

AIRCRAFT CIRCULARS
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 192

THE BERNARD 82 MILITARY AIRPLANE (FRENCH)

A Long-Range Monoplane

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A Long-Range Monoplane

The Bernard 82 is a scaled-up version of the 80 G.R., alike in design, but of greater span and wing area, deeper chord, higher fuselage, and a thicker wing for the bombs. Even the wing sections belong to the same family, although those of the 82 are of higher lift, with a higher C_{m_0} and a lower $C_{x_{min}}$ and are set at 4° incidence instead of at 2° .

Because of its clean lines, the Bernard 82 is well fitted for high and fast flying, a requirement which is being demanded of long-distance bombers. With its few machine guns, twin guns in the rear and above the fuselage, and one below the fuselage, it relies on its speed to get away from pursuers. Two of this type have been built, and were flown last December, and March, respectively.

DESCRIPTION

The wing comprises a center section, two ailerons with compensating flaps, and two detachable trailing edges. The structure follows the conventional Bernard design: box spars, boxed main ribs, longitudinal stringers, and plywood covering. The spar flanges are so arranged as to form a large manhole corresponding to the fuselage corridor. The flanges are glued plies, and the manhole is edged with plywood.

The fuselage consists of two parts, each attached to the wing by four ball joints. The rear end is formed of four spruce longerons, frames, and false frames, the front end of two lateral webs and three robust box frames.

The fuel tanks are lodged in the wing, each tank having a capacity of 1,290 liters (340.8 gallons), and fitted with a dump mechanism. The engine mount is attached at

*From L'Aeronautique, March 1934.

four points to the fuselage by means of lugs bolted to the longerons. The bearer is of L.2 R alloy, the supports of welded chrome-molybdenum steel tubes.

The bombs (8 G.P.U. - 100 or 200 kg each) (220.5 or 440.9 lb.) are carried in the wing, each bomb having its own door, which at the moment of launching is opened by the weight of the bomb. The doors close automatically. The bombs are mounted from above through openings in the upper surface of the wing. The release is electrical.

The divided landing gear is retractable. Each unit consists of a rigid V, the upper ends being linked to the wing. The vertical strut carries a Messier shock absorber having a 240 mm (9.45 in.) travel. The wheels of 1450 x 300 mm (57.1 x 11.8 in.) are fitted with Messier differential brakes linked to the rudder bar.

The tail skid is fitted with oleo-pneumatic shock absorber of 60 mm (2.36 in.) travel and steerable tail wheel.

The landing gear is retracted by means of a stirrup at the upper end of the oleo strut which slides along an oblique rail mounted to the front of the forward longeron. The operation of raising and lowering is as follows: a push button starts the electric motor, the door opens, upon reaching the end of its backward slide it closes an electric contact and lights a signal lamp. A pull on a lever releases two locking cones, closes a valve on the jack and starts the oil pump. The plunger of the jack is pushed down, engages one of the 4 pulleys for the cables attached to the ends of the oleo struts and the linkages slide along the oblique rails. Upon reaching the end the door again closes a contact and lights a lamp on the instrument board, after which the pilot pulls the lever back again. The whole operation of raising takes one minute.

The lowering also consists of two distinct operations: the opening of the cover plate and the lowering proper.

A comparison of the weights of a fixed and a retractable landing gear presents some interesting figures:

a) For landing gear, fixed or retractable:

Strut assembly	84 kg	185.2 lb.
Shock absorbers, Messier	36 kg	79.4 lb.

Ferrules of shock absorbers	4 kg	8.8 lb.
Detachable wheels, Messier, with axles	230 kg	507.1 lb.
Wheel brakes and controls	10 kg	22.0 lb.
	<hr/>	<hr/>
	364 kg	802.5 lb.

b) Parts necessary for retraction:

Slide rails, locking fittings, guides, jack, guide pulleys, etc.	30 kg	66.1 lb.
Wheel locking mechanism	4 kg	8.8 lb.
Oil and oil tank	7 kg	15.4 lb.
Boysson oil pump and gearing	2 kg	4.4 lb.
Pipes, control gear	8 kg	17.7 lb.
	<hr/>	<hr/>
	51 kg	112.4 lb.
Total weight	415 kg	914.9 lb.

The gain, in the face of the slightly greater weight fully justifies the use of the somewhat complicated mechanism.

