests. Under the terms of the contract B.O.C. undertakes to supply over a period of one year whatever quantities of gas the customer may require. No total quantity is specified but the price at which B.O.C. undertakes to supply is based upon total estimated consumption over the whole year. As the customer obtains the advantage of a price based on his estimated requirement for the year it is considered not unreasonable that he should undertake, for the year during which B.O.C. is bound by the agreed price, to fulfil that requirement from B.O.C. and not from elsewhere. Further-

more, as is mentioned in the following paragraph, the evaporators and pipelines are installed on a customer's premises as part of the B.O.C. service, and it is not thought that it would be reasonable to expect B.O.C. to incur this expenditure and then allow someone else to supply the gas to be used with B.O.C.'s installations. B.O.C. would raise no objection, however, if a customer wished to take 50 per cent. of his gas from B.O.C. and 50 per cent. from elsewhere, provided this was made clear at the beginning of the year; the price would then be based on 50 per cent. of the estimated total requirement. B.O.C. has drawn attention to the fact (which we have mentioned in paragraph 76) that in 1954 only 1,575 customers out of a total of 99,438 were supplied under written contracts containing the clause in question, and has pointed out that the remainder took their supplies free of any such restriction.

Evaporator and Pipeline Installations

205. B.O.C. has said that the arrangement whereby it provides evaporators and pipelines in a customer's premises does not have the object of securing the gas sale to B.O.C.: it is part of the service rendered by B.O.C. The installations are costly and require maintenance and repair, and extensions and adjustments of supply points are frequently necessary. All this work has to be carried out in conformity with a strict code of safe practice involving regular hydraulic testing and overhaul. This is done by B.O.C. as part of its service, to the advantage of the customer and the safety of his workpeople. It is a practice adopted by suppliers throughout the world and a service which customers have come to expect. When B.O.C. in 1938 made uniform the practice whereby it installs and retains ownership of evaporators and pipelines, every customer with one exception welcomed the new arrangement.

Undisclosed Subsidiary Companies

206. B.O.C. denies that the maintenance of British Industrial Gases Ltd. and Industrial Gases (Scotland) Ltd. as ostensible competitors had the object of assisting to secure complete control of the gases industry. At the time of the acquisition of the former company and the setting up of the latter, the non-disclosure of ownership was presumably thought to be of some value because customers liked to feel that they had an independent or smaller source of supply, whether or not there was in fact any benefit from such supply. It had long been felt that any purpose this might have had was no longer valid, and the continuance of the arrangement reflected the little interest that B.O.C. had in the matter over a period when it was developing very rapidly. B.O.C. has no purpose today in maintaining ostensible competition, and when attention became focussed on the matter in 1954 it was decided to make public acknowledgment of the ownership of the two companies, and of British Industrial Gases' subsidiary, Oxhycarbon. This was done in the Report and Statement of Accounts for 1954 presented in May, 1955.

207. B.O.C. denies that it at any time engaged in a "price war" in Scotland: it was in a position to meet and match competition by Saturn and did so. Industrial Gases (Scotland) was used as a fighting company to cut the price to the point of competition. B.O.C.'s prices were not increased in Scotland after Saturn had ceased to operate there.

The Supply of Dissolved Acetylene

208. In the first paragraph of this chapter we mentioned B.O.C.'s reference to the economic advantages of combining the production of oxygen and of dissolved acetylene in the hands of one concern. B.O.C. also points out that

a large amount of acetylene is produced privately from generators (obtainable from a number of sources) and that this is in active competition with dissolved acetylene. Moreover, one of the principal difficulties for the producer user is the disposal of the waste lime/water sludge. This may be a serious matter because each ton of calcium carbide used produces from five to eight tons of sludge. With large acetylene generators such as are used for the production of dissolved acetylene, special plants are installed for collecting, processing and handling this sludge to convert it into a condition where it can be disposed of conveniently, but seldom profitably. With the smaller generators such as are used on site, no such plants are installed, and as the sludge must not be passed down sewers and drains or put into rivers, disposal is a constant problem and expense. There is no corresponding nuisance or trouble to the user of dissolved acetylene who has only to return the empty cylinders for refilling. Further, it is possible and practicable to obtain a higher overall yield of acetylene with the more efficient plants operated in large scale production than with direct use from generators on site.

Dissolved Acetylene and Propane

209. B.O.C. says that it is an open question whether propane or dissolved acetylene is in general the better fuel gas for use in oxygen cutting: each has advantages suited to particular circumstances. In using propane, more oxygen is required than if dissolved acetylene were used instead. For certain types of work, although propane would serve the purpose, if jobs were costed in detail it could be proved that dissolved acetylene had more advantages. B.O.C. takes the view that a sufficient measure of competition between the two gases already exists, that both are freely available together with generated acetylene, and that the customer's choice, based on his experience and preference, is all the competition required. B.O.C. is as willing to sell propane as dissolved acetylene despite the better return on the latter, and, while not pushing propane, it supplies special blowpipes for it and "all inquiries are dealt with". Sales of propane are increasing, and B.O.C. says that it has not kept the price unduly high as a result of its interest in dissolved acetylene: in fact, the price to the public has not been increased since B.O.C. began to market propane in 1943, in spite of the substantial increase in costs.

210. B.O.C. has pointed out that the oxy-acetylene process has competitors in the welding field. A large trade is done by the many manufacturers of electrodes and arc welding apparatus. The electric process is to an extent complementary to the oxy-acetylene process but nevertheless is competitive in certain respects.

Research and Development

211. B.O.C. maintains that it has played its full part in research and development and that it has always had a considerable technical side which, over the years, contributed importantly to the Brin oxygen process, the early work of hydrogen liquefaction, the safe storage of acetylene in cylinders, and the like. B.O.C. was the first to introduce the mild steel cylinder which was a big advance over the heavy iron cylinders which had been in use prior to 1886. The types and sizes of cylinders used by B.O.C. became the recognised standards in the trade not only in this country but throughout the world. B.O.C. claims that recommendations issued by the Home Office in 1895 for the guidance of the trade were largely based on the company's standard practice and remained in operation until embodied in the Gas Cylinders (Conveyance) Regulations, 1931. B.O.C. admits that none of these developments marked such an industrially important step as the air liquefaction processes of Claude and Linde, the Heylandt process for making liquid

oxygen or the initial work on tonnage oxygen production by the Linde-Fränkl process—processes which appeared on the Continent during the first forty years of this century, but claims that having regard to the heavy expenditure entailed in research into gas separation problems, it pursued a policy of international linkage, a policy which it believes to be sensible and which is followed in many industries where technical advance can be achieved only at very high cost. The adoption of liquid oxygen by its organisation was, B.O.C. maintains, a real contribution and was pursued so vigorously that it outstripped developments in other countries and enabled more favourable prices to be offered than elsewhere in the world.

212. Immediately the war was over, in 1945, B.O.C. set up a separate Research and Development Department, and in 1948 a Research and Development Director was appointed to the Board specially to represent this aspect of the company's activities. Today, the Research and Development Department at Morden, Surrey, has a staff of nearly four hundred trained research workers, and in the financial year 1954, £230,000 out of the total expenditure of £348,000 on research was allocated to work in connection with the three gases under inquiry*. This effort which has now been in operation for ten years has been devoted primarily to development work in the company's natural fields. Thus the basis of oxygen plant design has been examined both in regard to fundamentals and engineering, and B.O.C.'s war time effort of making its own plants has been strengthened until at the present time its standard liquid oxygen plants are the largest in Europe and, as far as B.O.C. can learn, the most efficient. B.O.C. believes that, while tonnage plants originated in Germany, its own Rescol tonnage oxygen process represents the biggest advance in this subject that has been made since. Coupled with the development of the tonnage process is B.O.C.'s extensive and continuing research into oxygen in steelmaking. In conclusion on this topic, B.O.C. has said that as in all industrial organisations the development aspect is greater than research and more applied than basic work is undertaken, but that in its case the proportion of the latter type of work has gradually increased and can now compare with any firm in the United Kingdom of comparable size.

Services

213. B.O.C. has told us that it is "frankly proud of its standards of service to its many customers". In 1954 it had upon its books 99,438 customers of whom about 96,000 took 27·78 per cent. of the total compressed oxygen sold. The average quantity bought in a year by each of these 96,000 customs was about 4,000 cubic feet, which in money value is rather less than £10. To find some complaints among so large a number of customers is inevitable, but the number of complaints is considered to be remarkably small, and B.O.C. does not regard them as in the least justified: in its experience there is "considerable satisfaction and a good deal of commendation". It considers its local arrangements for cylinder floats satisfactory both for the small and the large user. B.O.C. has had great difficulty in the matter of the return of empty cylinders, and has constantly to press for their return. If this pressure were relaxed B.O.C. estimates that it would have to increase its cylinder holding by approximately 30 per cent. This would involve capital expenditure of £2,670,000 in respect of oxygen and dissolved acetylene cylinders, and on the same volume of output, an increase in the depreciation charge alone of 1s. 6d. a 1,000 cubic feet on oxygen and 3s. 1d. a 1,000 cubic feet on dissolved

* See paragraph 245.

acetylene. The average selling price would have to be increased by at least as much. Within the last year supplies of cylinders have been a little easier thanks to the expanded capacity of the manufacturer and the improved supply of steel.

214. B.O.C. is proud of its service to hospitals. The great majority of hospitals are within its delivery areas, and B.O.C. regards its arrangements for hospitals outside the delivery areas as adequate. Hospitals outside such areas receive larger stocks than would otherwise be the case, and every request from a hospital for an increased allocation of cylinders is dealt with at once.

215. B.O.C. stresses the value of the work done by its Sales Technical Service Department. On the industrial side, it has a force of 158 demonstrators, of whom 25 are specialists in steel and technical applications, 45 staff the Sales Technical Service and Training School at Cricklewood, and the remainder are distributed between the eight districts. The Sales Technical Service Department is the medium through which the latest developments in welding, cutting and treatment of metals are made known. At practically all the works there is a school, run by the Department, where customers' employees may attend for special tuition. Lectures are frequently given to technical bodies in all parts of the country. The smaller industrial customers are made aware of the free technical sales service ; every customer is waited upon by the sales staff, and B.O.C.'s trade literature publicises the sales technical service which it gives. On the medical side, B.O.C. collaborates closely with anaesthetists through their Society and operates a nation-wide maintenance service for medical apparatus and pipeline systems in hospitals. A staff of trained engineers is available at any time to attend to calls from hospitals in the event of any breakdown in supply. Finally, B.O.C. claims that it does not adopt expensive advertising methods and seeks to avoid extravagance in its service.

Prices, Costs and Profits

216. *Prices.* B.O.C. says that its price level has been determined by the desire to expand the use of oxygen and claims that the production figures show the remarkable success that has been achieved in this aim by maintaining a constant policy of keeping prices as low as efficient production and moderate profits will allow. " Any arbitrary limitation which would prevent commercial procedure for adjustment of all units to make one composite whole according to changing circumstances could only be harmful and would retard freedom of development."

217. B.O.C. has drawn attention to what it regards as sufficient safeguards against the charging of excessive prices. It points out that it is open to users who hold the view that its prices are excessive to install their own plant and produce their own gas. If prices and profits are in fact excessive, it says others will be induced to start the manufacture of gases on a competitive scale. In support of the claim that its prices are moderate it has pointed out that they have risen comparatively little since 1938. A comparative Price Index Graph submitted by B.O.C. showing the trend of industrial compressed oxygen, liquid oxygen and dissolved acetylene prices charged by B.O.C. over the years 1938 to 1954 as compared with the Board of Trade Index of Wholesale Prices and the London and Cambridge Economic Service Index of Retail Prices will be found in Appendix 15. The following is a summary of the graph:

	1938	1954
Board of Trade: Index of Wholesale Prices	100	327
London and Cambridge Economic Service: Index of Retail Prices	100	236
B.O.C.: Industrial Cylinder Oxygen Prices	100	143
B.O.C.: Liquid Oxygen Prices	100	94
B.O.C.: Dissolved Acetylene Prices	100	144

A statement showing B.O.C. sales of compressed oxygen, liquid oxygen and dissolved acetylene with average prices from 1920 to 1954 is given in Appendix 13. B.O.C. gives the following explanation of the difference in price movements between liquid oxygen, compressed oxygen and dissolved acetylene. The price of liquid oxygen between 1938 and 1954 fell from 100 to 94 points, and the sale of this bulk product increased from 234 million cubic feet to 3,837 million cubic feet during the same period. The benefit of the increase in volume has been passed on to the customer in the price. Furthermore, the plants of today are much larger than those which were in operation in 1938, giving economies which again have been passed on in the price. The price of compressed oxygen advanced from 100 to 143 points. The increased cost of the cylinders and transport has had a marked effect on the increase in the price of this commodity. The benefit of increased volume does not apply, as whenever a customer's demand reaches a certain quantity he is offered liquid oxygen. The price of dissolved acetylene advanced from 100 to 144 points. Similar considerations apply in regard to the cost of cylinders and transport, and in addition, the price of carbide has risen considerably. Volume increase has practically no effect. B.O.C. claims that its prices for industrial oxygen and dissolved acetylene are lower than the prices charged for these gases in France, Germany and the U.S.A.

218. B.O.C. is firmly of the opinion that more general competition would not bring about a general reduction in prices, but indeed the contrary. It points to the high capital costs, the proportion of costs attributable to containers, transport and distribution in relation to the value of the actual product, and the necessity for prompt and regular delivery on a nation-wide basis. In an industry where such conditions prevail, the duplication of costs that would result from competing suppliers seeking to cover the same areas would have a far reaching adverse effect upon economic production. The economies of large commercial production would be lost without any compensating advantage. B.O.C. has instanced the fact that a bulk insulated container designed to carry 100,000 cubic feet of liquid oxygen weighs 5 tons loaded whereas the weight of a vehicle and cylinders carrying the same quantity of gas is 40 tons. The advantage of bulk distribution of liquid oxygen to compressing stations and to large users is clear. The policy of B.O.C. has always been to reduce prices whenever improvements in efficiency and production methods lead to a saving in costs, and price reductions have taken place on many occasions since the national scale came into operation. Medical oxygen has been sold for many years at below cost. B.O.C. says that since the national price policy was fully implemented in 1945 it has not sold industrial gases at lower prices in areas where it has been faced with competition: it agrees that variations in average realised selling prices do occur, but says that this is due to the fact that one district may have a preponderance of large users whereas in another the customers may be small users scattered over a wider area.

219. B.O.C. maintains that its experience over a long period of years has confirmed its belief that the differences in the prices to different categories of purchaser reflect differences in costs, and that there is no justification for any suggestion that the small and medium users are at a disadvantage. Reference has already been made to the fact that out of 99,438 compressed oxygen customers in 1954, about 96,000 bought quantities on average worth less than £10. The detailed figures are as follows:

Group	Number of customers	Price delivered per 1,000 cubic feet	Average purchases of each customer per annum	Group percentage of total cylinder sales
		s. d. s. d.	cubic feet	
No. 1	96,006	47 0	4,000	28
No. 2	2,712	41 0 to 30 6	120,000	23
No. 3	704	30 0 to 23 0	783,000	39
No. 4	16	22 6 to 18 0	8,743,000	10
Total	99,438			100

B.O.C. stresses that the cost involved in supplying the small users is very much higher than the cost of supplying the large user. B.O.C. would have no objection to the publication of a price scale for small consumers if we came to the conclusion that this was desirable, but believes that the circumstances vary so much in the case of the relatively smaller number of large consumers that no advantage would be afforded by the publication of a scale.

220. Many years ago, B.O.C. experimented with a system of prices ex-works for gases in cylinders by making a reduction of 1s. 0d. or so a 1,000 cubic feet to customers who collected ex-works. The system was proved to be unsatisfactory and was abandoned. It meant, in effect, that when a customer's transport was not otherwise employed he collected his supplies himself and saved 1s. 0d. a 1,000 cubic feet and when he had no transport to spare he ordered supplies to be delivered. B.O.C. never knew when a customer would require delivery or when he would collect ex-works himself, and transport had to be kept available to deliver all supplies. A constant stream of callers at the works for trifling lots of cylinders would involve having extra labour available for handling and would increase costs.

221. B.O.C. is of the opinion that a national price scheme is preferable to a local one. The cost of production varies from district to district for reasons over which B.O.C. has no control. About 50 per cent. of the cost of liquid oxygen production in practically all B.O.C. works represents the cost of electricity. The price of electricity varies from district to district: for example, the price of 0·64d. a unit at Leeds represents a cost of 2s. 4d. a 1,000 cubic feet of oxygen while the price of 0·99d. a unit at Wembley represents a cost of 3s. 6d. a 1,000 cubic feet of oxygen. Variations in the cost of transporting and distributing liquid oxygen depend on the proximity of the customers to the plant. A concentration of large customers in an area calls for a large scale production with consequent saving in costs, and the age of the plant affects the sum attributable to depreciation. By operating on a national basis and averaging the costs of production at each factory, it is possible to maintain a reasonable and stable scale of prices irrespective of the location of the customer, so long as his premises are within any B.O.C. delivery area, as is the case in practically all industrial areas. If local prices were adopted there would be constant fluctuations as new plants with high rates of depreciation were installed or other circumstances affected costs.

Under the present system a rise in costs in one area—for example, in the cost of electricity—may be compensated by a reduction—for example, owing to greater output—in another area.

222. *Cost Control.* B.O.C. claims that the considerable variation in cost between one factory and compressing station and another, and the efforts made to secure greater economy and efficiency of production, are the subject of constant and systematic attention and that no advantage in these directions would result from the adoption of a local price scheme. B.O.C. has described to us its method of cost control. On completion of each quarter, accounts are drawn up in summarised form giving essential information to each member of the Board of Directors, the Chief Executive Financial, and the Secretary. Accounts in greater detail, highlighting particularly the trading account aspects including production, compressing and transport costs, and district office and selling expenses, are prepared and provided for each member of the Operations Committee, which is composed of the Chief Executive Sales, the Chief Executive Technical, the General Sales Manager—Industrial, the General Sales Manager—Medical, the Production Manager, the General Transport Manager and the Chief Accountant. Summarised schedules showing production and compressing costs by types of expense and factories are provided to the Production Manager, together with additional copies for each District Engineer, so that relative comparisons of factory costs can be made and efficiencies studied. Similar information is provided for oxygen and dissolved acetylene works overheads which is used to compare the results with previous quarters and other factories and forms the basis of discussions and works studies. In this connection it is normal practice for the Production Manager to receive a copy of the individual works production, compressing and overhead schedules as prepared by each district, which incorporate, among other items, hours worked in the case of labour, weight used in the case of materials, and quantities used in the case of items such as electricity, gas and water, and commodity units and values. These schedules are intensively studied by the Production Manager and his staff at Head Office and provide basic information of a control nature which enables performances and efficiencies to be actively reviewed, and the results of new methods or improvements are shown up. Similar detailed schedules are prepared showing appropriate types of expense and district or works figures for (*a*) transport expenses which are distributed to District Accountants for District Transport Superintendents (in addition detailed costs by types of vehicles and commodities carried, which are allocated to particular gases by the application of an estimated conversion factor, reviewed from time to time, are provided by districts to the General Transport Manager at Head Office), (*b*) office expenses, which are distributed to District Accountants, (*c*) selling expenses, distributed to District Sales Managers and (*d*) canteen expenses, distributed to the District Accountants.

223. B.O.C. tells us that the purpose of assembling all this information is to promote economy and efficiency in production. It constitutes the working basis for the meetings of all Works Engineers, which take place regularly. At these meetings costs and results at each factory are submitted to detailed scrutiny and close comparisons made between the achievements of the several factories in economy and production.

