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Sir Leon Bagrit 'The Father of Automation'

By

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1st May 2022

Sir Leon Bagrit

The salvation of the Company and new jobs on the Airport site were due to the entrepreneur Leon Bagrit. Leon Bagrit was born on 13 March 1902 in Kiev, Ukraine, the younger son and second of three children of Manuel Bagrit, jewellery designer and jeweller, and his wife, Rachel Yousopovich. The family left the Ukraine when he was a small child and arrived in London from Belgium in 1914, *‘having lost all their possessions as a result of the German invasion’*. Leon Bagrit knew no English then, but mastered it quickly, and soon gained a school prize for English literature at St Olave's School in Southwark, whose headmaster, W. G. Rushbrooke, took a close personal interest in the development of his many-sided gifts. These gifts included music and playing the violin in the Royal Philharmonic orchestra helped him through the precarious early adult years. It was his strong technical and inventive ability that he eventually decided to base his career on . [1]

The Oxford National Biography states that Leon Bagrit read law at Birkbeck College,[2] London University. However his Application Form shown in **Fig 1**. indicates that he only did a one year Matriculation course in 1923 for which he was registered for English, Maths, Chemistry, French and History. He was at the start of the course aged 21 and lived at 458 New Cross Road London SE14. Leon Bagrit joined Messrs W. & T. Avery, manufacturers of weighing machines [3] and it may be this first job as a Commercial Traveller which is noted on the College application. He had no formal training in engineering but possessed an exceptional understanding of engineering and related matters which was vitally important to his subsequent career. He was soon promoted to Divisional Manager under Lord Mills [4].

In 1926 Leon Bagrit married Stella Feldman and they had two daughters, Valerie and Patricia, and eventually at least six grandchildren.

In 1929 aged only 27 he moved to become General Manager of a rival company Herbert and Sons. He was an inventor and held more than seven British and foreign patents in the weighing machine business [5], which he wished to exploit (one for weighing machines and the other for meat mincers). The recruitment by Fitz Herbert of Herbert & Sons was no doubt seen as quite a coup, but the 27-year-old Bagrit had ideas and a drive that Herberts found difficult to handle. (Fig 1 is from around this time)

In 1935 he fell out with Fitz Herbert and Sons when Mr Fitz Herbert refused to adopt his proposal for what he later declared was a ‘Meccano’ machine. Bagrit then set up his own company, *‘A thorn in our side until 1960’* said Richard Herbert in 2010. Leon Bagrit left to form the Swift Scale

Company to exploit his own patents and designs [6] for the manufacture of commercial scales and weighing machines, in the conviction that with a good product and aggressive marketing it would be possible to compete with established manufacturers. In spite of the period of trade depression the business became established. Swift soon became a serious competitor of Herberts with a large factory on the North Circular Road. The factory was established on the Rochester Airport site in about 1939 [7] .

During the Second World War the manufacturing company, styled B & P Swift Limited [8] turned to war work, and manufactured aircraft equipment for the Ministry of Aircraft Production. This included flap and undercarriage actuators, which called for good gear and screw-cutting facilities, for which the company, though small, developed a high reputation. One of their contracts was for the provision of geared controls for Short's Stirling bomber. This aircraft had many problems in development and production and Swifts spend a huge effort to resolve the issues. Leon Bagrit showed his tenacity by concentrating the company's efforts on this task until success was achieved. B & P Swift had leased two factories for this wartime work but with the end of the war one of these factories had to be given up and a new more modern factory was sought. It was always said while Herberts in WW2 turned its production almost totally to war work, Swift maintained its scale production, so in 1946 was one of the only companies that were able to start quickly back into the manufacture and supply of retail scales and mincers.

Both Leon Bagrit and his partner in B&P Swift, Dr Lawrence (Lotti) Ross were interested in electronics and a small subsidiary was established called Electro Methods [9] to pursue electronic instruments which was another step into the field of electronic control or automation.

In June 1946 the London and South Eastern Regional Board for Industry announced that it was in discussion with several 'good' firms to take over the Shorts factory at Rochester. In October 1946 'THE TIMES' stated [10] that the Board of Trade had already allocated some 350,000sq ft (nearly half of the Shorts Brothers factory space) to three businesses. Leon Bagrit of B & P Swift and Geoffrey Lee of Elliotts collaborated on their approach to the Government to acquire space at Rochester. Their bid was successful and airfield factory space was taken by B&P Swift Ltd (and its subsidiary company Swift and Swallow Ltd) which employed 450 men on the manufacture of gears, automatic scales and hydraulic pumps and by Elliott Bros (London) Ltd who undertook to employ 500 men on the manufacture of electrical and mechanical instruments. CAV took over the seaplane works and employed around 1,200 people on the manufacture of fuel injection pumps and electrical