CHARACTERISTICS

<u>Dimensions:</u>	<u>m</u>	<u>ft.</u>
Span	27.10	88.91
Length	17.97	58.96
Height	3.65	11.98
Maximum wing chord	5	16.40
Distance of center of ailerons from axis of airplane	8.96	29.40
Horizontal tail surface, span	6.85	22.47
Vertical tail surface, height	2.30	7.55
 <u>Areas:</u>	 <u>m²</u>	 <u>sq. ft.</u>
Wing	90	968.75
One aileron (5.81 x 0.59)	3.35 (19.06 x 1.94)	36.06
Horizontal tail surface, area	10.09	108.61
Stabilizer	6.05	65.12
Vertical tail surface, area	4.15	44.67
of which, fin area is	2.20	23.68
 <u>Weights:</u>	 <u>kg</u>	 <u>lb.</u>
Weight empty	3650	8046.9
Full load	7800	17196.0

Performance: (Calculated for Hispano-Suiza 12 Ybrs engine)

	<u>km/h</u>	<u>mi./hr.</u>
Maximum speed (sea level)	280	174
" " (4000 to 5000 m) (13,120 to 16,400 ft.)	327	203
Speed at 9/10 of rated horsepower at 4000 to 5000 m	308-310	191-192
Maximum speed at 7000 m (22,965 ft.) at return, i.e. with 5930 kg (13,073 lb.) half fuel load, no bombs	300	186
Climb,	<u>hr.</u>	<u>min.</u> <u>sec.</u>
to 1000 m (3280 ft.)		4 59
" 3000 " (9842 ")		14 38
" 5000 " (16,400 ft.)		24 24
" 7000 " (22,965 ")		39 29
" 9000 " (29,527 ")		1 26
Theoretical ceiling	9500 m (31,168 ft.)	
Range: going at 5000 m (16,400 ft.), return at 7000 m (22,965 ft.), after dropping 1000 kg (2204 lb.) bombs	2800 km (1740 mi.)	

LEGENDS

FIGURE 1.-Showing the trap door, P, the rear gun mount and gun sight Televiz.

FIGURE 2.-Dimensions of model Bernard 82.

FIGURE 3.-Lift/drag curves of model 82 in wind tunnel.

FIGURE 4.-A diagrammatic sketch of installation and wing structure. 1) automatic opening bomb hatch; 2) reinforcing gusset of bomb rack; 3) bomb control mechanism; 4) automatic catch; 5) bomb; 6) electric bomb release control; 7) main rib; 8) wheel well; 9) wheel; 10) main rib for rail support (door sliding on rails which carry ribs 7) and 10); 11) partition; 12) rib at bridge; 13) oleo strut rail; 14) reserved for fuel tank; 15) oleo strut; 16) landing gear brace; 17) inspection hole; 18) gasoline gage fitting; 19) bomb rack type D, 10 by 50; (note dump valves below 40-liter main tank); 20) the square tube transverse member to which the frame of the bomb rack is mounted; 21) corridor; 22) bomb rack F, 12 by 10; 23) fuel tank with dump mechanism V_R , filter and distant reading fuel gage; 24) tank straps; 25) curved panel; 26) fairing plate control lever; (note that the end is fastened to an electrically operated chain); 27) cross strut of wheel; 28) projector Gaba, 24 volt; 29) aileron control of extended duralumin; 30) lead mass for aileron balance; 31) tab; 32) transmission from electric motor to chain opening door; 33) inspection panel; 34) Michelin flare (2 installed in trailing edge on either side of fuselage); 35) longeron connecting tubes; 36) navigator's compass; 37) bomb gear.

FIGURE 5.-Showing principal engine mount joints.

FIGURE 6.-Bomb hatches in wing, showing hinge assembly.

FIGURE 7.-Wheel retracting system. C and C' are locking cones; K, device for holding wheel in rear position; P, retracting lever; P_h , Boysson oil pump driven from engine; R, valve of jack, V; l, control lever for lowering landing gear; p, pulleys for raising landing gear; r, valve control rod; I, valve control rod; II, oil-pump control rod; III, landing gear release control; IV, control operated by lever l for closing R.

FIGURE 8.-Locking of shock-absorber strut (details, 3, fig. 10). C, locking cone; E, engagement of linkage; L, rocker controlled by III; c, catch; k, pawls; p, scissors spring; ρ and ρ' are compression springs. Raising: the pilot pulls on III, L rocks, C is pulled out and compresses ρ ; at end of rocking L catches in c; the jack operates and the wheel is raised. Lowering: the wheel drops, the sleeve (black piece in figure at right) engages with E and contacts with two pawls such as k. The latter act by rotating about a series of levers and release c; spring ρ returns L and C.

FIGURE 9.- Blocking of hinge joint of oleo strut. At left the cone C is pulled out; spring ρ is extended and rocker L is held at c. At right the cone is forced back under the action of ρ ; the catches c are released.

FIGURE 10a.-Showing front of landing gear.

FIGURE 10b.-Details of p of fig. 10a. A cable fitting, p_4 pulley with four grooves, the right-hand cables are shown as dotted lines.