224. *Profits.* In arguing the reasonableness of the agreed profit figures of 24 per cent., 23½ per cent. and 23 per cent.* for the years 1952, 1953 and 1954 respectively, B.O.C. points out that there is only one profit—there are no middlemen—and that the resources needed for development are "very

* Basis A, see paragraph 158.

great". When fresh capital has to be obtained from the investing public, B.O.C. needs to be in a position to provide a certain measure of capital extension from reserves. For the past fifteen years, the company has operated at full capacity, and if there were any trade recession there would certainly be considerable inroads on the profits: profits would be heavily affected, and B.O.C.'s expert advisers regard it as doubtful whether sufficient allowance for the possibility of recession is made under the present profit rates. B.O.C. submits that in the particular circumstances of the industry, the fair way is to consider profit not on the historic cost of the fixed assets but on current replacement values. If the company is to survive it must recover in its profit rate a sufficient amount to enable it to replace its assets, and at current prices. On the basis of replacement at current prices, the present profit level would be 16½ or 17 per cent. and B.O.C. has pointed to the fact that at a time when the iron and steel industry (which is B.O.C.'s largest customer) was under direct government price control, the Iron and Steel Corporation of Great Britain adopted the basis of current replacement values for the purpose of its 1952 accounts and that on that basis the profit on the capital employed was 17 per cent. B.O.C. considers that if a "government controlled industry" under price control was allowed to make 17 per cent. on a replacement basis it would be unfair to criticise one of its suppliers for making the same profit.

The Public Interest

225. In conclusion, B.O.C. submits that it has shown that the arrangements operated by it have been and are in the best interest of the public, and that it produces and distributes gases by the most efficient and economic means. It believes that if there were a number of suppliers they would not in fact be competitive. What might happen has been seen in other countries, where companies take different areas and restrict their operations accordingly. As indicated in paragraph 218, B.O.C. contends that there are dangers in localised monopoly: local suppliers in number would involve multiplication of costs to an extent that would be uneconomic and contrary to the public interest. B.O.C. claims that it has a fine record of fair dealing with no history of price fixing, collective boycott or discriminatory practice. Its present position has been brought about, it says, by two parallel causes: the first is the high degree of efficiency of the company, and the second is that no other firm, although it was open to any to do so, embarked on production and distribution of the kind carried on by B.O.C. It claims that the history of B.O.C. has seen two world wars in which every need was met, and that while the company is undoubtedly in a pre-eminent position, there is nothing to show that its power—which it submits was properly acquired—has in any way been misused.

Part II: Saturn and the Propane Producers

Saturn Industrial Gases Ltd.

226. We invited Saturn's observations on the question, which was also put to the propane producers, whether a greater measure of competition between dissolved acetylene and propane would be desirable, and if so what steps should be taken.

227. In Saturn's view, propane has definite technical advantages over dissolved acetylene as a cutting gas for most purposes and is cheaper. Saturn maintains that with a proper adjustment of pressure the amount of oxygen required with propane is no greater than with dissolved acetylene. In general, Saturn finds that the consuming industries are conservative; the

cost of cutting operations is only a small part of a fabrication job, and managements are not very conscious of gas prices. Increased sales of propane depend on two factors: price and the conversion of industry to the use of the new gas. Saturn's own increase in sales has been accomplished partly by converting its existing customers to propane, partly by finding new customers and by giving prompt, careful and interested service. In the North-East area, where it supplies both dissolved acetylene and propane, Saturn finds that the need to take account of the economics of its dissolved acetylene plant at Sunderland creates a conflict of interests which places its salesmen at some disadvantage. In the rest of the country, where 60 per cent. of Saturn's propane sales are made, no such conflict of interests exists, and propane can be pushed freely without considering the possible effect on sales of dissolved acetylene. Saturn's prices for all three gases in the reference are, we are told, determined largely by B.O.C.'s prices. Saturn considers that Esso's price for propane is reasonable; it has been able to obtain all the propane it required and the only limitation on sales has been the extent of the demand.

The Propane Producers

228. We invited the observations of the producers of propane on the question of competition between dissolved acetylene and propane and also on two further questions: (*a*) whether the profits which are being made on the production of propane are excessive and (*b*) if so, whether the level of such profits is limiting the extent to which consumers use propane and is supporting the monopoly in dissolved acetylene.

229. *Esso Petroleum Company Ltd.* considers that the maximum degree of competition between dissolved acetylene and propane is desirable in the public interest. Apart from the welding of ferrous metals, in which propane can never be competitive with dissolved acetylene, the price on a thermal basis already favours propane to a marked degree, thus placing propane in a highly competitive position. With regard to any steps which might be taken to increase competition, Esso is planning to double propane production at Fawley in the near future. It is hopeful that this increased production can be disposed of, but is unable to forecast whether this will be at the expense of the dissolved acetylene market. So far as its potential production of propane is concerned, Esso points out that there are many alternative uses for the refinery gases from which propane is separated and that in considering any plans for increased propane production, due consideration must be given to these alternative uses.

230. Esso does not consider that its profits on the production of propane are excessive. It maintains that the profit figures supplied, which we have set out in paragraph 179, do not represent the true profit position, since the figures were compiled for inter-departmental purposes upon an arbitrary basis, which does not take into consideration certain cost factors which should properly be charged against propane production. If the notional profit margin were halved, and its distributors passed on to consumers the full benefit of the price reduction, the price to the consumer would be reduced only by three-eighths of a penny a pound. Esso does not feel that such a reduction would have any effect on the competition between propane and dissolved acetylene.

231. Esso has given us the following comparison of price between dissolved acetylene and propane on a thermal basis:

(a) *Dissolved Acetylene.* Retail price to large consumers. £6 7s. 0d. per 1,000 cubic feet = 105d. per therm.

(b) *Propane.* Ex-Fawley price. £20 6s. 0d. per ton (2·17d. per lb.) = 10·4d. per therm. Average retail price to large consumers 6½d. per lb. = 31d. per therm.

232. *Imperial Chemical Industries Ltd.* considers that as alternatives for metal cutting and at current market prices there is little to choose between dissolved acetylene and propane and that what advantage there is lies with propane. Competition will therefore be at its maximum when prices of the gases are equal. It has no information on whether or not propane holds the major share of the market but assumes that in time whichever is the cheaper for the same technical performance will be preferred.

233. Since I.C.I. produces propane as a by-product of the creosote hydrogenation process, it has no data on which it can base an opinion on whether its profit is excessive or not. Its propane sales make a contribution to the whole process from which propane arises. Its selling price for propane is lower, it points out, than for other hydrocarbons, such as butane and petrol. I.C.I. makes no comment on the question whether the level of profit is limiting the extent to which consumers use propane. It could not supply more than 10 per cent. more propane.

234. *BP Trading Ltd.* points out that apart from metal cutting and welding there are other uses of propane which are being developed (e.g. commercial cooking, testing large gas engines, refrigeration, furnaces and drying ovens) where dissolved acetylene is not an alternative and so does not compete with propane. BP Trading maintains that it is not possible to cost propane through the refinery and that the return which it receives from sales of propane priced on the basis which has been summarised in paragraph 175 is not excessive. It has no comments to offer on the question whether the level of profits is limiting the extent to which consumers use propane except to say that it has no desire to limit the use of propane nor to support any monopoly in dissolved acetylene. Apart from these comments, BP Trading asked Shell-Mex & B.P. to reply on its behalf to the question whether a greater measure of competition between dissolved acetylene and propane was desirable because, as a distributor of propane, Shell-Mex & B.P. was better able to comment upon the marketing aspects.

235. *The Shell Petroleum Company Ltd.* also referred to Shell-Mex & B.P. for a reply to our first question on the competition between dissolved acetylene and propane. As regards the level of profits, the company claims that it is not practicable to isolate the production costs applicable to any individual end product, such as separated propane, in a comprehensive petroleum refinery. For this reason alone, it is unable to provide a reasoned answer to the question whether production profits on propane are excessive. The return ex-refinery which it seeks to obtain on propane is based on the minimum economic return for butane, which is derived from its alternative disposal value as a motor spirit component, this value being readily ascertained by reference to recognised market supply prices for motor spirit. Shell Petroleum considers that having regard to the alternative disposal value of the components of the C_3 gas stream, and the cost of segregation and bottling operations, the return on bottled propane as related to butane is not excessive. It cannot tell whether the prices charged for propane have a deterrent effect on the use of propane as an alternative to dissolved acetylene. For the reasons given by Shell-Mex & B.P., which are set out in the following paragraph, it does not believe that potential users of the two gases who now use dissolved acetylene to the exclusion of or in preference to propane do so for price considerations. From a comparison of the prices which it pays for small quantities of dissolved acetylene with the

price for propane which is charged to B.O.C., it would appear that propane is the cheaper gas, and that if cost were the only factor there should therefore be a greater demand for it than for dissolved acetylene.

236. *Shell-Mex & B.P. Ltd.* points out that although it supplies propane to B.O.C., which sells it for use with oxygen as an alternative to dissolved acetylene, it is not otherwise engaged in marketing propane in competition with dissolved acetylene and cannot therefore say whether there should be a greater measure of competition between the two gases. It emphasises that there are no arrangements between it and B.O.C. which would in any way prevent it from progressively developing propane sales in competition with B.O.C. should it wish to do so. Until recently, it had no substantial quantities of propane available for commercial purposes. As increased quantities have become available it has been considering the best and most favourable uses to be made of propane, and has concluded that the principal outlets which should be examined are commercial cooking plants, use in specialised types of furnaces and other industrial processes. It is convinced that these offer far greater prospects than the metal cutting and welding market for the following reasons:

(*a*) Oxygen is required for use with propane where propane is used for metal cutting and welding. Shell-Mex & B.P. has no supplies of oxygen available and would have to purchase these. Whether or not such supplies would be available is a question it has not yet considered in view of the other factors mentioned below.

(*b*) For metal cutting and welding a greater quantity of oxygen is required for use with propane than is required for use with dissolved acetylene. Shell-Mex & B.P. has not investigated the extent to which the additional oxygen cost might be offset by the lower propane cost.*

(*c*) Propane is not suitable for ferrous welding whereas dissolved acetylene is suitable for both ferrous and non-ferrous welding as well as for metal cutting. In view of this, it is Shell-Mex & B.P.'s opinion that a high proportion of users would refuse to buy propane on the ground that it was uneconomical and of no practical advantage to use two different gases in conjunction with oxygen on the same premises.

(*d*) The gas cutting market is a specialised market and is small in comparison with the alternative industrial outlets for propane. Irrespective of whether it might be possible to price propane very much lower than dissolved acetylene, its special physical characteristics and performance render it more effective and useful in these alternative outlets where dissolved acetylene is not suitable.

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* See also paragraphs 209 and 227.

CHAPTER 9: CONCLUSIONS ON THE PUBLIC INTEREST AND RECOMMENDATIONS

The Suppliers of the Gases

237. In this inquiry we have not found any evidence of restrictive agreements or arrangements between the suppliers of oxygen, dissolved acetylene and propane, except for the marketing arrangements on propane referred to below, but, as explained in Chapter 7, at least one supplier of each gas is responsible for more than one-third of the supply in the United Kingdom. Both as producers and distributors The British Oxygen Co. Ltd. and its subsidiary companies account for over 98 per cent. of the oxygen supplied, and over 98 per cent. of the dissolved acetylene*. On the average of the years 1953, 1954 and 1955, "Shell" Refining & Marketing Co. Ltd.† and The British Petroleum Co. Ltd.‡, with Eagle Oil & Shipping Co. Ltd. supplied, through the common marketing agency of Shell-Mex & B.P. Ltd., just over 60 per cent. of the propane produced, and by virtue of their marketing arrangements they so conduct their affairs as to restrict competition in the supply of propane. Imperial Chemical Industries Ltd. supplied about 37 per cent. during the same period and Esso Petroleum Co. Ltd. about 35 per cent. Shell-Mex & B.P. also has an understanding with B.O.C. that it will not, without giving due notice, compete with B.O.C. in direct sales of propane for use with oxygen for cutting gas purposes. The B.O.C. Group supplied about 59 per cent. of the propane supplied by distributors, and Saturn Industrial Gases Ltd. supplied about 36 per cent. About 58 per cent. was supplied by producers *to* the B.O.C. Group.

238. We are concerned, therefore, with a number of "monopoly" suppliers, of which B.O.C. is much the most important in relation to the gases in our reference. In the case of oxygen and dissolved acetylene, B.O.C.'s monopoly is almost complete, and we deal first with these gases.

Public Interest: Oxygen and Dissolved Acetylene

239. We have to consider whether the "conditions" to which the Act applies operate or may be expected to operate against the public interest, and also whether any "things done" by B.O.C. as a result of or for the purpose of preserving those conditions operate or may be expected to operate against the public interest. It is difficult in a case of this kind to draw a clear distinction between the effects of the conditions and the effects of "things done" as a result of or in order to preserve the conditions. In the analysis which follows we consider these matters together, expressing our conclusions and making our recommendations on the various "things done" as they arise and leaving our conclusion on the "conditions" to the end.

240. There are possible dangers in the control by one supplier of so large a proportion of the market for two essential commodities such as oxygen and dissolved acetylene. It is in a position to determine within wide limits the profit which it wishes to make, and it can then fix its prices in relation to costs at a level which will normally ensure to it the return which it desires.

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* Even if account were taken of the acetylene gas generated by consumers for their own use, which is not, of course, dissolved acetylene and is in any case not "supplied", but which is estimated as roughly 20 per cent. of the amount of dissolved acetylene produced by B.O.C. (see paragraph 145), B.O.C. would still be providing well over four-fifths of all the available gas produced by both methods.

† As from 31st December, 1955, The Shell Petroleum Co. Ltd.

‡ As from 31st December, 1954, BP Trading Ltd.

Even if the powers which such a monopoly possesses are at a given time exercised with moderation, the risk will always remain that at some time in the future it may use its position to make excessive profits at the expense of the consumer. There is in addition the danger that the absence of competition may lead to lack of enterprise and inefficiency which in turn may give rise to unnecessarily high prices. We recognise, however, that in this industry there may be some substantial economies in operating as a monopoly, whether on a national or a local basis. We understand that somewhat similar conditions prevail in some other countries, including France where there is something approaching a national monopoly, and Holland where there are a number of regional monopolies.

The Efficiency of B.O.C.

241. A point of great importance is whether because it is a monopoly B.O.C. is operated less efficiently than would be the case if there were more competition and whether, in consequence, the public suffers because resources are wasted, or because of deficiencies in the services rendered by B.O.C.

242. We have had very few complaints from amongst B.O.C.'s many thousands of customers. Indeed, the only subject on which we received a significant number of complaints was the operation of the float system, whereby an allowance of cylinders is made to a customer and he may get no more unless he returns his empties. There is no doubt that for some years after the war there was a serious shortage of cylinders for reasons over which B.O.C. had no control. In recent years B.O.C. has been able to augment its stock of cylinders. If it were to obtain still more and to exert less pressure for the return of empties, this would be regarded by some customers as a convenience. Any considerable easement in this respect would, however, entail a substantial increase in the total number of cylinders carried by B.O.C. The cost of a cylinder far exceeds that of the gas which it contains, and we accept B.O.C.'s evidence that the capital cost of providing any substantially larger float of cylinders could only result in a substantial increase in overall selling prices which would not be justified.

243. Subject to what is said in the following paragraphs, we have no evidence to suggest that the efficiency, technical and otherwise, of B.O.C. falls below the standard which might reasonably be expected of a company of its standing and resources.

B.O.C.'s Technical Services

244. We have considered the technical services provided by B.O.C. to its customers. They are comprehensive, and we have had no complaint about them, but the cost of providing these services has to be covered in the selling price of oxygen and dissolved acetylene, and we have asked ourselves whether many consumers might not in fact be paying for services which they had little, if any, occasion to use. We think that in so far as the extent of the use made of the services by different classes of consumers can be ascertained, it should be reflected in the prices charged to each class. This point is covered by the recommendations which we make later (paragraphs 272 to 276) on the revision of B.O.C.'s price scales.

Research and Development

245. In view of its almost complete monopoly a heavy responsibility falls upon B.O.C. to ensure that the full requirements of industry, of the hospitals and of the Armed Services will continue to be met, and that in the field of research the United Kingdom will at least keep pace with other countries.

So far as development is concerned, B.O.C. has explained to us its plans for expansion over the next few years. These seem to be on a scale adequate to ensure that during, say, the next five years, B.O.C. will be able on any reasonable expectation to supply in full the expanding demands of the United Kingdom. B.O.C. now devotes 2½ per cent. of its income to research, but we cannot determine the proportion which is spent on the reference gases.* It was only immediately after the war that a special research department was set up, and it will be seen from Chapter 4 that in its long history B.O.C. has not been responsible for the discovery of any of the successive important new processes for the production or distribution of oxygen. Indeed, almost all these were first developed abroad and B.O.C.'s part has been to acquire the necessary patent rights or licences and exploit them in this country. Our impression is that at least until recently most of the research work done by B.O.C. has related either to improvements in existing plant or machinery or to research into possible uses for the gases with a view to increasing sales. On such evidence as is available to us, it seems that rapid technical progress is still being made abroad, notably in the U.S.A. and Germany. In view of its monopoly position, it will depend entirely upon B.O.C. whether this country keeps abreast of overseas manufacturers, or whether we lag behind and remain dependent on them for improved methods of production and distribution. We do not find it possible on the information available to reach a definite conclusion as to whether the present research activities are adequate. We attach great importance, however, to a substantial effort by B.O.C. in the field of research.

Steps taken by B.O.C. to Develop and Preserve its Monopoly

246. We next consider:

(*a*) Whether B.O.C. has tried to obtain exclusive control over the provision of plant and equipment to other suppliers or to consumers who might wish to make their own gas.

(*b*) The steps taken by B.O.C. both to acquire other suppliers and to obtain plants worked by consumers.

(*c*) The use which B.O.C. has made of fighting companies.

(*d*) The making of agreements under which B.O.C. has the exclusive right to supply certain customers.

247. *Control over Plant and Equipment.* The steps by which B.O.C. has at various periods obtained control over the distribution of oxygen plant are described in paragraphs 39 and 40, and 115 to 123. As will have been seen from B.O.C.'s own explanation of these developments (see paragraphs 197 and 200), B.O.C. denies that it has ever been its policy to secure complete control in the oxygen field. According to B.O.C., there has for many years been little or no demand for customer plant for the production of oxygen, because it has been cheaper and more efficient to obtain the oxygen itself from B.O.C. It is claimed that this situation only began to change recently when the introduction of tonnage plants became possible and that it is for this reason that B.O.C. has not sold any oxygen-producing plant under the various agencies which it has

* In paragraph 212 we quote the figure of £230,000 a year, which was given to us by B.O.C. The cost of research cannot be directly allocated to products, and this estimate of the cost of work done on the reference gases is arrived at by taking the total cost of the research done on all the company's products and charging to each product a proportion of the total based on the proportion which the cost of that product bears to the company's total costs.

acquired. B.O.C. has also stated that at the present time plant could be supplied in this country by any one of five companies:

The Butterley Company Ltd.
Société L'Air Liquide (of France).
Air Products Inc. (of U.S.A.).
British Oxygen Linde Ltd.
Messer G.m.b.H. (of Germany) (through Oxhycarbon Ltd.).

Of these five, however, Oxhycarbon Ltd., which holds the Messer agency, is a wholly-owned subsidiary of B.O.C.; and British Oxygen Linde Ltd., which is half-owned by B.O.C., is in effect the agent for the German Linde plant. B.O.C. has told us in another connection that it is very unlikely that either Linde of Germany or B.O.C. itself would quote in competition with each other or with their subsidiary. L'Air Liquide has told us that in the United Kingdom, owing to import duty and transport costs of roughly 30 per cent., it is only possible in "very exceptional cases to compete with British manufacturers". Butterley is the licensee in the United Kingdom for Air Products Inc., and for this purpose these two companies can be regarded as a single source of supply. The fact, therefore, appears to be that there is only one manufacturer of oxygen plant—Butterley—which is both independent of B.O.C. and able in practice to compete in the supply of plant. There is no evidence that B.O.C. exercises any control over the provision of plant for producing dissolved acetylene, or over the supply of customer generating plant for this gas. The capital cost of each is less than that of oxygen plant, and there are now no limitations on production due to patents.