equipment. The Board of Trade anticipated that the remaining space would be occupied by the end of the year. The 40-foot and 25-foot Hangars were allocated to Portsmouth Aviation but in fact remained empty until in 1950 they were occupied by Le Grand Sutcliffe and Gell Ltd (Civil Engineers who made heavy fabrications possibly for use in oilfields). Le Grande Sutcliffe & Gell had their name painted on the hangar in huge letters, where Elliott Automation would later be. The work at the Rochester site on precision gears was to be very important for the future of Elliott Bros [11]. Access to a large number of skilled and semi-skilled workers must have made the airport a promising site for relocation.

At the end of the war, the aircraft industry began the design of larger and faster aircraft, and it began to appear that pilots would have difficulty in controlling them because of the larger forces required. The Ministry of Supply therefore initiated the development of electromechanical power assisters, and placed a contract with B&P Swift Ltd. This contract was not the first aircraft related contract as the company had made gearboxes for aircraft controls and flap and undercarriage actuators for Short Bros during WWII [12]. Installations were completed in a large flying boat built by Short Brothers, the 'Shetland', and 'Tudor' commercial airliners built by A V Roe. It is likely that this foray into Avionics led Sir Leon Bagrit to encourage Elliott Bros into this emerging market in the 60's rather than any influence from Borehamwood.

In 1947 the number of employees at Swift and Swallow was reduced from 450 to 190 [13]. Bill Kemp who was Shop Steward at the time recalls Mr Leon Bagrit reassuring them that they had good long-term employment prospects.

Geoffrey Lee had from at least 1946, been trying to establish a merger of Elliotts with other instrument companies and he put the merger with B&P Swift before the Elliott Board in 1947. Despite some opposition in May 1947 Leon Bagrit acquired control of Elliott Bros London [14]. The company report of 1953 states rather that Elliott Bros acquired B&P Swift Ltd but as stated in Chapter 3 the Company was in no financial position to do so; a report in the press in 1967 by Cdr. Henry. Pasley-Tyler R.N. (Retd), [15] states that in 1950 Elliotts was close to bankruptcy. It seems most likely that this was a merger encouraged by Leon Bagrit. Leon Bagrit first became joint Managing Director, and not long afterwards, when Geoffrey Lee retired, sole Managing Director. It was around this time that Leon Bagrit determined that there were two dominant technologies emerging. One was atomic energy and the other related business was in control engineering particularly automatic operation. These ideas were applied to Elliott Brothers; that it should grow to

offer a full range of automation from detailed equipment to advice. Leon Bagrit increased his personal investment in the Company and began to encourage electronic design.

In the days after WWII conditions were not good and one employee recalls that clothes rationing was still in force [16] and he was required to sign a document promising to surrender nine coupons in order to provide his protective clothing!

The Company Report of May 1953 certainly shows that the Company was trading at a loss from 1946 to 1950 and no Dividend was issued [17]. The Company had in fact lost something like a quarter of a million pounds in 1946 alone and in 1947 the profit was only £2500.

Leon Bagrit immediately set about overhauling the company finances and seeking both new work in existing areas and new directions for growth [18]. He had brought with him from B & P Swift some excellent staff with first-class engineering and commercial expertise (for example Mr Lawrence Lazlo Ross was appointed Technical Director and General Manager). His first step was to begin modernizing the plant with the view, of taking advantage of the post-war demand. Owing to the lack of systematic information and the primitive organization available he found that there was no reliable data. It was impossible to ascertain the facts except by the most unorthodox and painful means and it was next to impossible to come to grips with the problems.

In the meantime, the financial situation had become desperate in spite of the valuable help obtained from banking friends in the city who raised £150,000 of preference capital [19]. Leon Bagrit believed, with great foresight, that electronics, control engineering and systems engineering would be the new technologies and that the Company should enter and pioneer these areas which he called 'Automation'. One approach that Leon Bagrit instigated was to open a research laboratory in October 1946 at Borehamwood to try to obtain Government money to pay for the technological developments required. However, The Company would have to struggle for many years and had little money to invest in research and of course, research does not pay the bills; for that, products actually in production are needed. Fortuitously the Admiralty placed a contract for research into a new electronic Fire-Control system and that gave impetus to the work at Borehamwood.