FIGURE 10c.-1) shock absorber, 2) hinge, 3) cone in low position, 4) ring of cable connection stirrup turns in a bushing which slides along the rail, 5) stirrup, 6) elektron support, 7) turnbuckle, 8) cable.

FIGURE 10d.-1) rail, 2) cable, 3) guide slot of sliding sleeve, 4) turnbuckle, 5) ring of cable stirrup 6), 7) fitting at main rib, 8) and 9) ratchet lever, 10) shock-absorber joint. L (or 9) and C are lever and cone of ratchet gear of fig. 8.

FIGURE 10e.-The pyramid hinges are 1, 2, and 3 (3'). C is the locking cone, K (fig. 10a) catch of wheel in retracted position, R, valve of screw jack V, controlled by connection I, p, pulleys.

FIGURE 11.-Fuselage design.

Left: engine mount panel.

Center: sides of fuselage.

Right: instrument board panel.

Bottom: top view showing oil tank (135 liters capacity) (35.7 gal.)

FIGURE 12.-Wing structure.

Left: central portion of rear spar.

Right: monoblock portion of wing.

Below: central portion of wing showing bomb release panel type D. C is the support, E, recess in rib to allow passage of front landing gear strut, L_N and L_R , front and rear spar, N, rear shock strut joint, P, pulley housing, c, c', c'', stiffeners for N, t_1 , t_2 , t_3 , spar connecting tubes.

Translation by J. Vanier,
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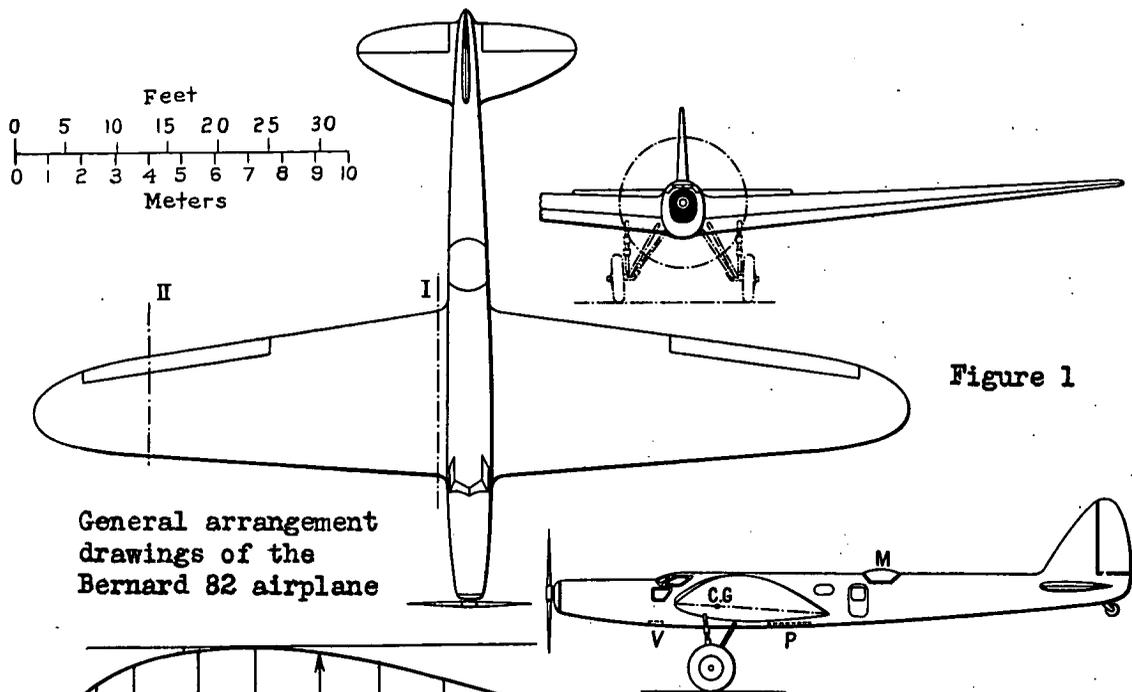


Figure 1

General arrangement drawings of the Bernard 82 airplane

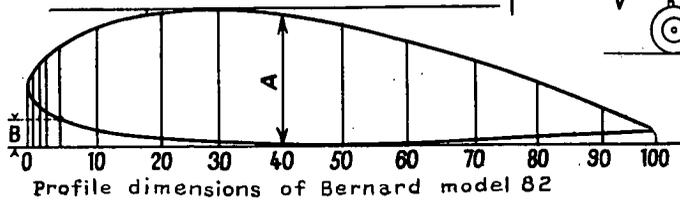


Figure 2

	0	2,5	5	10	20	40	60	80	100
A	15,8	27	31,7	37,5	42,3	40,1	30,4	17,1	2,2
B		10,8	8,8	6,3	3,2	0,4	0,1	0,9	0

Profile at section II (plan form) - L = 120mm. (4.72in.)

