CHAPTER 2. THE MANUFACTURING INDUSTRY

Early history

25. The three companies which were first concerned in the development of electronic valves in the United Kingdom were A.C. Cossor Ltd. (Cossor), Edison Swan Electric Co. Ltd. (Edison Swan) and Marconi's Wireless Telegraph Co. Ltd. (Marconi). The first two were already familiar with the technique of evacuating glass bulbs and Marconi's interest stemmed from the application of valves to radio communication.

26. Edison Swan was formed in 1883* as an amalgamation of two manufacturers of electric lamps. It was while acting as a consultant to the company that Fleming carried out the investigation of the blackening of the incandescent lamp bulb ("the Edison Effect") which led to his invention of the electronic valve.

27. Cossor† originated about 1890 in a family business which specialised in blowing scientific glassware and made the earliest X-ray tubes for Crookes, Lodge and others. Cossor made the first valves for Fleming.

28. Marconi was formed in 1897 by the radio pioneer, G. Marconi. The early work on radio communication did not depend on valves, although the first application of valves was in radio, and the Marconi company has been intimately concerned with the valve industry since its earliest days and has played a considerable part in the development of valve application. It has founded many overseas companies some of which, however, for various reasons, are no longer linked with it. One of the company's main interests has always been the use of radio for ships at sea, and the Marconi International Marine Communication Co. Ltd., which was founded in 1900 and obtained technical assistance and supplies from Marconi, established service depots all over the world.

29. Large-scale production of valves began during the first world war when the Armed Forces wanted valves in quantity for radio communication. Quantity production was begun by Edison Swan and Cossor, but to meet the demand three other lamp manufacturers also started to make valves. These were the General Electric Co. Ltd. (G.E.C.) which had been formed as a private company in 1889‡; British Thomson-Houston Co. Ltd. (B.T.H.), which was formed in 1896, and Metropolitan-Vickers Electrical Co. Ltd. (Metrovick), then called British Westinghouse Electrical and Manufacturing Co. Ltd., which was formed in 1899. By the end of 1918, the principal customers for valves were the Government and Marconi.

30. In the immediate post-war years amateurs began to use radio, and they often made their own equipment. Commercial production of radio valves and receiving sets began in 1919–20; much of the set construction at this time was still, however, done by amateurs, and to meet this demand "kits" of valves and radio components were sold. Cossor, Edison Swan, B.T.H. and Metrovick continued their valve production. G.E.C.'s valve factory was taken over by a joint company which G.E.C. formed with Marconi, each owning half the shares. The new company was entitled to free use of each party's patents relating to the manufacture of valves. The joint venture, The Marconi–Osram Valve Co. Ltd.—"Osram" being the trade name of G.E.C.'s lamps and valves—was formed in 1919. A year later the name of the company was changed to The M.O. Valve Co. Ltd. (M.O. Valve).

* The company was then called Edison and Swan United Electric Light Co. Ltd. The present name was adopted in 1916.

† Cossor was formed as a private company in 1908 and became a public company in 1938.

‡ G.E.C. became a public company in 1903.

31. During the war Captain S. R. Mullard had been engaged in high vacuum technique and development work for the Admiralty, and in organising the design and production of radio valves for the Services at various Admiralty establishments. In 1919 he entered into an arrangement with the Admiralty for the development of high-power transmitting valves; the arrangement provided for the application of valve patents held jointly by the Admiralty and himself. He began the manufacture of receiving and transmitting valves on a small scale to meet Admiralty requirements, and in 1920 founded The Mullard Radio Valve Co. Ltd. (Mullard). Production started at Hammersmith and two years later the factory was moved to larger premises at Balham.

Development between 1922 and 1930

32. By 1922 the United Kingdom manufacturers of valves were Cossor, Edison Swan, B.T.H., Metrovick, M.O. Valve, Mullard and a few smaller concerns. There were several companies making receiving sets, including Edison Swan, B.T.H., G.E.C. and Marconi. In 1922 a group of manufacturers of valves and sets formed the British Broadcasting Company and the regular broadcasting of entertainment began from the Marconi premises at the Strand. There was a rapid increase in the demand for valves and the set-making industry became established. In 1923 Marconi ceased to manufacture receiving sets, and sold to a subsidiary company, The Marconiphone Co. Ltd. (Marconiphone), the goodwill of its set-making business and the right to use the "Marconi" trade marks. Since the formation of Marconiphone, Marconi itself has not been directly concerned with the domestic side of the radio industry: its main interests have been in the wider field of radio engineering. At about the same time the company then called Western Electric Co. Ltd., now called Standard Telephones and Cables Ltd. (Standard), started the manufacture of valves and also of sets. This company had been registered in 1910 to take over a business which had already been trading for some years. It was then a wholly-owned subsidiary of the International Western Electric Co. of the U.S.A. whose interests were transferred in 1925 to the International Standard Electric Corporation of New York, when the British company's name was changed to its present form.

