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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

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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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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 $52.73\left(\frac{\eta}{C_D S}\right)^{\frac{1}{3}}$ 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 $\frac{\eta}{C_D S}$ 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.

REFERENCES

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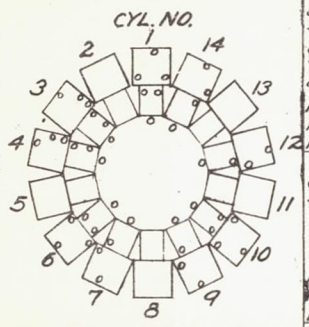
Table I(a) Pressure Data (Sheet 1)

XP-42 AIRPLANE
C COWL
SPINNER & CUFFS

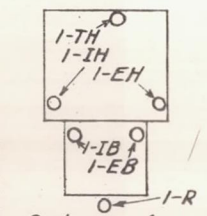
TEST NO.- FLT. NO.	18-5					18-6				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIR SPEED, MPH	334	336	335	333	335	332	332	332	331	333
q_c, IN. H_2O	35.5	34.6	33.3	32.0	31.2	35.3	34.1	33.0	33.3	34.8
ATM. PRESS., IN. HG.	17.53	16.86	16.19	15.56	14.96	17.57	16.88	16.20	16.51	17.22
ATM. TEMP. °F.	34	34	28	23	21	33	28	24	25	33
σ, DENSITY RATIO	.616	.592	.576	.559	.540	.618	.600	.581	.590	.606
DENSITY ALT., FT.	15650	16850	17700	18600	19600	15550	16350	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									

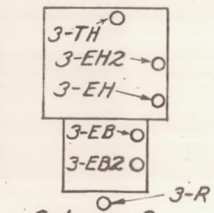
IND. AIRSPEED, MPH	17-4B				17-4A			
	1	2	3	4	1	2	3	4
q_c	156	151	153	153	137	137	138	135
AV. PRESS. ALT.	12.0	11.3	11.5	11.6	9.3	9.3	9.4	9.0
AV. FREE AIR, °F	4900	10000	15100	19000	5200	9900	15100	19000
AV. BHP	63	49	33	18	59	43	28	15
AV. MANIF. PRESS.	860	880	820	710	870	900	740	620
RPM	40.0	39.0	36.0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

ENGINE PRESSURE TUBE LOCATIONS



METHOD OF DESIGNATING TUBE LOCATIONS FOR TYPICAL CYLINDERS





		PRESSURE RATIO, p/q_c														
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	.61	.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	.73	.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 BARREL	.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	.38

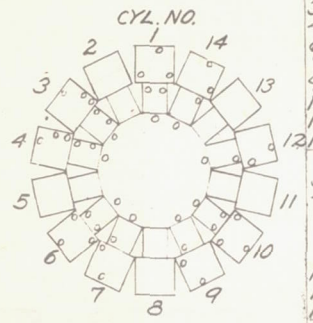
Table I(a) Pressure Data (Sheet 2)

XP-42 AIRPLANE
C COWL
CUFFS ONLY

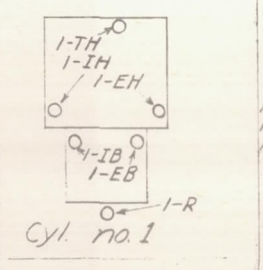
TEST NO.-FLT. NO.	19-1					19-2				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED, MPH.	332	331	332	330	330	331	331	331	332	334
q_c, IN. H_2O	35.0	33.7	32.8	31.4	30.3	34.0	33.0	31.7	30.8	33.9
ATM. PRESS. IN. HG.	17.48	16.83	16.16	15.51	14.90	16.89	16.22	15.59	14.94	16.53
ATM. TEMP. °F	33	30	27	21	18	26	23	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
B.H.P.	928	900	877	849	816	909	877	853	812	905
R.P.M.	← 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									

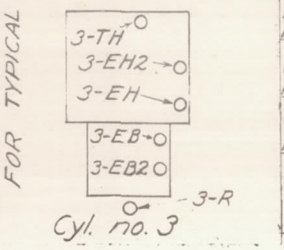
	20-1				20-2			
	1	2	3	4	1	2	3	4
IND. AIRSPEED, MPH.	155	154	153	152	140	139	139	136
q_c	12.0	11.8	11.6	11.5	9.7	9.5	9.5	9.2
AV. PRESS. ALT.	3800	9100	13900	18900	3800	8300	14000	17800
AV. FREE AIR, °F	66	48	34	21	69	48	31	21
AV. BHP	870	900	840	750	930	930	780	660
AV. MAN. PRESS.								
RPM	← 2580 →				← 2570 →			
	AUTO. RICH CLIMB WITH CUFFS, WITHOUT SPINNER				FULL RICH CLIMB			

ENGINE PRESSURE TUBE LOCATIONS



METHOD OF DESIGNATING TUBE LOCATIONS FOR TYPICAL CYLINDERS





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 BARREL 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

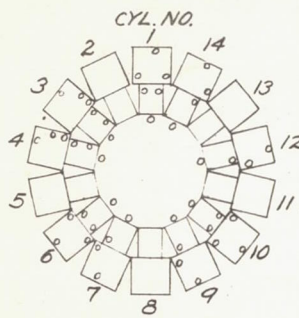
Table I(a) Pressure Data (Sheet 3)

XP-42 AIRPLANE
C COWL
NO CUFFS OR SPINNER

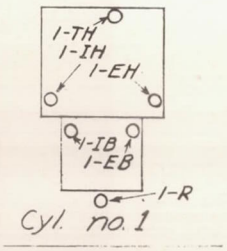
TEST NO. - FLT. NO.	22-1					22-2				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED, MPH	331	331	331	330	330	329	329	330	330	327
q_c, IN. H_2O	34.6	33.7	32.3	31.0	30.3	33.9	32.8	31.9	30.8	29.2
ATM. PRESS., IN. HG.	17.23	16.54	15.90	15.27	14.66	17.16	16.47	15.84	15.19	14.60
ATM. TEMP., °F	28	23	23	19	13	28	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 NO SPINNER OR CUFFS				FULL RICH CLIMB			

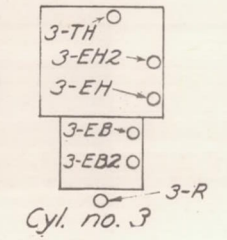
ENGINE PRESSURE TUBE LOCATIONS



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	-.41	-.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 (SHELTERED TUBES BEHIND ENGINE)	.22	.22	.23	.22	.22	.25	.26	.24	.24	.25	-.36	-.36	-.33	-.36	-.43	-.43	-.38	-.43
1-EB	.72	.72	.72	.72	.72	.73	.73	.72	.73	.73	.52	.53	.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 (EXHAUST SIDE OF BARREL)	.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
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 (EXHAUST SIDE OF HEAD)	.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
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 (TOP OF HEAD)	.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
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 (INTAKE SIDE OF BARREL HEAD)	.78	.78	.78	.79	.78	.80	.80	.78	.80	.81	.79	.79	.84	.81	.80	.85	.86	.82
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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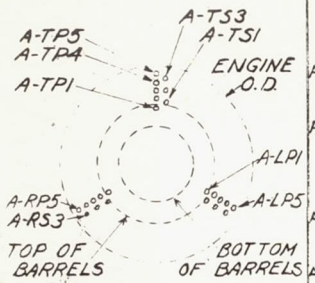
Table I(b) Pressure Data (Sheet 1)

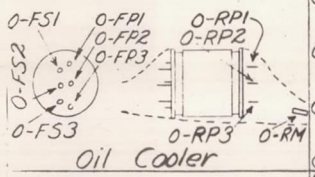
XP-42 AIRPLANE
C COWL
SPINNER & CUFFS

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	.618	.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									

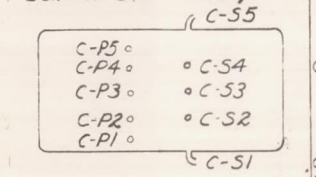
IND. AIRSPEED, MPH	17-4B				17-4A			
	1	2	3	4	1	2	3	4
q_c	156	151	153	153	137	137	138	135
AV. PRESS. ALT.	12.0	11.3	11.5	11.6	9.3	9.3	9.4	9.0
AV. FREE AIR, °F	4900	10000	15100	19000	5200	9900	15100	19000
AV. BHP	63	49	33	18	59	43	28	15
AV. MANIF. PRESS.	860	880	820	710	870	900	740	630
R.P.M.	40.0	39.0	36.0	30.9	42.0	42.0	35.0	30.0
	← 2560 →				← 2540 →			
	AUTO RICH CLIMB				FULL RICH CLIMB			
	SPINNER AND CUFFS							



Survey Ahead of Engine



Oil Cooler



PRESSURE RATIO P/q_c

A-TP1	IMPACT TUBE	TOP SURVEY RAKE	.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	STATIC TUBE		.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	IMPACT TUBE	RIGHT SURVEY	.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	.67	.47	.51	.54	.55	.48	.50	.51	.52
4			.66	.68	.68	.67	.66	.66	.68	.67	.66	.67	.60	.60	.63	.63	.62	.60	.63	.64
5			.66	.65	.64	.64	.63	.66	.66	.64	.65	.65	.53	.53	.53	.68	.50	.50	.49	.52
A-RS 1	STATIC TUBE		.66	.64	.64	.62	.62	.64	.64	.64	.64	.62								
2			.64	.64	.62	.62	.61	.62	.63	.62	.63	.64								
3			.65	.64	.63	.63	.62	.65	.64	.64	.65	.64	.42	.50	.52	.53	.45	.49	.50	.49
A-LP 1	IMPACT TUBE	LEFT SURVEY	.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	.63	.65	.65	.64	.64	.64	.51	.53	.52	.60	.53	.50	.49	.50
5			.68	.67	.66	.66	.65	.67	.67	.67	.66	.66	.52	.55	.54	.54	.52	.52	.51	.54
A-LS 1	STATIC TUBE		.64	.64	.64	.62	.62	.64	.64	.64	.64	.64								
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-FP 1	IMPACT TUBES	FRONT SURVEY	.85	.86	.84	.85	.84	.85	.86	.85	.86	.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-FS 1	STATIC TUBES		.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-RP 1	IMPACT TUBES	REAR SURVEY	.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	IMPACT TUBES		.89	.88	.90	.87	.85	.90	.90	.89	.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	.93	.93	.92	.93	.94	.94	.94	.95	.94	1.00	1.03	1.01	.94	1.14	1.01	.99	.98
4			.97	.94	.94	.95	.94	.95	.96	.96	.96	.96	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	.96	1.12	1.13	1.06	1.04	1.18	1.14	1.11	1.09
C-S1	STATIC TUBES		.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

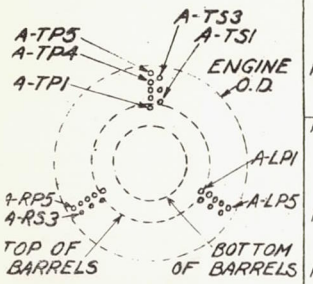
NATIONAL ADVISORY
COMMITTEE FOR AERONAUTICS

XP-42 AIRPLANE
C COWL
CUFFS ONLY

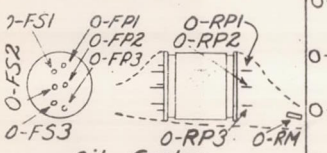
TABLE I(b) PRESSURE DATA (SHEET 2)

TEST NO. — FLT. NO.	19-1					19-2				
RUN NO.	1	2	3	4	5	1	2	3	4	5
TRUE AIRSPEED	332	331	332	330	330	331	331	331	332	334
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
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					2680				
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				

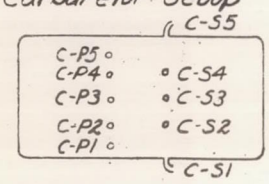
IND. AIRSPEED, MPH	20-1				20-2			
	1	2	3	4	1	2	3	4
q_c	155	154	153	152	140	139	139	136
AV. PRESS. ALT	12.0	11.8	11.6	11.5	9.7	9.5	9.5	9.2
AV. FREE AIR, °F	3800	9100	13900	18900	3800	8800	14000	17800
AV. BHP	66	48	34	21	69	48	31	21
AV. MANIF. PRESS	870	900	840	750	930	930	780	660
R. P. M.	2580 AUTO RICH CLIMB CUFFS				2570 FULL RICH CLIMB ONLY			



Survey Ahead of Engine



Oil Cooler



PRESSURE RATIO P/q_c

A-TP	1	.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-TS	1	.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-RP	1	.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	.74	.74	.76	.66	.67	.66	.70	.67	.66	.68	.67
A-RS	1	.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-LP	1	.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-LS	1	.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
O-FP	1	.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-FS	1	.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-RP	1	.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
C-P	1	.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-S	1	.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

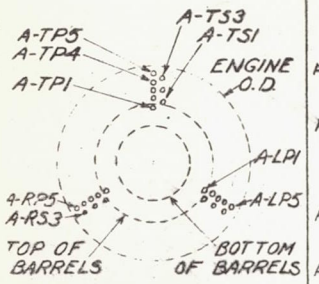
NATIONAL ADVISORY
COMMITTEE FOR AERONAUTICS

