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DECEMBER 1944
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SUMMARY # 18

JUDY 12

Issued by the Division of Naval Intelligence
By
Combined Personnel of United States and British Services
for the Use of Allied Forces

TECHNICAL AIR INTELLIGENCE CENTER

NAVAL AIR STATION ANACOSTIA D C

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TECHNICAL AIR INTELLIGENCE CENTER
NAVAL AIR STATION
ANACOSTIA, D.C.

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JUDY 12

"Suisei 12" Carrier-borne Dive Bomber (D4Y2) & "Type 2" Land Reconnaissance (D4Y2-R)

Summary:-

JUDY 12 is a clean, single-engine, two-place Japanese Naval aircraft which at present has two distinct versions, the dive bomber and the photographic reconnaissance model; both planes are in the 380-395 mph class. Powered with a liquid-cooled, inverted 'V', 12-cylinder "Atsuta 31" engine, JUDY may become the most important carrier-borne dive bomber in the Japanese Naval Air Force.

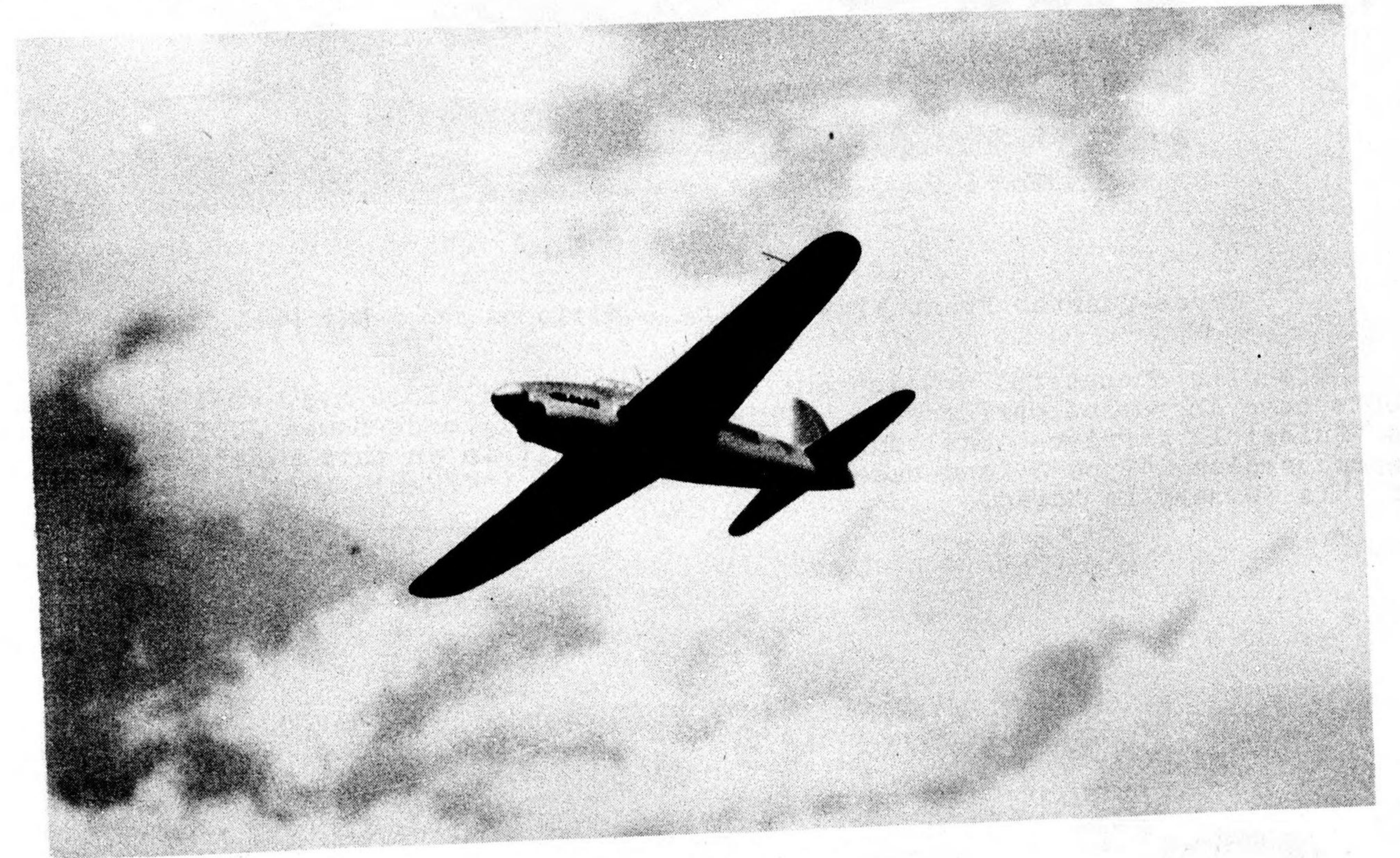


Fig. 1
JUDY in Flight

History:-

The development of JUDY has been confusing. Evolved from the "13 Experimental carrier-borne bomber", the originally accepted service version was "Type 2 carrier-borne reconnaissance plane Model 11", (D4Y1-C), and was coded as JUDY 11. This aircraft, fitted with an Atsuta 21 engine rated at 1180 h.p, was apparently produced only in limited quantities. In the middle of 1943, JUDY 11 was converted to a carrier-borne bomber, brought into heavier production, and adopted by the Japanese as "Suisei Model 11", (D4Y1). This was the first known instance of Japanese dual-purpose designation, which pattern has since been followed in the case of IRVING, FRANCES, and probably GRACE.

As an off-shoot of JUDY 11 "Suisei Model 11", (D4Y1), a documentary reference has been made to the conversion of this model for use as a catapult plane. In view of the alteration of the Japanese BB's "ISE" and "HYUGA" to permit carrying of float planes and dive bombers, it is considered likely that this modification of JUDY 11 "Suisei 21", code-named JUDY 21, may be used for that purpose.



Fig. 2

Three-Quarter Front View Showing Additional Bomb Bay Fuel Tank

With the successful development of the Atsuta 31, 1385 h.p. engine, the newer JUDYs have increased performance. This latest model, code-named JUDY 12, is known as "Suisei 12 carrier-borne bomber", (D4Y2), and it is on this model, and its recco version, "Type 2 land-based Reconnaissance", (D4Y2-R), that the remainder of this Summary is based.



Fig. 3
Front View

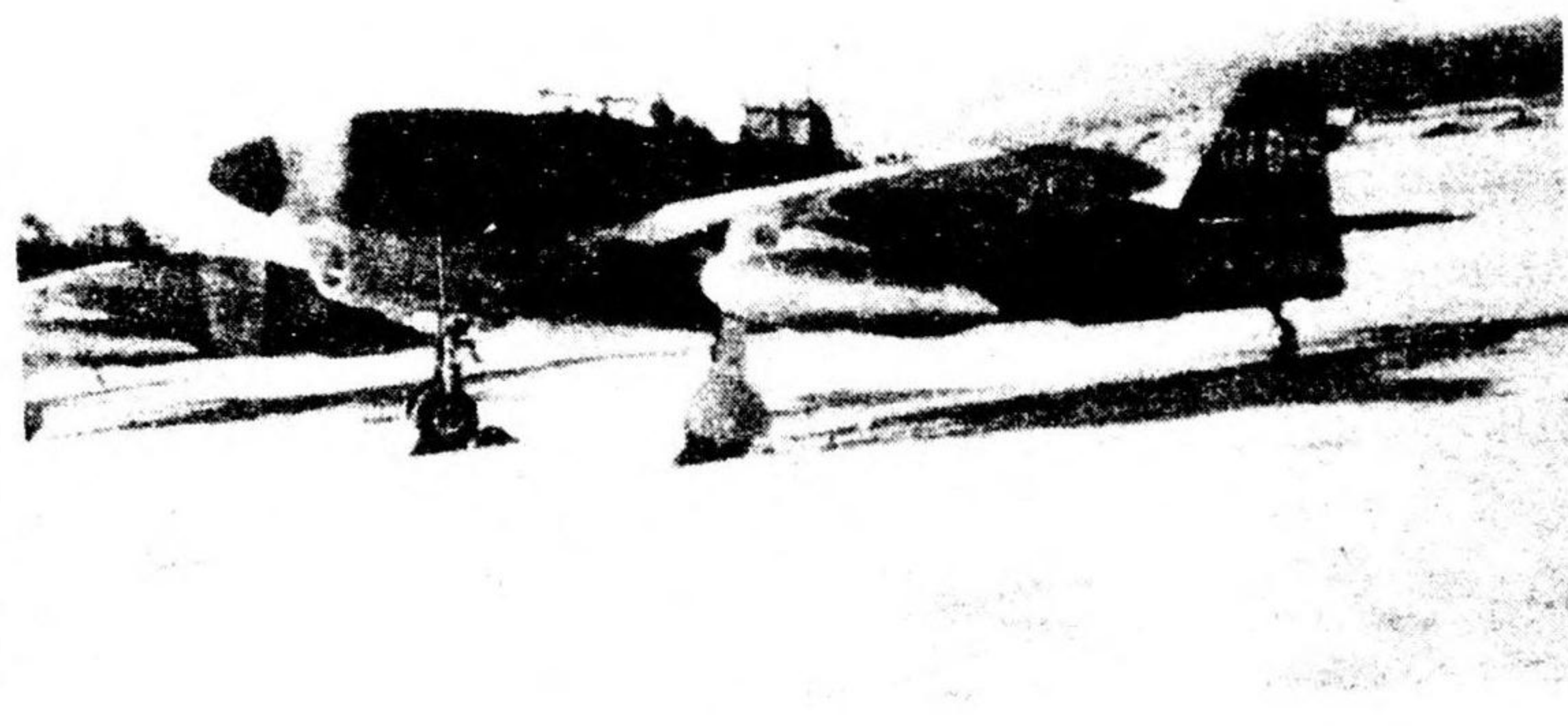


Fig. 4
Three-Quarter Side View

The following chart shows the development of JUDY:

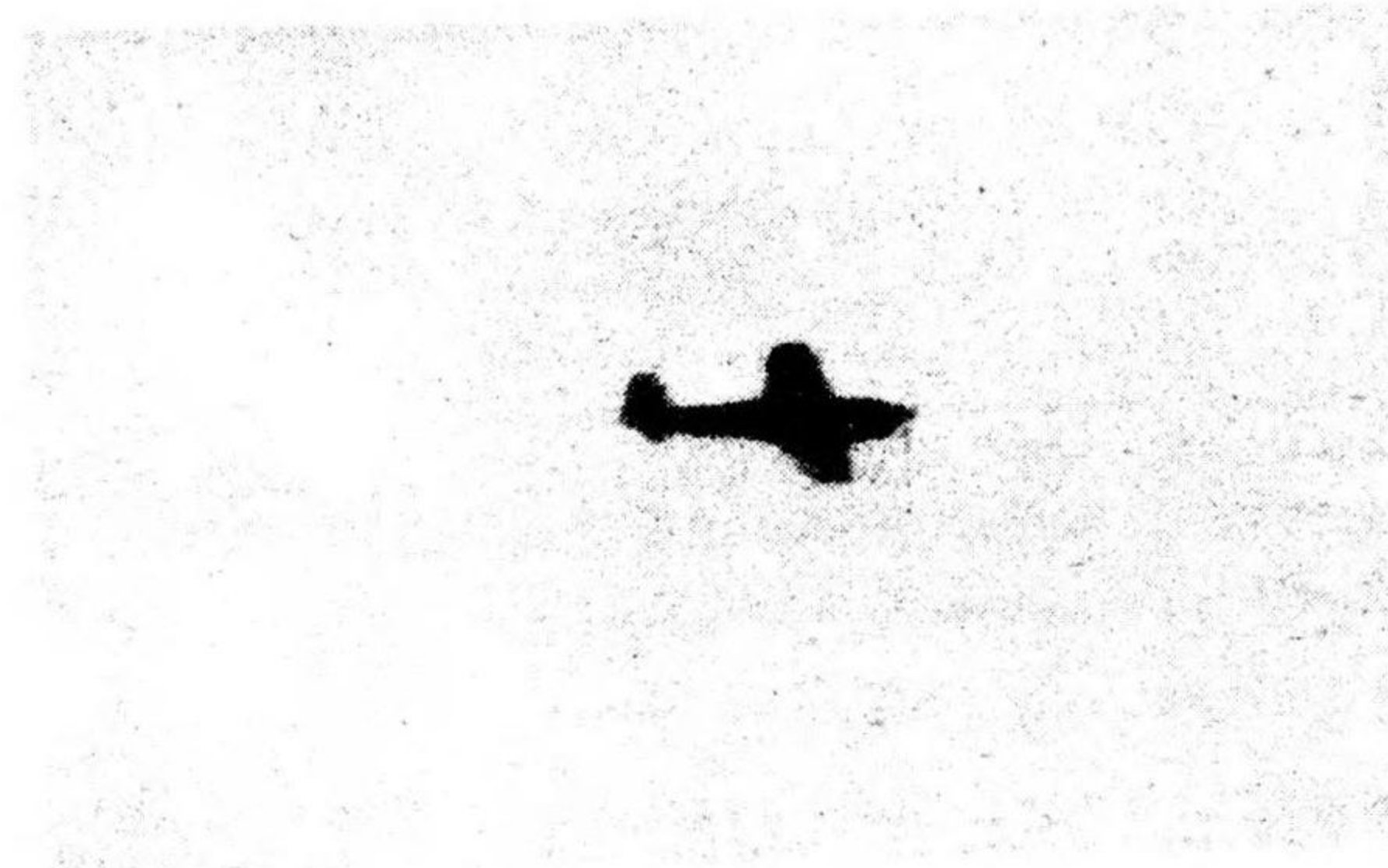
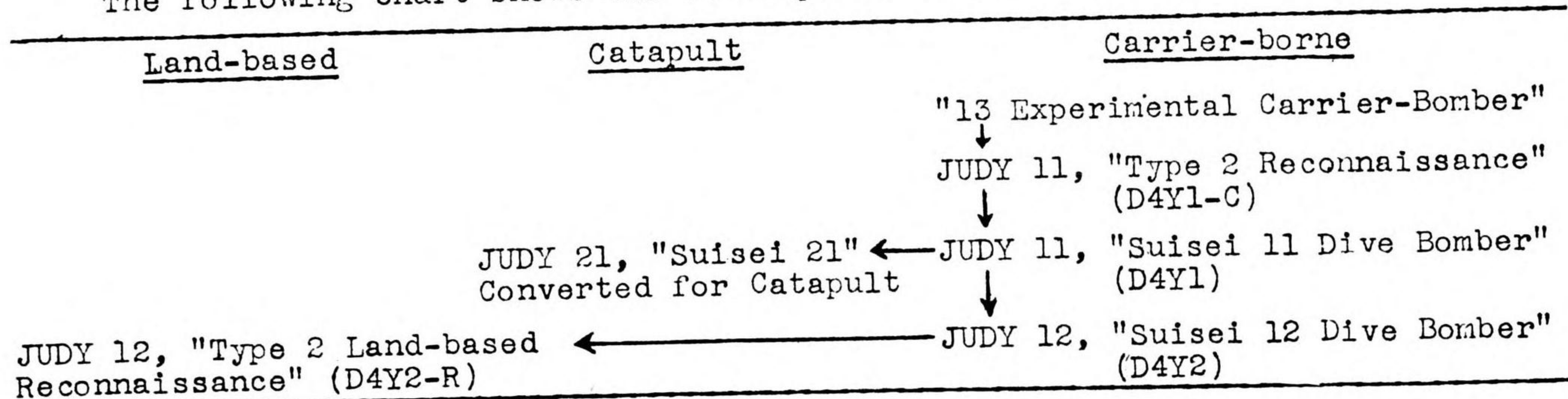


Fig. 5
Enter JUDY

At first glance, it would seem that all carrier-borne aircraft may be operated with equal ease from either ship or shore, but such is not the case with the two JUDY 12's. The D4Y2-R version is equipped with a built-in 'K8' vertically mounted camera, and this installation is such that the camera opening in the underside of the fuselage precludes the use of an arrester hook and, consequently, prevents its operation from ship-board. A document states, however, that this is a temporary condition that will be overcome by a modification to the installation.

JUDY 12 ("Suisei 12", D4Y2)
Carrier-borne Dive Bomber

Manufacturer:-

Aichi Kokuki KK

Duty:-

Dive bombing.

Type:-

Single-engine, low mid-wing monoplane.

Crew:-

Two (Pilot, navigator-rear-gunner).

Performance Details, Dimensions, etc:-

Re-computation of performance based on recent data shows that this should be much higher than has previously been estimated for JUDY 12. See page 12.

Construction Details

Air Frame:-

Fuselage - All metal, stressed-skin, flush rivetted fuselage, oval in shape. A telescoping plexiglass cockpit cover over both the pilot's and gunner's compartments is streamlined into the fuselage.

Overall length	33.5'
Maximum width	3.5'
Maximum depth	6.0'

Main Wing - All-metal, low mid-wing of one-piece construction. Two aluminum I-beam spars extend out to the wing-tip attachments. Wing tips are rounded.

Span	37.7'
Central Chord	9.2'
Wing Area	254 sq. ft.
Dihedral	3.5°
Leading edge backward taper	5°
Trailing edge forward taper	9°

Ailerons - Torque-tube controlled, fabric-covered, with a metal protected leading edge. The metal trim tab is $3\frac{1}{2}$ " wide, 3' long and starts at a point 1.9' from the inboard end of the aileron.

Length	5.9' (Nearly to the wing tip, the last 18" of the aileron forming part of the wing-tip curve.)
Chord	1.4' inboard to .98' outboard
Surface Area	8.1 sq. ft.
Angle of Operation	28° up to 18° down

Flaps - The Fowler-type flaps operate on a curved track with two rollers and are driven by an electric motor geared to a torque tube running along the trailing edge of the wing. See Figure 7. An interesting differential adjustment is provided whereby a drive shaft leads from the flap-operating mechanism to the leading edge of the wing and then operates a worm gear which alters the pivotal position of the aileron crank lever. This presumably allows a slight droop in each aileron when the flaps are down thus giving greater flap effect. Like the ailerons, the flaps are fabric covered with metal protection along the leading edge.

Length	9.9'
Chord	2.1' inboard to 1.45' outboard
Surface Area	17 sq. ft.
Operating Range	0° - 37½° down