33. In 1924 Mullard needed further finance for development and production and obtained this by selling half the shares of the company to N.V. Philips Gloeilampenfabrieken of Eindhoven, Holland (N.V. Philips). In 1925 N.V. Philips registered a new subsidiary in this country, Philips Lamps Ltd., and took up all its shares. This company, now called Philips Electrical Ltd. (Philips), was formed primarily for the purpose of manufacturing electric lamps but a few years later it started to market radio receiving sets and other electronic equipment.

34. By 1924 total production of valves was 2½ million. In that year the Valve Manufacturers' Association was formed. Two years later it was superseded by the present manufacturers' association, the British Radio Valve Manufacturers' Association (BVA). The companies joining the association included Cossor, Edison Swan, G.E.C., Marconiphone, Mullard and Standard.

35. During the next five years there were various company reorganisations and some of the companies changed their manufacturing policy. Cossor stopped lamp production in 1926 and thereafter concentrated on valves, receiving sets and other electronic equipment. N.V. Philips bought the remaining half of the Mullard shares in 1927 and since that date Mullard has been a wholly-owned subsidiary of the Dutch company, which is itself a manufacturer of valves and other electronic and electric devices. Its fellow

subsidiary of N.V. Philips, Philips Lamps Ltd., started marketing various types of rectifying valves imported from N.V. Philips and in 1930 became an associate member of the BVA.

36. Associated Electrical Industries Ltd. (A.E.I.) was formed in 1928 and acquired all the ordinary shares of Edison Swan, B.T.H. and Metrovick. As a result of this merger, the radio and radio valve departments of the three companies were amalgamated and rationalised. Metrovick had made the "Cosmos" valve, B.T.H. the "Mazda" valve and Edison Swan the "Ediswan" valve. Valve production for the group was taken over by Edison Swan, set production by B.T.H. and Metrovick ceased to manufacture valves. Since then B.T.H. has concentrated its valve activities on the manufacture of such special electronic valves as it requires for its production of non-domestic electronic equipment. About three years later the A.E.I. group suspended the manufacture of domestic receiving sets.

37. In 1929 full ownership of the Marconiphone company, together with the Marconi shareholding in M.O. Valve, was acquired by The Gramophone Co. Ltd., which, in the same year, started the manufacture and sale of domestic radio sets under the trade name of "His Master's Voice". M.O. Valve has, however, remained an important source of valves for the Marconi company. Electric and Musical Industries Ltd. (E.M.I.), was registered as a public company in 1931 to acquire the shares of The Gramophone Co. Ltd. and the Columbia Graphophone Co. Ltd. in exchange for E.M.I. shares. It is a holding company and does not manufacture or sell.

Growth of the industry between 1930 and 1945

38. Valve production reached 5 million by 1930 and had doubled by 1935. Three more of the manufacturers now in the industry entered it during this period. Ferranti Ltd. (Ferranti), manufacturers of all kinds of electrical equipment and plant, which had been incorporated in 1905 to take over an earlier business founded by S.Z. de Ferranti about 1882, started making valves and receiving sets in 1930. It joined the BVA. The Freedman Valve Co. Ltd., later The High Vacuum Valve Co. Ltd. and now called Hivac Ltd. (Hivac), started making receiving valves and subsequently became the first manufacturer to produce a midget valve. British Tungsram Radio Works Ltd. (British Tungsram), which was a subsidiary of a Hungarian concern, the United Incandescent Co. of Budapest, was incorporated in 1933. Its production was based on the assembly and sealing of imported parts. Hivac and British Tungsram did not join the BVA.

39. Until 1936, when regular television broadcasts began in London, production of cathode ray tubes had been on quite a small scale for instruments such as oscillographs. To meet the new demand, G.E.C., Edison Swan, Marconiphone, Ferranti and Mullard began making television tubes. G.E.C., Ferranti and Marconiphone also made television receiving sets. The market in sets and tubes was confined to the London area and remained small until after the war.