XP-42 AIRPLANE
C COWL
NO CUFFS OR SPINNER

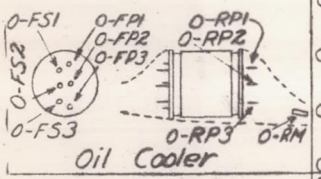
TABLE 1(b) PRESSURE DATA (SHEET 3)

TEST NO. - FLT. NO.	22-1					22-2				
RUN NO	1	2	3	4	5	1	2	3	4	5
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
	HIGH SPEED									

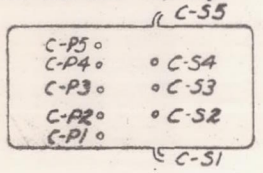
IND. AIRSPEED, MPH	21-1A				21-1B			
	1	2	3	4	1	2	3	4
q_c	155	153	154	153	139	138	136	135
AV. PRESS. ALT	11.9	11.6	11.7	11.5	9.5	9.4	9.2	9.0
AV. FREE AIR. °F	4200	8900	14200	17800	3900	9700	13800	17700
AV. BHP	52	49	37	23	53	51	36	20
AV. MANIF. PRESS	930	930	840	760	1000	940	790	680
R. P. M.	39.8	40.0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



Survey Ahead of Engine



Oil Cooler



PRESSURE RATIO P/q_c

A-TP1	.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	.66
4	.81	.80	.80	.81	.80	.81	.82	.80	.82	.81	.64	.66	.69	.66	.61	.71	.63	.66
5	.76	.78	.79	.78	.77	.79	.80	.78	.79	.78	.64	.65	.67	.67	.58	.62	.63	.66
A-TS1	.73	.74	.74	.74	.75	.76	.76	.74	.76	.75	.62	.61	.67	.65	.57	.63	.63	.66
2	.74	.74	.74	.74	.74	.74	.77	.74	.75	.75	.62	.64	.66	.64	.57	.63	.63	.66
3	.74	.75	.76	.75	.74	.76	.77	.75	.76	.76	.64	.64	.68	.65	.63	.66	.66	.63
A-RP1	.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	.70	.69
4	.75	.76	.76	.75	.76	.76	.76	.77	.77	.75	.73	.73	.76	.74	.70	.72	.67	.69
5	.75	.76	.76	.75	.76	.77	.77	.77	.77	.76	.69	.72	.72	.72	.68	.70	.67	.64
A-RS1	.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	.66	.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	.76	.75	.76	.76	.76	.76	.78	.76	.77	.77	.73	.71	.76	.75	.78	.81	.80	.80
2	.76	.76	.77	.76	.77	.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	.72	.70	.67
5	.77	.77	.78	.77	.78	.78	.79	.79	.79	.79	.70	.69	.73	.73	.66	.72	.70	.67
A-LS1	.69	.68	.70	.65	.69	.74	.76	.74	.74	.75	.63	.64	.66	.64	.59	.65	.63	.59
2	.74	.74	.75	.74	.75	.75	.77	.75	.76	.75	.65	.65	.68	.66	.60	.65	.65	.63
3	.75	.75	.76	.76	.75	.76	.77	.76	.76	.76	.66	.67	.71	.70	.65	.72	.66	.64
O-FP1	.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	.85
3	.94	.94	.94	.96	.94	.94	.95	.94	.95	.96	.87	.88	.90	.92	.90	.92	.96	.93
O-FS1	.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	.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
O-SP	.49	.49	.51	.49	.50	.51	.53	.52	.51	.52	.15	.17	.18	.16	.13	.16	.16	.14
C-P1	.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	.94	.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	.72	.73	.73	.73	.73	.74	.75	.74	.75	.74	.42	.35	.37	.41	.21	.01	.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	.08	.15	.18
5	.68	.69	.69	.70	.68	.68	.70	.70	.70	.70	.42	.32	.32	.35	.15	.03	.15	.18
C-TH IMPACT PRESS IN CARB	.73	.73	.74	.74	.74	.75	.75	.75	.75	.74	.46	.36	.39	.41	.19	.08	.16	.20

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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 →					← 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	290	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	322	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	219	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	38	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		165	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	146	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

TABLE 2 TEMPERATURE DATA (SHEET 2)

TEST NO-FLIGHT 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
B.H.P.	928	900	877	849	816	909	877	853	812	905
R.P.M.	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					HIGH SPEED				

	20-1				20-2			
	1	2	3	4	1	2	3	4
IND. AIRSPEED	154	153	153	151	138	135	136	136
Q_c IN. H_2O	11.7	11.5	11.5	11.2	9.4	9.0	9.1	9.1
AVE. PRESS. ALT.	4600	10800	14700	18800	4000	9900	14900	18600
AVE. FREE AIR °F	62	42	31	19	67	44	28	19
AVE. B.H.P.	850	905	807	720	939	900	758	650
AVE. MANIF. PRESS.								
R. P. M.	2580				2570			
	AUTO RICH CLIMB				FULL RICH CLIMB CUFFS ONLY			

CYL NO PT. OF MEASUREMENT	TEMP. °F.									
1 - REAR SP. PL. GASKET	377	375	378	382	388	389	383	397	393	379
2	375	375	379	382	388	383	389	399	395	381
3	384	379	384	388	393	392	395	409	406	388
4										
5										
6	379	377	382	384	386	381	390	399	395	386
7	434	432	436	439	443	440	444	458	452	438
8	395	395	400	400	402	399	406	418	411	404
9										
10	420	420	424	427	429	424	430	442	436	429
11	427	427	432	436	439	438	440	454	444	436
12	402	404	407	412	416	410	417	429	420	414
13										
14										
1 - REAR ℄ BARREL FLANGE	307	302	304	304	311	305	313	318	318	300
2	309	300	307	309						
3	302	295	298	298	302	302	304	311	309	295
4	304	300	304	304	307	304	307	313	313	295
5	293	286	288	291	293	293	295	300	300	283
6	307	304	304	304	309	304	309	315	315	297
7	302	295	298	298	300	302	302	306	309	290
8	298	293	295	295	298	293	295	302	302	286
9	316	313	316	316	320	318	318	327	325	311
10	325	325	325	327	327	325	329	336	334	318
11	298	295	295	295	300	302	302	306	306	293
12										
13	304	300	302	302	304	304	304	313	311	297
14	313	309	311	313	316	316	316	322	322	309
10 MIX. AT INTAKE PORT	221	219	219	219	219	219	222	225	223	223
" " BLOWER RIM	169	163	160	160	160	167	164	164	167	162
FUEL - SUC. SIDE PUMP	89	92	92	92	92	88	91	96	93	93
" - PR. " "	92	94	94	94	94	93	93	96	96	99
" - CARB. FLOAT CHAMBER	89	89	89	89	89	88	88	91	93	91
11 - FRT. SP. PL. ELBOW	68	65	62	59	59	64	62	64	62	64
11 - REAR " " "	77	74	73	71	68	73	70	73	70	76
RECORDED FREE AIR	48	46	42	39	36	44	41	41	38	44
AIR - CARB. SCOOP	51	48	45	42	39	47	41	44	41	47
" - FRT. CYL. 14	51	45	42	42	36	44	41	41	38	44
" - FRT CYL 1.	54	51	51	45	42	50	47	47	44	50
" - REAR " "	143	141	146	149	154	139	142	148	148	139
" - OIL COOLER EXIT	83	80	80	77	74	82	79	79	79	79
OIL - IN LINE	146	141	138	138	138	142	139	142	148	139
OIL - OUT	219	214	214	214	214	217	212	217	217	209
ACCESSORY COMPT.	116	115	115	112	112	114	114	116	114	114
LEFT MAGNETO	106	106	103	103	103	105	102	105	102	99
PILOTS COCKPIT	94	94	94	92	92	93	93	93	93	93
RECORDING INSTR. COMPT.	74	73	71	68	68	82	85	85	88	85

	20-1				20-2			
	1	2	3	4	1	2	3	4
1 - REAR SP. PL. GASKET	387	403	401	401	376	381	352	331
2	387	403	398	394	381	381	352	329
3	392	410	407	403	390	386	358	336
4								
5								
6	385	396	394	390	374	376	361	339
7	430	449	455	452	424	431	420	401
8	401	413	419	413	390	399	388	372
9								
10	412	427	436	432	401	410	404	384
11	419	434	443	441	404	410	404	386
12	396	407	412	407	390	390	376	358
13								
14								
1 - REAR ℄ BARREL FLANGE	298	311	311	311	283	297	290	278
2					283	299	285	280
3	288	305	305	305	283	292	285	278
4	298	311	311	309	285	297	288	278
5	279	290	290	290	267	280	274	267
6	290	307	309	309	280	294	292	285
7	287	300	300	300	274	288	285	278
8	279	295	298	298	271	288	285	278
9	300	317	322	322	288	304	302	297
10	309	324	327	329	292	315	313	304
11	288	300	302	302	276	290	288	278
12								
13	288	300	302	302	278	290	285	276
14	300	313	316	316	288	299	290	283
10 MIX. AT INTAKE PORT	229	220	215	211	225	211	204	194
" " BLOWER RIM	177	179	174	165	166	181	169	155
FUEL - SUC. SIDE PUMP	82	79	79	76	84	84	84	81
" - PR. " "	82	82	79	76	87	84	84	81
" - CARB. FLOAT CHAMBER	82	79	76	73	87	81	78	75
11 - FRT. SP. PL. ELBOW	85	68	62	50	84	78		46
11 - REAR " " "	102	88	79	68	107	90	75	64
RECORDED FREE AIR	66	48	38	22	70	50	36	25
AIR - CARB. SCOOP	68	50	36	24	73	55	37	19
" - FRT. CYL. 14	68	50	36	24	73	55	37	19
" - FRT CYL 1.	76	56	47	33	78	60	46	37
" - REAR " "	177	179	179	177	183	186	144	133
" - OIL COOLER EXIT	93	82	76	65	93	87	75	60
OIL - IN LINE	144	138	135	132	147	141	135	133
OIL - OUT	204	215	215	209	197	205	202	197
ACCESSORY COMPT.	107	96	90	82	107	98	87	78
LEFT MAGNETO	96	93	90	85	98	95	90	84
PILOTS COCKPIT	85	79	76	70	93	84	78	69
RECORDING INSTR. COMPT.	90	82	76	70	95	87	78	69

TABLE 2 — TEMPERATURE DATA (SHEET 3)