Leon Bagrit recognised the sheer scale of the new technologies needed and that the United States was already far ahead in this field. So, in 1948 he began to travel to the USA and forge contacts for licensing technology in accordance with his policy of 'Don't re-invent'. Leon Bagrit insisted that there was no point in developing a product in Britain if it already existed elsewhere although he insisted on substantial home design where possible and in 1960 some 2,000 people were involved in

research and development. He also insisted that the licensed product should not be redesigned; for example, an Elliott control valve made in the UK would be entirely interchangeable with a Bendix item made in the USA. This was the second arm of his recovery strategy; to bring in licenced items for immediate production.

The first of these was an agreement in 1949 with the Fisher Governor Company of Iowa for the manufacture of oil control valves and production commenced at Rochester in 1950. The food processing equipment work of B & P Swift continued to grow [20] as did the hydraulic, sheet metal and precision gear Divisions. The Company Report of 1953 states that there were two wholly owned trading subsidiaries, B & P Swift Ltd and The Fisher Governor Co. Ltd. An important agreement was established with Bendix Aviation Corporation of Delaware U.S.A. in 1953 [21]. Bendix acquired stock in Elliott Brothers (London) Ltd and as long as £75,000 Ordinary Stock was held they had the right to appoint three out of ten Directors. The range of aircraft instruments this brought into the company was a major asset.

Lewisham benefited from yet another agreement with Bristol Instruments in 1954.

The Company Report of 1953 [22] states that the factory at Rochester was a modern single storey building of 185,000 sq ft and was under tenancy from the Ministry of Supply at £12,200 p.a. This lease and that at Borehamwood were due to expire in 1956 but the company intended to renew them for 21 years or 50 years. Modern machine tools were installed to handle quantity production with much of this equipment provided by the Government on a rental basis. This building was probably the long brick factory building to the West of the Hangars. The office building fronting the airfield, incorporating the entrance known for a time as the William Elliott entrance, was made into its present two storeys in about 1961. Interestingly the upper storey is cantilevered out over the lower onto pillars as the original structure could not support the weight of a second storey.

In 1948 the first Apprentices were taken on at Rochester starting a regular intake in most years [23]. In 1953 Century Works at Lewisham had expanded to 155,000 sq ft with the company taking over in addition some 38,000 sq ft of the Admiralty space established in 1940. The Company had a Sports Ground at New Eltham and a property at Radlett called '*Lamorna*' which was a 16-room residence in extensive grounds.

In 1951 or 1952 Swift & Swallow who made large scale food processing equipment as well as weighing machines, B & P Swift and possibly Gear and other Divisions of Elliotts were at Lewisham but shortly moved to Rochester. In 1954 there were four or five Divisions at Rochester [24]. The Fisher Governor Division made fluid control valves, the Naval Division continued Elliott's navy

work on gunnery directors and Swift & Swallow were making weighing machines. There was a small Radar Division and the Aviation Division whose work included some of the early analogue computers . [25]

In 1956 Elliott Brothers posted a pre-tax profit of £260,685 for the previous year. The Chairman Mr Rudolph. Edgar Francis de Trafford OBE noted that ‘Our range today extends from industrial control instruments and valves to electronic digital and analogue computers and servo mechanisms and our products are used by a wide range of industries, including oil refining, chemicals, steel, power generation and nuclear energy and in aircraft and guided missiles.’ He further comments on the growth of Government contracts in aviation and reinforced the message from Leon Bagrit by stating that *“Application of these modern automation techniques will grow at an increasing rate and will bring with them a very large demand for all kinds of automation equipment. It is with this in mind that we are now planning your company’s future.”* [26] (Fig 2 shows Leon Bagrit in 1955 as Managing Director of Elliott Brothers (London) Ltd)

During that year the Company began to expand at Rochester to the North of the Airfield with the acquisition of 6.2 acres on which portable buildings were initially erected in 1957.

The Instruments , Electronics and Automation Exhibition was held at Olympia in May 1957 [27]. Apart from the technical exhibits there was a collection of demonstrations of a more light-hearted nature to show the how our lives might be affected. The central feature was called ‘Electronics at work and play’. Mr Leon Bagrit on a more serious note stated that *‘there appeared to be an indifference to progress in Britain which must be rapidly discarded if we were to hold our own in the production field’* He noted that the competition was *‘gigantic Russia and big America’*.

In 1957 Elliott Bros merged with the Rotameter Manufacturing Company of Croydon and in October of that year a more important merger took place. Elliott Brothers (London) and Associated Automation Ltd of Willesden after some years of close collaboration were merged to form Elliott-Automation [28]. Elliott-Automation had been formed in 1950 but now became the overarching company allotting its shares in exchange for the shares in the other two companies. The two companies were thereafter known as Members of the Elliott-Automation Group of Companies [29]. The merger brought together two complementary operations with valuable global connections and also gave extensive research facilities believed to be on a scale and character unique in the United Kingdom. Although Elliott-Automation was small by American standards it became the largest organisation in Europe concerned with automation and instrumentation. Leon Bagrit was appointed

as Deputy Chairman and Managing Director. The New Scientist of 1st May 1958 commented that the value of the company's shares was not so much in their immediate return but in their potential value in a market area expected to expand greatly. The preliminary statement of the new company at the end of 1957 reported a profit of £919,331 after depreciation a significant improvement of company fortunes and by 1960 this had improved to over £1million with more than 9,000 employees.

