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FLIGHT INVESTIGATION OF THE PERFORMANCE AND COOLING CHARACTERISTICS OF AN NACA C COWLING ON THE XP-42 AIRPLANE

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MEMORANDUM REPORT

for

Army Air Forces, Materiel Command

FLIGHT INVESTIGATION OF THE PERFORMANCE AND COOLING CHARACTERISTICS OF AN NACA C COWLING ON THE XP-42 AIRPLANE

By J. Ford Johnston and Stefan A. Cavallo

SUMMARY

Results are presented of high-speed and climb tests of an NACA C cowling on the XP-42 airplane. These tests were made for comparison with tests of NACA type D cowlings on the same airplane.

The top speed corresponding to the engine military power (1000 hp at 14,500 ft) was 336 miles per hour; the addition of Curtiss narrow-chord propeller cuffs increased this speed by 1 mile per hour; and the addition of cuffs and a 24-inch-diameter spinner increased the speed by 3 miles per hour.

Cooling-air-pressure recovery on the front of the engine in climb, at 140 miles per hour indicated airspeed, averaged 58 percent of airplane impact pressure with the spinner and cuffs, 68 percent with cuffs only, and 67 percent without spinner or cuffs. Corresponding pressure recoveries in full-throttle level flight were 69, 74, and 74 percent.

The ground cooling with spinner and cuffs was satisfactory. With cuffs only, spark-plug elbow temperatures exceeded their limit by 29° F after cut-off in the ground run.

Without cuffs or spinner, they exceeded their limit by 65° F, and the oil-in temperature also exceeded its limit.

INTRODUCTION

The NACA has conducted an extensive flight investigation, on the XP-42 airplane, of NACA type D cowlings for radial air-cooled engines. Tests of a long-nose high-inlet-velocity cowling have been reported in reference 1, those of a short-nose high-inlet-velocity cowling in references 2 and 3, and of a short-nose low-inlet-velocity cowling in references 4 and 5. In order to compare these cowlings with the conventional NACA C type now in general use, the flight investigation was extended to include tests of a C cowling, reported herein.

The conditions investigated with the C cowling included:

Test number	Airplane condition
17	C cowling with 24-inch spinner and narrow-chord propeller cuffs - climb
18	C cowling with 24-inch spinner and narrow-chord propeller cuffs - high speed
19	C cowling with cuffs only - high speed
20	C cowling with cuffs only - climb
21	C cowling without spinner or cuffs - climb
22	C cowling without spinner or cuffs - high speed

XP-42 AIRPLANE WITH C COWLING

The XP-42 airplane with its P. & W. 1830 engine was described in reference 2. The C cowl external shape (reference 6) was obtained by adding a lip to the D cowling of references 2, 3, 4, and 5. The internal changes consisted of removing the cowl inner liner and the afterbody of the spinner which together formed the diffuser section typical of the D cowling. A dimensioned drawing of the C cowl installation is given in figure 1. Figures 2 and 3 show the airplane with the spinner and cuffs; figures 4 and 5, with cuffs only; and figures 6 and 7, without spinner or cuffs.

The cuffs and spinner were manufactured by the Propeller Division of the Curtiss-Wright Corporation, and were of the standard design for the 10-foot-diameter Curtiss propeller, drawing number 512 cc 1.5.

The modified cowl flaps used in the tests of references 3, 4, and 5 are shown open in figures 2, 3, and 4, and closed in figures 6 and 7.

TEST APPARATUS

The installation of the test equipment was essentially the same as described in reference 2, with the exception that the three pressure survey rakes which had been installed in the annular diffuser section were moved to a position just forward of the front cylinder-valve push rods at the same

120° intervals around the engine. The left rake may be seen inside the cowling in figure 7.

PROCEDURE

The procedure followed in making the high-speed and climb tests is described in references 2 and 4. For each condition, the high speed was determined from two flights of five runs each. The climb tests for each condition consisted of one climb at 155 miles per hour indicated with the mixture control in automatic rich, and one at 140 miles per hour indicated in the full rich setting, in which the altitude compensator is bypassed.

The ground cooling was checked for each condition by a 10-minute run at 1400 rpm with the cowl flaps open and the propeller in the low-pitch position, followed by a 5-minute idling period. Temperatures were recorded during the runs and for approximately 10 minutes after cut-off.

RESULTS

The data obtained during the high-speed level-flight runs and during the climbs are presented in tables 1(a), 1(b), and 2. Time histories of the climbs are shown in figures 8, 9, and 10.

Analyses of the high-speed performance are given in figures 11 and 12. The observed cooling-air pressure distributions in the high-speed and climb conditions are shown in figures 13 and 14, and typical cylinder-head and barrel temperature distributions, in figures 15 through 18.

Time histories of the ground-cooling tests are presented in figures 19, 20, and 21.

Table 3 gives a comparison of the maximum speeds at military power and the average cooling-air-pressure recoveries with all the cowlings tested on the XP-42 airplane.

DISCUSSION

Maximum Speed

The values of maximum speed and power observed during the full-throttle level runs with each arrangement tested are shown on figure 11. The figure also includes the parameters $\left(\frac{bhp}{\sigma}\right)^{\frac{1}{3}}$, representative of the effective power, and $52.73\left(\frac{\eta}{C_D S}\right)^{\frac{1}{3}}$, representative of the airplane cleanness, as explained in references 1 and 2. The product of these two parameters is the speed of the airplane. The installation having the highest value of the latter parameter will evidently have the highest speed at a given power and altitude.

It was shown in reference 4 that the installation of the modified cowl flaps in the closed position caused an increase of form drag, resulting in a decrease of approximately two-thirds of 1 percent in the parameter $52.73\left(\frac{\eta}{C_D S}\right)^{\frac{1}{3}}$. This increase of drag is attributed to air leakage around the modified flaps and would not be present in a well-designed flap installation. Hence, for comparison with the results of previous tests with the original cowl flaps, it is desirable

to increase by two-thirds of 1 percent the values of speed and $52.73\left(\frac{\eta}{C_DS}\right)^{\frac{1}{3}}$ observed in the present tests. This correction of 2 miles per hour, while not shown on figure 11, has been incorporated in the data plotted on figure 12, which presents a comparison of the speeds obtained with the various cowling arrangements tested on the XP-42 airplane. Points corresponding to the official performance figures for similar airplanes with conventional air-cooled (P-36A) and liquid-cooled (P-40C) installations are also shown.

Examination of figure 12 shows that if in each case the engine had delivered its rated military power (1000 hp at 14,500 ft; $\frac{bhp}{\sigma} = 1564$), the speeds would have been as listed in table 3. As explained in reference 1, this figure may be used for comparing the speeds of various installations at the same power and altitude by movement of the test points along lines of constant $\frac{\eta}{C_DS}$ to a common value of $\frac{bhp}{\sigma}$. Such a comparison at the rated military power of the engine (1000 hp at 14,500 ft ; $\frac{bhp}{\sigma} = 1564$) is presented in table 3 for all the cowling arrangements tested on the XP-42 airplane.

Examination of table 3 shows that the speed with the C cowling was increased 1 mile per hour by the addition of cuffs and 3 miles per hour by the addition of cuffs and a spinner. It appears that an improvement in the external-flow conditions around the cowl nose was obtained by use of the spinner. The pressure recovery data listed in table 3 indicate

that the cuffs were not loaded in the high-speed condition. It is probable that the cuffs served to streamline the propeller shanks and thus to increase the propulsive efficiency.

It should be noted that the fairing material on the nose of the C cowling (see figs. 3, 5, and 7) was subjected to cracking under flight vibration. Although the fairing was smooth before each high-speed test, some cracks appeared during flight. These cracks would cause a premature transition from a laminar to a turbulent boundary layer and a consequent speed loss estimated at not over 1 mile per hour. No correction has been made for this possible source of drag.

Pressures and Temperatures

The average cooling-air pressures on the front of the engine in full-power level flight with each arrangement are listed in table 3. The pressure recovery at high speed averaged approximately $0.74q_c$ for either case without the spinner, and $0.69q_c$ with cuffs and spinner. Engine cooling-air pressure distributions for the three modifications are shown on figure 13 for the high-speed condition. The values plotted are the average over 10 runs for each location of pressure measurement. The pressures noted on the exhaust side of the barrel of cylinder 3 may be expected to be low because points of measurement lay in the wake of a large ~~ignition cable~~ conduit and next to a hole in the baffling.

The pressures as shown in figure 13 are reasonably uniform, but they are, in general, lower than would be expected from an open-nose cowling. The low inlet velocity in either case without the spinner would preclude any but negligible losses from the cowl entrance to the front of the engine. With the spinner, the inlet velocity ratio is estimated at very nearly 0.25, so that the q at inlet would be $0.06q_c$. An assumption that 90 percent of the inlet q is lost in turbulence due to the lack of a diffuser section behind the spinner leads to the conclusion that the impact pressure at the cowl entrance referred to free-stream static pressure must have been $0.69q_c + 0.05q_c = 0.74q_c$, or the same as that without the spinner.

It appears that about $0.26q_c$ becomes unavailable, as far as the internal pressure recovery is concerned, because of the presence of the propeller ahead of the cowling. Reference 7 shows that the pressure recovery of a model of a similar cowling (with air flow) was $0.97q$ without the propeller, $0.57q$ with a model propeller hub, and $0.62q$ with an operating propeller ahead of the cowling.

As listed in table 3, the pressure recovery on the front of the engine in full-power climb at 140 miles per hour was $0.58q_c$ with spinner and cuffs, $0.68q_c$ with cuffs only, and $0.67q_c$ without cuffs or spinner. Recoveries in climb at 155 miles per hour were the same or $0.01q_c$ higher. It is obvious from these data that the cuffs were ineffective

in climb. The loss due to the spinner was $0.10q_c$. This increased loss is associated with the increase in inlet-velocity ratio in climb as compared with the high-speed condition.

Typical pressure distributions in climb are shown on figure 14. It is noted that the highest pressures occurred on the lower left side of the engine (cylinders 8 to 12) as a result of high angle of attack, slipstream rotation, and the right yaw of the airplane associated with the full-power climb condition. This pressure gradient across the face of the engine is characteristic of the open-nose cowling. When the inlet velocity was increased by use of the spinner, the pressure distribution became more nearly uniform, as may be seen in figure 14. The dumping losses previously noted, however, reduced the general pressure level.

Typical distributions of the cylinder-head and barrel temperatures are shown in figure 15 for the high-speed condition, in figures 16 and 17 for two altitude ranges in the full-rich climb condition, and in figure 18 for the automatic-rich climb. These data have not been corrected to the same conditions, but runs made near the same altitude were selected for each comparison. It appears from these figures that variations in mixture strength and other factors from cylinder to cylinder obscure the effect of variations of cooling-air pressure drop around the engine. It is seen

that the temperature distributions are essentially similar in all cases. Comparison of figures 16 and 17 shows that the distribution becomes more uneven as the mixture strength increases with altitude in the full-rich climb.

Ground Cooling

Time histories of representative temperatures observed during the ground cooling runs are shown in figures 19, 20, and 21 for the cowling with spinner and cuffs, with cuffs only, and without spinner or cuffs.

In no case with spinner and cuffs did any of the temperatures become critical when corrected to Army standards. However, the oil-in temperature did come within 1° of its limit of 185° F.

In the test with cuffs only, corrected head and barrel temperatures stayed below their Army limits of 500° and 335° F, respectively, but were slightly higher than the spinner-and-cuff condition. The rear spark-plug elbow of cylinder number 7, which was the hottest elbow measured throughout the ground run, ran 29° over its Army limit of 248° F 7 minutes after cut-off.

Without cuffs or spinner, the temperatures of heads and bases were within their limits, but were noticeably higher than with the other two modifications. Spark-plug-elbow temperatures increased throughout the run until at cut-off they were 19° F over their limit and went to 65° F above the

critical temperature 8 minutes after cut-off. Oil-in temperatures also showed a steady increase, passing their critical, when corrected, $7\frac{1}{2}$ minutes after the start of the run and going to 24° F over in 16 minutes, which was the point of cut-off. The magneto operated within its limit throughout the run.

The large change in air temperatures ahead of and behind cylinder number 1, in each case, shows that the air flow reverses direction after the engine is stopped. The fact that in one case (fig. 21) the maximum front spark-plug elbow exceeded even the maximum rear gasket temperature 7 minutes after cut-off is regarded as further evidence of this forward air flow. Comparison of the air temperatures after cut-off in figures 19 and 20 shows that the spinner had no apparent tendency to trap the air in front of the engine.

The cuffs alone improved the ground cooling, and the addition of the spinner gave further improvement. The effect of the spinner was probably to prevent air leakage forward along the propeller shaft.

Langley Memorial Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., November 24, 1942.

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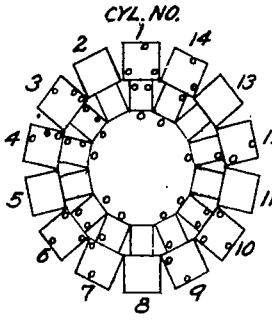
Table 1(a) Pressure Data (Sheet 1)

XP-42 AIRPLANE
C COWL
SPINNER & CUFFS

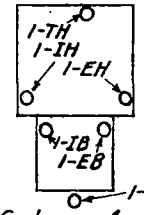
TEST NO.- FLT. NO.	18-5					18-6				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED, MPH	334	336	335	333	335	332	332	332	331	333
q_c, IN. H_2O	35.5	34.6	33.3	32.0	31.2	35.9	39.1	33.0	33.3	34.8
ATM. PRESS., IN. HG.	17.53	16.86	16.19	15.56	14.96	17.57	16.88	16.20	16.51	17.22
ATM. TEMP. °F	34	34	28	23	21	33	28	24	25	33
σ, DENSITY RATIO	.616	.592	.576	.559	.540	.618	.600	.581	.590	.606
DENSITY ALT., FT.	15650	16850	17700	18600	19600	15550	16850	17400	17000	16150
BHP	928	905	872	849	821	919	896	868	886	919
RPM	← 2680 →									
MANIF. PR., IN. HG.	40.7	39.1	37.8	36.4	35.3	40.5	39.3	37.5	38.4	39.8
	HIGH SPEED									

IND. AIRSPEED, MPH	17-4B 1	2	3	4	17-4A 1	2	3	4
IND. AIRSPEED, MPH	156	151	153	153	137	137	138	135
q_c	12.0	11.3	11.5	11.6	9.3	9.3	9.4	9.0
AV. PRESS. ALT.	4900	10000	15100	19000	5200	9900	15100	19000
AV. FREE AIR, °F	63	49	33	18	59	43	28	15
AV. BHP	860	880	820	710	870	900	740	620
AV. MANIF. PRESS.	40.0	39.0	36.0	30.9	42.0	42.0	35.0	30.0
RPM	← 2560 →				← 2540 →			
	AUTO RICH CLIMB				FULL RICH CLIMB			
	WITH SPINNER & CUFFS							

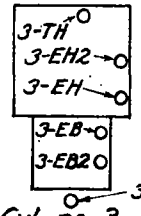
ENGINE PRESSURE TUBE LOCATIONS



METHOD OF DESIGNATING TUBE LOCATIONS FOR TYPICAL CYLINDERS



Cyl. no. 1



Cyl. no. 3

PRESSURE RATIO, p/q_c		18-5 1	2	3	4	5	18-6 1	2	3	4	5	17-4B 1	2	3	4	17-4A 1	2	3	4
1-R	SHELTERED TUBES BEHIND ENGINE	.26	.24	.24	.23	.23	.26	.26	.25	.25	.25	-.33	-.34	-.31	-.31	-.40	-.37	-.36	-.34
3-R		.26	.24	.24	.23	.23	.26	.26	.25	.26	.25	-.28	-.28	-.28	-.29	-.34	-.34	-.33	-.31
4-R		.25	.24	.23	.22	.22	.25	.25	.24	.25	.24	-.32	-.35	-.33	-.32	-.40	-.37	-.38	-.37
6-R		.28	.27	.26	.25	.25	.29	.28	.28	.28	.28	-.20	-.18	-.17	-.17	-.24	-.22	-.21	-.21
7-R		.28	.27	.27	.25	.25	.29	.29	.28	.28	.28	-.19	-.18	-.16	-.16	-.23	-.22	-.21	-.21
9-R		.29	.27	.27	.25	.26	.29	.29	.28	.28	.28	-.20	-.20	-.17	-.17	-.26	-.24	-.23	-.22
10-R		.29	.27	.27	.25	.26	.29	.29	.28	.28	.28	-.21	-.21	-.18	-.17	-.26	-.26	-.24	-.22
12-R		.26	.25	.25	.24	.23	.26	.26	.26	.26	.25	-.31	-.32	-.30	-.28	-.38	-.37	-.36	-.34
14-R		.26	.24	.24	.23	.23	.26	.26	.25	.25	.25	-.32	-.33	-.30	-.28	-.38	-.37	-.36	-.34
1-EB	EXHAUST SIDE OF BARREL	.67	.67	.67	.66	.66	.68	.68	.67	.67	.67	.50	.60	.67	.61	.65	.61	.65	.59
3-EB		.60	.60	.60	.59	.58	.67	.61	.60	.61	.60	.35	.35	.36	.40	.31	.32	.35	.48
4-EB		.71	.70	.69	.68	.68	.70	.69	.69	.70	.70	.44	.46	.48	.53	.45	.47	.50	.48
6-EB		.73	.72	.72	.71	.70	.73	.72	.72	.73	.72	.68	.70	.67	.72	.67	.70	.69	.68
7-EB		.71	.70	.69	.69	.69	.70	.71	.70	.72	.70	.64	.66	.64	.66	.67	.66	.67	.66
9-EB		.73	.73	.72	.72	.71	.73	.74	.73	.74	.73	.67	.68	.66	.68	.68	.68	.67	.68
10-EB		.72	.72	.71	.71	.70	.72	.72	.72	.72	.72	.67	.69	.67	.70	.66	.66	.68	.68
12-EB		.73	.73	.72	.71	.71	.72	.72	.71	.72	.72	.60	.60	.63	.63	.62	.59	.65	.63
14-EB		.74	.73	.73	.72	.71	.72	.72	.72	.72	.72	.60	.62	.63	.65	.61	.56	.61	.61
1-EH	EXHAUST SIDE OF HEAD	.74	.74	.73	.72	.72	.73	.73	.73	.73	.73	.58	.61	.60	.62	.59	.60	.60	.59
3-EH		.70	.69	.68	.68	.68	.69	.68	.68	.69	.69	.43	.46	.48	.50	.48	.45	.48	.44
4-EH		.73	.73	.71	.71	.71	.72	.71	.71	.72	.72	.55	.57	.57	.63	.51	.54	.55	.57
6-EH		.66	.64	.65	.65	.65	.66	.66	.65	.66	.65	.44	.50	.56	.55	.46	.56	.55	.54
7-EH		.73	.73	.72	.70	.71	.72	.72	.71	.72	.72	.60	.63	.65	.63	.63	.66	.68	.62
9-EH		.68	.68	.67	.66	.66	.68	.68	.67	.67	.67	.66	.64	.66	.62	.56	.55	.62	.66
10-EH		.68	.66	.66	.64	.64	.66	.66	.66	.66	.66	.56	.60	.60	.57	.54	.53	.56	.58
12-EH		.70	.70	.71	.68	.67	.70	.70	.70	.69	.69	.56	.61	.60	.59	.65	.68	.68	.76
14-EH		.72	.71	.71	.69	.68	.72	.70	.71	.70	.70	.67	.68	.66	.68	.64	.63	.65	.66
1-TH	TOP OF HEAD	.72	.71	.71	.69	.69	.71	.70	.70	.70	.70	.57	.66	.69	.66	.64	.61	.66	.62
3-TH		.72	.71	.71	.69	.69	.71	.70	.71	.71	.71	.54	.60	.63	.62	.56	.55	.64	.60
4-TH		.70	.70	.68	.67	.67	.69	.69	.69	.70	.68	.60	.60	.64	.62	.54	.60	.57	.60
6-TH		.67	.68	.66	.64	.65	.67	.66	.66	.66	.66	.58	.58	.62	.60	.55	.60	.61	.60
7-TH		.69	.69	.67	.67	.67	.68	.68	.68	.69	.68	.59	.59	.61	.59	.64	.65	.66	.61
9-TH		.70	.71	.71	.70	.69	.70	.70	.70	.70	.70	.63	.62	.68	.62	.62	.60	.66	.63
10-TH		.70	.70	.71	.70	.69	.69	.69	.69	.69	.68	.59	.60	.62	.60	.58	.58	.62	.62
12-TH		.70	.70	.71	.69	.69	.68	.69	.69	.69	.68	.62	.62	.62	.63	.62	.61	.64	.70
14-TH		.65	.65	.65	.65	.63	.66	.65	.64	.64	.67	.53	.54	.57	.57	.49	.53	.56	.53
1-IH	INTAKE SIDE OF CAR. HEAD	.73	.74	.73	.73	.71	.72	.72	.72	.73	.72	.60	.62	.66	.66	.60	.63	.64	.62
6-IH		.70	.69	.68	.69	.68	.68	.69	.68	.69	.68	.65	.61	.64	.64	.62	.65	.62	.62
10-IH		.75	.76	.75	.74	.73	.74	.74	.73	.74	.74	.72	.69	.74	.74	.69	.74	.74	.74
1-IB		.67	.67	.66	.66	.64	.67	.66	.67	.67	.66								
6-IB		.74	.74	.73	.73	.73	.73	.74	.73	.74	.72								
10-IB		.72	.73	.72	.72	.70	.72	.72	.72	.73	.71								
3-EH2		.63	.63	.63	.62	.61	.62	.62	.62	.61	.63	.27	.32	.35	.38	.32	.31	.33	.37
4-EH2		.70	.70	.69	.68	.68	.70	.69	.69	.70	.70	.42	.49	.55	.58	.46	.54	.53	.54
3-EB2		.54	.55	.55	.54	.54	.55	.55	.55	.55	.54	.23	.26	.29	.31	.23	.24	.23	.32
4-EB2		.60	.60	.60	.60	.60	.61	.61	.60	.63	.62	.36	.40	.39	.42	.24	.38	.42	[illegible]