TEST NO. - FLIGHT 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 M. P. H.	331	331	331	330	330	329	329	330	330	327	IND. AIRSPEED	155	153	152	152	140	137	135	135
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	q_c	11.8	11.4	11.3	11.3	9.6	9.2	9.0	8.9
ATM. PRESS., IN. HG.	17.23	16.54	15.90	15.27	14.66	17.16	16.47	15.84	15.19	14.60	AV. PRESS. ALT.	4600	9400	14200	17600	5200	8700	14300	17700
ATM. TEMP., °F	28	23	23	19	13	28	26	23	21	19	AV. FREE AIR, °F	52	47	37	24	55	53	35	19
σ, DENSITY RATIO	.616	.594	.571	.553	.538	.610	.588	.569	.548	.529	AV. B. H. P.	941	930	845	762	1019	933	771	680
DENSITY ALT., FT.	15650	16750	17950	18900	19700	15950	17050	18050	19150	20200	AV. MANIF. PRESS.	39.8	39.9	36.1	31.9	42.9	43.1	35.5	30.8
B. H. P.	928	900	877	840	816	919	891	863	830	793	R. P. M.	← 2560 →				← 2540 →			
R. P. M.	← 2680 →											AUTO RICH CLIMB NO SPINNER				FULL RICH CLIMB OR CUFFS			
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		383	406	406	406	361	390	352	338
2	369	365	372	374	379	373	366	370	373	375		381	401	397	394	359	385	350	332
3	374	366	374	379	383	377	370	375	379	382		390	403	399	397	366	390	356	341
4												390	399	390	390	361	383	350	332
5																			
6	374	369	374	376	379	373	373	375	377	377		383	399	394	392	363	381	361	345
7	430	428	430	434	434	430	428	430	435	435		439	453	457	455	412	434	419	401
8	394	392	394	394	397	393	390	393	397	397		403	419	421	417	383	403	390	376
9																372	392	403	397
10	423	419	426	426	428	419	419	423	426	426		417	437	448	443	401	419	412	394
11	423	421	428	428	432	422	422	426	428	430		421	441	450	452	401	419	408	397
12	401	397	403	403	407	397	397	401	404	404		401	419	424	421	383	397	385	370
13																			
14																			
1 — REAR ℄ BARREL FLANGE	313	327	306	306	306	312	303	303	305	305		296	309	312	325	294	303	294	282
2																			
3	302	293	293	297	299	301	294	294	296	298		289	303	305	305	289	298	289	280
4	304	299	299	302	304	303	301	301	303	303		294	309	309	307	296	305	291	282
5	291	286	286	288	288	291	287	287	290	290		280	294	294	294	280	287	278	271
6	304	302	302	302	304	303	301	303	303	305		291	307	309	309	294	303	298	289
7	302	295	297	297	297	301	296	296	298	298		287	298	303	300	282	291	284	278
8	293	288	291	291	288	294	290	291	291	291		284	298	303	303	284	294	289	282
9	320	313	315	315	318	319	314	314	314	316		303	318	325	323	303	309	309	303
10	327	325	325	327	327	327	325	325	325	327		307	330	336	332	314	327	323	314
11	299	293	295	295	297	294	291	294	294	296		287	300	305	305	289	294	291	284
12																			
13	302	297	297	297	299	301	298	298	301	301		289	303	309	305	291	296	291	282
14	313	309	311	311	313	312	310	310	312	312		300	318	323	321	303	309	298	289
10-MIX. AT INTAKE PORT	219	215	215	215	215	218	218	216	216	216		223	221	221	213	221	213	204	195
" " BLOWER RIM	168	157	157	157	154	166	164	155	158	161		166	174	172	169	169	174	166	158
FUEL - SUCTION SIDE PUMP	81	84	84	84	84	85	88	91	91	93		77	77	77	77	77	77	77	74
" PRESS. " "	86	86	86	89	89	91	93	91	93	96		80	80	77	77	77	77	77	74
" CARB. FLOAT CHAMBER	81	81	81	81	81	85	88	82	88	88		80	74	77	74	74	77	74	72
11 — FRT. SP. PL. ELBOW	64	64	57	57	52	64	64					74	77	68	60	71	74	66	53
11 — REAR " " "	75	69	69	66	64	73	76	68	68	68		91	91	83	74	88	94	83	71
RECORDED FREE AIR	46	40	40	36	31	47	46	41	38	38		57	52	42	30	60	58	42	26
AIR CARB SCOOP	46	43	40	38	34	47	46	41	38	38		60	54	43	28	60	57	40	28
" FRT. CYL. NO. 14	46	43	40	38	34	47	46	41	38	38		60	57	43	28	60	60	43	28
" FRT. CYL. NO. 1	57	55	55	55	55	56	56	50	47	41		66	66	54	46	68	66	54	43
" REAR " " 1	118	115	115	118	120	119	119	119	122	127		144	152	152	150	150	155	147	149
" OIL COOLER EXIT	84	78	78	72	72	82	82	72	76	76		88	88	83	74	97	97	83	57
OIL — IN LINE	145	140	140	137	137	150	144	142	142	142		147	144	144	142	142	147	144	139
" OUT	220	214	212	212	212	221	216	208	213	216		204	210	215	215	204	199	210	204
ACCESSORY COMP'T.	115	109	109	109	106	113	113	111	111	111		100	100	94	86	97	100	91	83
LEFT MAGNETO	101	101	95	98	95	105	105	96	99	99		91	91	91	88	94	97	97	91
PILOT'S COCKPIT.	89	89	86	86	84	85	91	88	85	85		80	77	71	68	74	77	72	51
RECORDING INSTR. COMP'T.	81	81	81	81	78	71	71	68	68	64		80	77	74	68	77	80	80	54

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) climb

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

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FIG. 1 XP-42 C COWLING

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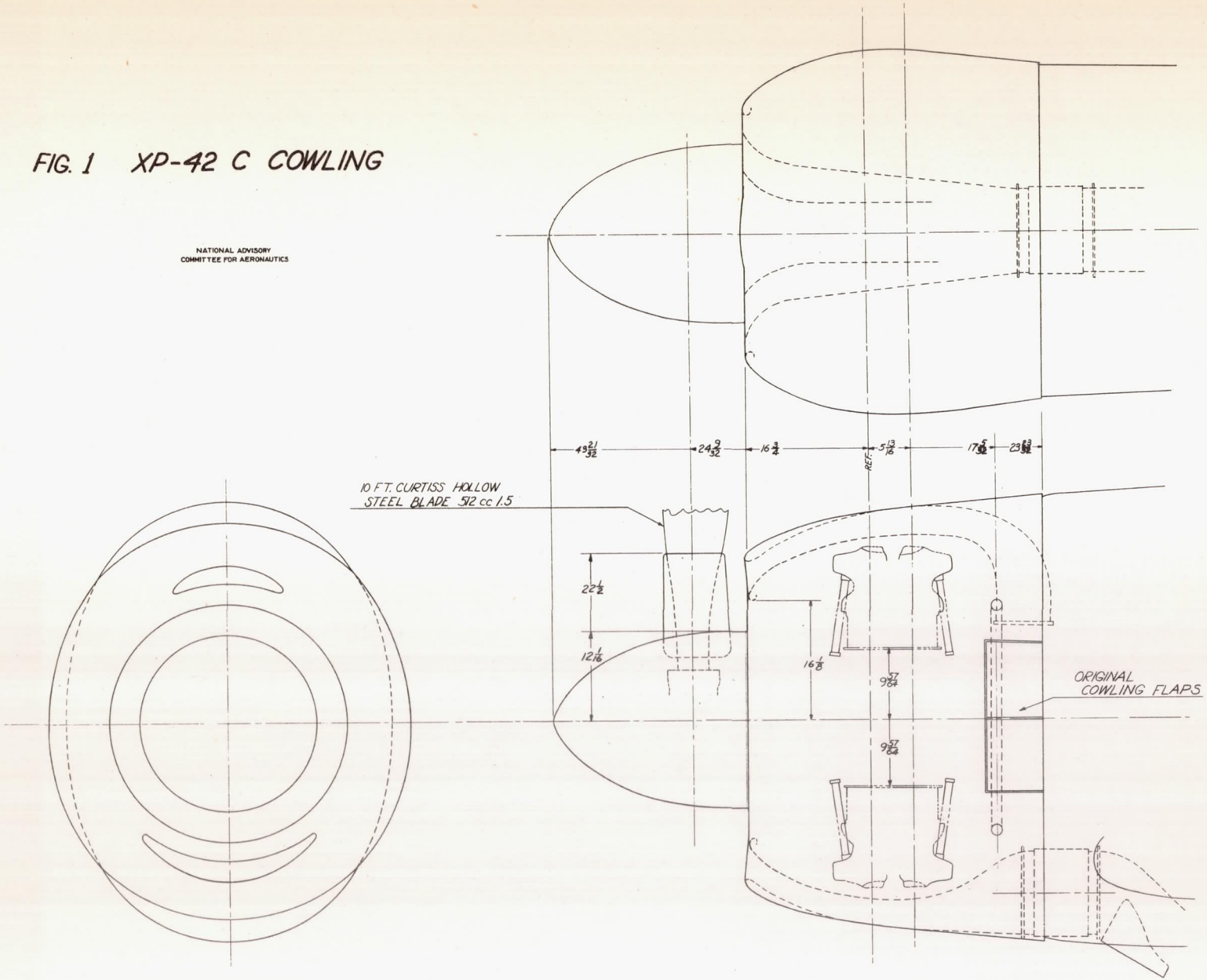

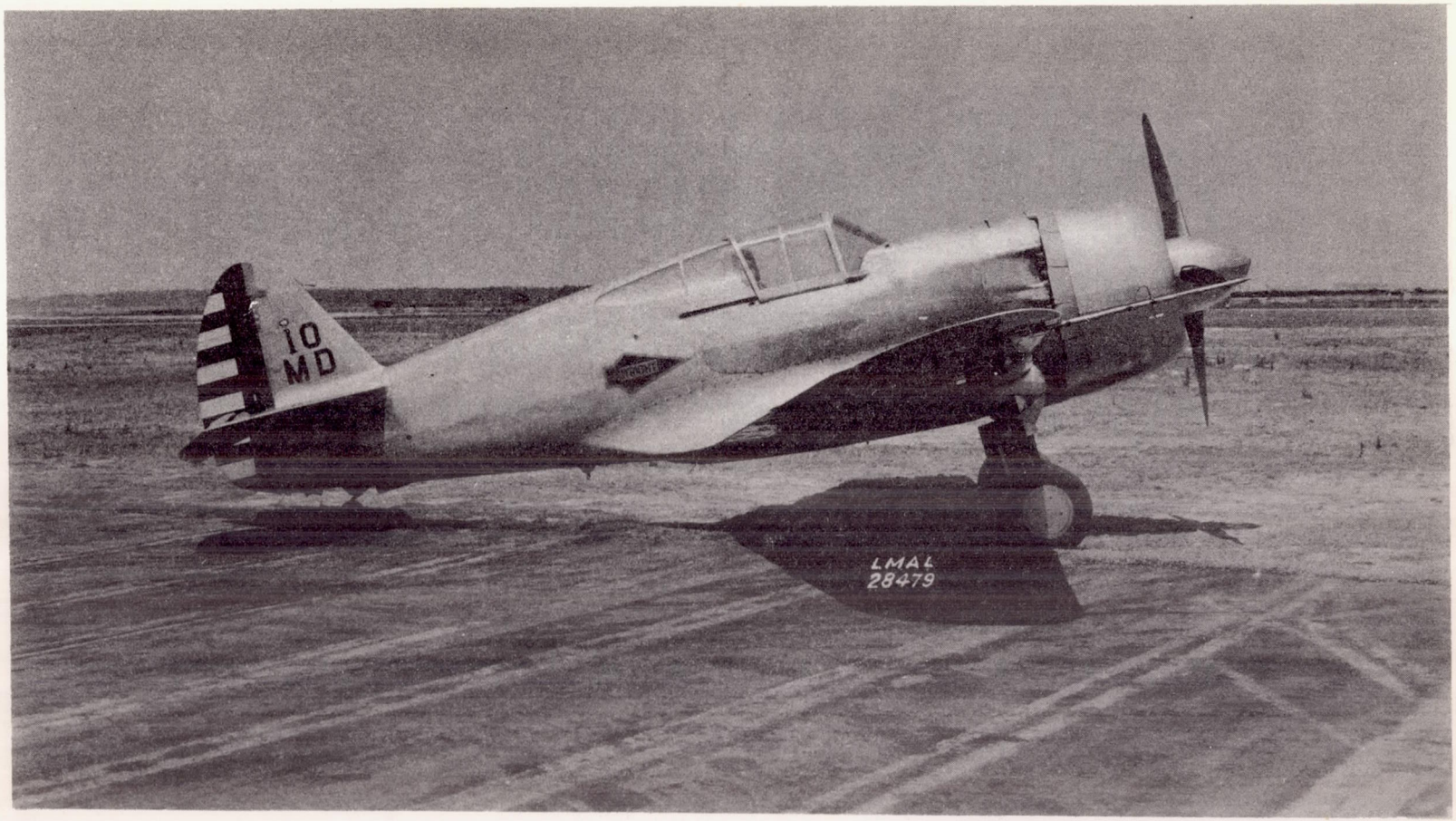

Figure 2.- Side view of airplane with C cowl, spinner, and cuffs.

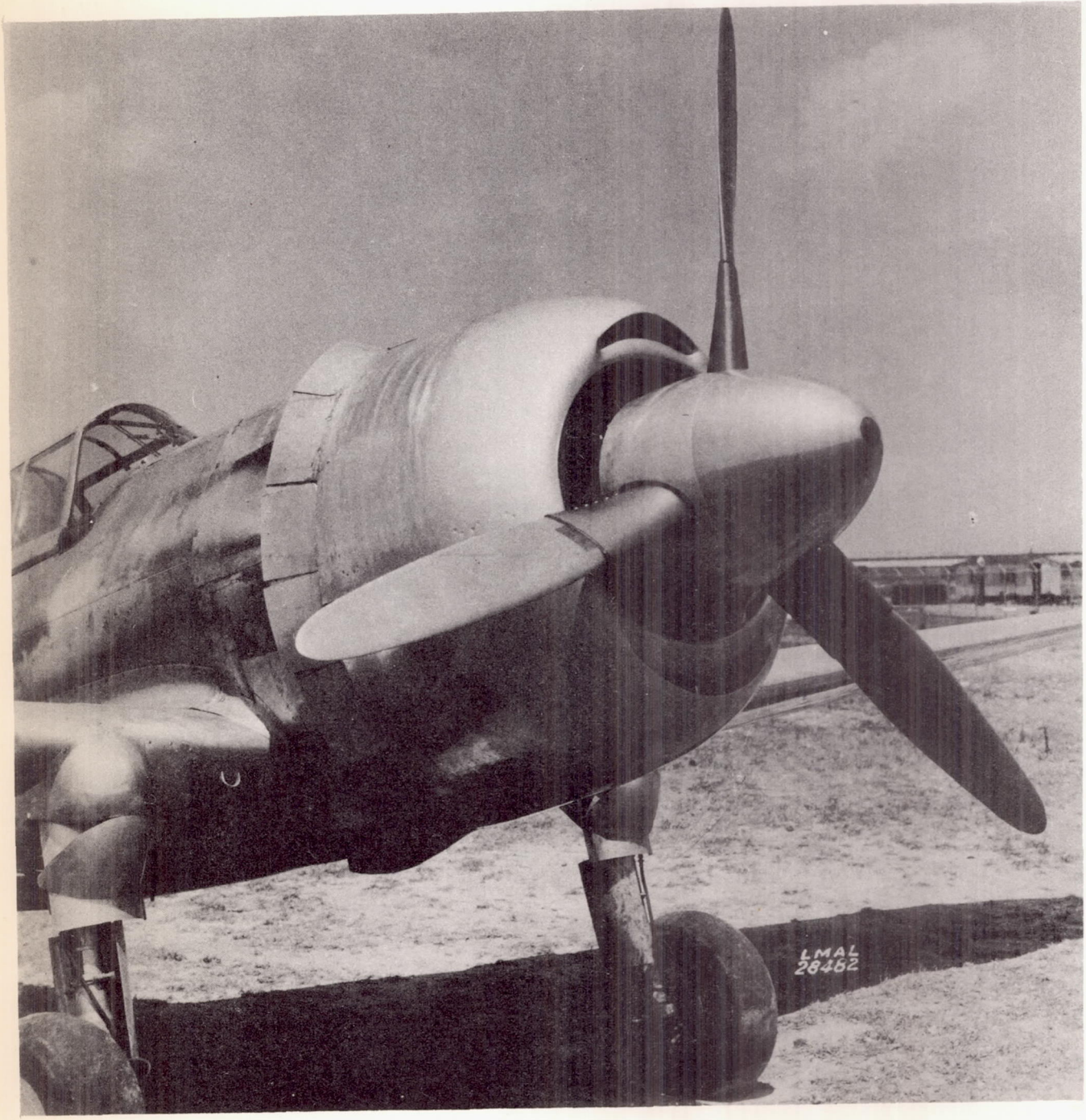

Figure 3.- Close-up of cowling with spinner and cuffs.