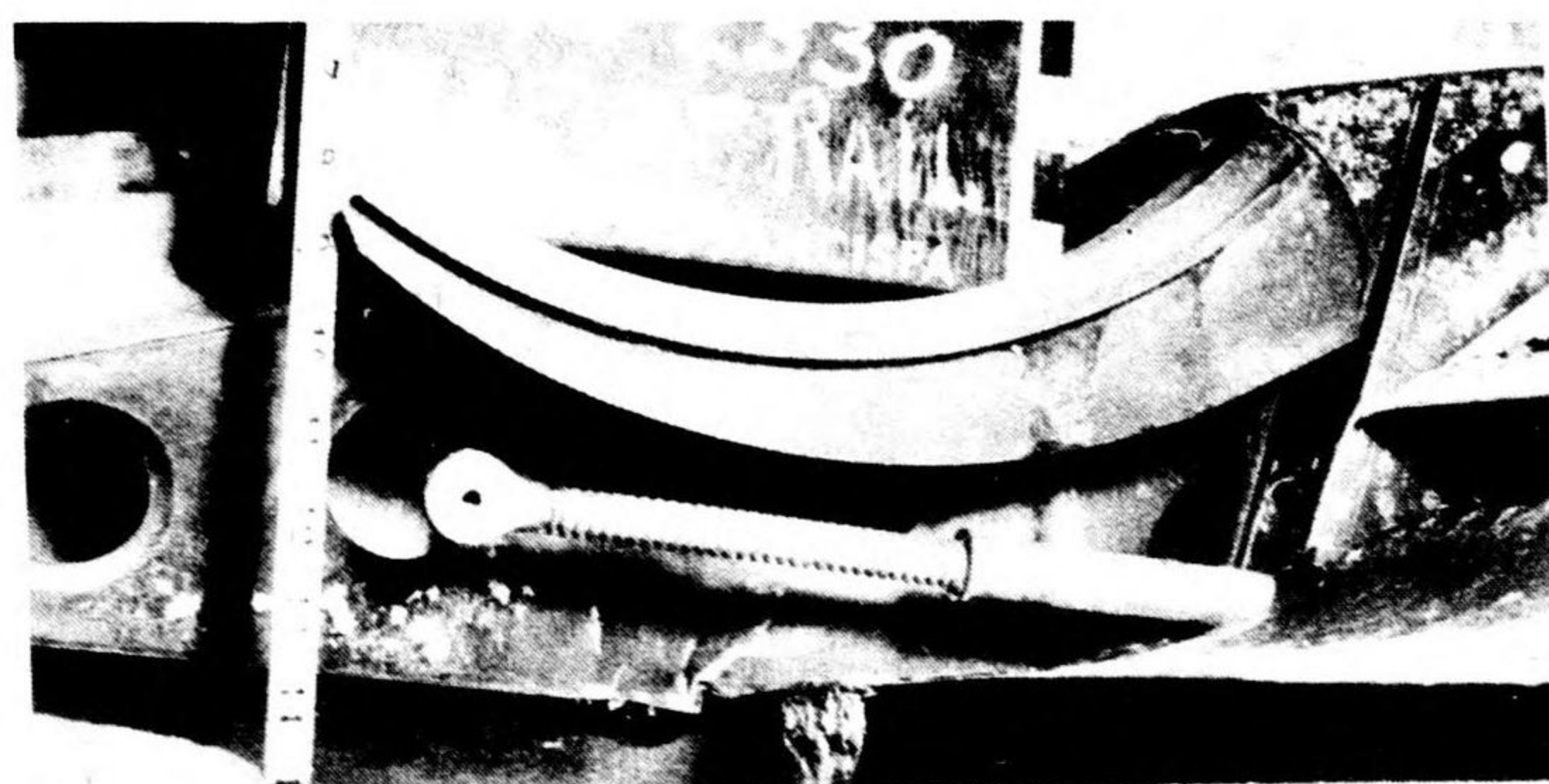


FIG. 7

Flap Rail and Operating Arm
(Inverted View)

Dive Brakes - The dive brakes are of solid metal type, and are actuated by means of a torque tube probably electrically driven. From documentary comments, it appears probable that the dive brakes are also used as combat maneuvering flaps. The document states, "The diving brakes are used as a braking device during dives and to reduce the turning radius in aerial combat". A brake-angle indicator is provided on the left side of the instrument panel.

Length	8.7'
Chord	.88' inboard to .59' outboard
Surface Area	6.2 sq. ft.
Angle of Operation	31° up and 70° down.

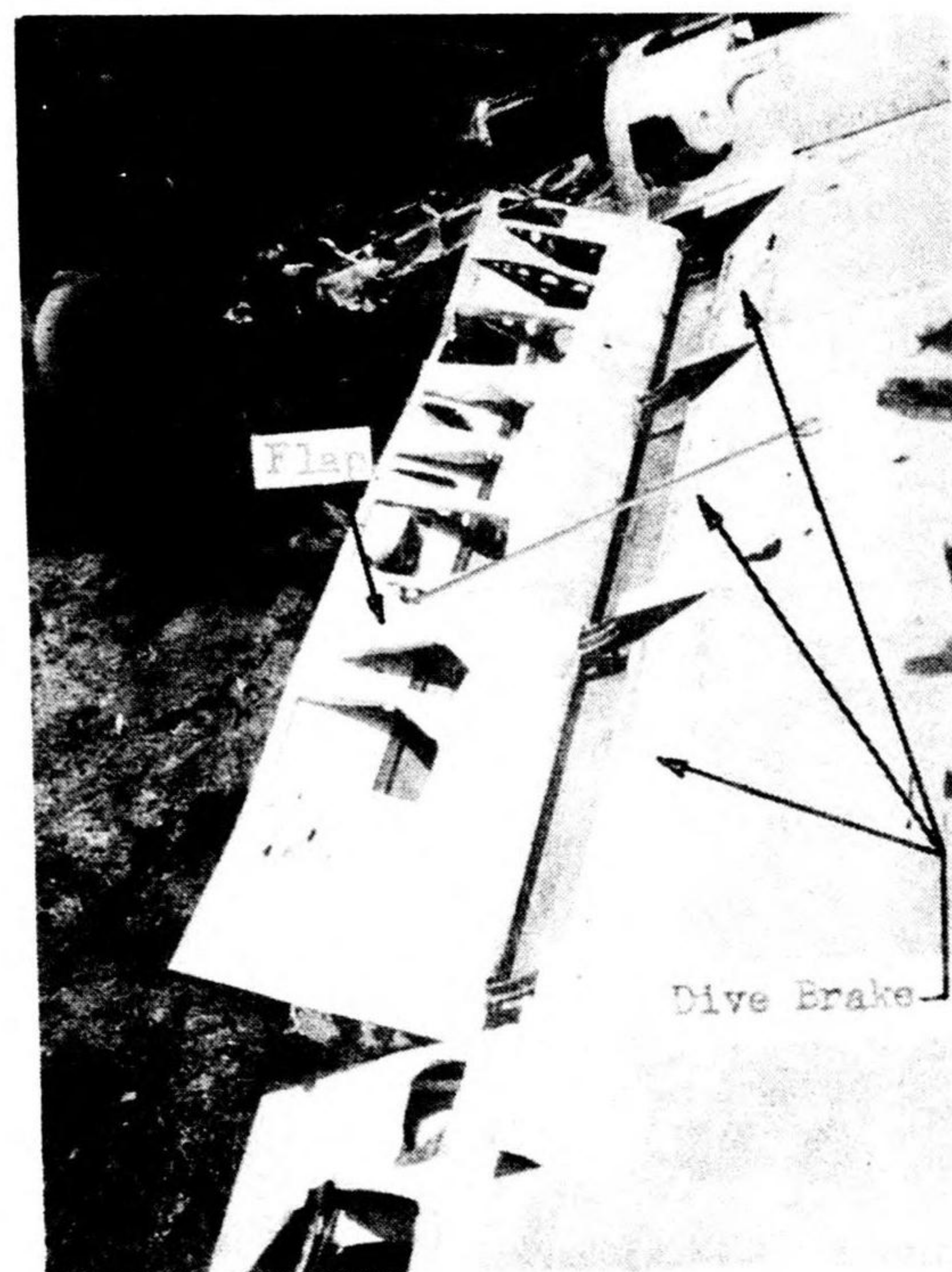


Fig. 8

Underside of Wing - Flap in Extended Position.

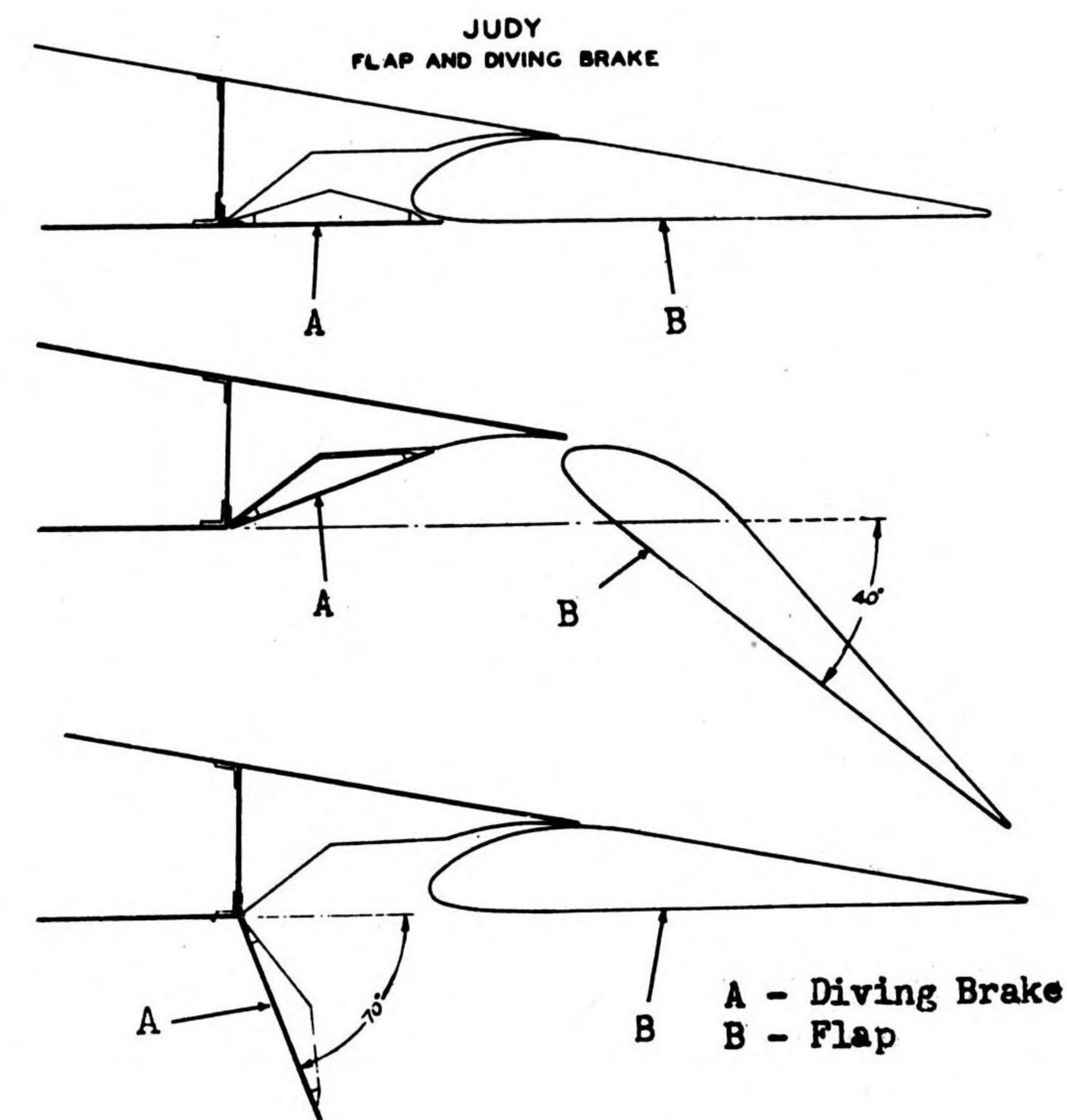


Fig. 9

Operation of Flap and Dive Brake

The dive brakes form the under side of the wing just forward of the flap-hinge line. Normally the brakes are streamlined with the wing, but when the flaps are lowered (extended), the dive brakes raise and open a slot for passage of air between the under side of the wing and over the top side of the flaps. However, when the dive brakes are lowered, the flaps remain streamlined into the wing. This interesting interrelationship between the flaps and the dive brakes is shown in Figure 9.

