AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 200

THE SHORT "SCION SENIOR" COMMERCIAL AIRPLANE (BRITISH)

A Four-Engine High-Wing Cantilever Monoplane

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THE SHORT "SCION SENIOR" COMMERCIAL AIRPLANE (BRITISH)*

A Four-Engine High-Wing Cantilever Monoplane

The "Scion Senior" may be said to be the logical development of the earlier twin-engine airplane, with which it shares its main structural and aerodynamic features. It is a high-wing cantilever monoplane of metal construction, with the four Pobjoy Niagara engines mounted abreast on the leading edge of the wing, into which they are neatly faired. The first airplane of the type has passed its first flying tests as a seaplane, but the next to come along will probably have a wheel landing gear. In our general arrangement drawings, both types of landing gear are shown, and it will be seen that both fit into the design very well.

Owing to the fact that the fuselage of the "Scion Senior" is a good deal longer than that of the twin-engine "Scion", while the depth is very little greater, the proportions are better and the result is an improvement in appearance, as the illustrations will show.

Well-tried methods of construction have been followed in the structure of the "Scion Senior". The fuselage has a primary structure of welded steel tubes, while the wing structure makes use of duralumin in extruded and tubular form. The covering is fabric doped with Titanine.

The main spar has flanges of extruded duralumin, of cruciform section. This lends itself readily to the attachment of the tubular bracing members, the fork ends of which are simply bolted to the flanges of the cruciform sections. The structure of the original "Scion" was of similar type, and was found to be economical in weight of material, remarkably stiff in torsion, and entirely free from troubles with flutter. The wing ribs, as well as the ailerons and tail unit, are of normal Short construction as employed in flying boats for a great number of years (figs. 2 and 6).

The cabin measures 17 feet in length, has an average width of 4 feet 6 inches, and a mean height of 5 feet.

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*From Flight, October 31, 1935, and The Aeroplane, October 30, 1935.

The windows are placed relatively low on the sides, and as the wing is above the fuselage, the view from the cabin is very good, the window height being such as to facilitate looking down on the ground or sea without craning.

Control surfaces are of orthodox design, the ailerons being of the Frise type, with set-back hinges and aerodynamic balance (figs. 7 and 8). They are also mass balanced. The tailplane is fixed and the elevators are provided with trimming tabs, while a similar tab is used on the rudder.

In the pilot's cockpit there is a very complete set of instruments (Smith's), including air-speed indicator, altimeter, fore-and-aft level, turn-and-bank indicator, compass ("Husun" Mark IIIa), oil-pressure gages, and 8-day clock. The four revolution indicators are of the Weston electric type. A very complete electrical installation is carried, including generator, battery, navigation lights, landing headlight in the nose of the fuselage, cabin lighting, and direct cranking electric engine starters. Radio can be fitted, but is not included in the weights given.

Sixty gallons of fuel are carried in two tanks in the wing roots, giving a cruising range of 400 miles for the seaplane and 420 miles for the landplane, in both cases cruising at 3,100 r.p.m. and at cruising speeds of 115 miles per hour, and 122 miles per hour, respectively. When cruising at 3,200 r.p.m., the respective cruising speeds are 121 miles per hour and 127 miles per hour, but the ranges are then slightly reduced. The fuel consumption of the four engines at 3,100 r.p.m. is taken as 18 gallons per hour.

The pay load of the seaplane, not counting the weight of fuel and oil for 400 miles, nor the weight of the pilot, is approximately 1,170 pounds, and for the landplane, the pay load is 1,500 pounds. The gross weight of the airplane is in both cases 5,750 pounds, and the tare weight of the seaplane fully equipped but without radio, is 3,886 pounds, while the landplane weighs 3,546 pounds. The total disposable loads are 1,864 pounds, and 2,204 pounds, respectively. In other words, the seaplane carries as disposable load, 48 percent of its own weight, and the landplane, 62 percent. For an airplane of this type, these figures are above the average.

SPECIFICATION*

Wings:

High-wing cantilever monoplane, tapering in chord and thickness.

Wing section, Göttingen 436 modified.

Each wing attached to top of fuselage and can be readily dismounted for shipment.

