F.I.A.T. FINAL REPORT No. 294.

INTERROGATION OF GERMAN TELEVISION AND ELECTRONIC AUTHORITIES

Report prepared by

FIELD INFORMATION AGENCY, TECHNICAL
UNITED STATES GROUP CONTROL COUNCIL FOR GERMANY

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INTERROGATION OF GERMAN TELEVISION AND ELECTRONIC AUTHORITIES

BY

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Technical Industrial Intelligence Committee

FIELD INFORMATION AGENCY, TECHNICAL

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PERSONNEL OF INVESTIGATING TEAM

R. H. McCarthy, U.S.
J. R. Townsend, U.S.
P. Mertz. U.S.

TARGET

Dr. Karolus, Professor at University of Leipzig
Rohrbacher Str. 79
Heidelberg, Germany

GENERAL DISCUSSION

Dr. Karolus supplied information regarding other possible targets, namely:

Prof. Fritz Schroeter	- Heiderheim War Ulm
Prof. Rukop	- " " "
Prof. Gunther	- " " "
Prof. Kautzky	- Weilburg near Frankfurt
Prof. Pohl	- Gottingen
Dr. Hackenbury	- "
Dr. Max Knoll	- Munich, with Telefunken
Dr. Heimann	- South Germany, possibly Konstang
Dr. Theile	- Gottingen
Dr. Diehlo	- "

Dr. Karolus discussed larger screen experiments with television. He described his own, which used individual lamps for the picture elements, switched mechanically for the lines and electronically for the elements in the lines. This had been set up at Leipzig and shown to Col. Ranger. It was used with a 200 line television system, and gave fair results. He discussed the experiments of Prof. Fischer at Zurich, which have been described in the Schweizer Archiv. It appears that the definition on this system was poor, in Dr. Karolus' opinion not better, with 441 lines, than his own with 200 lines. A serious trouble is the disintegration of the liquid sprayed by the cathode beams. This develops hairs which rise out of the liquid by reason of the electrostatic forces. These destroy both resolution and contrast. The latter is apt to be not much better than 2:1. All this is not relieved sufficiently by the rotating of the liquid and scraping of the surface to give a fresh area. It appears that though he visited Zurich four times, not once was the apparatus functioning well enough for a demonstration, though he saw fair motion picture records of its operation.

Dr. Karolus described dark trace tubes that he and Dr. Bartels had worked with. These consist of a layer of KCP deposited on a thin layer of tungsten (translucent) which itself is deposited on a layer of SiO_2 (or thin quartz). The principal trouble with these is that when good contrast is obtained the erasing time is long. To erase fast they put heavier connections across the two opposite edges of the tungsten film and passed current through it to heat it. This he claimed, was more effective than setting up a voltage gradient through the KCP via two tungsten films between which the KCP is sandwiched. Dr. Karolus also briefly discussed the Krawinkel storage system which has been described in detail in German literature. He considers the switching arrangement for it too complicated.

Dr. Karolus stated that he had prepared a book on television developments, edited by F. Schroeter. It was entitled "Fortschritte der Fernseh-Technik, 1936-7" verlag Springer.

He mentioned that although the television network had been set up in Germany for 441 lines with a 4mc band, they had not actually been used with this band. He thought that they had been used up to only 180 lines.

He described briefly a high speed facsimile system, which he had been working on and had shown Col. Ranger. This uses a band of 10 kc., about 10 times the usual speed. It employs a supersonic light valve at the receiver, somewhat similar to the Scophony valve except that it does not need an immobilizer because at the speed required the motion of the wave train in the liquid cell is fast enough for the delay across the aperture to be negligible compared to the time of one picture element. This fast system he was expecting to use on the German broad band networks.

TARGET

Dr. Ludwig Wesch, Director of the Institutes fur Weltpost und Weltnachrichtenswesen and Electrooptisches Institute
Prison at Heidelberg - held for Nazi activities

DISCUSSION

Dr. Wesch had prepared a long report in German, which will be summarized in due course. This deals with broad general discussions on:

1. Phosphors
2. Dielectric constant photocells
3. Dielectrics for bolometers
4. Triodes and magnetrons for cm. waves
5. Capacity feed back generator using dielectric constant photocell
6. General work on infra-red
7. High pressure high temperature oven (for phosphors)
8. Absorption of cm. waves
9. Problems of remote control of moving vehicles, such as planes, gliders, and rockets.

Discussion with Dr. Wesch indicated that his knowledge on these subjects, though of a very widespread nature, was also very general, and it was difficult to obtain very specific information from him. Study of his report may indicate more useful information than appears on the surface. It seems that he has been very extensively questioned by a number of agencies.

TARGET

Dr. Bothe, Director Institute
Physics Kaiser Wilhelm Institute
Heidelberg, Germany

GENERAL

Dr. Bothe stated that Dr. Kuhn was the administrative head of the Institute and that each department head was called a Director and the department, an institute. Thus, Dr. Bothe is director of the Institute of Physics of KWI. Dr. Bothe stated he had 25 people in his department and about 30 during the war. He is a famous physicist and has visited America, delivering lectures at Pasadena, etc.