Elliott-Automation pioneered the use of computers in industry and made “automation” a household word. With remarkable foresight Mr Leon Bagrit had stated that ‘*complete automation in the control and navigation of aircraft – start of take-off to end of landing- would eventually come to be both practicable and acceptable*’. A 200,000-sq.-ft. portion of the old Short Brothers factory at the airport, which had become vacant when Le Grand Sutcliffe and Gell Ltd moved out, was acquired in 1959 and nearly half of it was immediately employed on aviation work [30].

At this point his undoubted flair for engineering was put to its greatest test, as he resolved to base the company's future on the introduction of automatic control as extensively as possible. Leon Bagrit believed that automation would herald a Second Industrial Revolution and in his ‘Automation’ brochure he states that automation is “perhaps Man’s most significant step forward”. He paid many visits to the United States, where important wartime developments had taken place and many of the basic ingredients of what subsequently became known as automation systems were already available. Elliot's sold Swift & Swallow Ltd in 1960 to the Herbert Group Ltd which was a not unexpected turn of events given that Leon Bagrit was previously their General Manager [31].

If automation were to be introduced successfully over the widest possible field, a number of decisions of principle were vital in order to make the best use of financial and human resources. Particularly in the United States, licences were available to enable the firm's own large development effort to be concentrated elsewhere. Financial and organizational control over the multitude of facets involved in the business could be assured only by the creation of a large number of divisions or subsidiary companies under separate managements responsible for their success and controlled by a rigid system of budgets and monthly accounts—an approach which is commonplace today, but which Leon Bagrit pioneered in Britain. The familiar Divisional structure stems from this time; financial and budgets were controlled centrally but the Divisional Manager, Sales Manager and Technical Manager had autonomy only answerable to Leon Bagrit himself. His plan was that it would encourage ‘young enthusiastic men with a feeling of real responsibility for the success of their

Division'. This developed as the Company grew and the Divisional Manager came to have complete Authority and responsibility for design, manufacture, cost accounting and sales and service but reported to a Joint General Manager who looks after several Divisions.

One of the key licence agreements to be negotiated in the aircraft equipment area was with the Bendix Corporation of America in the field of automatic flight control systems and flight instruments. Another typical acquisition in 1960 was The Rheostatic Company (later Satchwell Controls) which gave significant business in heating, ventilating and appliance controls [32].

The New Year Honours list of 1962 announced the award of Knight Bachelor to Leon Bagrit and in the same year he was elected Chairman and Managing Director of Elliott-Automation Ltd when Mr R.E.F. de Trafford OBE retired [33] (Fig 3). At the same time Commander Henry Pasley-Tyler R.N Retd was appointed to the Board. Sir Leon stated *'It is my belief that the rapid adoption of advanced technology and automation, with the consequent rise in productivity, is vital for the well-being and progress of this country, and indeed for the survival of the Western World'. 'In aviation, both civil and military, our progress is no less significant. We are supplying autopilots and flight control systems for the VC-10 and the BAC 1-11 long and short haul civil air-liners and, in collaboration with Bendix Aviation Corporation of U.S.A., development is proceeding on all-weather landing capabilities. In the military field, we have long been associated with the most advanced British aircraft such as the Lightning and, more recently, the Buccaneer, and we have designed and are manufacturing the Inertial Guidance system for 'Blue Steel' on which, for some years to come, the defence of this country primarily rests.'* The profit before tax was £3,188,000 and a company was established in Australia and yet another, Elliott-Automation Continental S.A., in Luxembourg which was to manage an increasing number of subsidiaries in Europe. Personnel now numbered nearly 17,000 in the United Kingdom alone.

Sir Leon Bagrit had decided that aviation, radar and computing were the new industries and can be seen that it was his action [34] that led to Elliott's re-entry into the aircraft instrument field, and the eventual formation of Elliott Flight Automation Limited.

Leon Bagrit is generally recognised as being extraordinarily prescient in his thinking. For instance, in his 1964 book *'The Age of Automation'* (Fig 4.) he predicted:

‘It is now possible to envisage personal computers, small enough to be taken around in one’s car, or even one’s pocket. They could be plugged into a national computer grid, to provide individual enquirers with almost unlimited information.’

