AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 129

VICKERS "VIASTRA I" COMMERCIAL AIRPLANE (BRITISH)

A High-Wing All-Metal Semicantilever Monoplane

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VICKERS "VIASTRA I" COMMERCIAL AIRPLANE (BRITISH).*

A High-Wing All-Metal Semicantilever Monoplane.

In aerodynamic design the "Viastra I" does not at first glance look very much out of the ordinary. It is a braced high-wing monoplane with wings of rectangular plan form and constant section (Figs. 1, 2, and 3).

It is, perhaps, from a structural point of view that the "Viastra I" is most interesting. Designed to have a good ratio of total to empty weight - or, in other words, a low structure weight - cheapness of production has been kept prominently in view, as well as a minimum of upkeep cost. The fundamental principle adopted in the structural design is that the skin or covering must take its part in the work of sustaining the loads. In the "Viastra I" there is incorporated the latest experience of the firm in truly all-metal construction.

The fuselage of the "Viastra I" incorporates a skeleton framework strong enough to carry its load, but needing the support of the metal skin to stabilize it (Figs. 4, 5, 6, 7, 8, and 9). In a general way it may be said that the system consists in using duralumin longerons of angle section, braced by vertical and diagonal duralumin members of angle section, T sec-

*From Flight, September 26, 1930.

tion and channel section, according to local loads and stresses. Riveted to this framework is a duralumin skin, put on in vertical strips having fore and aft corrugations for stiffening purposes. The production of these corrugated strips has been reduced to a very simple operation at the Vickers Works, and the system helps very materially in cutting down the cost of production of the airplane.

The floor of the cabin and other portions of the fuselage is strengthened by transverse floor bearers projecting downward from the main fuselage structure. These bearers consist of top and bottom channels joined by a "wandering web" of a type similar to that used in the wing spars. The external covering, of corrugated duralumin, is then riveted to the bottom of these floor bearers (Figs. 10, 11, and 12).

With the exception of the metal covering, and the difference in wing rib construction resulting therefrom, the wing construction of the "Viastra I" follows fairly closely that of previous Vickers airplanes. The system of wing construction has already been fairly fully described in Flight of September 15, 1927 (See N.A.C.A. Technical Memorandum No. 440: Metal Aircraft Construction at Vickers - Some Interesting New Forms Developed), and it will suffice if we here confine ourselves to a brief summary of the features.

The main wing spars have flanges of flat duralumin strip, laminations being added as and where local stresses demand.

These flange strips are riveted near their edges to angle section corner strips, and the "wandering web," i.e., a web of strip duralumin which runs in zigzag from front to rear face of the spar (Fig. 13). By the fact that the web crosses in this manner, it forms diagonal diaphragms between the top and bottom flanges, and diaphragms of the ordinary type become superfluous. This type of spar has been found to give very good results from a strength/weight point of view, and is relatively very cheap to manufacture.

The wing covering in the "Viastra I" is in the form of duralumin panels of standard width, corrugated in a fore and aft direction, and with the free edges at the sides of each panel turned up. These free edges are then riveted to the rib flanges, which are flat strips placed vertically. The construction will be clear from an examination of Figure 14, which shows a view inside the wing. The rib webs are Warren girders of duralumin tube, slotted at the ends to fork the rib flange strip. It will be seen that the wing spars do not occupy in depth the whole of the airfoil section, and that the rib flanges are supported from the spar flanges on simple bent plate clips. To stiffen the wing covering, angle strips running at right angles to the wing chord are placed at intervals. These strips are interrupted at the rib flanges, as shown in Figure 14.

The center section of the wing is built integral with the fuselage, the construction being visible in Figure 3. The con-

centrated stresses from the wing spars are taken by a tubular structure in the roof of the fuselage, this structure taking the form of a plain transverse tube to which is attached the apex of a vee formed by two other tubes.

Externally the two wing halves are braced by steel tubes, the arrangement of which can be seen in Figures 1, 2, and 3. From the point on the front wing bracing strut, to which is attached the telescopic leg of the landing gear a diagonal strut runs to the top longeron of the fuselage (Figs. 15 and 16).

Bristol-Frise type ailerons are fitted, the type of bracket supporting them being shown in Figure 17. The first "Viastra I" to be built is in addition fitted with Handley Page automatic slots.

