AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 30

THE "DORNIER MERCURY" COMMERCIAL AIRPLANE WITH B.M.W. VI 600 HP. ENGINE

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THE "DORNIER MERCURY" COMMERCIAL AIRPLANE WITH B.M.W. VI 600 HP. ENGINE.*

The "Dornier Mercury" has been developed from the approved "Dornier Komet" type on the basis of experience recently gathered. It is particularly interesting that its design was not handicapped by the "established specifications," so that it was possible to increase not only the performance but also the ceiling with a B.M.W. VI engine. The increase in ceiling is a desirable property, particularly for Alpine flights.

The "Dornier Mercury" is built as a passenger airplane with seats for eight to ten persons, and for carrying goods the size of which is limited by the comparatively wide loading entrance of 7 ft. 3 in. by 2 ft. 2-5/16 in., this being the height and width of a door in the starboard shell of the goods compartment. (Figs. 1, 2, 3, and 4.)

The superior speed of 108 miles per hour on land compares favorably with that of other types.

Construction

Only metal, steel for high-stressed parts, duralumin for all others. To avoid corrosion, the steel is alloyed and the duralumin parts, though duralumin is the most corrosion-resisting light alloy, are protected by paint.

* From a circular published by the Dornier Company.

Apart from a few fittings, only plate is employed for the construction, sections being bent from strips of plate and drawn in dies. Very rugged struts are obtained from two channel sections, and plates are braced very effectively by securing to them flanged channel sections. Said sections are placed in the direction of the streamlines on the outside and at right angles thereto on the inside so that the shell is subdivided into small rectangular areas. Tubes and corrugated plate are strictly eliminated because in tubes one head of each rivet is concealed and corrugated plate does not permit pitching the rivets as required for the stress. As compared with corrugated plate, flat plate has the further good feature that the shell may be utilized for absorbing stresses in any direction. The simple connection of the parts by rivets which are accessible from either side enables them to be readily replaced and repaired by unskilled labor. Attention is much facilitated by the ready accessibility of all parts.

Arrangement

The feature of the "Dornier Mercury" type is the arrangement of the supporting wings at a short distance above the fuselage, the two ends of the wings being secured to a center section but detachable, the latter being secured to the fuselage, also detachable, and are braced at about half their length by a pair of struts extending toward the base of the fuselage. The

landing gear is so designed that the fuselage and consequently the center of gravity of the airplane is at a low level from the ground, so that nosing over is avoided even with bad landings. The engine is installed in the nose of the fuselage.

The Fuselage

The sections bracing the cell and arranged at right angles to the streamlines on the inside of the fuselage, as mentioned and for the reasons explained above, constitute struts for bracing the fuselage. When assembling the airplane the struts are fixed by means of a suitable jig, the shell being attached to the struts and the sections extending along the streamlines being then attached to the cell on the outside. In this manner the interior of the fuselage becomes entirely unobstructed to the end of the tail and the rivets may be inspected throughout. Diagonal braces are eliminated altogether so that the cabin is also unobstructed. The cabin is 10 ft. long, 5 ft. 8 in. high, and 4 ft. 9 in. wide. Light wicker seats are arranged near its windows (Fig. 6).

The fuselage is subdivided into the following compartments. The engine cabin, in the nose of the fuselage where the engine is supported on two bearers, the cockpit, with seats for two pilots, the cabin, and the toilet. Below the engine an oil-tight luggage compartment is arranged which besides, may be utilized for trimming the airplane.

The Wings

By supporting the two ends of the wings by struts it is possible to design them with a constant chord and an invariable section of moderate thickness of the most favorable aerodynamic characteristics. Air forces are absorbed by the metal shell and transferred to two wing spars by strong box ribs. The spars, built up from steel sections, do not require bracing due to the box ribs.

Smooth strips of plate are placed on the ribs, and strips of plate ribbed on the inside are placed intermediate to increase the strength of the shell. The edges of the strips are flanged upwards and are connected by rivets after small channel sections have been placed over them. The spars are equipped with sectioned bracings extending in parallel to them so that their gussets are much relieved.

