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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 63

THE PITCAIRN "MAILWING" PA-5
A Single-Seat Commercial Biplane

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THE PITCAIRN "MAILWING" PA-5*

A Single-Seat Commercial Biplane.

The Pitcairn "Mailwing," a single-seat biplane designed primarily for mail and express service, is equipped with a Wright Whirlwind J-5-C engine and can be arranged to carry two passengers in an open cockpit in place of the mail compartment. The conception of the PA-5, as the "Mailwing" is designated, was based upon the need for a small load-carrying airplane with a high performance. The airplane was designed with full recognition of the fact that, particularly in regular night flying over difficult country, the major requirements of a transport airplane included high cruising speed, a wide speed range, and a rapid rate of climb in order to secure not only economical operations, but a high degree of reliability in the event of forced landings becoming necessary in small intermediate fields (Figures 1, 2, 3).

In spite, however, of its high performance, the "Mailwing" easily carries from 500 to 600 pounds of mail or express matter, while the cubic capacity of the mail compartment, which is situated ahead of the pilot and immediately behind the engine bulkhead, is 26 cubic feet, which is sufficient to insure accommodations for at least 200 pounds of the bulkiest mail matter.

*Prepared by Pitcairn Aviation, Inc.

With a full load, the Pitcairn "Mailwing" has a high speed of 136 M.P.H., landing speed of 45 M.P.H., and a cruising radius at 105 M.P.H. of about 600 miles.

The welded steel tube fuselage of the airplane is of normal Warren truss design with four longerons, its chief characteristic being the use of square section tubing for the longerons (Figure 4). This material is approximately 1 inch square in section with round corners and has the great advantage of materially simplifying the process of welding and having very great strength. No wires whatever are used in the fuselage structure, all bracing being by means of circular steel tubing or tie rods. In the forward section ahead of the pilot's cockpit and at the points of attachment of the lower wing beams and the landing gear strut, square section tubing is used for the cross members. The fuselage is very well faired over the top and sides with "U" section steel, similar to that used for wing trailing edges. Fabric covering is used except over the mail compartment and engine, which are covered with quickly detachable aluminum cowlings.

With a view to rendering engine change a rapid and readily accomplished operation, the entire power unit, including the five-gallon oil tank, is mounted on a quickly detachable steel mount with all gasoline and oil lines arranged for quick disconnection (Figure 5). The 60-gallon gasoline tank is fitted immediately back of the engine mounting in the fuselage. In spite,

however, of this arrangement of the fuel tank in the fuselage where all weights are centralized, the feed is by gravity, a system seldom possible except with wing tanks. As a safeguard against fire in the air, a pressure pyrene fire extinguisher is installed with special nozzles distributed back of the engine, so as to cover all vital parts. The operation of this precautionary system is controlled from the pilot's cockpit.

The mail compartment is situated in front of the pilot's cockpit and partially under the gasoline tank. The base is formed of three-ply wood covered with .035 gauge duralumin, while the sides of the compartment are of .051 duralumin. An aluminum cover is fitted with quick-release clips and forms part of the engine cowling. This disposition of the mail load is convenient for it is so close to the center of gravity that, regardless of the quantity of mail carried, there is a movement in the c.g. position of little more than 1 inch. Furthermore, by careful attention to detail design, the entrance to the mail compartment is arranged so that there is no interference of any kind with the loading or removal of mail bags.

The mail compartment is transformed into a two-passenger cockpit by fitting an open cowling and a seat.

The biplane wings which are staggered forward 22 inches, providing excellent visibility for the pilot, whose cockpit is behind the trailing edge of the lowest wing, are of conventional fabric covered wood construction. The main and rear spars are

routed spruce members, while plywood is used very largely in the construction of the ribs. Considerable attention has been given to lightness without any sacrifice of strength or rigidity. In fact, a load factor for the entire airplane as high as 7.5, which is more than that specified by the Department of Commerce for airplanes of this type, has been maintained, one of the objects being to permit the maximum use being made by the pilot of the excellent maneuverability of the airplane.