248. The conclusion that we draw from the facts set out in Chapters 3 and 5 is that in the past B.O.C. has deliberately sought to control the provision of oxygen plant to others in order to maintain its monopoly in the supply of oxygen, and that it has had a considerable degree of success in doing so. On the evidence provided by statements of policy contained in B.O.C.'s Board minutes and internal memoranda (in particular the policy outlined in the memorandum dated 3rd December, 1953, which is quoted in paragraph 131 and of which we have seen no later modification), we are satisfied that B.O.C. is still pursuing this policy and that it is likely to continue to do so, although the extent to which it may be able to retain control may be reduced by two factors: the competition offered by Butterley, and the development of the new-style tonnage plants, which may make it more attractive to large users to produce oxygen for their own consumption. We consider that in so far as this policy is pursued with success this operates and may be expected to operate against the public interest since it may discourage or prevent the acquisition of oxygen plant by other producers, including consumers who might produce oxygen for their own use as well as producers who might supply others. The public may thus be deprived of the advantages of alternative sources of supply and such competition in service, technical development and price as this might produce.

249. Existing legislation does not seem to provide any effective means of dealing with this situation. B.O.C. has operated largely as a licensee under foreign patents and as the sole agent for the sale in this country of machinery of kinds which it uses itself for the production of oxygen and which might have been similarly used by its competitors or customers. At the moment the competition from Butterley provides some safeguard of the public interest but in our opinion there remains a danger to the public interest where a large monopoly such as B.O.C. has a substantial measure of control over the provision of plant and machinery for the production of the goods which the monopoly itself sells.

250. *The Taking over of other Producers.* We have also considered the evidence relating to the taking over of other suppliers of oxygen and dissolved acetylene and of the oxygen and dissolved acetylene plants of firms which formerly produced these gases for their own use. The evidence set out in paragraphs 31 to 37 and 41 to 44* leaves us in no doubt that it has been B.O.C.'s consistent policy, wherever possible, to take over or to buy out other producers of oxygen and dissolved acetylene and that it has done this primarily, though not solely, in order to extend and preserve its own monopoly in the supply of these gases. There is, however, no evidence that B.O.C. is at present seeking to eliminate the small amount of competition that remains.

251. *The Use of Fighting Companies.* The evidence summarised in paragraph 52 shows that B.O.C. made use of Industrial Gases (Scotland) Ltd. as a fighting company and that the activities of this company probably contributed towards the withdrawal of Saturn from the Glasgow area. B.O.C.'s ownership of this company and of two other companies, British Industrial Gases Ltd. and Oxhycarbon Ltd., had still not been publicly acknowledged when the present inquiry started, and they continued to trade ostensibly in competition with B.O.C. It was only in 1955, in B.O.C.'s Report and Statement of Accounts for the year ended 31st December, 1954, that their relationship to B.O.C. was disclosed, though we do not doubt that, as B.O.C. told us, it was known to some customers. We think that the use of Industrial Gases (Scotland) Ltd. as a fighting company and the concealment of the ownership of all three were "things done" by B.O.C. in order to preserve its "monopoly". It is in our view contrary to the public interest that a monopoly such as B.O.C. should take advantage of its position to eliminate competitors by making local and selective reductions in prices instead of extending to all consumers the benefits of any price reductions which may be possible. But since B.O.C.'s ownership of these companies has now been made public we need only recommend that, in meeting any competition which may arise in future, B.O.C. should refrain from making use of fighting companies.

252. *Exclusivity Terms in Contracts.* Certain terms of the standard contract which B.O.C. enters into with the majority of its larger customers make exclusive buying a condition of supply. These provisions are set out in paragraph 76. It will be seen that they applied only to 1,575 out of a total of 99,438 customers in 1954, and the main lines of the contract (which is reproduced in full in Appendix 10) follow normal business practice. We have considered whether the requirement of exclusive dealing is an unreasonable limitation upon the right of the consumer to buy where he pleases. The contract provides that the consumer must take from B.O.C. his total requirements of the named gases for which prices are stated (in the case of oxygen, whether in liquid or gaseous form), unless it is expressly agreed in writing to the contrary. It also lays down that B.O.C. will provide and maintain any necessary apparatus, on terms to be agreed, and that the consumer will use this apparatus only in conjunction with gas supplied by B.O.C. B.O.C. told us that it normally installed and maintained the apparatus free of charge and that it would not in practice enforce the requirement that a consumer

* The origin of B.O.C.'s monopoly in dissolved acetylene lies in the amalgamation of Allen-Liversidge Ltd. with B.O.C. in 1930, and it was strengthened by the later acquisitions of Oxygen Industries Ltd., British Industrial Gases Ltd., Hydrogen Oxygen & Plant Co. Ltd., and Saturn's dissolved acetylene plant and premises at Glasgow. All these firms, with the exception of Allen-Liversidge Ltd., supplied both oxygen and dissolved acetylene. The other take-overs referred to in Chapter 3 related to producers of oxygen only or makers of oxygen plant.

must take his total supplies of gas from itself, but that it could not reasonably be expected to provide free apparatus and allow that apparatus to be used for the supply of gas by some other concern. We have come across one case in which the exclusivity clause in the contract has been expressly modified and a few where it seemed to be ignored, but it is clear that many customers do not question it. We do not object to the rule that any apparatus supplied free by B.O.C. must be used only in conjunction with gas supplied by B.O.C., but the requirement that the consumer must take from B.O.C. his total requirements of the named gases, including in some cases gas for which the apparatus is not used at all, seems to us to be too wide. Its purpose can only be to preserve B.O.C.'s monopoly position, and in our view it limits the customer's freedom of choice to an extent which is contrary to the public interest. A consumer ought not to be forced to use B.O.C. apparatus in order to obtain supplies of gas, and if he does choose to use B.O.C. apparatus for one gas he ought not, as a consequence, to be compelled to take from B.O.C. other gases or gas supplied in a form which permits it to be used without the apparatus. The principles to be applied should, we consider, be that B.O.C. should give the customer a free choice as to whether he buys and maintains the apparatus himself, whether he hires it from B.O.C. and maintains it himself, or whether he accepts B.O.C.'s offer to provide and maintain it free of charge. If he chooses to buy or hire the apparatus, B.O.C. should be prepared to sell or hire it to him at a reasonable price or rental and still to supply him on reasonable terms with any gas which he wishes to buy from B.O.C., while at the same time he remains free to buy from other sources if he so wishes. If the customer chooses free installation and maintenance by B.O.C. he may reasonably be required to take from B.O.C. such minimum quantity of gas as would justify the cost of installation and maintenance, and to use the B.O.C. apparatus only with B.O.C. gas, but he should not be compelled to take from B.O.C. his total requirements of gas if these exceed that minimum. We recommend that the exclusivity clause in B.O.C.'s contracts be amended accordingly.

Special Considerations Applicable to Dissolved Acetylene

253. The position with regard to dissolved acetylene differs from that of oxygen in that a substantial number of consumers possess acetylene generating plant with which they produce acetylene gas for their own use. We have not been able to ascertain the total volume of gas produced in this way but the figures of carbide used suggest that it is probably about 20 per cent. of that produced and supplied by B.O.C. (see paragraph 145).

254. While B.O.C. enjoys some advantages in the supply of carbide, inasmuch as it owns Odda Smelteverk in Norway and unlike the other users of carbide for dissolved or generated acetylene production is also able to buy direct from the Distillers Company's plant at Kenfig instead of through the Carbide Distributing Agency, there is no evidence that any users have difficulty in obtaining adequate supplies of carbide. Nor is there any evidence of shortage of dissolved acetylene.

255. At the Public Interest hearing, B.O.C. told us that the existence of numerous customer plants generating acetylene gas provided substantial competition for its own dissolved acetylene, but at an earlier stage of the inquiry it had argued that, in general, customer production was not economic and that in many cases it was not practicable, owing to the difficulties of sludge disposal and the severe safety precautions necessary. It also stressed that a great advantage of dissolved acetylene over generated acetylene is its

portability as a gas in cylinders. Our impression is that many of the firms generating their own acetylene for welding and cutting are small and that many of the larger users have, as B.O.C. has said, gone over from generated to dissolved acetylene in recent years.

256. For certain cutting purposes propane and coal gas are competitive with dissolved acetylene, and for certain welding processes electric methods are competitive. The evidence which we have received about the use of these alternative processes is summarised in paragraph 112. B.O.C. is thus subject to competition from the use of customer generating plants and from alternative processes for certain limited purposes, but this competition covers only part of the field and over most of the field B.O.C.'s monopoly is virtually unchallenged.

257. The conclusions in paragraphs 250, 251 and 252 apply to dissolved acetylene as well as to oxygen. Nothing which B.O.C. does in respect of dissolved acetylene alone calls for comment in relation to the public interest.

Price Policy: B.O.C.'s Profits

258. In considering the conduct of any monopoly, and particularly one as comprehensive as B.O.C., considerable importance attaches to the price policy which it follows. This raises a number of questions, the first of which is whether B.O.C. has taken advantage of its position to make profits which are unjustifiably high. It will have been seen from Chapter 6 that on the reference gases taken together*, in 1952 to 1954, B.O.C. made a profit of 23 to 24 per cent. on capital employed, the capital being calculated on an historical cost basis†. In 1939 the rate for gases was 25 per cent., and B.O.C. has told us that it regards 23 to 25 per cent. on capital employed (using the historical basis) as a reasonable return, and about the rate of profit which it requires in order to support its modernisation and research programme and to enable it to raise additional money on the market. From 1945 to 1951, B.O.C. paid a dividend of 20 per cent. on its ordinary capital and in the latter year made a bonus issue equal to 50 per cent. of its existing ordinary stock. From 1952 to 1954 the dividend was 15 per cent. (which was equivalent to 22½ per cent. on the capital before the bonus issue), and in 1954 this was about 5 per cent. on its capital employed (on an historical cost basis). In 1955, B.O.C. raised £8 million of new capital by offering £1 units for 50s., which at the rate of dividend of 15 per cent. would give a return to the stockholder of 6 per cent.‡ on his outlay. Thus, taking together the existing and the new capital, B.O.C. will in future need between 5 and 6 per cent. on capital employed to continue to pay dividends at the existing level. To give shareholders 6 per cent. at present requires a profit before taxation of just over 9 per cent. from which to pay it. Even, therefore, if B.O.C.'s contention that profit on capital employed should be calculated on a replacement basis were to be accepted, it will be seen that a substantial part of B.O.C.'s profits would remain after giving this return to the stockholders.

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* In 1954 B.O.C.'s profit as a percentage on cost was 24·3 per cent. for oxygen, 26·6 per cent. for dissolved acetylene and 16·8 per cent. for propane. Even if the profit in relation to capital is higher on propane than on oxygen and dissolved acetylene (see paragraph 182) this could not make any material difference to the figure of 23 to 24 per cent. on capital employed for oxygen and dissolved acetylene because propane represents only a very small part of the reference gases supplied by B.O.C.

† These figures correspond to 16½ per cent. on capital taken on a replacement basis, see paragraph 158.

‡ In 1955 as well as paying a cash dividend of 15 per cent., B.O.C. made a bonus issue equal to 50 per cent. of its existing ordinary stock by utilising premiums arising from share issues.

259. As far as its business in oxygen and dissolved acetylene is concerned, B.O.C. enjoys to a very high degree the advantages of a monopoly position. It has little to fear from competition, it is dealing with essential commodities, the cost of which is a small item in the costs of most of its customers, and it is in a position to make a very close assessment of its share of the available market. The element of risk in its operations is confined mainly to the risks involved in changes in the general level of industrial activity. Its replacement requirements are no more than is normal in industry, while it can operate with lower reserves than companies which have to take a substantial measure of risk. In these respects its position is closely parallel to that of some of the recognised public utility concerns before nationalisation. We are bound to confine our attention to those gases which are included in our terms of reference but in respect of its business in oxygen and dissolved acetylene it should be in a position to raise money on more favourable terms than if it were bearing normal trading risks. It seems to us indeed that it should be able to obtain a considerable part of the capital required for the expansion of its business from debentures and similar forms of borrowing which would require a somewhat lower rate of interest.* In order to maintain and develop its business, a monopoly company in B.O.C.'s position does not, therefore, need to earn the same return on capital as a company in a competitive industry.

260. These are, we think, the considerations which should be taken into account in determining the appropriate level of profit for B.O.C.'s business in oxygen and dissolved acetylene, and we have examined B.O.C.'s profit record with them in mind. Taking the years for which we have figures—1952 to 1954†—there is no doubt that instead of being below the general level B.O.C. made a larger profit on capital employed in its gases business than was earned in manufacturing industries generally. The guidance which is given by our own reports on profit levels in other industries during these years is limited : they only relate to a few industries which cannot be regarded as wholly representative. For the purpose of comparison we have, therefore, relied mainly on the statistics published quarterly in *The Economist* covering the results of over 2,000‡ leading companies (see Appendix 16). According to these statistics the weighted average profits during the years 1952 to 1954 in each of the 17 industry groups which are mainly manufacturing groups, were lower than those made by B.O.C. (23 to 24 per cent.) except in the motors, cycles and aircraft group in 1953 and 1954, with average profit rates of respectively 25 and 27 per cent., and the newspapers, paper and printing group in 1954 only, with an average profit rate of 25 per cent. In the other manufacturing groups the average ranged from 11 per cent. to 20 per cent. in 1954, and the profit rates of B.O.C. in 1952 to 1954 were roughly from one-third to one-half higher than the weighted average for all manufacturing industries. It is true of course that, as we have found in our own inquiries, there are substantial variations of profit rate as between different firms in the same industry. We also recognise that no precise comparison is possible, but

* B.O.C. issued £4,000,000 Unsecured Loan Stock at 3¾ per cent. interest in 1950, but repaid this out of the new ordinary capital issue in 1955. This issue was, of course, related to B.O.C.'s business as a whole.

† While our detailed examination did not extend beyond 1954 we have noted that the published results for the B.O.C. Group, including home and overseas subsidiaries and relating to both industrial gases and other products, for a trading period of nine months to 30th September, 1955, show the overall profit to be slightly higher than during the corresponding period a year earlier.

‡ The number of individual companies is much greater than 2,000 because the results of a group of inter-connected companies are counted as one.

we have adjusted the figures in *The Economist* so that they are substantially on the same basis as our own computation of the profits of B.O.C., subject only to the fact that we have insufficient information to make the necessary adjustments in the comparatively few cases where individual companies have revalued their assets in their accounts to allow for higher replacement costs. We are, however, satisfied that *The Economist's* statistics provide a fair measure of comparison for the purpose for which we are now using them.

261. B.O.C. differs from firms which are in competitive industries in the extent to which it is able to set its prices at whatever levels suit it best. We note that both before and since the war B.O.C. has aimed at and secured profits in the region of 23 to 25 per cent. on capital employed and that even in 1952 to 1954, which were prosperous years for industry generally, its profits were well above the average level in manufacturing industry. After making full allowance for the seller's market which has prevailed during most of the post-war period we consider that B.O.C.'s profits have been unjustifiably high for an almost complete monopoly facing a limited financial risk.*

B.O.C.'s Prices

262. It follows that the prices charged by B.O.C. for oxygen and dissolved acetylene are too high. While it may be that some economies could be made, we have no evidence upon which we could base any general finding that B.O.C.'s costs are too high, but to the extent that B.O.C.'s profits are too high there is scope for reduction in the prices charged to consumers. We should not consider it any answer to this to say that it would involve B.O.C. having recourse to the market in future for a greater proportion of the capital which it may require for the extension of its business as distinct from the replacement of its existing assets. We do not think that a monopoly should take advantage of its position to charge current consumers with the cost of its future expansion as distinct from replacement. As an illustration of the scope for reduction, if the profit on capital employed had been limited to 15 per cent. in 1954, prices could have been reduced on average by nearly 7 per cent. If a reduction in price of the order of 7 per cent. had been uniformly applied, the average price of liquid oxygen would have fallen from 13s. 4d. to 12s. 5d. a 1,000 cubic feet; of industrial compressed oxygen from 33s. 9d. to 31s. 6d.; and of dissolved acetylene from 148s. 6d. to 138s. 4d.†

263. We find that B.O.C. charges unjustifiably high prices for oxygen and dissolved acetylene and that this operates and may be expected to operate against the public interest. We recommend that steps should be taken to prevent B.O.C. from charging prices which will produce a higher return of profit on capital employed than is reasonable having regard to the company's monopoly position and to the considerations set out in paragraph 260. We recognise that the appropriate level of profit may vary according to the circumstances, including current rates of interest. In paragraphs 281 and 282 we discuss the way in which effect might be given to this recommendation.

264. *Price Scales and Method of Charging.* We have also, however, to consider whether taking account of its monopoly B.O.C.'s price policy is consistent with the public interest in other respects. In the case of oxygen the evidence shows that B.O.C.'s costs vary widely in different parts of the

* See Reservation, paragraphs 301 to 311.

† The profits made on and prices charged for propane by B.O.C. are considered in paragraph 289.

country. We examined the figures for eleven out of fourteen factories producing liquid oxygen, and the average cost of production over the two-year period 1952 and 1953 varied from 5s. 2d. to 7s. 1d. a 1,000 cubic feet, with a weighted average of 5s. 11d. For compressed oxygen we looked at the figures for thirty out of the thirty-six factories. Their range of costs was from 11s. 7d. to 19s. 0d. a 1,000 cubic feet (with one exceptionally at 24s. 9d.) and a weighted average of 15s. 0d.

265. The consumption of dissolved acetylene is more localised and the range of variation in costs of production is narrower. At the time of our examination, there were in all sixteen factories, whose average costs of production over the two-year period 1952 and 1953 varied from 88s. 0d. to 99s. 11d. a 1,000 cubic feet, with a weighted average of 95s. 0d.

266. We have considered whether the national price scheme operates against the public interest as compared with a regional price scheme under which, in each of the eight districts into which B.O.C. divides the country, there would be a local price scheme based on the average total costs of production in that area. The national price scheme which is at present in force is explained in paragraph 147. With trifling exceptions, all prices are delivered prices.

267. The case against a national scheme and in favour of a regional one may be stated as follows:

(*a*) Existing and potential customers should enjoy any local advantages which their district may possess arising from such factors as the volume and concentration of demand in the district, the local cost of power, labour, etc., and the relative efficiency of the supplying plant in the district.

(*b*) As a general proposition the establishment of an average national price, regardless of differences in costs of production, tends to engender an uneconomic employment of resources. This may be of small importance in relation to the affairs of the large number of individual users of small quantities of either gas, but it may well become significant in relation to some of the new oxygen-employing processes in the steel industry, where a large volume of oxygen is required and where its cost may be a significant factor.

(*c*) If an area has to stand on its own feet in the matter of price, this may have a marked effect upon the company's works and transport policy because old and possibly uneconomic works would become more difficult to carry, and economies in transport, e.g., by the introduction of bulk carriers, would become of increased importance. Higher cost regions would come under pressure to reduce their costs and prices.

(*d*) Under a regional scheme there would be a greater incentive for large consumers of oxygen in high cost areas to install their own tonnage plants, possibly also putting themselves into a position in which they could supply their immediate neighbours with oxygen which was surplus to their own requirements.

(*e*) By avoiding over-centralisation a regional price scheme might prove to be the cheaper.

268. On the other hand B.O.C. has represented to us strongly that the disadvantages of a regional scheme would greatly outweigh its advantages (see paragraph 221), and we should not be entitled to recommend the abolition of the national scheme unless we were positively satisfied that it operated

against the public interest. There are the following arguments in favour of a national scheme :

(*a*) A regional scheme would be more difficult, and almost certainly more expensive, to administer.