40. Two set makers entered the valve industry for short periods in the middle 1930s. One of them, Lissen Ltd., became a member of the BVA but a year later its membership was linked with that of an existing member, The Ever Ready Radio Valve Co. Ltd. (Ever Ready). Ever Ready was the successor company to a small manufacturer of valves which had joined the BVA on its formation but had ceased to make valves by 1928. The other set maker, E.K. Cole Ltd., considered joining the BVA and for a time observed the Association's prices and terms. It sold its valve interests to Mullard in 1938.

41. During the 1930s most valve manufacturers extended their production and some of them opened new factories, but since 1936 there have been no new entrants to the manufacture of ordinary receiving valves or to the membership of the BVA. British Tungsram remained the principal non-member manufacturer of domestic receiving valves. Hivac specialised in midget valves for portable radios and hearing aids. Automatic Telephone and Electric Co. Ltd. took a controlling interest in the company in 1939 with the object of providing facilities for electronic development work in the telecommunications field. In 1944, Automatic Telephone and Electric Co. Ltd. became the sole owner of Hivac.

42. The war-time needs of the Government were heavy, and several companies entered the industry to meet the demand. The E.M.I. group started making special types of valves; Ferranti, which had hitherto made valves and tubes only for its own sets, expanded production particularly on special types of valves. The Marconi laboratories started making special types of valves as a war-time measure. British Tungsram began full manufacture, buying or making the components when it could no longer import them. The capacity of the bigger manufacturers was fully used and much extended. The production of receiving valves for the civilian market was very much curtailed. Television broadcasts were suspended and the production capacity for television tubes was turned over to the manufacture of radar tubes. Cinema-Television Ltd. (Cinema-Television), which had been registered in 1937 with the original purpose of developing and manufacturing large-screen television equipment for use in cinemas, in 1940 took over for Government work the production facilities of Baird Television Ltd., pioneer manufacturers of television transmitting and receiving equipment.

Period 1945 to 1956

43. After the war the manufacturers at first faced a severe reduction in demand until the set making industry reverted to civilian production and the resumption of television broadcasts gave rise to a large demand for television sets. Several companies reorganised their business. Cossor concentrated its valve and tube production in one unit and then formed Electronic Tubes Ltd. (Electronic Tubes) as a subsidiary company to take over this side of its business. In 1949, by an arrangement with E.M.I., all the ordinary shares of Electronic Tubes were converted into preference shares and a small issue of ordinary shares was subscribed by E.M.I., which from that time has controlled and financed Electronic Tubes. Thus control of Cossor's business in valves has passed to a subsidiary of E.M.I., although Cossor still has a financial interest as a preference shareholder. Cossor still draws much of its supplies of valves and tubes for set production from Electronic Tubes.

44. In 1945 E.M.I., through the Gramophone Co. Ltd., formed jointly with Smith's Motor Accessories Ltd. a private company, S. Smith and Sons (Radiomobile) Ltd. (originally registered as Radiomobile Ltd.) to market car radios manufactured and developed by The Gramophone Co. Ltd. Each parent company holds half the capital. In 1946 the E.M.I. group of companies was re-organised and The Gramophone Co. Ltd.'s interests in design, research and production were divided between three subsidiaries. The other interests of E.M.I. in valve and tube production were then Electronic Tubes and the shareholding in M.O. Valve. Marconiphone represents the E.M.I. interests in the BVA.

45. Ferranti began to supply valves to other set makers in 1946 and similarly became a general supplier of tubes in 1948. In 1948 G.E.C. formed Glass Bulbs Ltd., jointly with B.T.H. Glass Bulbs Ltd. supplies the blown

glass for valves made by M.O. Valve and some of the glass used by several other valve manufacturers. Most of Glass Bulbs Ltd.'s sales have, however, been of glass bulbs for lamps. Cinema-Television remained in the valve industry. Its production of cathode ray tubes is mostly of industrial types. In 1945 it obtained full control of Bush Radio Ltd., which primarily manufactures sets, but which obtains all its valve and tube supplies from other sources.

46. In 1946 English Electric Co. Ltd. acquired financial control of Marconi from Cable and Wireless (Holding) Ltd. It subsequently transferred the Marconi valve making interests, which had developed during the war, to a new and wholly-owned subsidiary, the English Electric Valve Co. Ltd. (E.E. Valve). The new company, which has since been a major supplier to Marconi, specialises in industrial valves and does not make ordinary receiving valves. Since the acquisition of the unit by the English Electric Co. Ltd., its production has been much expanded and now includes a wide range of valves for the companies in the English Electric group, the Government and others. In 1951 its range of products was extended to include television and other cathode ray tubes.