The Controls

The controls are arranged on the end of the fuselage and pivoted by four readily detachable pins. The fins and the rudder are covered with plate; the other controls are covered with cloth fairing in order to reduce the inertia. The elevators and ailerons are balanced by opposite planes. The horizontal stabilizer is adjustable.

The Engine

The engine, as mentioned, is arranged in the nose of the fuselage and the propeller is direct-driven. Instead of a

B.M.W. VI engine, other engines may be installed. Cooling is effected by a radiator below the engine which is in the flow of air from the propeller and connected with the engine by very short pipe lines. Other radiators, such as side, back, and wing radiators, may be provided (Fig. 5).

Fuel is carried in two main tanks arranged in the wings directly adjacent the central section, at 63 gallons each, and two auxiliary tanks below the driver's seat, at 30 gallons each. The total fuel supply is consequently 186 gallons, weighing 1477 pounds, sufficient for a distance of 750 to 870 miles, according to the speed.

The fuel flows from the upper tanks to the carburetor by gravity. The upper tanks can be refilled from the lower ones by an "Allweiler" hand pump.

The lubricating oil tanks which are arranged directly at the rear of the engine below the upper surface of the fuselage, have a capacity of 13 gallons each, or 26 gallons total capacity.

The high output of the engine in proportion to the power required is a better safeguard for reliability than would be several engines each of which is liable to failure to a certain degree, for the excess power available permits operations with highly throttled carburetor.

The Cockpit

Two seats are provided which are adjustable, and double control is arranged. The instruments, etc., are so arranged as to be within easy reach of both pilots.

Equipment

All instruments, etc., required for the navigation and the supervision of the airplane and the engine, as well as all contrivances for driving and starting, are provided, including a tool box and other accessories. Further, the equipment includes a complete outfit for the passenger cabin and toilet.

Dimensions

Length, over all	40 ft.
Height, " "	11 ft. 4 in.
Span	60 ft.
Chord	10 ft. 6 in.
Total area of the wings	667 sq.ft.
Weight, empty	4800 lb.

Passenger Cabin

Height	5 ft. 8 in.
Length	10 ft.
Width	4 ft. 9 in.
Luggage compartments, capacity	57 cu.ft.

Performance	On land	On sea
Normal load	2600 lb.	2200 lb.
Maximum speed, miles per hour	120	114
Climbing periods, minutes		
From 1 to 2 km 3280 to 6560 ft.	8	11
" 2 to 3 km 6560 to 9840 ft.	9	13
" 3 to 4 km 9840 to 13120 ft.	15	21
Ceiling, feet	17700	16370
Maximum load	3700 lb.	3000 lb.

Usefulness of the "Dornier Mercury"

As compared with other makes, the "Dornier Mercury" has a very wide range of usefulness. With some slight alterations, a passenger airplane may be changed into an airplane for carrying wounded soldiers, or large loads, or for surveying purposes. When used as an ambulance, the cabin may be rendered readily accessible through a large door in one of its side walls, through which, for instance, stretchers may be introduced from the ground in horizontal position. The airplane is equipped with two stretchers, one of which is suspended, and the other is supported, by resilient means. A seat for four men is arranged beside the stretchers which, if required, may constitute a third bed, and a seat for the attendant the end of which may be lifted and the seat then serves as an incline. Cupboards for medicine and in-

struments are secured to the walls.

The large inner space of the airplane, which is quite free of draft, makes the airplane very suitable for surveying purposes, and the high ceiling attained with the B.M.W. VI engine is particularly useful in this case for taking photographs from high altitudes and for reaching quieter layers of air. A door is provided between the cockpit and the cabin which facilitates communication of the surveyor with the pilot. Part of the cabin may be changed into a dark chamber, where photographs may be developed during the flight.