‘Perhaps the most far-reaching use of the new generation of computers will be in the retention and communication of information of all sorts within a national, possibly a world-wide, information system.’

‘In many industrial and commercial applications we are moving steadily away from large, centralized computers towards much simpler decentralized units, systems of small, cheap, special-purpose units, rather like building bricks.’

‘Car drivers could be told immediately about traffic hold-ups and road works and given alternative routes....’

It was in this same year that Sir Leon Bagrit presented the BBC Reith Lectures on ‘The Age of Automation’ which explore how the increased technological development in computing has changed the world we live in. He was invited to give the whole series of six Reith Lectures and interestingly these talks were referenced in a 2022 Reith Lecture by Stuart Russell on ‘AI in the economy’ (Episode 3 of 4), ‘Living With Artificial Intelligence Artificial Intelligence’.

Sir Leon Bagrit was always keen to extol the benefits of computing and in October 1965 he led a three-day course on computer appreciation for some 75 MPs. **(Figs 5 and 6)**

In 1973 Sir Leon Bagrit retired as Chairman of GEC-Elliott Automation Ltd and he died on April 22nd, 1979. He is buried with his wife Stella in Willesden United Synagogue Cemetery.

In 1987 Lady Stella Bagrit founded The Sir Leon Bagrit Memorial Trust in honour of Sir Leon. The Trust was set up by Farre & Co a London Law firm. Lady Bagrit was instrumental in the Trust’s support for the creation of the Sir Leon Bagrit Centre in 1991, later, the Bioengineering Department. MSc bioengineering scholarship schemes, and student achievement awards continue to be supported by the Trust. The annual Bagrit Lecture commemorates the Bagrit name. The Stella Bagrit Centenary Memorial Prize commemorates Lady Bagrit’s huge involvement with bioengineering at Imperial.

He was a member of the Council for Scientific and Industrial Research, 1963-1965 and the Advisory Council on Technology, 1964-1979.

He was a director of the Royal Opera House, Covent Garden from 1962 to 1970 and founded the Friends of Covent Garden, chairing it from 1962 to 1969.

Through charitable Trusts and scholarships support from the Leon and Stella Bagrit continue to support scientific and artistic endeavours such as the Royal Ballet School and the Ben Gurion University in Israel.

Notes

1. ‘*The New Scientist*’, 1st September 1960.
2. Oxford DICTIONARY OF National Biography, 2004 Vol 3, pp244-245
3. “THE TIMES” June 13th, 1946 ‘Aircraft Factory Transfer. Governments Reasons’ and June 22nd, 1946 ‘The Aircraft Factory at Rochester’.
4. ‘Moving Targets’ by Simon Lavington has a very full account of the life of Leon Bagrit. An article from Herbert & Sons has the statement that Leon Bagrit was promoted to Divisional Manager but in Simon Lavington’s book he quotes an ‘*Agreement for Employment and Service*’ dated 1st September 1929 which defines his job as ‘*Industrial Weigher Salesman at London*’. His salary was £300 p.a plus commission and his address is given as 77 Stanhope Avenue, Finchley, London N3.
5. Leon Bagrit’s patents are ‘*Improvements in and relating to weighing Machines*’ GB13405 1933, ‘*Improvements in or relating to mincing machines*’ GB419155 1933 both assigned to Herbert and Sons Ltd. ‘*Improvements in or relating to scales and weighing machines*’ GB464832 1035, ‘*Improvements in or relating to power driven mincing machines*’ GB512805 1938, ‘*Improvements in or relating to weighing machines*’ GB5523782 1938, ‘*A new and improved weighing scale*’ GB551640 1941, ‘*Improvements relating to mixing machines*’ GB608174 1946 all assigned to B & P Swift Ltd. ‘*Improvements in jointing strips for sheet metal or like structures*’ GB659619 1959 assigned to Elliott Brothers London Ltd and ‘*Improvements in or relating to reservoir writing instruments of the ball-point type*’ GB793269 assigned to Henry C Stephens Ltd (Leon Bagrit was for a time around 1958, Chairman of Henry C Stephens Ltd). A number of these patents were also filed in other countries.
6. Comments from Mr Richard Herbert, the current Chairman of The Herbert Group Ltd. See the Herbert Group website www.herberthistory.co.uk
7. ‘A brief history of Marconi-Elliott Avionic Systems Ltd @ Airport Works, Rochester’ says 1930.
8. B & P Swift Ltd was named after Bagrit and Pollard. Dickie Pollard was a technical expert and was certainly friendly with both Leon Bagrit and Dr Lawrence Ross. Dr Ross was Hungarian and originally named Rossz or Roszwlgi and was to become the Technical Director of Elliott Automation. ‘Moving Targets’ by Simon Lavington).