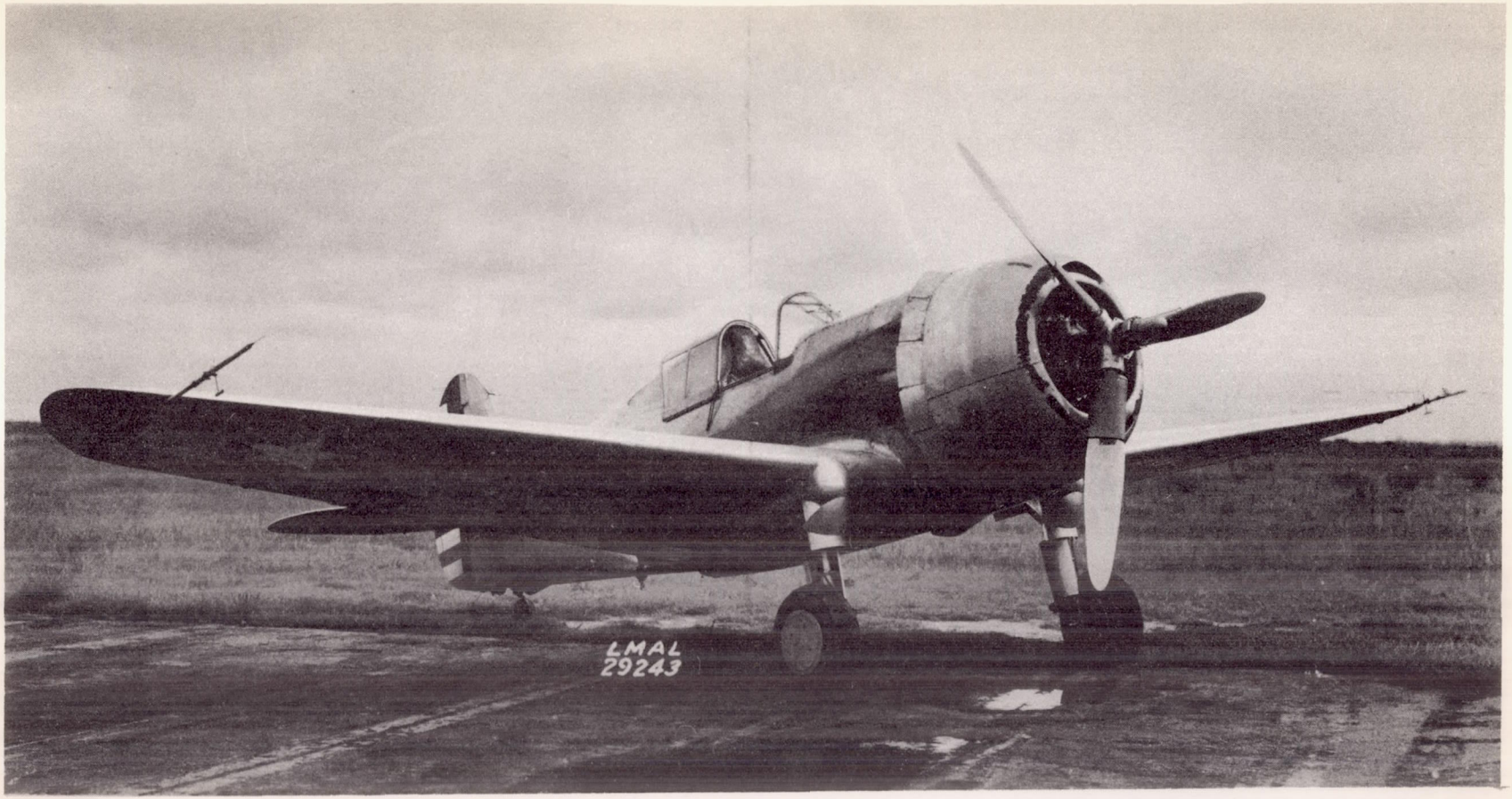

Figure 4.- Three-quarter front view of airplane with C cowl, cuffs only.

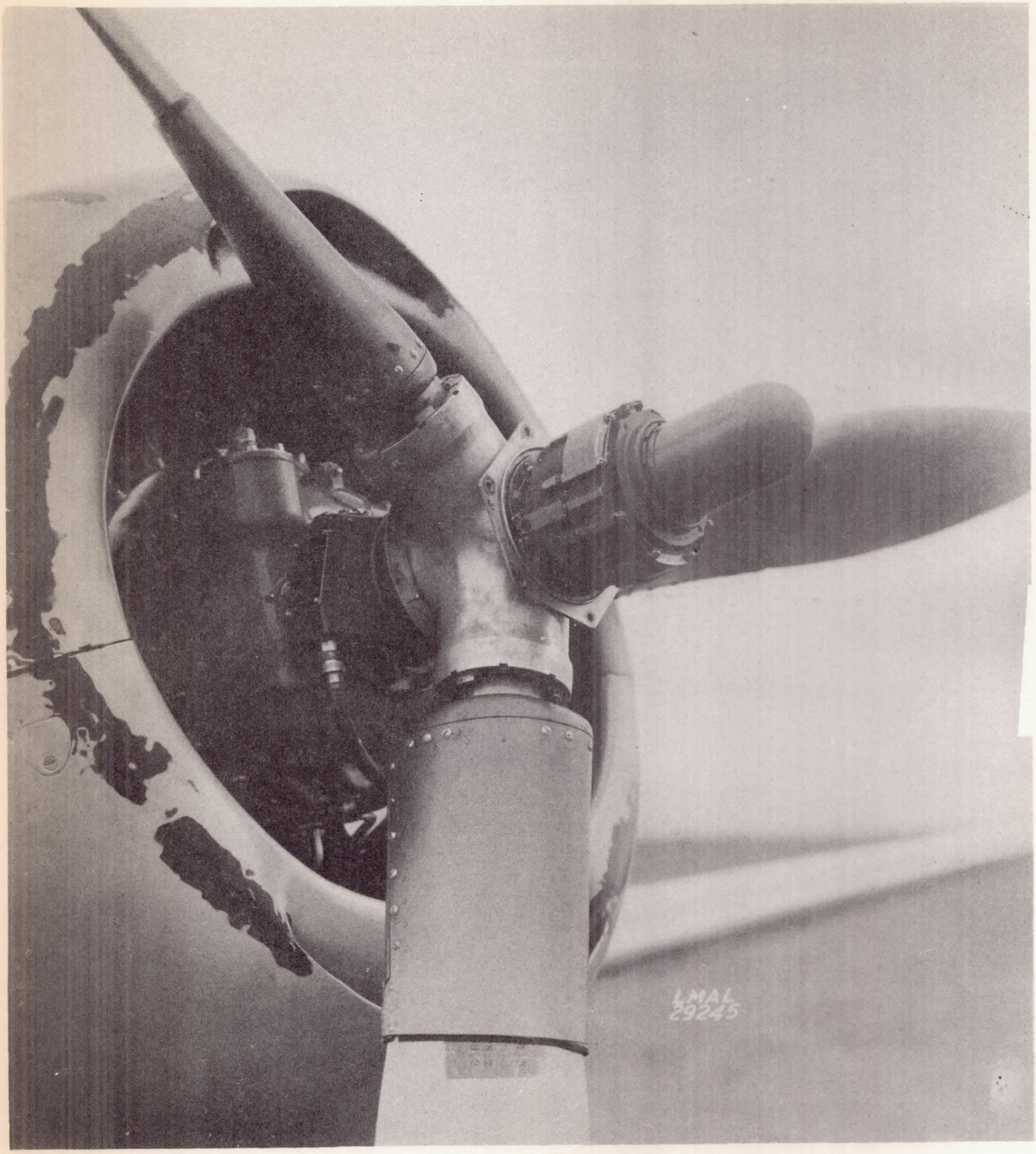

Figure 5.- Close-up of cowling with cuffs only.

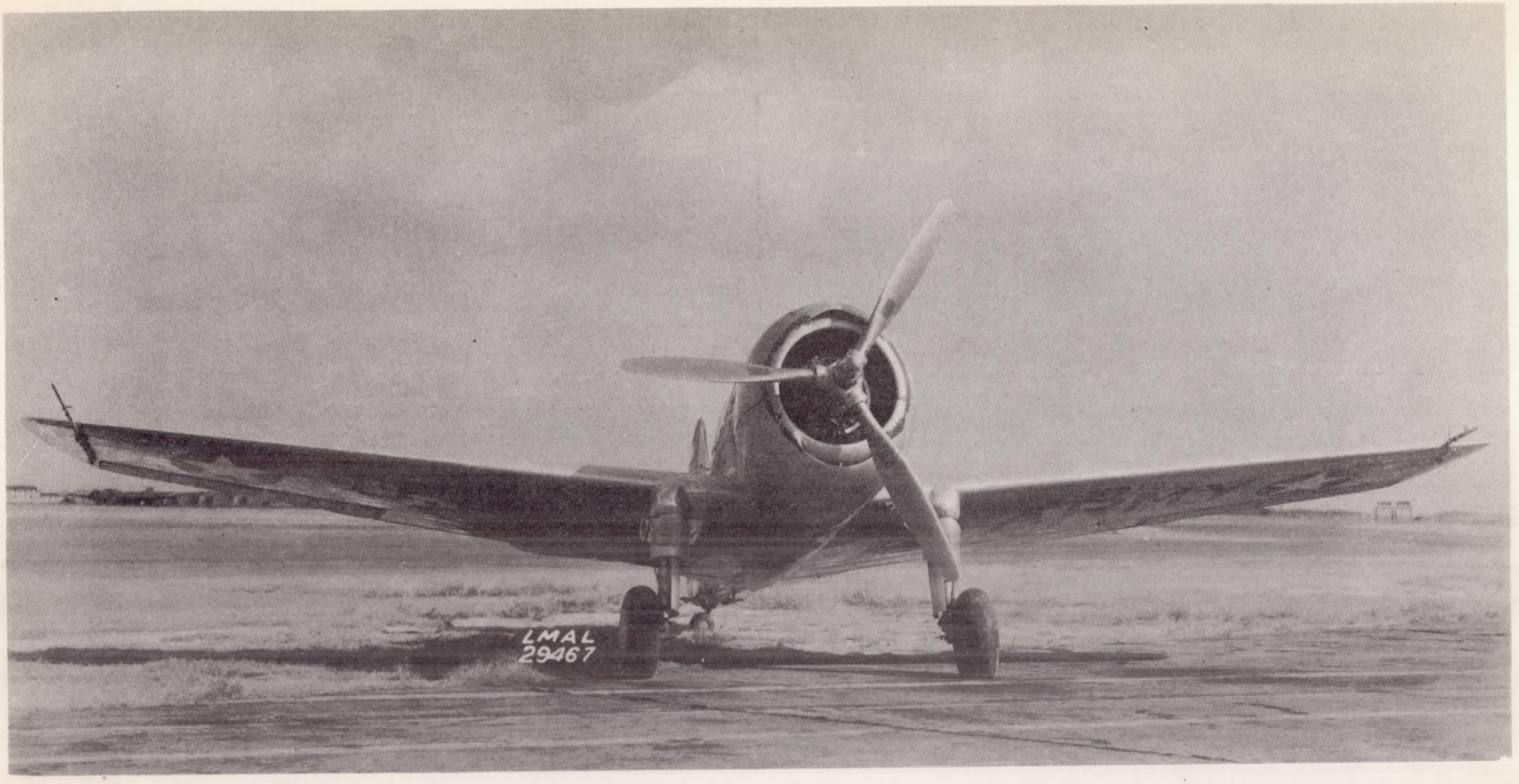

Figure 6.- Front view of cowling without spinner or cuffs.