(*b*) It is doubtful whether in practice a regional scheme would lead to greater efficiency in production.

(*c*) Anomalies would be likely to arise where consumers near the boundary between two regions are charged different prices.

(*d*) Under a national scheme B.O.C. is in a better position to ensure that a reasonable standard of service is maintained throughout the country. There would be a risk that outlying areas would suffer under a regional scheme.

269. On balance we have reached the conclusion that although a good deal can be said against the national price scheme and in favour of a regional one, the arguments are not sufficiently strong to justify us in finding that the existing national price scheme operates against the public interest.* We see no reason to differentiate in this respect between oxygen and dissolved acetylene.

270. We have also considered whether in view of the relatively high cost of transport (see paragraph 170) it would be preferable that even with a national price scheme the national prices should be ex-works and there should be separate charges for delivery according to distance, no doubt on a zonal system. It seems to us, however, that broadly the same considerations apply as in our discussion of a regional scheme. No customers have suggested that the present arrangements should be changed, the change would be opposed by B.O.C., and although we see the theoretical arguments for it, anomalies would still remain short of a system under which there were separate delivery charges for each journey. In the circumstances we do not find that the present arrangements operate against the public interest*. It is true (see paragraph 147) that an additional charge is made at present for collection ex-depots but this is not a delivery charge. It is a contribution towards the cost of maintaining depots where customers can collect their own supplies in outlying areas, which are not covered by B.O.C.'s normal delivery service.

271. We have also considered the subsidiary question whether B.O.C. should be prepared to sell ex-works leaving customers to collect in their own transport. At present B.O.C. actively discourages customers from collecting cylinders from works in their own transport on the ground that this tends to disorganise the works. In the odd cases where it does allow such collection it makes no reduction in price. We accept B.O.C.'s evidence that if any substantial number of customers were to seek to collect cylinder oxygen or dissolved acetylene in their own transport from B.O.C.'s works (as distinct from depots) this might lead to some degree of disorganisation in the works, which might reduce the efficiency of its service to customers generally. Accordingly, we do not recommend that B.O.C. should be prepared to sell ex-works.

272. In the case of a monopoly in the position of B.O.C., the prices which it charges should in our view operate fairly as between different customers and there should be no discrimination between customers in similar circumstances. B.O.C.'s present prices do not satisfy this condition, because they are not based upon the actual cost of supply to any individual customer or the average cost of supply to any class of customer. B.O.C. appears merely

* See Addendum, paragraphs 296 to 300.

to aim at a sufficient overall return to give what it regards as a satisfactory margin of profit. B.O.C. told us in evidence that it had tried on several occasions to produce a system of prices based on costs, but that it had been unable to do so. We cannot accept the view that any insuperable difficulty would be encountered in setting up such a system, and B.O.C. has submitted no evidence to suggest that it would be more difficult than in the many other cases where it has been done.

273. B.O.C. also said in evidence that even its unpublished price list was not strictly applied, but merely served as a guide to its staff in negotiating prices. In the case of the medium and small users, these negotiations are carried on by local officers in each of the eight districts, while in the case of "special" customers, large buyers not in the special class, and group contracts, they are negotiated from headquarters. These circumstances also suggest some degree of variation in the treatment of individual customers in a like position. In this connection we would attach importance not merely to ensuring that the prices charged were in fact equitable but, in view of B.O.C.'s monopoly, that it should be manifest to everyone that this was so. B.O.C. also told us that "in a general way" its policy is to accept a lower rate of profit per unit on sales of larger quantities. The generalisation of this principle again suggests that the small users, who constitute some 96 per cent. of B.O.C.'s customers, may well be providing a larger share of its profits than they fairly should.

274. We have referred above to the fact that B.O.C.'s prices are not published. A number of users have indicated that they regard this as disadvantageous to them. Clearly it makes it impossible for the individual consumer to know whether he is being treated in the same way as other consumers whose circumstances are similar.

275. In our view the underlying principles should be that there should be no discrimination either between individual consumers or between classes of consumers in similar circumstances; that the scales of charges should be based on relevant costs; and that they should be made known to all consumers. B.O.C.'s present methods of charging for oxygen and dissolved acetylene do not satisfy these conditions, and we find that in this way they operate and may be expected to operate against the public interest.

276. It will be convenient to make one comprehensive recommendation to remedy this state of affairs. We recommend that new scales of prices should be drawn up for all B.O.C.'s customers, who should be grouped into classes according to the method of supply, whether by pipeline, as liquid or as gas in cylinders, and according to the quantities taken within certain ranges. Prices should be fixed for each class of customer which should have regard to the national average cost of supply to customers in that class. These price scales should be published and should be applied without discrimination to all customers in each class. Only very special circumstances should justify the negotiation of special terms outside the scale: e.g. where a firm was embarking upon some new process which, if commercially successful, might ultimately result in a large increase in the consumption of gas. In such a case the consumer might be given from the outset the scale price appropriate to the level of consumption which it was expected that he would ultimately reach, on the understanding that if he did not reach that level within a reasonable and limited time he would revert to the scale appropriate to his actual consumption. B.O.C. should make the necessary changes in its accounting procedures to enable price scales on these lines to be prepared.

277. *Medical Oxygen.* There is no national scale for medical liquid oxygen but, as explained in paragraphs 152 to 155, a national price scheme is in force for compressed medical oxygen. A number of hospitals were amongst those users who indicated that they regard the absence of published prices as disadvantageous, and some of these said that different hospitals within the same Management Group were paying different prices. We note that B.O.C. has it in mind to rearrange prices for medical oxygen when, as it says, the hospitals have settled down, and that in B.O.C.'s view the anomalies in the present price scheme should then disappear. Owing to the arbitrary nature of the costings for "medical" oxygen and the inclusion in them of liquid oxygen supplied to the Air Ministry for high flying, it is not possible to say with any degree of certainty what is the loss (if any) on sales of oxygen for medical purposes in the strict sense of the term. The records of B.O.C. show an average loss of 11 per cent. on cost for "medical" oxygen in all forms, including liquid oxygen for high flying, and there does not seem to us to be any justification for any losses sustained on the sales of "medical" oxygen being, in effect, carried by the industrial consumers. We recommend that published price scales for "medical" oxygen should be prepared on the same lines as for industrial oxygen.

Conclusions on Oxygen and Dissolved Acetylene

278. "Conditions to which the Act applies" prevail in respect of oxygen and dissolved acetylene because B.O.C. has an almost complete monopoly of the supply. We have to consider whether in the manner in which, and to the extent to which, they prevail the conditions we have found to exist, or any of the "things done" as a result of, or for the purpose of preserving, those conditions, operate or may be expected to operate against the public interest. We recognise, as we have said, that in this industry there may be substantial economies in operating as a monopoly, but, as our own inquiry has shown, there are also serious dangers in the control of virtually all the supplies by a single group which has not been content to rely on its advantages of scale and experience but has continued for many years to pursue a policy of suppressing and restricting competition. Among the "things done" with this objective have been the control exercised over plant and equipment, the taking over of other producers, the use of fighting companies, and the incorporation of exclusivity terms in contracts. It is impossible to say how far competition would have developed if B.O.C. had not taken these steps, but we do not think that there is any doubt that B.O.C.'s policy of deliberately restricting competition has had the effect of depriving the public of the possible advantages of greater competition. We have also found that among the "things done" as a result of the "conditions" B.O.C. has taken advantage of the position which it has built up to charge prices which we regard as unjustifiably high, and has pursued a price policy which is in other respects open to objection. In all these circumstances we find that both the existing "conditions" and "things done" as a result of, or for the purpose of preserving them, operate against the public interest and that they may be expected to continue to operate against the public interest unless changes are made, and safeguards introduced, in accordance with the recommendations we have made.

Methods of Implementation

279. Our main recommendations have related to the prices charged by B.O.C. for oxygen and dissolved acetylene (paragraph 263) and the pricing policy which should be followed in other respects (paragraphs 276 and 277). In addition we have recommended in connection with these gases that B.O.C.

should refrain from the use of fighting companies in future (paragraph 251) and proposed that the exclusivity clause in its contracts should be modified (paragraph 252). We have also drawn attention to the desirability of a substantial effort by B.O.C. in the field of research (paragraph 245), and to the danger which arises when a monopoly obtains a substantial measure of control over the provision of plant which might be used by its competitors or customers (paragraph 249).

280. In considering the best method of giving effect to our recommendations on prices we have paid particular attention to the importance of doing nothing which will deprive B.O.C. of adequate incentives to continued and increasing efficiency. For this reason we do not recommend that there should be any formal limitation on the profits which may be earned, and we also hope that it may be possible to avoid the detailed regulation of prices with the rigidity and the interference in day-to-day management which would be involved. The object should be to leave the company with as much freedom as is compatible with the need to safeguard the public interest.

281. This object would, we think, be best secured by an arrangement under which the Board of Trade or other competent authority was able to satisfy itself by periodical reviews that effect was being given to our recommendations.* Such reviews should, we suggest, take place at intervals of two or at most three years. It would be necessary for the Board or other authority to have access to all the information relating to prices, costs, profits, capital employed and other matters which it needed to enable it to exercise its supervision of prices effectively, but the primary responsibility would rest on B.O.C. to satisfy the Board or other authority that full effect was being given to our recommendations. We have set out in paragraphs 259 to 261 the considerations which we think should be taken into account in determining the level of profit in the "monopoly" conditions which prevail as far as oxygen and dissolved acetylene are concerned, and as we indicated in paragraph 261, we think the profit aimed at should be substantially less than the range of 23 per cent. to 25 per cent. which has been aimed at in the past.

282. There is no power at present under Section 10 of the Monopolies and Restrictive Practices Act, 1948, or, as far as we are aware, otherwise, to enforce arrangements such as these. It is not for us to express a view on the question whether legislation would prove to be necessary in practice, but if there should be legislation, we suggest that in view of the conditions of almost complete monopoly the opportunity should be taken to place every supplier of oxygen and dissolved acetylene under a duty to supply any bona fide consumer at a reasonable price provided that he had supplies available.

Propane

283. As a producer of propane Esso Petroleum Co. Ltd. supplies about 35 per cent. of the total supply. "Shell" Refining & Marketing Co. Ltd.† and The British Petroleum Co. Ltd.‡, with Eagle Oil & Shipping Co. Ltd. (taken together since they supply through the common agency of Shell-Mex & B.P. Ltd.) supply just over 60 per cent. Imperial Chemical Industries Ltd., the fourth producer, supplies about 37 per cent.§ We have no evidence

* See Addendum, paragraphs 291 to 295.
† As from 31st December, 1955, The Shell Petroleum Co. Ltd.
‡ As from 31st December, 1954, BP Trading Ltd.
§ As these percentages include propane purchased by one producer from another for resale their total exceeds 100 per cent.

of any restrictive practices operated by the producers either individually or collectively except that "Shell" Refining & Marketing* and British Petroleum† use Shell-Mex & B.P. as a common selling agent disposing of the propane produced by the first two companies on their behalf and on behalf of a third company, Eagle Oil & Shipping. This arrangement restricts competition between these producers to the extent that they sell at a common price and the proceeds are divided in agreed proportions between the three principals. Shell-Mex & B.P. also has an understanding with B.O.C. that it will not, without due notice, compete with B.O.C. in direct sales of propane for use with oxygen. We do not know of any distributor being unable to obtain as much propane as he could sell. The production of propane is expanding, and there is nothing to prevent other refineries from entering the field of propane production if they so wish. It is also possible that substantial new uses may be developed for propane. In either of these events the present pattern of production and distribution might change radically. There is, therefore, both competition and flexibility in the pattern of trade.

284. We have considered whether the prices charged and profits made by the producers of propane are excessive, but because it is a minor by-product produced in the refining of motor spirit we have been unable to obtain any accurate and reliable costings for propane production. "Shell" Refining & Marketing* and British Petroleum† do not cost any of their by-products separately. Esso and I.C.I. deal separately with propane in their internal accounts, and on this basis their profits, and especially those of Esso, seem high.‡ But both emphasised in their evidence the notional character of the figures given and the impossibility of determining what part of the total cost of the whole refining operation should be attributed to propane. In practice, although the methods of calculation of these producers differ slightly, the main yardstick used in determining the minimum selling price of propane seems to be its value to the producer if consumed in the refinery as an alternative to oil fuel.

285. We have no evidence that the producers have used their monopoly position to fix their prices at a level which will yield excessive profits and, as we have pointed out, there is competition between them with the possibility of additional competition from other refineries. Because of the arbitrary element in the computation of costs and profits, we can form no definite opinion about the prices charged by the propane producers. Taken at their face value the profit figures provided by the producers themselves (see paragraph 179) suggest that they could reduce their propane prices considerably and yet continue to make reasonable profits, but there is nothing to show that the prices are fixed as a result of, or in order to preserve, the "conditions" to which the Act applies.

286. In view of the circumstances described towards the end of paragraph 283, we do not attach any particular importance in this inquiry to the fact that "Shell" Refining & Marketing*, British Petroleum†, and Eagle Oil & Shipping use a common selling agency, or to the understanding between Shell-Mex & B.P. and B.O.C.

287. As distributors of propane, B.O.C. and Saturn respectively supply about 58 per cent. and about 36 per cent. of the total supplied, and there is competition between them everywhere, except in Wales.§ This competition seems to be effective, and we do not find that in this respect the "conditions"

* As from 31st December, 1955, The Shell Petroleum Co. Ltd.
† As from 31st December, 1954, BP Trading Ltd.
‡ See paragraph 179.
§ See Table II, paragraph 21.

operate against the public interest. The position would, however, need to be considered again if Saturn were to be taken over by B.O.C. or ceased to supply propane on something like the present scale.

288. We have also considered whether there is sufficient competition between propane and dissolved acetylene in view of the fact that for some processes either gas can be used. A comparison of the relative prices of each gas has been given in paragraph 112. We are satisfied that both B.O.C. nationally and Saturn in the North East of England, where it is also a producer of dissolved acetylene, are to some extent emabarrassed in their efforts to sell propane by their natural desire to keep their dissolved acetylene plants fully employed. We do not consider, however, that either practises any deliberate policy of restriction in relation to sales of propane, although B.O.C. has told us that it prefers to sell dissolved acetylene. Moreover, over most of the country Saturn is selling only propane, and its competition is not restrained by its dissolved acetylene interests.

289. The profit of B.O.C. on the distribution of propane was from 9 per cent. to 10 per cent. on cost in 1952 and 1953 and 17 per cent. in 1954, as compared with 24 per cent. and 26 per cent. on cost in 1954 on the production and distribution of oxygen and dissolved acetylene. We have not attempted to calculate the amount of capital employed separately for the three gases, but, as B.O.C. does not manufacture propane, the amount of capital in relation to cost will be considerably less for this gas than it is for oxygen and dissolved acetylene. B.O.C. has told us that if the capital had been separately calculated the profit rate on capital for propane would probably be not less than on dissolved acetylene. We have earlier described B.O.C.'s profits on oxygen and dissolved acetylene as being unjustifiably high having regard to its monopoly position. The circumstances in which a similar rate of profit is earned on propane are, however, different. B.O.C. is not in the same preponderant position. Saturn provides effective competition on a substantial scale over the whole of England and Scotland, and the competition between the two companies is not restricted in any way. In the circumstances, we do not find in the prices which they charge for propane either B.O.C. or Saturn is operating against the public interest. We are, however, of the opinion that the matter should be reviewed if Saturn were taken over or ceased to supply propane on something like the present scale.

290. We do not consider that the monopoly "conditions" in respect of the supply of propane by either the producers or the distributors operate against the public interest, or that they may be expected to do so in the future provided that something like the present degree of competition continues. We have found no "things done" by the suppliers of propane which operate against the public interest or may be expected so to operate.

DAVID CAIRNS (*Chairman*).

T. J. BARNES (subject to the Reservation below).

ALAN BIRCH (subject to the Addendum below).

W. L. HEYWOOD (subject to the Addendum below).

I. C. HILL (subject to the Addendum below).

ARNOLD PLANT (subject to the Addendum below).

C. E. WRANGHAM (subject to the Reservation below).

R. E. YEABSLEY.

J. A. R. PIMLOTT (*Secretary*).

21st June, 1956.

Addendum by Mr. Birch and Mr. Heywood

291. We have signed the Report of the Commission subject to this note. We cannot regard the methods proposed in paragraphs 280 and 281 to give effect to the recommendations on prices as adequate for the future control of B.O.C.'s monopoly position in the interests of users of the reference gases. In paragraphs 259 to 261 it is argued that a monopoly company in B.O.C.'s position does not need to earn the same return on capital as a company in a competitive industry. After comparing B.O.C.'s profits with those in other industries, the conclusion is reached that they have been unjustifiably high. From this arises the further conclusion that prices charged by B.O.C. to consumers are excessive. The case for a voluntary arrangement to limit prices is related directly to these conclusions and the object is stated to be to leave the company with as much freedom as is compatible with the need to safeguard the public interest.

292. Some questions must, therefore, be asked. What curtailment of freedom will be tolerable to private shareholders? Will this be sufficient to ensure that prices will be reduced to and maintained at the lowest possible level? Will investors accept an arbitrary restriction on profits earned while in other respects retaining full control over the company's activities? It seems to us that at the best such an approach will lead only to a continuing source of conflict between shareholders and the statutory authority responsible for price supervision and at the worst to an appearance of Governmental approval of price levels fixed on a basis not differing materially from that adopted in recent years.

293. If, as is clearly intended, the prices to be agreed between the company and the Board of Trade are such as to yield a return on capital less than that which might be justified in a competitive industry, the basis on which an equitable return shall be determined is of paramount importance. No such basis exists, unless the prevailing interest rates on Government guaranteed stocks are taken. But the more the yield on capital invested in B.O.C. is reduced down to this level as a result of Government intervention, the more logical it will become that the Government should assume a similar guarantee. In view of this, and the fact that the only curb on excessive prices in this case is some form of public supervision, we think that the desirability of this taking the form of public ownership and management, with a guaranteed return on capital invested, must be seriously considered.

294. The position might be different were there in evidence any measure of competition from other sources of supply or alternative materials. It is, however, clear to us that the installation by consumers of their own oxygen producing plants is limited by economic considerations and that there is bound to be a very large field of British industry dependent on mass produced oxygen, which is indispensable to present and future production methods. Moreover, the Commission's inquiry into the manufacture and distribution of the reference gases reveals that monopoly production on a national scale, certainly of oxygen in its different forms and to a great extent of dissolved acetylene, has economic advantages not likely to be achieved by a system of unco-ordinated and competitive manufacture and supply. The result of the inquiry, therefore, demonstrates to us that a publicly owned monopoly for the bulk production and supply of industrial gases, from which the element of private profit has been removed, is both feasible and would provide an essential service to industry on the most economical lines.

295. As to the application of the principle of public ownership in this case, we do not consider ourselves called upon in the circumstances of an inquiry under Section 2 of the Monopolies and Restrictive Practices Act,

to particularise. While the company's trading operations in industrial and medical gases have recently been transferred to a subsidiary, British Oxygen Gases Ltd., some indication has been given in this Report of the other activities of B.O.C. It was not the Commission's function to inquire closely into them. Such an inquiry and its relation to our own proposal would be a necessary preliminary step, as would consideration of the position of present shareholders. Another matter to be investigated would be whether a newly created public body to take over the bulk production and distribution of the reference gases should be given a complete monopoly over all or certain of them or whether, as we think likely, it would be sufficient for our purposes for the present range of B.O.C.'s activities as a producer and distributor of oxygen and acetylene and as a distributor of propane to be publicly owned and managed. Nevertheless, the nature of the present Report and general conclusions justifies, in our view, a more far reaching decision as to the future of this industry, pending which the recommendation to which we have appended our signatures may be regarded as an interim measure.

ALAN BIRCH.