NATIONAL ADVISORY
COMMITTEE FOR AERONAUTICS

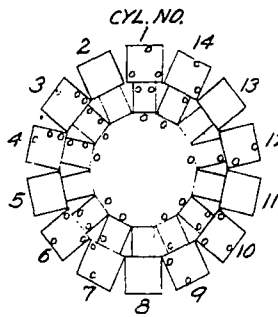
Table 1(a) Pressure Data (Sheet 2)

XP-42 AIRPLANE
C COWL
CUFFS ONLY

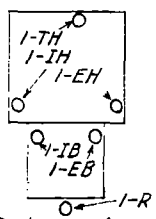
TEST NO.-FLT. NO.	19-1					19-2				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED, MPH.	332	331	332	330	330	331	331	331	332	334
q_c, IN. H_2O	35.0	33.7	32.8	31.4	30.3	34.0	33.0	31.7	30.8	33.9
ATM. PRESS. IN. HG.	17.48	16.83	16.16	15.51	14.90	16.89	16.22	15.59	14.94	16.53
ATM. TEMP. °F	33	30	27	21	18	26	23	23	20	27
σ, DENSITY RATIO	.616	.596	.576	.560	.541	.603	.583	.560	.540	.589
DENSITY ALT., FT.	15650	16700	17700	18500	19600	16500	17300	18500	19650	17050
BHP.	928	900	877	849	816	909	877	853	812	905
RPM	← 2680 →									
MAN. PRESS., IN. HG.	40.5	39.0	37.6	36.3	34.9	39.2	38.0	36.5	35.0	38.6
	HIGH SPEED, FULL THROTTLE									

	20-1				20-2			
	1	2	3	4	1	2	3	4
IND. AIRSPEED, MPH.	155	154	153	152	140	139	139	136
q_c	12.0	11.8	11.6	11.5	9.7	9.5	9.5	9.2
AV. PRESS. ALT.	3800	9100	13900	18900	3800	8800	14000	17800
AV. FREE AIR, °F	66	48	34	21	69	48	31	21
AV. BHP	870	900	840	750	930	930	780	660
AV. MAN. PRESS.	← 2580 →				← 2570 →			
RPM	AUTO. RICH CLIMB				FULL RICH CLIMB			
	WITH CUFFS, WITHOUT SPINNER							

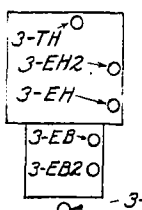
ENGINE PRESSURE TUBE LOCATIONS



METHOD OF DESIGNATING TUBE LOCATIONS FOR TYPICAL CYLINDERS



Cyl. no. 1



Cyl. no. 3

PRESSURE RATIO, p/q_c

		19-1 1	2	3	4	5	19-2 1	2	3	4	5	20-1 1	2	3	4	20-2 1	2	3	4
1-R	SHELTERED TUBES BEHIND ENGINE	.27	.26	.26	.25	.26	.27	.28	.26	.27	.27	-.34	-.34	-.35	-.34		-.42	-.42	-.40
3-R		.27	.26	.26	.25	.26	.27	.28	.26	.26	.26	-.31	-.33	-.32	-.32	-.35	-.37	-.40	-.36
4-R		.25	.26	.26	.24	.25	.27	.27	.26	.26	.26	-.35	-.38	-.37	-.36	-.40	-.44	-.43	-.40
6-R		.29	.28	.29	.28	.28	.29	.29	.28	.28	.29	-.19	-.21	-.20	-.21	-.23	-.24	-.29	-.22
7-R		.30	.29	.30	.28	.28	.30	.29	.28	.28	.28	-.18	-.19	-.20	-.21	-.23	-.25	-.29	-.22
9-R		.30	.29	.30	.28	.29	.31	.31	.30	.30	.29	-.18	-.21	-.20	-.19	-.23	-.24	-.29	-.27
10-R		.30	.29	.30	.28	.29	.31	.30	.29	.30	.29	-.21	-.21	-.22	-.21	-.26	-.27	-.28	-.28
12-R		.27	.27	.27	.26	.26	.28	.28	.27	.27	.28	-.30	-.33	-.32	-.32	-.38	-.40	-.40	-.38
14-R		.27	.26	.26	.25	.26	.27	.28	.26	.26	.27	-.32	-.34	-.34	-.34	-.38	-.40	-.42	-.38
1-EB	EXHAUST SIDE OF BARREL	.73	.72	.73	.71	.72	.72	.72	.71	.72	.74	.54	.58	.57	.58		.53	.50	.52
3-EB		.63	.63	.62	.63	.62	.63	.63	.62	.62	.64	.42	.41	.40	.45	.38	.38	.38	.44
4-EB		.73	.73	.73	.73	.73	.72	.72	.73	.72	.74	.66	.61	.63	.67	.59	.63	.63	.69
6-EB		.78	.78	.78	.78	.77	.77	.78	.77	.78	.78	.80	.78	.78	.76	.74	.78	.74	.77
7-EB		.76	.77	.75	.75	.77	.75	.75	.75	.76	.76	.75	.76	.72	.72	.74	.73	.70	.70
9-EB		.79	.79	.80	.78	.80	.78	.80	.78	.79	.78	.83	.80	.84	.82	.84	.82	.79	.81
10-EB		.78	.77	.78	.77	.78	.76	.78	.77	.78	.76	.83	.83	.82	.84	.84	.82	.82	.84
12-EB		.79	.77	.78	.76	.78	.77	.80	.77	.78	.78	.77	.79	.78	.76		.79	.76	.82
14-EB		.79	.80	.79	.78	.78	.79	.80	.78	.79	.79	.72	.73	.71	.72	.76	.68	.68	.70
1-EH	EXHAUST SIDE OF HEAD	.81	.80	.80	.79	.80	.81	.81	.80	.80	.80	.68	.69	.67	.70	.66	.65	.65	.67
3-EH		.70	.70	.70	.69	.70	.70	.70	.70	.69	.71	.50	.50	.50	.53	.50	.50	.49	.50
4-EH		.74	.75	.74	.75	.74	.74	.74	.73	.73	.76	.61	.60	.61	.66	.64	.64	.61	.65
6-EH		.70	.70	.71	.71	.71	.71	.72	.70	.70	.71	.66	.64	.67	.64	.68	.69	.61	.67
7-EH		.79	.78	.78	.78	.79	.78	.79	.79	.78	.78	.79	.79	.78	.84	.82	.78	.74	.79
9-EH		.76	.75	.76	.76	.76	.76	.77	.75	.75	.75	.74	.75	.74	.75		.75	.71	.74
10-EH		.76	.76	.76	.76	.76	.76	.77	.75	.76	.75	.78	.76	.78	.77	.81	.78	.73	.78
12-EH		.77	.77	.76	.76	.76	.77	.78	.76	.76	.75	.88	.87	.82	.85	.88	.87	.87	.87
14-EH		.79	.79	.78	.77	.79	.79	.80	.79	.78	.78	.73	.74	.72	.73	.76	.72	.73	.71
1-TH	TOP OF HEAD	.79	.79	.79	.77	.79	.79	.79	.79	.78	.79	.67	.66	.68	.67	.68	.64	.62	.66
3-TH		.75	.75	.75	.76	.75	.76	.76	.74	.74	.76	.62	.61	.60	.60	.58	.61	.60	.62
4-TH		.75	.75	.75	.74	.75	.76	.75	.74	.73	.75	.65	.65	.65	.65	.65	.66	.65	.65
6-TH		.74	.74	.74	.74	.75	.75	.74	.74	.72	.75	.69	.66	.70	.69	.67	.68	.62	.66
7-TH		.76	.75	.76	.75	.76	.76	.76	.75	.75	.75	.76	.73	.72	.75	.77	.74	.71	.74
9-TH		.80	.79	.79	.79	.80	.79	.80	.78	.79	.78	.85	.83	.82	.82		.85	.80	.80
10-TH		.80	.79	.79	.79	.79	.78	.80	.78	.80	.78	.81	.80	.82	.82	.84	.80	.76	.78
12-TH		.78	.77	.77	.76	.77	.77	.79	.77	.78	.76	.88	.87	.82	.83	.89	.87	.90	.87
14-TH		.73	.73	.73	.73	.73	.73	.74	.73	.73	.72	.62	.63	.63	.64	.61	.58	.55	.56
1-IH	INTAKE SIDE OF BAR. HEAD	.80	.79	.80	.80	.80	.79	.80	.79	.79	.79	.72	.72	.71	.69	.64	.65	.63	.65
6-IH		.77	.77	.76	.77	.77	.77	.76	.75	.74	.76	.78	.78	.75	.73	.79	.74	.72	.69
10-IH		.79	.79	.80	.78	.80	.79	.81	.78	.79	.77	.91	.90	.92	.89	.95	.94	.91	.90
1-IB		.73	.72	.73	.72	.73	.72	.73	.72	.72	.73	.54	.57	.56	.57		.52	.52	.53
6-IB		.79	.78	.78	.78	.79	.78	.79	.78	.79	.78	.80	.80	.80	.81	.84	.80	.77	.79
10-IB		.77	.77	.77	.78	.76	.76	.79	.77	.77	.75	.84	.83	.82	.83	.88	.85	.86	.87
3-EH2		.63	.63	.64	.63	.63	.63	.62	.63	.63	.64	.37	.38	.39	.41	.32	.37	.34	.40
4-EH2		.71	.72	.70	.71	.71	.72	.70	.71	.69	.72	.57	.58	.60	.58	.64	.61	.59	.59
3-EB2		.58	.58	.58	.58	.59	.58	.59	.58	.58	.58	.31	.31	.32	.34	.26	.26	.26	.29
4-EB2		.60	.61	.60	.61	.60	.59	.59	.60	.59	.61	.50	.46	.47	.51	.47	.52	.46	.52

NATIONAL ADVISORY
COMMITTEE FOR AERONAUTICS

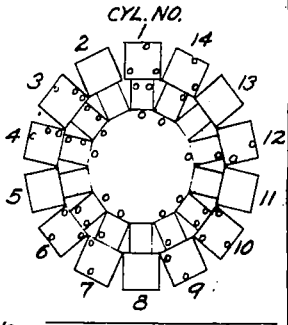
Table 1(a) Pressure Data (Sheet 3)

XP-42 AIRPLANE
C COWL
NO CUFFS OR SPINNER

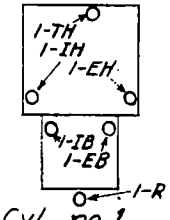
TEST NO. - FLT. NO.	22-1					22-2				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED, MPH.	331	331	331	330	330	329	329	330	330	327
q_c, IN. H_2O	34.6	33.7	32.3	31.0	30.3	33.9	32.8	31.9	30.8	29.2
ATM. PRESS. IN. HG.	17.23	16.54	15.90	15.27	14.66	17.16	16.47	15.84	15.19	14.60
ATM. TEMP. °F	28	23	23	19	13	28	26	23	21	19
σ; DENSITY RATIO	.616	.594	.571	.553	.538	.610	.588	.569	.548	.529
DENSITY ALT., FT.	15650	16750	17950	18900	19700	15950	17050	18050	19150	20200
BHP	928	900	877	840	816	919	891	863	830	793
RPM	← 2680 →									
MANIF. PR., IN. HG.	39.9	38.2	36.8	35.3	34.2	39.7	38.1	36.6	35.3	33.9
	HIGH SPEED									

IND. AIRSPEED, MPH.	21-1A				21-1B			
	1	2	3	4	1	2	3	4
q_c	155	153	154	153	139	138	136	135
AV. PRESS. ALT.	11.9	11.6	11.7	11.5	9.5	9.4	9.2	9.0
AV. FREE AIR, °F	4200	8900	14200	17800	3900	9700	13800	17700
AV. BHP	52	49	37	23	53	51	36	20
AV. MAN. PRESS.	930	930	840	760	1000	940	790	680
RPM	39.8	40.0	36.1	31.8	43.0	42.0	36.0	30.8
	← 2560 →				← 2540 →			
	AUTO. RICH CLIMB				FULL RICH CLIMB			
	NO SPINNER OR CUFFS							

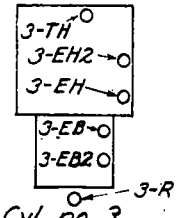
ENGINE PRESSURE TUBE LOCATIONS



METHOD OF DESIGNATING TUBE LOCATIONS FOR TYPICAL CYLINDERS



Cyl. no. 1



Cyl. no. 3

	PRESSURE RATIO, P/q_c																			
1-R	.22	.22	.23	.22	.22	.25	.26	.24	.23	.25	-.38	-.38	-.35	-.36	-.45	-.45	-.40	-.46
3-R	.22	.22	.23	.22	.22	.24	.26	.24	.23	.25	-.33	-.34	-.31	-.33	-.41	-.41	-.36	-.41
4-R	.20	.20	.21	.21	.20	.23	.25	.22	.23	.24	-.40	-.40	-.36	-.38	-.45	-.45	-.40	-.46
6-R	.25	.26	.26	.26	.26	.29	.30	.28	.27	.29	-.23	-.21	-.20	-.23	-.28	-.29	-.23	-.31
7-R	.25	.26	.26	.26	.25	.29	.30	.28	.27	.29	-.24	-.21	-.20	-.20	-.28	-.26	-.23	-.27
9-R	.26	.26	.27	.26	.26	.29	.31	.28	.28	.30	-.22	-.22	-.18	-.20	-.28	-.26	-.21	-.25
10-R	.26	.26	.27	.26	.26	.29	.30	.28	.27	.30	-.25	-.24	-.22	-.24	-.32	-.30	-.23	-.27
12-R	.23	.23	.24	.23	.23	.26	.27	.25	.24	.26	-.35	-.34	-.33	-.34	-.44	-.41	-.36	-.41
14-R	.22	.22	.23	.22	.22	.25	.26	.24	.24	.25	-.36	-.36	-.33	-.36	-.43	-.43	-.38	-.43
(SHELTERED TUBES BEHIND ENGINE)																		
1-EB	.72	.72	.72	.72	.72	.73	.73	.72	.73	.73	.52	.58	.56	.56	.49	.52	.54	.53
3-EB	.61	.62	.62	.61	.62	.62	.63	.61	.63	.63	.43	.43	.46	.45	.40	.39	.45	.41
4-EB	.71	.73	.74	.72	.73	.73	.74	.72	.74	.73	.67	.68	.71	.70	.66	.71	.70	.66
6-EB	.76	.76	.78	.77	.77	.77	.79	.77	.78	.79	.74	.75	.78	.77	.73	.74	.79	.75
7-EB	.75	.75	.76	.76	.76	.76	.78	.76	.74	.78	.68	.71	.72	.70	.70	.72	.72	.71
9-EB	.78	.79	.79	.79	.78	.79	.81	.80	.79	.81	.75	.77	.81	.78	.75	.80	.82	.79
10-EB	.77	.76	.77	.77	.77	.77	.79	.78	.78	.78	.77	.75	.78	.76	.81	.79	.84	.79
12-EB	.78	.79	.79	.78	.78	.79	.80	.79	.79	.80	.67	.65	.70	.69	.70	.73	.77	.74
14-EB	.80	.79	.80	.78	.78	.80	.80	.80	.80	.80	.66	.66	.69	.69	.58	.68	.67	.67
(EXHAUST SIDE OF BARREL)																		
1-EH	.80	.80	.81	.80	.79	.80	.82	.80	.81	.80	.64	.65	.69	.68	.58	.63	.65	.64
3-EH	.68	.69	.69	.69	.70	.69	.70	.70	.70	.69	.54	.55	.57	.55	.45	.51	.53	.50
4-EH	.73	.74	.75	.73	.73	.74	.75	.73	.74	.74	.65	.68	.71	.70	.61	.65	.67	.64
6-EH	.71	.72	.72	.72	.72	.72	.73	.72	.72	.73	.60	.62	.65	.60	.59	.64	.63	.60
7-EH	.77	.78	.78	.76	.78	.78	.80	.79	.79	.79	.75	.76	.79	.75	.72	.77	.77	.77
9-EH	.75	.76	.75	.74	.75	.76	.78	.76	.76	.77	.68	.68	.74	.74	.65	.67	.72	.71
10-EH	.76	.75	.76	.75	.75	.73	.78	.76	.76	.78	.71	.70	.76	.76	.69	.71	.74	.71
12-EH	.78	.77	.78	.77	.77	.79	.79	.77	.78	.79	.72	.69	.74	.75	.78	.79	.80	.82
14-EH	.78	.79	.80	.79	.78	.80	.81	.80	.80	.80	.66	.66	.70	.70	.65	.67	.68	.66
(EXHAUST SIDE OF HEAD)																		
1-TH	.78	.80	.80	.79	.79	.81	.82	.81	.81	.81	.66	.64	.70	.69	.63	.64	.64	.61
3-TH	.74	.75	.76	.74	.75	.75	.76	.74	.75	.76	.66	.70	.72	.69	.63	.67	.64	.63
4-TH	.75	.76	.76	.75	.75	.75	.78	.74	.76	.77	.68	.70	.76	.74	.67	.70	.72	.68
6-TH	.75	.75	.76	.75	.75	.76	.77	.76	.76	.77	.69	.70	.76	.73	.68	.72	.72	.68
7-TH	.76	.76	.76	.75	.76	.76	.78	.76	.76	.77	.70	.73	.76	.74	.69	.71	.74	.71
9-TH	.79	.79	.79	.79	.80	.80	.80	.79	.81	.81	.76	.76	.80	.80	.73	.76	.80	.78
10-TH	.82	.78	.80	.79	.78	.80	.80	.78	.80	.82	.76	.77	.80	.80	.73	.75	.78	.78
12-TH	.78	.78	.79	.78	.78	.80	.80	.78	.80	.80	.75	.72	.76	.76	.73	.76	.80	.80
14-TH	.73	.74	.75	.74	.74	.75	.76	.76	.76	.75	.57	.56	.61	.61	.55	.55	.63	.62
(TOP OF HEAD)																		
1-IH	.79	.79	.80	.79	.78	.80	.80	.80	.80	.80	.69	.67	.72	.69	.62	.66	.67	.66
6-IH	.76	.75	.76	.77	.76	.76	.77	.77	.76	.78	.74	.77	.80	.78	.74	.76	.78	.74
10-IH	.78	.78	.78	.79	.78	.80	.80	.78	.80	.81	.79	.79	.84	.81	.80	.85	.86	.82
(INTAKE SIDE OF BARREL HEAD)																		
1-IB	.71	.72	.73	.72	.72	.72	.74	.72	.73	.72	.53	.53	.57	.56	.46	.50	.54	.51
6-IB	.78	.75	.79	.78	.76	.78	.80	.78	.78	.79	.74	.76	.77	.76	.74	.78	.77	.74
10-IB	.76	.76	.76	.76	.76	.77	.78	.76	.77	.79	.74	.73	.77	.75	.74	.77	.79	.77
3-EH2	.61	.62	.62	.62	.62	.62	.63	.62	.64	.62	.40	.43	.44	.44	.34	.42	.38	.35
4-EH2	.71	.72	.72	.72	–	.71	.73	.72	.71	.72	.63	.64	.66	.63	.57	.61	.61	.60
3-EB2	.56	.56	.57	.56	.56	.57	.58	.57	.58	.59	.29	.33	.35	.33	.22	.27	.29	.31
4-EB2	.57	.59	.61	.59	.60	.60	.60	.61	.61	.60	.43	.52	.56	.56	.46	.50	.48	.43