Tail Unit

Single Fin and Rudder - All-metal, cantilever construction. The rudder consists of a metal frame, fabric covered with metal protection on the leading edge. There is straight taper on both fin and rudder to a rounded tip.

Fin

Height	5.3'
Maximum Chord	5.7'

Rudder

Height	4.3'
Maximum Chord	2.1'
Surface Area	9.5 sq. ft.
Angle of Operation	31° either way

Tailplane - All-metal, cantilever construction and of one-piece design, with straight taper on trailing and leading edges to rounded tips. Fabric covered elevators with metal protected leading edges. Controllable trim tabs fitted to both elevators and rudder.

Horizontal Stabilizer

Length	16.4'
Maximum Chord	4.9'

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Elevator

Length	7.3'
Maximum Chord	1.5'
Surface Area	14.9 sq. ft. each
Angle of Operation	40° up to 25° down

Undercarriage - The landing gear has a track of 15.2' and may be either electrically or mechanically retracted inwards and upwards along the forward edge of the wing. When retracted, the landing gear is completely enclosed. Wheels have hydraulic brakes and are small for this size of aircraft, being 20" in diameter with 600 x 175 mm tires. Solid tire tail wheel 200 x 075 mm retracts electrically, in conjunction with the main landing gear, and is fully enclosed when retracted.

Arrester Gear - The arrester hook retracts into a channel but it not enclosed and has an approximate length of 3'. It is attached to an anchored support built into the bottom of the gunner's compartment. See Figure 10.



Fig. 10
Arrester Hook Channel Underside
of Fuselage.

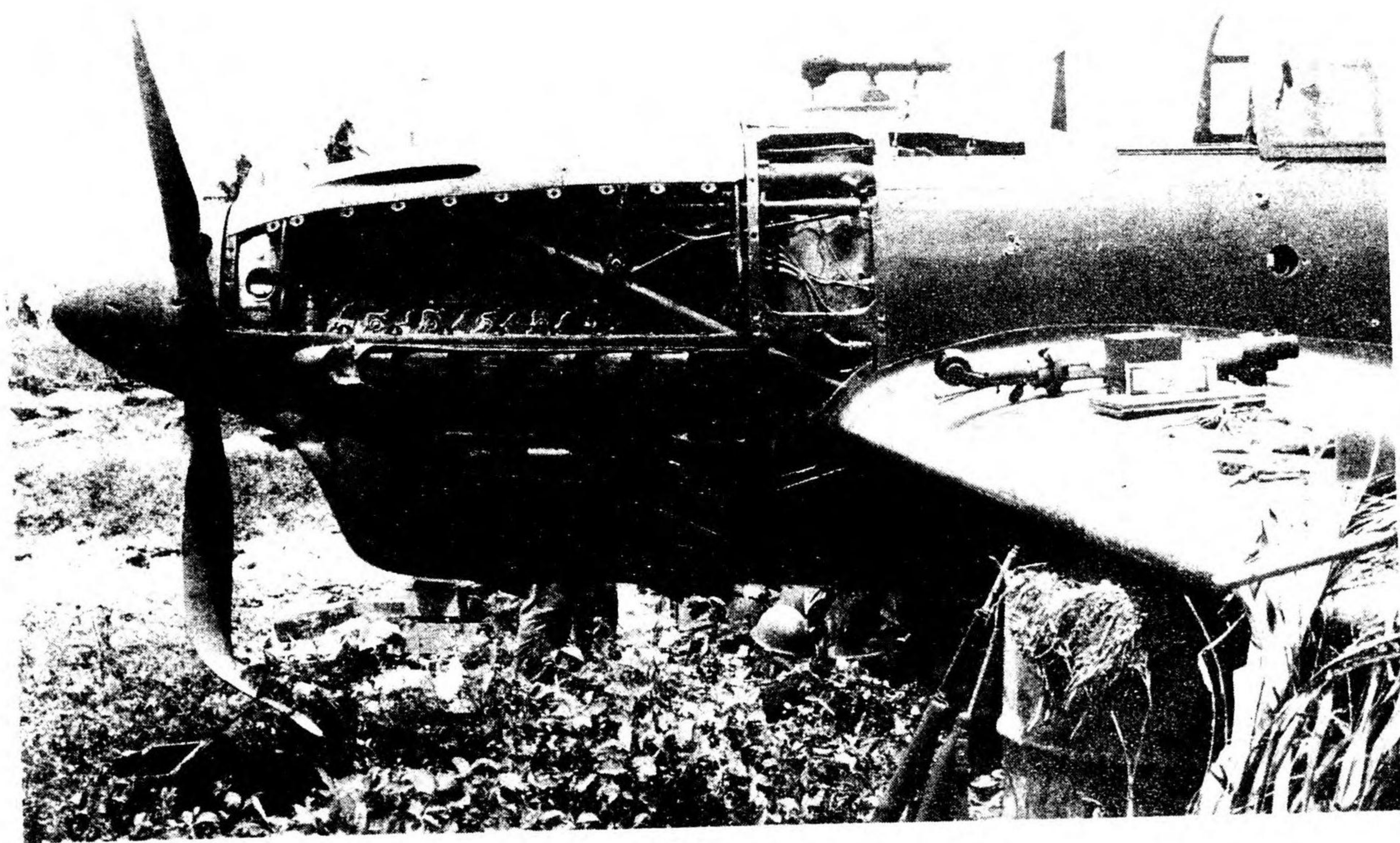


Fig. 11
JUDY Cowling Arrangement.

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Engine - The fitting of the "Atsuta 31" to the JUDY 12 has made no noticeable difference to the cowling arrangement from that of JUDY 11 with the Atsuta 21. The principal differences in the power plant are: the incorporation of a single dual-magneto in lieu of the two magnetos used on the older engine; the use of a one-piece propeller shaft in place of the two-piece flange joined shaft on the 21; improved valve timing with increased overlap of the intake and exhaust valves; increased compression ratio, higher RPM, and greater capacity of the supercharger. As a result, an increase in both rated horsepower and altitude have been attained.

Propeller - 3-blade, constant-speed Hamilton Type, 10.5' diameter.

Armament:-

All JUDYs examined to date have been fitted with 2 x 7.7 mm x 400 rpg. fixed Type 97 MGs in forward fuselage and 1 x 7.7 mm flexible Type 92 dorsal gun MG with 6 x 97 rd. magazines. This free gun is mounted on a pedestal which is connected to a swing-mounted gunner's seat which raises and lowers with the gun.

Armor:-

One crash report from a JUDY examined at Choiseul Island stated that armor plate had been found, one piece 9.5" x 16" and two pieces 33" x 16" - all 12 mm thick. The location of this armor is unknown and there has been no documentary confirmation of this to date.

Bomb Bay:-

On the under-side of the fuselage aft of the engine cowling and below the pilot is an enclosed bomb bay, See Figures 12, 13 & 14. Dimensions are: 7.3' long, maximum depth 1.3', width 1.9' forward increasing to 2.1' aft. The metal doors are electrically operated through torque tubes. Under the gunner's compartment are three fabric covered plywood sections totaling 7.3' in length and forming the under-side of the fuselage. The exact purpose of this is unknown but it is believed to be merely an attempt to save metal. Previous statements that this may be removed to install a torpedo shackle are believed unfounded inasmuch as the documentary maximum overload condition gives the largest bomb load carried as 1 x 500 kg. The plywood under-side is separated from the bomb bay by a metal section integral with the fuselage and approximately 2' long through which the bomb sight extends. The pilot appears to control the bomb release, although the combination bomb and drift sight is installed in the navigator-gunner's compartment as shown in Figure 16.

