ITEM No. 5, 26.
FILE No. XI—6, XII—9, and XIV—4

DESCRIPTION OF JUNKERS ·004 (203) JET PROPULSION ENGINES

COMBINED INTELLIGENCE OBJECTIVES SUB-COMMITTEE

LONDON—H.M. STATIONERY OFFICE

DESCRIPTION OF JUNKERS .004 (203) JET PROPULSION ENGINES

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CIOS Black List Items

5. Jet Propulsion
26. Aircraft Engines

COMBINED INTELLIGENCE OBJECTIVES SUB-COMITTEE
G-2 Division, SHAEF (Rear) APO 413.

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ALSOS INTELLIGENCE MISSION
UNITED STATES NAVY
Paris, France

I. Junkers Aircraft Engines - Plant at Strassburg in Alsace.

Summary of Plant's History.

On November 30, 1944, Cmdr. Den Hartog visited the Junkers Aircraft Factory at 200, rue de Colmar, Strassbourg. This plant prior to 1940 had been operated by Matford, making Ford cars. The name of the firm is a contraction of Mathis, name of the operator prior to 1935 and Ford. In September 1939, on the outbreak of war the French Government caused the company to remove all its machine tools from the premises to Bordeaux and other towns remote from the border. When the Germans walked in in June 1940 only empty buildings were left. The Junkers aircraft company, engine department took over and reequipped the place. They made and repaired standard Junkers piston engines at a rate of 500 engines repaired and 250 newly built piston engines each month during the entire war. In May 1944 the plant was bombed in plain daylight with very good accuracy; the machine shops and assembly plant being completely destroyed. Only the repair shop sustained practically no damage. As a result all activity in the plant stopped, and the machine tools were dug from the ruins, some 60 percent of them were repaired and sent to other small plants in the vicinity, where production was resumed several months later. The locations of these plants were given as: Mutzig, Lutsenhausen, Rethau, Benfeld and Breusch-Urbach, all within a 30 mile radius around Strassburg.

Junkers Plants in Magdeburg and Köthen.

We talked with Alfred Bauer, chief of the production department, who had previously worked for Matford and later for Junkers at the same plant. The establishment was operated entirely with Alsation and imported Russian personnel, under a German management. Our informant Bauer was quite familiar with the other engine plants of the Junkers corporation and gave the following names of key personnel:

at Magdeburg: PLATH, head of production department.
HARTMANN, shop superintendent.

at Köthen: AURICH, chief constructor.
HIRSCH, production superintendent.

The plant at Magdeburg had a peak production of 800 engines per month and at Köthen 1,000 engines per month. Both plants were completely destroyed by our raids, and were dispersed to small places just like it was done at Strassburg.

Description of Aircraft Turbo-Jet Engine.

The important find in this factory was one turbo-jet engine of which all pieces except the compressor ware found in the Director's room. The existence of this engine was not known to the Alsatian personnel, although individual pieces had been manufactured by the plant. The production superintendent Bauer did not know how those pieces went together. The engine was picked up by the U.S. Army Air Forces for further study and is in the custody of Col. H.G. Bunker, director of Technical Services, Air Service Command, HQ. U.S. Strategic Air Forces in Europe, APO 633. It is understood that it is going to Farnborough for further study. A descriptionof the engine is as follows:

Overall length ..... 15 feet.
Diameter of shell ..... 32 inches.
cylindrical over some 70 per cent of its length,
tapered down to about 20 inches at each end.

The air enters the shell and passes through an 8 stage axial type air compressor (this piece was missing, but information was supplied by one of the Germans caught there). The axial length of the compressor is slightly over 3 ft. Behind the compressor there is a six-ribbed aluminium casting (non-rotating) about 3 ft. long, and 28 in. diameter having 6 equally spaced holes of about 7 in. diameter in which fit the six burners. The burners are about 12 in. long and of 7 in. maximum diameter. At their entrance there are 6 vanes of thin steel for the purpose of giving a fast spin to the incoming compressed air. The fuel entrance is a single hole of some 3/8 in. diameter about 4 in. behind the entrance vanes. After this the burner tapers down somewhat and has 10 longitudinal slits in it, some 4 in. long and ½ in. wide. The six streams then merge again and enter a set of stationary guide vanes of some 28 in. outer diameter, prior to entering the single turbine wheel. This brings us to about 60 percent of the length of the device from the front end.

After leaving the turbine wheel the gases do not pass through any more guide vanes but enter immediately into the contracting nozzle with an adjustable conical center piece, comprising the after 40 percent of the entire length. The connection between the turbine wheel and the eight stage axial compressor is by a shaft some 3 ft. long supported by three bearings held by the central aluminium casting. A feature of the engine is that apart from the rotating parts the whole is built up of thin steel sheet covered with what looks like some aluminum spray.

5th December 1944.

J.P. DEN HARTOG,
Cmdr.,U.S.N.R.,Navy ALSOS

II. JUNKERS .004 JET UNIT AT MATFORD PLAND, STRASBOURG.

A. JUNKERS AIRCRAFT MOTORS, INCLUDING JET MOTOR 004 (203)

Summary. This report contains the information collected by ALSOS during visit to the plant at Strasbourg used before 1939 by the Mathis Company for assembly of Ford cars. It is located 1 mile south of the city at a place known as Matford. First used by the Germans for quantity overhaul of Junkers inverted-V engines, this plant took part also in development of the Junkers Jet Motor 004, also referred to as 203. The activities of the plant are described and a detailed description of 004 is appended. The report should be of interest to all agencies concerned in design, production, or overhaul of aircraft motors.

Narrative. The use of the Matford plant for war purposes first became known to ALSOS through the Paris agency of the Mathis Company, interviewed by Cdr.Den Hartog on 24 November 1944 and mentioned in Navy ALSOS Report 36. As soon as Strasbourg was open, he visited the plant on 29 November and found that Major Gette of ATI was collecting parts of 004. He therefore turned to other targets and contented himself with an oral report to S.N.M.A. on return to Paris 2 December. When transport became available, on 9 December Dr.H.J.E.Reid, director of the Aerodynamic Laboratory of Langley Field and Captain W.R.Roop, USN, proceeded to Strasbourg. It was soon found that a great deal of information could be obtained in addition to what seemed possible for Major Gette to have picked up. A systematic search for such information continued through the whole week of 11 to 16 December.

It was understood that Major Gette had shipped a single set of obtainable parts to Farnboro. We set ourselves the task of putting together 3 sets for further distribution. The plant was under guard of the 147th QM Battalion (M) DUKW, and the officers and men of this group gave us the most complete co-operation and assistance. It would have been impossible to complete the job without the aid of Captain John C. McKnight of Elkin, South Carolina.

After assembly of the parts was well started we were joined by Lieut.N.G.Froomkin of ATI, who when with us on a visit to auxiliary plants near by and gave valuable help in transport. Two of the sets of parts were finally turned over to him and he is understood to have forwarded them by air from Le Bourget about 18 December to Wright Field and Farnboro. Lieut. Froomkin found a set of plans in the office of the space used for assembly of 004; Dr. Reid had the benefit of a look at these plans before making up his sketches.

A group of some of the parts was found at the Omefa Works at Pfaffenhafen about 50 miles north of Strasbourg by the quick wit of Capt. van Daum of the XIIth Tactical Air Command then operating from Saverne, where we were able to photograph them. They included two pieces not found elsewhere, as mentioned in Dr.Reid's report. These were found too

late for inclusion with other parts shipped. A set of parts which we finally brought out is being shipped to the David Taylor Model Basin.

Description of the Plants. The main plant is known as the Junkers-Meinau Works. Prior to 1940 it was a Ford assembly plant of the Mathis Co. and so bears the name of Matford and is so designated on the Michelin map. It has an area of over 20 acres on the west side of the Colmar Pike, N68, 1 mile south of Strasbourg. The whole frontage on the pike is occupied by a four-storey office building. Just behind this is the shop for manufacture of parts, completely bombed out on 6 June. Further back are two buildings for overhaul of Jumo 211, and at the rear of the lot a group of about 20 test stands. A layout is shown on pages 13 and 14.