The power plant of the "Viastra I" consists of three Armstrong-Siddeley geared "Lynx" engines of 235 hp each (Fig. 18). The engine mountings have been so designed that a variety of different engines can be fitted, and the wing engines can be removed altogether and the airplane used as a single-engined type. In that case the central engine will, of course, be one of much greater power than the "Lynx."

The gasoline is carried in two tanks in the wings giving direct gravity feed. A new type of tank has been evolved and is, we believe, used for the first time in the "Viastra." This type of tank consists of two identical halves joined in the middle (Fig. 19). At the joint the tank plating is flanged up and

the two halves are held together by a series of bolts and slotted sleeves, with a packing between the two flanges to make a gasoline-tight joint. The oil tanks are of different shape, but of the same form of construction. In the gasoline tanks a loose framework inside serves both to strengthen the tank and to act as a baffle to prevent surging of the fuel. This framework is so designed that the two halves of the tank shell slip over it when the tank is being assembled.

The landing gear of the "Viastra I" is of the "split" type, with oleopneumatic shock absorbers, Dunlop wheels and Vickers hydraulic brakes (Figs. 20 and 21). These can be operated together or separately, and a tail wheel with castor action allows of turning the airplane in a very small circle on the ground.

The biplane tail is of unusual design, in that it is, so to speak, of the single-spar biplane type (Fig. 22). The two rudders at the ends of the horizontal tail surfaces are pivoted around vertical tubes which remain stationary, serving as the vertical struts of the biplane tail system. In construction, the biplane tail is very similar to the main wings, i.e., of all-metal construction, even to the covering.

The cabin of the "Viastra" is of large dimensions (length, 20 ft. 3 in.; width, 5 ft.; height, 6 ft. 1 in.), and when the airplane is used as a passenger carrier there is seating accommodation for 12 passengers, 6 along each side of the cabin. The ventilation system is novel, in that each passenger has an

adjustable ventilation shutter placed near his seat. The windows can therefore be kept closed, which in itself reduces the amount of engine noise which reaches the cabin. With metal covering it was to be expected that "drumming" might be somewhat pronounced, and to reduce this the designers have introduced in each small panel in the fuselage wall a tiny bag filled with sand.

Aft of the cabin is the lavatory (Fig. 23), very neatly arranged, with a door which alternatively shuts off the lavatory from the cabin, or, when passengers are entering or leaving the airplane. Reached by a separate external door behind the lavatory is a large baggage compartment. This is fitted with a specially strong, false floor, which can be raised, as shown in one of our photographs.

The cockpit of the "Viastra" is ahead of the wing and well protected by windshields. The view from the cockpit is good in all important directions, and when the airplane is used as a twin-engined type, the view is, of course, even better. Dual controls are provided in front of the two side-by-side seats. A door in the rear wall of the cockpit communicates with the cabin.

As the "Viastra I" has not yet been through the type tests at Martlesham Heath, actual performance figures cannot be given.

Characteristics

Dimensions

Length	70 ft. 0 in.
Span	48 " 6 "