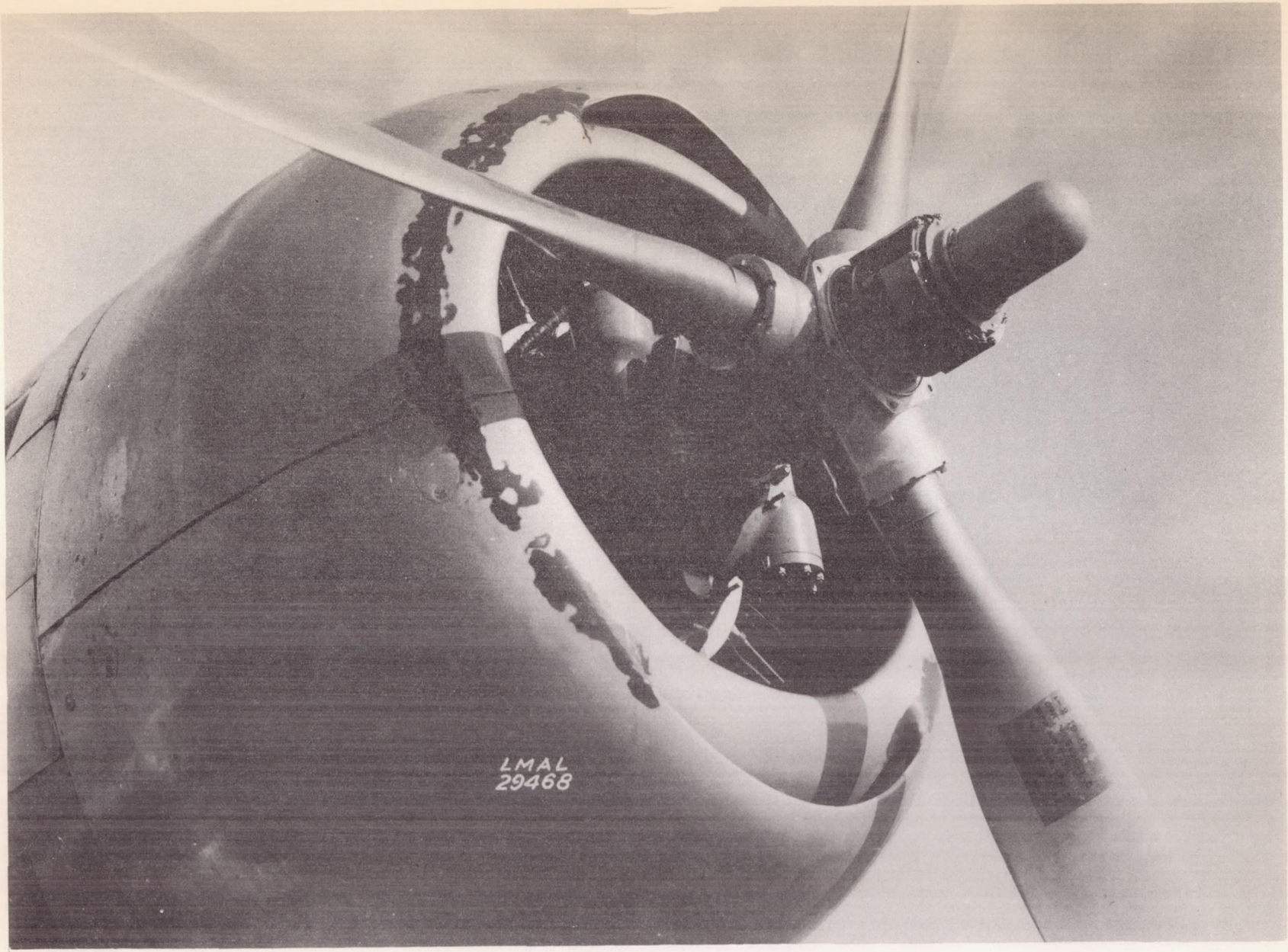

Figure 7.- Close-up of cowling without spinner or cuffs.

