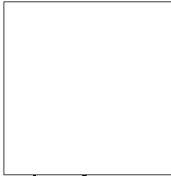


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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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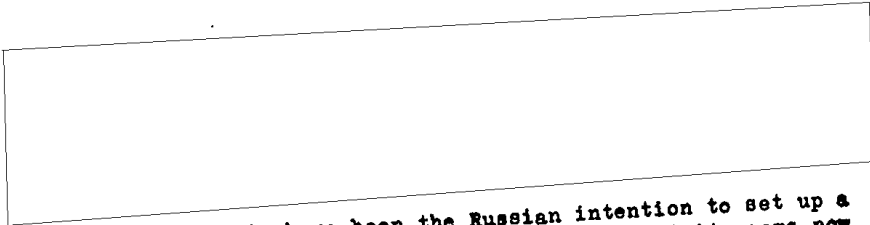
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It appears to have been the Russian intention to set up a central valve group at Fryazino, near Moscow, but it seems now that the organization at Fryazino is only one of several similar plants in Russia.

The organization at Fryazino was the development and production center for electronic tubes (not equipment) and was referred to as Russia's equivalent to the R.C.A. Laboratories at Princeton. [redacted] the parallel is only partly correct since R.C.A., Princeton, is a research laboratory, whereas Fryazino includes development and a certain scale of mass production. For example, there appears to be a vertical tube drawing plant which would support rather large scale manufacture of receiving and other tubes although the present output of the plant is very low.

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The plant at Fryazino carries out the development and manufacture of receiving tubes, transmitting valves, mercury rectifiers, V.H.F. tubes, etc., but no lamp manufacture.

No detailed information was available about the scale of development other than a remark that work was progressing on 8 mm klystrons and magnetrons. This might indicate a wide field of development activities, similar indeed to the R. C. A. at Princeton, or the Mullard organization at Mitcham.

[redacted] some 6,000 to 8,000 people were already employed there. This is indeed amazing for an organization which had few machines and personnel in 1946. The rapid build-up to such a degree would

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certainly account for [redacted] inefficiencies [redacted] but the potential in such an organization, when fully trained, would be extremely high. This is referred to later.

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[redacted] estimated [redacted] production from Fryasino at about 200,000 electronic tubes per month, which having regard to certain mass production equipment there would indicate inefficient manufacture resulting from the rapid build-up of the organization. The average efficiency of manufacture of receiving tubes apparently does not exceed about 40% (comparable figures for America and Britain is about 90%).

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In general the plant was organized on single-shift working, and double-shifts and overtime were only necessary for bottlenecks or abnormal breakdowns.

Mr. PALME was concerned exclusively with the development and operation of machines for American type miniature valves (originated by R.C.A. in 1939) [redacted]

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Apparently it was the intention of the Soviet Union to develop and manufacture sub-miniature valves at Fryasino, but this was never implemented and [redacted] no knowledge of any work on sub-miniature tubes for guided weapons, miniaturised equipment or proximity shell fuses, etc. ([redacted] such manufacture had commenced at Kalinin).

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Some of the equipment at Fryasino was of American manufacture given to Russia under the "Lease-lend" arrangements in 1944 or 1945, and similar or identical to the plant imported into Great Britain. How much technical assistance was given is not known, but lack of this would account for the difficulties in miniature tube manufacture [redacted]

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1. Sealing machines for miniature valves were of 12, 16, or 24-head varieties and it was known that four Selex (R.C.A.) machines were used in production. In addition two units existed for the manufacture of metal tubes - a method of manufacture very common in America in 1939, but now largely superseded by miniature tube manufacture. These six units alone operating at the reported low efficiency of 40% would have a capacity of approximately 3,000,000 tubes per annum on single shift, but were probably not fully loaded.

The sealing machines used the conventional method with the exhaust stem pointing upwards, but development was in hand to design a machine which would permit sealing with the stem pointing downwards. The necessity for such a development would seem to indicate difficulties in production with thermionic emission.