Areas

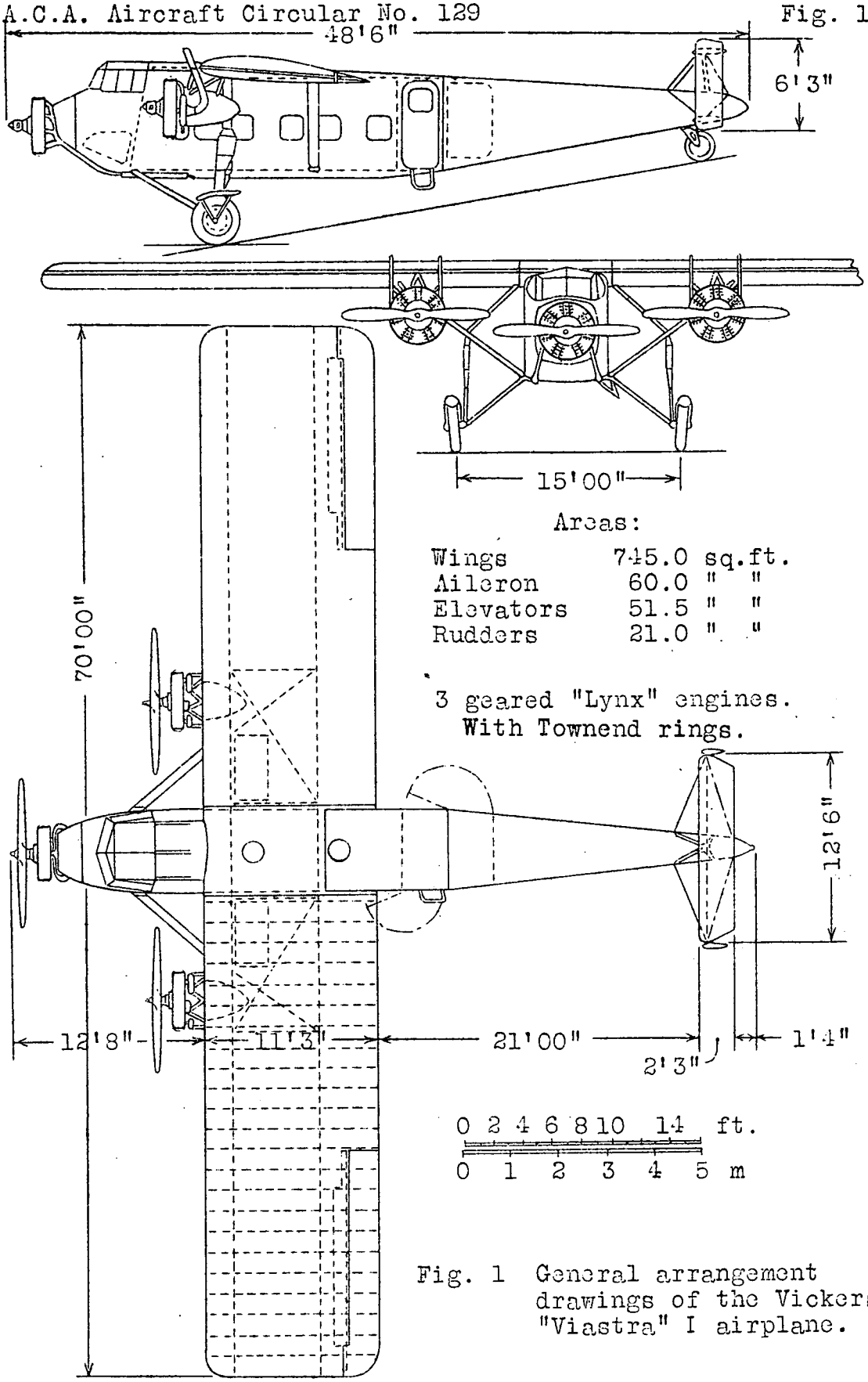
Wings	745 sq.ft.
Ailerons	60 "
Elevators	51.5 "
Rudders	21.0 "

Weights

Weight, empty	6,980 lb.
Pay load	3,460 "
Weight of fuel (300-mile cruise), crew, etc.	1,210 "
Total weight	10,650 "
Total-empty ratio	1.527,
giving a disposable load of	52.7%
of the empty weight, or	5.2 lb./hp
Pay loading	3½ lb./hp

Performance

High speed (estimated)	140 m.p.h.
Cruising speed (estimated)	120 m.p.h.



Areas:

Wings	745.0	sq.ft.
Aileron	60.0	" "
Elevators	51.5	" "
Rudders	21.0	" "

3 geared "Lynx" engines.
With Townend rings.

Fig. 1 General arrangement drawings of the Vickers "Viastra" I airplane.

Figs. 10 & 11 False flooring in freight compartment in normal and raised position.
From "Flight" Sept. 26, 1930

Figs. 2 & 3 Three-quarter front and rear views of the Vickers "Viastra" commercial monoplane.
From "The Aeroplane" Sept. 24, 1930

Fig. 7 Finished cabin before seats are installed. From "Flight"

Fig. 8 Photograph of framework showing sand bags and ventilators. "Flight"

Fig. 9 The "Viastra" cabin looking aft. Note roof lights. From "Flight"