The normal landing gear may readily be exchanged for a pair of floats. The floats increase the weight about 330 pounds, with the resistance in proportion, so that the performance is somewhat inferior to that on land, as shown above. However, by ordering floats the buyer will have, at a slight increase of cost, an airplane which may be flown on land as well as on the sea and, as compared with a flying boat, will possess the advantage that the floats can be more readily exchanged if damaged by driftwood, or by contact with the ground, whereas the repair of flying boats requires more time.

Economy

With the record flights indicated below, the fuel consumption was about 198 lb. of fuel per hr., that is, at a speed of 102 miles per hour, making the fuel consumption about 1.21 pound per kilometer. Under the same conditions of load but at a speed

which is reduced about 12 miles per hour, the consumption was reduced to 1.06 pound per kilometer. If it is considered that at this fuel consumption not only the load but also the considerable amount of fuel for the long distance and duration of flight was carried during the record flights, the fuel consumption for normal flights through shorter distances will be about 33 grams per kilogram and kilometer, which compares favorably with the consumption of other makes.

World Records

On June 24, and 29, 1926, a Dornier Mercury airplane, flown by Mittelholzer and Zinsmair at Dubendorf, Switzerland, has set up a number of world records, 7 of which count under the new rules for world records, dated July 1, 1926. As with this alteration of the rules the number of all records for landplanes has been reduced to 26, the "Dornier Mercury" is in possession of more than 25 per cent of these records.

The record performances were -

On June 24, 1926:

Load, 1100 lb.

Duration, 14 hr. 43 min.

Distance, 2300 km (1429 mi.)

Speed, 163 " (101.3 mi.) per hr. on a course of
2000 " (1243 ")

The former record was 9 hr. 11 min., and a distance of 950 km (590 mi.), flown in the U.S.A. The performance of the "Dornier Mercury" beats this 60 per cent as to duration, and

140 per cent as to distance.

* On June 29, 1926:

Load,	2200 lb.	
Duration,	10 hr. 5 min.	
Distance,	1400 km (870 mi.)	
Speed,	162 " (100.7 mi.)	per hr. on a course of
	500 " (311 ")	
	162 " (100.7 mi.)	per hr. on a course of
	1000 " (621 ")	

The former record was 3 hr. 46 min., and a distance of 200 km (124.3 mi.) flown in France, and beaten by the "Dornier Mercury" 170 per cent as to duration, and 600 per cent as to distance.

These records were set up not with a specially designed airplane, but with a normal series airplane. They may therefore be valued as performances which any series airplane should attain. The load of 1100 lb. corresponds to the weight of six to eight persons, and so many people will be quite comfortable in the cabin, the floor area of which, as will be remembered, is 10 ft. by 4 ft. 9 in. A load of 2200 lb. may be attained by carrying more passengers with additional seats and by increasing the weight of the luggage or mail at least 550 lb.

The distances flown without interval with these loads, 2300 and 1400 km (1429 and 870 miles), respectively, correspond to the distances from London to Athens, and from London to Stockholm.