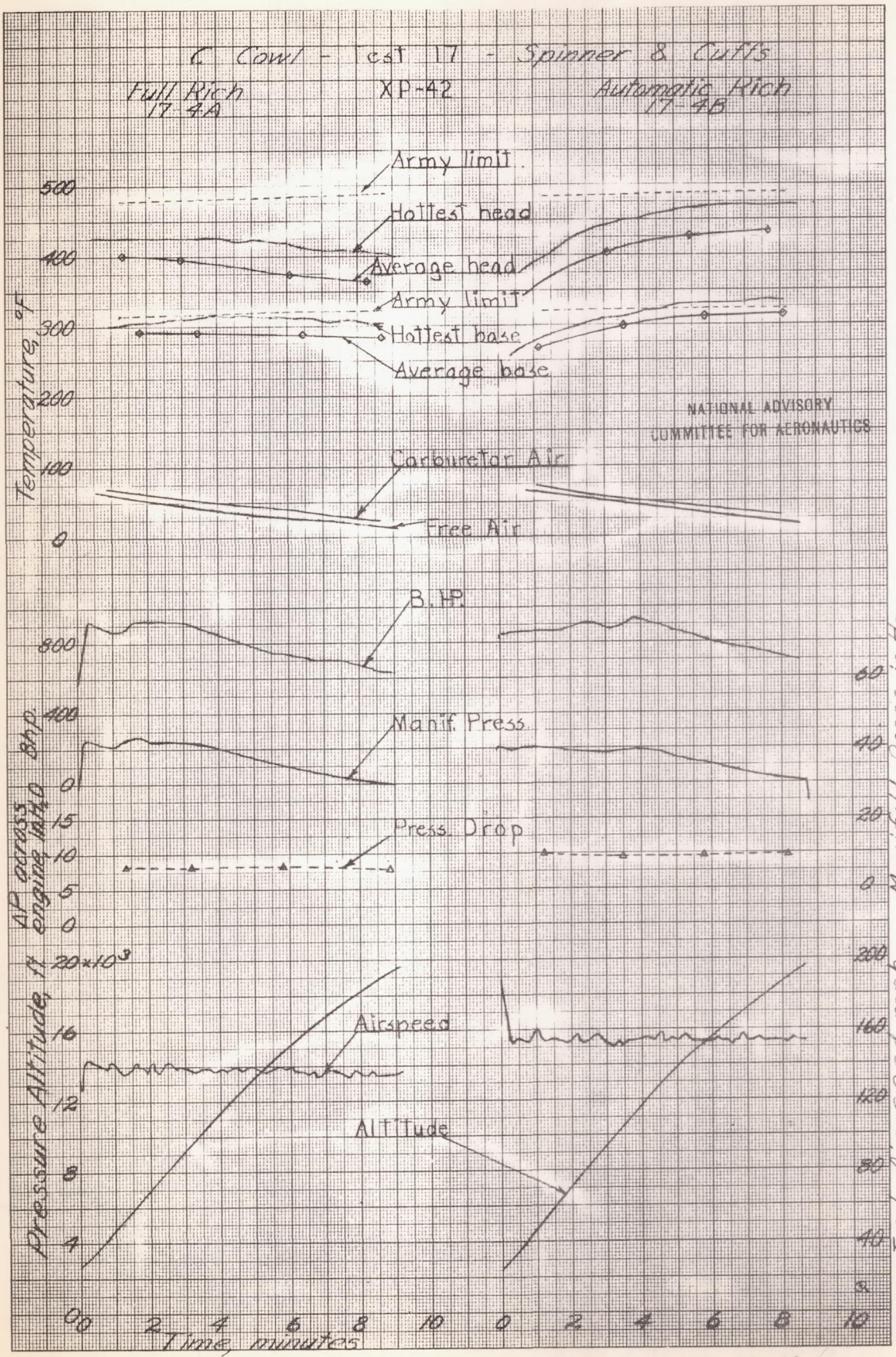

Fig. 8 Time History of Climbs with Spinner & Cuffs

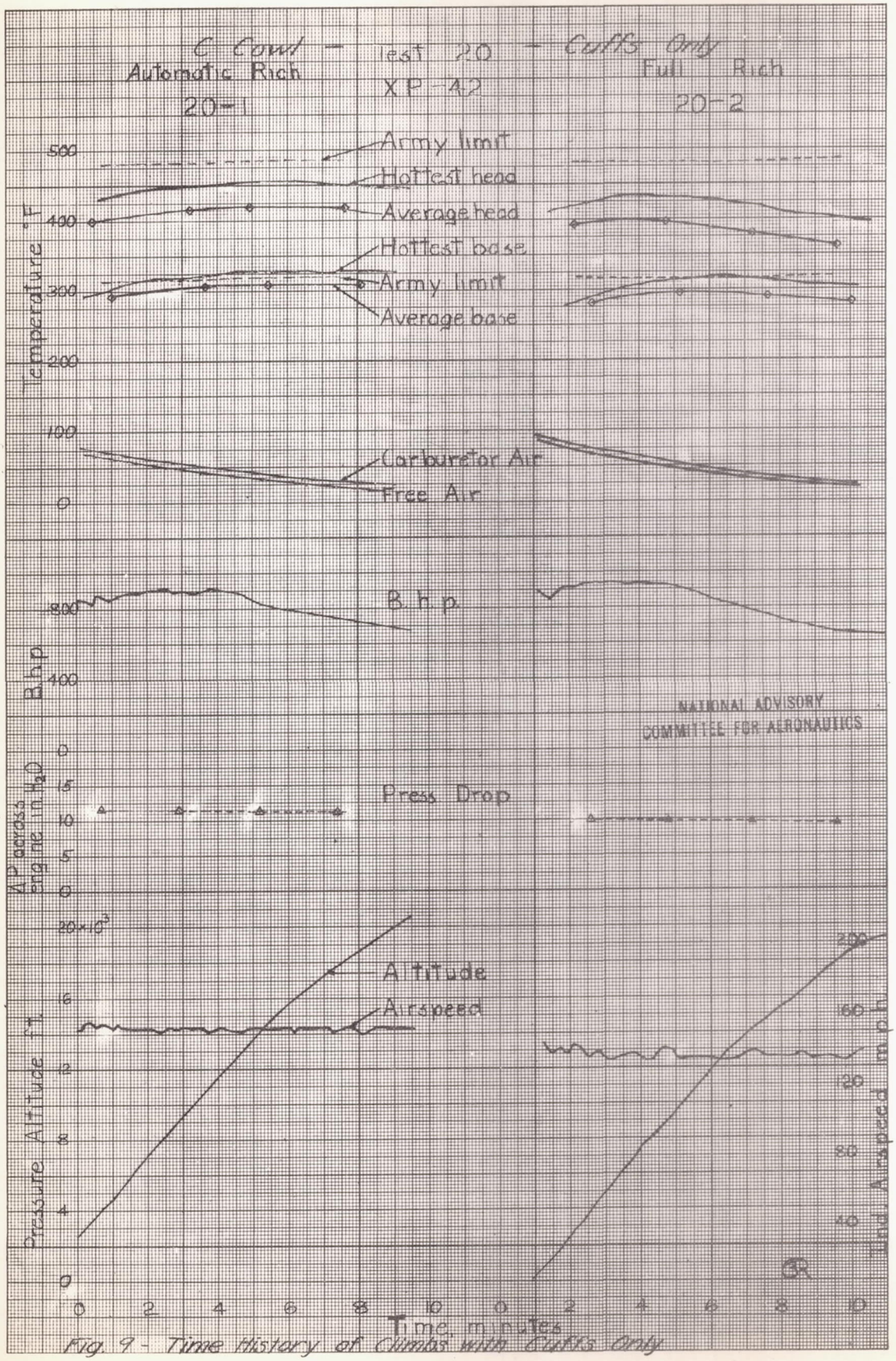

Fig. 9 - Time History of Climbs with Cuffs Only

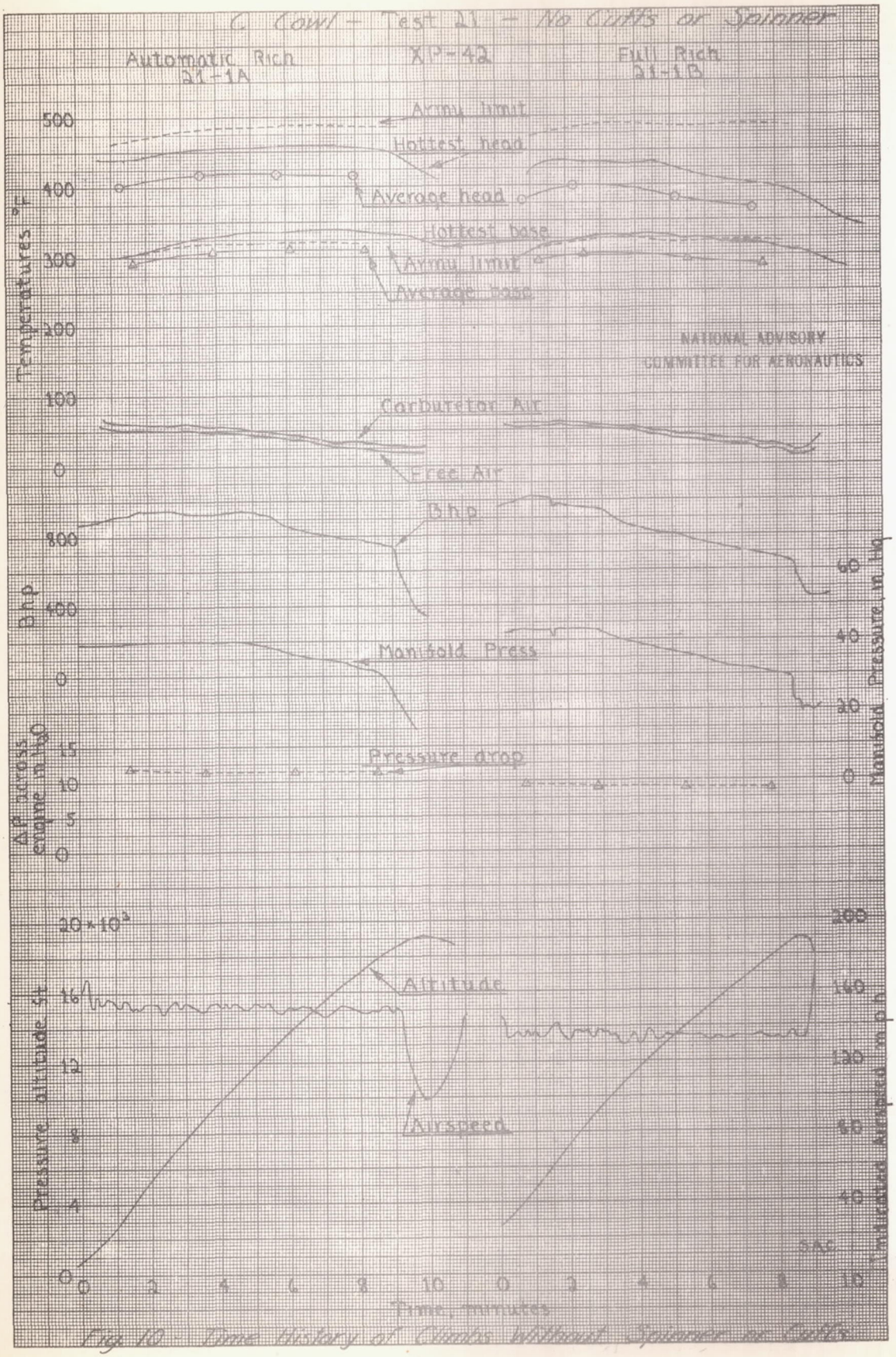

Fig. 10 - Time history of climbs without spinner or cuffs

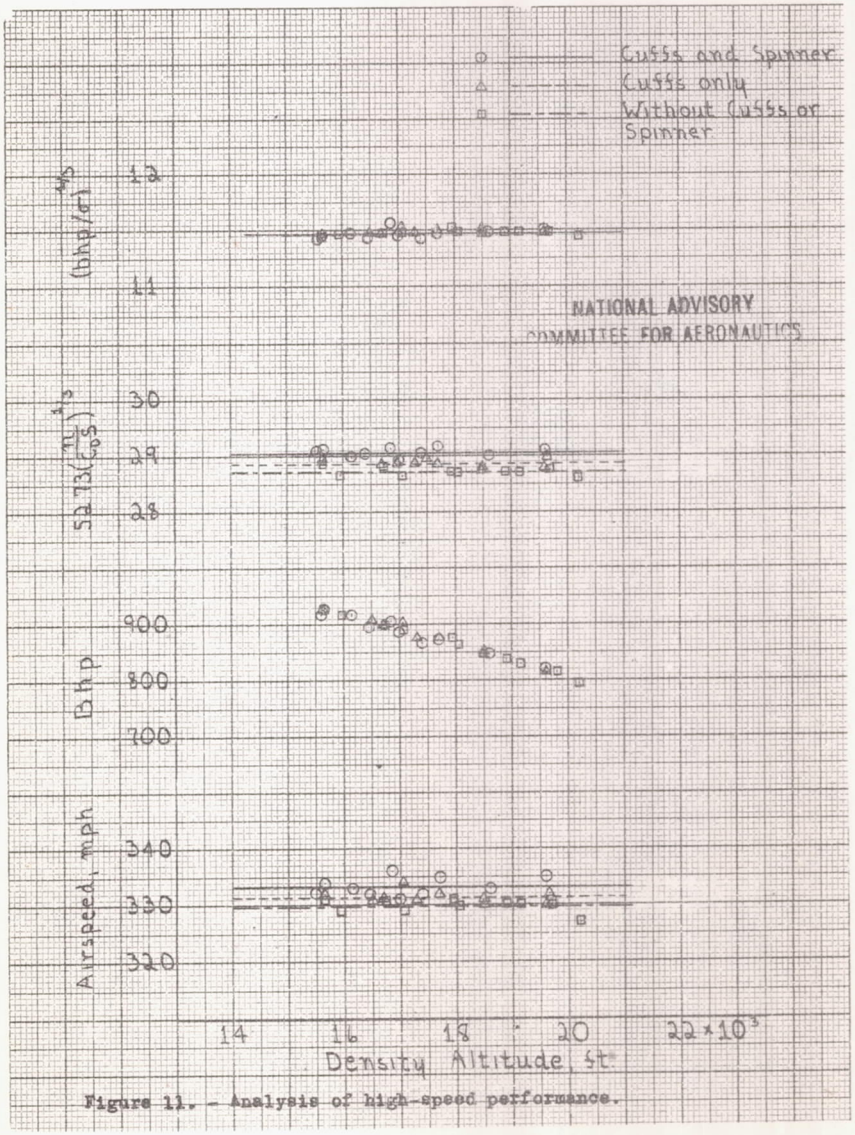

Figure 11. - Analysis of high-speed performance.

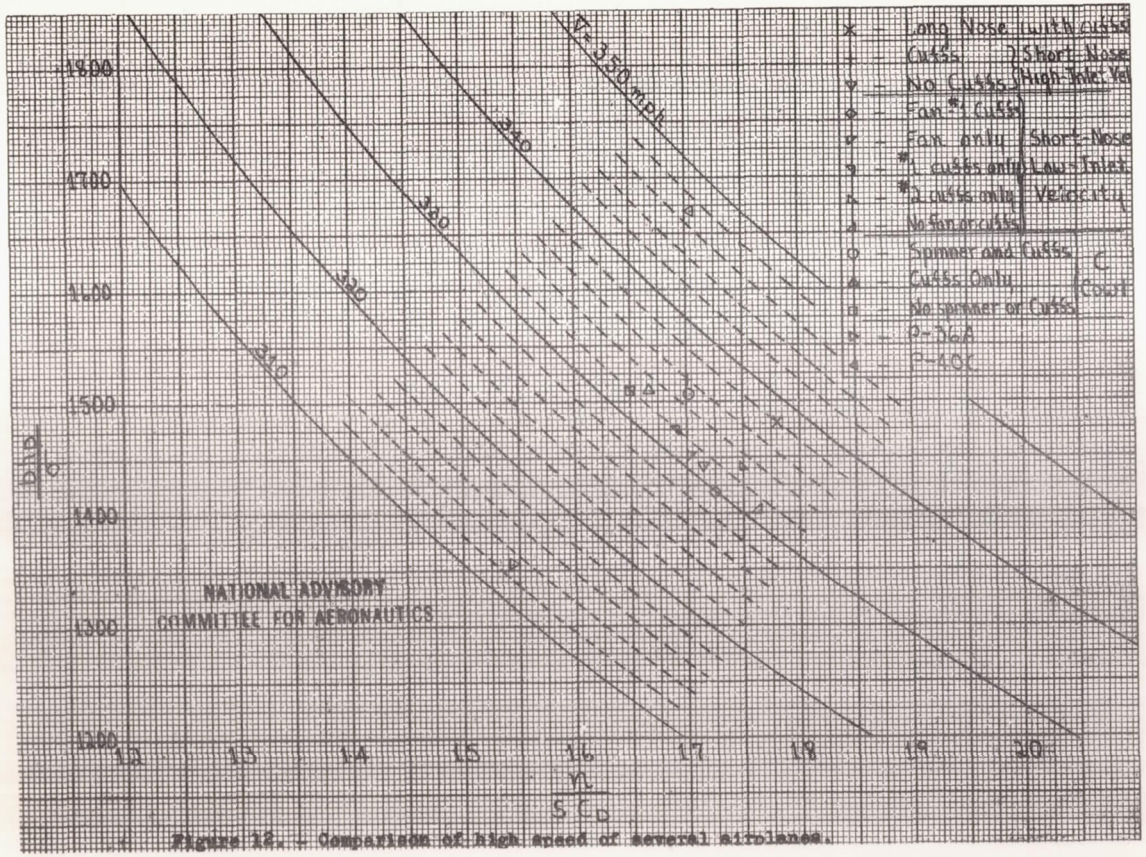

Figure 12.- Comparison of high speed of several airplanes.

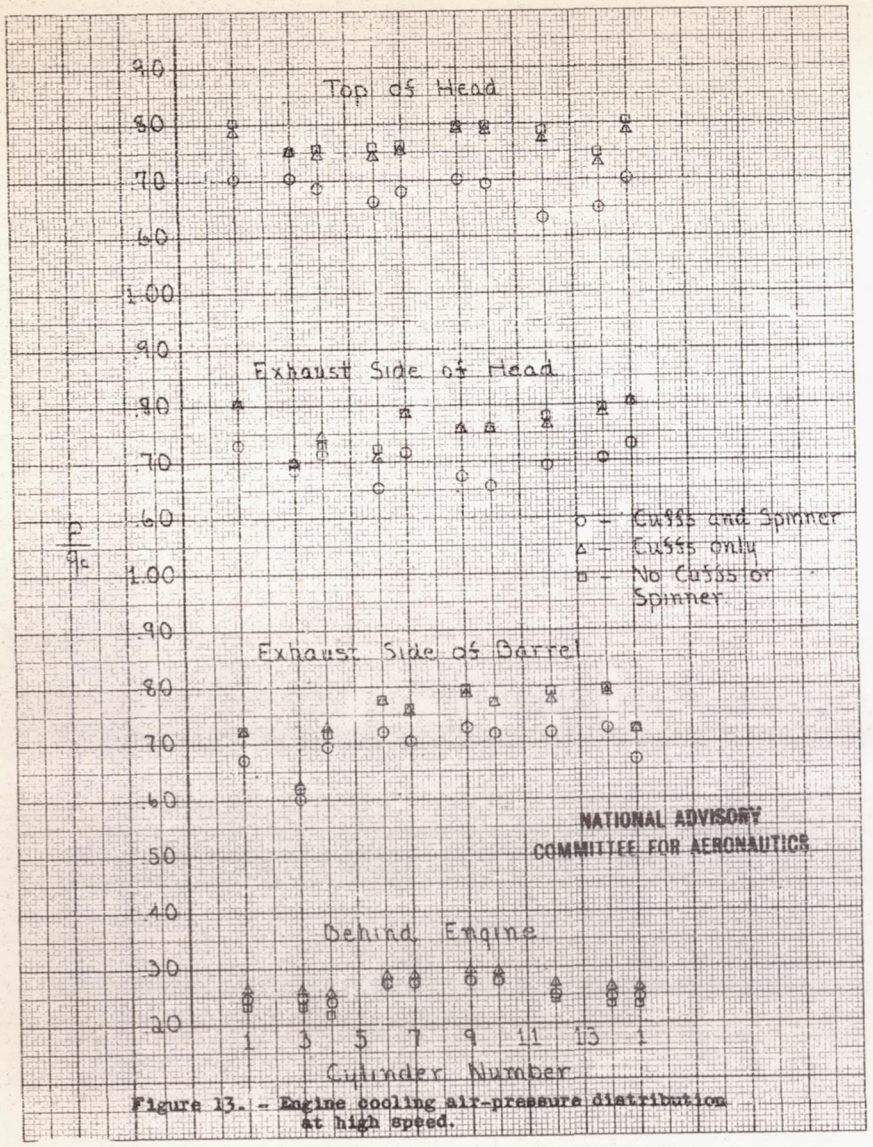

Figure 13. - Engine cooling air-pressure distribution at high speed.