The shops contained perhaps 200 Jumo 211s, ranging from newly-received units in damaged condition, to fully completed ones ready for shipment. It was evident that work had been suspended quite abruptly. The offices contained elaborate accounting and other facilities, including apprentice training, looking toward support of the overhaul work. In addition, the manufacture of small parts in quantity had occupied about half the space prior to the bombing.

A policy of decentralization had been under consideration for a long time. A visit was made to a small plant in the woods near Illkirch, a mile south of the junction of N68 and N83, and about $\frac{1}{4}$ mile east of N68. Experiments with overhaul of Jumo 211 on a small scale were said to have been made here since 1940.

After the bombing the manufacture of parts was to have been transferred to a similar detached plant set up in a textile mill at Lutzelhouse. A few crated motors were also found there. A river barge loaded with nearly 300 of these engines was found in a berth in the port.

Jumo 211 had been stepped up by 400 horsepower by changes, mainly increasing the size of the supercharger, and the modification was designated Jumo 213. A plant for this work at Benfield was not visited.

Chief interest centers in the work on the jet motor. Its assembly or that of a major part of it, was to have been done at Matford, and parts of it were found in various different places in the plant, including the drafting room.

The main production of 004 was to have been done in the isolated plants. At Illkirch a complete shop with about 10,000 sq.ft. floor space had been set up for machining the turbine disk and assembling the rotor. Only the brazing operation was to have been done elsewhere, at a shop in Strasbourg, not yet wholly ready. A very elaborate mill performing six successive operations without resetting the work is still there. It was built by the Graffenstaden Works nearby, and had been put into partial operation. Rejection slips indicated that the machine had not been completely reduced to satisfactory operation. About 20 other machine tools were associated with this, some of them improvised. Work on these rotors was just beginning to be taken up in earnest.

At Mutzig, near Molsheim, in an old textile plant just to the left coming into the town from eastward, a complete production line had been set up for performing a series of about 20 machine tool operations on the heavy frame casting which forms the principal strength number of the motor.

At Rothau, a little beyond Schirmeck, a larger building, with say 60,000 sq.ft. floor space, housed about 100 machine tools. The only work actually in hand was the shaft of 004.

Records indicated still another shop at Wema, but no place of this name could be found.

Production and the Jet Motor. The technical description and discussion of this motor is contained in Dr. Reid's report, but some comments will be made from the point of view of supply.

One of its principal advantages was said to lie in its ability to burn lower grade fuel than the Jumo 211. However, it was clearly still in course of development. Many changes had been made, one of the most important being from solid to hollow blades. These came from the Prym plant at Stolberg.

The parts found were not sufficient to make up a whole assembly; especially missing was the pump, believed to be an 8-stage axial flow turbo-compressor. The complete absence of parts forward of the collector ring, just ahead of the burners, leads to the conjecture that another plant is still to be found.

The jet motor was distinctly incidental, to the purposes of the Matford plant, which was highly organized for production of small parts of motors and for repair of Jumo 211. However, the attention which was being given it in the dispersed plants shows that the jet motor was being taken very seriously and its quantity production was expected to be accomplished very soon.

The dispersal of the auxiliary plants was not for the purpose of protection, as in case of dispersal of aircraft at a landing field, since the disablement of a single one of these plants would have served to interrupt the whole line of production of the motor. It is believed rather to have been a matter of use of the most available facilities. The choice of this region for work of this nature is noteworthy. A motive existed for putting repair facilities for Jumo 211 as near the operating front as possible. But when the Germans entrusted the development and production of the jet motor to Alsatian plants they proved their assurance of permanent occupation.

The Matford plant was highly organized for its function of production and the volume of paper work seemed great. It included a punch-card accounting system but the sorting machines were presumably to be found only at the home plant at Dessau. Elaborate attention was given to matters of personal administration.

Even though evacuation was generally unexpected time was taken for destruction of papers. The fact that papers were burned was reported to us and it was confirmed by our failure to find anything more than incidental records of the jet motor. Drafting boards in the room where the plans were expected to be found had partly finished mottoes of Nazi sentiments in ornamental letters.

The capacity of the Illkirch-Graffstaden Mill for rotor disks was said to be 400 pieces per month but the designed production capacity of the plants had clearly not been realized. The capacity of the Prym Blade Works was 40,000 blades per month. The number of blades per rotor is 61.

Some attempt was made to find the reason for the delay in production. Partly no doubt this is to be explained by the fact that development had not reached the stage where it would be possible. At the same time, the existance of line-production plants specially set up for this work indicates that confidence was felt that no further changes of a radical sort would be required. These plants involved decisions that must have been made months ago. The difficulties still being met were those of production and not of design. The basic data for the design must have been obtained in laboratory work done more than a year ago. No evidence as to the location of that laboratory was found beyond the surmise that it would be at the parent Junkers center at Dessau.

It is also possible that the attitude of workmen may have been partly accountable for the delay. Certainly, the Germans felt freer to trust this plant with secret work than they did those in France or Belgium. They regarded this as part of Germany, the Reichsland; the people as Germans liberated from the French yoke. Although the leading posts were occupied by Nazis, Alsatian assistants were rather freely used. Laborers deported from the East were utilized, whereas in France and Belgium deportations seemed more apt to be in the other direction. Nevertheless, it is my opinion that the collaboration obtained was through fear rather than real preference. Some evidence of this may be seen in production figures. These need verification, and the data are available in the Mutford offices needing only time for study. An estimate places the number of man-hours for complete shop overhaul of a Jumo 211 at over 300 man-hours, whereas an earlier standard figure was 180. This shows definite slowing up, but less than the drop to 30% found in Belgium plants.

An incident which seems to me significant occurred at the first visit to the plant. We had to ask our way and did it with the words "Wo ist die Colmare Strasse?" The answer was given with a smile "C'est ici". A month earlier that might have been ground for deportation or execution.

Intelligence Operational Notes. Before entering the area of military operations, a call was made at H.Q. of the 6th Army Group where we were very cordially received and given every facility, including official passes of limited duration.

A brief contact was also made with the Group T-Force which was at the time established at Luneville.

At Strasbourg, quarters requisitioned by Lt. Col. Pash for the ALSOS Mission were utilized, with mess privileges at the H.Q. of the 3rd Division. Early contact was made with the senior G-2 officer and assistance given and received with technical intelligence projects. In particular two civilians were interrogated at length on his request and his office was kept informed of our work.

The fullest co-operation was given by the guards at the plant and by Capt. McKnight. It was he who put us in touch with Charles Ludwig, plant engineer, who was our main informant. We used every means of checking Ludwig's reliability and came to feel complete confidence in his information At the same time his principle motive seemed to be concern for his plant. He realized that he would be outlawed by the Germans. His best chance of getting back into the Ford production lay with us, and so he took it wholeheartedly. An entirely independent confirmation was had by interrogation

of two employees who knew him but were not known by him.

The personnel records at the plant were found intact with Ludwig's help. Salaried employees were headed by Auerswald, general manager, Steinmayer, chief engineer, and Diclier, chief of personnel. An important name in connection with the jet motor is Siegrist. Chief draftsman was Kuphal. About 25 salaried employees and 200 supervisors were entrusted with leadership of 4,000 to 5,000 employees. Of the salaried men others beside Ludwig are almost surely still present in Strasbourg. Only those of highest rank were evacuated to Germany.

A list of telephone numbers of important connections in Germany was lifted from the manager's desk. This will be analyzed for target information. Undoubtedly a large amount of similar information could still be found by further detailed study of this plant.

Notice was received, however, on the morning of Thursday, 14th December, that the 147th Battalion was to be relieved of the guard duty that afternoon. In view of all the circumstances it seemed best to make prior removal of the pertinent material. Further intelligence work at this plant would require a new beginning with approach through the channels of the agency which took over the guard duty.