47. Two other companies have entered the industry in recent years; both are specialists in a narrow range of valves and tubes with industrial applications. 20th Century Electronics Ltd. (20th Century) began production of cold cathode valves (such as are used in Geiger Muller counters) in 1946, and of cathode ray tubes in 1947. Ericsson Telephones Ltd. (Ericsson) began making cold cathode valves in 1950 as a result of a war-time development.

48. The Pye group of companies, now the largest set makers in the country, decided in 1951 to develop its own manufacture of television tubes and to undertake development work on both valves and tubes. Accordingly small-scale manufacture of cathode ray tubes was started by a company in the Pye group, Cathodeon Ltd., in 1952. In the following year production was expanded to include some special types of valves, and in 1954 the whole production was transferred to a new subsidiary, Cathodeon Electronic Ltd. (Cathodeon). In 1954 this company supplied about 8 per cent. of the Pye group's requirements of television tubes.

49. The companies in this country which were owned by N.V. Philips of Eindhoven were re-organised in 1947 and both Mullard and Philips became wholly-owned subsidiaries of a new company, Philips Electrical Industries Ltd. The last named company acquired a controlling interest in British Tungsram in 1952 and arranged for Mullard to take over its management. Mullard has its own wholly-owned subsidiaries (see paragraph 276) and in this report "Mullard" includes these subsidiaries except when it is clear from the context that the reference is to the parent company only.

50. In August, 1955, Thorn Electrical Industries Ltd. (one of whose subsidiaries, Ferguson Ltd., is primarily a set manufacturer) announced its intention of embarking on large-scale production of television tubes in competition with the BVA members. The new manufacture is to be in conjunction with Sylvania Electric Products Inc., of the U.S.A. In July, 1956, G.E.C. purchased the E.M.I. shareholding in M.O. Valve and became the sole owner of the company.

51. Throughout the history of the valve industry, the bulk of the production has been in the hands of the BVA members and their associated companies: the few new entrants to the trade since 1933 account for a small part of the total production. The well-established manufacturers were at first concentrated around London but several have opened new factories, some in Development Areas, in order to increase their production, and have

created feeder units in areas where labour for the delicate assembly work is easier to find and train. Considerable space is needed for the mass production of cathode ray tubes, and the larger manufacturers of tubes have had to take new premises for this purpose.

CHAPTER 3. THE PRESENT POSITION OF THE BVA MEMBERS AND OF THE NON-MEMBER MANUFACTURERS

Number of manufacturers

52. There are sixteen manufacturers of valves and tubes in the United Kingdom who supply these products to others. Our investigation is concerned with the "supply" of valves and tubes, and in computing total production we have taken no account of the activities of a few companies which are not suppliers but which manufacture special types of valves and tubes, in small quantities, for incorporation in equipment or plant of their own manufacture. The figures for total supply differ from the figures for total production largely on account of the inclusion of substantial imports in the figures for total supply. Some of the valve and tube manufacturers sell part of their production in complete equipment. The figures for sales by individual companies are also complicated by inter-trading between the manufacturers.

53. Of the sixteen manufacturers, six are members of the BVA, four are closely associated with the members of the BVA and the other six are independent of the BVA. The BVA has three other members who do not make valves or tubes although two of them did so formerly. The ten manufacturers who are either BVA members or associated with members accounted in 1954 for 97 per cent. by quantity of the total production of both valves and tubes.

54. The members of the BVA and the other ten manufacturers of valves and tubes are as follows:—

A. BVA MEMBERS

(i) *Manufacturers of Valves and Tubes*

Edison Swan Electric Co. Ltd. (Edison Swan)
Ferranti Ltd. (Ferranti)
General Electric Co. Ltd. (G.E.C.)
Marconiphone Ltd. (Marconiphone)
Mullard Ltd. (Mullard)
Standard Telephones & Cables Ltd. (Standard)

(ii) *Non-Manufacturers of Valves and Tubes*

A.C. Cossor Ltd. (Cossor)
Ever Ready Radio Valve Co. Ltd. (Ever Ready)
Philips Electrical Ltd. (Philips)

B. *Subsidiaries and Associates of BVA Members*

Electronic Tubes Ltd. (Electronic Tubes)
M.O. Valve Co. Ltd. (M.O. Valve)
British Thomson-Houston Co. Ltd. (B.T.H.)
British Tungsram Radio Works Ltd. (British Tungsram)