RESTRICTED.

2nd Part of Report No. A.&A.E.E./814.c

21 APR 1945

AIRCRAFT AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN.

Corsair F Mk. IV KD. 227
(Double Wasp R2800-8W)

Level speed trials with and without water injection.

This report deals with the aircraft or equipment as tested. Action to remedy defects or decisions to accept items not in strict compliance with the specification are matters for decision and action by M.A.P.

A.&A.E.E. ref: 5703,a/8/JNH
M.A.P. ref: Res.Air.5461/11/ADRDN
Period of tests: 12th - 16th December, 1944.

Progress of issue of report.

Report No.	Title
1st Part of A.&A.E.E./814,c	KD. 227 - Carbon monoxide contamination tests.

Summary.

The Corsair F Mk. IV differs from Corsair F Mk. II in the following respects:-

(a) The use of water injection.
(b) U.S. Navy glossy blue finish in place of the standard British camouflage
(c) Different propeller including a change in diameter from 13' 3" to 13' 1".

In auxiliary high supercharger gear, the increase of boost from 52.5 ins. Hg to 60 in. Hg. allowed by the use of water injection, was found to give an increase of speed of 20 mph TAS at all heights up to 18,400 ft., the full throttle height at 60 ins. Hg boost. The maximum true airspeed attained was 400 mph (347 knots at 18,400 ft.

1. Introduction.

The Corsair IV differs from Corsair II, on which performance measurements have previously been made at this Establishment, by:-

(a) The use of water injection, allowing increased boost pressure and hence greater power.
(b) U.S. Navy glossy blue finish, instead of standard British camouflage.
(c) A different propeller including a change in diameter from 13' 3" to 13' 1".

Level speed performance measurements were made on this aircraft primarily to determine the effect of water injection and secondly to establish the level speed performance of this variant. The results of the tests are given in this part of the Report, together with those of the static position error determination used in the analysis of the results.

Preliminary results have been forwarded to MAP in a letter dated January 9th, 1945.

It should be noted that no correction for pitot error has been applied, since the aircraft crashed before this could be determined. It is, however, intended to determine the pitot error on a replacement aircraft, which will shortly arrive at this station. The results of this determination and its effects on the level speeds, quoted here, will be the subject of an addendum to this Report.

2. Condition of aircraft relevant to tests.

2.1 General. The aircraft was a production Mk. IV Corsair fighter, built by the Goodyear Corporation and powered by a Pratt and Whitney Double Wasp engine (see para. 2.4)

/The main

The main features of the aircraft were :-

Hamilton 3-bladed Hydromatic propeller of paddle-blade design (see para.2.2)
Three exhausts on each side of cowling base.
Oil cooler and intercooler intakes at leading edge of port and starboard wing roots.
Armament - 6 x 0.5 ins. Mk.II Browning guns, 3 in each wing. Gun ports and ejection chutes sealed.
Aerial mast on nose, midway between cockpit and engine cowling. The W/T aerial ran to a short mast on top of the rudder, with a lead-in to the starboard side of the fuselage about 2 feet behind the cockpit hood.
Rod aerial on top of fuselage approximately $\frac{1}{3}$ distance from hood to tail.
Two short rod aerials underneath fuselage, one at leading edge, and one 3 ft. further back.
Deck arrestor hook under tail.
Details of the airspeed indicator system are given in para.2.3 and Fig.1.

The following table gives the principle differences between this aircraft and the Corsair II, the Mark previously tested at this station.

Aircraft	Propellers		Surface finish
	Propeller dia.	Blade Drg.No.	
Corsair IV KD.227	13' 1"	6541A - D (paddle-type)	U.S. Navy glossy blue finish
Corsair II JT.417 and JT.259	13' 3"	6443A - 21	Standard British camouflage

Care was taken throughout the tests to maintain the high polish of the wings and to remove any dirt which might accumulate. No unevenness or distortion of the leading edge or surfaces of the wings was perceptible. As usual, however, with Corsair aircraft, the edges of the inspection panels were bevelled and consequently a small groove surrounded each panel.

2.2 Propeller details. Main details were :-

Hamilton Hydromatic	Type No.23E50-495
Diameter	13' 1"
No. of blades	3
Direction of rotation	Right hand
Hub Serial No.	66885
Blade No.1 Serial No.	245762
2	245763
3	245764
Construction	Hollow steel.

2.3 Airspeed indicator system. The pitot and static sides of the airspeed indicator were connected to a Kollsman pressure head, type AN.5816-2, which was mounted on the leading edge of the port wing tip (see Fig.1).