W. L. HEYWOOD.

Addendum by Mr. Hill and Sir Arnold Plant

296. Whilst, in the absence of any effective means of introducing a general measure of competition in oxygen and acetylene in the face of a monopoly as firmly entrenched as B.O.C., we support the main conclusions and recommendations of our colleagues, we believe that the recommendations overlook some of the possibilities of bringing about a higher degree of competition and may even result in the elimination of such competition as at present exists. Furthermore, we are of the opinion that the form of Board of Trade supervision suggested, unaided by an active awareness on the part of industrial users of the widely varying regional costs of oxygen production and distribution, can at best be only a partial palliative of the more obvious effects of monopoly : indeed, at worst, it might induce a measure of technical stagnation.

297. We believe, therefore, that such positive recommendations in relation to regional and ex-works pricing as are practicable should be put forward on the grounds that where costs vary widely either in production or in transport, steps should be taken to ensure that such variations are reflected in the prices charged. Such a step would have not only the direct advantages enumerated in paragraph 267 but also the indirect advantage of introducing a quasi-competitive atmosphere within B.O.C. and of indicating those regions where competition, unhampered by those practices employed by B.O.C. in building up its monopoly and aided by the new conditions introduced by the competitive sale of tonnage plants, might have some expectation of being successfully established.

Regional Prices

298. B.O.C.'s claims in arguing for the retention of a national price basis are mainly summarised in paragraph 221. The arguments forwarded are partially of a negative nature based on the assertion that a local price scheme would bring neither greater economy nor greater efficiency in

production*, whilst the positive arguments, namely that only on a national basis can prices be kept reasonable and stable and that a regional scheme would reduce the flexibility of the organisation as a whole, are difficult to understand. Whether or not prices are reasonable is a matter of pricing in relation to cost, whilst stability of price over a period is a decision of sales policy which would in any case be made at headquarters. Reference to paragraphs 163 and 164 shows that regional works costs (for a two year period) varied for liquid oxygen between 5s. 2d. and 7s. 1d. a 1,000 cubic feet and for compressed oxygen between 11s. 7d. and 19s. 0d. (with one exceptionally at 24s. 9d.) a 1,000 cubic feet. As regards flexibility, it is difficult to understand why in production or distribution any desirable overlap between regions could be arranged better at headquarters (paragraph 268 (*c*)) than between the zones affected, whilst in the case of selling prices the Commission is recommending price scales based on quantity to classes of consumer which are specifically aimed at eliminating "flexibility" in the sense of discrimination in the treatment of similar classes of customer. It should further be noted (paragraph 273) that regional arrangements are already in force for negotiating prices with medium and small users.

Ex-works Pricing

299. An analysis of the journeys and their mileage within distribution areas shows that distribution of oxygen may be effected as much as 85 miles distant from the producing plant. Where transport and delivery for compressed oxygen, for example, amounts overall to as much as 28·3 per cent. of the combined production and distribution costs or 23·5 per cent. of the total costs (see paragraph 170), because of the large element represented by carriage of full and empty cylinders, it would appear to be not unreasonable to assume that there is a wide variation in the delivered cost of oxygen. Although it may be sound policy for B.O.C. in its endeavour to maintain its monopoly to subsidise outlying areas at the expense of the more compact zones, such a distortion of price in relation to cost is against the public interest in so far as it restricts the possibility of specialised local competition in gases and adds to prices elsewhere. It is relevant that Saturn negotiates selling prices with individual customers on the basis of transport as well as production costs. Whilst it is not argued that prices should be ex-works prices allowing the customer to collect at works, it is our contention that an ex-works price plus a distribution charge based on zones of delivery would be in the national interest.

300. We therefore recommend that:

(*a*) Price lists should be published regionally and based on regional costs and

(*b*) The regional price lists should list an ex-works price plus a variable addition for delivery based on the cost of transport.

I. C. HILL.

ARNOLD PLANT.

* In paragraph 268 (*a*) and (*b*) the Commission's arguments have gone beyond the claims made by B.O.C.

Reservation by Sir Thomas Barnes and Mr. Wrangham

301. We do not agree with the finding in paragraph 261 that B.O.C. profits are unjustifiably high. In our view the evidence does not justify that finding.

302. The arguments and evidence on which the finding is largely based are set out in paragraphs 258 to 260. In paragraph 260 a comparison is drawn between the profits of B.O.C. in respect of gases to which the reference relates and the profits of a number of miscellaneous industries taken from the statistics published in *The Economist* for the years 1952 to 1954 adjusted as mentioned in the report.

303. It is said that during those years B.O.C. made a larger profit on capital employed in its gases business than was earned in manufacturing industries generally. This may be so, but it will be seen that for the purposes of the comparison the Company's operations in gases have been isolated from its other operations and no account is taken of those other operations.

304. The fact is, of course, that B.O.C. was a composite Company carrying on a number of different activities both within and without the United Kingdom. The reference gases activities in the United Kingdom comprised something less than 50 per cent. of the total activities of the Company. In our view the directors of B.O.C. in past years were entitled—and, indeed, were bound—to consider the whole of their undertaking when planning prices, profits and the general financial policy of the Company and would be justified in using the general revenue for the general benefit of the whole undertaking.

305. Looking at the matter in this light it is significant to observe that if the percentage of profit calculated on the capital used in the whole undertaking is ascertained it will be found that in 1953 and 1954 that percentage was approximately 17 per cent. and in 1952 slightly less than 17 per cent. These figures are almost identical with the average percentage of profits of the large number of industrial companies comprised in the statistics published in *The Economist,* referred to and relied upon in paragraph 260.

306. It is not perhaps irrelevant to mention here the point made by the Company (see paragraph 224) that even if its gases undertaking is isolated and the percentage of profit is calculated on replacement values as distinct from historical values, that percentage of profits is no more than the percentage calculated on the same basis by the State-owned Iron and Steel Corporation for the purposes of its 1952 accounts. In these circumstances we do not accept the view that the profits have been unreasonably high.

307. Neither do we agree with what is said in paragraph 259 with regard to the Company's capital requirements. We have not had the benefit of hearing the views either of the Company or of those who advise it on appropriate methods of raising capital from time to time, but we think it doubtful whether it was practicable for the Company to treat its gases activities differently from its whole undertaking when raising capital for the general purposes of the Company.

308. The finding in paragraph 262 that the prices for oxygen and dissolved acetylene are too high is apparently based on the argument that as the profits were too high the prices must also have been too high. We do not accept this. We do not think there is any evidence that the prices have been fixed at too high a level. We are impressed by the fact (see paragraph 242) that there have been so few complaints from amongst B.O.C.'s many

thousands of customers. Of these a very small number relate to price and are in the main based on general statements that as there is no competition the prices are probably too high. This is very far from affording evidence that the prices are in fact too high. As will be seen from Chapter 4, Part III, most of B.O.C.'s customers appear to be satisfied both with the service provided by the Company and with the prices they are asked to pay.

309. In our view therefore it cannot be said with justification that in the matter of profits and prices B.O.C. has acted in any way contrary to the public interest.

310. Nevertheless we agree with the statement in paragraph 240 that " there are *possible* dangers in the control by one supplier over so large a proportion of the market of two essential commodities such as oxygen and dissolved acetylene ". In our view the operations of the Company should be examined from time to time by or on behalf of the Government to ensure that there is no abuse of the monopoly, and the fact that B.O.C. has now transferred its activities in gases to a separate operating Company will facilitate the examination. Any legally enforceable control of prices would, we assume, require legislation, but this might be unnecessary if the Company were prepared to enter into arrangements with the Board of Trade or other competent authority to give to them such information as the authority may require in order to satisfy itself from time to time that the prices charged are reasonable.

311. With the other recommendations in the report we are in general agreement.

T. J. BARNES.

C. E. WRANGHAM.

APPENDIX 1

(Referred to in paragraph (i) of the Introduction)

REFERENCE FROM THE BOARD OF TRADE

THE MONOPOLIES AND RESTRICTIVE PRACTICES (INQUIRY AND CONTROL) ACT, 1948

CERTAIN INDUSTRIAL AND MEDICAL GASES

Whereas it appears to the Board of Trade that conditions to which the Monopolies and Restrictive Practices (Inquiry and Control) Act, 1948 applies prevail as respects the supply of each of the following descriptions of goods, that is to say:—

(*a*) oxygen;

(*b*) dissolved acetylene;

(*c*) propane:

Now therefore the Board in pursuance of Section 2 (1) of the said Act hereby refer to the Monopolies and Restrictive Practices Commission for investigation and report the matter of such supply.

The Commission shall as respects such supply investigate and report on

(1) whether the conditions to which the Act applies in fact prevail and if so in what manner and to what extent;

(2) the things which are done by the parties concerned as a result of or for the purpose of preserving those conditions; and

(3) whether the conditions in question or all or any of the things done as aforesaid operate or may be expected to operate against the public interest.

Dated this first day of February, 1954.

(Signed) M. J. DEAN.
A Secretary of the Board of Trade.

APPENDIX 2

(Referred to in paragraph (iv) of the Introduction and paragraph 108)

PRINCIPAL SOURCES OF EVIDENCE

Air Ministry
Board of Trade
British Constructional Steelwork Association
The British Iron and Steel Research Association
The British Oxygen Co. Ltd.
BP Trading Ltd.
British Standards Institution
British Transport Commission
The Butterley Co. Ltd.
Calor Gas (Distributing) Co. Ltd.
The Carbide Distributing Agency Ltd.
Central Electricity Authority
The Chesterfield Tube Co. Ltd.
Colvilles Ltd.
Department of Scientific and Industrial Research
The Distillers Co. Ltd.
Dorman Long (Steel) Ltd.
Eagle Oil & Shipping Co. Ltd.
Esso Petroleum Co. Ltd.
The Gas Accumulator Co. (United Kingdom) Ltd.
Hadfields Ltd.
Home Office
Imperial Chemical Industries Ltd.
Kingston Chemicals Ltd.
Lea & Son (Runcorn) Ltd.
Lee-Midgley, Whitehead & Co. Ltd.
Ministry of Fuel and Power
Ministry of Health
Ministry of Supply
National Coal Board
Rubery, Owen & Co. Ltd.
Joseph Sankey & Sons Ltd.
Saturn Industrial Gases Ltd.
Shell-Mex & B.P. Ltd.
The Shell Petroleum Co. Ltd.
The Shipbuilding Conference
The Steel Company of Wales Ltd.
Stewarts & Lloyds Ltd.
The United Steel Companies Ltd.
Thos. W. Ward Ltd.

Evidence was also obtained from other Government Departments, 23 local authorities, 54 hospitals, Gas Boards and industrial users, including 34 iron and steel manufacturers, 43 motor car and motor accessory manufacturers, 24 electrical machinery manufacturers, 22 aircraft constructors, 36 general engineers, 6 public works contractors, 5 shipbreakers, 10 chemical manufacturers and 2 scrap metal merchants.

APPENDIX 3

(Referred to in paragraph 2)

THE PRODUCTION OF OXYGEN

The process of extraction of oxygen from the air either as liquid or as gas involves three fundamental phases, (*a*) air purification, (*b*) partial liquefaction of the air by compression and expansion, (*c*) separation into oxygen and nitrogen by fractional distillation.

Two main impurities have to be removed, namely carbon dioxide, which would solidify and choke the distillation column, and water vapour, which is always present in the air. Carbon dioxide is absorbed in contact with a solution of caustic soda in a scrubbing tower, generally after the first stage of compression of the air, while water is removed firstly by separation as liquid in the further stages of compression, and secondly either by refrigeration where it is deposited as ice, or sometimes by absorption on activated alumina.

Since oxygen liquefies at −183° C. and nitrogen at −196° C., it is necessary to provide a large amount of refrigeration in order to liquefy sufficient of the air to enable liquid oxygen to be produced.

The air is compressed in stages, with cooling between stages, and refrigeration is obtained firstly by expanding a proportion of the compressed air in an engine whereby the air does work and thereby cools itself, and secondly by subjecting the compressed air in a heat exchanger to the flow of the cold nitrogen leaving the distillation stage.

In practice, it is found that if the air is subjected to a pressure exceeding 140 atmospheres (2,100 p.s.i.g.) and if 60 per cent. of this air is expanded in an engine, sufficient refrigeration will be produced to liquefy approximately 26 per cent. of the total air supplied. Since the amount of oxygen contained in the atmosphere is about 20 per cent. by volume, it is by this means technically possible to liquefy all the oxygen and provide sufficient refrigeration to overcome the ingress of heat and the other losses inherent in a process of this nature.

The liquid air so produced is then distilled or rectified to separate the oxygen. Rectification is carried out in two stages in a so-called double column. In the first or high pressure stage which is operated at about five atmospheres, the liquid air is separated into a nitrogen fraction, which is practically pure nitrogen, and an oxygen-enriched fraction which contains 35 to 40 per cent. of oxygen.

The oxygen-rich fraction from the bottom of the high pressure column is expanded into the second or low pressure column which is operated at only slightly above atmosphere pressure, while the nitrogen fraction from the top of the high pressure column is expanded into the low pressure column above the oxygen-rich fraction. This nitrogen fraction washes out the oxygen from the rising vapours of the oxygen-rich fraction. Thus the descending liquid becomes richer and richer in oxygen whilst the rising vapours become richer and richer in nitrogen. The nitrogen from the top of the column is used, as previously stated, to cool the compressed air. At the bottom of the column a liquid collects which has a purity of about 99·7 per cent. of oxygen and this is progressively withdrawn and stored in insulated storage tanks for distribution as required.

The equipment for liquefying and rectifying air operates at such a low temperature that it has to be completely insulated, and in practice non-combustible insulating materials having a very low conductivity, such as slag wool, are employed.

Plants from which oxygen is withdrawn as a gas operate on very similar principles, but much less refrigeration is required since less cold is removed from the cycle of operations by the withdrawal of gaseous oxygen as compared with that removed when the oxygen is withdrawn as liquid. Consequently the operating pressure and hence the power required is somewhat less and gaseous oxygen plants can be made to operate at pressures below 20 atmospheres.

APPENDIX 4

(Referred to in paragraph 10)

TECHNICAL TERMS USED IN THE IRON AND STEEL INDUSTRY

Air enrichment	Oxygen is mixed with the combustion air supplied to the open hearth furnace or is blown into the furnace adjacent to the point of entry of gas or other fuel for firing. The resultant intensified combustion accelerates the melting process and leads to an increase of steel output and some fuel saving.
Enrichment of air blast	Oxygen is added to the air blast which is blown into the molten metal in the Bessemer converter.
Desiliconisation *Decarburisation*	These are methods for removing by oxidation the silicon and carbon contents of the metal and so accelerating the process of refining. Oxygen is injected through a lance into the ladle or the mixer of molten metal before it is put into the furnace, or by inserting the lance through the door of the furnace. The lance is consumed and the silicon and carbon content reduced. At one large steel works a patented process has been developed by which the oxygen is injected by means of a gun through the roof of the furnace; the oxygen penetrates through the slag into the molten metal and the gun is not consumed as it is kept above the surface and will therefore last for a number of operations. This method enables an exact carbon analysis of the steel to be obtained and refining can therefore be carried out to exact requirements. As silicon is reduced before carbon elimination begins, desiliconisation is carried out by lancing in the ladle or mixer. Very dense fumes are produced, which constitute a problem. Lancing for decarburisation in the furnace is a process which is becoming more widespread.
Deseaming *Scarfing*	These are dressing operations to remove from the surface of steel ingots, blooms and billets any imperfections or irregularities which would adversely affect further fabrication of the steel. Oxygen is used to burn away the surface of the ingot, possibly up to $\frac{1}{4}$ in., and the process may be done by hand with various types of torches and blowpipes or by machines which have rows of nozzles, whose areas of operation are arranged to overlap, so that the entire surface of an ingot on all four sides is treated at the same time. If the steel is already hot enough (i.e. over 1,000° C.), deseaming is done by oxygen alone, but when colder material is being treated an oxy-acetylene flame is initially applied for pre-heating, before the burning with oxygen can be operated. Propane may be used for pre-heating in deseaming.

APPENDIX 5

(Referred to in paragraph 54)

PROPANE AGREEMENT CONCLUDED BETWEEN IMPERIAL CHEMICAL INDUSTRIES LTD. AND SHELL-MEX & B.P. LTD., 13th AUGUST, 1941

The arrangements discussed between us to regulate the sale of Propane in the United Kingdom of Great Britain and Northern Ireland, and in Eire, for industrial processes excluding mineral oil refining, which arrangements are to be as follows:

(1) *Definition of Propane*

The term " Propane " means any hydrocarbon product consisting predominantly of Propane and/or Propylene.

(2) *Method of Sale*

All sales of Propane in the market defined above shall be made by Shell-Mex & B.P. Ltd. Imperial Chemical Industries Ltd. will not sell Propane into that market except through Shell-Mex & B.P. Ltd.

(3) *Participation of Anglo-American Oil Co. Ltd.*

It is envisaged that the Anglo-American Oil Co. Ltd. (and/or its Associated and Subsidiary Companies) may later by agreement between Shell-Mex & B.P. Ltd. and Imperial Chemical Industries Ltd. become a party to this agreement.

In this case, Shell-Mex & B.P. Ltd. and Imperial Chemical Industries Ltd. will meet together to agree amendment of quotas mentioned in paragraph (5) below, in order to make room for the Anglo-American Oil Co. Ltd.

(4) *Period of Agreement*

The arrangement will be for an initial period of fourteen months from November 1st, 1940, until 31st December, 1941, and will continue in force thereafter until terminated by either party giving the other twelve months' notice in writing.

(5) *Quotas*

The total sales of Propane for the agreed purposes shall be divided as follows:

(i) Shell-Mex & B.P. Ltd. (and/or its Associated and Subsidiary Companies) shall have a minimum quota of 400 tons in any calendar year.

(ii) Any sales in excess of 400 tons shall be divided as to 60 per cent. to Imperial Chemical Industries Ltd. (and/or its Associated and Subsidiary Companies) as to 40 per cent. to Shell-Mex & B.P. Ltd. (and/or its Associated and Subsidiary Companies).

(iii) When the total sales shall have reached a figure of 2,400 tons in any year, then all sales in excess of 2,400 tons shall be divided equally between the two parties.

Under normal conditions the method for the adjustment of quotas shall follow so far as is appropriate and practicable that laid down in Schedule A. of the Butane Agreement between the parties.

It is recognised however, that should war conditions cause one party's supplies to fail either wholly or partly then the other party is at liberty to supply in excess of its quota in order to avoid restricting the total market. In this event it is understood that every effort will be made to adjust in each six-monthly period (i.e. January 1st to June 30th, and July 1st to December 31st) any disproportionate delivery carried forward into it from the previous six-monthly period, and if the party who has become under-delivered in any such six-monthly period fails to offer in the next following six-monthly period sufficient additional Propane to adjust the quota, then that party shall have no further claim in respect of such quantity as it shall have failed to offer.

As regards November and December, 1940, Shell-Mex & B.P. Ltd.'s minimum quota for the two months shall be one-sixth of 400 tons, i.e. 66·7 tons, and the price

to be paid to Imperial Chemical Industries Ltd. shall be based on the average sales price charged to buyers during those two months in the manner prescribed in paragraph (6) below.

(6) *Prices*

The price to be paid to Imperial Chemical Industries Ltd. by Shell-Mex & B.P. Ltd. shall be based on the average sales price charged to buyers.

When the average sales price is 6d. per lb. the price to be paid to Imperial Chemical Industries Ltd. shall be 1·8d. per lb. in cylinders provided by Shell-Mex & B.P. Ltd. to be placed free on rail or lorry at Billingham when full. If the average sales price is other than 6d. per lb. then the price to be paid to Imperial Chemical Industries Ltd. shall be in the same proportion to 1·8d. per lb. as the actual realised sale price is to 6d. per lb. If, however, the actual realised sale price exceeds 6d. per lb., any increase in the all-in container costs over the basic figure of 1·084d. per lb. shall be deducted before calculating the increased price to be paid to Imperial Chemical Industries Ltd.