WORK

Dr. Bothe stated that the Institute of Physics had a Van Der Graff generator and a cyclotron. They also have a 10,000,000 volt betatron under construction. Most of the work of the Institute is in the realm of nuclear physics such as the Uranium problem, radio active substances, artificial radio activity, fusion amd problems in nuclear physics related to medicine. His papers to 1944 have dealt with measurements of absorption cross section of uranium and other substances, details of fission and energy of fission products.

Dr. Bothe had no information on magnetic materials or dielectrics in his experimental work on products of Siemens and Hereaus Vacuum, Smeltze, I. G. Farben and others. He has not experimented in the field of high frequency.

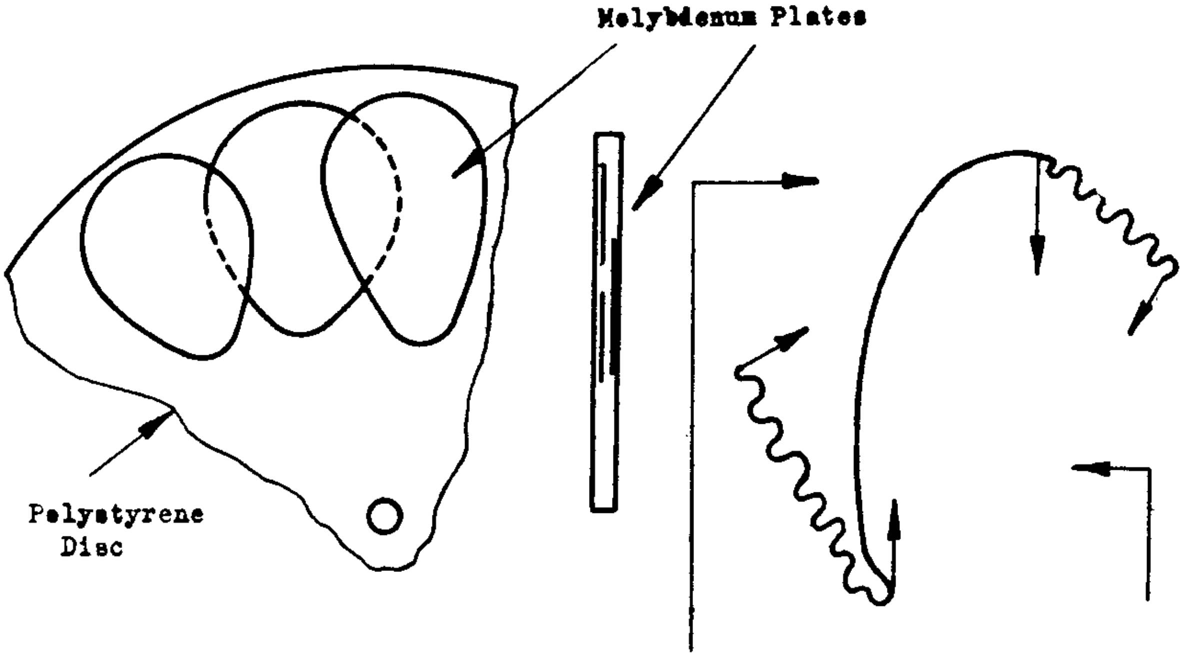
TARGET

Dr. Carl Bosch
Schlosswolfsbrunneu Weg 61
Heidelberg, Germany

COMPACT HIGH TENSION GENERATOR

In order to construct this generator Dr. Bosch was required to make several developments in materials of singular importance. The purpose of the high tension generator was to develop a light weight device for use with infra-red image tubes. It was planned to build many thousand of these generators. Dr. Bosch worked with A.E.G. in Berlin and stated that his laboratory had been bombed out four times.

The generator was constructed in a manner similar to the Wirmshurst machine. The arrangement of the brushes and connections is as follows:



The insulation for Dr. Bosch's machine was made of polystyrene. This material has very low dielectric loss and high electric strength. The inductor plates were made of molybdenum. These plates had to be interleaved between layers of polystyrene and these were required to be fused together. An adhesive for this purpose would require the same properties as the plates. Monostyrol proved to be such an adhesive. This was spread between the plates and the sheets of polystyrene and heated with ultra-violet light. During the heating the monostyrol polymeriz to form a polymer and the whole mass fuses together. He exhibited a 4" disc and a 10" disc rotor. The polymer has the same dielectric strength as the polystyrene namely, 50 Kilo volts per mm. The 4" rotor generates 12,000 volts and the 10" disc 500,000 volts. The 4" disc apparatus weights 350 grams, the 10" machine has a power output of 200 watts. A 70,000 volt 2 watt machine model was exhibited. The apparatus had a 4000 hour life at 12,000 RPM.

A lubricant was required for the bearings that would not be decomposed by ozone. He found that chlorinated hydrocarbon was such a material. He used polyvinyl chloride studs and butyl and ethyl acetate covered leads. A further proposal of his was to place the machine in CO_2 gas which has a higher breakdown voltage than air.