2. Pumping machines for the manufacture of miniature valves were of the American variety with 24-heads running at 750 per hour. A new pump was under development in which oil diffusion pumps were used directly under the valves on the rotating head - similar to the Mullard system except that we use mercury diffusion pumps. Such a development with oil diffusion pumps seems to indicate some lack of knowledge of the properties of oil diffusion pumps on mass production systems.
3. The manufacture of stems, or bases, for miniature tubes was carried out on 12 or 24-head machines made in Russia, but similar to the American R.C.A. equipment. The 24-head machines, as far as we can gather, appear to be identical with R.C.A. type machines. Very many difficulties were experienced with these machines, particularly with the automatic feeding of electrodes and glass rings. Apparently hand feeding was the practice in production.
4. Electrode manufacturing machines. It would appear that the machines for the manufacture of three-piece leads for miniature valves were of American origin (General Electric), identical to the four machines supplied to Great Britain in 1945.

It seems that eight or ten machines shipped to Russia stood in one factory and were apparently forgotten for three or four years. When found they were in poor condition and all the factories were informed. Fryasino

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was allocated one such machine. After this machine was repaired and drawings made by the Russian engineers, it was installed for manufacture at the end of about one year. Operating this machine incurred great difficulties and it seems that similar troubles were experienced with the other machines, as one of the Russian engineers from Fryazino was sent in 1949 to Tashkent to assist in operating the machine, or machines, there.

This engineer remained for two to three months until the machines operated successfully. One machine at Fryazino has been in production since 1951 and would have a capacity of about $1\frac{1}{2}$ million valves per annum on M.R.V. standards.

The metal pins used for this electrode manufacture were apparently made on German Osram machines using burners, but we regard this as highly unsatisfactory.

5. Welding machines were copies of those obtained from Telefunken and were fitted with time controllers.
6. Heaters were made by both the cataphoretic and drag coating processes, which is quite understandable in view of the American and European techniques current in Russian occupied countries at the end of the war.
7. The manufacture of bulbs for miniature valves was done on standard Anbeg machines, no doubt with tubing of the requisite diameter made on a vertical tube drawing plant at Fryazino. The fact that the plant had a vertical tube drawing machine in addition to the Danner would indicate a substantial glass works and could certainly support mass production quite easily of millions of tubes per annum (one such vertical tube drawing system at Blackburn is capable of supporting some 30,000,000 tubes per annum).

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GENERAL OBSERVATIONS

[redacted] the mechanical engineering department which includes electrical plant building such as test gear and accommodated about 500 people in 45,000 square feet. This area included planning, testing, library, etc. The drawing office itself consisted of 150 designers. The apprenticeship scheme, including all grades, covered some 800 people - such a scale of apprenticeship training is extremely high and could not be paralleled in free enterprise in Britain or America and would indicate a vigorous attempt to bring about a rapid build-up of the organization at Fryazino.

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The only other information available as regards space was an estimate of 40,000 square feet which is used for valve production. This included wire drawing, but not basic tungsten and molybdenum manufacture from natural ores.

The known facts about space and personnel are tabulated below:

- 1. Number of people in the engineering department (including 150 people in the drawing office) 500
- 2. Area occupied by mechanical engineering department 45,000 sq. ft.
- 3. Area occupied by mass production of small receiving valves 40,000 sq. ft.
- 4. Total number of people employed 6,000 to 8,000
- 5. Annual production of all types 2,400,000

For comparison the following figures are given for that part of the M.R.V. Co. at Mitcham, which we consider to be a close parallel to the organization at Fryazino, although much smaller in personnel strength:

- 1. Number of people in the engineering department (including 25 people in the drawing office) 165
- 2. Area occupied by mechanical engineering department 20,000 sq. ft.
- 3. Area occupied by mass production of small receiving valves 60,000 sq. ft.
- 4. Total number of people employed, including canteen, administration staff, etc. 2,200
- 5. Annual production of all types 8,000,000
- 6. Total area (including stores, etc.) 350,000 sq. ft.

At first sight it would appear that the organization at Fryazino is about three times as large as that part of the M.R.V. Co., situated at Mitcham.

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The ratio of total personnel to the number of people engaged in the engineering department is approximately the same at Fryazino as it is at Mitcham, and [] is the acceptable proportion for an electronic tube industry engaged in research, development, and manufacture. It would, of course, be capable only of development and manufacture on single machines, and repeat orders for quantities of the machines for mass production would have to be made in appropriate machine factories. Apparently this is the case at Fryazino which does the development and prototype manufacture and prepares drawings for the actual building at machine building factories elsewhere. This would account for the large number (150) of draughtsmen and designers in the drawing office. The M.R.V. Co. at Mitcham is under-staffed in this respect and in any case is less concerned with new mass production plant.