Shell-Mex & B.P. Ltd. will certify to Imperial Chemical Industries Ltd. on or before the 31st July and the 31st January, the actual achieved average sales price in the half year ending the 30th June and 31st December respectively, and the certificate of the Chief Accountant of Shell-Mex & B.P. Ltd. shall be accepted by Imperial Chemical Industries Ltd. in confirmation of such declarations.

Any increase in the all-in container costs which would affect the price to be paid to Imperial Chemical Industries Ltd. will also be certified by the Chief Accountant of Shell-Mex & B.P. Ltd. and his certificate accepted by Imperial Chemical Industries Ltd.

Shell-Mex & B.P. Ltd. agree to consult Imperial Chemical Industries Ltd. before making any change in the schedule of re-sale prices. Imperial Chemical Industries Ltd. shall have the right to ask for a revision of sales prices, and Shell-Mex & B.P. Ltd. will not unreasonably with-hold their agreement to such revision.

APPENDIX 6

(Referred to in paragraphs 58 and 149)

SUMMARY OF AGREEMENT BETWEEN THE BRITISH OXYGEN COMPANY LTD. AND THE STEEL COMPANY OF WALES LTD. FOR THE SUPPLY OF OXYGEN BY PIPELINE TO THE MARGAM WORKS

1. The agreement was concluded on 10th May, 1951. The preamble refers to a companion and in part related agreement made the same day between B.O.C. and British Industrial Solvents Ltd. (as agents for the Ministry of Supply) for the sale of nitrogen to the Ministry of Supply factory at Kenfig. It provides for building a B.O.C. factory on a site convenient to both the Steel Company of Wales's works and Kenfig, for the Steel Company of Wales to give help on obtaining way-leaves, etc. for the pipeline from the B.O.C. factory to their works, for the property in the pipeline and its branches to vest in B.O.C., and for B.O.C. to bear the cost of installation and to be responsible for maintenance.

2. The Steel Company of Wales shall purchase from B.O.C. and B.O.C. shall supply all the oxygen which the Steel Company of Wales shall require up to a maximum of 85 million cubic feet a year at a purity of 99·5 per cent. at a pressure of 250 p.s.i. If B.O.C. cannot for the time being supply the Steel Company of Wales's requirements, the Steel Company of Wales shall purchase not less than 40 million cubic feet a year.

3. B.O.C. shall invoice oxygen to the Steel Company of Wales at a basic price of 9s. 0d. a 1,000 cubic feet and nitrogen to British Industrial Solvents at a basic price of 1s. 6d. (the latter being subject, in the companion B.O.C./British Industrial Solvents agreement, to annual adjustments for quantity as shown in column 4 of the Table below and a minimum annual payment of £7,500). At the end of the year the Steel Company of Wales's payments shall be adjusted in accordance with the following Table and the other extracts from Clauses 8 and 9 cited below:

" 8. . . .

OXYGEN		NITROGEN		
1.	2.	3.	4.	5.
Volume Million cu. ft. p.a.	Scale price per 1,000 cu. ft.	Scale limit Million cu. ft. p.a.	Scale price per 1,000 cu. ft.	Total cost at scale rate
				£
Over 40 under 45	9/–	Up to and incl. 125	1/6	9,375
45 50	8/6	140	1/6	10,500
50 55	8/–	155	1/5	10,979
55 60	7/6	170	1/5	12,042
60 65	7/–	185	1/4	12,333
65 70	6/6	200	1/3	12,500
70 75	6/–	215	1/2	12,543
75 80	5/6	230	1/1	12,458
80 85	5/–	250	1/–	12,500

. . . If the volume of nitrogen taken by the M.O.S. factory falls short of the quantity shown under the heading of Scale Limit (column 3) of the above Table against the range of oxygen volume taken by the Steel Company (column 1) the Steel Company will be charged with the amount by which the total volume of nitrogen actually taken calculated at the Scale Price for nitrogen (column 4) appropriate to the volume of oxygen taken or the amount of £7,500 whichever is the greater falls short of the Total Cost of nitrogen at the Scale Rate (column 5) also appropriate to the volume of oxygen actually taken . . ."

" 9. In the event of the annual consumption of oxygen exceeding the maximum of 85,000,000 cubic feet indicated on the Table in Clause 8 and if the M.O.S. factory does not take nitrogen in excess of 250,000,000 cubic feet then the amount to be

realised from the Steel Company for oxygen and from British Industrial Solvents for nitrogen (taking into account that the minimum payment to be made by British Industrial Solvents for nitrogen shall be £7,500 per annum) shall be in total equal to the amount arrived at by multiplying the volume of oxygen taken by the Steel Company by a price of Nine Shillings per 1,000 cubic feet." In the event of British Industrial Solvents' demand for nitrogen rising above 250 million cubic feet there is provision for negotiating revised prices for oxygen taken by the Steel Company of Wales at a rate in excess of 85 million cubic feet a year. (And, in the companion agreement, for comparable negotiations with British Industrial Solvents on their nitrogen prices.)

Note: It appears from correspondence filed by B.O.C. with these Agreements that:

(*a*) There was some understanding between the parties, but no provision in the Agreement, that the Steel Company of Wales should provide the unskilled labour, works' tackle, etc. required for the pipeline installation. In the event it agreed to bear a half of these expenses.

(*b*) B.O.C. agreed, after the Steel Company of Wales's representations, to provide routine day-to-day maintenance for the Steel Company of Wales's pipeline. B.O.C.'s usual practice in such cases is to provide for periodic visits and overhauls by its engineers and to leave the ordinary day-to-day unskilled supervision to the customer's workmen.

APPENDIX 7

(Referred to in paragraph 62)

THE BRITISH OXYGEN COMPANY LTD.

CAPITAL ISSUED AND DIVIDENDS PAID 1938 TO 1956

CAPITAL ISSUED

Description	*Date of Issue*	*Nominal Value* £
6½ per cent. Cumulative Preference Stock	Before 1939	500,000
5 per cent. Cumulative Second Preference Stock	,, ,,	1,000,000
4 per cent. ,, ,, ,, ,, ...	1945 ,,	1,000,000
Ordinary Stock	see below	17,047,166

Issues of Ordinary Capital

	Nominal Value £	*Issued Price* (per unit of £1)	*Amount Realised* £	*Issued other than for cash*
Before 1939...	2,884,252	—		
1940...	576,850	—		Bonus issue (1 for 5)
1949...	8,000	—		Part consideration on purchase of New Zealand company
Nov. 1950...	693,820	70s.	2,428,370	
June 1952...	2,081,461	—		Bonus issue (1 for 2)
Nov. 1952...	1,873,315	40s.	3,746,630	
Aug. 1955...	3,247,079	50s.	8,117,697	
May 1956...	5,682,389	—		Bonus issue (1 for 2)
	£17,047,166			

£4,000,000 of the issue in August, 1955, was used to repay at par a 3¾ per cent. Unsecured Loan Stock, 1953–55, issued at 99½ in November, 1950.

DIVIDENDS PAID

Accounting Year	*Rate on Nominal Value of Stock* per cent.	
1938	17	
9	17	plus capital bonus of 20 per cent.
1940	15	(equal to 18 per cent. on capital before bonus issue)
1	14	
2	15	
3	15	
4	16	
5	20	
6	20	
7	20	
8	20	
9	20	
1950	20	
1	20	plus capital bonus of 50 per cent.
2	15	(equal to 22½ per cent. before bonus issue)
3	15	
4	15	
5*	15	plus capital bonus of 50 per cent.

The rate of dividend of 15 per cent. on the nominal value in 1952–5 is equivalent to:—

27 per cent. on the capital subscribed before 1939
6½ per cent. on the capital subscribed in November, 1950
7½ per cent. on the capital subscribed in November, 1952
6 per cent. on the capital subscribed in July, 1955
5 per cent. to a purchaser buying on the market at 59s. 6d. per unit (the price on 26th April, 1956).

* In 1955 the accounting period was changed and the accounts incorporated the results of the parent company for the nine months and the subsidiary companies for the twelve months ended 30th September, 1955.

APPENDIX 8

(Referred to in paragraph 62)

THE BRITISH OXYGEN COMPANY LTD. SUBSIDIARY AND ASSOCIATED COMPANIES

HOME

The Alliance Calcar Co. Ltd.
Charles Bingham & Co. Ltd.
British Industrial Gases Ltd.
British Oxygen Aro Equipment Ltd.
British Oxygen Chemicals Ltd.
British Oxygen Engineering Ltd.
British Oxygen Gases Ltd.
British Oxygen Linde Ltd.
Fusarc Ltd.
Industrial Gases (I.F.S.) Ltd.
Industrial Gases (Scotland) Ltd.
A. Charles King Ltd.
Medical Gases Ltd.
Oxhycarbon Co. Ltd.
Quasi-Arc Ltd.
Sparklets Ltd.
Thorn & Hoddle Ltd.

OVERSEAS

African Oxygen & Acetylene (Pty.) Ltd.
The British Oxygen Canada Ltd.
Burma Oxygen & Acetylene Co. Ltd.
Ceylon Oxygen & Acetylene Co. Ltd.
China Oxygen & Acetylene Co. Ltd.
The Commonwealth Industrial Gases Ltd.
Egyptian Oxygen & Acetylene Co. Ltd.
The Indian Oxygen & Acetylene Co. Ltd.
Industrial Gases (Malaya) Ltd.
New Zealand Industrial Gases Ltd.
Odda Smelteverk A/S Norway.
Pakistan Oxygen & Acetylene Co. Ltd.

APPENDIX 9

(Referred to in paragraphs 65 and 72)

THE BRITISH OXYGEN COMPANY LTD.

LOCATION OF OXYGEN AND DISSOLVED ACETYLENE WORKS

District	Oxygen			Dissolved Acetylene†
	Liquid	Compressed	Medical*	
Scotland (inc. N. Ireland)				
Aberdeen		x T		
Belfast	x	x L		x
Dundee		x T		x
Glasgow				
Hillington (3 works)	x		x	x
Polmadie	x	x L		
Govan				x
Leith		x T		
North-East				
Billingham		x T		
Chester-le-Street	x	x L		x
Lancashire				
Barrow		x GT		
Bromborough		x TB		
Crewe		x T		x
Liverpool				x
Manchester	x	x LB		
Worsley	x	x L	x	x
Yorkshire				
Brinsworth	x			
Goole		x T		
Leeds	x	x L		
Rotherham	x	x L		
Sheffield				x
Midlands				
Aston		x T		
Bilston				x
Corby	x	x L		
Coventry		x T		
Derby		x T		
Hockley		x T		
Wolverhampton	x	x L		
Western				
Bristol		x T		x
Cardiff	x	x L		x
Margam	x	x L		
Plymouth		x T		
London				
Brentford			x	
Cricklewood				x
Erith		x B		
Greenwich		x GT		
Ilford		x B		
Ipswich		x T		x
Poplar				x
Southampton (2 works)		x T		x
Wembley	x	x LG		

Compressed Oxygen

L from liquid oxygen produced at the same factory.
T from liquid oxygen transferred by road from another factory.
G from gas produced at the same factory.
B from gas bought in.

* *Medical Oxygen* is also produced at most of the factories making compressed oxygen but is not shown separately in the table. Those marked produce medical oxygen only.

† *Dissolved Acetylene* is produced at the stations marked, but is also distributed to customers from other works where compressed oxygen is produced.

APPENDIX 10

(Referred to in paragraph 76)

CONTRACT

BRITISH OXYGEN GASES LIMITED (hereinafter called "the Company") of the one part and

(hereinafter called "the Customer") of the other part WHEREBY the Company agrees to sell and deliver and the Customer agrees to accept at the following prices and subject to the conditions overleaf their total requirements of gases below mentioned (whether in liquid or gaseous form) during the period from 1st January 19 to 31st December 19 unless expressly agreed in writing to the contrary.

	Price per 1,000 c.f.
Liquid Oxygen (Bulk)	
Liquid Oxygen (Flasks)	
Gaseous Oxygen	
Dissolved Acetylene	
Hydrogen	
Propane	
Coal Gas	
Liquid Nitrogen (Bulk)	
Liquid Nitrogen (Flasks)	
Gaseous Nitrogen	
Liquid Air (Flasks)	
Compressed Air	
Argon (Argonarc)	
Gas Mixtures	
Rare Gases	

PRODUCING WORKS

SCOTTISH DISTRICT
Glasgow Leith *Aberdeen *Dundee

NORTHERN IRELAND
Belfast

NORTH EASTERN DISTRICT
Chester-le-Street Billingham

LANCASHIRE DISTRICT
Manchester Bromborough Crewe Preston *Barrow

YORKSHIRE DISTRICT
Rotherham Leeds Goole

MIDLANDS DISTRICT
Birmingham Wolverhampton Coventry
Derby *Corby

WESTERN DISTRICT
Cardiff Margam-Port Talbot Bristol *Plymouth

LONDON DISTRICT
Wembley Southampton
Greenwich *Ipswich

APPROVED STORES

NORTH EASTERN DISTRICT
Carlisle Berwick-on-Tweed

LANCASHIRE DISTRICT
Workington

YORKSHIRE DISTRICT
York Scarborough

MIDLANDS DISTRICT
Shrewsbury

WESTERN DISTRICT
Hereford Milford Haven Pembroke

LONDON DISTRICT
Cambridge Brighton Norwich

Prices for Oxygen, Hydrogen, Coal Gas, Nitrogen, Compressed Air and Argon cover supplies in Cylinders of 100 cu. ft. capacity and upwards.

Price for Dissolved Acetylene applies to Cylinders of 200 cu. ft. (nominal) capacity. Additional charges for this gas in Cylinders of 100 cu. ft. (nominal) capacity 5/- per 1,000 cu. ft.—in Cylinders of 60 cu. ft. (nominal) capacity 10/- per 1,000 cu. ft.

Supplies of Hydrogen, Coal Gas, Nitrogen and Compressed Air are subject to a surcharge of 10/- per 1000 cu. ft. when supplied from Works marked thus*.

Approved Stores supply Oxygen and Dissolved Acetylene. Each gas is subject to a surcharge of 10/- per 1,000 cu. ft. and prices are ex Stores.

For BRITISH OXYGEN GASES LIMITED

Signed.....

For .....(The Customer)

Signed.....

Date.....

Form 871 (56)

C.B.H. 29497 - Wt. 1202 - Dd. 3378 - 3000 - 12/56

CONDITIONS APPLICABLE TO THE SUPPLY UNDER CONTRACT OF INDUSTRIAL GASES IN CYLINDERS AND LIQUID IN BULK QUANTITIES

1. GASES AND CYLINDERS.
All Gases and Cylinders supplied by the Company are for the sole use of the Customer who shall not re-sell or loan. All Company Cylinders comply with Statutory Requirements.

2. DELIVERY.
(a) Prices quoted for the supply of Gas in Cylinders include free delivery and collection of Cylinders during normal business hours in all districts served by the Company's regular transport service. Supplies taken at the Company's works or handed to Railways or Carriers are charged at the same prices without allowance for cartage, the cost of any carriage involved being borne by the Customer, who is also responsible for the return of empty Cylinders carriage paid.
(b) Prices quoted for the supply of Liquid in Bulk Quantities include free delivery, by our Road Tankers.
(c) The delivery and collection of goods beyond the main gateway of the Customer's premises is made on the understanding that there is a safe and proper access to and from the point at which delivery or collection is to be made. The Customer shall accept all responsibility for damage to vehicles or loads due to unsuitability of means of access from the main gateway to and from the loading or unloading points. The Company shall not be responsible for damage to roadways, entrance gates, mains, pipes, bridges, weighbridges, buildings or other erections or approaches within the Customer's premises leading to and from the loading or unloading point, unless such damage is caused by the negligence of the Company or its servants.

3. GASES RETURNED.
No allowance can be made for Gas returned except in Cylinders from which Gas has not been withdrawn. To enable any such allowance to be claimed an advice bearing the reference numbers on the Cylinders to be returned must be received prior to arrival of the Cylinders at the Company's Works.

4. DAMAGE OR INJURY.
The Company warrants the safety of Evaporating Equipment, Cylinder Manifolds, Pipelines (hereinafter referred to as Apparatus) and Cylinders which have been sold and installed by the Company to the Customer or which are on loan from the Company to the Customer. No responsibility can be accepted for any Apparatus or Cylinders not sold and installed or loaned by the Company.
The Company will only be responsible for injury to persons or damage to property or any other damage arising from :—
(a) Faults in Apparatus or Cylinders sold and installed or loaned by the Company where such fault or faults are proved to be due to the negligence or default of the Company.
(b) Any Cylinder owned and filled by the Company which is proved to be faulty where such faults have been directly caused by the negligence or default of the Company.
In no circumstances will the Company accept responsibility for injury or damage where Gas is used from a Cylinder, Battery of Cylinders, Evaporating Equipment or other container which has not been filled by or with the authority of the Company, nor when Company Cylinders are used in connection with Cylinder Manifolds or Pipeline Services which have not been supplied and installed by the Company or have had their approval. The Company will accept no responsibility for any loss, injury or damage suffered by any person in the course of installation or delivery or removal or maintenance of Apparatus or Cylinders unless caused by the negligence of the Company, its servants or agents and any skilled or unskilled labour supplied by the Customer shall be deemed the servant or agent of the Customer.

5. STATUTORY OBLIGATIONS UNDER THE FACTORIES ACT.
The Company will offer every co-operation in observing safe working conditions but the responsibility for the observance of requirements of the Factories Act, or any other Statutory or Common Law obligation placed upon the occupier of the Factory or other place where the Apparatus is installed, rests with the Customer who shall indemnify the Company against all claims arising under the said Factories Act or other Statutory or Common Law obligation placed upon the occupier of the Factory.

6. APPARATUS AND CYLINDERS NOT TO BE MORTGAGED.
The Customer shall not sell or offer for sale mortgage pledge underlet lend or part with the possession of Apparatus or Cylinders supplied by the Company nor allow any lien to be created thereon and shall pay all rent rates taxes charges and impositions payable in respect of the premises whereon such Apparatus or Cylinders are situate and shall protect such Apparatus or Cylinders against distress execution or seizure and indemnify the Company against all losses damages and expenses incurred by them by reason or in respect thereof.

7. EMERGENCY.
The Company will use every endeavour to execute all orders hereunder at the prices stated in this Contract and to maintain supplies and services so far as possible, but reserves the right to alter the said prices and to suspend deliveries if necessitated by increases in the cost of materials, labour or transport or by other circumstances beyond its control.

8. SUPPLIES ONLY TO BE OBTAINED FROM THE COMPANY.
(a) The Customer shall not during the continuance of this Contract use or obtain any Gas the subject of this Contract other than that obtained from the Company except for any period during which the Company cannot supply the Customer's requirements under this Contract or arrange for a sufficient supply from elsewhere.
(b) If through any cause beyond their control the Company cannot supply for the time being the Customer's requirements under this Contract or arrange for a sufficient supply from elsewhere the Customer shall not have any claim for damages against the Company but shall be entitled to make up the deficiency of supply from such other source as may be available until the Company can resume delivery.

9. TERMINATION OF CONTRACT AND REMOVAL OF APPARATUS.
If the Customer shall commit any breach of the terms of this Contract the Company shall have the right by notice in writing to terminate this Contract forthwith notwithstanding any previous waiver of this right. The Company may by notice in writing cancel this Contract forthwith if the Customer becomes bankrupt or makes any composition for the benefit of his creditors, or being a Company goes into liquidation either voluntarily or compulsorily. On termination of this Contract whether by effluxion of time or by any other cause, the Company shall have the right of entry to the Customer's Works during normal working hours, for the removal therefrom of all Apparatus and Cylinders which are the Company's property and the Customer shall supply the necessary labour and handling facilities for the removal of the Apparatus.