He used an electronic tube in the output circuit of the machine to regulate the voltage as the current drawn increases. He stated that his regulator tube effected a reduction of 100 to 1 in the apparent interal resistance of the machine.

PHOSPHORS

Dr. Bosch described an especially fine grain phosphor which he had prepared principally for the "Bildwandler" infra-red tube, but which could be used for cathode ray tubes generally.

The phosphor is made up as a solution in water of zinc cadmium sulphide. This is then precipitated by the use of HCl and sensitized with the appropriate sensitizer. This is filtered. The residue is heated gradually to a temperature of 400 to 500 degrees C, where it is kept for 3 hours perhaps and then cooled slowly. A solution is then made with waterglass and a small amount of albumen, and a suspension of the phosphor made in this. This is allowed to stand 10 hours over the final surface to be coated. The surface liquid is drained and the residue allowed to dry. This is then covered with a thin layer of nitrocellulose, over which a layer of 10-4 mm, of aluminum is deposited. This is then heated to 400°C, disintegrating the nitrocellulose into NO_2 and CO_2 which evaporate, leaving the aluminum coating. The coating prevents the building up of a charge on the phosphor to reduce the effective voltage of the cathode beam. The phosphor screen has an optimum thickness depending upon the cathode beam voltage. About 20 mm. is an optimum for 12 to 15 kilovolts. The screen described has a quick decay - 10-4 seconds, and is very sensitive for use in the bildwandler tube. The grain size is about 1 mu which permits a resolving power of 5 mu, giving a very sharp picture.

PHOTOCATHODES

Dr. Bosch stated that he considered the sensitivity of photocathodes could be greatly increased by forming the sensitive surface on a spongy material so as greatly to increase its effective surface and possibility of absorption of the incident light. To test this he had carried out some experiments in which he had obtained on one occasion a sensitivity of 50 times the normal value. He had been unable to continue the experiments, however, and this figure was not reproducible. The process consisted in coating the surface of glass to be used with a solution of SiO_2, ZrO_2, or ACO in waterglass.

This was coagulated with HCl vapor, then washed with distilled water for 10 hours, then dried and coated by exposure to caesium vapor. He estimated that the granulations were of the order of 10^{-6} mm. This is invisible even in a microscope but was estimated from the dye retaining properties of the phosphor. He further estimated that the effective surface was 60 square meters per cm. of gross surface.

Dr. Bosch also proposed the sensitizing of photo cathodes to specific spectral regions by the use of dyestuffs, similar to the process used for photographic plates. By the use of cyanine dyestuffs he hadonce been able to sensitize a surface to the region of 2.4 mu. This lasted 4 hours, after which the sensitivity dropped to zero.

TARGET

Dr. Bernhardt Bartels
Rohrbacher Str. 79
Heidelberg, Germany

GENERAL CONSIDERATIONS

Dr. Bartels was living in the same apartment house with Dr. Karolus and was introduced to us by him. He had been working with semi-conductors and with flourescent screens. He freely gave us the following descriptions.

SILICON DETECTOR CELLS (BARTEL CELL)

The original idea of this cell was a suggestion of Dr. Gunther of the University of Breslau, a chemist and specialist in semi-conductors.

A series of cylindircal rods of carbon 1.5 mm in diameter and a convenient length are introduced into a quartz tube and arranged so that they stand on end. Some powdered aluminum is introduced into the end of the tube. The tube is placed on a tubular electric furnace. The quartz tube is evacuated of air and then silicon tetrachloride is introduced into the tube under 10 mm pressure. The furnace is then raised to a temperature of 800°C. Crystals of silicon are then deposited on the surface of the carbon. Several hours are required for the operation. One should watch for the evaporation of the aluminum.

The cell is completed by mounting the carbon cylinder on a ceramic base and bringing a metal electrode into contact with the crystals on the end of the carbon rod. A .1 mm dia. electrode of nickel or tungsten under light pressure is all that is required. The crystals of silicon are not oriented and the contacting electrode is not pointed, so it subtends a number of the crystals.

The finished cell will withstand a 10 g blow, voltage to 10 volts max. and it has been used to detect 3 and 9 cm waves. About 1000 cells have been made.

CONCLUSION

If the above can be verified by experiment it seems a simpler method than that now in use for manufacture of U.S.

and British detectors. It seems to require no adjustment, is not sensitive to shock and requires little adjustment in manufacture.

FLUORESCENT SCREEN

The second sheet is zinc sulphide plus a few per cent of cadmium sulphide activated with copper. The second sheet is activated more in the red than American tubes.

The first sheet is activated to 400 mmu. It was his experience that 310 mmu. was too short.

The second sheet absorbs optically to 400 mmu. and has a maximum of 600 mmu. This optical absorption takes the place of the extra amber color filter used in U.S. tubes.

The above process is described in an article by Dr. Bartels in Zeitschrift fur Physik, 1942.

CONCLUSION

If the results herewith described can be attained, this screen seems to offer some advantage over current processed screens.

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