Single box-girder spar with booms of extruded duralumin sections and tubular duralumin cross and bracing struts.

Tubular ribs of typical Short type.

Leading edge covered with light-alloy sheeting right around nose from bottom to top flange of spar.

Fabric covered over all.

Frise ailerons, consisting of flanged duralumin diaphragms clipped to tubular spar and covered with fabric.

Fuselage:

Rectangular tubular structure with welded side frames of steel, linked with tubular duralumin cross struts and wire bracing.

Fabric covering over wooden stringers.

Tail unit:

Fixed cantilever stabilizer.

Trimming tabs in trailing edge of elevators.

Cantilever fin.

Trimming tab in trailing edge of rudder.

Entire structure of duralumin covered with fabric.

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*From The Aeroplane, October 30, 1935.

Landing gear (landplane):

Divided type.

Vertical Vickers shock absorbers to wings.

Dunlop intermediate pressure wheels.

Dunlop compressed-air differentially operable wheel brakes.

Fully castoring Dowty tail wheel has automatic self-centering device.

Landing gear (seaplane):

Twin single-step floats.

Typical Short construction with seven watertight compartments.

Stainless steel struts.

Power plant:

Four 90-horsepower Pobjoy Niagaras.

Light-alloy tanks of 96-gallon total capacity in wings.

Each engine is fed by its own pump and suction pipe direct from tank. Should any pump fail, engine concerned is automatically fed by the pump of another, as each pump can supply more than enough fuel for two engines.

Electric starters to each engine.

Accommodation:

Single seat in nose for pilot, with separate entrance door in port side separated from cabin by bulkhead.

Main cabin 17 feet long by 4 feet 6 inches wide by 5 feet mean height.

Volume, 382 cubic feet.

Door in port side.

Separate luggage compartment.

Up to 10 passengers are carried.

Weights (landplane):

Tare weight, fully equipped but less radio, 3,546 lb. (1,680 kg).

Fuel (60 gal. at 7.7 lb. per gal.), 462 lb. (209.5 kg).

Oil (6 gal. at 9.7 lb. per gal.), 58 lb. (26.3 kg).

Pilot, passengers, and luggage, 1,700 lb. (773 kg).

Loaded weight, 5,750 lb. (2,610 kg).

Weights (seaplane):

Tare weight, fully equipped but less radio, 3,886 lb. (1,764 kg).

Fuel (60 gal. at 7.7 lb. per gal.), 462 lb. (209.5 kg).

Oil (6 gal. at 9.7 lb. per gal.), 58 lb. (26.3 kg).

Pilot, passengers, and luggage, 1,344 lb. (613.2 kg).

Loaded weight, 5,750 lb. (2,610 kg).

Performance (landplane):

Maximum speed, 140 m.p.h. (225 k.p.h.).

Cruising speed at 3,200 r.p.m., 127 m.p.h. (204 k.p.h.).

Cruising speed at 3,100 r.p.m., 122 m.p.h. (196 k.p.h.).

Landing speed, 55 m.p.h. (88 k.p.h.).

Rate of climb (sea level), 725 ft. per min. (222 m/min.).

Rate of climb on 3 engines, 400 ft. per min. (122 m/min.).

Ceiling on 3 engines (service), 6,500 ft. (1,980 m).

Rate of climb on 2 engines and ceiling on 2 engines, just positive.

Fuel consumption at 3,100 r.p.m., 18 gal. per hr.

Air miles per gallon at 3,100 r.p.m., 6.77.

Performance (seaplane):

Maximum speed, 134 m.p.h. (215 k.p.h.).

Cruising speed at 3,200 r.p.m., 121 m.p.h. (194 k.p.h.).

Cruising speed at 3,100 r.p.m., 115 m.p.h. (185 k.p.h.).

Landing speed, 55 m.p.h. (88 k.p.h.).

Rate of climb (sea level), 650 ft. per min. (198.4 m/min.).

Ceiling (service), 10,000 ft. (3,050 m).