10. ARBITRATION.
This Contract shall be governed and construed in accordance with English Law. In case of any dispute or difference arising between the Company and the Customer as to the construction of this Contract or the rights, duties or obligations of either party hereunder or any matter arising out of or concerning the same, every such dispute or matter in difference shall be referred to a single arbitrator, in case the parties can agree upon one, otherwise to some person appointed by the President for the time being of the Institution of Mechanical Engineers and in either case in accordance with and subject to the provisions of the Arbitration Act, 1950, or any statutory modification or re-enactment thereof for the time being in force.

11. TERMS OF PAYMENT.
Nett Cash. Payment within the month following month of delivery.

SUPPLIES IN CYLINDERS

1. LOAN OF CYLINDERS.
All Cylinders loaned by the Company are, whilst remaining on loan, for the sole use of the Customer, who shall not re-fill or allow to be re-filled any of the said Cylinders or allow them to be used for any purpose other than for storage or transport of Gas or Gases compressed therein by the Company.

2. HANDLING AND RETURN OF CYLINDERS.
(a) Where the Customer returns Cylinders by means other than the Company's vehicles, advice shall be given to the Company of the number of Cylinders so returned and the date and route of despatch. The Customer shall label the Cylinders with his name and address and shall see that all Cylinder valves are properly closed and that valve protecting caps are properly fitted where provided.
(b) Where arrangements are made for empty Cylinders to be collected by the Company's transport vehicles, it is the Customer's responsibility to have such Cylinders gathered together at a central point easily accessible to the Company's transport and ready for prompt loading. The Customer shall see that all Cylinder valves are properly closed and that valve protecting caps are properly fitted where provided.
(c) It is the responsibility of the Customer to provide adequate labour for the loading and unloading of all Cylinders at his premises.
(d) In cases where 2,000 cu. ft. cylinders (weight approximately 1 ton each) are supplied, it is Customer's responsibility to provide a suitable Lifting Machine and Lifting Tackle as defined in "The Factories Act 1937" as approved by the Company, to facilitate the loading and unloading of the cylinders.

3. CUSTOMER'S RESPONSIBILITY FOR COMPANY'S CYLINDERS.
Cylinders are supplied free on loan for two weeks or one calendar month from date of despatch, after which rent shall be payable by the Customer at the rates fixed by the Company and quoted from time to time in the Company's Price List or other publications. In the event of the said rent being in arrear the Customer shall be under obligation to return the Cylinder or Cylinders to the Company forthwith, whether formally demanded or not. The maximum period during which a Cylinder is loaned is 12 calendar months from the date of despatch, thereafter the Cylinder shall be returnable to the Company without notice. The stated period of 12 calendar months may be extended at the option of the Company.
In the event of failure on the part of the Customer to comply with his obligations to return the Cylinder or Cylinders the Company is hereby granted a licence to enter into the Customer's premises during normal working hours for the purpose of re-taking the Cylinder or Cylinders. (The Customer shall be entitled to no refund in respect of unused Gases remaining in any Cylinder or Cylinders returned or re-taken under the foregoing conditions, except at the Company's absolute discretion in any appropriate case).
As from time of delivery of any Cylinders to the Customer, whether at the Company's Works or by the Company or its Agents at the agreed place of delivery and until received back by the Company, the Customer shall :—
(a) Be solely responsible for the safe custody and proper use of such Cylinders in conjunction with Cylinder Manifolds, Pipelines with appropriate safety devices, valve attachments, pressure gauges, regulators or gas controlling and consuming devices of appropriate and efficient design and safe construction.
(b) In the case of loaned Cylinders, indemnify the Company for and against all loss of or damage to such Cylinders from whatsoever cause, including Fire and Explosion (fair wear and tear only excepted).
(c) Take all necessary precautions to ensure that no foreign matter can enter the Cylinders.

4. PRECAUTIONS TO BE OBSERVED IN THE HANDLING AND USE OF CYLINDERS.
Precautions to be observed in order to secure safety in the handling and use of gas cylinders appear on labels attached to cylinders, and in various instruction booklets issued from time to time free of charge. Customers who have not already in their possession copies of the booklets can obtain them free of charge on application to the Company. These precautions must be strictly observed by the Customer, who is responsible for bringing them to the attention of all persons using or handling cylinders on behalf of the Customer.

5. TESTING AND FILLING OF PRIVATELY OWNED CYLINDERS.
All privately owned Cylinders other than Dissolved Acetylene Cylinders before being filled by the Company for the first time are hydraulically tested in accordance with the British Government Regulations.
The Company reserves the right to charge for such initial testing and also for periodical re-testing, as required by the same Regulations.
The Company does not undertake the filling of Cylinders other than those of its own manufacture except under special conditions, and at owner's risk.

6. SUPPLY OF CYLINDER MANIFOLD APPARATUS.
The Company will provide and maintain on terms to be agreed Cylinder Manifolds and Distribution Pipelines for various Gases. The said Apparatus will remain the property of the Company and the Customer shall be responsible for the safe custody of the Apparatus and shall indemnify the Company against all loss or damage to the Apparatus from whatsoever cause occurring other than loss or damage by Fire or Explosion, unless such Fire or Explosion arises as a result of the negligence or default of the Customer. Immediate notification must be given to the Company of any defect in the Apparatus. The Customer shall not be entitled to make any use of the Apparatus other than for the purpose for which the Company supplied the Apparatus.

SUPPLIES OF LIQUID IN BULK QUANTITIES

1 SUPPLY OF APPARATUS.
The Company will provide, and maintain on terms to be agreed. Apparatus for evaporating, storing and distributing the liquified Gas. The said Apparatus will remain the property of the Company and the Customer shall be responsible for the safe custody of the said Apparatus and shall indemnify the Company against all loss or damage to the said Apparatus from whatsoever cause occurring other than loss or damage by Fire or Explosion unless such Fire or Explosion arises as a result of the negligence or default of the Customer or the Customer's servants or agents.

2. SUPPLY AND INSTALLATION OF APPARATUS.
(a) It shall be the responsibility of the Company to provide :
(1) On terms to be agreed the Apparatus carriage paid to site.
(2) The services of skilled erectors.
(b) It shall be the responsibility of the Customer to provide :
(1) All the skilled and unskilled labour required by the Company to install or remove the Apparatus.
(2) The use of suitable lifting and handling gear as may be required by the erectors.
(3) All bolts, clips, haugers and other pipe fasteners, all secondary equipment and materials required for installation.
(4) The supply and erection of conduits and/or carrier wires.
(5) All breaking out and making good.
(6) Oxygen and Dissolved Acetylene desired for erection and test purposes.
(7) A site for the building to house the Apparatus which should afford adequate access for the liquid tank vehicles and should enable the vehicles to stand in the open within the Customer's own premises while the process of evaporator filling is in progress.
(8) A building on the site for the purpose of housing the Apparatus, the design and specification of which must conform with the Company's Standard Drawings for such buildings and must be free from any peculiar hazard and possess ventilation direct to the open air.
(9) Safe custody of all Apparatus delivered to the site.
It shall further be the responsibility of the Customer to :
(a) Provide the necessary heating (to be approved by the Company) for the Apparatus.
(b) Provide the necessary heating in the building to prevent the formation of ice on the Apparatus.
(c) Operate the Apparatus in accordance with the working instructions as laid down by the Company.
(d) Keep the Apparatus and building in clean condition.
(e) Refrain from installing in the vicinity of the Apparatus a furnace or other heat emitting unit (other than that required in sub-clauses (a) and (b) hereof), or operate any plant likely to interfere with the normal working of the Apparatus.
(f) Provide labour for operation of the Apparatus.

3. NOTIFICATION OF FAULTS.
Immediate notification must be given to the Company of any defect in the Apparatus coming to the Customer's knowledge and the Company shall only be responsible for any loss of Liquid or Gas due to defects in the said Apparatus arising from normal conditions of usage as from the time that such notification is given.

4. DELIVERY AND MAINTENANCE.
The Company shall have free access to and from the Apparatus with their transport for the purpose of delivery of Liquid thereto, and shall at all reasonable times have access to the Pipeline and Apparatus for inspection or to effect repairs. The Company may discontinue the supply of liquid temporarily, after giving notice to the Customer, for the purpose of making leakage tests, hydraulic tests or repairs or replacement, or for any other necessary purpose and if necessary, may remove the Apparatus for such purpose. In any such case the Customer at his own cost shall supply the necessary labour and handling facilities. In the event of such interruption of supply of Liquid the Company shall provide an equivalent supply of Gas in portable cylinders at Contract Rate for Gas.

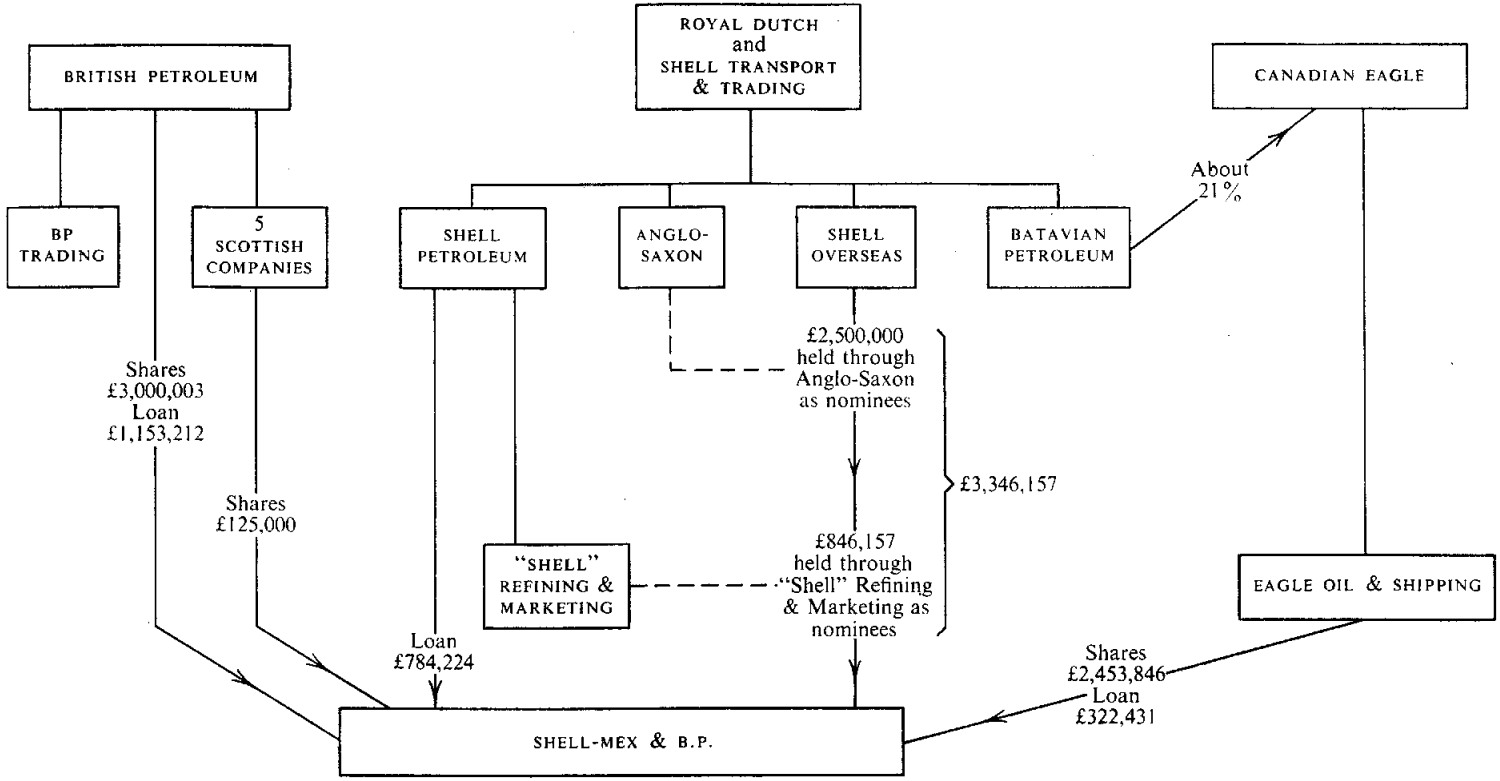
5. OPERATION OF APPARATUS.
The Customer shall not alter or interfere in any way with the Apparatus except to adjust the pressure therein by the valves provided for such purpose.
The Customer shall not be entitled to make any use of the Apparatus except to draw off and use through the Pipeline the evaporated Gas and shall not place or allow anything to be placed therein other than the Liquid supplied by the Company. The Liquid delivered into the Apparatus is for the use of the Customer through the Pipeline only and the Customer shall not use the same for filling portable Cylinders or containers except as authorised by the Company.

6. COMPANY'S RESPONSIBILITY.
The Company shall not in any event be responsible for the Apparatus beyond the fixed outlet points.

APPENDIX 11

(Referred to in paragraph 98)

SHELL-MEX & B.P. LTD. : PRESENT RELATIONSHIP TO PARENT COMPANIES



APPENDIX 12

(Referred to in paragraph 99)

AGENCY AGREEMENT DATED 31st DECEMBER, 1931: "SHELL" MARKETING CO. LTD., EAGLE OIL & SHIPPING CO. LTD., ANGLO-PERSIAN OIL CO. LTD. AND SHELL-MEX & B.P. LTD.

AN AGREEMENT made the 31st day of December 1931 Between "SHELL" MARKETING COMPANY LIMITED whose registered office is at St. Helen's Court Great St. Helen's in the City of London (hereinafter called "Shell Marketing") of the first part EAGLE OIL & SHIPPING COMPANY LIMITED whose registered office is at 16 Finsbury Circus in the City of London (hereinafter called "Eagle") of the second part ANGLO-PERSIAN OIL COMPANY LIMITED whose registered office is at Britannic House Finsbury Circus aforesaid (hereinafter called "Anglo-Persian") of the third part and SHELL-MEX AND B.P. LIMITED whose registered office is at St. Helen's Court aforesaid (hereinafter called "New") of the fourth part.

WHEREBY IT IS AGREED as follows:—

1. SHELL Marketing Eagle and Anglo-Persian are hereinafter sometimes collectively referred to as "the Consigning Companies."

2. THE duration of this Agreement shall be for 20 years from the 1st day of January 1932 (inclusive) and thereafter unless and until determined on the 31st December 1951 or on the 31st December in any subsequent year by not less than 24 calendar months' previous notice in writing given by the Consigning Companies to New or vice versa.

3. THE expression "Oil" shall embrace and include crude petroleum and each and every product of crude petroleum whether supplied to the consumer straight run cracked or as an admixture in whatever proportions of substances whether of other hydro-carbons or otherwise together with all other liquids or solids not being crude petroleum or any of its products but which may at any time be available and in demand to serve all or any purposes which may previously have been filled by crude petroleum and/or its products whether straight run cracked or as admixtures with other substances.

4. THIS Agreement shall not extend to or include lubricating oil bunkers wax or candles. The expression "lubricating oil" shall mean oil for the purpose of lubrication and the expression "bunkers" shall mean oil for the propulsion of sea-going vessels other than trawlers fishing-boats and similar smaller coasting vessels.

5. SUBJECT as hereinafter provided each of the Consigning Companies shall as from the 1st day of January 1932 inclusive during the continuance of this Agreement employ New as its sole and exclusive consignee and agent for the sale and distribution of oil for consumption within the whole area of the United Kingdom and the Irish Free State Isle of Man and Channel Islands (hereinafter called "the said area") and New shall as such consignee and agent use its best endeavours to promote the interests of the Consigning Companies and New shall not knowingly sell oil for resale outside the said area. ALWAYS provided that to the extent that the Consigning Companies respectively have for themselves or (in the case of the first two named of the Consigning Companies) through Shell-Mex Limited or (in the case of the last named of the Consigning Companies) through British Petroleum Company Limited assumed contractual obligations which are now subsisting and whereby oil has been entrusted for sale and distribution in the said area to organisations other than one of the Consigning Companies the Consigning Company concerned shall be free to observe and satisfy such obligations.

6. DURING the continuance of this Agreement the Consigning Companies shall not nor shall any of them be directly or indirectly interested except through the agency of New in the sale of oil for consumption in the said area save as in the last preceding clause provided.

7. NEW may at any time purchase on its own account any oil for resale on its own account but only for consumption in the said area and only if and so far as such purchases and resales of oil by New on its own account shall not interfere with or prejudice the sale by New of any oil which any of the Consigning Companies has the right and is under obligation to sell through New.

8. DELIVERY of the oil required by New as laid down in Clause 20 hereof shall be made by the Consigning Companies to New c.i.f. such ports in the said area as New may direct but such directions shall provide for adequate notice of shipments and have due regard to shipping conditions.

9. NEW as agent for sale under this Agreement shall have the fullest liberty in respect of the sale of oil delivered to it under this Agreement and may sell the same either in its own name or otherwise and in such manner and at such prices and upon such terms and conditions as it may think advisable.

10. NEW shall during the continuance of this Agreement provide all such means of inland transport storage packing handling sale and distribution distilling refining and treatment of oil as shall be necessary for the proper conduct of its business.

11. THE commission payable to New for its services as such agent shall be such as may from time to time be agreed between the parties hereto or in the absence of Agreement as may be determined by the Chairmen of Shell Marketing and Anglo-Persian jointly or failing agreement between them by a sole arbitrator appointed by them provided that no rate shall be fixed without the express agreement of New in respect of any product which would make the rate of commission payable less than the actual cost of effecting the sale of such product. Any such rate may be retrospective in its application if so agreed upon or determined.

It is agreed that the commission for No. 1 and No. 3 grades of Benzine shall be the same.

Should such commission as aforesaid not provide sufficient profit to enable New to depreciate its assets by an amount equal to at least the maximum amount allowed by the Income Tax Commissioners for the purpose of ascertaining the basis of profit upon which Income Tax is chargeable then it shall be an obligation upon the parties hereto to vary such commission in such manner as may be agreed between them or as in the absence of agreement shall be determined as aforesaid so as to ensure that the total profits earned by New shall be sufficient to make the before-mentioned depreciation.

This commission shall cover all expenses of whatever nature so that the Consigning Companies shall receive the gross selling price of all the products sold less only the said commission.

12. IF in the said area any of the products supplied by any of the Consigning Companies shall enjoy a fiscal advantage by way of Preferential Tariff or any similar privilege over the same products supplied by the others or other of the Consigning Companies such fiscal advantage shall accrue solely to the Consigning Company whose product enjoys it and import duties shall therefore not be a general charge but shall be a direct charge against the Company consigning the products by which the said duty is incurred.

13. FINAL accounts in respect of each calendar year shall as soon as practicable after the end of such year be made out and rendered by New to each of the Consigning Companies.

14. AT the end of each year before the preparation of such final accounts the Consigning Companies shall agree as to:—

(A) The standard quality of each product for the purposes of the accounts.

(B) The different qualities of such product delivered to New.

(C) The differential in values necessary to adjust the product referred to unde (B) to the standard of the product referred to under (A).

In the event of the Consigning Companies failing to agree on any of the said matters the same shall be determined by the Chairmen of Shell Marketing and Anglo-Persian jointly or failing agreement between them by a sole arbitrator appointed by them.

The differential so established shall be properly taken into account in ascertaining the proceeds of sale.

15. EACH of the Consigning Companies shall bear its due proportion of all shortages or losses by leakage or otherwise on each product in the proportion that the deliveries of such product to New made by it bear to the total deliveries of such product made to New by the Consigning Companies and by any other person firm or company from whom New may have purchased or received deliveries.

16. SEPARATE accounts shall be kept in respect of each product and each quality of each product delivered to New and sold by it.

17. EACH quality of each product delivered by each of the Consigning Companies shall be considered as forming part of the total quantity of that quality of such product received by New from all sources and the Consigning Companies shall participate in the net proceeds in respect of the total sales of such quality in the proportion that the quantity of such quality of product delivered by each of the Consigning Companies to New in each year bears to the total quantity of such quality of product delivered to New during that year.