2.4 Engine numbers and limitations. The aircraft was powered by a Pratt and Whitney engine R2800-8W (Makers No.HP206106).

The relevant engine limitations applicable to auxiliary high supercharger gear at the time of test were :-

	RPM	Manifold pressure in. of Hg.
Max. for level flight at combat power	2700	52.5 without water injection
	2700	60 with do.

2.5 Loading. The take-off weight for these trials was 12,080 lb. (no external load carried), and the c.g. was 100.2 in. aft of the axis of reference.

/3.

3. Scope of tests.

3.1 Position error. The static position error was measured by the aneroid method in level flight, with flaps and undercarriage up over a speed range of 120 mph ASI to 320 mph ASI.

These tests were undertaken for use in the reduction of the level speed results.

3.2 Level speed. Level speeds were measured with engine cowling gills, intercooler shutter and oil cooler shutter closed at heights between 10,000 and 24,000 ft. in auxiliary high supercharger gear, both with and without water injection.

4. Results of tests.

The results have been corrected to standard atmospheric conditions by the methods of A.&.A.E.E./Res/170.

Both level speed and position error correction results have been corrected to 11,500 lb. (95% of take-off weight). The compressibility correction has been determined by the method of Report No. A.&.A.E.E./Res/208.

4.1 Position error. The static position error correction varied from +1 mph at 120 mph ASI to +9.7 mph at 320 mph ASI. Full details are given in Fig.2.

Correction curves for the altimeter when connected to the static side of the airspeed indicator system are given in Fig.3.

4.2 Level speed. Results of the level speed tests are given in Table I and Fig.4.

The maximum true airspeeds attained were :-

With water injection	400 mph (347 knots)	at 18,400 ft.
Without water injection	395 mph (343 knots)	at 22,500 ft.

At all heights up to 18,400 ft. an increase of speed of 20 mph (17.4 knots) TAS was obtained by the use of the increased boost with water injection.

4.3 Propeller tip Mach number. The highest propeller tip Mach numbers obtained were :-

Height	Mach No.	Remarks.
18,400	1.04	FTH with water injection
22,500	1.06	FTH without water injection.
24,000	1.06	Highest altitude reached.

As the aircraft crashed, it was not possible to investigate the effect of decreasing rpm (and hence Mach number) on the level speed performance.

The differences in temperature from ICAN standard values were within the ranges given below:

10,000 ft. to 15,000 ft.	-2 to +1 °C
15,000 ft. to 20,000 ft.	-7 to +0.5 °C
20,000 ft. to 24,000 ft.	-6 to -3 °C

5. Comparison with previous results.

The following table gives a comparison of the performance of this aircraft with that of Corsair II JT.417, reported in the 12th part of Report No. A.&.A.E.E./814,a.

/Table.

Aircraft	*Max. speed without water injection. mph (knots)	Height ft.	95% take-off weight lbs.
Corsair II JT.417	393 (341)	23,400	11,290
Corsair IV KD.227	395 (343)	22,500	11,500

* 2700 rpm, 52.5 in. Hg. manifold pressure.

This comparison is intended merely to demonstrate the approximate agreement in level speed performance between the two variants.

TABLE I.

Level speed performances.

Corrected to 95% of the take-off weight - viz. to 11500 lb.

Engine cowling gills, intercooler shutter, and oil cooler shutter closed.

Standard height ft.	TAS mph(knots)	ASI mph(knots)	Corrections PE mph	Corrections CE mph	Manifold pressure in. of Hg.	RPM	S/c gear
10,000	349 (303)	300 (261)	9.0	-3.2	52.5	2700	Aux. high (without water injection)
12,000	356 (309)	296 (257)	9.0	-3.8			
14,000	363 (315)	293 (255)	8.9	-4.4			
16,000	371 (322)	289 (251)	8.8	-4.9			
18,000	378 (328)	285 (248)	8.7	-5.4			
20,000	385 (334)	281 (244)	8.6	-5.9			
22,000	392 (341)	277 (241)	8.5	-6.5			
*22,500	395 (343)	276 (240)	8.5	-6.6			
24,000	393 (341)	268 (233)	8.2	-6.7	49.8		Aux. high (with & without)
10,000	369 (321)	317 (275)	9.4	-3.7	60		Aux. high (with water injection)
12,000	376 (327)	313 (272)	9.4	-4.4			
14,000	384 (334)	309 (268)	9.3	-5.1			
16,000	391 (340)	305 (265)	9.2	-5.7			
18,000	398 (346)	300 (261)	9.2	-6.4			
*18,400	400 (347)	299 (260)	9.2	-6.6			
20,000	398 (346)	291 (253)	8.9	-6.6	57		
22,000	395 (343)	279 (242)	8.6	-6.7	53.5		

*Full throttle heights.