	0	2,5	5	10	20	40	60	80	100
A	8,4	13	14,8	16,8	18,3	16,7	12,4	8,8	0
B		6,5	5,6	4,4	3	1,2	0,4	0,9	0

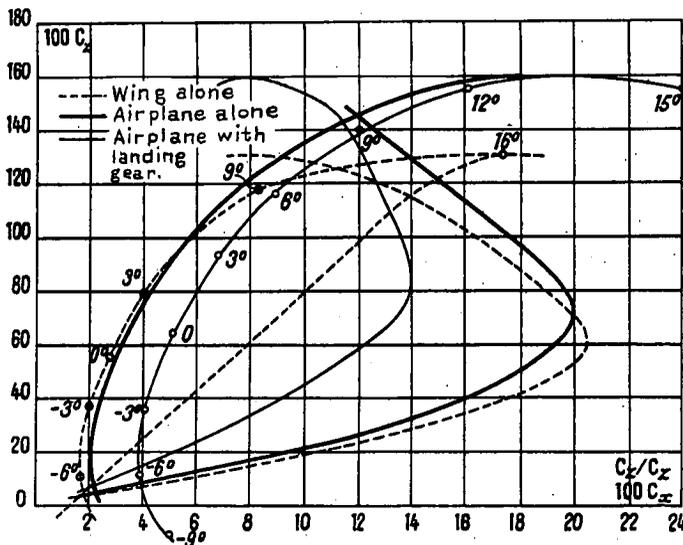


Figure 3

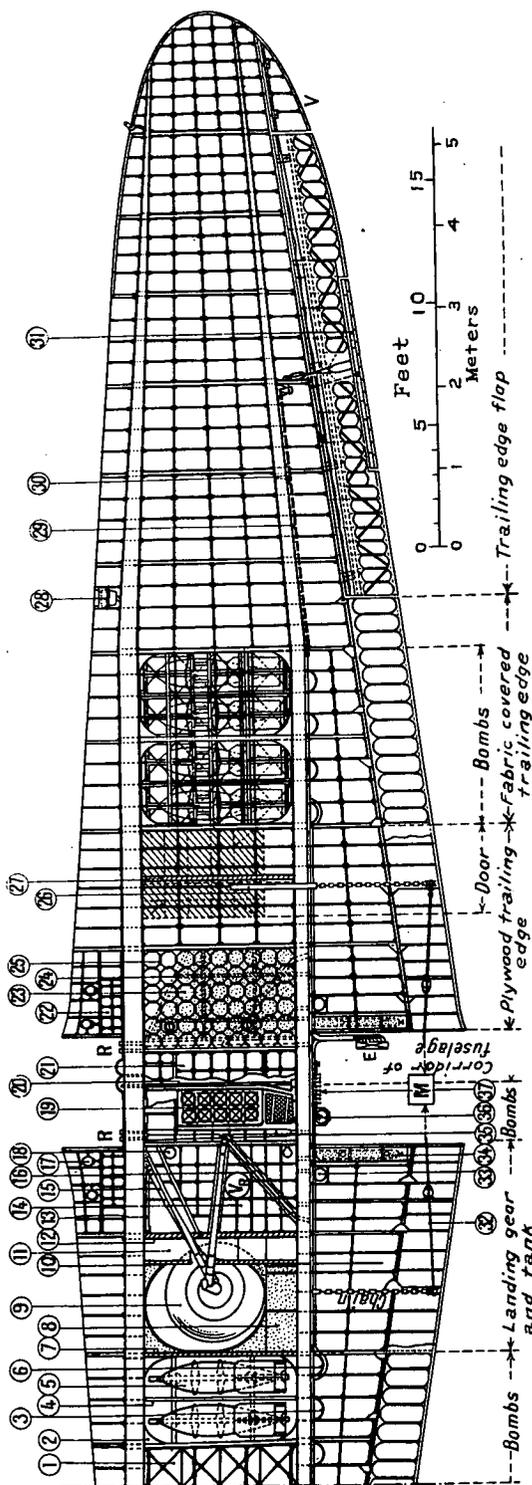


Figure 4.- Diagrammatic sketch of installation and wing structure.