18. THE total quantity of each quality of each product sold by New in each year shall be ascertained by adding to the stocks of each quality of such product held by New at the commencement of such year the quantity of the quality of such product delivered to it by the Consigning Companies or purchased by New during such period and deducting the stocks of such quality of such product held by New at the close of such year. Any quantity so purchased by New shall be deemed to have been sold by New during the year during which it is purchased save to the extent that the amount so purchased exceeds the total sold.

19. THE stocks left at the end of such year shall be ascertained and shall be allocated to the respective parties who have delivered them to New during the said year in the proportions that the deliveries made by each party respectively bear to the total deliveries received by New and the stocks shall be carried forward to the following year and deemed to be delivered by the respective parties for and on account of the following year.

20. NEW shall three calendar months before the 1st day of January and 1st day of July each year notify the Consigning Companies the approximate quantity of each quality of each product which it anticipates being able to market in the said area during the coming six calendar months commencing on such 1st January and 1st July and the Consigning Companies shall (subject to Act of God enemies of His Majesty the King or any foreign state fire flood tempest riot civil wars and commotions strikes lockouts or any other cause operating as force majeure) have the obligation and the right to supply such quantity of each quality of each product in the proportions specified in a Memorandum bearing even date herewith and signed by Frederick Godber and Robert Percy Brousson and William Fraser for identification as the Memorandum here referred to.

In the event of one petroleum product taking the place of another for a recognised trade the rights and obligations of the parties as regards their quotas shall not be altered for example if Kerosene is substituted for Benzine such Kerosene will as regards quotas be treated as though it were Benzine. And the above shall then represent the quota of each party and they shall accordingly be bound to deliver such quantities.

For any new petroleum products for which there is no quota each party shall have the right and obligation to supply such new products in the same proportion as its position exists in the products from which these new products are taken.

21. SHOULD any of the Consigning Companies having supplied oil to New desire to export oil of a similar kind from any of the installations of New in the said area to a destination outside the said area such Consigning Company shall be permitted so to do and the quantity of such oil which it has supplied to New shall be reduced accordingly but so that its right and obligation to supply for consumption in the said area shall be in no way varied. The Consigning Company exercising this right shall however reimburse to New any expenses including depreciation which New has incurred on the landing storing handling treating or blending of such exported oil but New shall not charge any profit on such expenses.

22. ON the requisition of a Consigning Company New shall provide all tankage necessary to enable the Consigning Company to carry on its business in bunkers and the Consigning Company shall pay for the use of such facilities a sum of three shillings and sixpence per ton on all deliveries ex tank. Should however the aggregate sum so paid by the Consigning Companies in each year not be sufficient to recoup to New the whole of the working expenses of the tankage relating to the said business in bunkers so provided by New together with a sum equal to 15 per cent. on the relative capital costs to New then the Consigning Company or Companies concerned shall pay to New such additional sum per ton on deliveries ex tank as together with the sums then already paid will equal the working expenses of such tankage together with the said 15 per cent. on such capital cost as aforesaid.

23. THE brands to be utilised for all sales to be effected by or on behalf of New shall be determined by New with a view to securing the greatest financial return and in this respect full consideration should be given to trade marks trade names and brands hitherto employed by the Consigning Companies either directly or indirectly in different parts of the said area subject always to the restriction that the marks previously used by Shell-Mex and the British Petroleum Company Limited shall never be used for products either straight run cracked or blended without the specific consent of Shell Marketing and Eagle in the first case and Anglo-Persian in the second case respectively. New shall be entitled to use free of charge trade marks trade names or brands registered or used by Shell-Mex Limited or British Petroleum Company limited in the said area and Shell Marketing and Eagle in the first case and Anglo-Persian in the second case warrant that they will procure that proper steps shall be taken to secure this result. In case of resale (other than for the purposes of amalgamation) or in case of liquidation (voluntary or otherwise) the said trade marks and trade names shall be retransferred as follows:—

(1) As regards marks and names acquired from Shell-Mex Limited such of these as were originally acquired by Shell-Mex Limited from Shell Marketing shall be transferred as Shell Marketing shall direct and such of these as were originally acquired from Eagle or its predecessors shall be transferred as Eagle shall direct.

(2) As regards trade marks and names acquired from British Petroleum Company Limited the same shall be transferred as Anglo-Persian shall direct.

24. THE trade marks and/or trade names referred to in Clause 23 hereof are as specified in a Memorandum bearing even date herewith and signed by Frederick Godber and Robert Percy Brousson and William Fraser for identification as the Memorandum here referred to.

IN WITNESS whereof the said parties to these presents have caused their respective Common Seals to be hereunto affixed the day and year first above written.

The Common Seal of " SHELL " MARKETING COMPANY LIMITED was hereunto affixed in the presence of } SEAL

ANDREW AGNEW
A. S. DEBENHAM } *Directors*

C. F. GREENSLADE *Secretary*

The Common Seal of EAGLE OIL & SHIPPING COMPANY LIMITED was hereunto affixed in the presence of } SEAL

R. P. BROUSSON
J. H. MACDONALD } *Directors*

C. H. M. C. WILSON *Secretary*

The Common Seal of ANGLO-PERSIAN OIL COMPANY LIMITED was hereunto affixed in the presence of } SEAL

W. FRASER, *Director*

JNO. CLARK, *Secretary*

The Common Seal of SHELL-MEX AND B.P. LIMITED was hereunto affixed in the presence of } SEAL

W. FRASER
F. GODBER } *Directors*

H. K. STEIN *Secretary.*

APPENDIX 13

(Referred to in paragraphs 165 and 217)

THE BRITISH OXYGEN COMPANY LTD.: SALES OF OXYGEN AND DISSOLVED ACETYLENE AND AVERAGE PRICES, 1920 TO 1954

Year	INDUSTRIAL OXYGEN						MEDICAL OXYGEN						TOTAL OXYGEN INDUSTRIAL AND MEDICAL	DISSOLVED ACETYLENE	
	COMPRESSED		LIQUID		TOTAL INDUSTRIAL OXYGEN	Average price per 1,000 cubic feet	COMPRESSED		LIQUID		TOTAL MEDICAL OXYGEN	Average price per 1,000 cubic feet			
	Million cubic feet	Average price per 1,000 cubic feet*	Million cubic feet	Average price per 1,000 cubic feet	Million cubic feet		Million cubic feet	Average price per 1,000 cubic feet	Million cubic feet	Average price per 1,000 cubic feet	Million cubic feet		Million cubic feet	Million cubic feet	Average price per 1,000 cubic feet*
	(1)	(2)	(3)	(4)	(5) [(1) & (3)]	(6)	(7)	(8)	(9)	(10)	(11) [(7) & (9)]	(12)	(13) [(5) & (11)]	(14)	(15)
		s. d.		s. d.		s. d.		s. d.		s. d.		s. d.			s. d.
†1919–20	176	43 8	—	—	176	43 8							176	12	228 10
1920–21	218	46 7	—	—	218	46 7							218	11	228 11
1921–22	167	46 8	—	—	167	46 8							167	13	208 3
1922–23	215	39 9	—	—	215	39 9							215	18	192 11
1924	328	32 7	—	—	328	32 7							328	19	184 10
1925	283	28 11	—	—	283	28 11							283	21	196 7
1926	251	28 4	—	—	251	28 4							251	24	175 8
1927	347	27 3	—	—	347	27 3							347	32	170 4
1928	375	26 11	—	—	375	26 11							375	36	158 11
1929	432	26 5	—	—	432	26 5							432	43	132 6
1930	396	24 6	—	—	396	24 6							396	45	115 10
1931	319	20 11	—	—	319	20 11							319	41	104 3
1932	335	19 1	7	13 8	342	19 1							342	45	99 7
1933	413	19 3	48	13 11	461	18 8							461	55	96 6
1934	517	19 4	76	13 10	593	18 8							593	74	95 4
1935	570	19 11	93	14 2	663	19 1							663	88	96 7
1936	658	20 3	138	13 5	796	19 1							796	105	97 1
1937	723	20 6	186	13 0	909	19 0							909	121	96 3
1938	663	22 10	234	14 2	897	20 7	4	30 8	—	—	4	30 8	901	125	98 11
1939	693	22 2	341	14 3	1,034	19 6	12	75 10	—	—	12	75 10	1,046	141	96 3
1940	762	23 11	574	14 9	1,336	19 11	15	58 6	—	—	15	58 6	1,351	176	107 7
†1941	859	24 1	817	15 0	1,676	19 8	35	51 2	—	—	35	51 2	1,711	212	110 5
1942	1,030	24 10	1,096	15 7	2,126	20 0	60	44 6	—	—	60	44 6	2,186	271	127 7
1943	1,184	22 11	1,379	14 10	2,563	18 6	100	41 0	18	11 0	118	36 5	2,681	312	126 3
1944	1,209	20 10	1,399	14 10	2,608	17 8	131	32 4	197	11 0	328	19 6	2,936	315	113 5
1945	1,067	20 11	1,284	14 10	2,351	17 7	53	36 6	142	11 0	195	17 11	2,546	262	111 10
1946	1,093	22 5	1,288	14 7	2,381	18 2	32	57 9	15	11 0	47	43 3	2,428	262	113 10
1947	1,104	26 2	1,436	14 5	2,540	19 7	38	58 1	7	11 0	45	50 6	2,585	285	115 2
1948	1,319	26 10	1,841	14 4	3,160	19 6	46	56 6	11	11 0	57	47 8	3,217	351	115 7
1949	1,316	26 8	2,123	13 10	3,439	18 9	55	55 4	—	—	55	55 4	3,494	368	117 9
§1950	1,316	27 6	2,397	13 9	3,713	18 7	69	53 0	—	—	69	53 0	3,782	387	122 5
1951	1,366	29 1	2,638	14 3	4,004	19 4	82	54 6	—	—	82	54 6	4,086	406	129 10
1952	1,414	32 9	2,979	14 4	4,393	20 3	82	67 5	—	—	82	67 5	4,475	432	139 1
1953	1,390	32 10	3,389	14 2	4,779	19 7	95	64 4	34	11 6	129	50 5	4,908	444	147 9
1954	1,409	32 10	3,838	13 4	5,247	18 7	96	64 6	30	11 11	126	52 4	5,373	462	142 10

Included under INDUSTRIAL COMPRESSED OXYGEN

NOTES.—* Prices for industrial compressed oxygen and dissolved acetylene do not include cylinder rentals.

† The average prices for the years 1920 to 1937 do not include carriage.

‡ High Flying Oxygen is included with Medical Oxygen except for the years 1949 to 1952. Sales of High Flying Oxygen were as follows:—

	Compressed	*Liquid*
	Million cubic feet	
1941	27	—
1942	52	—
1943	89	18
1944	116	197
1945	38	142
1946	4	15
1947	2	7
1948	2	11
1953	9	33
1954	16	28

§ From 1950 Compressed Oxygen figures include adjustment for Boyles Law (that is, the difference between the nominal and actual content of the cylinder) as follows:—

	Compressed Oxygen	
	Industrial	*Medical*
	Million cubic feet	
1950	60	3
1951	114	7
1952	118	7
1953	116	8
1954	117	8

APPENDIX 14

(Referred to in paragraph 169)

THE BRITISH OXYGEN COMPANY LTD.

INDUSTRIAL LIQUID AND COMPRESSED OXYGEN AND DISSOLVED ACETYLENE, DISTRICT SELLING PRICES, COSTS AND PROFITS*, 1953—AVERAGE PER 1,000 CUBIC FEET

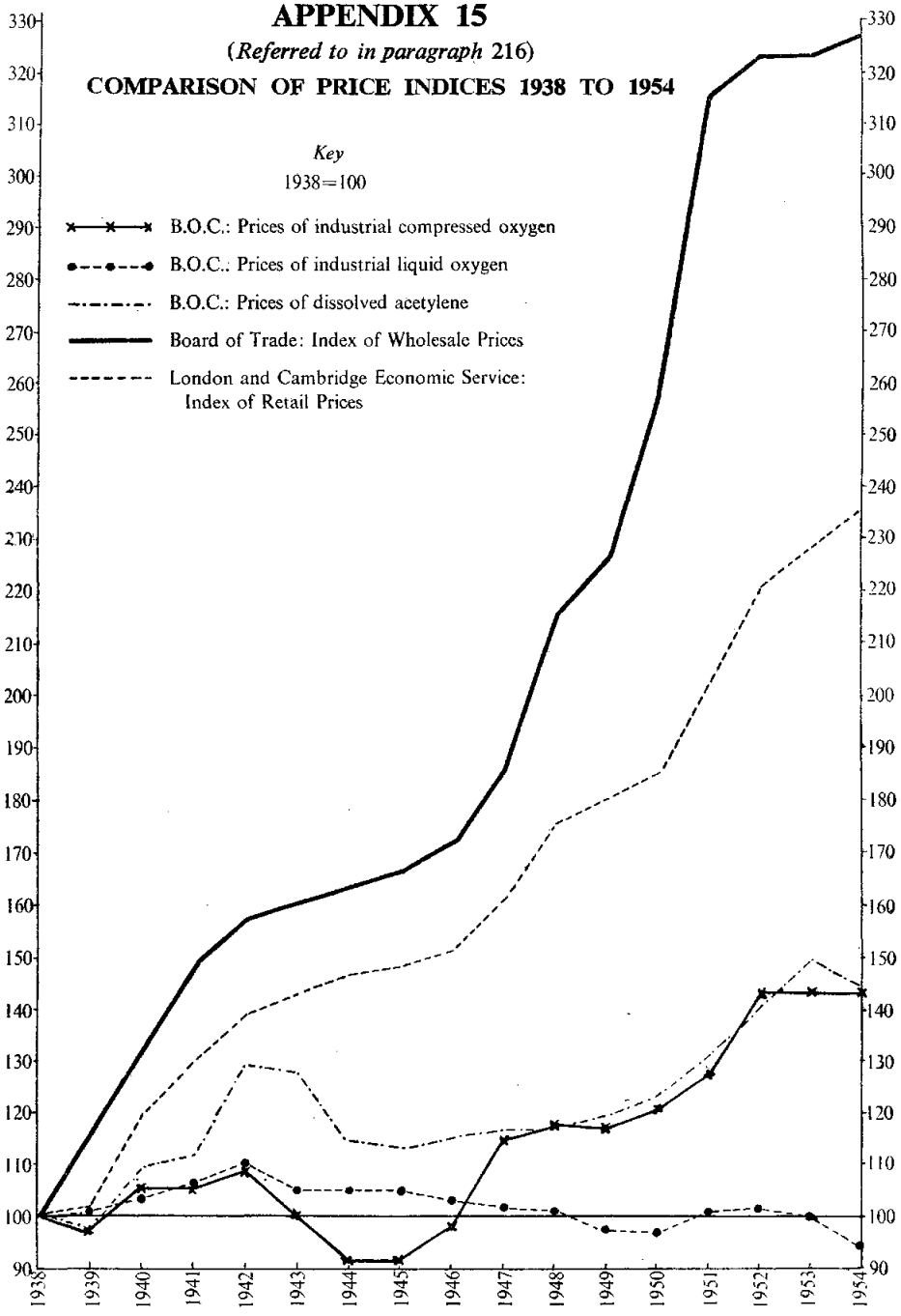
Districts	Liquid Oxygen			Compressed Oxygen			Dissolved Acetylene		
	Realised Selling Prices	Costs	Profits as Percentage on Costs	Realised Selling Prices	Costs	Profits as Percentage on Costs	Realised Selling Prices	Costs	Profits as Percentage on Costs
	s. d.	s. d.	per cent.	s. d.	s. d.	per cent.	s. d.	s. d.	per cent.
Scotland (including Northern Ireland)	13 10	9 6	46	31 2	21 8	44	147 6	110 0	34
North East	14 3	8 6	67	29 11	20 1	49	143 0	92 11	54
Lancashire	15 2	10 10	40	34 1	24 8	38	152 3	105 5	44
Yorkshire	13 5	8 3	63	32 8	19 8	66	155 2	111 11	39
Midlands	14 9	9 8	52	33 7	24 2	39	150 2	104 0	44
Western	12 5	9 5	32	32 10	24 5	35	156 5	110 5	42
London (Greenwich)	16 4	11 9	39	36 4	24 8	47	161 1	112 5	43
London (Wembley)	17 6	12 3	43	38 8	27 2	42	163 7	113 0	45
Weighted Average	14 2	9 5	50	33 9	23 5	44	153 7	107 9	43

* The costs do not include District and General Overheads, and the profit rates have been arrived at before taking account of this expenditure.

APPENDIX 15

(Referred to in paragraph 216)

COMPARISON OF PRICE INDICES 1938 TO 1954



APPENDIX 16

(Referred to in paragraph 260)

PROFIT AS YIELD ON AVERAGE CAPITAL EMPLOYED

WEIGHTED AVERAGE YIELDS FOR 23 INDUSTRY GROUPS COMPRISED OF COMPANIES WHOSE BALANCE SHEETS WERE PUBLISHED DURING THE FIRST THREE QUARTERS OF EACH OF THE LAST FOUR YEARS

Industry Group (Arranged in ascending order of yield for 1954)	*Number of Companies (in 1954)*	*Year to which figures relate (see notes)* 1951	1952	1953	1954
		per cent.			
(i) MANUFACTURING					
Rubber	224	28	12	6	11
Chemicals and Paint	67	14	10	12	13
Breweries and Distilleries	58	14	11	14	13
Cotton	36	23	8	11	13
Silk and Rayon	15	19	8	16	13
Iron and Steel	46	16	19	15	14
Wool	44	10	16	17	15
Other Textiles	36	19	12	15	15
Shipbuilding	11	17	16	14	16
Electrical Manufacturing	59	19	17	16	16
Clothing and Footwear	79	18	14	17	17
Tobacco	15	20	17	17	18
Miscellaneous Manufacturing	282	23	17	18	18
Food and Confectionery	108	18	14	18	19
Engineering	194	22	21	19	20
Newspapers, Paper and Printing	71	33	20	22	25
Motors, Cycles and Aircraft	74	21	20	25	27
Average for Manufacturing	1,419	19·4	15·4	16·6	17·2
(ii) NON-MANUFACTURING					
Shipping	27	19	17	11	8
Other Companies	366	9	9	10	10
Building	111	20	20	20	20
Shops and Stores	42	23	24	28	28
Tea	108	15	6	22	38
Oil	18	49	64	57	39
Average for Non-Manufacturing	672	19·4	21·1	21·1	19·4
ALL GROUPS	2,091	19·4	16·7	17·6	17·7

NOTES:

1. The data in this table have been prepared from statistics of Industrial Profits and Assets appearing quarterly in *The Economist.*

2. It has been assumed that the profits shown in the accounts published between January and September will have been earned mainly in the preceding calendar year. Thus the column headed " 1954 " relates to accounts published between January and September 1955. Figures from accounts published in the fourth quarter have been omitted because they are likely to relate to approximately half of the previous year and half of the year in which they are published.

3. The classification of industries between manufacturing and non-manufacturing is a broad one: it is probable that within each group there are some exceptions.

4. Capital employed has been calculated by taking the total assets, other than outside investments and goodwill items, and deducting therefrom current liabilities and provisions. Thus it is represented not only by share capital but all forms of borrowing (including debentures and bank overdrafts) and also capital and revenue reserves (including provision for future taxation).

5. Profit yields are based on the published profits (i) before deduction of taxation; (ii) before payment of interest on loans and overdrafts (which has been estimated at a rate of 4 per cent.), because these items are treated as capital employed; and (iii) after deducting non-trading profits (which have been estimated as equal to one-half of the non-recurring profits).

6. The figures given above very largely relate to " historical " capital (see paragraph 158). A few companies have, however, revalued their assets for balance sheet purposes and such cases will tend to reduce the average profit rates.

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