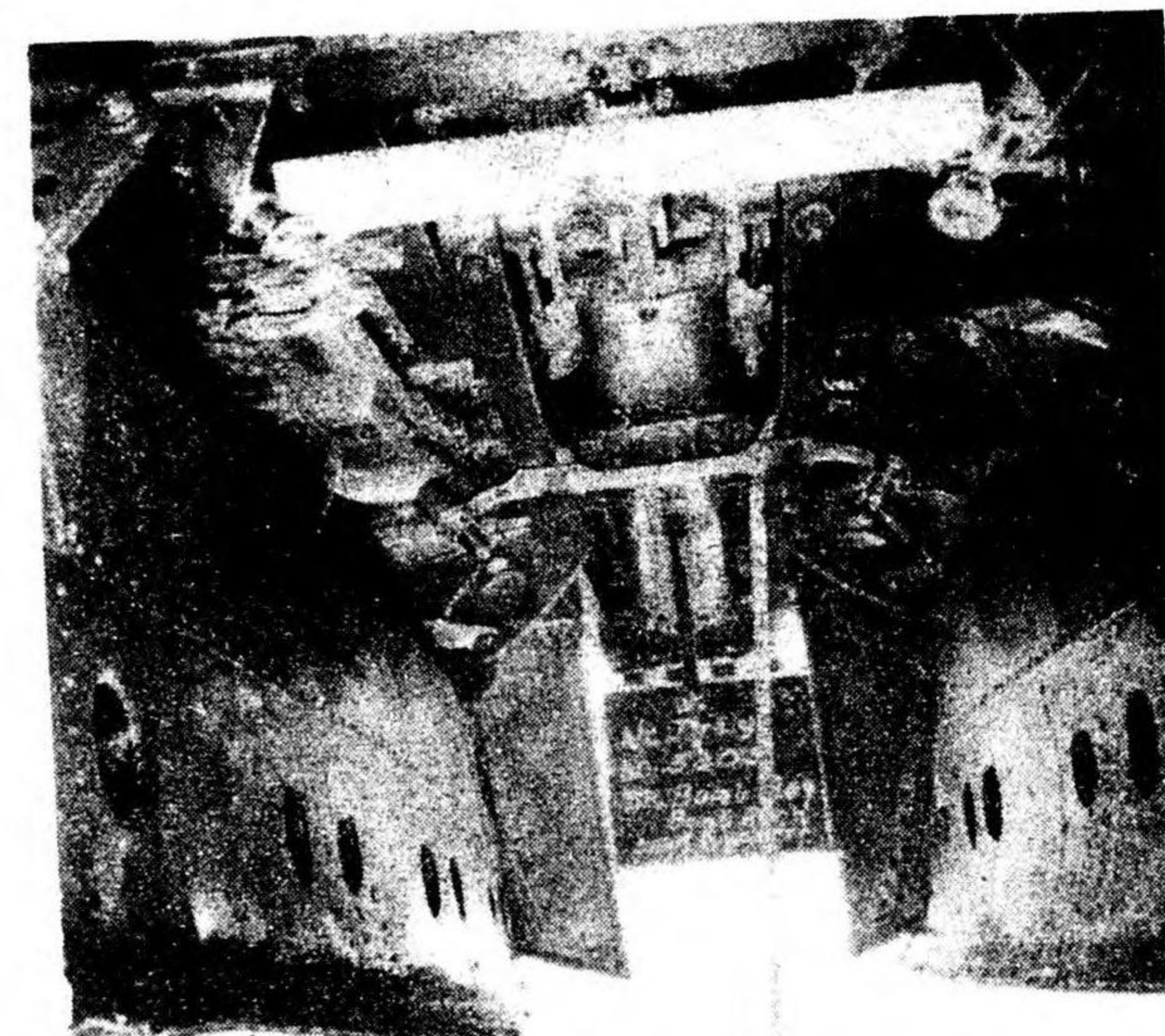


Fig. 12
Interior of Bomb Bay

Bombs:-

Only two sizes of bombs have been indicated by documents and crash investigations, 1 x 250 kg. or 1 x 500 kg.; either is carried internally on displacement gear. Crash examination on Guam offers evidence that 2 x 60 kg. wing bombs could be mounted as an alternative to each of the jettisonable tanks although this has no documentary confirmation.

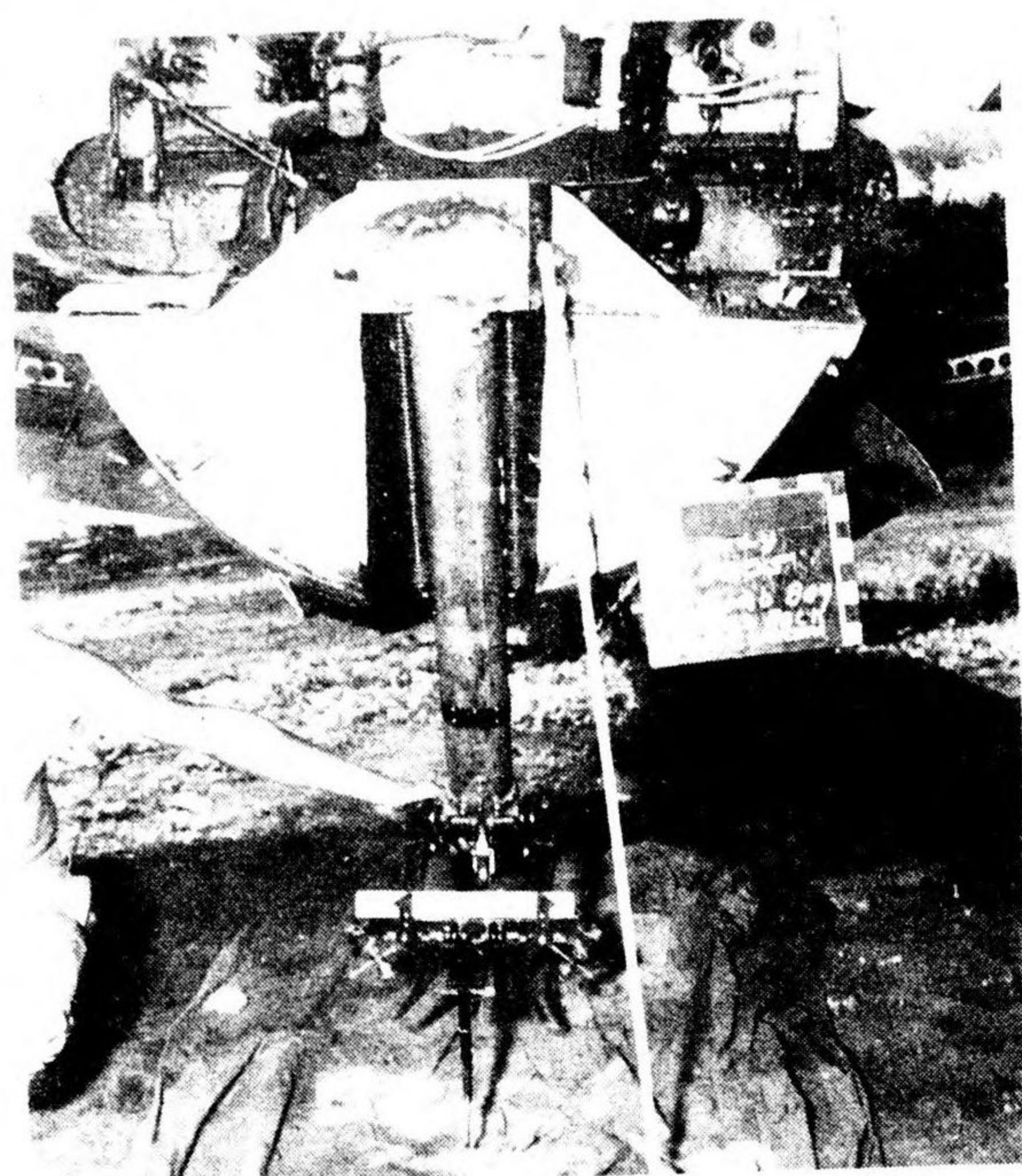


FIG. 13

Bomb Displacement Gear
Front View

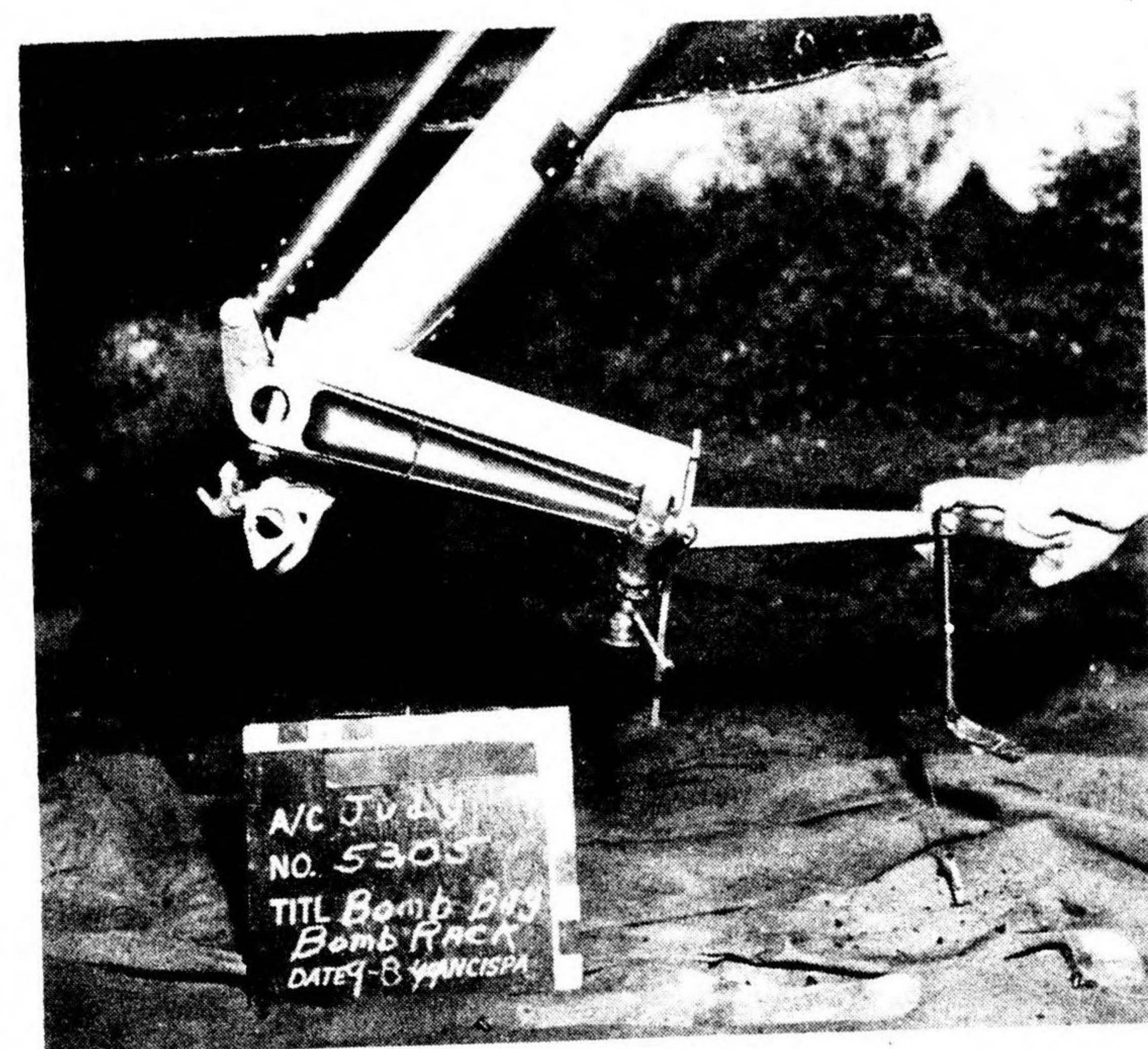


FIG. 14

Bomb Displacement Gear
Side View

Fuel Tankage:-

Four fuel tanks are located in the wing, two on each side just outboard from the fuselage and flush with the under-side of the wing. A fifth tank is carried in the fuselage forming the top of the bomb bay, and two jettisonable tanks can be carried - one outboard of each landing-wheel strut. No crash report or captured document yet mentions self-sealing protection, although this may be included on later models. The capacities are:

Built-in wing tanks	(4)	780 liters	206.0 US gals.	171.6 Imp. gals.
Fuselage Tank	(1)	260 liters	68.6 US gals.	57.2 Imp. gals.
Jettisonable tanks	(2)	610 liters	161.0 US gals.	134.2 Imp. gals.
Total		1650 liters	435.6 US gals.	363 Imp. gals.

Miscellaneous:-

Radar and Radio - There has been no indication of radar being carried, although it is considered possible on late models. Radio installation consists of a Type 96 Aero Mk 2 radio and Type 1 Aero Mk 3 radio direction finder.

Oxygen - Three oxygen bottles are carried vertically on the starboard side of the rear cockpit, and three more horizontally on the port side aft of the rear cockpit.

Other Equipment - Equipment includes complete navigation gear with a Type 97 Mk 1 drift indicator, an automatic pilot, navigation flares, target course indicator, Model 1 signal pistol and cartridges, and 31 lbs of "Life-saving Devices".

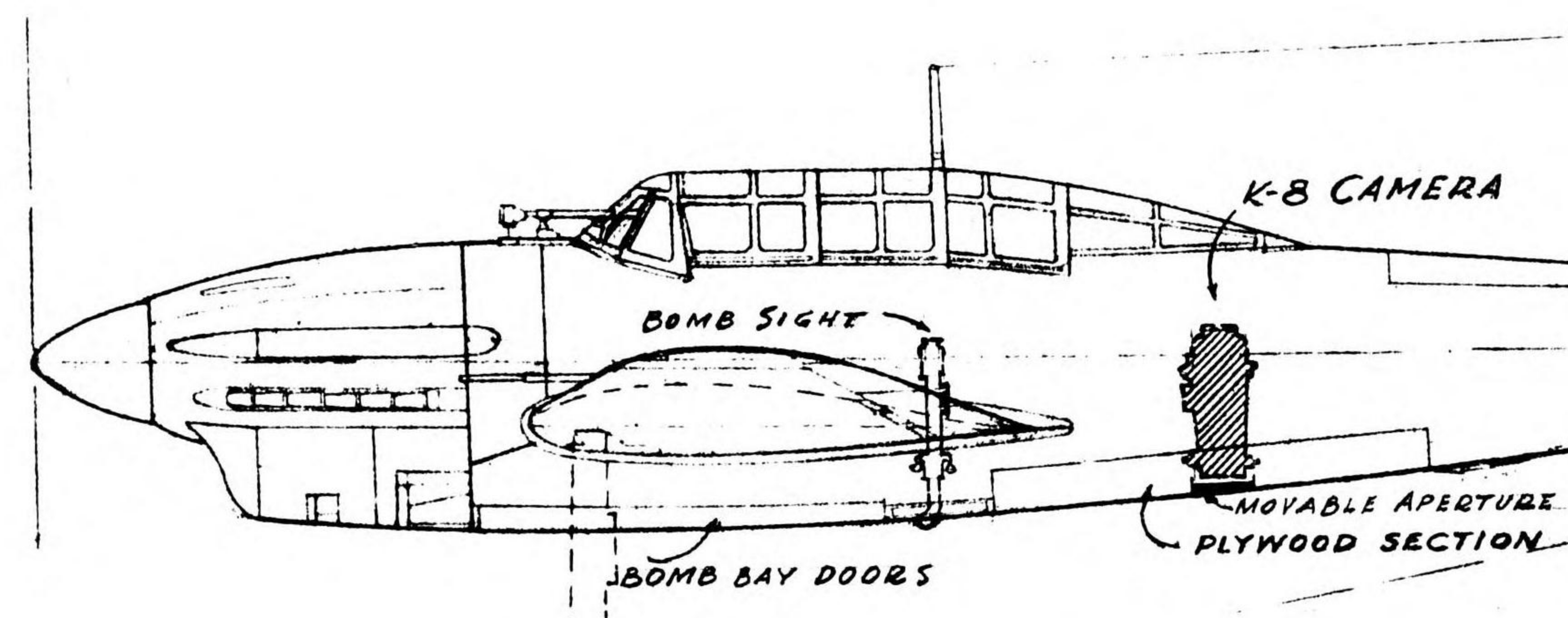


Fig. 15

Camera and Bombsight Installation

Camera - In the "Type 2 land-reconnaissance" version (D4Y2-R), a 'K8' camera (either 25 cm or 50 cm) is installed, together with suitable electrical equipment for operating the camera. The camera is located in the floor of the aft end of the rear cockpit. It is installed from underneath the fuselage through a removable belly hatch. A photographing aperture fitted into this hatch may be opened or closed by means of a door which is cable-operated from the navigator-gunner's compartment.

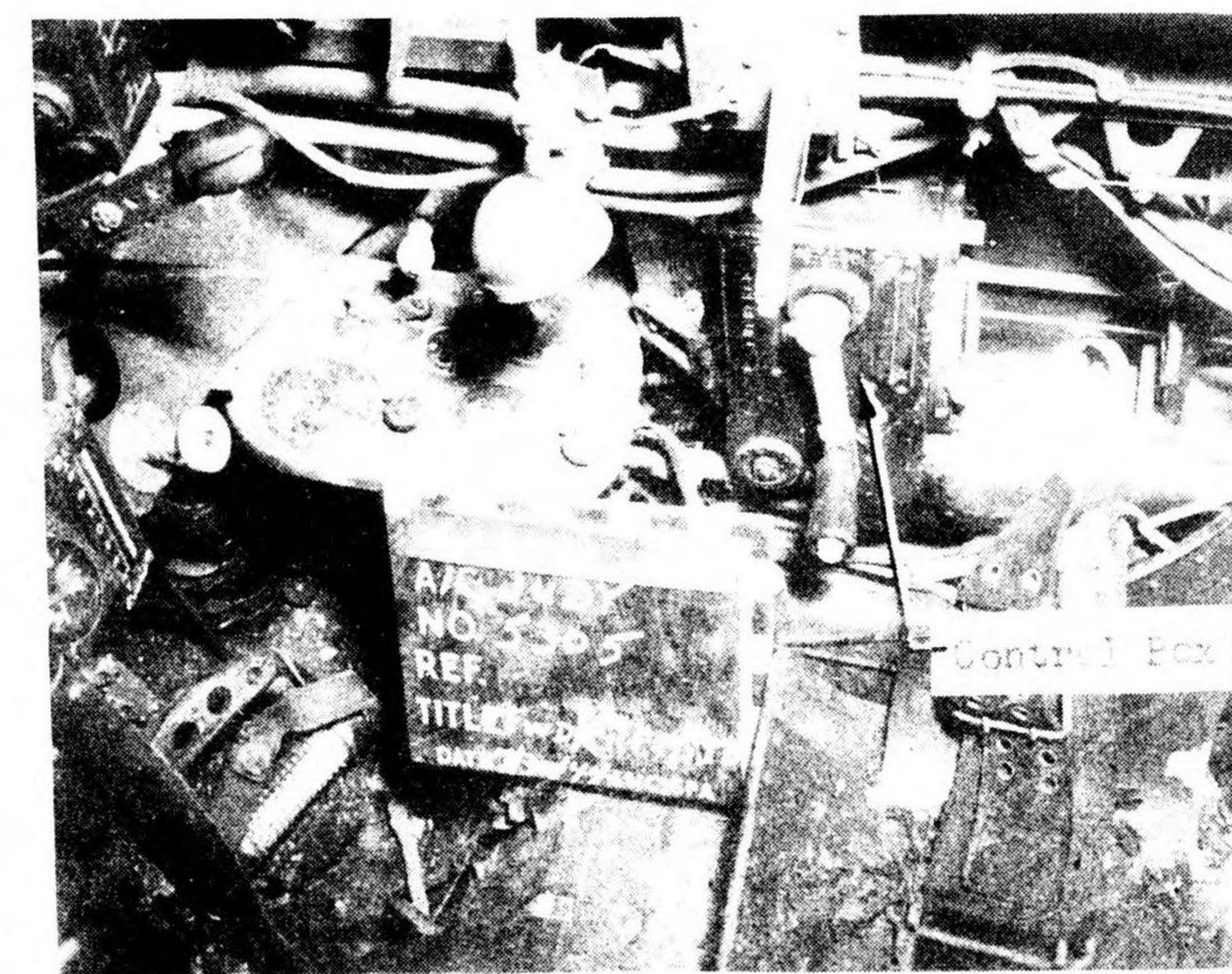


Fig. 16

Control Box - Manual Operation

Manual Control of Flaps, etc. - There is an ingenious arrangement for control of the flaps, dive brakes, bomb bay doors, and landing gear by manual operation in the event of failure of the electrical system. This control box is mounted on the starboard side of the pilot's compartment and has a hand crank, selector arm, and suitable instruments to indicate the degree of operation of the flaps and dive brakes. See Figure 16.