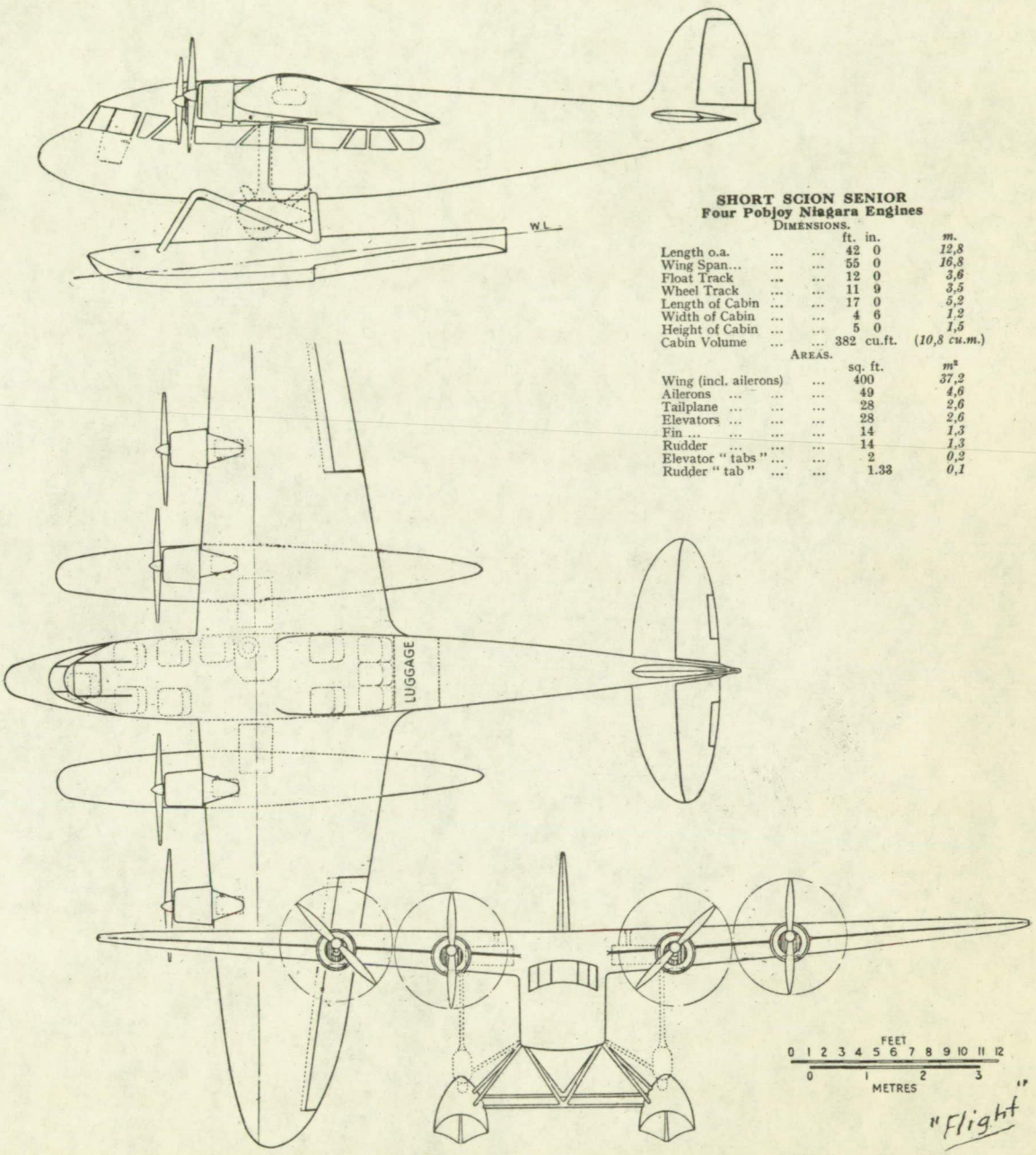
Rate of climb on 3 engines, 300 ft. per min. (91.5 m/min.).

Ceiling on 3 engines (service), 5,500 ft. (1,680 m).

Rate of climb and ceiling on 2 engines, just negative.

Fuel consumption at 3,100 r.p.m., 18 gal. per hr.

Air miles per gallon at 3,100 r.p.m., 6.44.