W. P. ROOP.

30 December 1944

B. Description of Junkers, •004(203) Jet Propulsion Engine.

1. This description is based on parts obtained by Captain W.P. Roop, USN, and H.J.E. Reid during their mission at Strasbourg, December 10-17, 1944, supplemented by information obtained from drawings found by Lt. N.G. Froomkin of the Tactical Research Section, Hq. 9th Air Force, and further from a sketch made by a French engineer for Maj. Gette of A.T.I. during his mission at Strasbourg at an earlier date.

2. A diagram of the Junkers •004(203) engine is enclosed. A list of parts obtained is added, together with drawing numbers, and the German names of the parts. There is also enclosed a set of photographs and sketches of the larger parts obtained. The item numbers on the diagram, list of parts, and the photographs refer to the same parts in each case.

3. The diagram shows the general layout of the engine, the lower part being a vertical half section. The dotted section of the lower half of the diagram indicates parts that were not obtained and for which no positive information was available. Maj. Gette stated that the compressor was an axial flow type having 8 stages and being about 1 meter (39 inches) in length.

4. Part number (1) is a large magnesium casting which probably forms the rear portion of the compressor as well as the support for the turbine rotor and combustion chambers. Into this casting there are fitted six combustion chamber sleeves (10). The down-stream ends of these sleeves are connected to a collector (15) which serves to conduct the hot gases from the individual combustion chambers and combine them into an annular jet impinging on the turbine stator or guide vanes (4). The hot gases then pass through the rotating blades (17) mounted on the rotor (16). Thence the gases pass to the rear through the exhaust throttle guide support section (5), the three skirts, fore part of tail cowling assembly (6), middle section of tail cowling assembly (7) and the exit flow guide (14). Part (9), the exhaust value needle, is movable axially and serves to throttle the exit flow of the gases and is probably controlled in such a manner as to prevent stalling of the compressor.

5. Inside each combustion chamber sleeve (10) there is a burner entrance piece (11), a burner mixer (12), and a burner insulation piece (13). Part of the air as it enters the sleeve (10)

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Description of Junkers ·004(203) Jet Propulsion Engine, (Cont'd).

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passes around the burner (11) and part goes through a set of radial vanes at the entrance of the burner; these induce a swirl as shown by the arrow. Each burner (11) is supported on its sleeve by 2 large and one small streamlined struts. The two larger ones have flanges which support ignition tubes connecting all burner sleeves. Each burner also has two fuel spray nozzles or possibly one fuel spray nozzle and a spark plug. This detail at the present moment is not clear. The burner mixer (12) serves to introduce some of the air from outside the burner (11) by means of tubes formed by the material cut from the mixer to form slots. These tubes are open at the upstream end and at the downstream and communicate with the inside of the mixer. The mixer is aluminized probably to prevent the carbonization of the steel and to act as a good heat reflector. The flames issue from the slots of the mixer and further burning undoubtedly takes place as mixing occurs in the jet of air passing between the burner (11) and the burner sleeve (10). The insulation piece (13) consists of a plain cylinder with a corrugated cover; this serves to conduct cool air between the inner wall of the insulation piece (13) and the sleeve (10). This part is also aluminized . The collector (15) has a double wall as shown and is aluminized, again to reduce the heat transfer to the outside and towards the inner large magnesium casting (1). For further protection of this large casting (1) and to help in the cooling system, there is an aluminized turbine inner fairing (8).

6. Part (2), the housing, is a double-walled cylinder having large openings in the end mating with the flange of the main casting (1). Cooling air is circulated between these walls as shown in the diagram. It exists through a multitude of small holes about 1/32" in diameter near the rear of the housing (note the arrows). The spacer ring (3) may be a piece used in the construction of the collector (15) or it may serve to fasten together the burner sleeves (10), the collector (15), and the turbine innerfairing (8).

7. Considerable care has been given to the ventilation or cooling of many parts. Provision is made for bleeding air from the compressor through the main casting (1) which perhaps serves to cool bearings, oil, and the rotor. Air is bled through the stationary

blades of the turbine as shown at (4). Provision is made for some sort of linkage to go through one of the six struts in the exhaust throttle guide support (5) for the purpose of adjusting the exhaust valve needle (9). At the same point the strut is open so as to carry cool air from the outside of the casing to the inner part of (5) as shown by the arrows. Cool air is probably circulated through the hollow rod in the needle valve (9) for cooling this part. Provision is made for cooling the several skirts (6), (7), (4), which in the ultimate assembly are probably spot-welded together into one stiff structure. The arrows show the direction of the cooling air which after cooling the outer shells flows into the exit chamber in such a manner as to form a cool boundary layer in contact with these parts. All these parts (5), (6), (7), (9), (14) are aluminized to prevent absorption of carbon and to reflect the heat.

8. The rotor of the turbine is interesting as the blades are hollow and tapered in wall-thickness. They are probably brazed or hard-soldered onto the hub by a high melting point alloy. The blades are hot-pressed and taper in thickness of wall from approximately 2 mm at the base to 1 mm at the tip. No completed rotor was found so it is not known whether provision is made for the ventilation of the hollow blades. It would seem, however, that this could easily be done.

9. The Junkers •004(203) is an important development and every effort should be made to obtain a complete jet propulsion engine of this design. The axial flow compressor is of particular interest as its use makes a small overall engine diameter possible and increases the internal aerodynamic efficiency of the engine. In searching for parts of this engine, it should be borne in mind that •004 is the number found on the earlier designs and 203 on later designs. Both designs are of interest as apparently many parts are interchangeable.

List of Numbers for Parts and Drawings

No. 1. Main Casting for supporting turbine on compressor - (Magnesium casting).

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Description of Junkers -004(203) Jet Propulsion Engine, (Cont'd).

No. 2. Housing (Black, of welded steel) "Tragmantel"
Dwg. 203, 354 - 001, 11.
Dwg. 203, 361 - 704, 37 (7).

No. 3. Spacer ring (steel).

No. 4. Turbine stator (steel). "Turbinenleitkranz".
Dwg. 203, 126 - 000, 11.

No. 5. Exhaust throttle guide support (steel, aluminized). "Schiebdüsenkörper"
Dwg. 203.401 - 701.11
Dwg. 203.401 - 100.11

No. 6. Fore part of tail cowling assembly (sheet steel, aluminized). "Federblech".
Dwg. 203.100 - 045.12

No. 7. Middle section of tail cowling assembly (sheet steel, aluminized). "Schiebdüsenmantel"
Dwg. 203.400 - 720.11

No. 8. Turbine inner fairing.

No. 9. Exhaust valve needle (steel aluminized). "Schiebdüsennadel".
203.420 - 701.11

No.10. Combustion chamber sleeve (steel). "Mantel"
203.314 - 703.11 for 2, 4, 6
203.304 - 705.11 for 1, 3, 5

No.11. Burner entrance piece (steel). "Zahnbüchse"
203.140 - 012.13

No.12. Burner mixer. (Steel aluminized). "Schlitzmischer"
203.304 - 703.11

No.13. Burner insulation (steel aluminized). "Einsatz".
203.304 - 704.12
203.304 - 002.12

ALSOS INTELLIGENCE MISSION
UNITED STATES NAVY

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Description of Junkers .004(203) Jet Propulsion Engine, (Cont'd).

No. 14. Exit flow guide (steel aluminized). "Leitblech".
203.400 - 748.12

No. 15. Collector (steel). "Sammler".
203-323-000.11
203-323-700.11

No. 16. Rotor (steel).

No. 17. Rotor blades (steel, hollow).