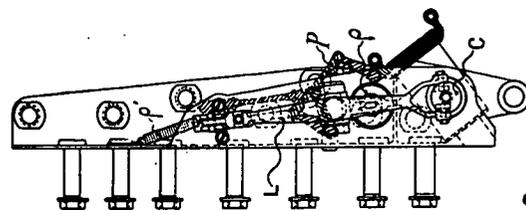
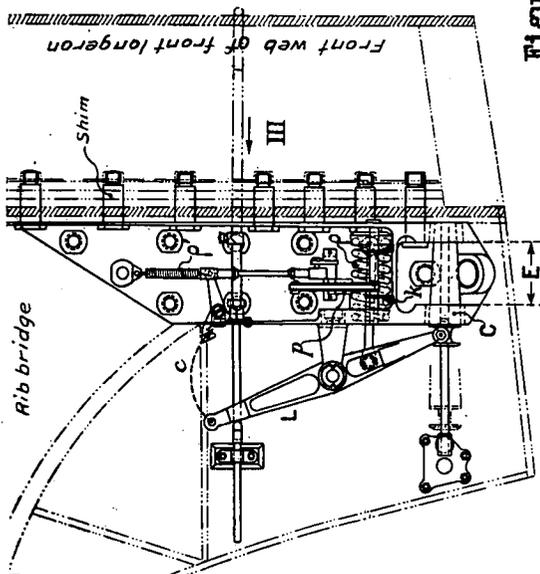


Figure 8



Locking of shock absorber strut details of fig., 10.

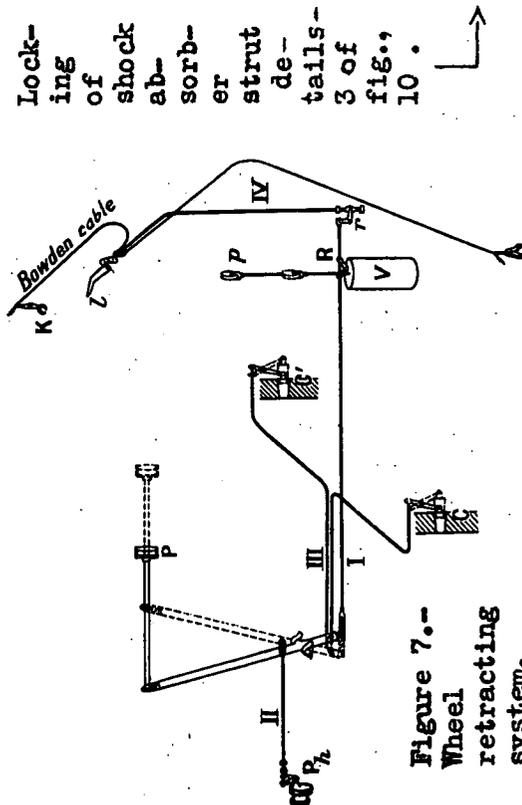


Figure 7.- Wheel retracting system.

*Engine mount of
Bernard 82.*

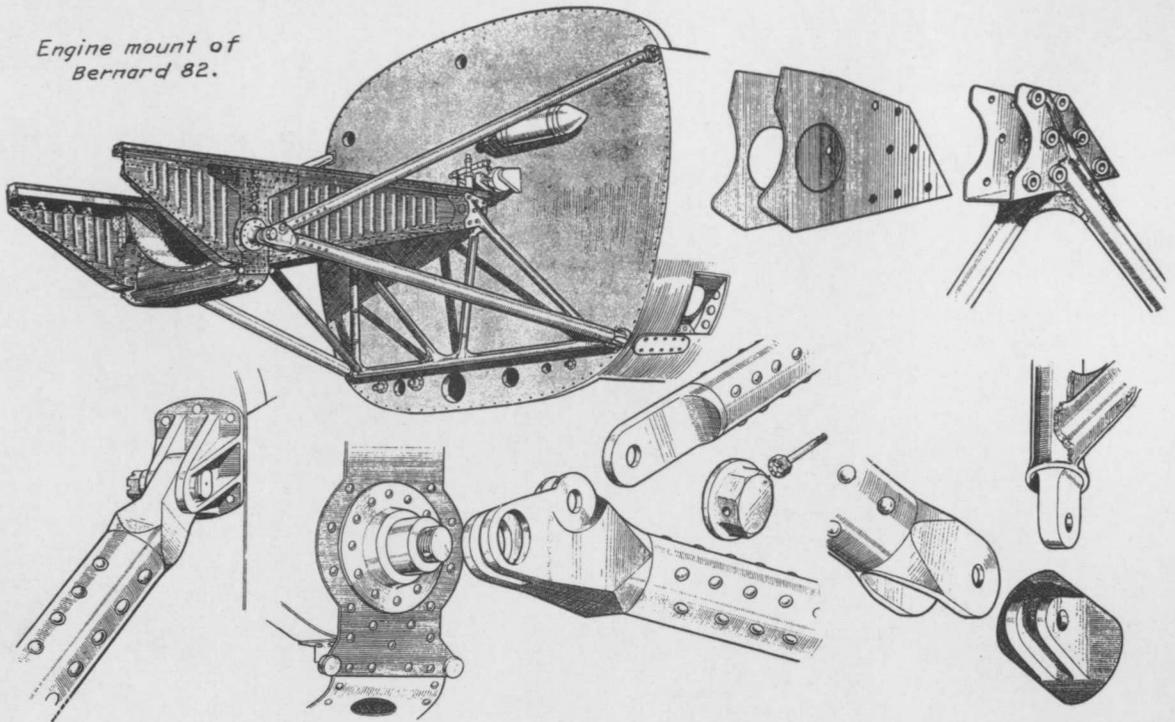


Figure 5
Principal engine mount joints.