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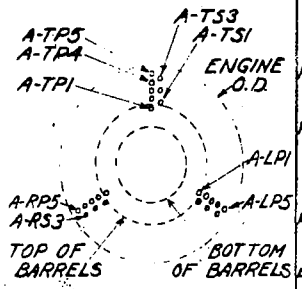
Table 1(b) Pressure Data (Sheet 1)

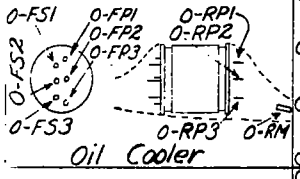
XP-42 AIRPLANE
C COWL
SPINNER & CUFFS

TEST NO.- FLT NO.	18-5					18-6				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED	334	336	335	333	335	332	332	332	331	333
q_c, INCHES H_2O	35.5	34.6	33.3	32.0	31.2	35.3	34.1	33.0	33.3	34.8
ATM. PRESS IN. HG	17.53	16.86	16.19	15.56	14.96	17.57	16.88	16.20	16.51	17.22
ATM TEMP °F	34	34	28	23	21	33	28	24	25	33
σ, DENSITY RATIO	.616	.592	.576	.559	.540	.619	.600	.581	.590	.606
DENSITY ALT., FT.	15650	16850	17700	18600	19600	15550	16450	17400	17000	16150
BHP	928	905	872	849	821	919	896	868	886	919
RPM	2680									
MANIF. PR., IN HG	40.7	39.1	37.8	36.4	35.3	40.5	39.3	37.5	38.4	39.8
	HIGH SPEED									

IND. AIRSPEED, MPH	17-4B 1	2	3	4	17-4A 1	2	3	4
	156	151	153	153	137	137	138	135
q_c	12.0	11.3	11.5	11.6	9.3	9.3	9.4	9.0
AV. PRESS. ALT.	4900	10000	15100	19000	5200	9900	15100	19000
AV. FREE AIR, °F	63	49	33	18	59	43	28	15
AV. BHP	860	880	820	710	870	900	740	620
AV. MANIF. PRESS.	40.0	39.0	36.0	30.9	42.0	42.0	35.0	30.0
R.P.M.	2560				2540			
	AUTO RICH CLIMB				FULL RICH CLIMB			
	SPINNER AND CUFFS							

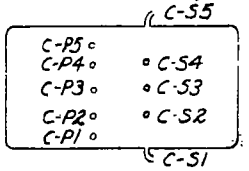


Survey Ahead of Engine



Oil Cooler

Carburetor Scoop



PRESSURE RATIO P/q_c

A-TP1	.65	.66	.64	.63	.63	.66	.65	.65	.65	.65	.52	.52	.54	.54	.52	.55	.52	.56
2	.65	.64	.64	.63	.62	.65	.64	.64	.65	.64	.51	.52	.52	.53	.48	.53	.52	.53
3	.64	.63	.62	.62	.62	.65	.63	.63	.61	.63	.50	.56	.57	.58	.56	.55	.53	.52
4	.69	.70	.69	.69	.67	.72	.71	.70	.71	.70	.65	.65	.67	.65	.71	.69	.66	.69
5	.77	.78	.77	.76	.75	.76	.77	.76	.77	.78	.67	.65	.70	.65	.65	.69	.68	.69
A-TS1	.67	.61	.64	.64	.62	.65	.64	.64	.64	.64								
2	.67	.64	.64	.62	.62	.65	.64	.64	.64	.63								
3	.63	.63	.61	.61	.60	.63	.62	.62	.62	.62	.44	.51	.52	.53	.48	.49	.48	.49
A-RP1	.72	.71	.69	.69	.68	.70	.71	.69	.71	.70	.67	.72	.68	.68	.63	.65	.71	.70
2	.70	.68	.68	.68	.67	.70	.70	.69	.70	.69	.62	.69	.63	.67	.59	.65	.66	.66
3	.66	.64	.64	.63	.63	.66	.65	.64	.65	.65	.47	.51	.54	.55	.48	.50	.51	.52
4	.69	.68	.68	.67	.66	.68	.68	.67	.67	.67	.60	.60	.63	.63	.62	.60	.63	.64
5	.66	.65	.66	.64	.63	.66	.66	.64	.65	.65	.53	.53	.53	.68	.50	.50	.49	.52
A-RS1	.65	.64	.64	.62	.62	.64	.64	.64	.64	.62								
2	.63	.64	.62	.62	.61	.62	.63	.62	.63	.62								
3	.65	.64	.63	.63	.62	.65	.64	.64	.65	.64	.42	.50	.52	.53	.45	.49	.50	.49
A-LP1	.70	.70	.69	.69	.68	.70	.70	.69	.69	.70	.69	.71	.72	.72	.70	.65	.69	.69
2	.72	.71	.71	.71	.68	.72	.72	.71	.72	.71	.63	.70	.68	.73	.64	.65	.67	.68
3	.69	.70	.68	.68	.67	.69	.68	.67	.68	.67	.51	.55	.57	.58	.50	.52	.51	.52
4	.65	.64	.64	.63	.62	.65	.65	.64	.64	.61	.51	.53	.52	.60	.53	.50	.49	.50
5	.68	.67	.66	.66	.65	.67	.67	.67	.67	.66	.52	.55	.54	.54	.52	.52	.51	.54
A-LS1	.64	.64	.64	.62	.62	.64	.64	.64	.64	.62								
2	.62	.62	.62	.62	.61	.62	.62	.61	.62	.62								
3	.65	.65	.63	.63	.62	.66	.64	.65	.65	.65	.48	.50	.54	.53	.44	.51	.50	.51
O-FP1	.85	.86	.84	.85	.84	.85	.86	.85	.87	.84	.99	.96	.94	.89	1.07	.99	1.02	1.00
2	.90	.92	.91	.91	.91	.91	.92	.92	.92	.91	1.03	1.02	1.00	.96	1.16	1.06	1.04	1.01
3	.98	.96	.95	.94	.95	.96	.97	.96	.97	.95	1.02	1.04	1.01	.96	1.09	1.10	1.04	1.04
O-FS1	.80	.79	.80	.79	.78	.81	.81	.81	.81	.80	.73	.82	.83	.79	.88	.87	.84	.86
2	.80	.80	.80	.80	.79	.81	.83	.81	.82	.81	.79	.83	.84	.79	.87	.87	.85	.86
3	.84	.84	.83	.83	.82	.84	.84	.81	.84	.83	.82	.82	.82	.79	.92	.89	.82	.86
O-RP1	.60	.60	.58	.58	.57	.60	.60	.58	.59	.59	.37	.38	.36	.36	.44	.39	.43	.36
2	.52	.54	.53	.53	.52	.55	.55	.54	.55	.53	.22	.25	.27	.26	.30	.30	.28	.27
3	.71	.70	.69	.68	.67	.71	.70	.69	.71	.70	.63	.61	.62	.56	.65	.65	.64	.60
O-SP	.51	.51	.51	.50	.49	.52	.52	.52	.51	.51	.22	.23	.24	.22	.30	.27	.25	.23
C-P1	.89	.88	.90	.87	.85	.90	.90	.88	.89	.89	.93	.87	.89	.88	1.03	.86	.88	.88
2	.91	.91	.92	.89	.88	.91	.90	.92	.92	.92	1.00	.92	.97	.91	1.08	.91	.96	.94
3	.94	.92	.92	.92	.93	.94	.94	.94	.95	.92	1.00	1.03	1.01	.94	1.14	1.01	.99	.98
4	.97	.94	.94	.95	.94	.95	.96	.96	.96	.94	1.02	1.08	1.07	1.00	1.18	1.12	1.03	1.07
5	.97	.94	.94	.94	.94	.96	.96	.96	.96	.94	1.12	1.13	1.06	1.04	1.18	1.14	1.11	1.09
C-S1	.73	.73	.72	.72	.71	.72	.72	.73	.73	.73	.71	.58	.56	.57	.64	.41	.43	.48
2	.72	.70	.71	.70	.69	.71	.70	.71	.71	.71	.65	.56	.53	.55	.59	.33	.40	.43
3	.69	.69	.69	.68	.69	.70	.70	.70	.70	.71	.57	.62	.62	.58	.62	.32	.39	.42
4	.69	.68	.69	.68	.69	.69	.70	.70	.70	.70	.55	.61	.62	.56	.61	.32	.39	.42
5	.69	.69	.68	.68	.68	.69	.69	.69	.70	.69								
C-TH IMPACT PRESS IN CARB	.72	.74	.75	.73	.72	.74	.73	.73	.74	.74	.72	.54	.58	.57	.67	.37	.48	.51

TOP SURVEY RAKE: A-TP1–5 IMPACT TUBE; A-TS1–3 STATIC TUBE
RIGHT SURVEY: A-RP1–5 IMPACT TUBE; A-RS1–3 STATIC TUBE
LEFT SURVEY: A-LP1–5 IMPACT TUBE; A-LS1–3 STATIC TUBE
FRONT SURVEY: O-FP1–3 IMPACT TUBES; O-FS1–3 STATIC TUBES
REAR SURVEY: O-RP1–3 IMPACT TUBES; O-SP
C-P1–5 IMPACT TUBES; C-S1–5 STATIC TUBES

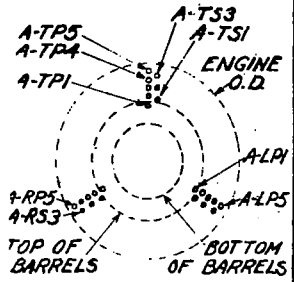
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

XP-42 AIRPLANE
C COWL
CUFFS ONLY

TABLE I(b) PRESSURE DATA (SHEET 2)

TEST NO. — FLT. NO.	19-1					19-2					20-1				20-2			
RUN NO.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4
TRUE AIRSPEED	332	331	332	330	330	331	331	331	332	334	155	154	153	152	140	139	139	136
q_c, INCHES H_2O	35.0	33.7	32.8	31.4	30.3	34.0	33.0	31.7	30.8	33.9	12.0	11.8	11.6	11.5	9.7	9.5	9.5	9.2
ATM. PRESS. IN. HG	17.48	16.83	16.16	15.51	14.90	16.89	16.22	15.59	14.94	16.53	3800	9100	13900	18900	3800	8800	14000	17800
ATM. TEMP °F	33	30	27	21	18	26	23	23	20	27	66	48	34	21	69	48	31	21
σ, DENSITY RATIO	.616	.596	.576	.560	.541	.603	.583	.560	.540	.589	870	900	840	750	930	930	780	660
DENSITY ALT., FT	15650	16700	17700	18500	19600	16500	17300	18500	19650	17050								
BHP	928	900	877	849	816	909	877	853	812	905								
RPM	2680										2580				2570			
MANIF. PR. IN HG	40.5	39.0	37.6	36.3	34.9	39.2	38.0	36.5	35.0	38.6								
		HIGH SPEED					HIGH SPEED				AUTO RICH CLIMB CUFFS ONLY				FULL RICH CLIMB			

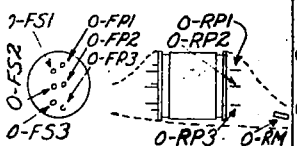
IND. AIRSPEED, MPH
q_c
AV. PRESS. ALT
AV. FREE AIR, °F
AV. BHP
AV. MANIF. PRESS
R.P.M.



Survey Ahead of Engine

PRESSURE RATIO P/q_c

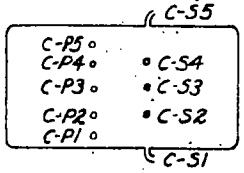
A-TP1	TOP SURVEY RAKE (STATIC IMPACT TUBES)	.75	.75	.75	.74	.75	.74	.75	.74	.74	.75		.63	.65	.66	.67	.62	.64	.64	.65
2		.76	.74	.74	.74	.74	.74	.75	.74	.74	.73		.66	.65	.66	.67	.64	.62	.66	.67
3		.78	.77	.78	.76	.76	.77	.78	.77	.78	.78		.72	.70	.69	.72	.68	.68	.65	.65
4		.82	.81	.80	.80	.80	.81	.81	.80	.80	.81		.68	.68	.67	.66	.64	.63	.60	.65
5		.76	.79	.79	.78	.78	.79	.80	.78	.79	.81		.73	.61	.63	.66	.58	.57	.61	.64
A-TS1		.73	.73	.73	.72	.73	.72	.75	.73	.73	.73		.62	.63	.63	.66	.59	.60	.61	.61
2		.74	.74	.74	.73	.73	.74	.75	.74	.74	.74		.60	.61	.63	.61	.57	.57	.59	.59
3		.74	.73	.73	.72	.73	.73	.72	.72	.73	.73		.66	.63	.66	.67	.64	.63	.64	.66
A-RP1	RIGHT SURVEY (STATIC IMPACT TUBES)	.75	.75	.75	.75	.75	.76	.75	.74	.74	.76		.74	.72	.73	.78		.76	.77	.80
2		.74	.75	.73	.74	.73	.74	.73	.73	.73	.75		.70	.70	.72	.74	.70	.73	.73	.76
3		.75	.75	.75	.75	.75	.76	.75	.74	.74	.75		.68	.66	.66	.64	.66	.65	.67	.66
4		.75	.75	.75	.75	.75	.76	.75	.74	.74	.75		.71	.72	.71	.72		.70	.72	.73
5		.75	.75	.75	.74	.75	.76	.75	.75	.74	.76		.66	.67	.66	.70	.67	.66	.68	.67
A-RS1		.73	.72	.73	.72	.73	.72	.72	.72	.72	.73		.66	.61	.63	.66	.58	.59	.58	.63
2		.73	.74	.73	.73	.73	.73	.73	.73	.72	.73		.60	.60	.63	.62	.57	.57	.55	.60
3		.77	.75	.75	.75	.75	.75	.75	.74	.74	.75		.67	.65	.66	.66	.65	.63	.65	.67
A-LP1	LEFT SURVEY (STATIC IMPACT TUBES)	.74	.75	.76	.75	.76	.76	.77	.75	.77	.75		.79	.81	.81	.81	.83	.82	.83	.85
2		.73	.75	.77	.75	.78	.76	.77	.76	.72	.76		.78	.83	.83	.84	.88	.89	.89	.91
3		.77	.77	.77	.75	.76	.76	.75	.76	.77	.75		.75	.74	.76	.72	.74	.73	.73	.74
4		.77	.75	.76	.75	.76	.76	.75	.76	.77	.76		.69	.69	.69	.68	.70	.69	.68	.67
5		.78	.77	.78	.76	.78	.77	.79	.77	.78	.76		.75	.72	.72	.73	.72	.74	.74	.72
A-LS1		.75	.75	.75	.74	.73	.74	.75	.74	.75	.74		.68	.66	.66	.65	.64	.67	.63	.65
2		.75	.74	.73	.73	.74	.74	.75	.74	.74	.73		.66	.64	.65	.66	.61	.59	.60	.63
3		.75	.75	.74	.74	.75	.74	.75	.74	.74	.74		.63	.68	.70	.66	.69	.70	.70	.71



Oil Cooler

O-FP1	FRONT SURVEY (STATIC IMPACT TUBES)	.86	.86	.86	.87	.87	.85	.87	.86	.86	.85		1.05	1.05	1.20	1.09		1.09	1.10	1.12
2		.92	.91	.93	.93	.94	.94	.94	.92	.93	.92		1.15	1.14	1.12	1.13	1.28	1.23	1.15	1.16
3		.98	.98	.98	.98	.98	.97	.99	.98	.98	.98		1.17	1.14	1.12	1.13	1.23	1.22	1.17	1.15
O-FS1		.78	.79	.78	.80	.79	.78	.78	.76	.79	.76									
2		.82	.82	.82	.81	.84	.82	.82	.80	.82	.81		.95	.90	.91	.87	1.01	.98	.95	.94
3		.85	.85	.86	.85	.87	.85	.85	.85	.84	.84		.91	.93	.91	.90	1.01	.98	.94	.96
O-RP1	REAR SURVEY (STATIC IMPACT TUBES)	.59	.58	.59	.58	.59	.59	.59	.59	.59	.58		.45	.42	.40	.40	.48	.47	.40	.43
2		.54	.54	.54	.54	.55	.54	.55	.53	.55	.54		.31	.29	.28	.26	.36	.34	.32	.32
3		.70	.70	.70	.69	.71	.71	.70	.70	.70	.70		.71	.67	.65	.60	.74	.73	.66	.63
O-SP		.52	.50	.51	.51	.52	.51	.52	.51	.51	.50		.27	.26	.23	.25	.32	.28	.28	.30