The wing structure consists of four single-bay wing panels and the center section, the lower wings attaching to fittings on the lower longerons, while the upper wings are attached to the wing center section supported on struts from the upper fuselage longerons. The somewhat exceptional width of the center section contributes to the easy access to the mail compartment. Furthermore, due to the wide spacing of the cabane struts, interference with the forward vision of the pilot is reduced to a minimum. There is 1 degree dihedral in the setting of the upper wings, the dihedral angle in the lower panels being 4 degrees.

The wings are completely bonded throughout, all-metal fittings being electrically connected with the metal fuselage by means of copper stripping. Not only does this permit the use of radio apparatus on the "Mailwing," but it is a great safeguard against fire in the air due to electrical storms.

The tail group is constructed throughout of welded steel tubing using square section tubing for the main hinge spar of

the stabilizer and 0.3125 inch by 0.035 inch tube as ribs. Fabric covering is used and the stabilizer is adjustable in flight from the pilot's cockpit.

The split-axle landing gear is fitted with Aerol strut shock absorbers. The tread is very wide, being as much as 76 inches and by means of a triangular structure of 3 struts, one from the upper longeron and two from the lower longeron on each side, the vertical compression leg of the landing gear is maintained very short. In fact, the Aerol strut shock absorbers constitute the entire vertical compression member from the wheel axle to the apex of the tripod, thus eliminating the possibility of whipping and bending which might take place under load in the event that a long compression strut from the wheel axle to the top longeron were employed. The landing gear struts are of streamline, heat-treated chrome-molybdenum tubing. The wheels are of size 28 x 4 and are fitted with wheel brakes.

The airplane is fitted with a standard steel adjustable blade duralumin propeller and wing tip and tail navigation lights, while for regular night flying, large high-powered head lights are built into the leading edge of the lower wing at the outer interplane strut of each side.

The control of the airplane in the air is very light, the standard form of rudder bar and control column being used in the pilot's cockpit, which is also completely equipped with navigation and engine instruments. Ailerons are fitted to the lower wing only and extend the entire length of the span, giving very

rapid and light lateral control.

The following are the dimensions of the Pitcairn "Mailwing" PA-5 and the performance figures:

Pitcairn "Mailwing" PA-5

Capacity, pilot and 500 to 600 pounds of mail or express or two passengers, dimensions:

Over-all wing span, upper	33 ft.
" " " lower	30 "
" length	21 ft. 10 $\frac{1}{2}$ in.
" height (standing on ground)	9 " 0 "
Wing chord, upper	54 "
" " lower	48 "
Mean aspect ratio	7.42
Wing area	262 sq.ft.
Wing section	Pitcairn development
Dihedral, upper wing	1 $^{\circ}$
" lower "	4 $^{\circ}$
Gap at fuselage	62 in.
Stagger	22 "
Area of ailerons	21 sq.ft.
" " stabilizer	15.5 sq.ft.
" " elevator	14.4 "
" " fin	4.2 "
" " runner	6.4 "

Weight, empty	1612 lb.
Weight, empty, including batteries, landing lights and parachute flares, etc.	1742 "
Total weight	2512 "
Wing loading	10 lb./sq.ft.
Power loading (200 HP.)	12.6 lb./HP.
Performance with normal full load, high speed at sea level	136 M.P.H.
Cruising speed at sea level at 1650 R.P.M.	105 "
High speed at 10,000 ft.	132 "
Rate of climb at sea level	1600 ft./min.
Rate of climb at 10,000 ft. (without oxygen)	1100 "
Absolute ceiling (without oxygen)	2100 or 2200 ft.
Landing speed	45 M.P.H.
Normal cruising range with 60 gal- lons of fuel	600 miles



Fig. 2
Pitcairn
"Mailwing"
PA-5
airplane,
showing
mail compartment.
Wright
"Whirlwind"
300 HP.
engine.



Fig. 3
Pitcairn
"Mailwing"
PA-5
airplane,
showing
passenger
cockpit
in place
of mail compartment.