*Wing doors
for bombs*

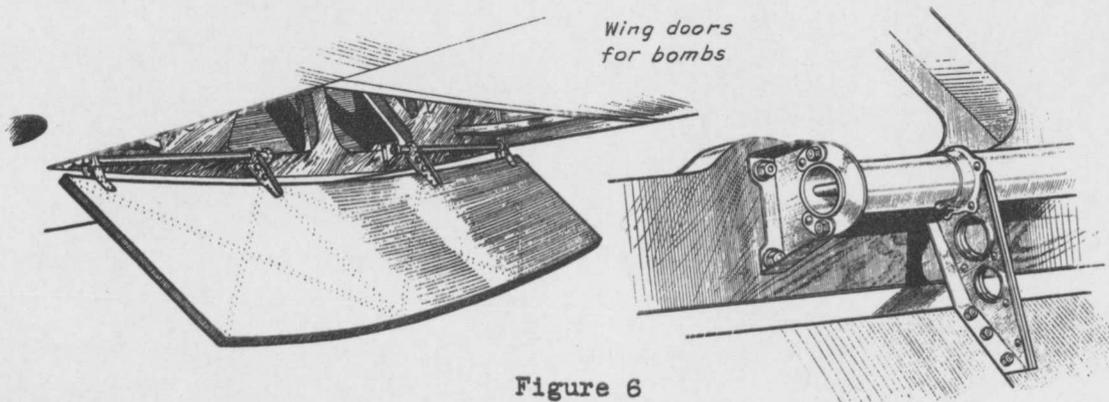
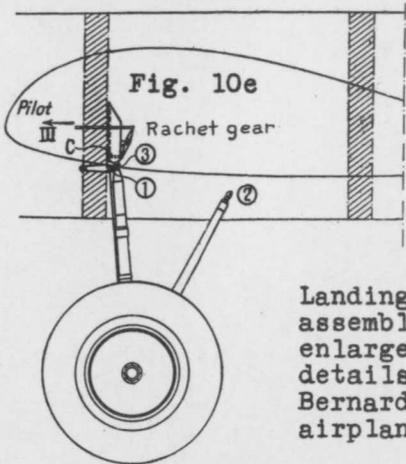


Figure 6
Bomb hatches in wing, showing hinge assembly.



Landing gear assembly and enlarged details of Bernard 82 airplane.