Carburetor Scoop



C-P1	IMPACT TUBES	.91	.90	.90	.88	.89	.89	.89	.88	.87	.89		.89	.84	.79	.74	.83	.61	.64	.68
2		.93	.92	.92	.91	.92	.93	.92	.92	.91	.93		.93	.90	.85	.86		.71	.75	.73
3		.96	.95	.94	.94	.94	.96	.95	.94	.94	.96		.97	.92	.91	.88	.98	.86	.85	.83
4		.97	.98	.97	.98	.96	.98	.98	.96	.97	.98		1.07	1.00	.97	.94	1.03	.97	.94	.88
5		.97	.98	.97	.98	.96	.98	.98	.98	.98	.98		1.07	1.00	.97	.96	1.07	.99	.94	.92
C-S1	STATIC TUBES	.75	.76	.75	.75	.75	.75	.76	.74	.75	.75		.66	.47	.41	.44	.39	.20	.24	.31
2		.73	.74	.74	.73	.73	.74	.75	.73	.74	.74		.60	.42	.38	.44	.39	.13	.18	.25
3		.71	.72	.73	.71	.72	.72	.73	.72	.72	.73		.60	.44	.39	.44	.41	.15	.18	.23
4		.71	.72	.72	.71	.71	.73	.73	.72	.72	.73		.61	.50	.39	.42	.38	.14	.21	.23
5		.71	.71	.71	.70	.71	.73	.73	.72	.71	.72		.60	.44	.35	.40	.38	.16	.20	.23
C-TH IMPACT PRESS. IN CARD		.77	.76	.77	.76	.76	.76	.77	.77	.75	.77		.68	.52	.43	.47		.18	.30	.34

NATIONAL ADVISORY
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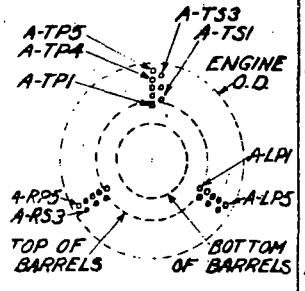
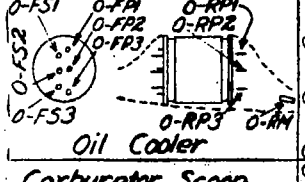
XP-42 AIRPLANE
C COWL
NO CUFFS OR SPINNER

TABLE 1(b) PRESSURE DATA (SHEET 3)

TEST NO. - FLT. NO.	22-1					22-2					21-1A				21-1B			
RUN NO	1	2	3	4	5	1	2	3	4	5	1	2	3	4	1	2	3	4
TRUE AIRSPEED	331	331	331	330	330	329	329	330	330	327								
q_c, INCHES H_2O	34.6	33.7	32.3	31.0	30.3	33.9	32.8	31.9	30.8	29.2								
ATM. PRESS. IN. HG	17.23	16.54	15.90	15.27	14.66	17.16	16.47	15.84	15.19	14.60								
ATM TEMP °F	28	23	23	19	13	28	26	23	21	19								
σ DENSITY RATIO	.616	.594	.571	.553	.538	.610	.588	.569	.548	.529								
DENSITY ALT., FT.	15650	16750	17950	18900	19700	15950	17050	18050	19150	20200								
BHP	928	900	877	840	816	919	891	863	830	793								
RPM	2680																	
MANIF. PR. IN HG	39.9	38.2	36.8	35.3	34.2	39.7	38.1	36.6	35.3	33.9								
IND. AIRSPEED, MPH											155	153	154	153	139	138	136	135
q_c											11.9	11.6	11.7	11.5	9.5	9.4	9.2	9.0
AV. PRESS. ALT											4200	8900	14200	17800	3900	9700	13800	17700
AV. FREE AIR. °F											52	49	37	23	53	51	36	20
AV. BHP											930	930	840	760	1000	940	790	680
AV. MANIF. PRESS											39.8	40.0	36.1	31.9	43.0	42.0	36.0	30.8
R. P. M.											2560				2540			
											AUTO RICH CLIMB				FULL RICH CLIMB.			
											NO SPINNER OR CUFFS.							
HIGH SPEED PRESSURE RATIO P/q_c																		
A-TP1 (TOP SURVEY RAKE, IMPACT TUBES)	.76	.76	.77	.76	.76	.76	.78	.75	.77	.78	.65	.64	.68	.65	.60	.69	.66	.66
2	.77	.75	.78	.78	.76	.77	.78	.76	.77	.78	.65	.66	.68	.70	.62	.64	.66	.66
3	.80	.80	.80	.79	.80	.80	.82	.80	.81	.81	.65	.67	.69	.68	.64	.68	.63	.60
4	.81	.80	.80	.81	.80	.81	.82	.80	.82	.81	.64	.66	.69	.66	.61	.71	.63	.60
5	.76	.78	.79	.78	.77	.79	.80	.78	.79	.78	.64	.65	.67	.67	.58	.62	.63	.60
A-TS1 (STATIC TUBES)	.73	.74	.74	.74	.75	.76	.76	.74	.76	.75	.62	.61	.67	.65	.57	.63	.63	.60
2	.74	.74	.74	.74	.74	.74	.77	.74	.75	.75	.62	.64	.66	.64	.57	.63	.63	.60
3	.74	.75	.76	.75	.74	.76	.77	.75	.76	.76	.64	.64	.68	.65	.63	.66	.66	.63
A-RP1 (RIGHT SURVEY, IMPACT TUBES)	.73	.75	.76	.75	.76	.75	.77	.77	.76	.75	.72	.72	.75	.73	.75	.71	.74	.70
2	.73	.74	.75	.75	.74	.75	.75	.75	.74	.75	.66	.71	.71	.71	.73	.69	.71	.68
3	.75	.76	.76	.76	.76	.77	.77	.76	.76	.76	.69	.70	.74	.70	.68	.71	.67	.64
4	.75	.76	.76	.75	.76	.76	.77	.76	.77	.75	.73	.73	.76	.74	.70	.72	.70	.69
5	.75	.76	.76	.75	.76	.77	.77	.77	.77	.76	.69	.72	.72	.72	.68	.70	.67	.64
A-RS1 (STATIC TUBES)	.72	.74	.74	.73	.73	.74	.74	.74	.74	.73	.65	.67	.68	.69	.62	.68	.65	.62
2	.73	.74	.74	.74	.73	.74	.75	.74	.75	.75	.64	.67	.70	.67	.61	.66	.65	.62
3	.75	.75	.77	.76	.76	.76	.77	.76	.76	.76	.66	.67	.72	.70	.67	.67	.68	.67
A-LP1 (LEFT SURVEY, IMPACT TUBES)	.76	.75	.76	.76	.76	.76	.78	.76	.77	.77	.73	.71	.76	.75	.78	.81	.70	.80
2	.76	.76	.77	.76	.76	.77	.78	.78	.77	.78	.77	.76	.78	.75	.76	.83	.83	.82
3	.77	.76	.77	.77	.77	.77	.78	.78	.77	.79	.72	.73	.77	.76	.68	.75	.73	.69
4	.77	.77	.77	.76	.76	.77	.79	.77	.78	.78	.69	.68	.72	.70	.66	.68	.65	.64
5	.77	.77	.78	.77	.78	.78	.79	.79	.79	.79	.70	.69	.73	.73	.66	.72	.70	.67
A-LS1 (STATIC TUBES)	.69	.68	.70	.65	.69	.74	.76	.74	.74	.75	.63	.64	.66	.64	.59	.63	.63	.59
2	.74	.74	.75	.74	.75	.75	.77	.75	.76	.75	.65	.65	.68	.66	.60	.65	.65	.62
3	.75	.75	.76	.76	.75	.76	.77	.76	.76	.76	.66	.67	.71	.70	.65	.72	.71	.68
O-FP1 (FRONT SURVEY, IMPACT TUBES)	.84	.84	.84	.84	.86	.84	.86	.85	.86	.86	.80	.78	.81	.81	.76	.79	.84	.81
2	.90	.90	.91	.91	.90	.90	.93	.90	.92	.92	.85	.83	.88	.87	.85	.86	.88	.88
3	.94	.94	.94	.96	.94	.94	.95	.94	.95	.96	.87	.88	.90	.92	.90	.92	.96	.93
O-FS1 (STATIC TUBES)	.81	.80	.81	.80	.81	.81	.83	.81	.82	.83	.64	.65	.70	.72	.64	.71	.74	.69
2	.82	.83	.83	.82	.83	.83	.84	.83	.83	.84	.65	.67	.70	.70	.68	.75	.74	.72
3	.57	.57	.58	.57	.57	.58	.60	.58	.59	.59	.28	.28	.30	.26	.30	.30	.30	.27
O-RP1 (REAR SURVEY, IMPACT TUBES)	.52	.53	.54	.54	.53	.54	.56	.54	.53	.55	.19	.19	.22	.20	.19	.18	.18	.20
2	.69	.69	.69	.69	.70	.70	.71	.70	.70	.71	.48	.50	.52	.49	.46	.52	.52	.47
3	.49	.49	.51	.49	.50	.51	.53	.52	.51	.52	.15	.17	.18	.16	.13	.16	.16	.14
O-SP																		
C-P1 (IMPACT TUBES)	.87	.87	.87	.86	.86	.87	.88	.88	.88	.87	.72	.76	.69	.69	.57	.59	.61	.58
2	.90	.91	.90	.88	.89	.90	.91	.90	.91	.90	.78	.76	.76	.75	.66	.66	.71	.68
3	.92	.93	.93	.92	.91	.92	.94	.93	.94	.92	.81	.79	.82	.81	.71	.76	.75	.72
4	.94	.94	.95	.94	.94	.94	.94	.94	.95	.94	.85	.85	.85	.84	.73	.75	.80	.80
5	.94	.94	.95	.94	.94	.94	.94	.94	.95	.94	.87	.84	.87	.84	.77	.78	.80	.78
C-S1 (STATIC TUBES)	.72	.73	.73	.73	.73	.74	.75	.74	.75	.74	.42	.35	.37	.41	.21	.07	.16	.22
2	.71	.73	.72	.71	.71	.73	.73	.73	.72	.73	.40	.29	.35	.39	.17	.03	.12	.17
3	.69	.70	.70	.70	.70	.70	.71	.71	.71	.71	.40	.32	.34	.35	.15	.04	.13	.16
4	.69	.70	.70	.70	.70	.70	.71	.71	.71	.71	.44	.33	.34	.36	.15	.02	.15	.19
5	.68	.69	.69	.70	.68	.69	.70	.70	.70	.70	.42	.32	.32	.35	.15	.03	.15	.19
C-TH IMPACT PRESS IN CARD	.73	.73	.74	.74	.74	.75	.75	.75	.75	.74	.46	.36	.39	.41	.19	.08	.16	.20



Survey Ahead of Engine



Oil Cooler

Carburetor Scoop

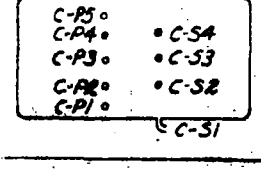


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TABLE 2 — TEMPERATURE DATA (SHEET 1)

TEST NO - FLIGHT NO.	18-5					18-6						17-4B				17-4A			
RUN NO.	1	2	3	4	5	1	2	3	4	5		1	2	3	4	1	2	3	4
TRUE AIRSPEED, M.P.H.	334	336	335	333	335	332	332	332	331	333	IND. AIRSPEED	154	152	154	154	140	138	137	135
q_c, IN H_2O	35.5	34.6	33.3	32.0	31.2	35.3	34.1	33.0	33.3	34.8	q_c IN. H_2O	11.7	11.4	11.7	11.7	9.6	9.4	9.3	9.0
ATM. PRESS. IN. HG.	17.53	16.86	16.19	15.56	14.96	17.57	16.88	16.20	16.51	17.22	AVE. PRESS. ALT.	5000	10700	15400	18800	6600	10200	16000	19100
ATM. TEMP. °F	34	34	28	23	21	33	28	24	25	33	AVE. FREE AIR, °F	63	47	32	19	55	43	26	15
σ DENSITY RATIO	.616	.592	.576	.559	.540	.618	.600	.581	.590	.606	AVE. B.H.P.	860	900	810	710	928	890	718	639
DENSITY ALT., FT.	15650	16850	17700	18600	19600	15550	16450	17400	17000	16150	AVE. MANIF. PRESS.	40.0	39.1	35.6	31.0	43.2	41.5	33.9	30.0
B.H.P.	928	905	872	849	821	919	896	868	886	919	R.P.M.	2560				2540			
R.P.M.	2680											AUTO RICH CLIMB				FULL RICH CLIMB			
MAN. PRESS IN. HG	40.7	39.1	37.8	36.4	35.3	40.5	39.3	37.5	38.4	39.8		SPINNER + CUFFS							
	HIGH SPEED					HIGH SPEED													
CYL. NO. PT. OF MEASUREMENT	TEMP. °F											TEMP. °F							
1 - REAR SP. PL. GASKET	397	389	391	399	422	392	389	398	398	398		328	393	412	424	390	386	346	335
2	382	382	387	394	418	387	387	396	396	396		324	384	397	402	375	370	337	321
3	397	394	399	403	430	396	394	403	401	401		335	395	408	419	390	384	350	337
4	399	394	399	403	432	401	396	403	398	396		321	399	399	412				
5																			
6	394	392	399	403	425	396	396	408	408	410		335	386	399	408	377	370	353	353
7	448	452	455	461	487	455	454	465	465	465		375	443	466	470	426	424	417	404
8	416	419	423	426	451	422	419	431	429	433		355	408	430	437	406	404	393	381
9												330	381						
10	429	430	437	439	462	438	435	447	445	447		359	417	442	446	406	404	399	386
11	442	442	448	451	480	446	445	456	456	456		361	424	450	457	410	408	399	390
12	414	416	421	426	448	419	419	431	431	433		350	406	428	433	395	393	381	368
13													412	428	437	412	408	384	368
14												355	410	426	430	399	393	355	341
1 - REAR ℄ BARREL FLANGE	314	313	314	317	328	320	313	317	317	317		267	299	315	319	297	290	281	279
2						316	313	315	313	317									
3	307	306	309	312	321	311	304	308	308	308		263	294	306	312	292	292	279	272
4	309	309	312	314	326	314	318	315	313	315		269	299	310	312	297	294	283	279
5	295	296	298	300	313	302	296	301	299	304		254	281	294	298	279	279	272	267
6	312	310	314	316	328	314	310	315	315	317		265	297	310	315	290	294	288	283
7	307	306	309	312	321	311	306	308	310	313		260	290	294	306	285	288	285	279
8	302	303	307	309	321	304	301	306	304	308		258	292	294	310	285	290	288	281
9	323	324	325	327	340	325	325	326	326	329		272	306	319	324	297	299	297	292
10	330	332	332	337	347	334	329	336	336	338		279	312	330	332	306	310	310	301
11	305	306	304	309	319	309	304	308	306	309		265	292	306	310	285	288	285	279
12																297	290		
13	307	308	309	314	324	311	318	313	313	315		269	297	312	315	292	292	288	277
14	317	320	321	321	335	320	317	323	325	326		274	306	315	321	297	299	288	279
10 MIX. AT INTAKE PORT	237	230	232	229	227	232	230	230	233	233		219	214	222	220	226	213	201	194
" " BLOWER RIM	164	168	168	177	169	174	168	168	171	174		161	174	171	168	179	171	161	152
FUEL - SUC. SIDE PUMP	92	96	96	99	99	90	93	96	96	99		79	79	76	76	79	79	79	79
" - PR. " "	95	99	99	102	102	93	99	100	102	102		79	79	76	79	82	79	79	76
" - CARB. FLOAT CHAMBER	90	93	93	93	96	91	93	93	96	96		82	79	72	72	82	79	72	72
" - FRT. SP. PL. ELBOW	66	64	63	63	57	66	63	60	63	66		82	72	59	52	82	72	55	45
" - REAR " " "	84	84	84	81	81	87	84	81	84	87		99	92	82	79	103	92	79	72
RECORDED FREE AIR	50	50	47	42	39	51	45	42	44	48		70	54	38	26	60	50	33	24
AIR - CARB. SCOOP	51	51	48	42	39	54	48	40	45	51		72	55	39	28	65	55	35	24
" - FRT. CYL. 14	49	48	45	42	39	51	45	42	45	51		72	55	38	28	65	55	35	24
" - FRT CYL 1.	57	60	57	57	57	60	60	57	57	60		76	59	45	38	69	59	42	35
" - REAR " "	148	151	154	157	163	154	151	163	157	157		185	174	174	178	175	171	161	155
" - OIL COOLER EXIT	84	84	84	81	81	89	84	84	84	87		89	89	79	69	92	86	72	65
OIL - IN LINE	148	146	148	145	148	154	147	140	146	148		148	139	135	135	139	139	132	129
OIL - OUT	219	217	219	219	225	217	217	217	217	219		194	203	210	210	205	203	200	197
ACCESSORY COMPT.	119	119	119	119	122	122	119	119	119	124		102	99	89	86	106	99	86	79
LEFT MAGNETO	107	108	108	107	105	112	109	108	108	110		96	96	92	92	96	96	92	86
PILOTS COCKPIT	102	102	105	102	102	99	100	102	99	102		79	79	69	65	82	79	69	65
RECORDING INSTR. COMPT.	87	90	93	90	90	87	90	89	75	90		82	82	76	69	86	83	72	69

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TABLE 2 — TEMPERATURE DATA (SHEET 3)