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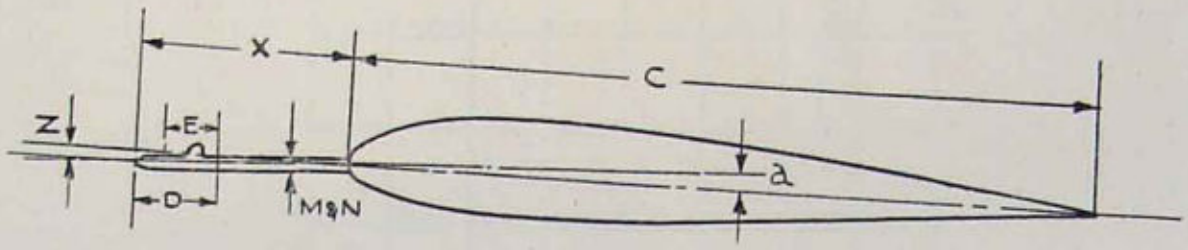
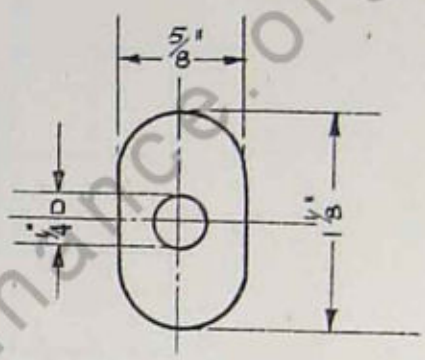
FIG. 1

PRESSURE HEAD POSITION

(L.E. WING)





DETAIL OF APERTURE

TYPE OF PRESSURE HEAD. KOLLSMAN AN 5816-2 24V MFRS PART No. 3690-012

RATIO OF APERTURE OF TUBE TO EXTERNAL DIA. OF STATIC TUBE — SEE SKETCH

INCIDENCE OF MAIN PLANE (ADJACENT TO PRESSURE HEAD) — +2°·05

a ANGLE OF HEAD TO CHORD OF MAIN PLANE — -5°-45'

NOSE OF HEAD TO MAIN PLANE (MINIMUM DISTANCE) — —

D " " " " " SUPPORTING STRUT — 9"

Z " " " " " CHORD LINE — 1 1/8"

X " " " " M.P. LEADING EDGE (PARALLEL TO CHORD.) — 25 3/8"

C LENGTH OF CHORD AT SECTION — 5'-4"

E STRUT TO VENTS (MEAN.) — 5 7/16"

M MAJOR AXIS OF STRUT — 1 1/4"

N MINOR — 1 1/4"

Y DISTANCE FROM PLANE OF SYMMETRY — 19' 4"

POSITION — LEADING EDGE PORT MAIN PLANE

SEMI SPAN — 20'-2"

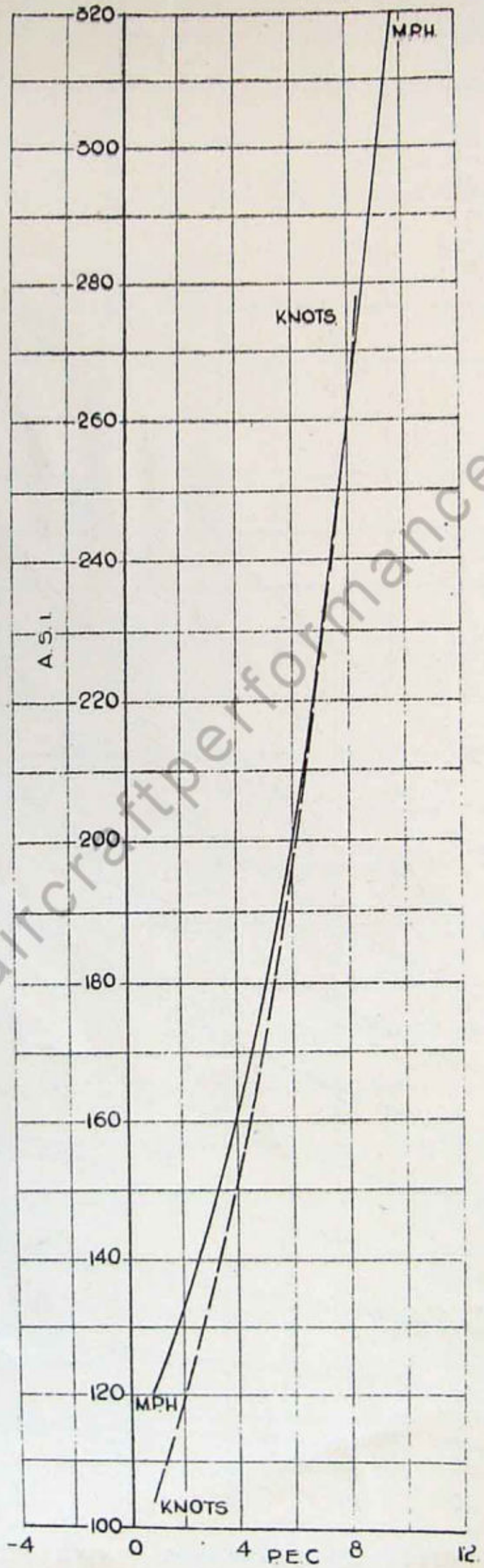
RATIO OF THICKNESS TO CHORD OF AEROFOIL SECTION, ADJACENT TO PRESSURE HEAD. — 55%