Variations between "Suisai 12" (D4Y2) and "Type 2" (D4Y2-R).

Although basically similar, the conversion of the "Suisai 12 Dive Bomber" (D4Y2) into the "Type 2 Land Reconnaissance" (D4Y2-R) results in the following changes:-

Equipment Removed from "Suisai 12"

- Arrester Hook
- Recce Plane Bombsight, Type 90
- Homing Direction Finder Type 1, Aero Mk. 3
- 7 Power Binoculars
- *2 x 7.7 Fixed Machine Guns
- Bombs
- Dive-bombing Release Gear
- "Rescue Devices"
- Target Course Indicator

Equipment Added to "Type 2"

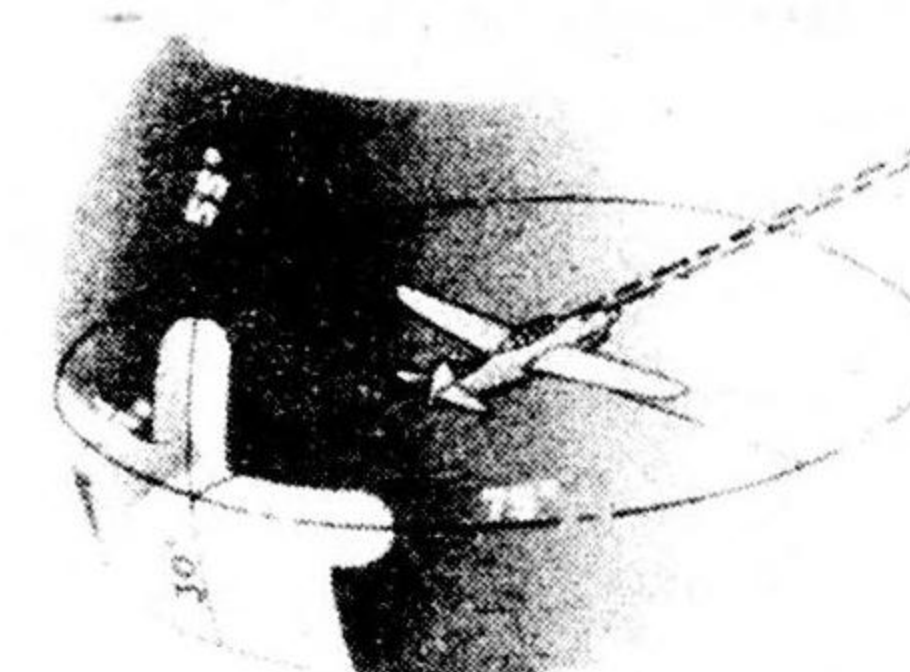
- K8 Camera (86 lb.)
- Additional Oxygen Inhaling Equipment
- Camera Door - under-side of Fuselage
- Electrical Photograph Interval Regulator
- Camera Mount

* The document is not clear on this point; the loading chart clearly omits the forward MGs yet the text definitely claims their inclusion. It is thought that of the two, retention is the more likely.

The following changes should be made to previous TAIC Summaries:

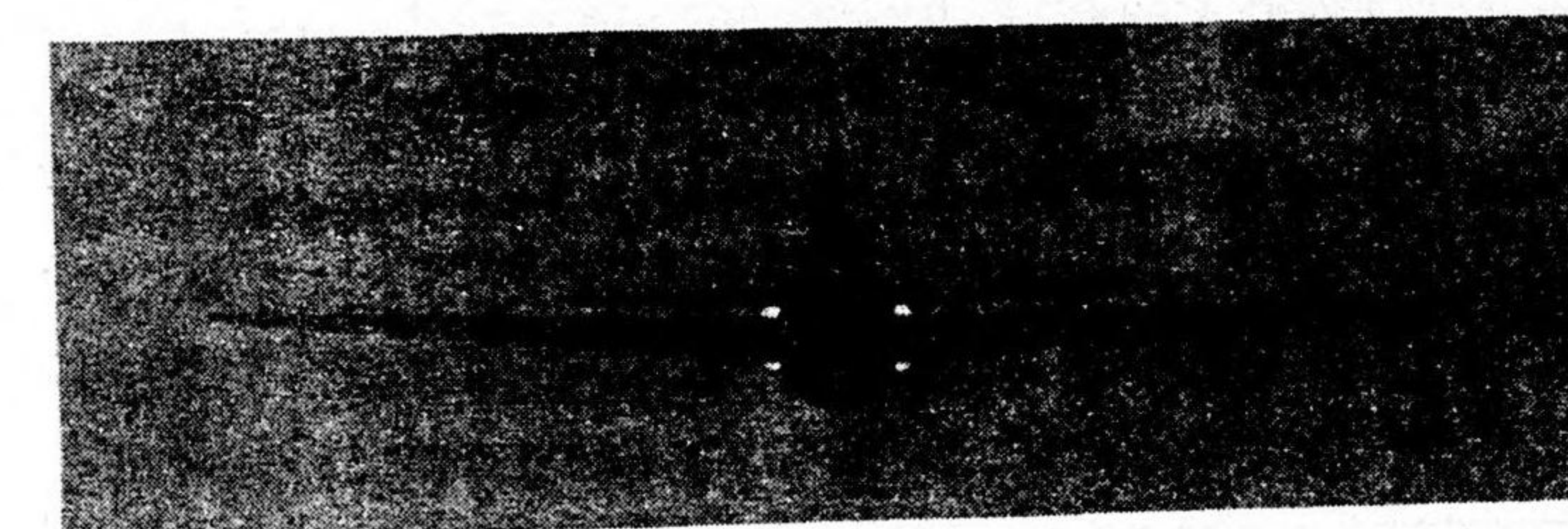
- Summary 10, Page 8 - FRANCES 1 x 250 kg bomb may be carried as an alternative to each of the jettisonable wing tip tanks.
 - Summary 11, Page 1 - ZEKE 52 2 x 12.7 mm fuselage and 2 x 20 mm wing guns have been reported in the most recent crash examinations. An SWPA report also mentions the finding of an additional 20 mm gun, which was fitted into the fuselage behind the pilot, at an angle of 30°, to fire up and forwards over the pilot's head and clearing the propeller arc.
 - Summary 17, Page 4 - REX A document states that the fitting of contra-rotating propellers was abandoned in November 1943.
 - Summary 17, Page 12 - PAUL The final report shows that probably only 1 x 250 kg. bomb is carried under the fuselage, and not two as originally understood.
- ERRATUM
- Summary 17, Page 7 - TOKAI Change the title to Fig. 7 to read "Tokai" instead of "Keiun"

FIELDS OF FIRE

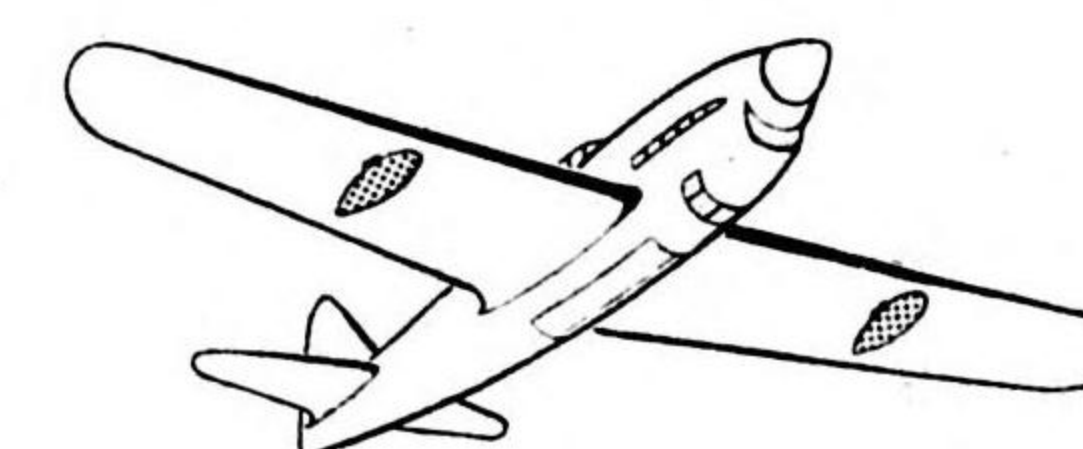


FORWARD GUNS "A" AND TOP GUN "B"
Rear view from above
TOP GUN "B" field of fire is provisional