TEST NO.- FLIGHT NO.	22-1					22-2				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED M.P.H.	331	331	331	330	330	329	329	330	330	327
q_c IN. H_2O	34.6	33.7	32.3	31.0	30.3	33.9	32.8	31.9	30.8	29.2
ATM. PRESS., IN. HG.	17.23	16.54	15.90	15.27	14.66	17.16	16.47	15.84	15.19	14.60
ATM. TEMP., °F	28	23	23	19	13	28	26	23	21	19
σ, DENSITY RATIO	.616	.594	.571	.553	.538	.610	.588	.569	.548	.529
DENSITY ALT., FT.	15650	16750	17950	18900	19700	15950	17050	18050	19150	20200
B.H.P.	928	900	877	840	816	919	891	863	830	793
R.P.M.	2680									
MANIF. PRESS, IN. HG.	39.9	38.2	36.8	35.3	34.2	39.7	38.1	36.6	35.3	33.9
	HIGH SPEED					HIGH SPEED				
CYL. NO.- PT. OF MEASUREM'T	TEMP, °F									
1 - REAR SP. PL. GASKET	369	367	372	374	379	377	368	373	377	377
2	369	365	372	374	379	373	366	370	373	375
3	374	366	374	379	383	377	370	375	379	382
4										
5										
6	374	369	374	376	379	373	373	375	377	377
7	430	428	430	434	434	430	428	430	435	435
8	394	392	394	394	397	393	390	393	397	397
9										
10	423	419	426	426	428	419	419	423	426	426
11	423	421	428	428	432	422	422	426	428	430
12	401	397	403	403	407	397	397	401	404	404
13										
14										
1 - REAR ℄ BARREL FLANGE	313	327	306	306	306	312	303	303	305	305
2										
3	302	293	293	297	299	301	294	294	296	298
4	304	299	299	302	304	303	301	301	303	303
5	291	286	286	288	288	291	287	287	290	290
6	304	302	302	302	304	303	301	303	303	305
7	302	295	297	297	297	301	296	296	298	298
8	293	288	291	291	288	294	290	291	291	291
9	320	313	315	315	318	319	314	314	314	316
10	327	325	325	327	327	327	325	325	325	327
11	299	293	295	295	297	294	291	294	294	296
12										
13	302	297	297	297	299	301	298	298	301	301
14	313	309	311	311	313	312	310	310	312	312
10-MIX. AT INTAKE PORT	219	215	215	215	215	218	218	216	216	216
" " BLOWER RIM	168	157	157	157	154	166	164	155	158	161
FUEL - SUCTION SIDE PUMP	81	84	84	84	84	85	88	91	91	93
" PRESS. " "	86	86	86	89	89	91	93	91	93	96
" CARB. FLOAT CHAMBER	81	81	81	81	81	85	88	82	88	88
11 - FRT. SP. PL. ELBOW	64	64	57	57	52	64	64			
11 - REAR " " "	75	69	69	66	64	73	76	68	68	68
RECORDED FREE AIR	46	40	40	36	31	47	46	41	38	38
AIR CARB SCOOP	46	43	40	38	34	47	46	41	38	38
" FRT. CYL. NO. 14	46	43	40	38	34	47	46	41	38	38
" FRT. CYL. NO. 1	57	55	55	55	55	56	56	50	47	41
" REAR " " 1	118	115	115	118	120	119	119	119	122	127
" OIL COOLER EXIT	84	78	78	72	72	82	82	72	76	76
OIL — IN LINE	145	140	140	137	137	150	144	142	142	142
" OUT	220	214	212	212	212	221	216	208	213	216
ACCESSORY COMP'T.	115	109	109	109	106	113	113	111	111	111
LEFT MAGNETO	101	101	95	98	95	105	105	96	99	99
PILOT'S COCKPIT.	89	89	86	86	84	85	91	88	85	85
RECORDING INSTR. COMP'T	81	81	81	81	78	71	71	68	68	64

	21-1A				21-1B			
	1	2	3	4	1	2	3	4
IND. AIRSPEED	155	153	152	152	140	137	135	135
q_c	11.8	11.4	11.3	11.3	9.6	9.2	9.0	8.9
AV. PRESS. ALT.	4600	9400	14200	17600	5200	8700	14300	17700
AV. FREE AIR, °F	52	47	37	24	55	53	35	19
AV. B.H.P.	941	930	845	762	1019	933	771	680
AV. MANIF. PRESS.	39.8	39.9	36.1	31.9	42.9	43.1	35.5	30.8
R.P.M.	2560				2540			
	AUTO RICH CLIMB NO SPINNER				FULL RICH CLIMB OR CUFFS			
CYL. NO.- PT. OF MEASUREM'T								
1 - REAR SP. PL. GASKET	383	406	406	406	361	390	352	338
2	381	401	397	394	359	385	350	332
3	390	403	399	397	366	390	356	341
4	390	399	390	390	361	383	350	332
5								
6	383	399	394	392	363	381	361	345
7	439	453	457	455	412	434	419	401
8	403	419	421	417	383	403	390	376
9					372	392	403	397
10	417	437	448	443	401	419	412	394
11	421	441	450	452	401	419	408	397
12	401	419	424	421	383	397	385	370
13								
14								
1 - REAR ℄ BARREL FLANGE	296	309	312	325	294	303	294	282
2								
3	289	303	305	305	289	298	289	280
4	294	309	309	307	296	305	291	282
5	280	294	294	294	280	287	278	271
6	291	307	309	309	294	303	298	289
7	287	298	303	300	282	291	284	278
8	284	298	303	303	284	294	289	282
9	303	318	325	323	303	309	309	303
10	307	330	336	332	314	327	323	314
11	287	300	305	305	289	294	291	284
12								
13	289	303	309	305	291	296	291	282
14	300	318	323	321	303	309	298	289
10-MIX. AT INTAKE PORT	223	221	221	213	221	213	204	195
" " BLOWER RIM	166	174	172	169	169	174	166	158
FUEL - SUCTION SIDE PUMP	77	77	77	77	77	77	77	74
" PRESS. " "	80	80	77	77	77	77	77	74
" CARB. FLOAT CHAMBER	80	74	77	74	74	77	74	72
11 - FRT. SP. PL. ELBOW	74	77	68	60	71	74	66	53
11 - REAR " " "	91	91	83	74	88	94	83	71
RECORDED FREE AIR	57	52	42	30	60	58	42	26
AIR CARB SCOOP	60	54	43	28	60	57	40	28
" FRT. CYL. NO. 14	60	57	43	28	60	60	43	28
" FRT. CYL. NO. 1	66	66	54	46	68	66	54	43
" REAR " " 1	144	152	152	150	150	155	147	149
" OIL COOLER EXIT	88	88	83	74	97	97	83	57
OIL — IN LINE	147	144	144	142	142	147	144	139
" OUT	204	210	215	215	204	199	210	204
ACCESSORY COMP'T.	100	100	94	86	97	100	91	83
LEFT MAGNETO	91	91	94	88	94	97	97	91
PILOT'S COCKPIT.	80	77	71	68	74	77	72	51
RECORDING INSTR. COMP'T	80	77	74	68	77	80	80	54

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Table 3: Speed and Pressure Recovery Data from Flight Investigations of XP-42 Airplane.

	Long Nose	S.N.-H.I.V.		S.N.—L.I.V.					C-Cowl		
	with cuffs	Cuffs	No Cuffs	Fan and #1 Cuffs	Fan Only	#1 Cuffs	#2 Cuffs	No Cuffs	Spinner Cuffs	Cuffs Only	No Cuffs or Spinner
(1)	344	339	340	337	339	339	342	343	339	337	336
(2)	.83	.80	.74	.87	.84	.80	.77	.76	.69	.74	.74
(3)	.86	.70	.62	1.02	.98	.86	.84	.74	.58	.68	.67
(4)	.83	.70	.62	.95	.95	.81	.82	.75	.58	.69	.68

(1) Maximum Speed at 1000 hp. at 14500 ft.-mph true airspeed

(2) Pressure recovery on front of engine at high speed, P/q_c

(3) Pressure recovery in 140-mph, (indicated airspeed) clim

(4) Pressure recovery in 155-mph climb (indicated airspee

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FIG. 1 XP-42 C COWLING

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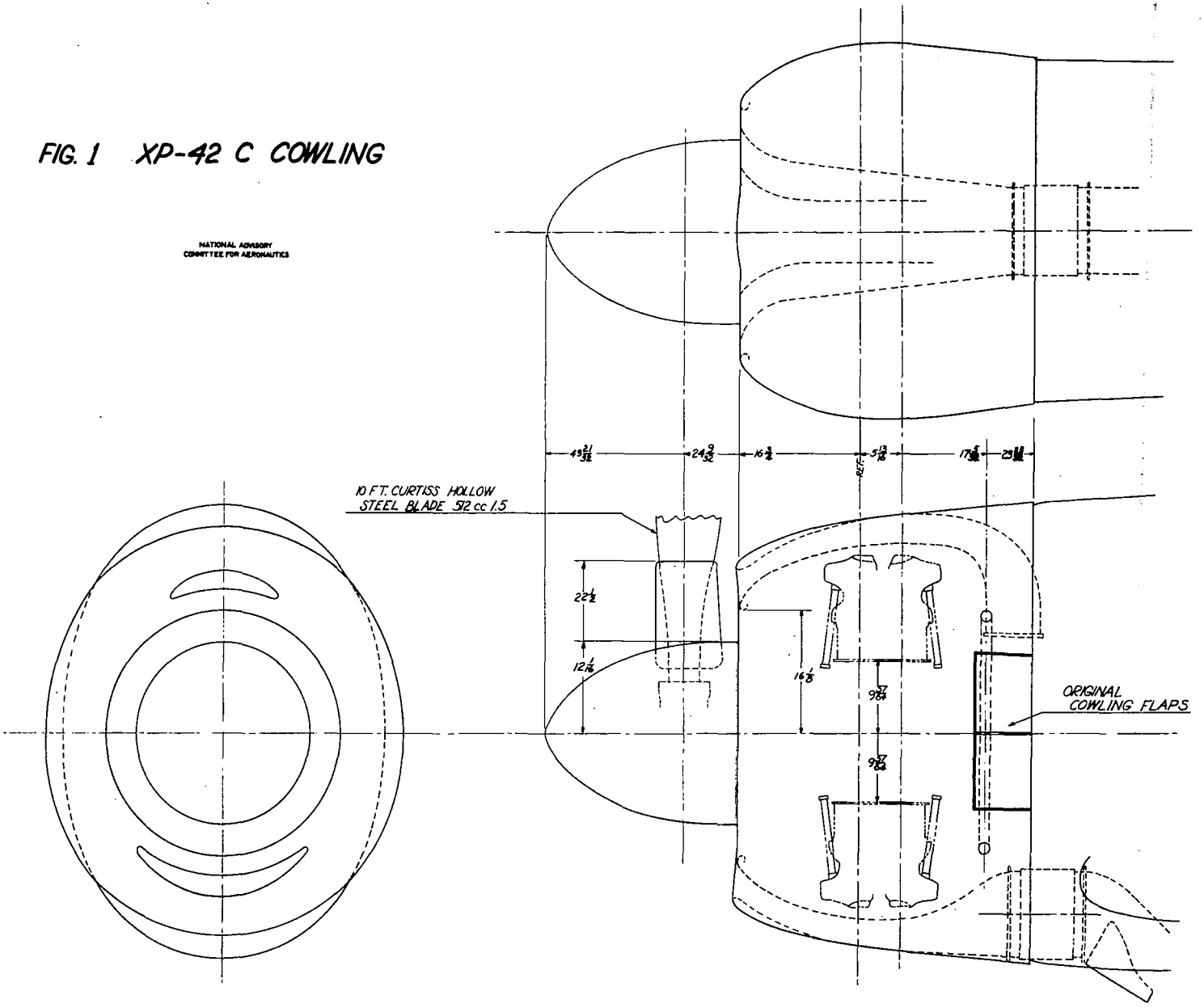

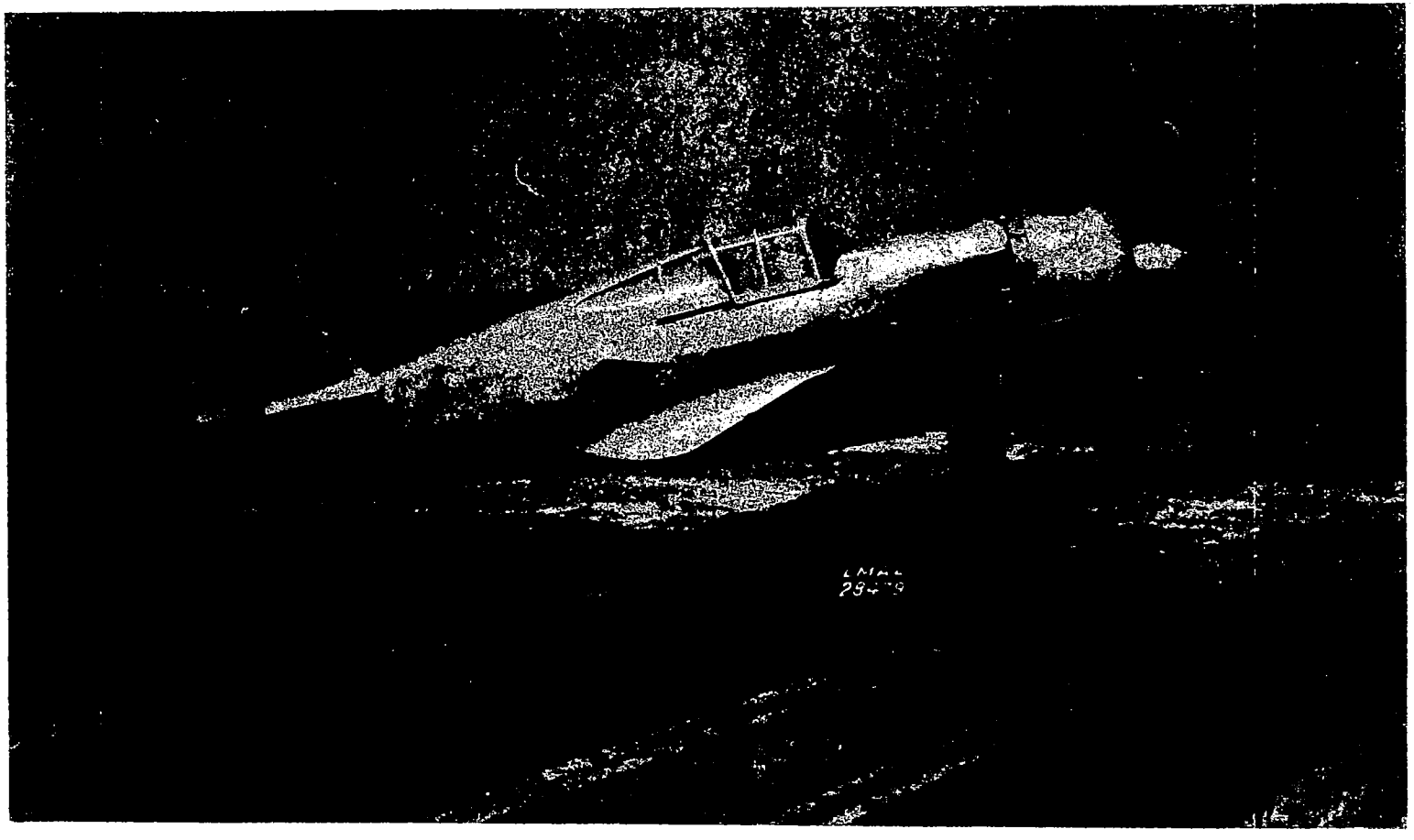

Figure 2.- Side view of airplane with C cowl, spinner, and cuffs.

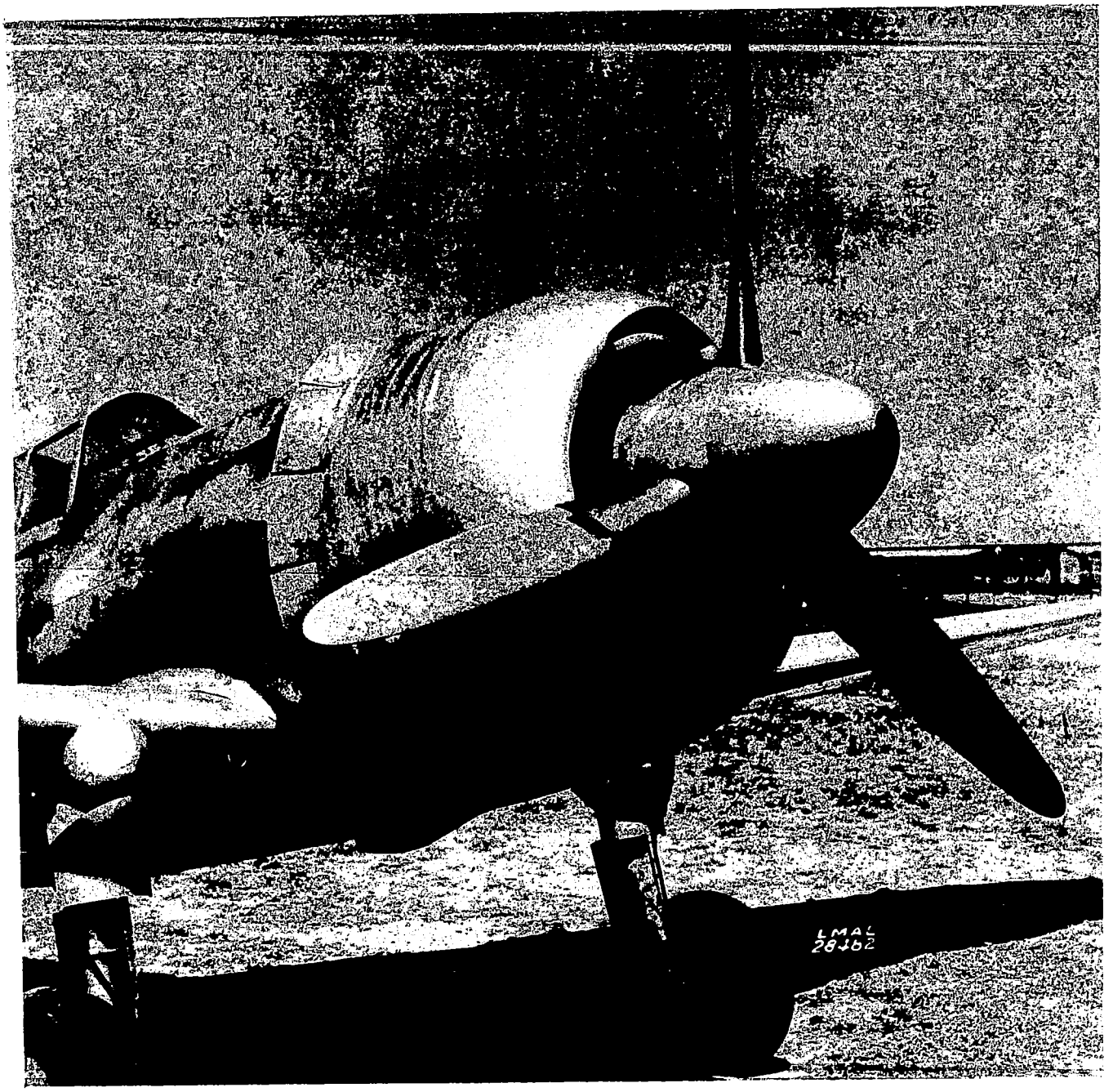

Figure 3.- Close-up of cowling with spinner and cuffs.