SHORT SCION SENIOR
Four Pobjoy Niagara Engines

DIMENSIONS.

	ft. in.	*m.*
Length o.a.	42 0	*12,8*
Wing Span...	55 0	*16,8*
Float Track	12 0	*3,6*
Wheel Track	11 9	*3,5*
Length of Cabin	17 0	*5,2*
Width of Cabin	4 6	*1,2*
Height of Cabin	5 0	*1,5*
Cabin Volume	382 cu.ft.	*(10,8 cu.m.)*

AREAS.

	sq. ft.	*m²*
Wing (incl. ailerons) ...	400	*37,2*
Ailerons	49	*4,6*
Tailplane	28	*2,6*
Elevators	28	*2,6*
Fin	14	*1,3*
Rudder	14	*1,3*
Elevator "tabs"	2	*0,2*
Rudder "tab"	1.33	*0,1*

Figure 1.- General arrangement drawings of the Short Scion Senior seaplane.

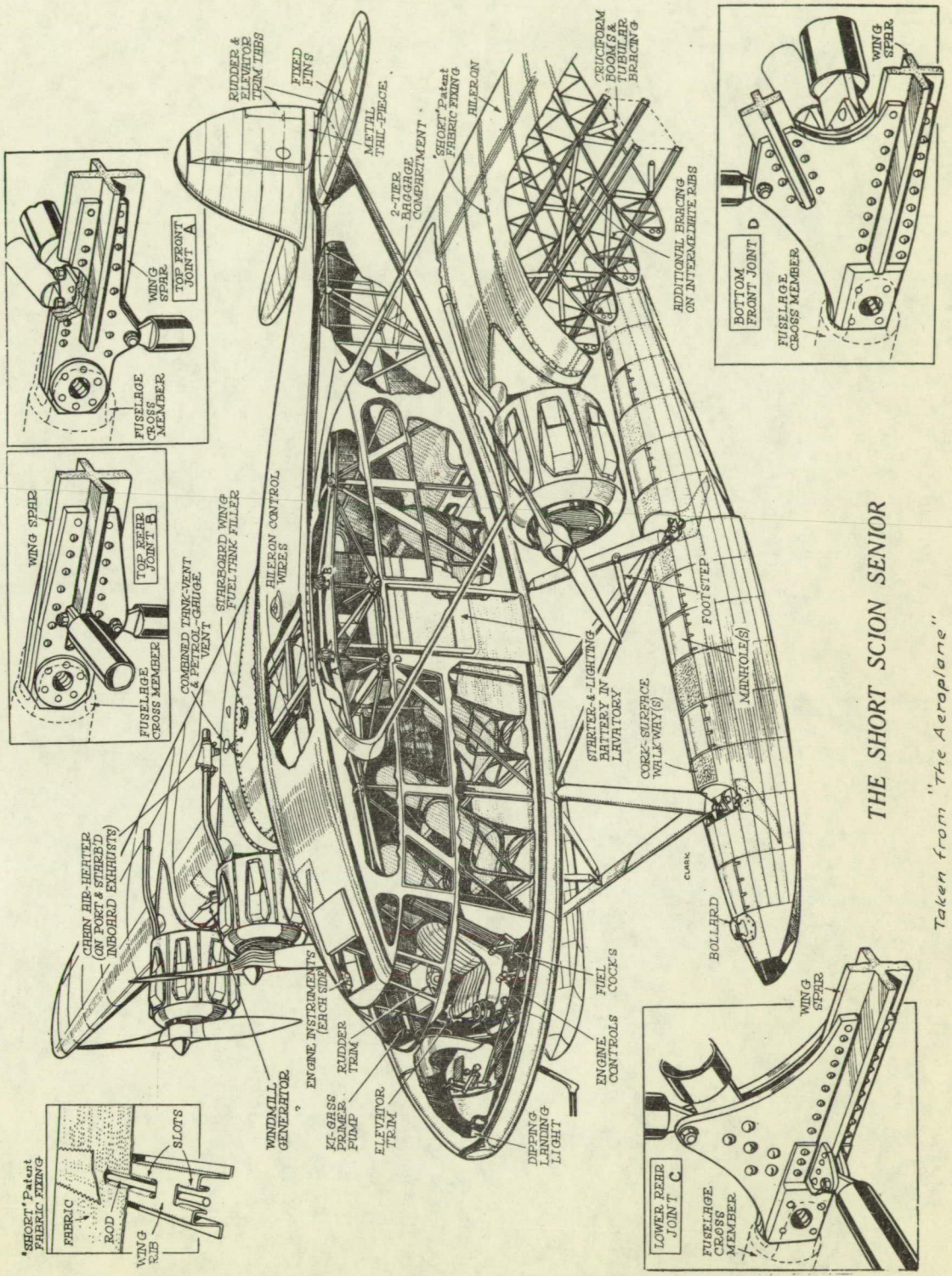


Figure 2.- Details and structural assembly of the Short Scion Senior seaplane.

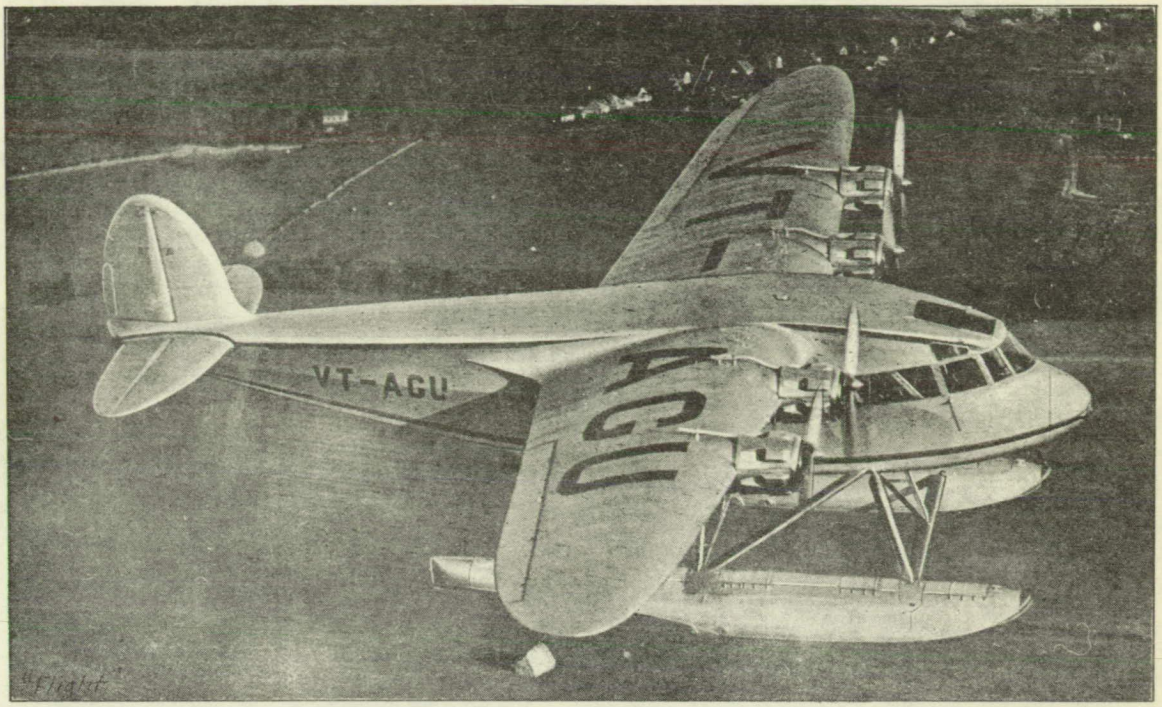


Figure 3.- The Short Scion Senior seaplane in flight.