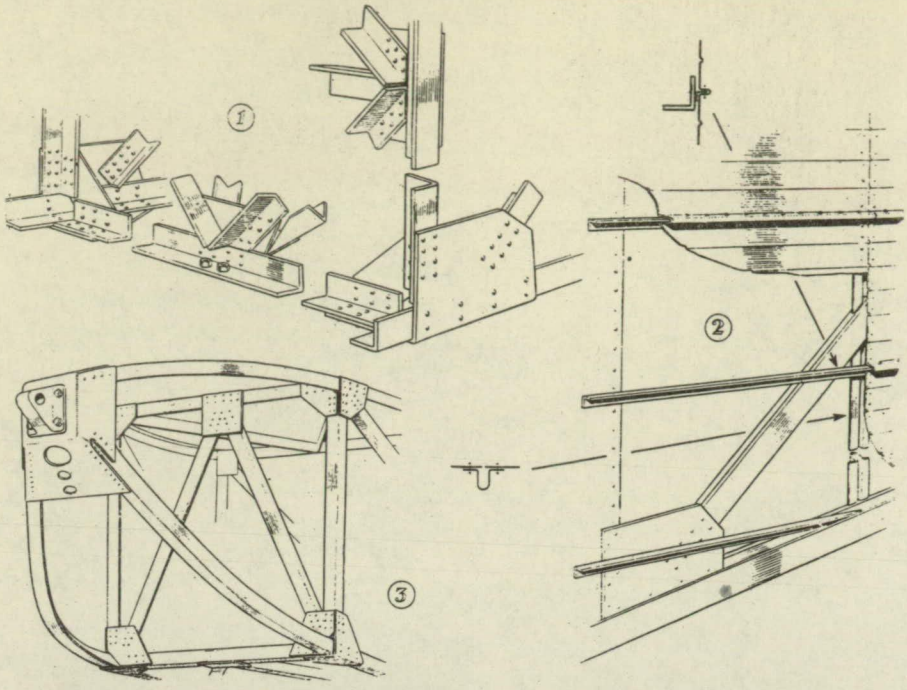


Fig. 4 (1) Four typical fuselage fittings which are of simple flat-plate type. (2) Method of attaching fuselage covering. (3) Tail-end of fuselage.

From "The Aeroplane" 9-24-30

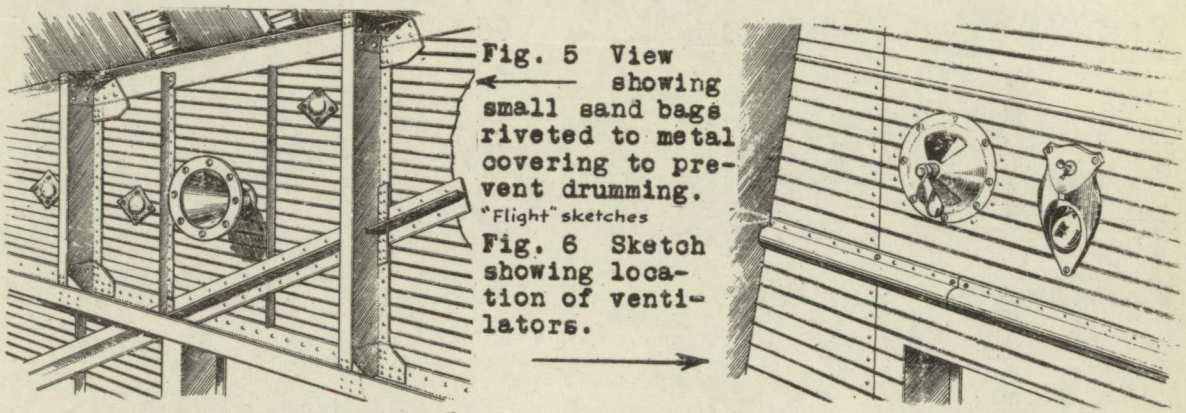


Fig. 5 View ← showing small sand bags riveted to metal covering to prevent drumming.