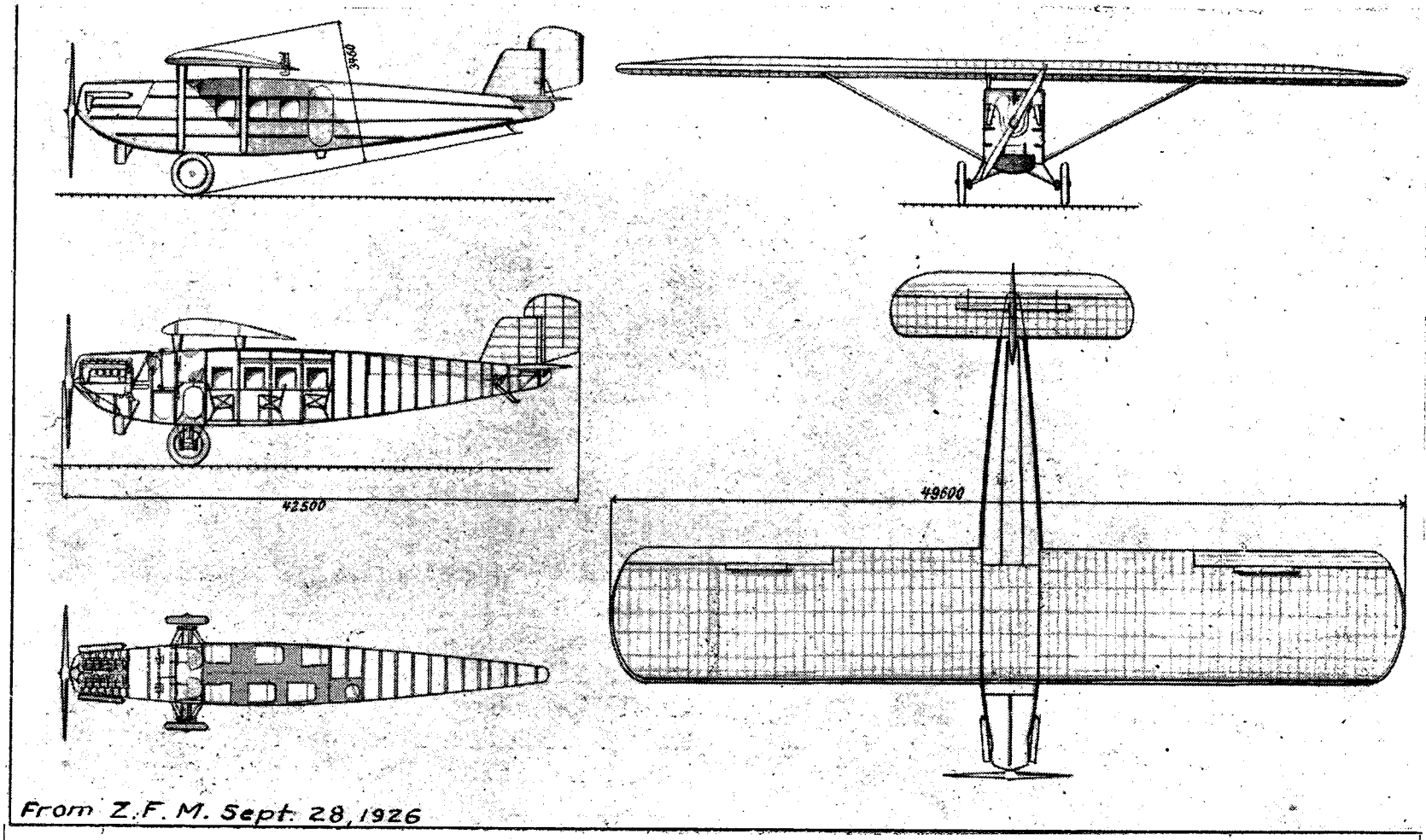

Fig.1 Plan elevation and sectional views of the Dornier "Mercury" airplane.