9. Electro Methods Ltd were electrical engineers and instrument makers was based in Stevenage and later had a factory in Biggleswade, to produce electrical connectors. In 1964 it became Ether Engineering and later Pye Ether. In 1974 it became Pye Connectors and later in 1983, Flexicon Systems.
10. 'THE TIMES' Oct 4th, 1946 'Civilian Industries at Short's Factory', Another company that moved into the area was Hobourn Aero Components Company. (See 'Short Brothers: The Rochester Years' by Philip Macdougall)
11. For some time there was a Cyanide bath installed on the site for gear hardening and it was located adjacent to the old Occupational Health room in the long Hangar (not far from the present Faraday Building). Ron Bristow is quoted in Simon Lavington's book 'Moving Targets' as noting in 1951/52 that ' *Elliotts could make any kind of gear from the largest to the smallest and to the highest degree of accuracy*'.
12. 'Moving Targets' by Simon Lavington Elliott Automation and the Dawn of the Computer Age in Britain, 1947-1967. Published by Springer. ISBN 978-1-84882-932-9
13. EFA News No.4 October 1967. Bill Kemp retired from Elliotts.
Marconi Avionics News Iss. 33 1981 It would seem that Swift and Swallow were not immune to business difficulties as an article in MEA News notes 'Bob Black on his retirement said " *Those early days at Swift and Swallow were full of excitement and trauma. One Friday the heads of the firm had to go out and sell two scales before any wages could be paid and there was a time when, in one day, 58 Inspectors were discharged*"
14. I think May 1947 is right, but some documents say 1948 (Author). The acquisition of B & P Swift was in exchange for £25,000 in Elliott Ordinary shares representing 25% of Elliott's equity.
15. 'THE TIMES' April 12, 1967 'Selling Defence to the Pentagon'. Cmdr H. Pasley-Tyler commented that when he joined in 1950 'when we were bankrupt' See also comments in Chapter 3 and Note 34.
16. 'Marconi Avionics News' No 20 November 1979. The employee was Len Childs who started with Swift & Swallow and retired in 1979.
17. There is a story from this time which tells that Elliott Bros at Rochester had an arrangement with Lynch, a scrap metal dealer in Rochester. When times were hard they would take a lot of sheet metal out of the stores and take it down to Lynch's where cash would be given much in the manner of a pawnbroker. The material would be recovered at a later date. *This story was told to me by Norman Foord who was an apprentice in the mid 50s but cannot be verified. Author*
18. 'Development and Organization of Elliott-Automation Limited' A paper read to the London School of Economics and Political Sciences on 20th January 1959 by Sir (then Mr) Leon Bagrit
19. "THE TIMES" Oct 16th, 1952. Mr Leon Bagrit was a Director of Mutual Finance Ltd as was Mr Rudolph.E.F. de Trafford and Mr Pierre Lachelin.
20. Elliott Bros (London) Ltd Company Report 1953 Wholly owned trading subsidiaries were established called The Fisher Governor Company Ltd and B & P Swift Ltd. Swift and Swallow was the distributor of the companies weighing machines and food preparing machinery such as slicers and cake mixers.
21. THE TIMES" Elliott Brothers (London) Ltd Company Report 8th May 1953
22. 'Mr. L. Bagrit, managing director of Elliott Bros. (London), Ltd., is at present in the United States on business. His visit is concerned with, among other things, the manufacture of certain types of Elliott electronic apparatus under licence.' The Bendix contract was established on the 20th February 1953. 'THE TIMES" Elliott Brothers (London) Ltd Company Report 8th May 1953.

See also Letter from Jack Pateman to Brian Drayson 22nd Feb 1992 giving a brief overview of the recent history of Elliott Bros
23. Roy Townsend and Bob Shepard were the first apprentices in October 1948. They completed their apprenticeship in 1953 and at a formal dinner they were presented with their indentures. The following week they travelled together to commence two years National Service.

24. *'The NEW SCIENTIST' 6th June 1957.*

25. Notes from Chas Atkins in 2018 who joined Elliotts as an Apprentice in 1954. He also supplied the site plan in Fig.4.3. The Hangars were built in the 60s to the Right of this plan and the Airfield is to the Left. Swift and Swallow are still there and Fisher Control Valves take up a major area. Apparently Naval Gunnery Director work was being done at Rochester although it is not clear if this was the hangover from the wartime equipment largely done at Lewisham as that factory was now in decline or work on the new MRS5 Admiralty system.
 The original area for the Apprentices was in the place marked 'Toolroom'.
 The Surgery was staffed by Sister McGarry and a very young Harry Staff who had trained as a Chiropodist. Even then the Social Secretary was Jim Collins. The old Pobjoy Engine works was at that time occupied by Kolster Brandes who made radio sets.