"Flight" sketches

Fig. 6 Sketch showing location of ventilators. →

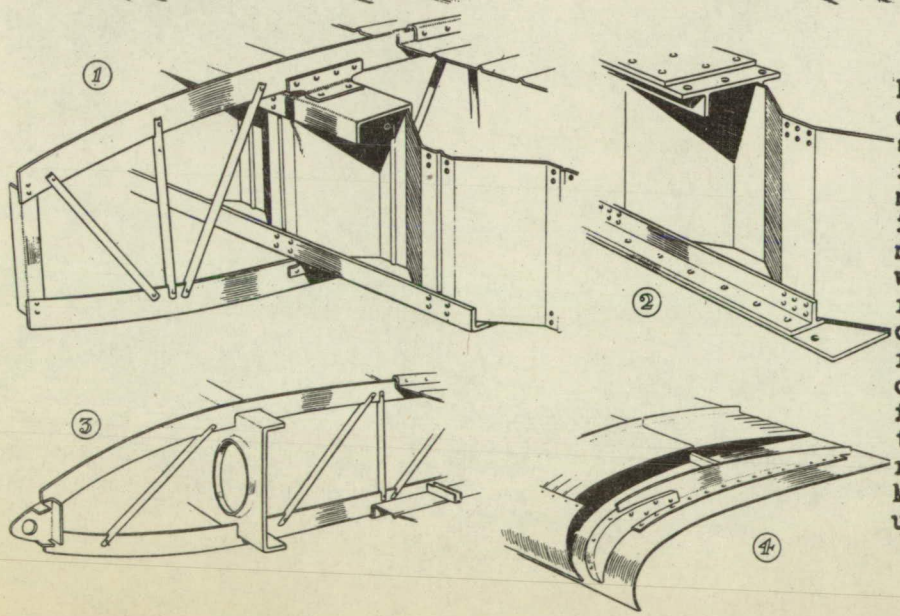


Fig.13 (1) Section of wing spar and standard rib showing "wandering web"; method of attaching rib to spar and method of attaching wing covering to rib. (2) A section of spar nearer the root, showing method of reinforcing flanges. (3) Section of spar and rib of aileron. (4) Method of building up wing slot.

From "The Aeroplane"

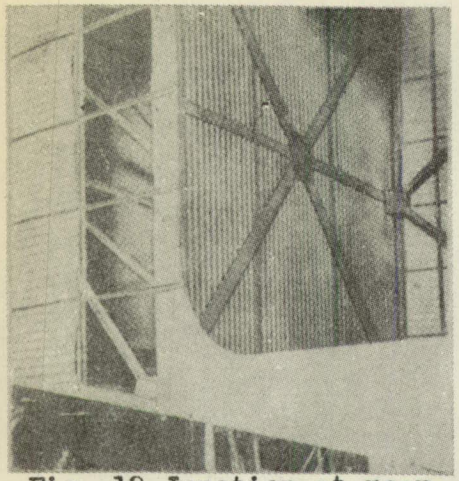


Fig. 12 Junction at rear of cabin.

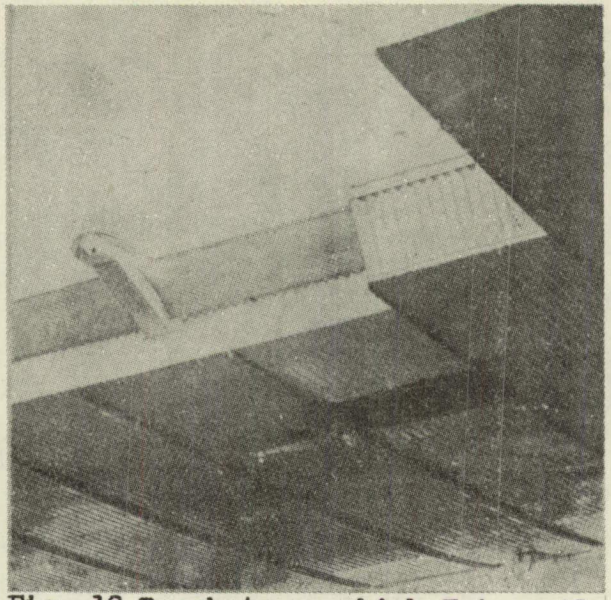


Fig. 19 Brackets on which Frise ailerons are supported.

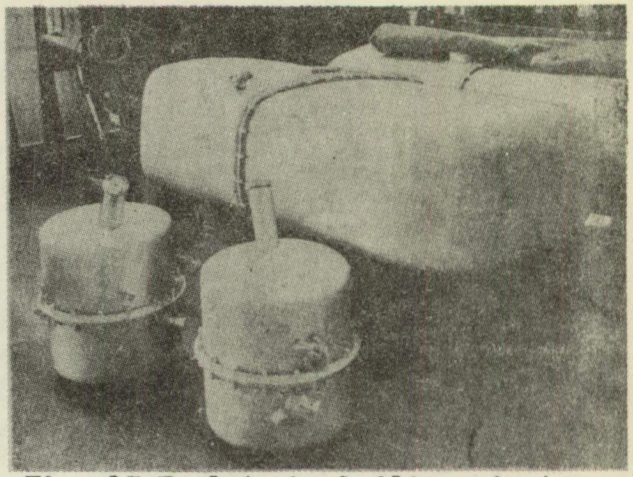


Fig. 17 Fuel tanks built up in two identical halves, joined in the center by a flange coupling of novel design.