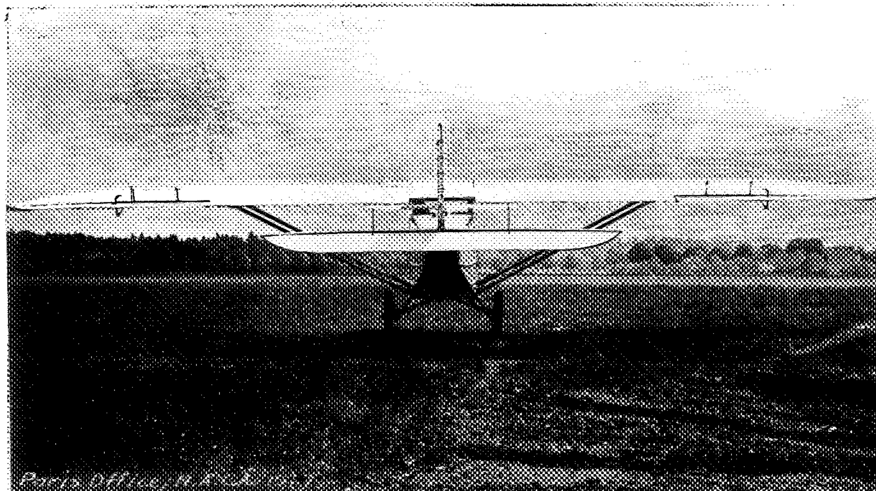

Fig.2

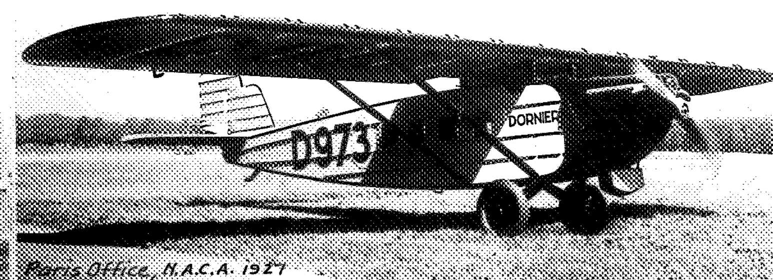

Fig.3

VIEWS OF THE DORNIER "MERCURY" AIRPLANE

Fig.6 Interior of the cabin.

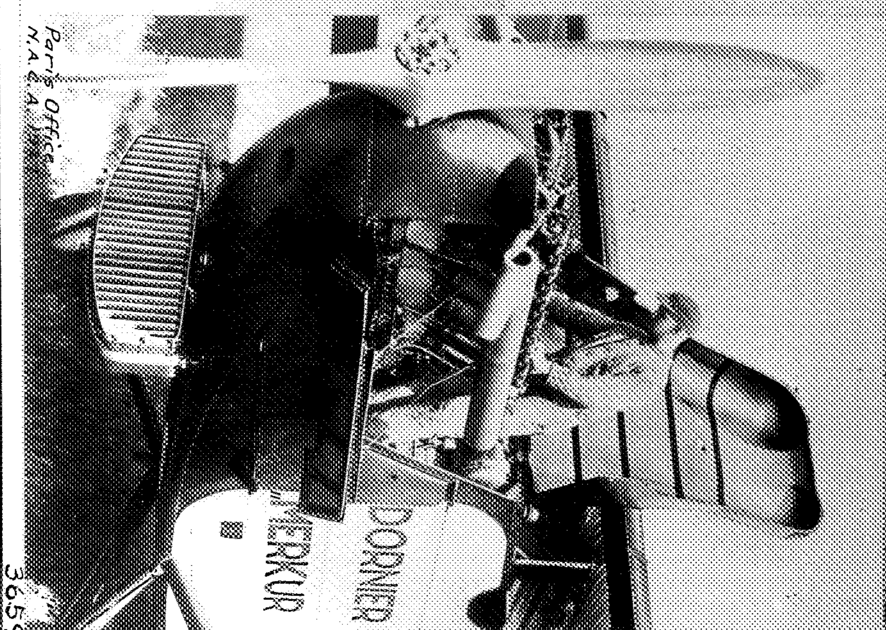

Fig.5

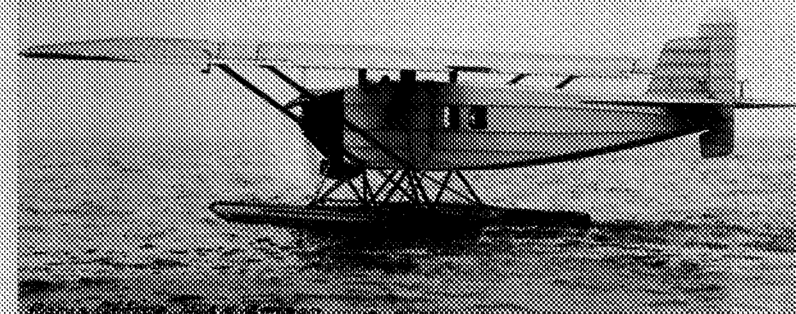

Fig.4

Figs.2,3,4,5 & 6

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