Other parts which were not obtained but for which drawings were obtained by Lt. Froomkin are as follows:

Ignition tube. "Zündrohr"
203.303-703.13

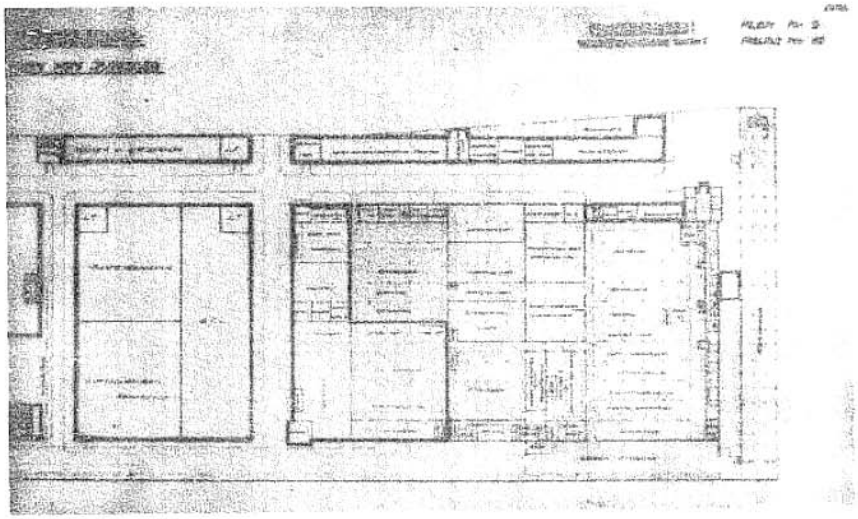
List of Burner parts. "Lists der Untergruppen und Einzelteile".
203.314 - 700.11

Cover Plate. "Deckblech".
203.100 - 703.11

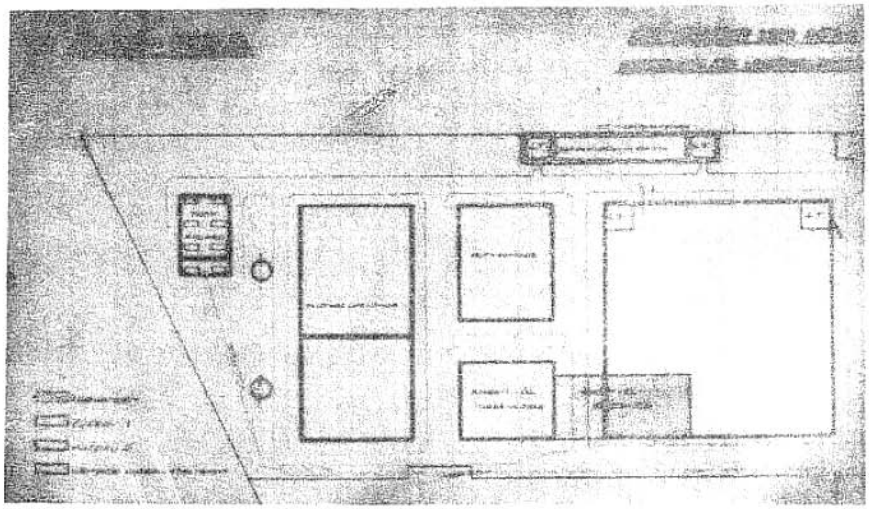
Exhaust valve wheel support. "Nadelhalter".
203.440 - 000 - 11

Cover. "Deckel".
203.100 - 709.12

H.J.E. REID



Layout of Matford Plant. Print No. 1.



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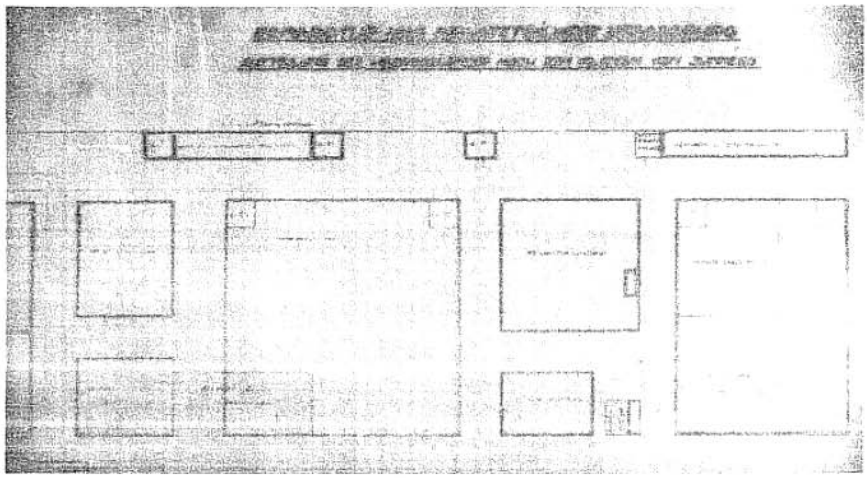

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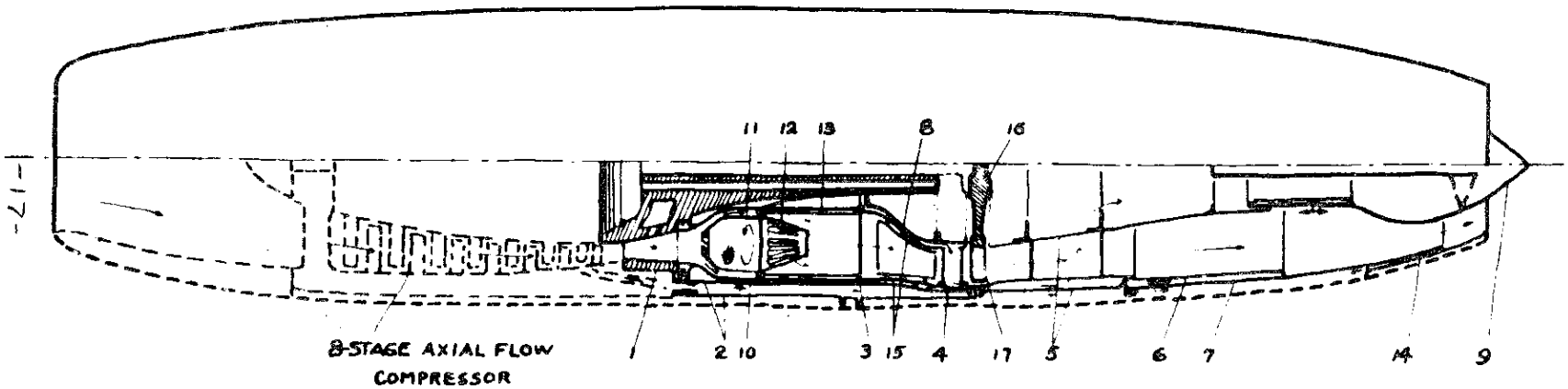
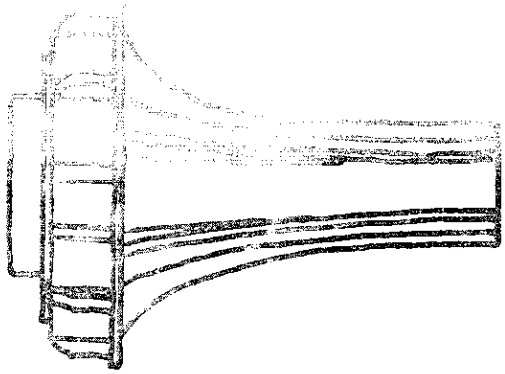
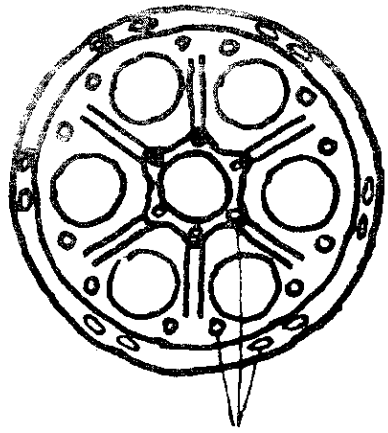