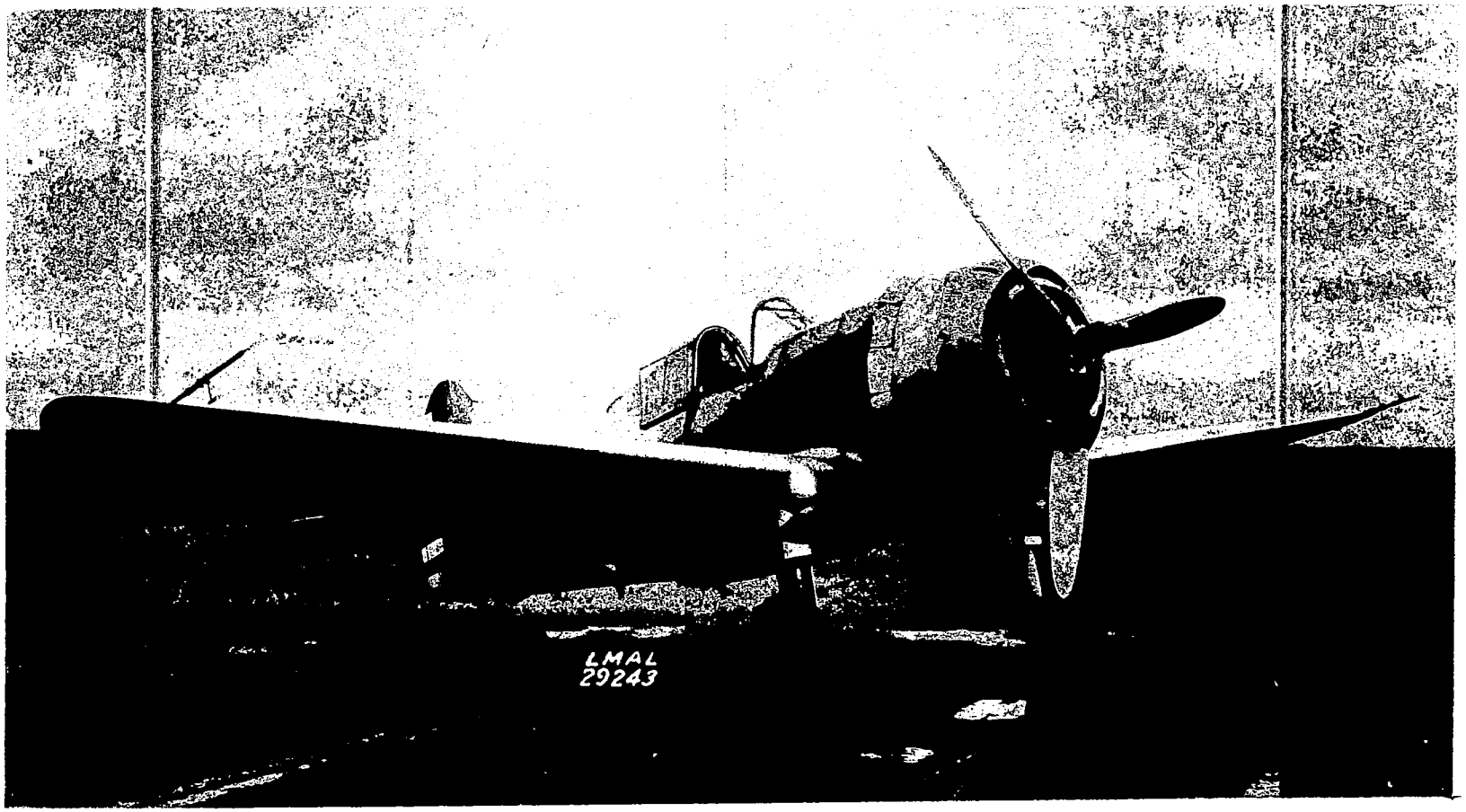

Figure 4.- Three-quarter front view of airplane with C cowl, cuffs only.

Figure 5.- Close-up of cowling with cuffs only.

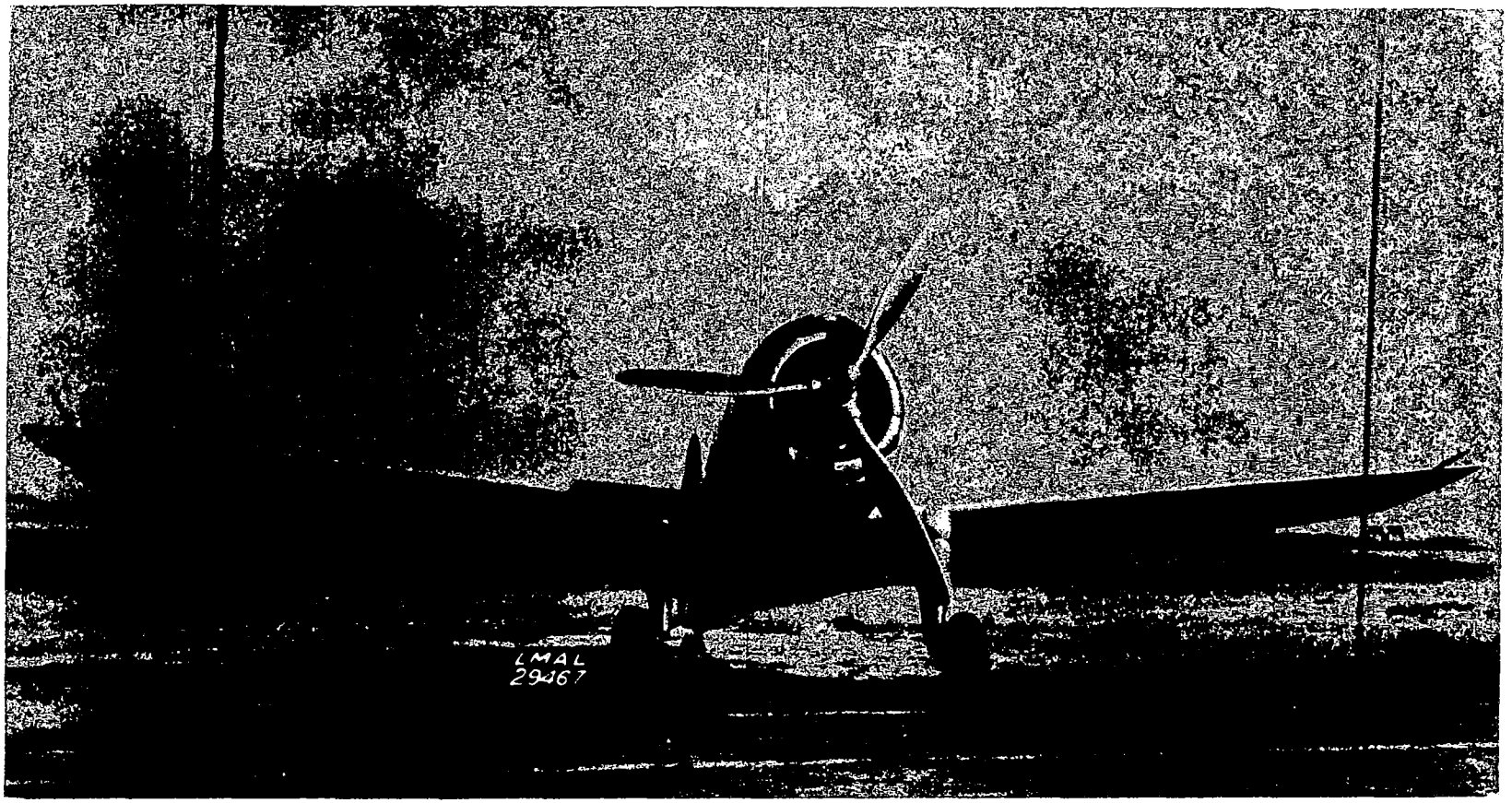

Figure 6.- Front view of cowling without spinner or cuffs.

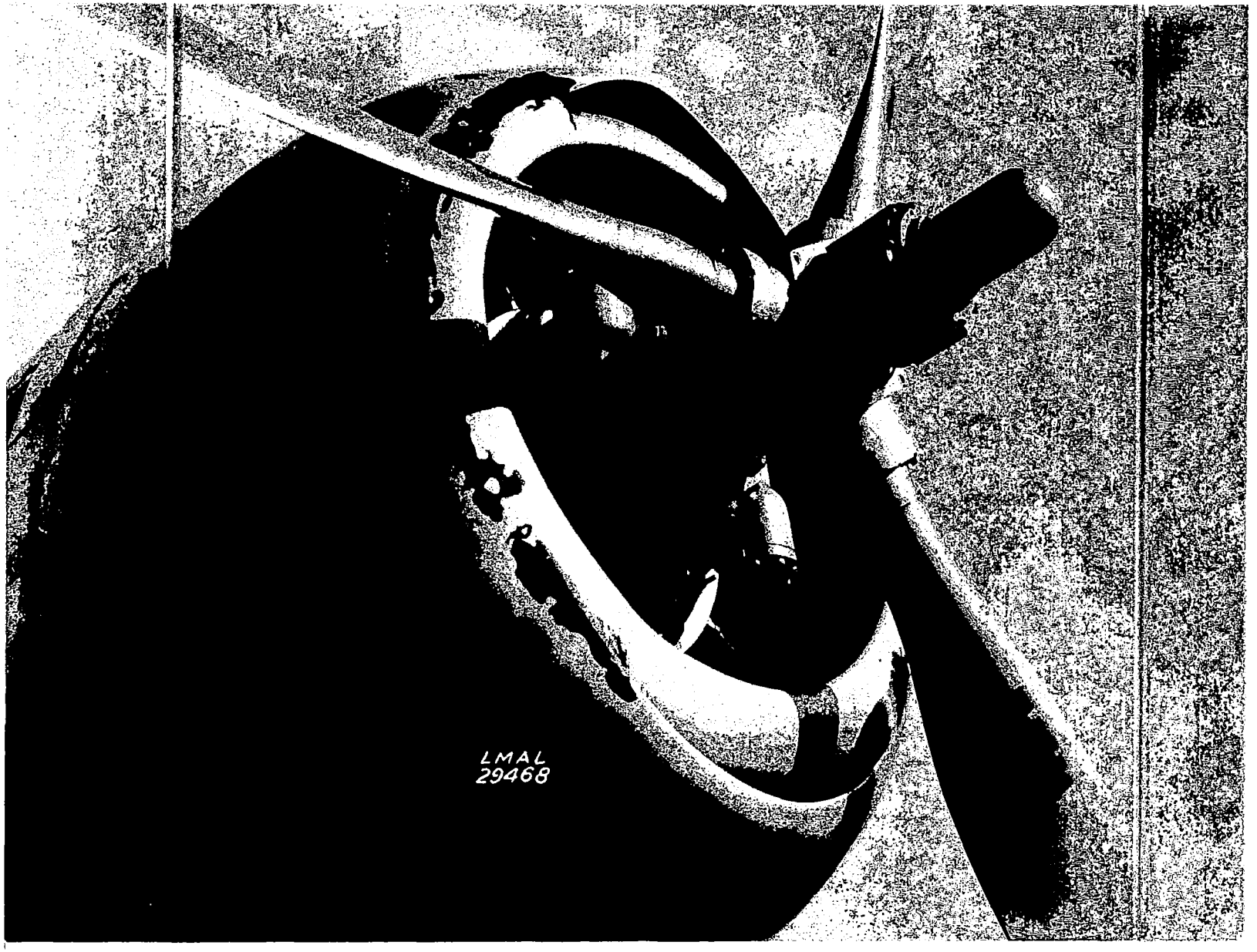

Figure 7.- Close-up of cowling without spinner or cuffs.