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The amount of space allocated for the production of small receiving type valves (40,000 square feet) would, on British and American standards, be sufficient on single-shift working for some 5,000,000 to 6,000,000 valves per annum at 90% efficiency and about 2,500,000 at the alledged low efficiency of 40% at Fryazino.

If we assume that a large percentage of the 2,400,000 annual tube output at Fryazino covers receiving valves, the space allocation at that plant, having regard to low efficiency, etc., is comparable to that at Mitcham, but this would not justify the employment of more than approximately 1,000 total personnel. It would appear, therefore, - and it is not improbable - that the remainder of the personnel at Fryazino (5,000 to 7,000) are engaged on research and development activities, manufacture of special tubes (that is, tubes other than those produced on mass production units), glass factory, administration, time study, etc. etc., and it is interesting to compare the production which would be achieved at Mitcham from less personnel. The total production annually from Mitcham from 2,200 people amounts to about 7,000,000 small mass production types, 300,000 large television tubes, and 400,000 special tubes, including transmitting valves, gas discharge tubes, X-ray tubes, etc. This last category at Mitcham requires approximately 800 people.

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[] that some 5,000 or 6,000 people at Fryazino are engaged on research and development, together with the production of similar special tubes and, further, that the manufacturing efficiency and output per manhour is in both cases about half the British and American figures, then the estimated output of Fryazino would be approximately 750,000 tubes per annum.

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These deductions lead to the following assessments of the plant at Fryazino:

Number of people engaged on mass production of small receiving valves	1,000
Production of small receiving valves (per annum)	1,750,000
Number of people engaged on research, development, engineering, etc., and production of special tubes	5,000 to 6,000
Output of special tubes (per annum)	750,000

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[redacted] the special tube manufacture in Russia is on the whole comparable to that at Mitcham and taking into account the lower efficiencies to be expected from such new plant, [redacted] the space for these special tubes would perhaps be about 300,000 square feet, which figure includes, of course, research, development, and technical departments, and if we add to this the allowance for stores, canteen, small scale mass production, engineering departments, administration, etc. etc., the total area of the plant might quite well be over 500,000 square feet. The density of population would then be between 70 and 100 square feet per operator, which compares with the Mitcham figure of about 150 square feet per operator.

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SUMMARY OF ASSESSMENT OF PLANT AT FRYAZINO

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- 3. In the manufacture of miniature valves, the USSR appears to be several years behind Britain and America. The intensive training scheme with 800 apprentices, however, will result in a speed-up of progress. The present efficiency of manufacture of miniature valves is 40 % and is rather less than half that of Britain and America.

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4. The output of 200,000 tubes per month from a total population of 6,000 to 8,000 and (having regard to the available mass production equipment for receiving valves) is indeed low, but quite explainable if we accept the low efficiency, the small area of 40,000 square feet allocated to mass production types and assume that the bulk of the organization is working on research, development, and production of special tubes.

The organization of the engineering department, [redacted] is in agreement with this interpretation of the plant.

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5. The assumption that the center is intended as a research and development organization, similar to R.C.A., Princeton, or M.R.V. Co., Mitcham, is supported by the remark that work was proceeding on 8 mm Klystrons and Magnetrons. These are indeed quite advanced developments, but is work which could certainly be embarked upon in a nationalized industry because of the detailed information available on such developments in such things as M.I.T publications, etc.
6. The existence of glass tube drawing would indicate activities other than research and development and would obviously be intended for use at Fryazino when fully developed.
7. When fully developed and operating efficiently to British and American standards and assuming, of course, more space allocated to mass production units, the plant may have quite formidable outputs.

If the plant is set up on similar lines to the M.R.V. Co., at Mitcham, which does research and development together with only a scale of mass production necessary for the successful progress of development and machine designs, the output from Fryazino could be 25,000,000 small valves, 750,000 television tubes and 1,200,000 special tubes.

8. The apprenticeship scheme in which 800 people are covered, indicates the vigorous attempt to bring the plant to normal output and efficiency irrespective of cost.

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