DIAGRAM OF JUNKERS .004 (203)
JET PROPULSION ENGINE

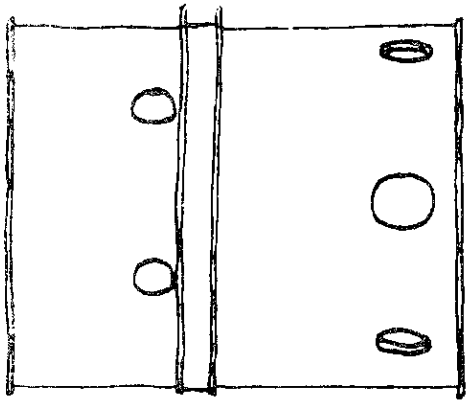
F.J.A. 20/12/44



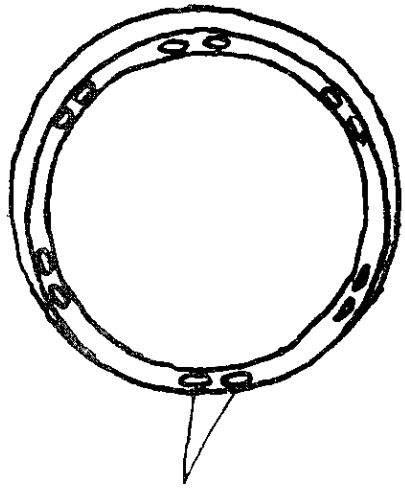
1 - MAIN CASTING



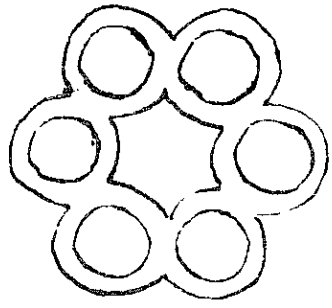
PASSAGES FOR COOLING AIR



2 HOUSING

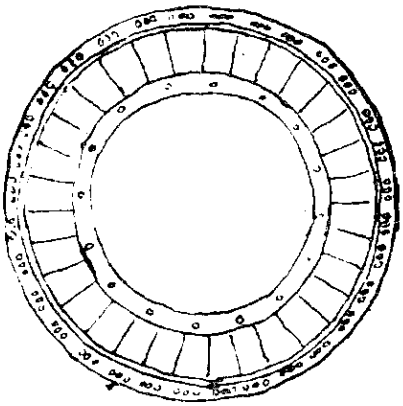


COOLING AIR PASSAGES



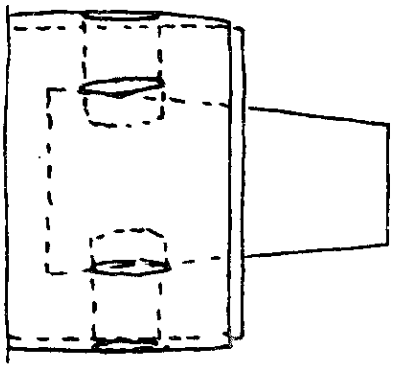
#3 SPACER RING

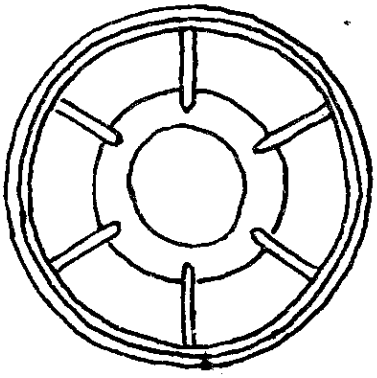
BLADE COOLING



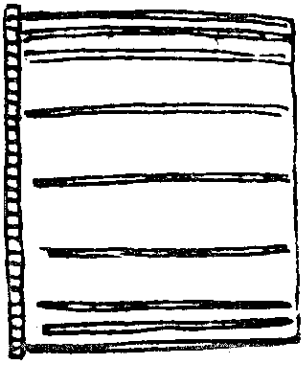
COOLING PASSAGES FOR TAIL COWLING

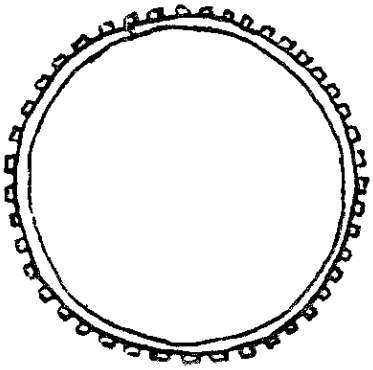
#4 TURBINE STATOR



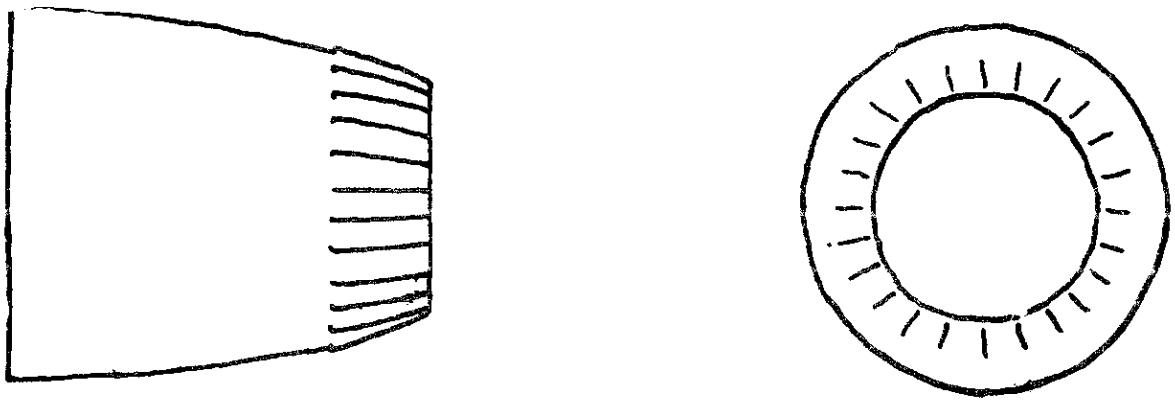


#5 EXHAUST THROTTLE GUIDE SUPPORT



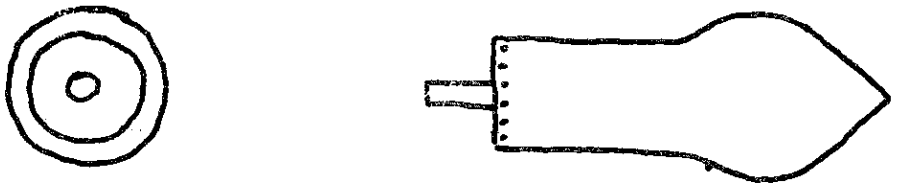


#6 FOREPART OF TAIL COWLING ASSEMBLY