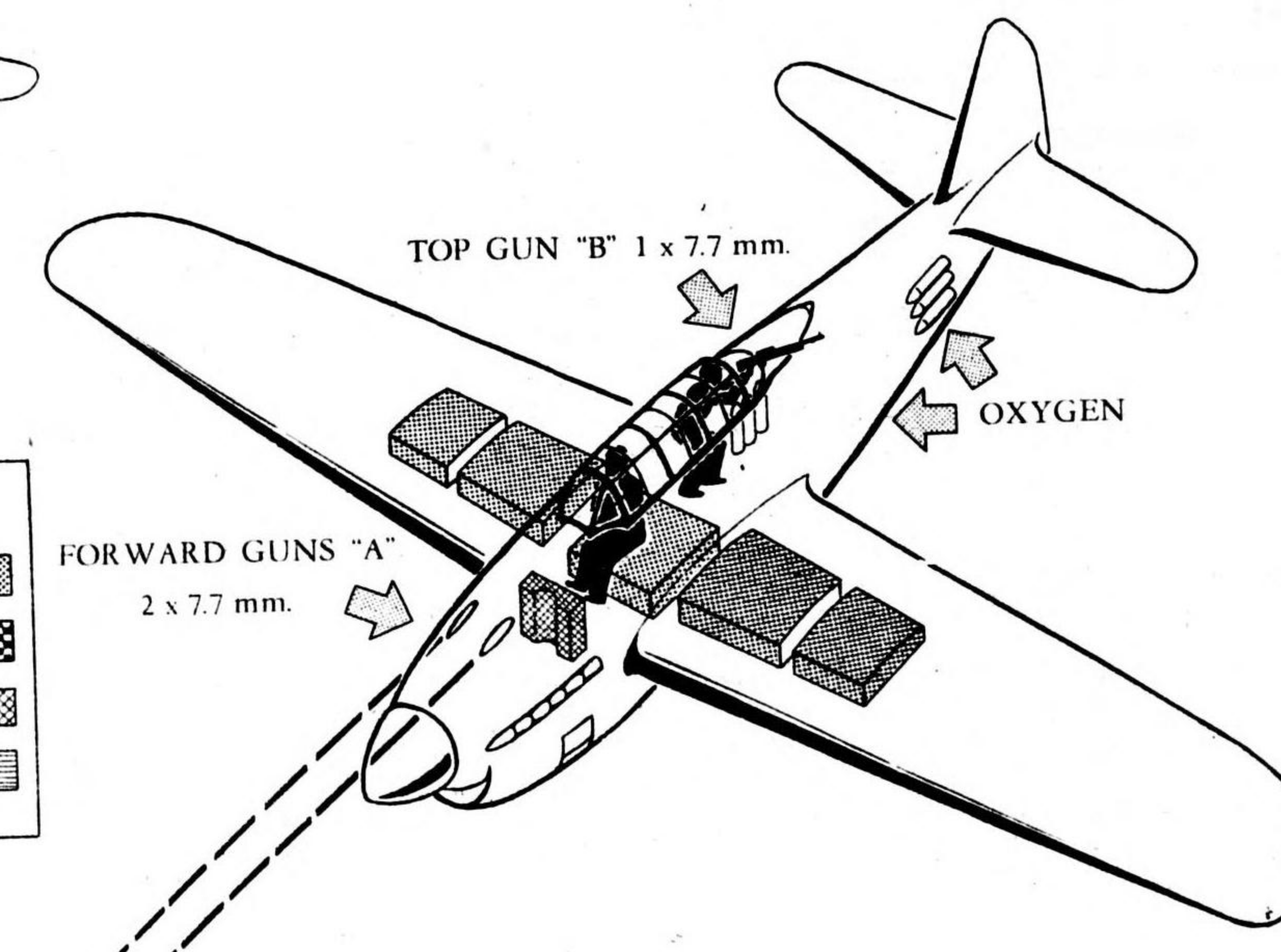
EXHAUST FLAME PATTERNS



VULNERABILITY



Auxiliary gas tanks
Jettisonable



LEGEND

Fuel tanks, unprotected	[Pattern]
Fuel tanks, self-sealing	[Pattern]
Oil tanks, unprotected	[Pattern]
Oil tanks, self-sealing	[Pattern]

FORWARD GUNS "A"
2 x 7.7 mm.

TOP GUN "B" 1 x 7.7 mm.

OXYGEN

ARMAMENT

	No.	Size	Rds. Gun	Type		No.	Size	Rds. Gun	Type
Forward Fuselage	2	7.7 mm	400	Fixed	Tail				
Top Rear Cockpit Side	1	7.7 mm	582	Flex.	Wing				
Bottom									

TACTICAL DATA

No protection for fuel tanks.

Oxygen bottles in after end of plane should be quite vulnerable.

DATE December 1944

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PERFORMANCE AND CHARACTERISTICS

JUDY 12 Name

TAKE-OFF

	Load	Feet
T.O. calm	8255	633
T.O. 25 kt. wind	8255	266
T.O. over 50' obstacle		
Landing over 50' obstacle		

CLIMB-CEILING

@ 8255 lbs.	lbs.	Feet	Min.
Rate @ S.L.		2730	1
Rate @ 5,550 ft.		2820	1
Time to 10,000'			3.7
Time to 20,000'			7.8
Service ceiling 35,800'			

AIRCRAFT

Duty Dive Bomber and Reconnaissance
 Designation SUISEI, Model 12
 Description Low-Mid-Wing Monoplane
 Mfg. Aichi
 Engines 1 Crew 2
 Construction All Metal •

SPEED

@ 8255 lbs.	Mph.	Knts.	Altitude
Maximum	313	271	@ S.L.
W.E.	323	280	@ S.L.
Maximum	388	336	@ 17,200'
W.E.	395	343	@ 18,500'
Cruising 75%	221	192	@ 1,500'
Economical			

BOMBS-CARGO

	No.	Size	Total Lbs.
Normal	4	60 kg.	528
and	1	250 kg.	550
or	1	500 kg.	1100
Maximum			1100

ENGINES

	H. P.	Altitude
Take-off	1380	S.L.
Normal		
Military	1265	S.L.
War Emerg.	1265	16,400'
	1440	5,700'
Mfg. Aichi		
Model Atsuta 31		
Type "V" In line		
Cylinders	12	Cooling Liquid
Supercharger	Hydraulic Drive	
Propeller	3 Blade Diam. 10.5' C.S.	
Fuel - Take-off	93 Cruising 93	

WEIGHTS

	Lbs.
Empty	5620
Gross	8255
Overload Bomber with max. Fuel	10025

FUEL

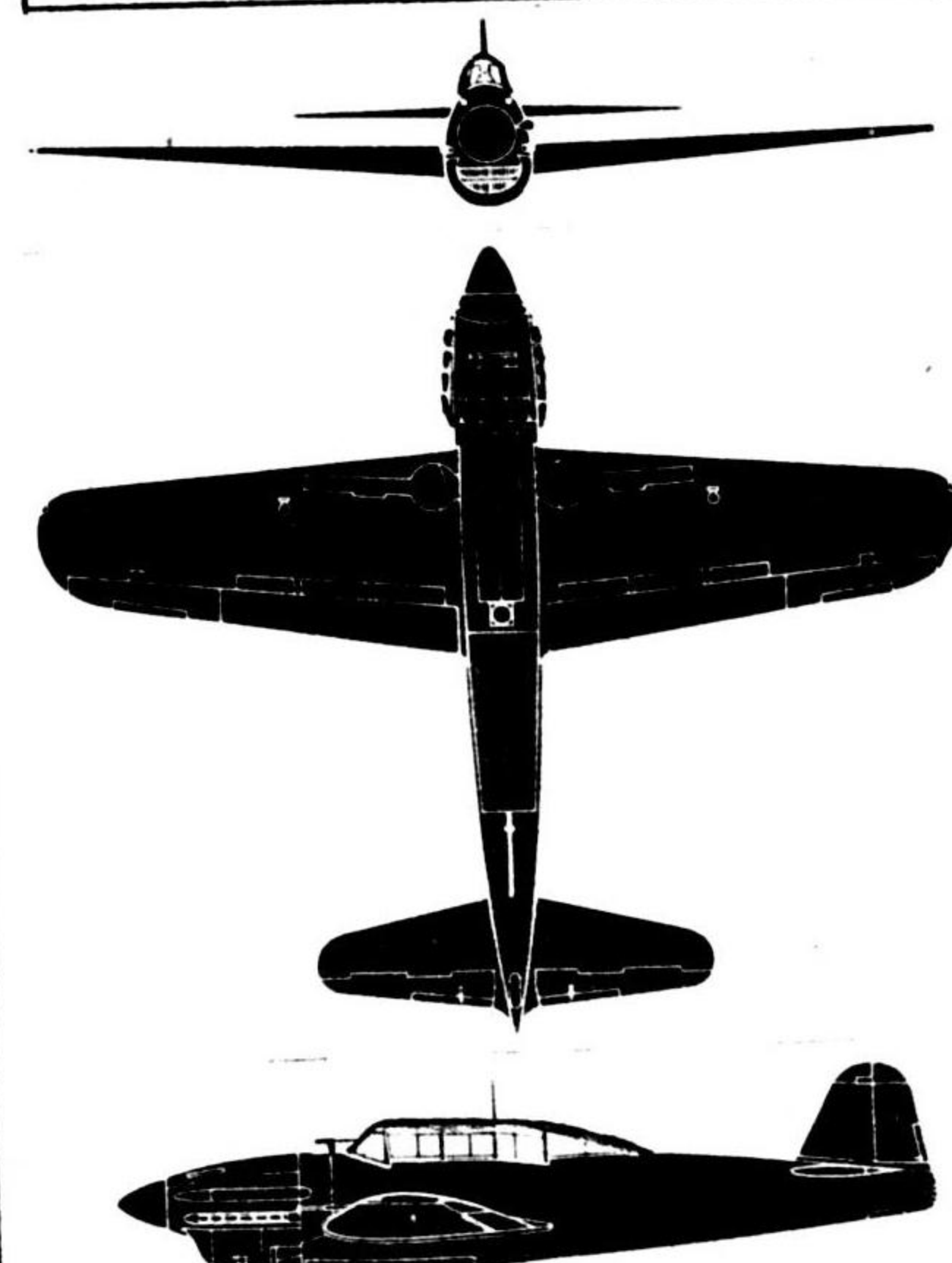
	U.S. gal.	Imp. gal.
Built-in	206	172
Internal (Removable)	69	57
External (drop)	161	134
Maximum	436	363

RANGE AND RADIUS

	Miles		Speed		Alt. feet	Fuel gal.		Bombs lbs.	Cargo lbs.
	stat.	naut.	mph.	Knts.		U. S.	Imp.		
Maximum range (maximum fuel)	2530	2197	165	143	1500	436	363	550	None
At 75% V _{max} .	2135	1854	212	184	1500	436	363	550	None
Maximum range (normal fuel)	1110	964	166	144	1500	172	143	550	None
At 75% V _{max} .	910	791	221	192	1500	172	143	550	None
Radius ()									
Radius ()									

DIMENSIONS

Span	37.7'	Length	33.5'
Height		Wing area	254 sq.ft.



GENERAL DATA

JUDY 12, Type 2 Land Reconnaissance should have performance comparable to the SUISEI Model except for Rate of Climb and Maximum Range which should be somewhat greater due to the absence of a bomb load.

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NATIONAL ARCHIVES MICROFILM PUBLICATIONS

Note: Roll 64

Documents XIIIc. 21 and XIIIc. 23 are missing.

NATIONAL ARCHIVES MICROFILM PUBLICATIONS