26. *'Moving Targets'* by Simon Lavington Elliott Automation and the Dawn of the Computer Age in Britain, 1947-1967. Published by Springer. ISBN 978-1-84882-932-9. A comment by Colin Thurston on employment at Rochester in 1954.

27. *"THE TIMES" May 7th, 1957 'Electronics at work and play'.*

28. Jan 12th, 1956 *'THE TIMES'*. Hall Telephone Accessories entered the growth area of automation in 1955 and decided to rename as Associated Automation Ltd. Directors were Sir Robert Watson-Watt and Mr A. Sperry of Panellit Inc, See also *"THE TIMES" August 27th 1957 'Elliott Automation Merger'*

29. BAE Systems Property Services in 2010 noted that in 1959 the site was manufacturing Bailey Bridges and other equipment for the army. This may have been Le Grand Sutcliffe and Gell Ltd as they did heavy engineering, but this product cannot be confirmed.

30. *"THE TIMES" August 27th, 1957, Elliott Automation Merger'. 'THE TIMES" Oct 8th, 1957, 'Elliott Automation Merger'*

31. Richard Herbert of The Herbert Group Ltd April 2010

32. Other licence agreements were set up with The Fisher Governor Co for control valves, with Continental for butterfly valves, with Farris for relief valves. Pneumatic instruments were licensed from The Bristol Company of Waterbury Connecticut by purchase of their UK subsidiary The Bristol Instrument Co. Ltd. Electronic instruments were brought in from Swartwout of Cleveland and data reduction systems from Panellit, Chicago. Quality control instrumentation was licensed from Consolidated Electrodynamics of Pasadena. At the same time Elliotts data processing equipment for business applications was sold to The National Cash Register Co. Ltd. Source Ref 56

33. *"THE TIMES" May 31st, 1963 'Sir Leon Bagrit's statement'. Mr Rudolph de Trafford had been associated with the Company for over 20 years and he was to continue as a Director. At this time Mr P. J. A. Lachelin retired as did others and a number of new appointments were made*

34. A review of Sir Leon Bagrit's career is given in *'Moving Targets'* by Simon Lavington. This is itself extracted from an article by Edgar Herzfiels in the 'Oxford Dictionary of National Biography'. In 1973 Sir Leon Bagrit retired as Chairman of GEC-Elliott Automation Ltd and he died on April 22nd, 1979. Sir Leon Bagrit is buried with his wife Stella in Willesden United Synagogue Cemetery.
 In 1991, Imperial College London established the Sir Leon Bagrit Centre which was the forerunner to the Department of Bioengineering with support from the Sir Leon Bagrit Memorial Trust. This Trust was founded by the late Lady Stella Bagrit in honour of Sir Leon, and it still provides support to Imperial bioengineers through MSc scholarship schemes and student achievement awards. The Bagrit name is honoured in the Department's Bagrit & Royal Academy of Engineering Chair in Medical Device Design.
 In September 2015 the Author met William Facer who had worked in the Nuclear Div. of Elliott Bros at Lewisham. He had retired but taken a job at Farrer & Co. the Law firm and he met Lady Bagrit who had come there to set up the Trust.

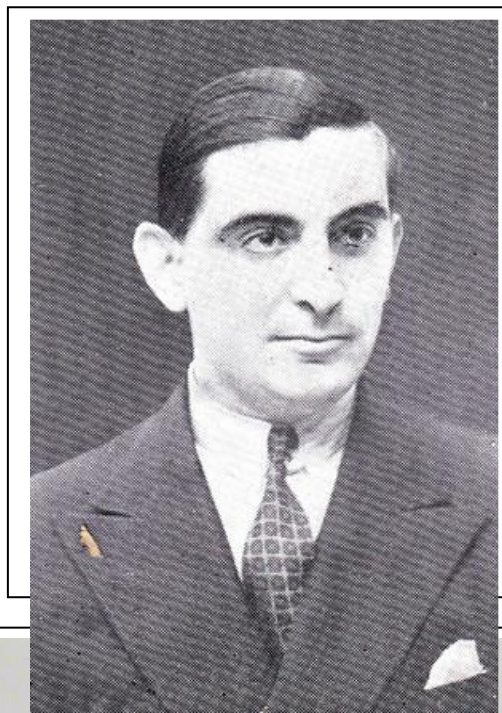


Fig 1.A young Leon Bagrit. c.1930s



Fig 2. Leon Bagrit in 1955
Managing Director of Elliott Bros (London) Ltd
Courtesy of National Portrait Gallery