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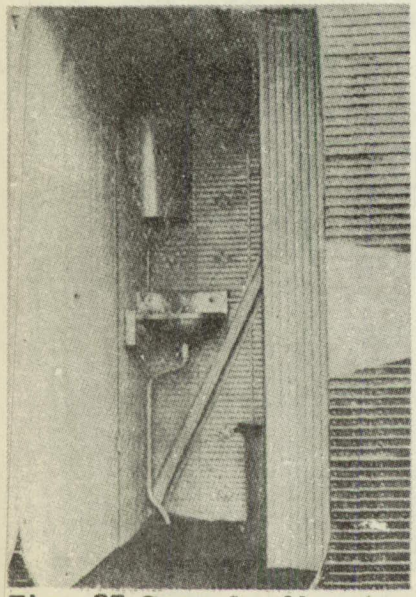

Fig. 23 Door leading to lavatory or exit.

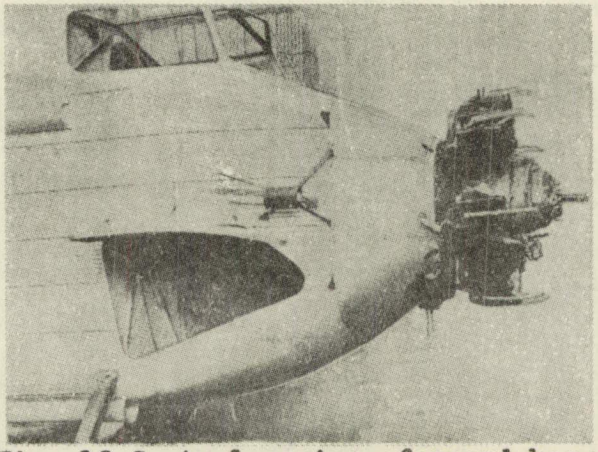

Fig. 18 Central engine, forward baggage compartment, and windscreen.

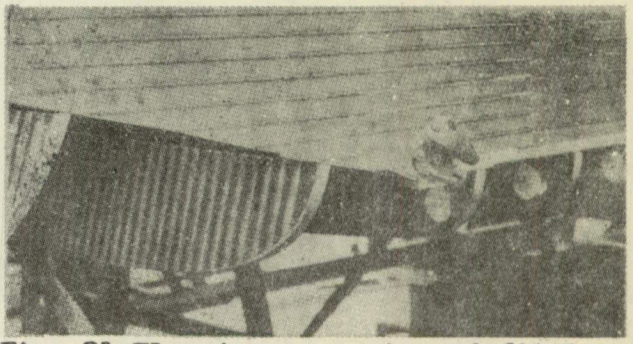

Fig. 21 Flooring supports and fittings for radius strut of landing gear.

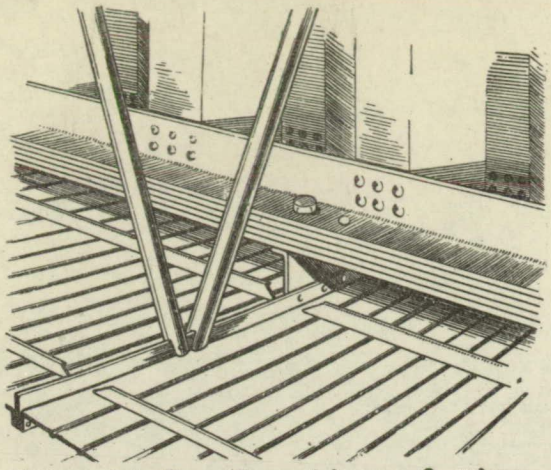

Fig. 14 Construction of wing spar and rib.

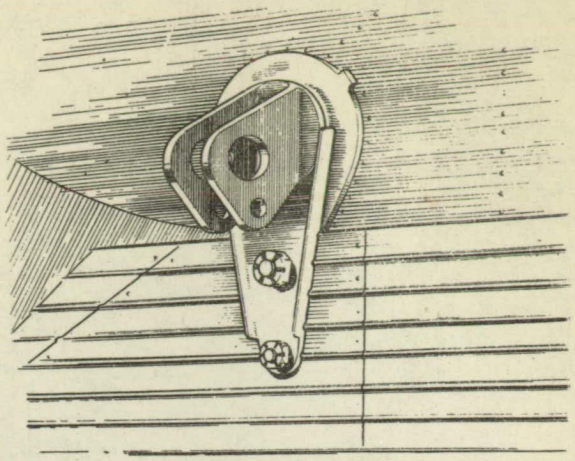

Fig. 15 Fitting on upper longeron for diagonal wing bracing.