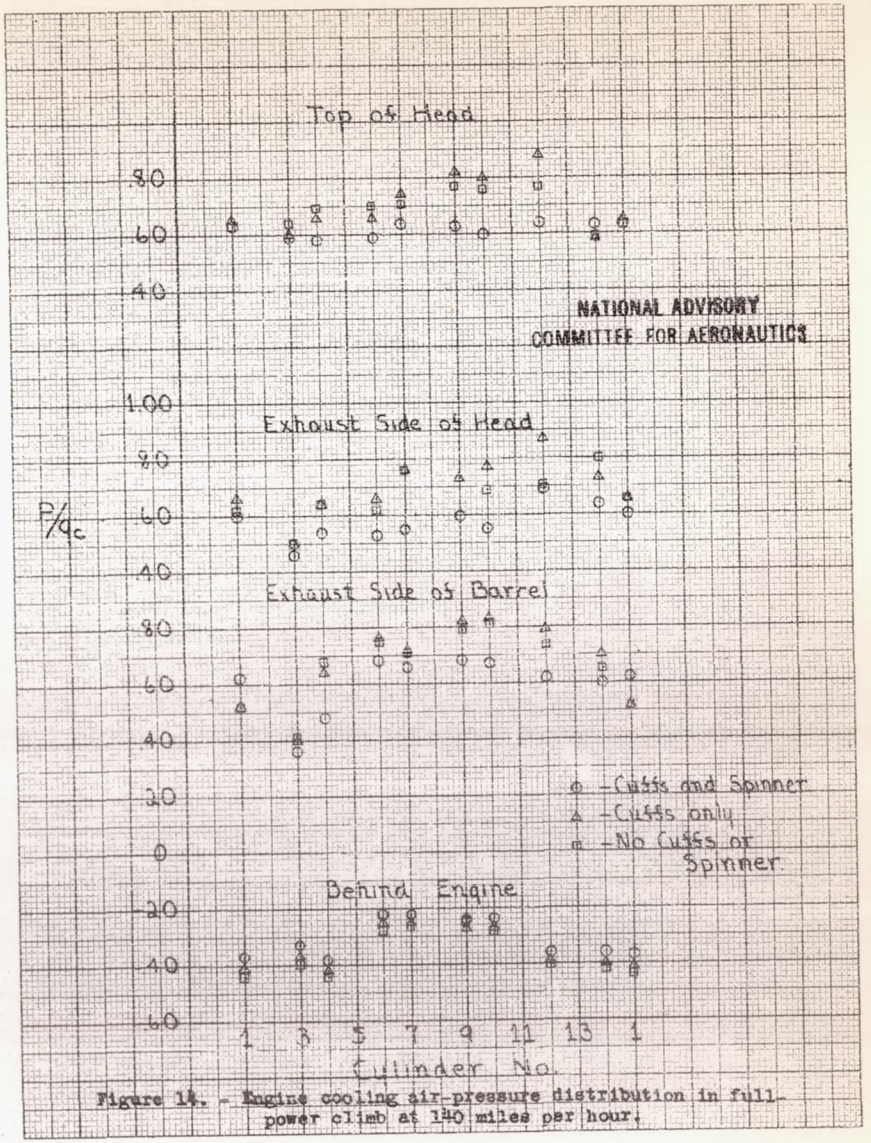

Figure 14. - Engine cooling air-pressure distribution in full-power climb at 140 miles per hour.

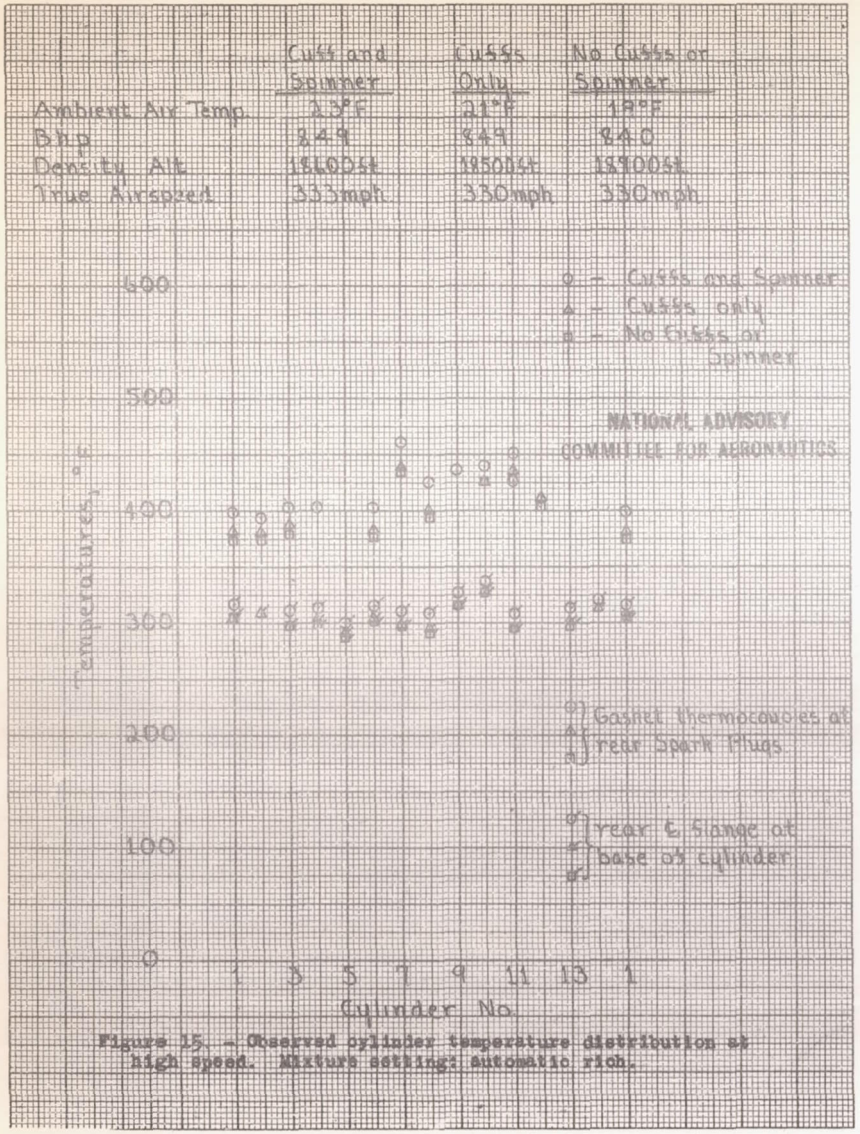

Figure 15. - Observed cylinder temperature distribution at high speed. Mixture setting: automatic rich.

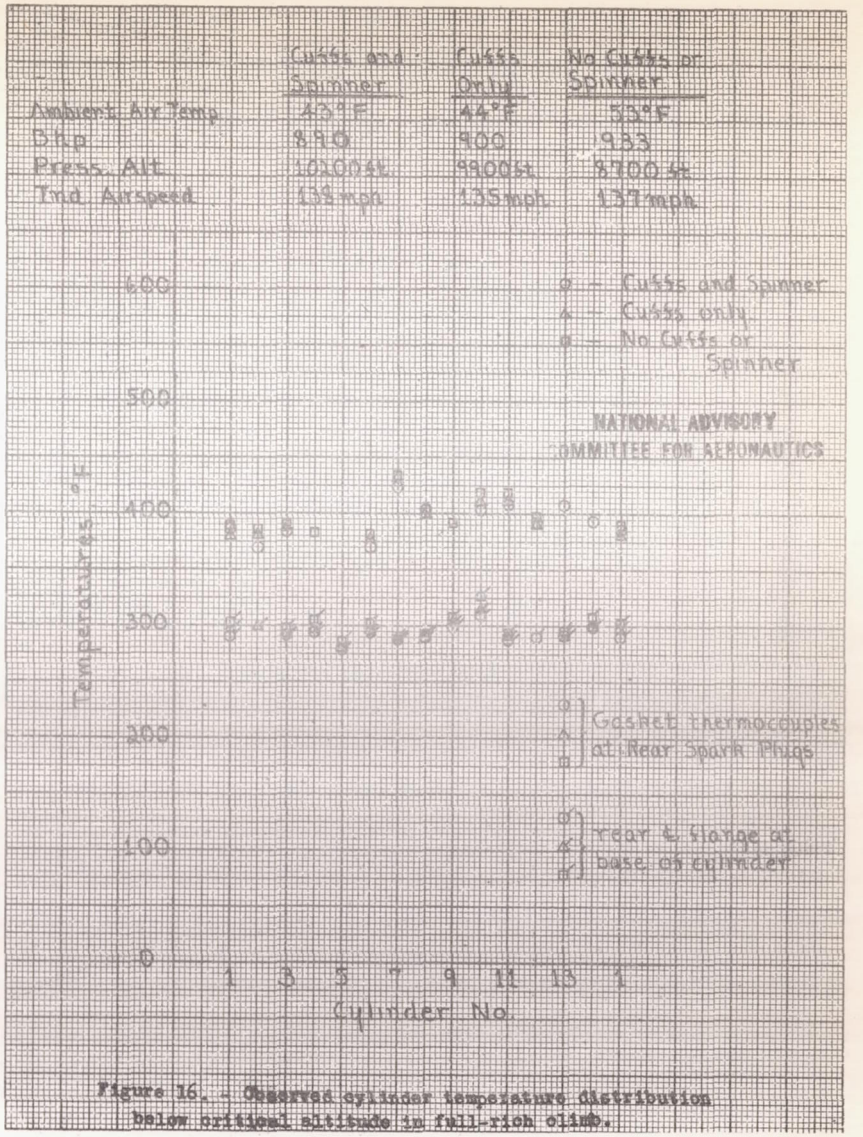

Figure 16. - Observed cylinder temperature distribution below critical altitude in full-rich climb.

	Cuffs and Spinner	Cuffs Only	No Cuffs or Spinner
Ambient Air Temp	15°F	19°F	19°F
Bhp	639	650	680
Pressure Alt	19100	18600	17700
Ind Airspeed	135 mph	136 mph	135 mph

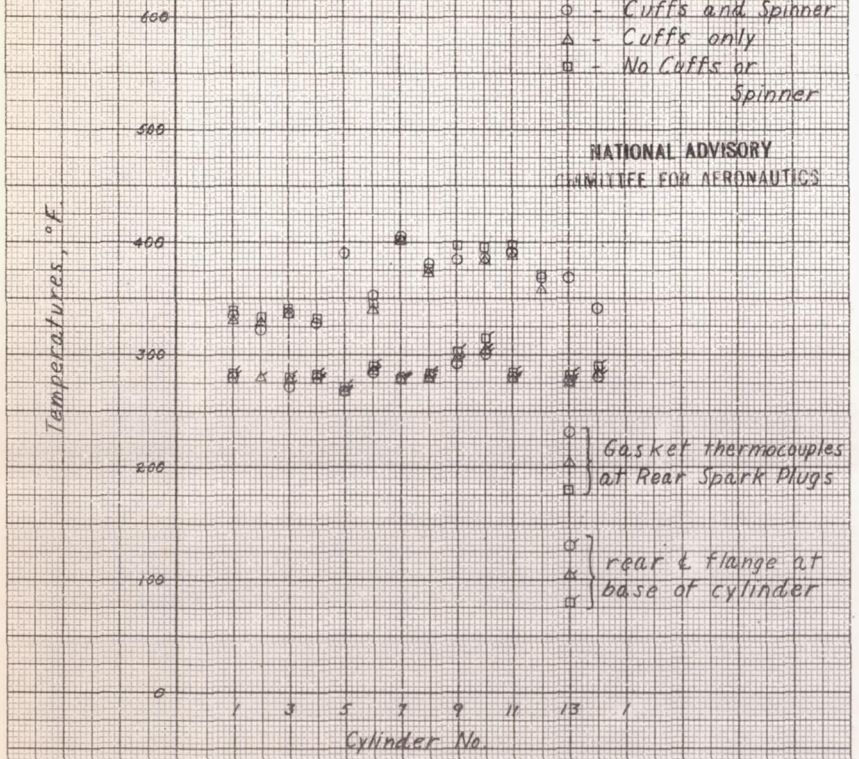

Figure 17. - Observed cylinder temperature distribution above critical altitude in full-rich climb.