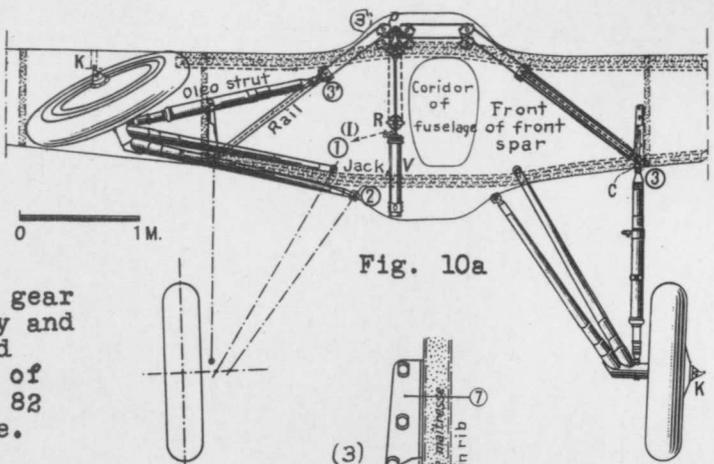


Fig. 10a

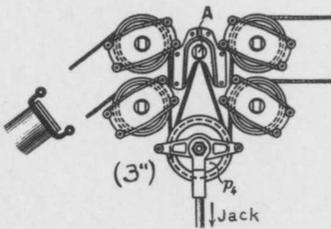


Fig. 10b

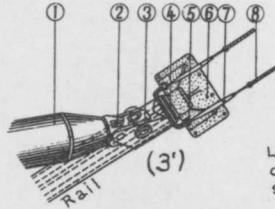


Fig. 10c

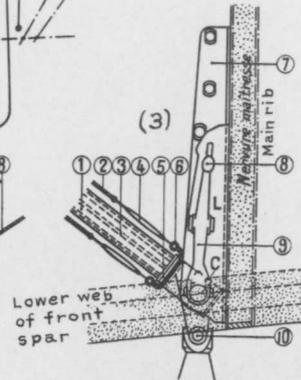


Fig. 10d

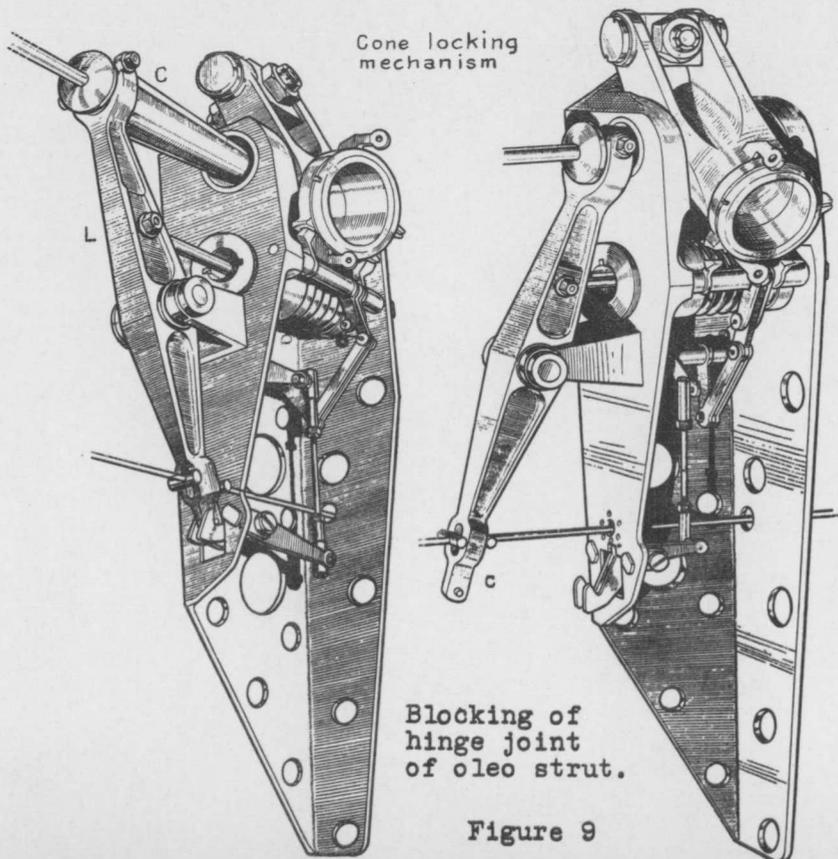
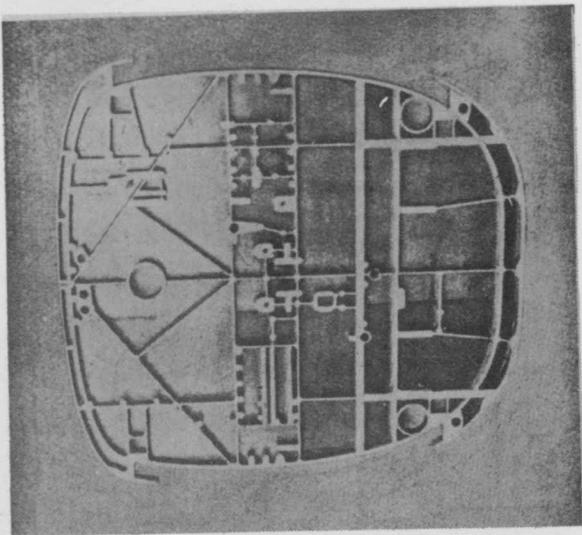
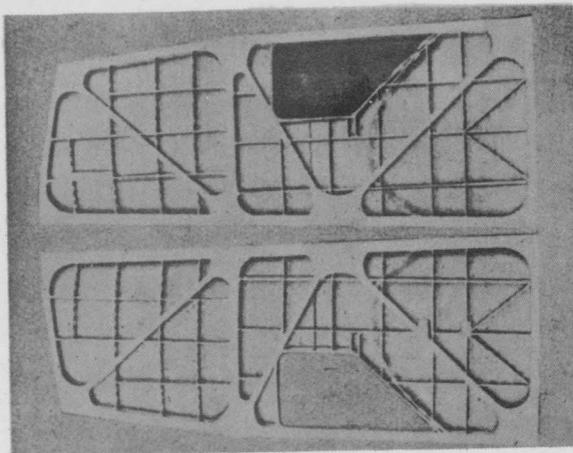