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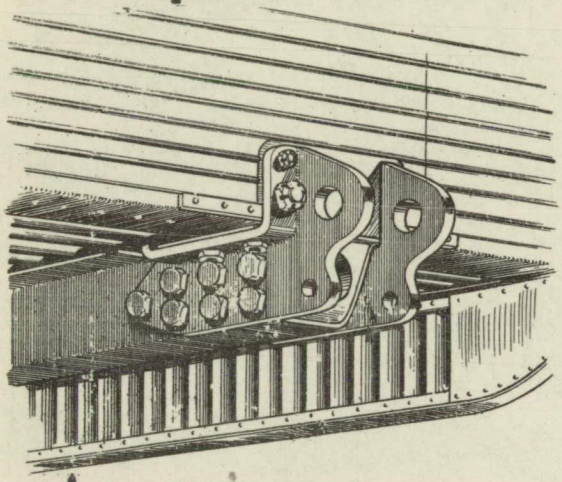


Fig. 16 Fitting for bent axle and main wing bracing strut.

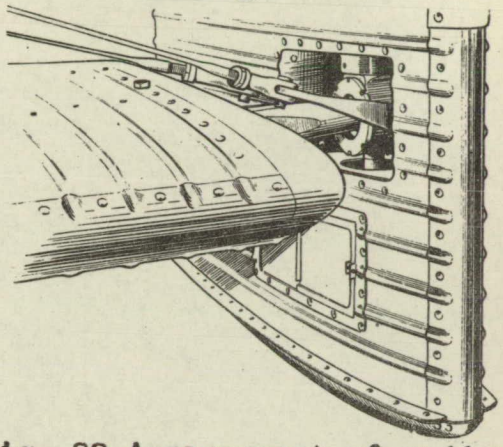
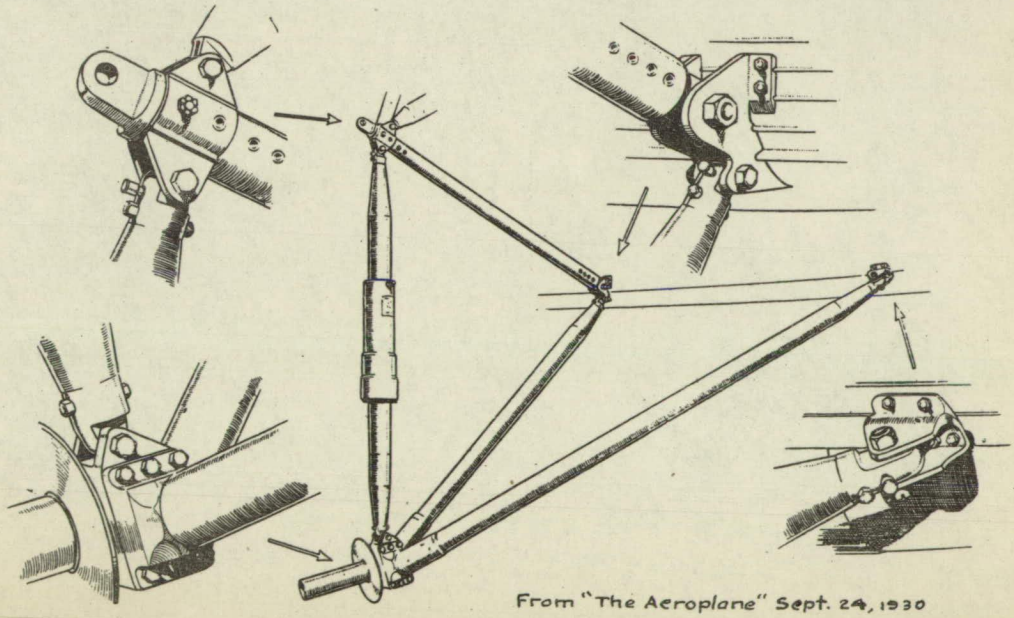


Fig. 22 Arrangement of rudders.



From "The Aeroplane" Sept. 24, 1930

Fig. 20 Half of landing gear with enlarged sketches of fittings.