	Cuffs & Spinner	Cuffs Only	No Cuffs or Spinner
Ambient Air Temp, °F	19	19	24
Bhp	710	720	762
Press Alt, ft	18800	18800	17600
Ind Airspeed, mph	154	151	152
Mixture Setting	Auto-Rich		

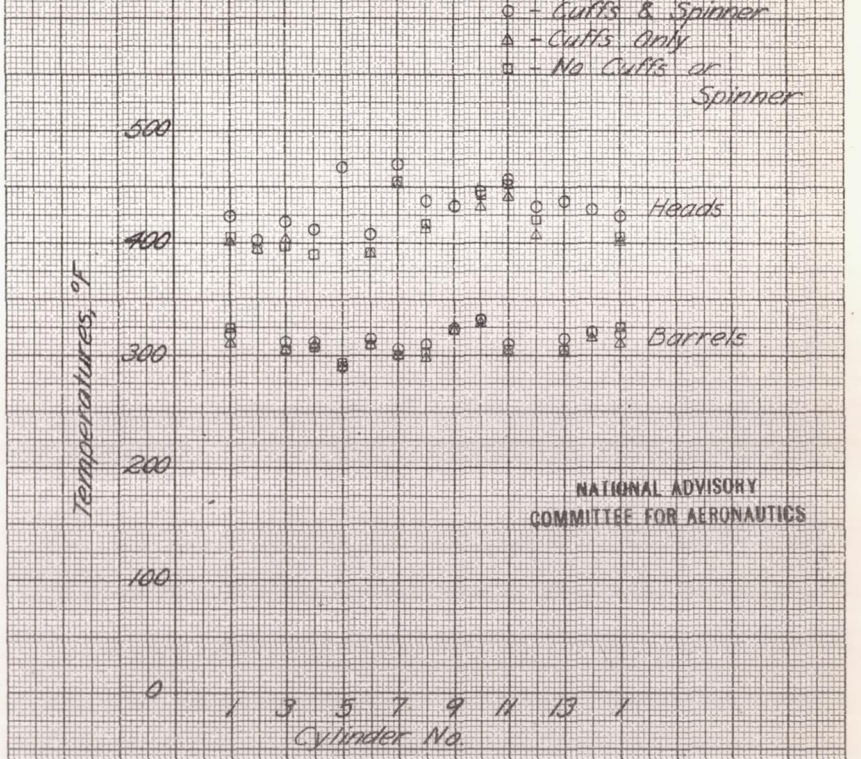

Figure 18. - Observed cylinder temperature distribution in automatic-rich climb.

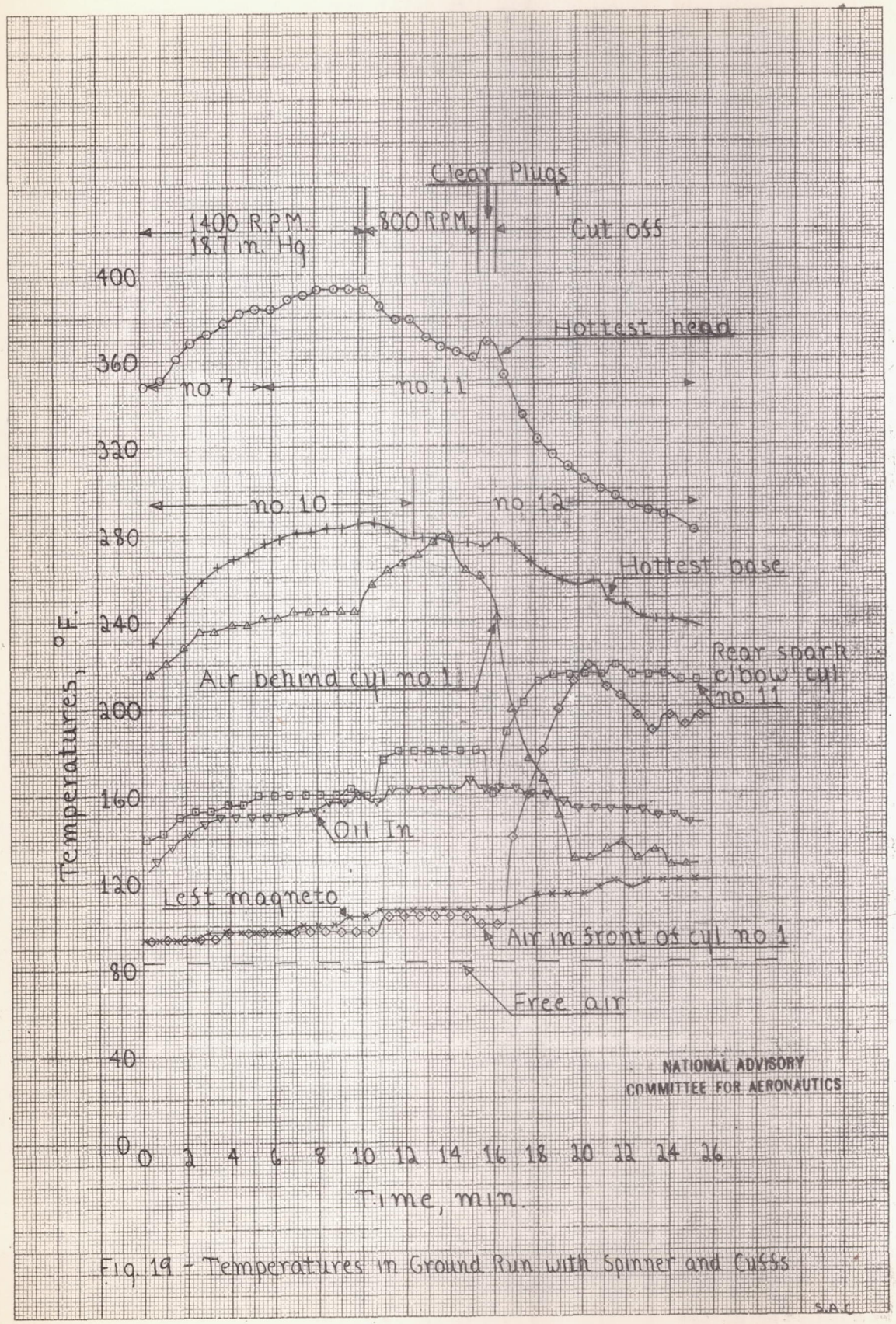

Fig. 19 - Temperatures in Ground Run with Spinner and Cusss

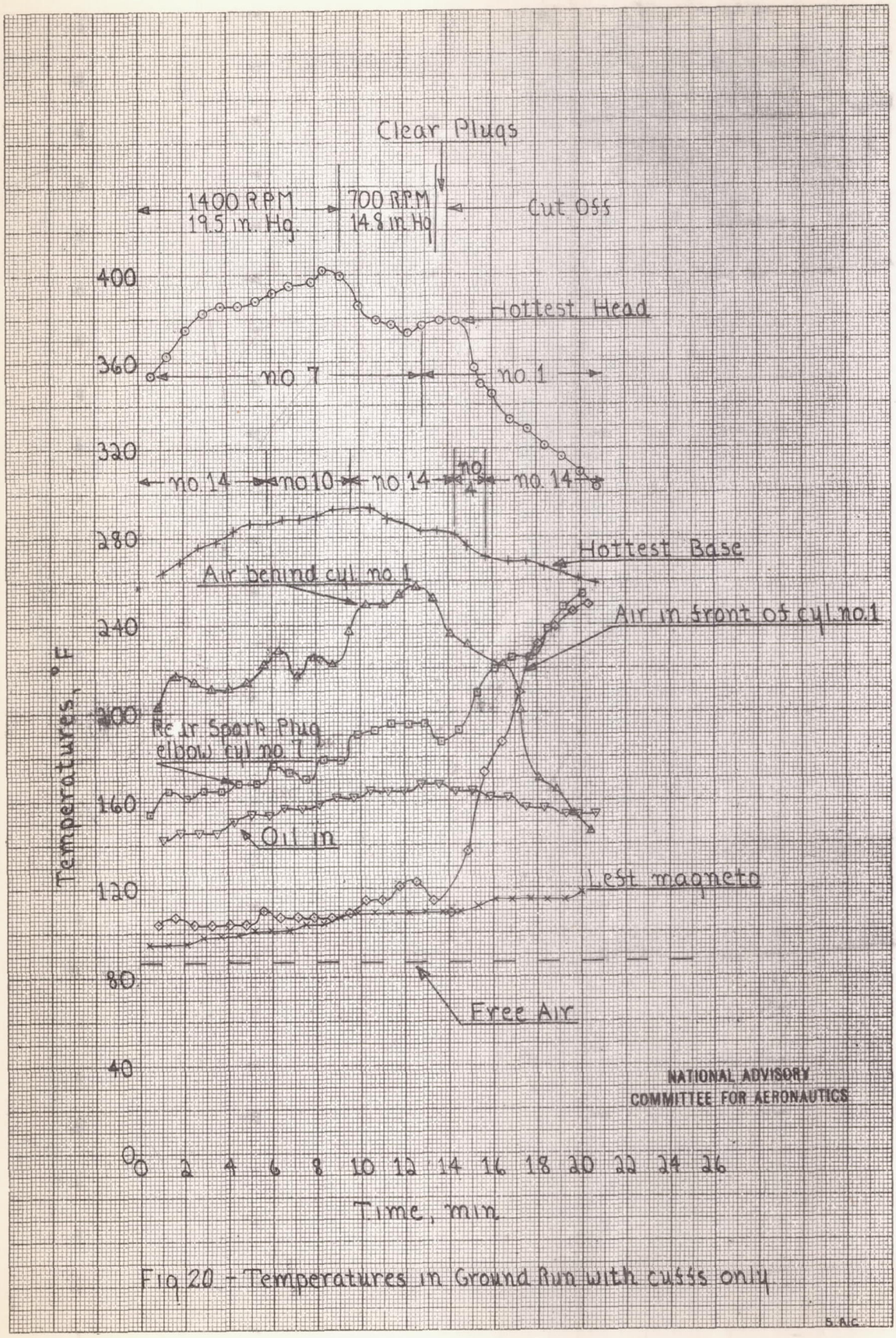

Fig. 20 - Temperatures in Ground Run with cutoss only.

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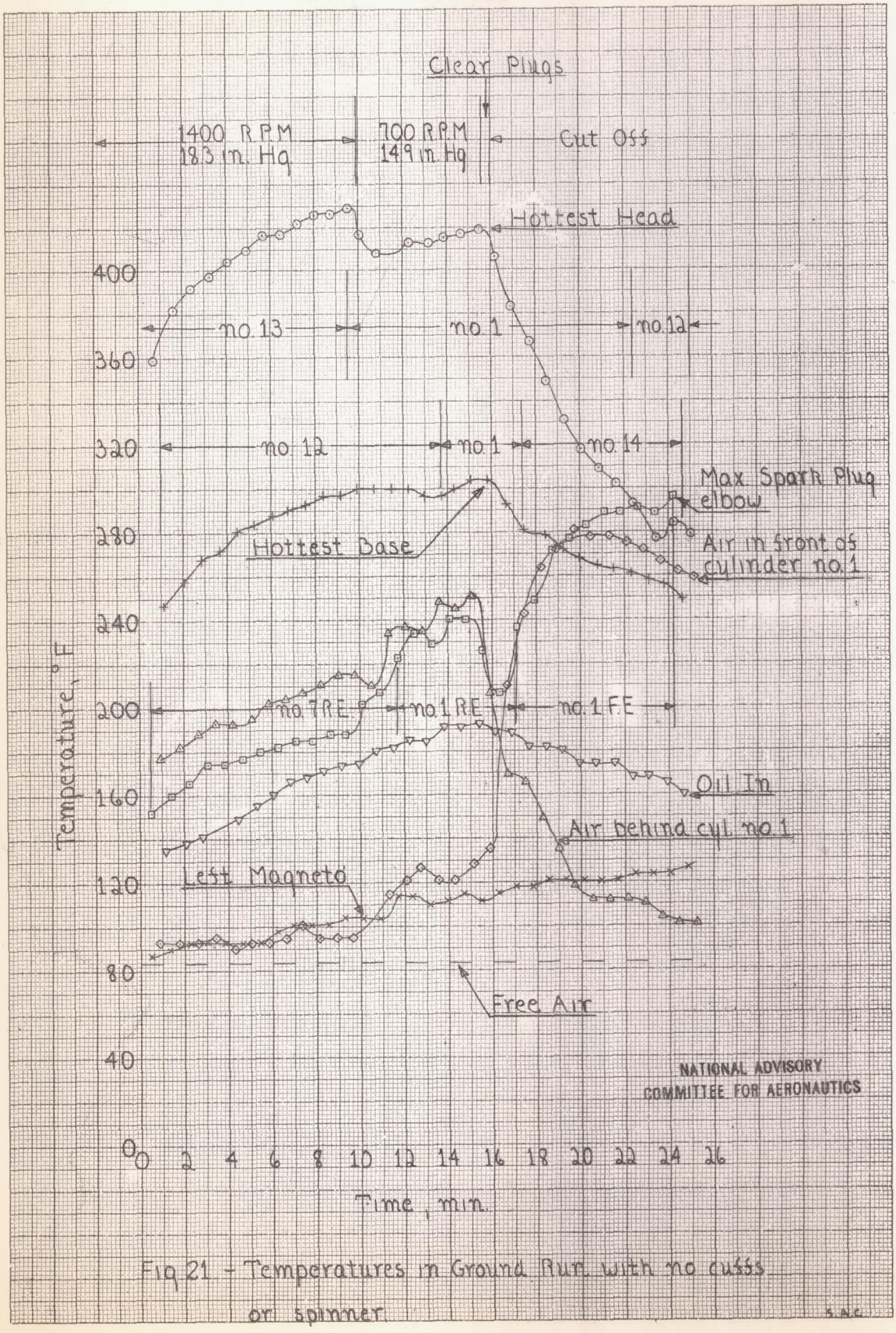

Fig 21 - Temperatures in Ground Run with no cuffs or spinner

S.A.C.