2nd PART OF REPORT No. A & A.E.E. 814a | CORSAIR IV K.D. 227 | SKETCH No. 3023 | TRACED A.A | DATE 30.3.45 | CHECKED J.A.R.W. | APPROVED M.G. | D.

FIG 2.

POSITION ERROR CORRECTION.

(CORRECTED TO 11,500 LBS. VIZ 95% TAKE-OFF WEIGHT)



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ALTIMETER CORRECTION.

CORRECTED TO 11500 LB. VIZ 95% OF TAKE-OFF WEIGHT.

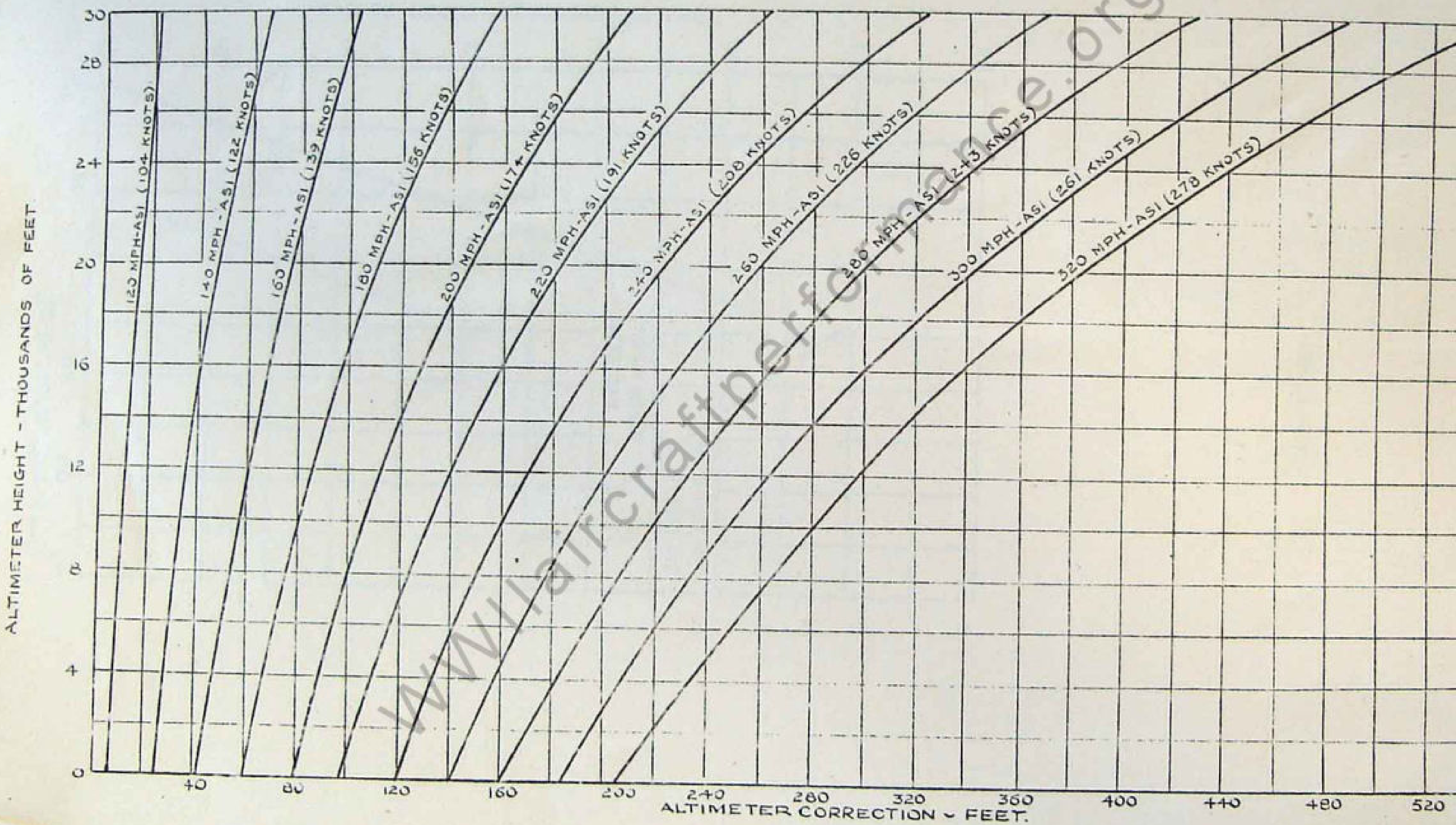