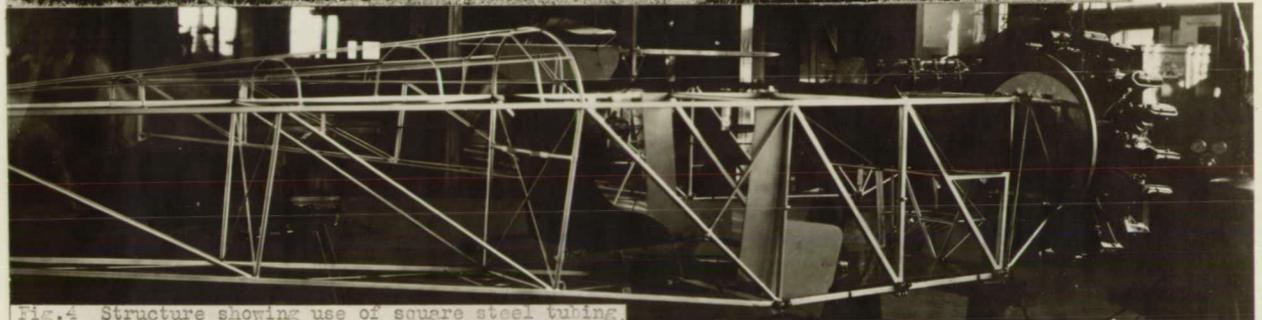


Fig. 4 Structure showing use of square steel tubing.

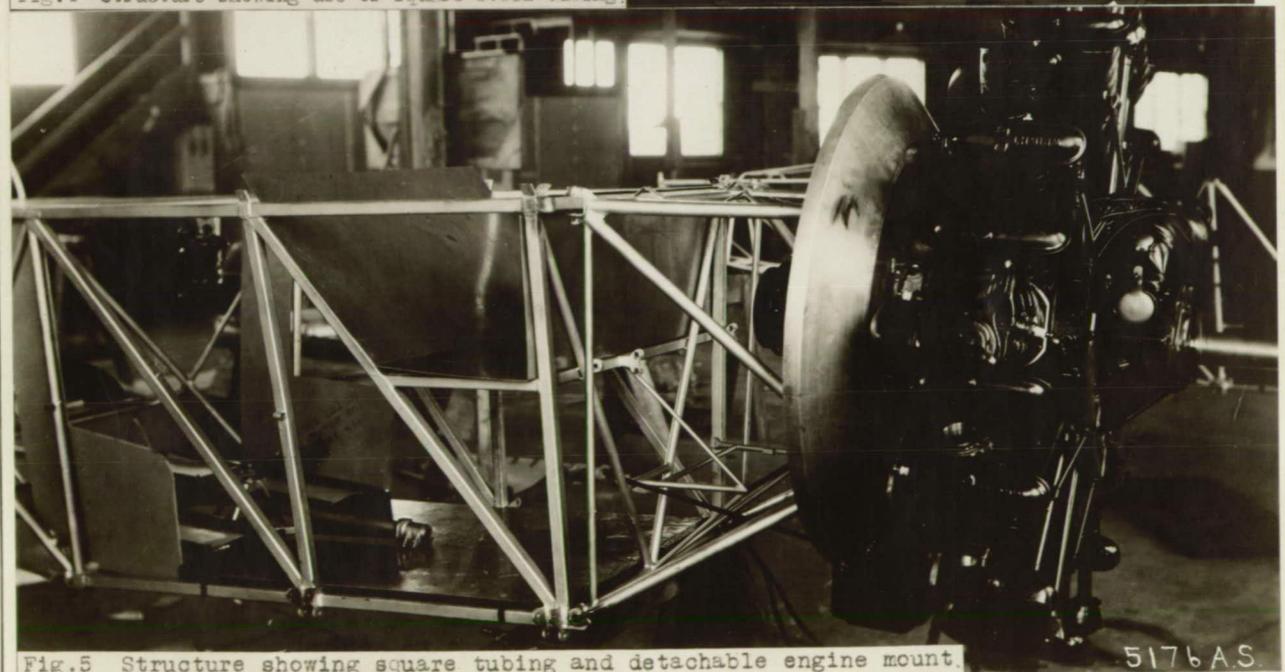


Fig. 5 Structure showing square tubing and detachable engine mount.