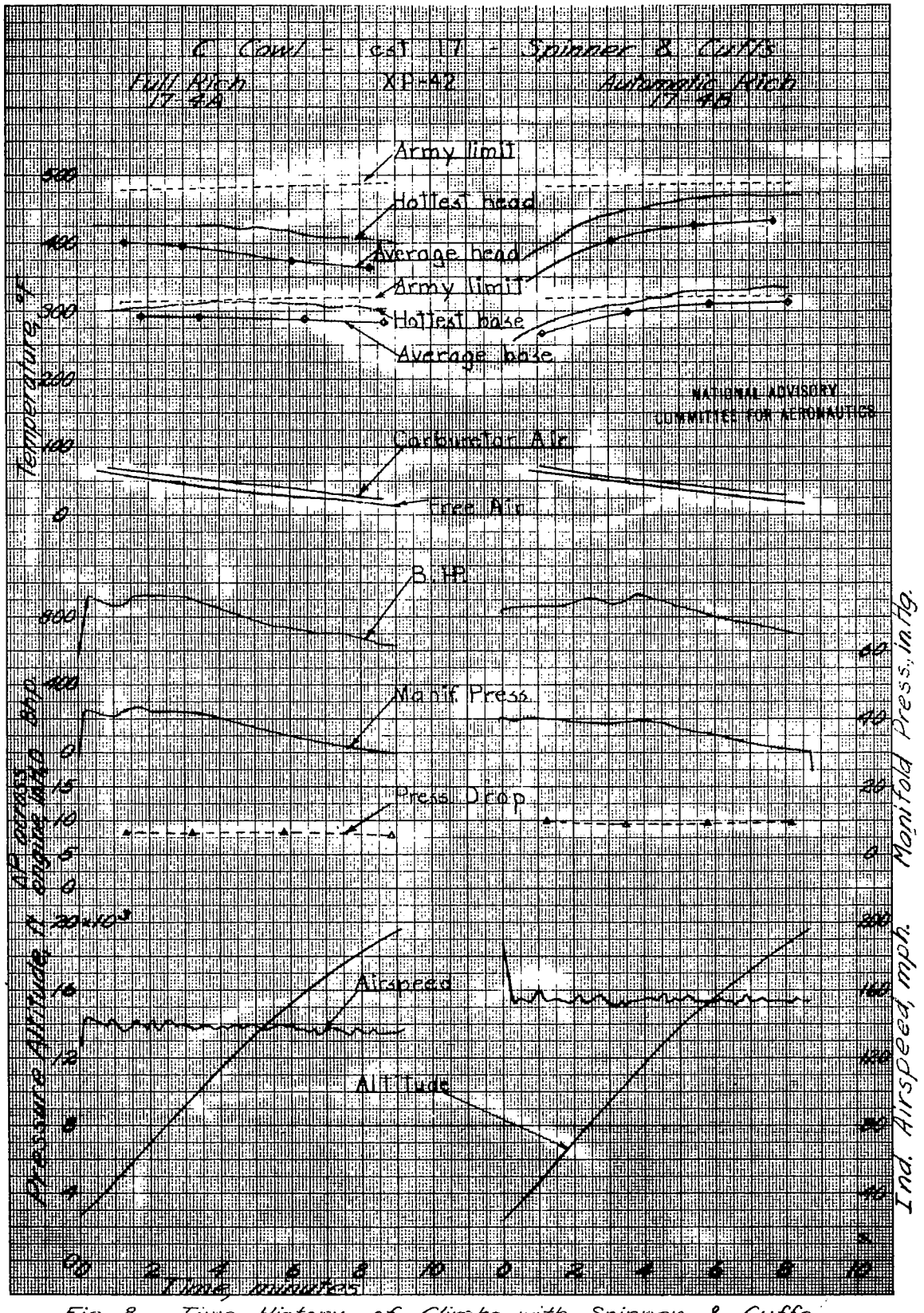

Fig. 8 Time History of Climbs with Spinner & Cuffs

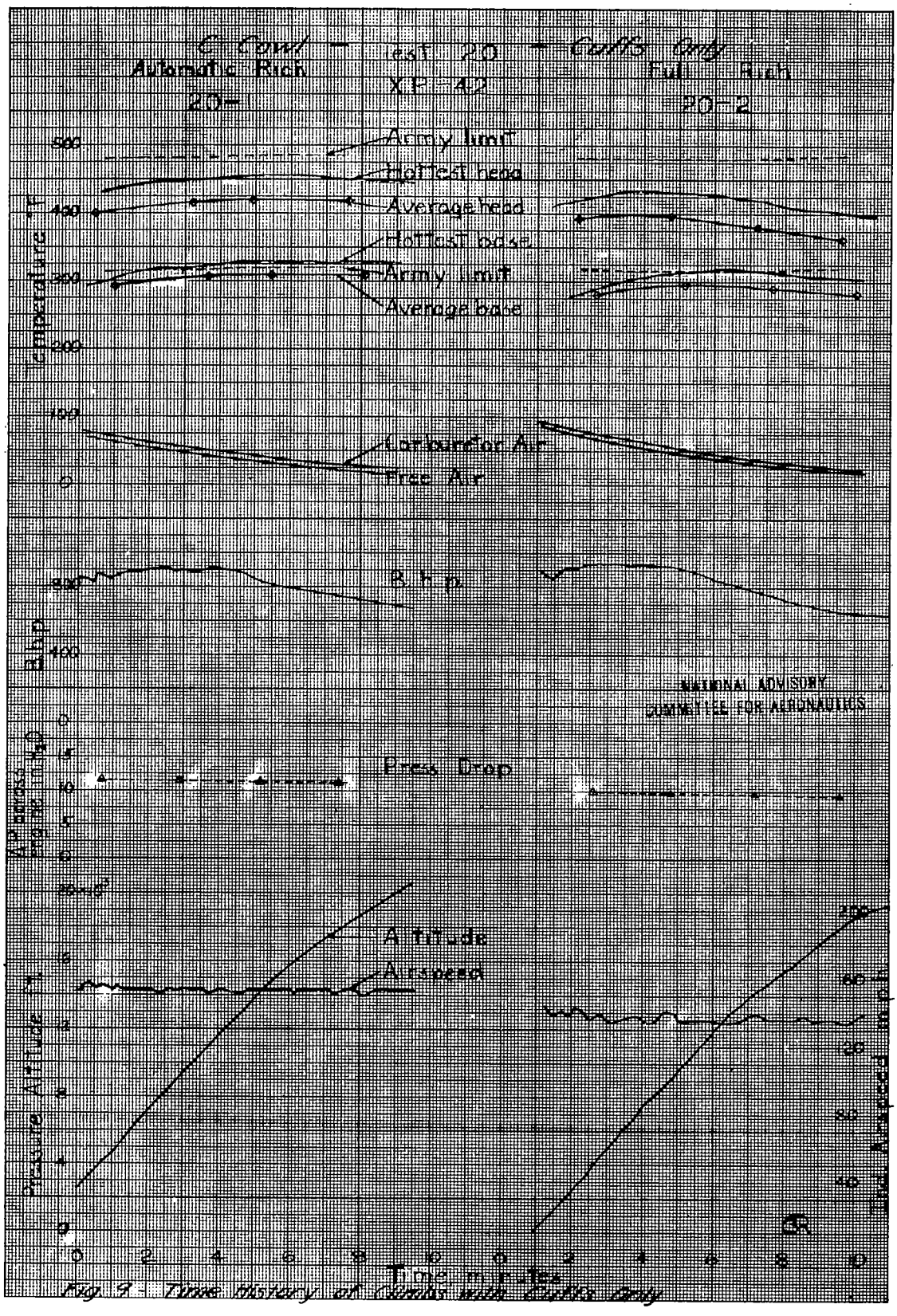

Fig. 9 - Time History of Climbs with Cuffs Only

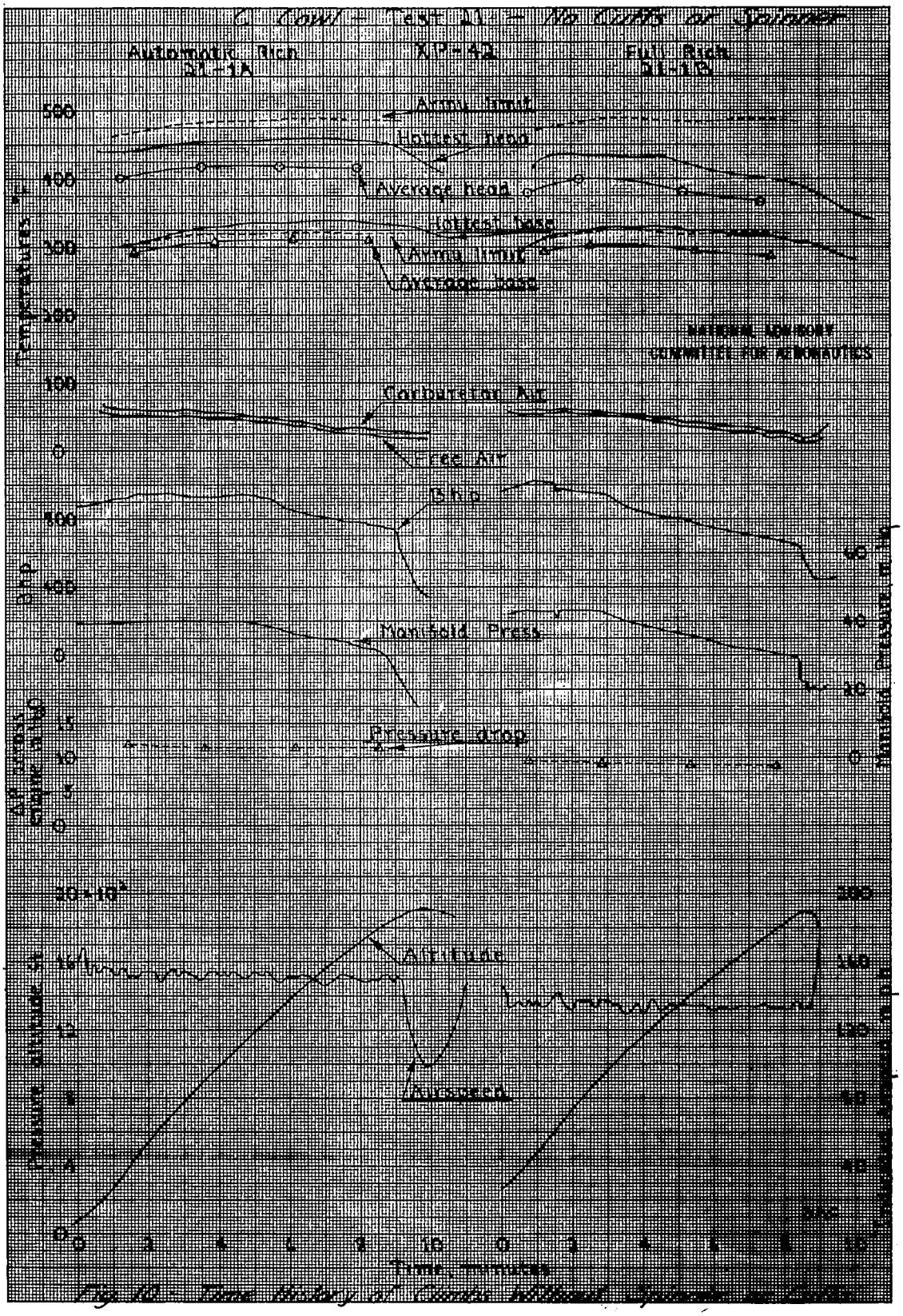

Fig. 10 - Time History of Cumbs Without Spinner or Cuffs

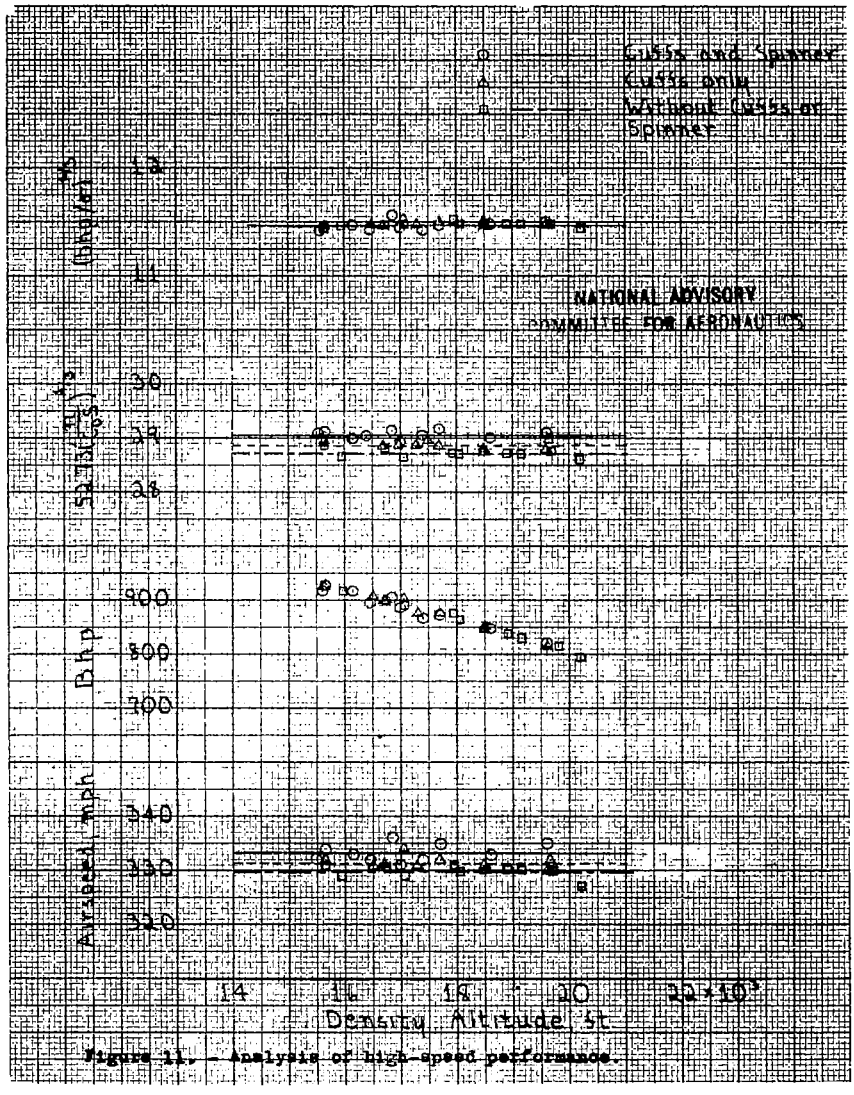

Figure 11. - Analysis of high-speed performance.

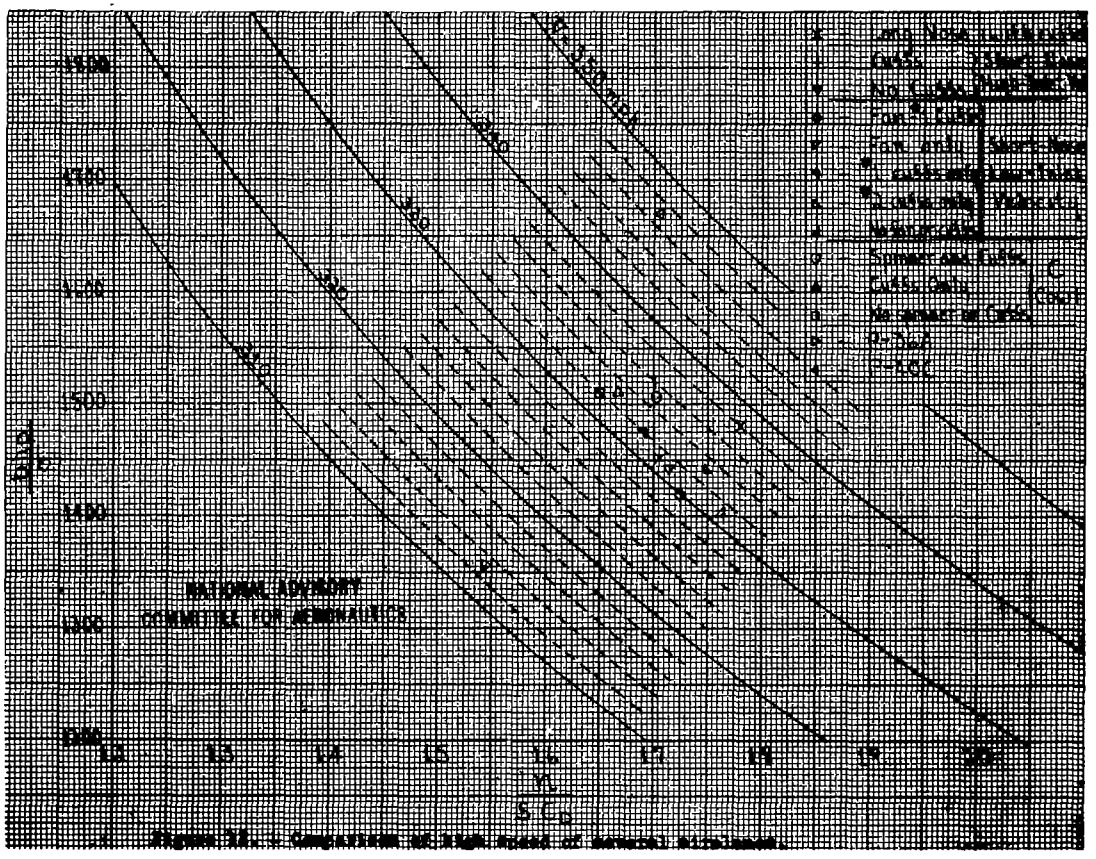

Figure 12. - Comparison of high speed of several airplanes.

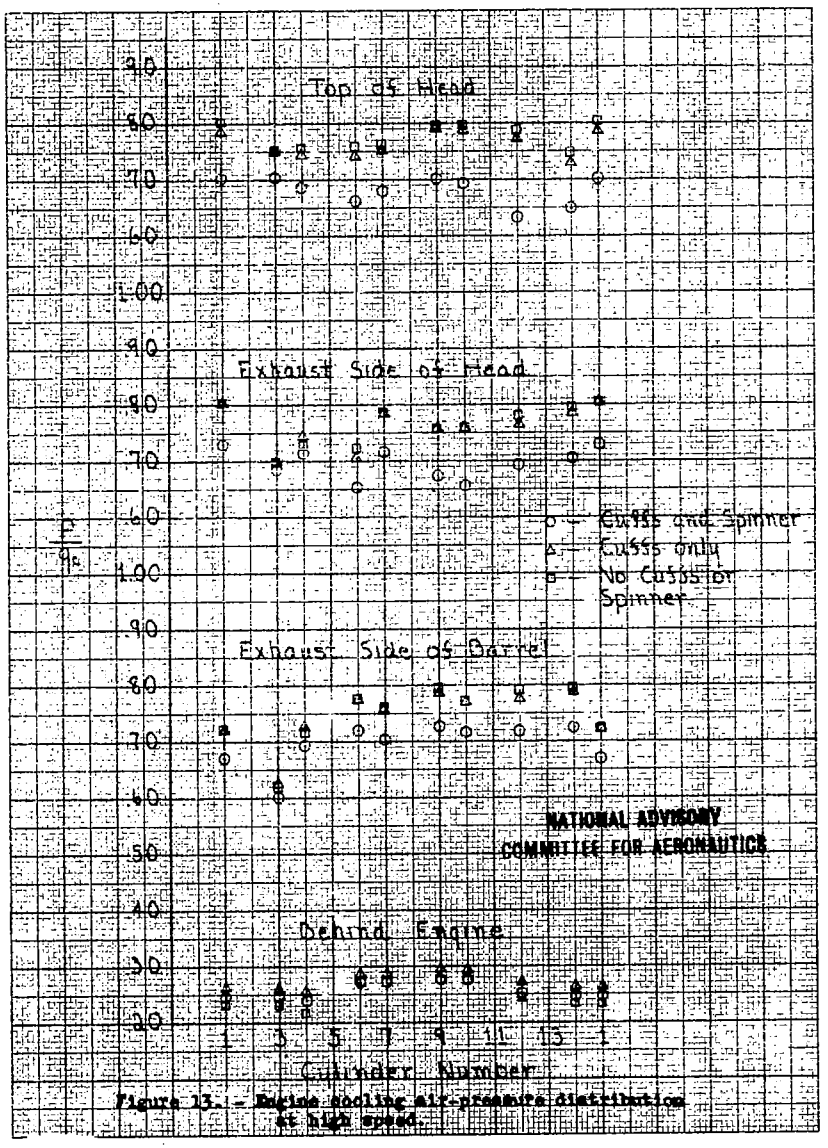

Figure 13. - Engine cooling air-pressure distribution at high speed.

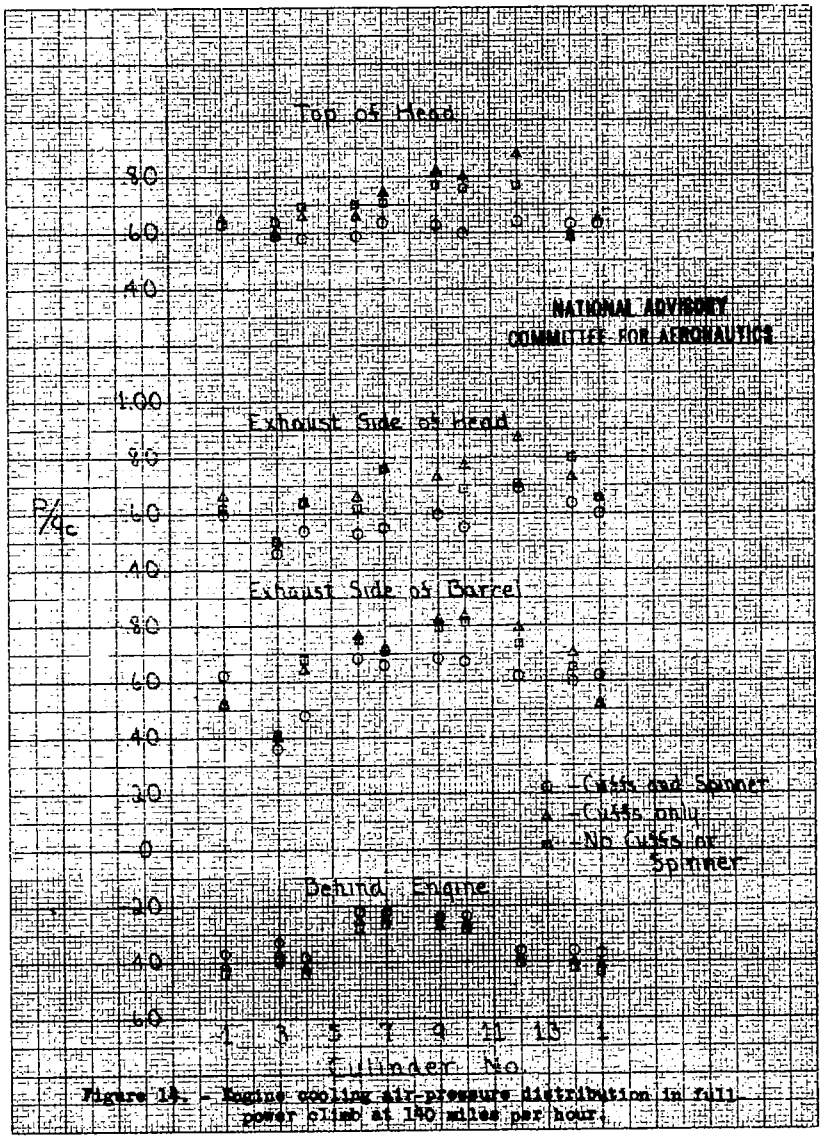

Figure 14. - Engine cooling air-pressure distribution in full power climb at 140 miles per hour.

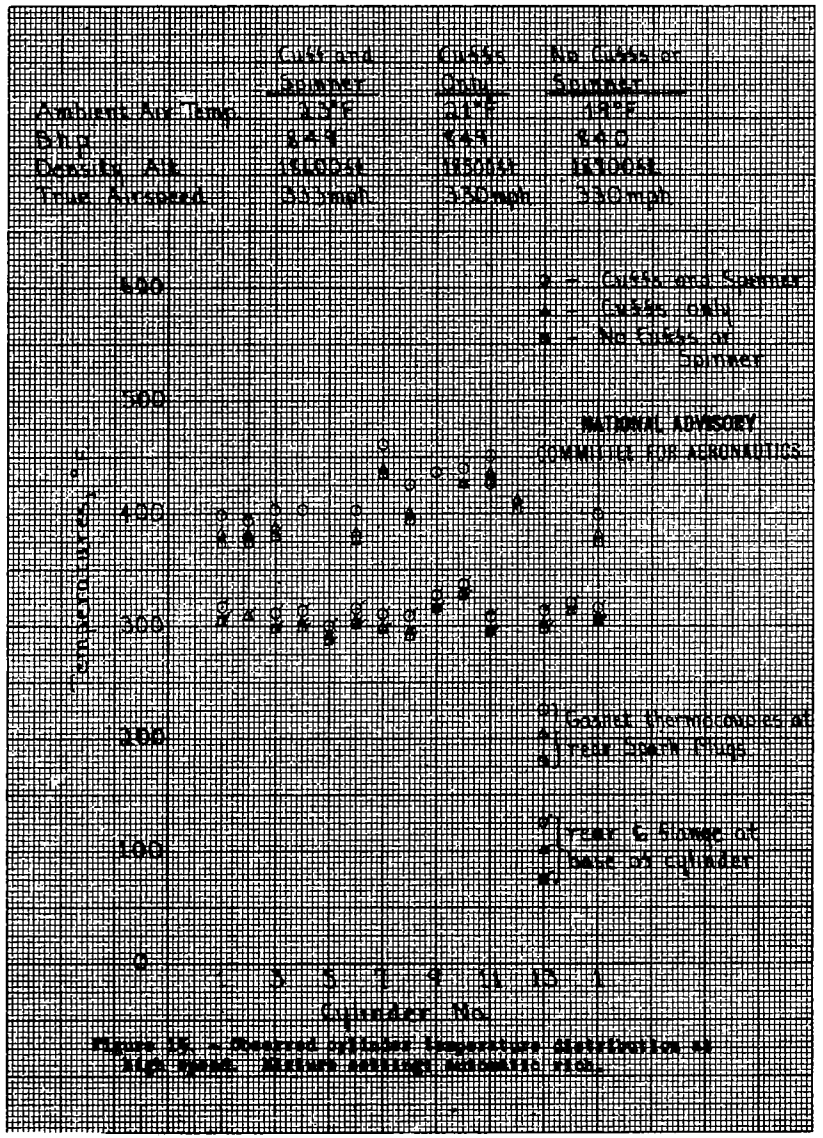

Figure 35. - Observed cylinder temperature distribution at high speed. Mixture settings automatic rich.