#7 MIDDLE SECTION-TAIL COWLING

#8 TURBINE INNER FAIRING



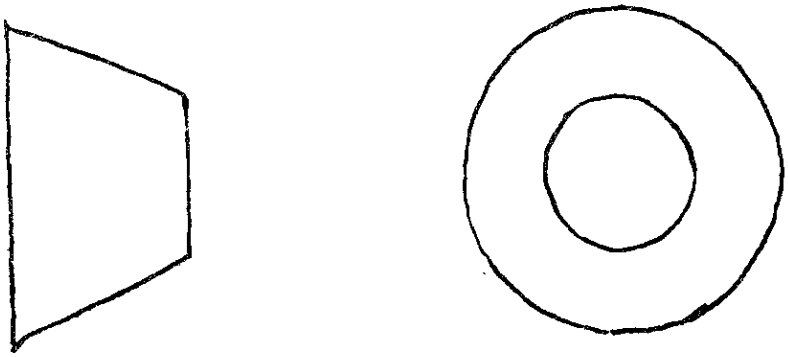
#9 EXHAUST VALVE NEEDLE

#10 COMBUSTION CHAMBER SLEEVE

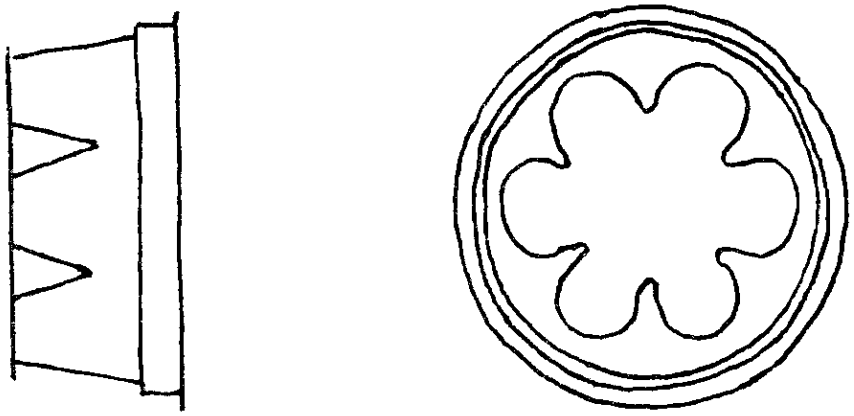
#11 BURNER ENTRANCE PIECE

#12 BURNER MIXER

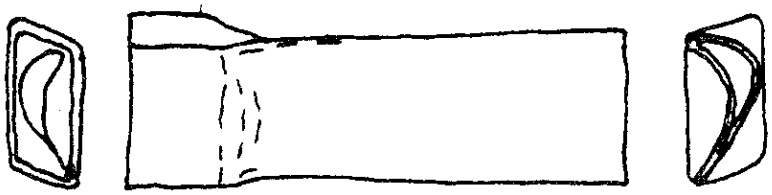
#13 BURNER INSULATION



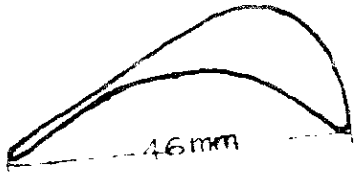
#14 EXIT FLOW GUIDE



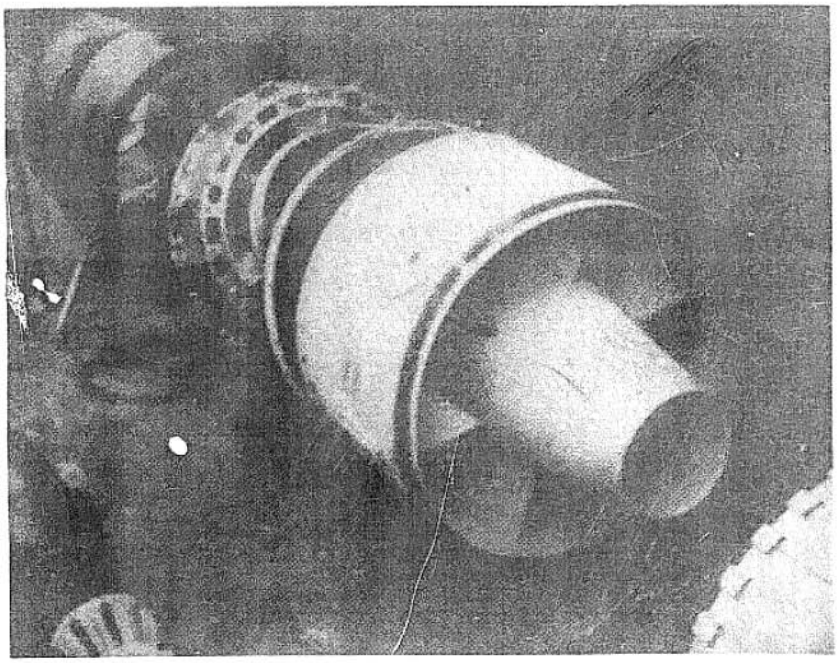
#15 COLLECTOR



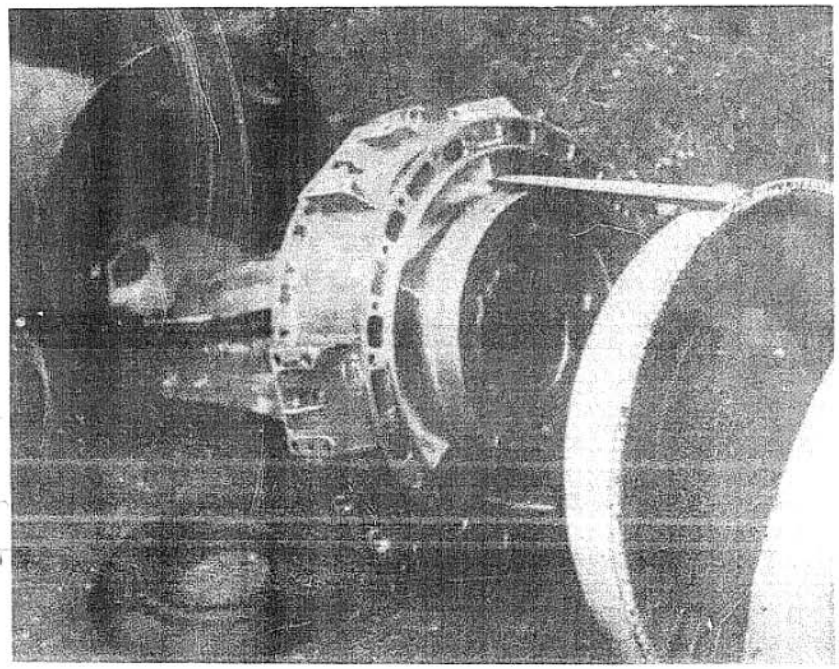
#17 BLADE OF TURBINE ROTOR

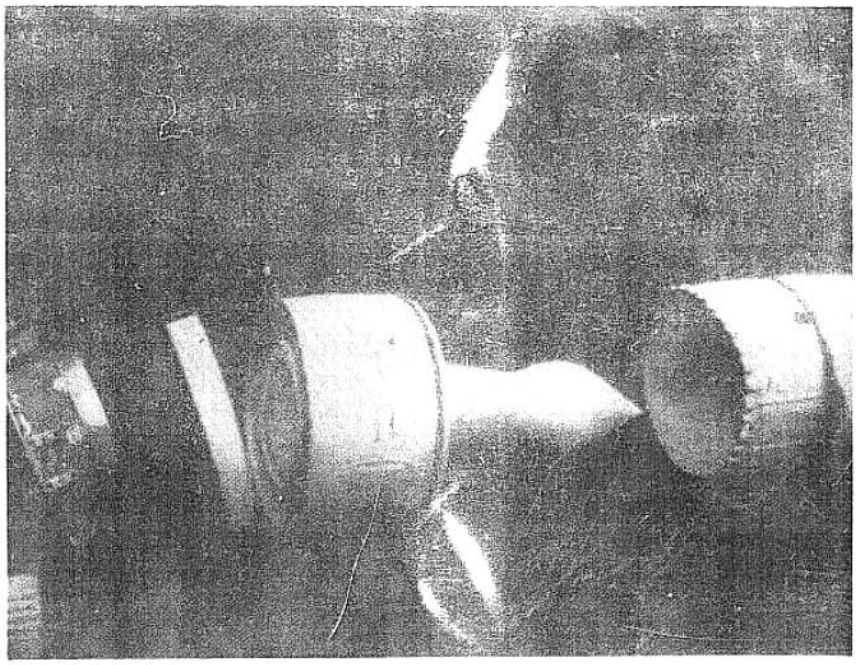


BLADE TIP CONTOUR



Parts of Junkers .004 (203) Jet Propulsion Engine.
The shaft and two circular disks are parts
not shown in diagram nor sketches.