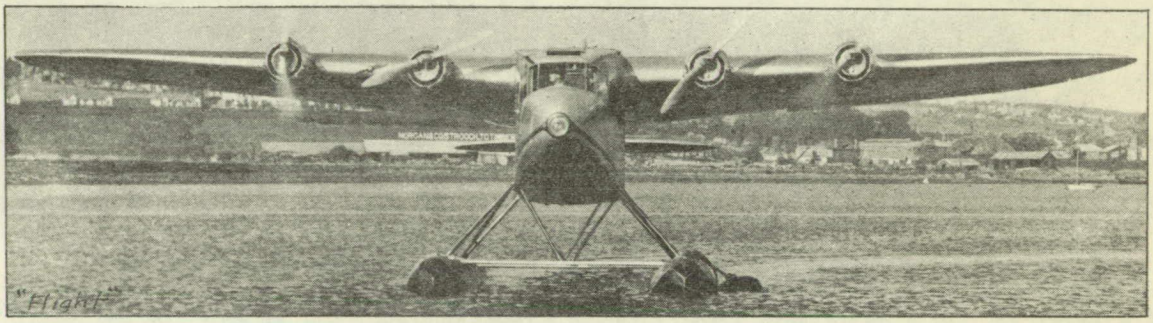


Figure 4.- Clean aerodynamic design endows the Short Scion Senior with a good performance in spite of the relatively low power.

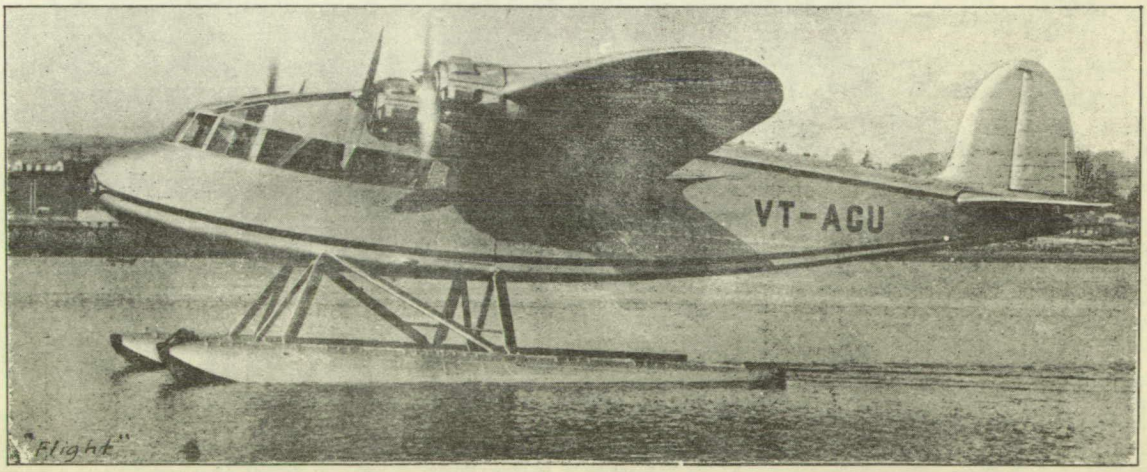


Figure 5.- The Short Scion Senior taxying.

Details of the wing construction. The spar is in the form of a girder "box," in which the corner flanges are of extruded cruciform section and the bracing members are tubular. In the sketch is seen one of the joints which secure the outer wings to the center-section.