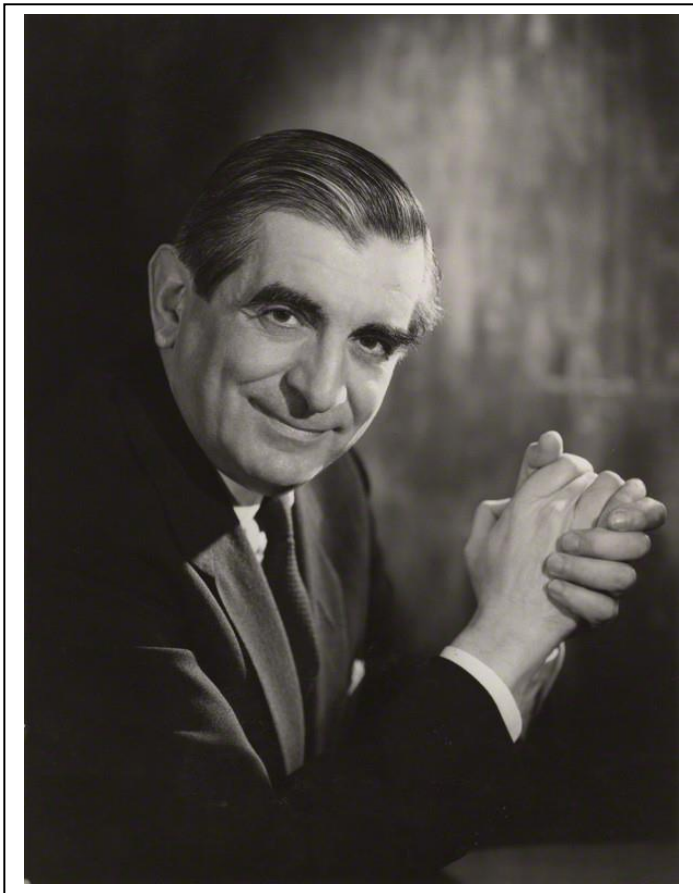


Fig 3. Sir Leon Bagrit
in 1965
*Courtesy of National Portrait
Gallery*

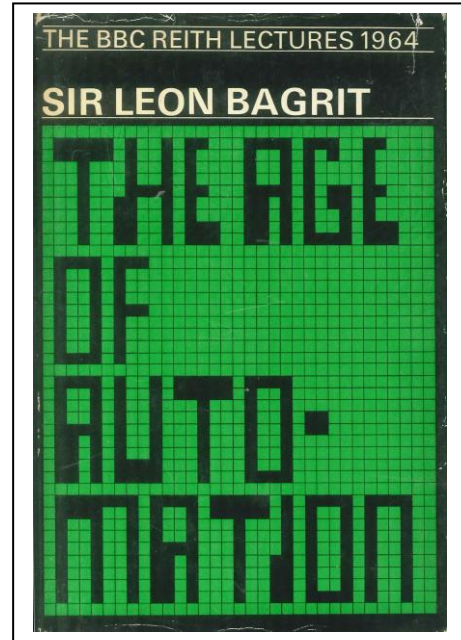


Fig 6. The book of Sir Leon
Bagrit's Reith Lecture book
Courtesy of BAE Systems

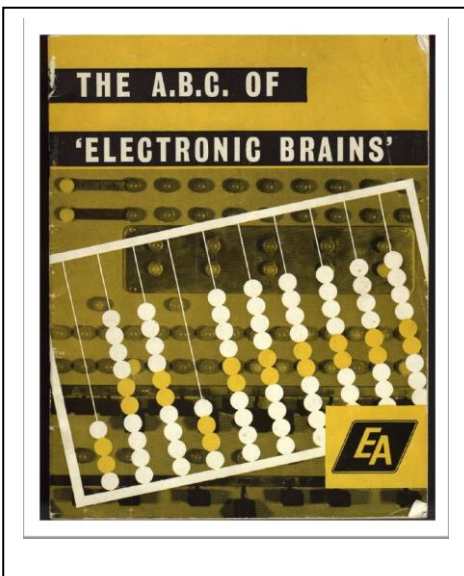


Fig 5. A book explaining how
computers work by Sir Leon
Bagrit.
Courtesy BAE Systems



Fig 6. Sir Leon Bagrit, chairman of Elliott-
Automation Ltd, arrives at the House of
Commons in London, carrying one of his
company's 920M miniature computer models,
June 1965.

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