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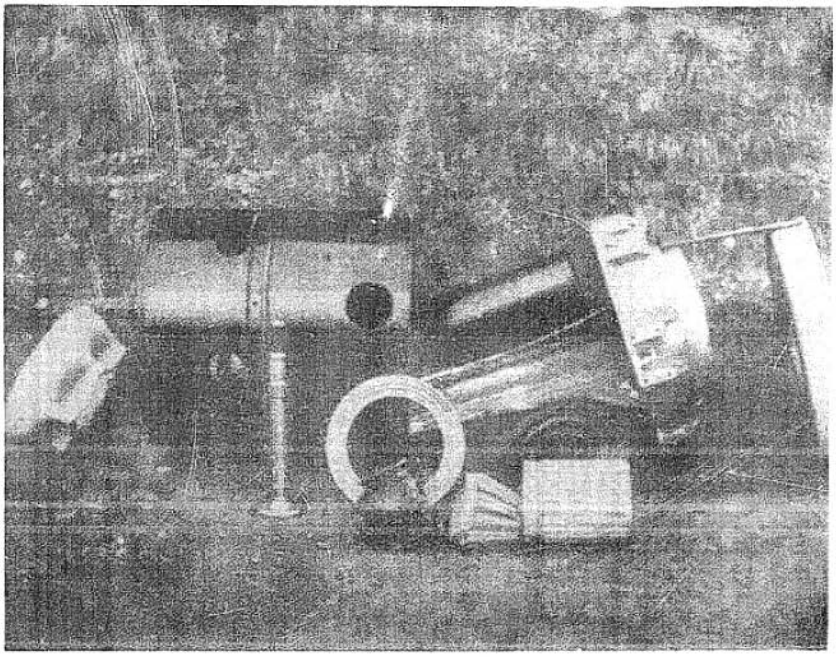


III. REPORT ON JUNKERS GAS TURBINE ACTIVITY AT STRASSBURG. INTERROGATIONS BY CIOS FIELD TEAM No.5.

1. Introduction.

The following employees of Junkers Motoren Werke, in the Matford factory at Strassburg, were interviewed at headquarters of U.S.S.T.A.F. A.T.1. 4 rue Octave Greard, Paris, on Thursday, January 18th by F/Lt. R.S. Sproule, M.A.P.

M. Bauer - in charge of procurement of material.
M. Mathis - engineer - draughtsman.
M. Siegrist - engineer.

2. Junkers Factories.

Information was given concerning Junkers dispersal factories in the Strassburg area as follows:-

Illkirch. In forest, mainly stores, but also machining and brazing turbine wheel. No furnace yet on hand. Considerable stocks of finished and unfinished material had been brought in. Visited by ALSOS.

Mutzig. - machining centre casting or "Turbinegehause". Visited by ALSOS.

Rothau. - machining turbine shafts. Visited by ALSOS.

Lutzelhausen. - hollow shaft and "Nadelantrieb" or bevel gear assembly for needle drive. Had about 400 machines for small parts.

Hasserode - were going to make centre casting, needle and combustion chamber envelope.

Benfeld - repairs to 211, 213 only.

Branch - Urbach - no activity, moved to Illkirch.

Wema - not known. (Alsos Report No.50)

The main factory in Strassburg (Junkers-Meinau) was not going to produce anything, but offices were still there.

These factories were in old textile mills and other requisitioned premises. All were still in the stage of studying production problems.

Only one sub contractor was named, OMEFA at Pfaffenhafen, who were to make all the sheet metal work, but had not yet started production. Had been visited by ALSOS and material photographed which was there for study of the manufacturing problems only.

Other Junkers factories named were:-

Muldenstein - source of all 203 parts received at Strassburg. One of the principal Junkers factories. Test beds for jet engines.

Nordhausen - the only known Junkers underground factory, under a hill in the Haase. Also a principal factory. Most work done by prisoners.

Prague - Very large, turbine activity unknown.

Zittan - only source of compressors. Also make all turbine parts. "Technical office."

Venusberg - probably governors and burners. (Near Chemnitz)

Zwickau - activity not specified.

Riesa - very large storage of 211 and 213 parts.

Dessau - Rumoured underground factory not confirmed. Head offices of Junkers Motoren Werke.

Location of Material and Literature.

The U.S.S.T.A.F. AT1 team collected, on orders from G2, SHAEF, T Sub division, one set of parts and drawings from a room in the Matford plant. These were sent to Farnborough and are now at Power Jets, Pyestock.

The ALSOS team collected 3 sets of parts and drawings, one for the U.S. Navy Department, one for Wright Field, and one for F'boro. These sets are all in transit, but the last two are both going to Wright Field.

Another jet pipe and turbine nozzle assembly, with other smaller parts, is at AT1, 4 Octave Gréard, Paris, marked for shipment to England.

Major Harry S. Barlerin, Economic Section, SHAEF, (from the 7th Army, it is believed) and Captain Hodge collected the most important part of the documentation. Whereabouts unknown.

Captain Mirles, of the French Air Ministry, 12 rue d'Aguessau, Paris, has the originals of most of the information collected by Major Barlerin, and possibly some more.

3. Technical Details

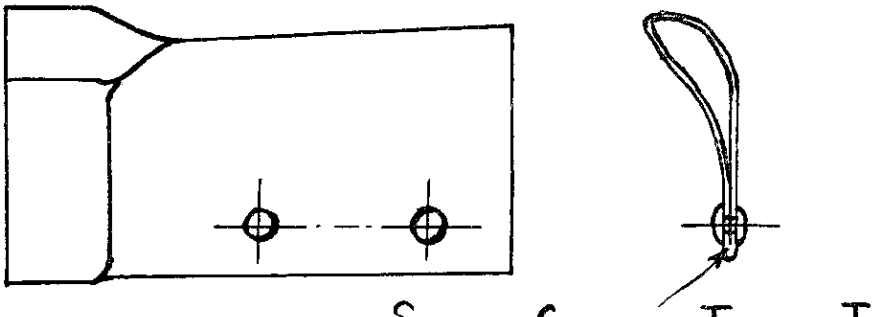
(a) Aluminizing of combustion and exhaust systems.

This is a standard aluminium spray with a pistol and aluminium wire, no treatment afterwards. Documentation in hands of Captain Mirles of French Air Ministry, also at M.A.P.

(b) Turbine Blades

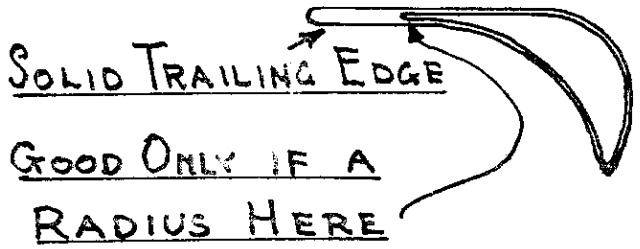
There was a belief that the hollow blades were inferior to the solid ones, although they save material.

Vibration troubles caused fatigue cracking at the trailing edge, as would be expected with the blades found at Strassburg, which have no internal radius. To change the frequency of vibration and to support the T.E. where cracking is expected, they were going to put two rivets, as shown by Sketch 1. M. Mathis did the detail drawings for this job.

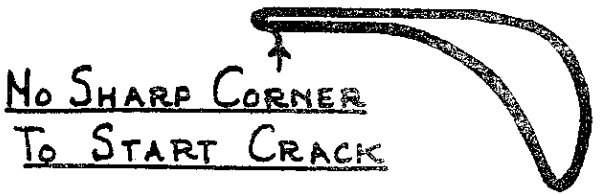


SKETCH 1

Mathis thought that they were developing a blade similar to the original trials by Prym, Sketch 2, but the finished blade found at Stalberg would appear to be a better solution, though the T.E. is very thick. Sketch 3.

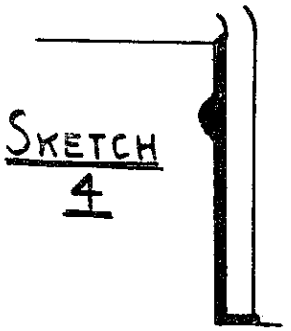


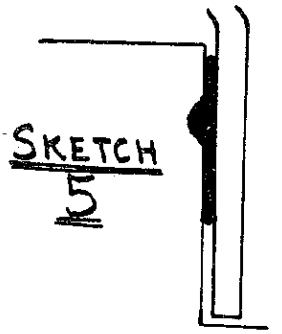
SKETCH 2



Sketch 3

Brazing of turbine blades is done in a gas heated furnace at 1050°C. The bladed wheel, with brazing wire in the grooves, is turned slowly in the furnace. The bronze is supposed to enter the crack by capillary action and make a complete joint as Sketch 4, but often results are as Sketch 5, the blade not being firmly fixed, and subject to excessive vibration.