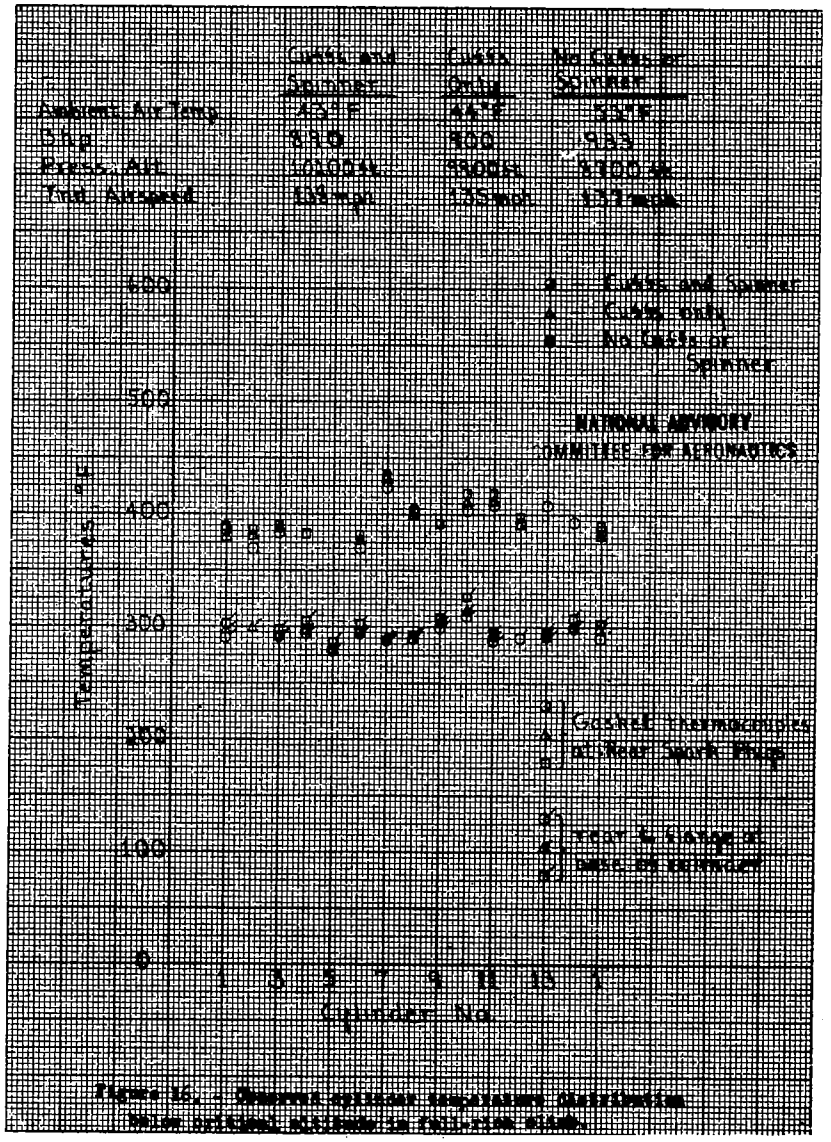

Figure 36. - Observed cylinder temperature distribution. Mixture settings automatic rich.

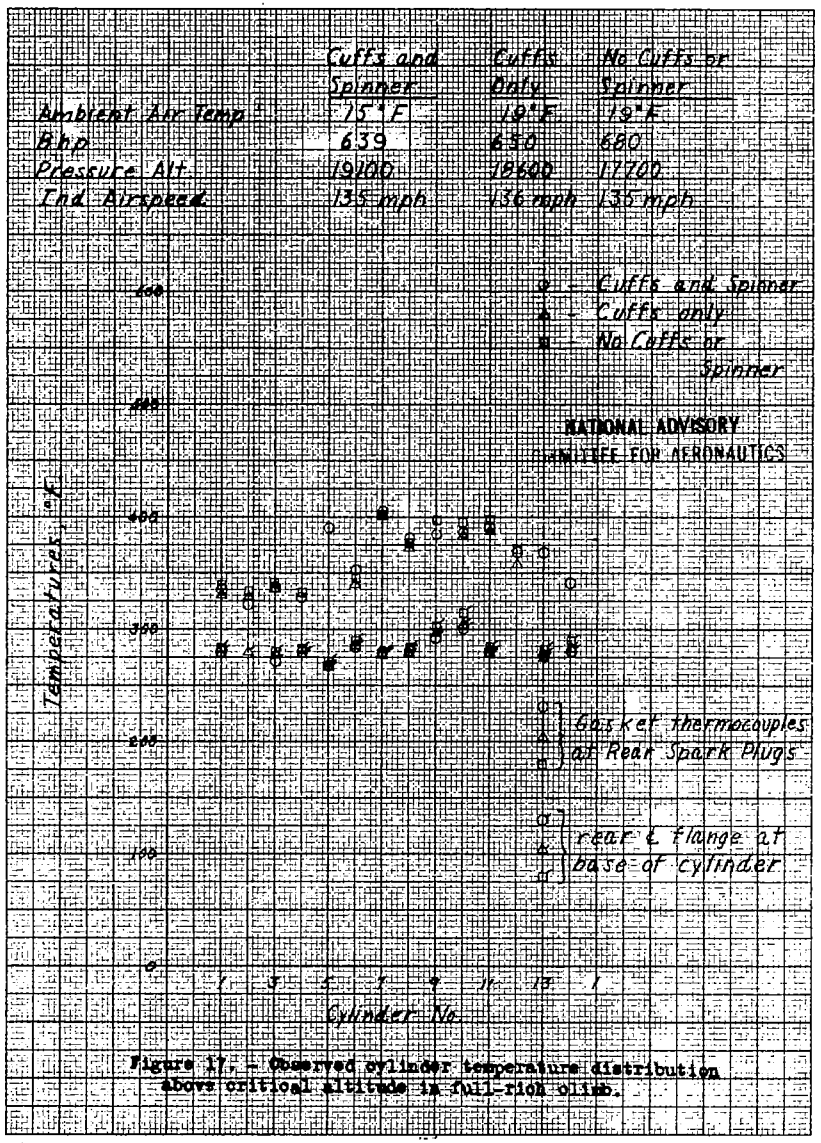

Figure 17. - Observed cylinder temperature distribution above critical altitude in full-rich climb.

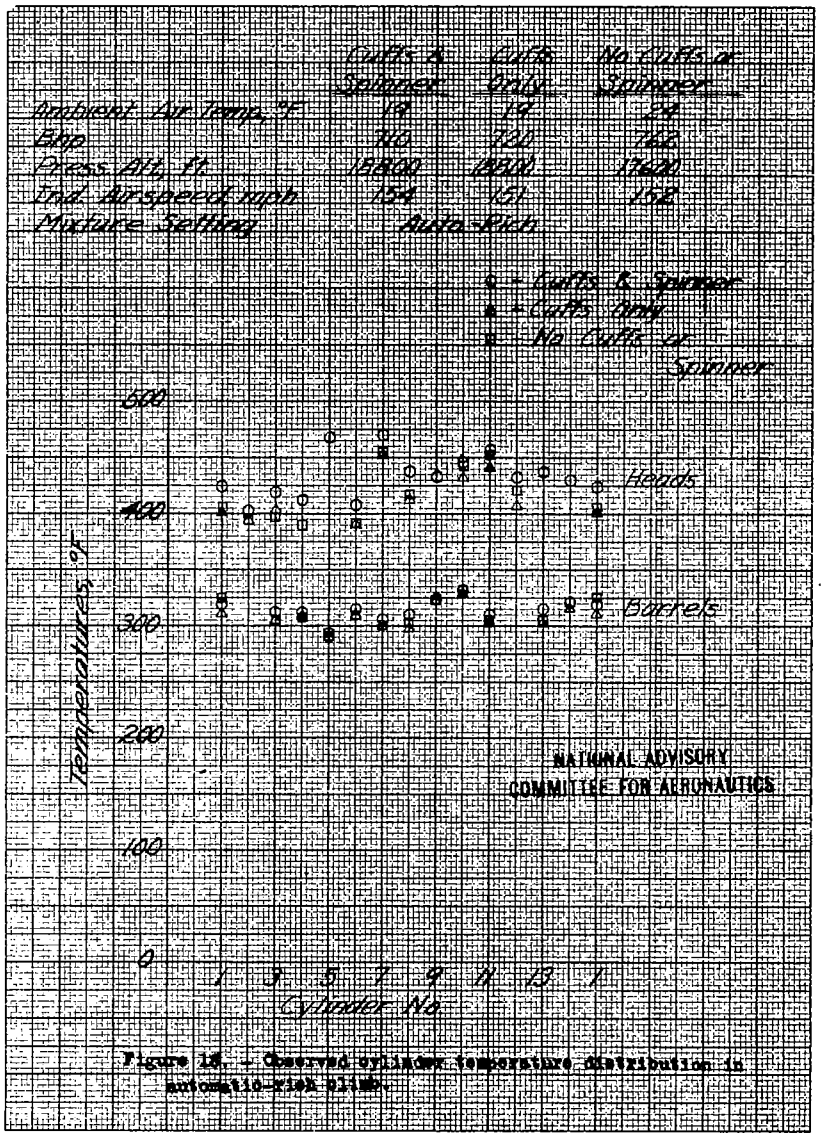

Figure 18. - Observed cylinder temperature distribution in automatic-rich climb.

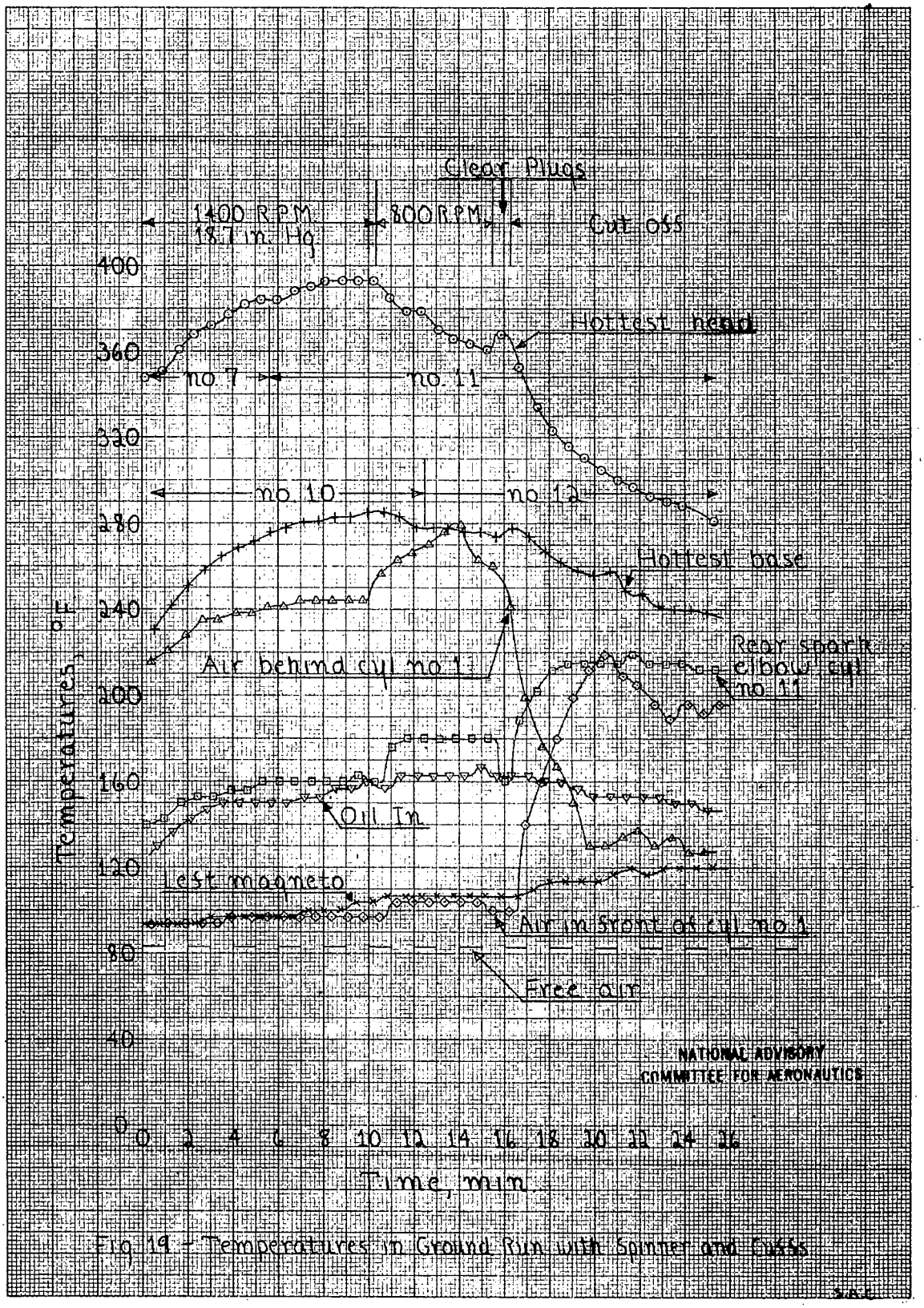

Fig. 19 - Temperatures in Ground Run with Spinner and Cuffs

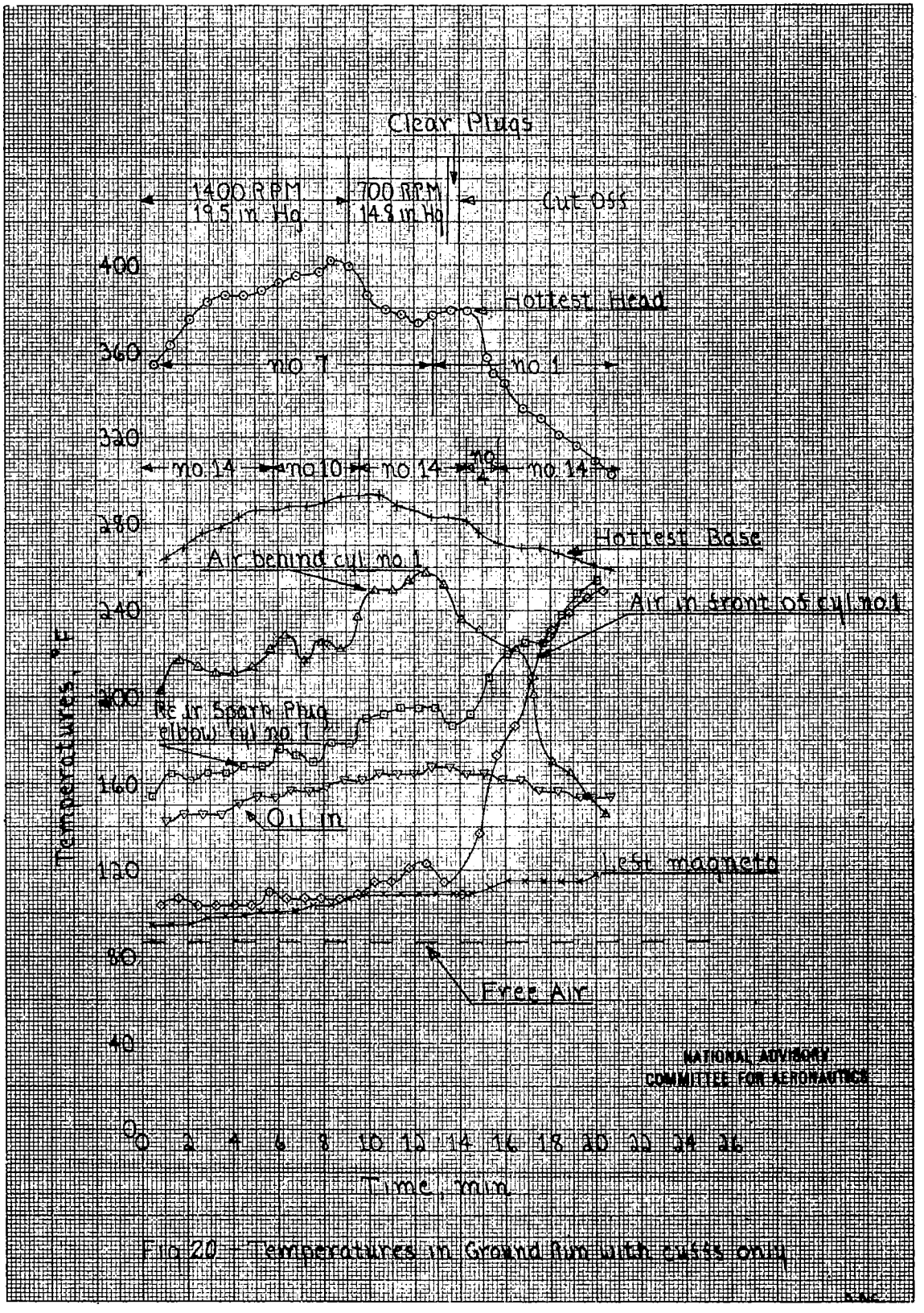

Fig 20 - Temperatures in Ground Run with cuffs only

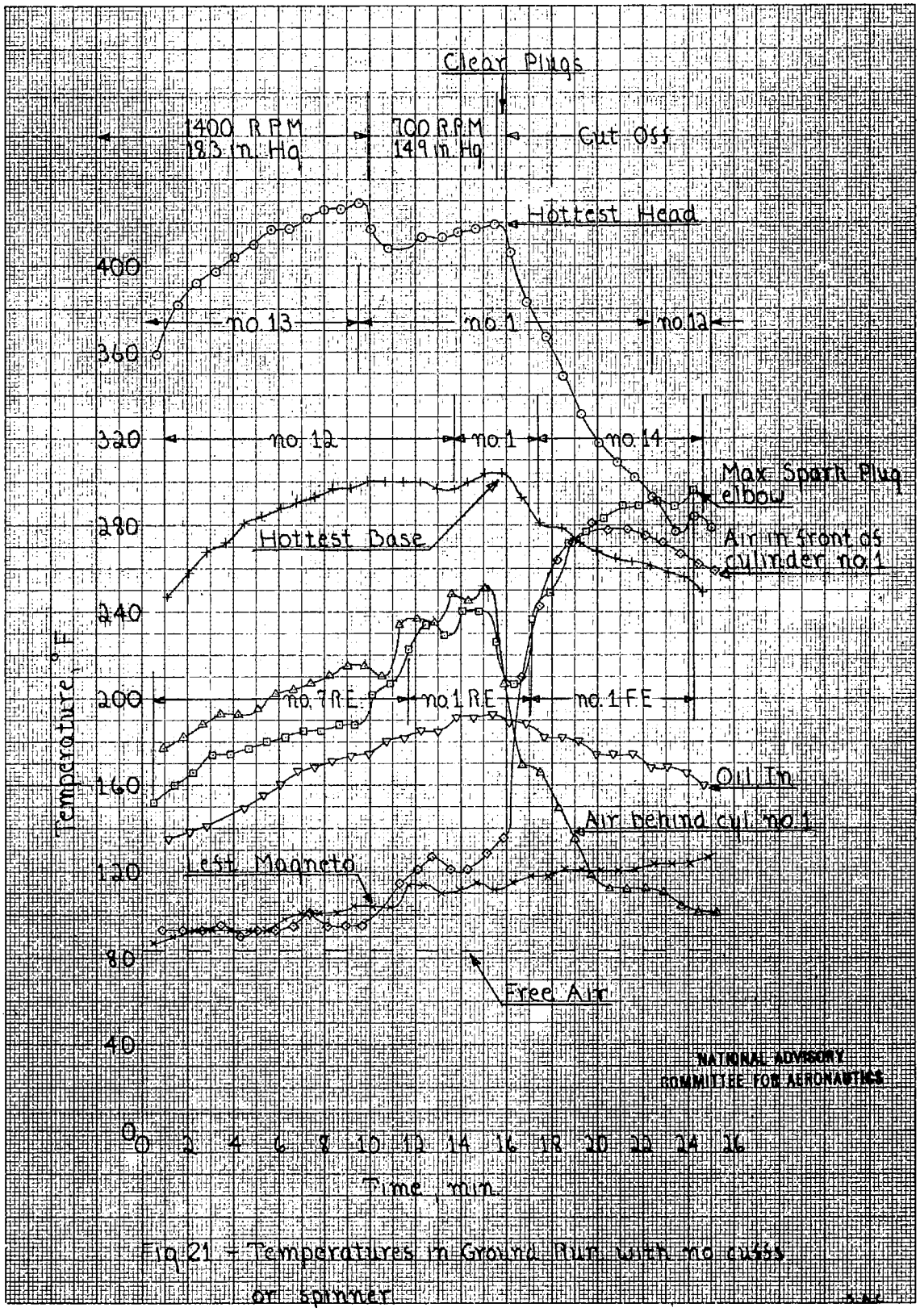

Fig. 21 - Temperatures in Ground Run with no cuss or spinner

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