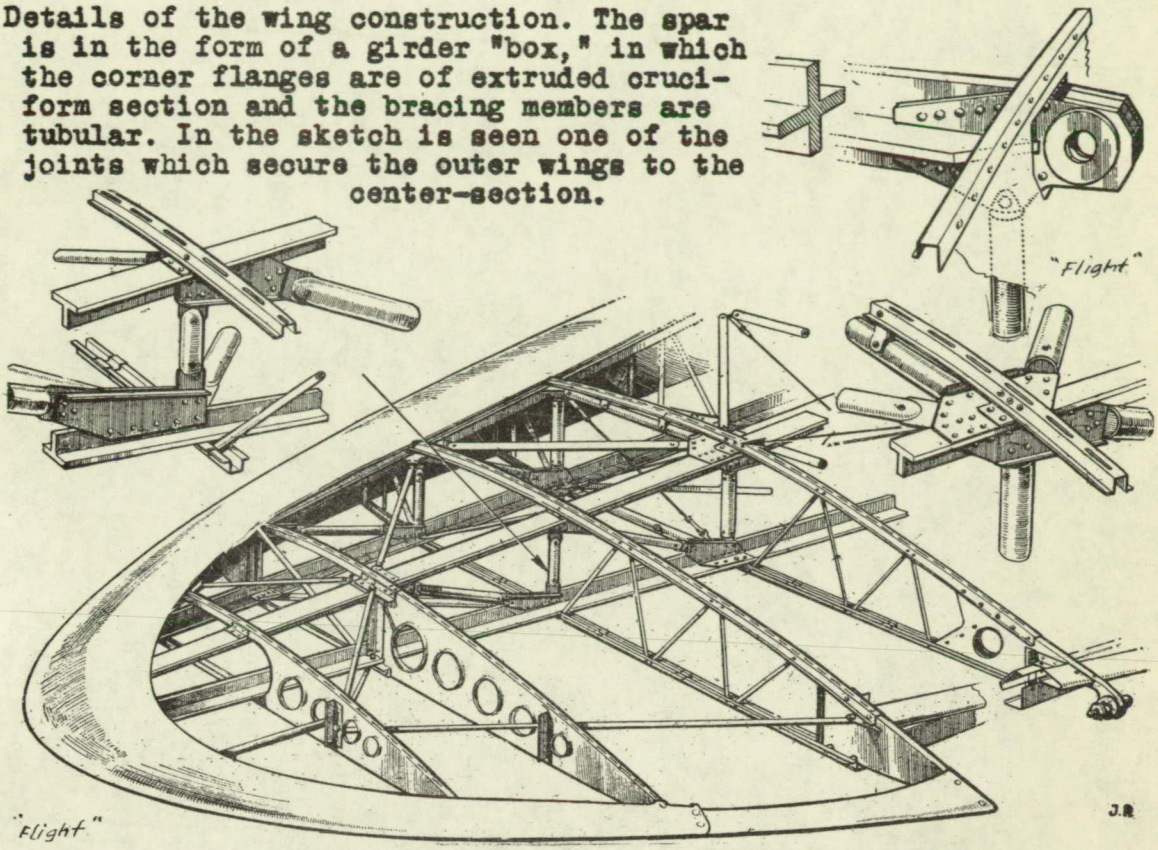


Figure 6.-Details and assembly of wing structure.
The Short Scion Senior

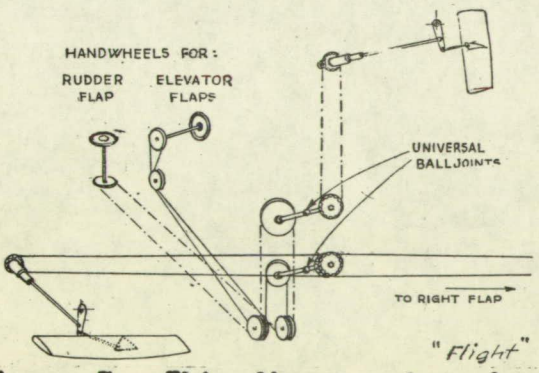


Figure 7.- This diagram shows how the control leads are arranged.

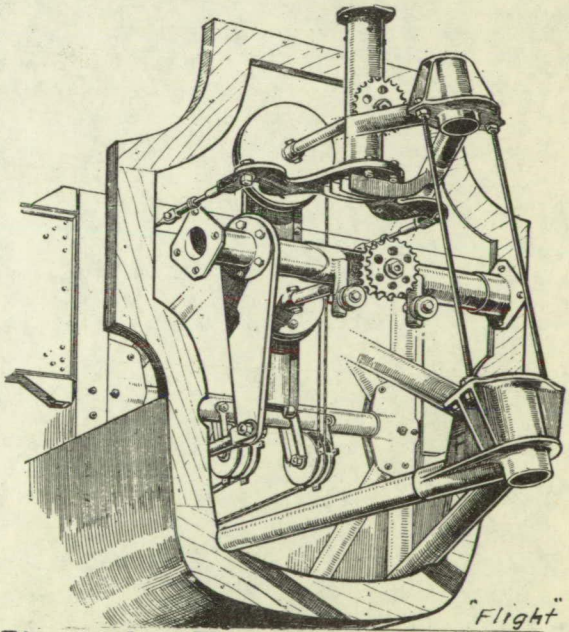


Figure 8.- The grouping, in the stern, of the elevator and rudder control leads. The sprockets and small pulleys are for the rudder and elevator "tab" controls.