Each blade is bowed with a violin bow after the brazing to detect blades not well fixed. This process is called prufenweisung, details are in papers taken by Major Barlerin.

Blades have come off in service, frequently according to what the Strassburg people had been told, both due to the brazing cracking after vibration and also due to the wheel getting too hot and melting the brazing.

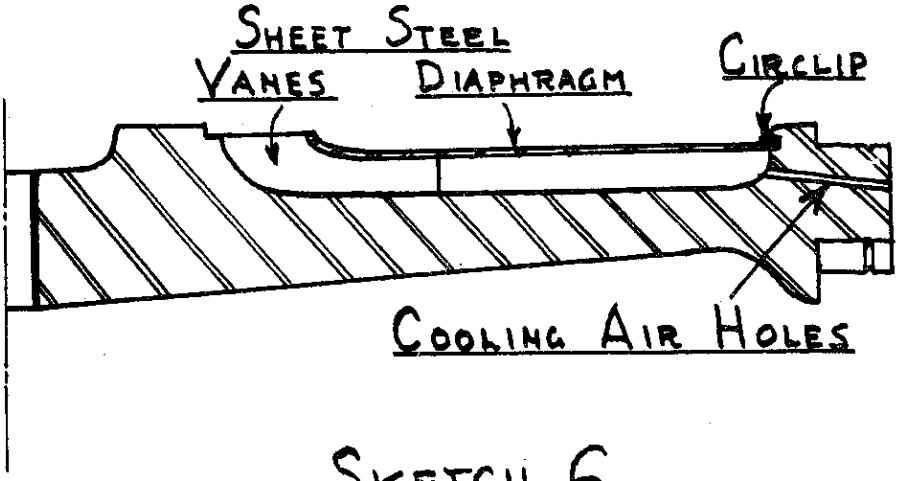
They believe the life of hollow blades so far has been only 24 hours, life being limited mainly by cracks in

trailing edge.

Experiments are still being done to determine the best clearance and the amount of brazing wire.

(c) Turbine Wheel Construction

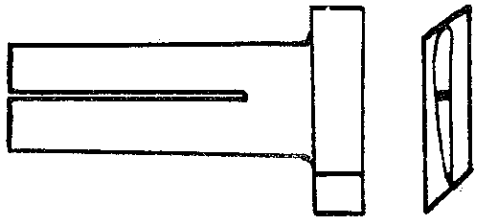
Air cooling of blades, through holes drilled in the stubs on turbine disc, is aided by a built in centrifugal compressor, arranged as shown by Sketch 6.



SKETCH 6

(d) Compressor Blades

The three men questioned knew little about the compressor, but Böttger had told them that there was trouble due to vibration, and the 1st, 3rd, 5th and 7th stages were to have a saw cut vertically down the blade, approximately as Sketch 7 in order to change the frequencies. Blades were machined by a steam turbine company whose name they had forgotten.



SKETCH 7

(e) Compressor Bearings

M. Mathis believes that the latest model compressor has roller bearings at both ends. He could not explain how the thrust is taken. The bearings have no inner race, the rollers rolling on the shaft. In this way the same bearing surface is used for dynamic balance, without having bearings which may be removed integral with the rotor.

(f) Proposed new materials

It is the policy of the Junkers firm to make development engines with the best material known, then to look for ersatz. A change-over to manganese steel turbine discs and "cromodur" blades was planned. The blades were to be welded to the disc.

(g) Speed of Rotation

The speed of units on test in September was believed to be 8,300 r.p.m. (Other evidence shows tests done at 8,700 on November 20th)

(h) Compressor Air Seal

The air seal after the last compressor stage is now on a face at right angles to the axis, instead of inclined as on early engines.

(i) Publications

All German aircraft material specification may be found in a book called Fliegwerkstoffnormen. Some of the American investigators and M. Du Merle of the Service Technique, 129 rue de la Convention, Paris (French MAP) have copies. The manganese steel disc proposed is 1310.5 following the number system used in this book, the figure after the period giving the heat treatment.

The specification of material now used in the disc is to be found in Junkers Normen 9, one of a series of

Junkers handbooks, which can be had at Steiners (a bookshop?) in Strassburg.

(j) Aircraft

The only aircraft of which they had heard using this engine was a single engined one of 4.5 meters span with variable angle wings. (They said variable through 90°). The pilot lies prone. Uses a cannon with range 2 - 3 km. Breaks off at 1 km. from bomber formation. Speed 1,200 km. per hour to be increased to 1,800! (750 to 1125 mph!) No value is to be attached to these rumours.

4. History of Junkers 203.

The men interviewed believe that the design originated with Campini (or another Italian source), was developed by Dr. Frantz of Junkers, Dessau and Wagner of Junkers, Magdeburg, into the Ju.004 B1 (which is the model recovered from crashed Me.262) and the chief brain behind it now is Böttger of Junkers, Muldenstein, though it is not clear when he came into the picture.

Model B2 had no changes, in the turbine end, that these men knew of, it was very short lived.

Model B3 was the first with hollow blades while B4 is the latest development, difference from B3 not specified.

The name was changed to Ju.203 mainly to bring it with the 200 series (211, 213 etc.) as camouflage.

5. Future Development

Machines for making turbine discs had to be ordered large enough to take a turbine 300 mm larger in diameter, but there is no other indication of the appearance of the larger model as yet.

6. Source of parts and materials.

All parts, finished, semi-finished and new, so far received had come from Junkers Muldenstein. In another week Bauer would have had the names of all the suppliers for their production programme, but now knows nothing. They say that the only source of large sheet steel stampings in Germany is Opel at Russelheim who have large presses not existent elsewhere. The sources of accessories were not yet known and they were not going to make compressors at Strassburg, but were to receive them complete. The Junkers factory at Zittau is the only factory making these compressors.

7. Destination of Finished Engines.

Engines when finished were to go to Muldenstein and Nordhausen. There had not as far been any provision for test stands at Strassburg so their impression that they were to assemble complete engines seems rather suspect. Siegrist heard the engines running on test at Muldenstein, but was not allowed to see the beds.

8. Official Production Programme.

After the bombing of 27th May, it was planned to start making the 004. The factory was dispersed, repairs were done to machinery and work started in July, 1944. The first pieces were received in October. The official programme was originally supposed to start with 20 complete engines in September, 1944, increasing steadily to 1,000 a month in July, 1945, at which level production was to continue indefinitely.

APPENDIX - PERSONALITIES

Some personalities of importance in the Junkers Motoren Werke Organization are the following:-

Cambeis - Dessau - General Manager
Langohr - Muldenstein - Director.
Baumseil - Magdeburg - sub contracts.
Mueller - " - chief engineer
Schunemann - " - planning production

Plath - Magdeburg
Hartmann - Magdeburg } High officials, well
Aurich - Köthen } versed on all engines
Hirsch - Köthen
Böttger - Muldenstein - Chief of Turbine construction (Nazi)
Wagner - Magdeburg - Turbine development
Dr. Franz - Dessau - " "

The following Germans were keymen at Strassburg.

Auerswald - Director General. Now at Altdorf.
Fassel - Politik man " " "
Frickinger- Controller " " "
Horst - Delegate of Speer " " "
concerned with quantity of production.
Jost - B.A.L. (or German A.I.D.) - quality of production
Rank of captain.
Steinmeier - Chief engineer and assistant director.
Best qualified technician.
Blumentritt - Factory police - Gestapo.
Grosse - Assistant director.
Nolte - under chief of "bureau d'etudes" or development section, and chief of Illkirch.
Meyer - chief of laboratory
Orth - Gestapo chief.

Alsatians still at Strassburg, it is believed, include,

Kuphal - chief of the "bureau d' ..udes" or development sections. (Worth interrogating).
Hautman } draughtsmen
Helfer }

Alsatians already interrogated.

Bauer - was in charge of procurement of materials. He was head of his department.
Siegrist - an engineer who had visited other junkers plants.
Mathis - eng.. er - draughtsman who detailed all the parts to be made in the Strassburg area.