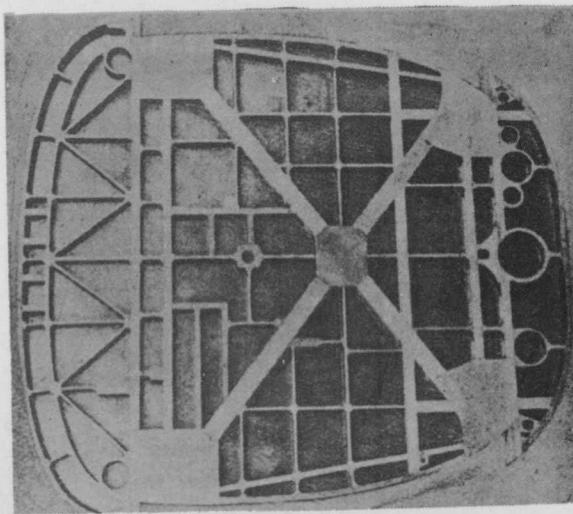
Figure 9



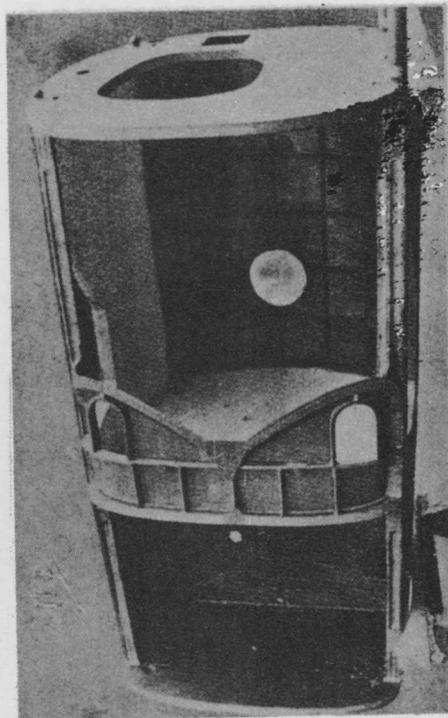
Instrument board panel



Sides of fuselage

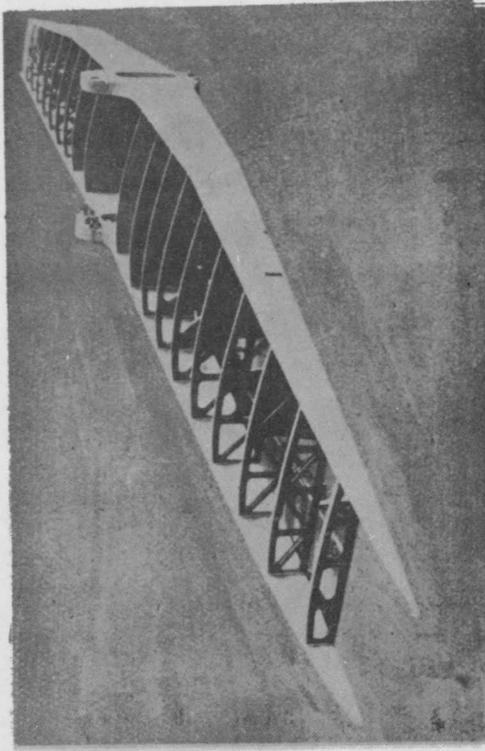


Engine mount panel



Top view showing oil tank (135 l capacity)

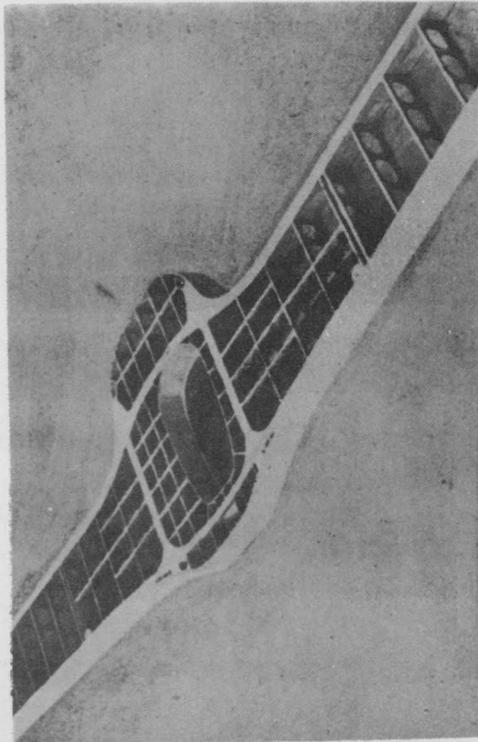
Figure 11.- Fuselage design.



Monoblock portion of wing

Central portion of wing showing bomb release panel type D. C is the support, E recess in rib to allow passage of front landing gear strut, L_A and L_R front and rear spar, N rear shock strut joint, P pulley housing, C, C', C'', stiffeners for N, t_1 , t_2 , t_3 spar connecting tubes.

Figure 12.- Wing structure.



Central portion of rear spar