FIG. 3

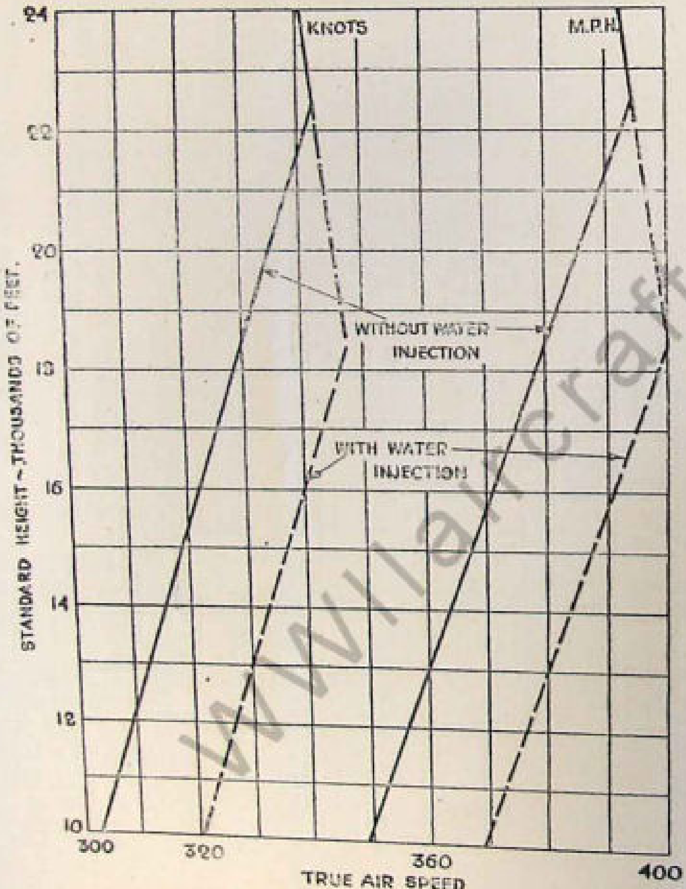
FIG. 4.

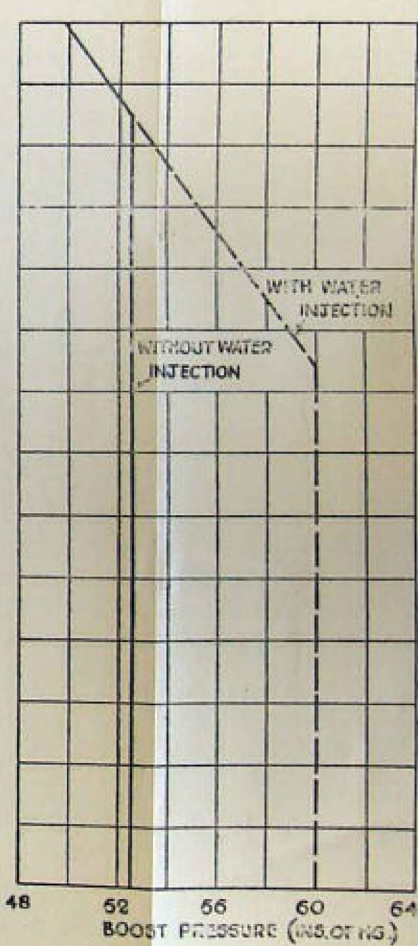
LEVEL SPEED PERFORMANCE.

IN AUXILIARY HIGH SUPERCHARGER GEAR
(WITH AND WITHOUT WATER INJECTION)

ENGINE COWLING GILLS ~ INTERCOOLER SHUTTER & OIL COOLER SHUTTER CLOSED.

CORRECTED TO 96 % TAKE~OFF WEIGHT VIZ~11500 LB.





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