

servo tabs and trim tabs to reduce control effort to a minimum. They provide a much greater rolling response than has characterised previous large aircraft.

The tailplane and elevators are identical in plan-form and size to those used on the present B-17s, although of different section and construction. To prevent stalling the stabiliser at a critical flight attitude, the tailplane section is modified so that the leading edge is turned up, giving the effect of an inverted aerofoil.

Design of the nacelles of the B-29 involved a long process of aerodynamic evaluation. For their size more air is drawn through B-29 nacelles than any others in existence.

To eliminate a multiplicity of air inlets in the wings it was decided to place one large duct in the nacelle nose. This gave an oval shape to the forward portion of the nacelle.

Aerodynamically the nacelle must be the smallest size possible, to reduce drag to the very minimum. But at the same time the nacelle had to be large enough to accommodate the dual turbo superchargers and the inter-coolers. In addition they had to provide adequate space in which to retract the landing gear, and at the same time to endeavour to provide reasonable accessibility to the nacelles. The nacelle design finally adopted has proved practical for all purposes.

Clay models of nacelles were made for more than a year before the design finally was adopted. This was necessary in order to arrive at a compromise between the demands of the aerodynamics and the structural and mechanical design units of the design departments.

After design of the XB-29 had largely been crystallised, and the Army Mockup Board had approved major aspects of the machines, progressive-thinking military technicians began introducing new ideas on the bomb bay.

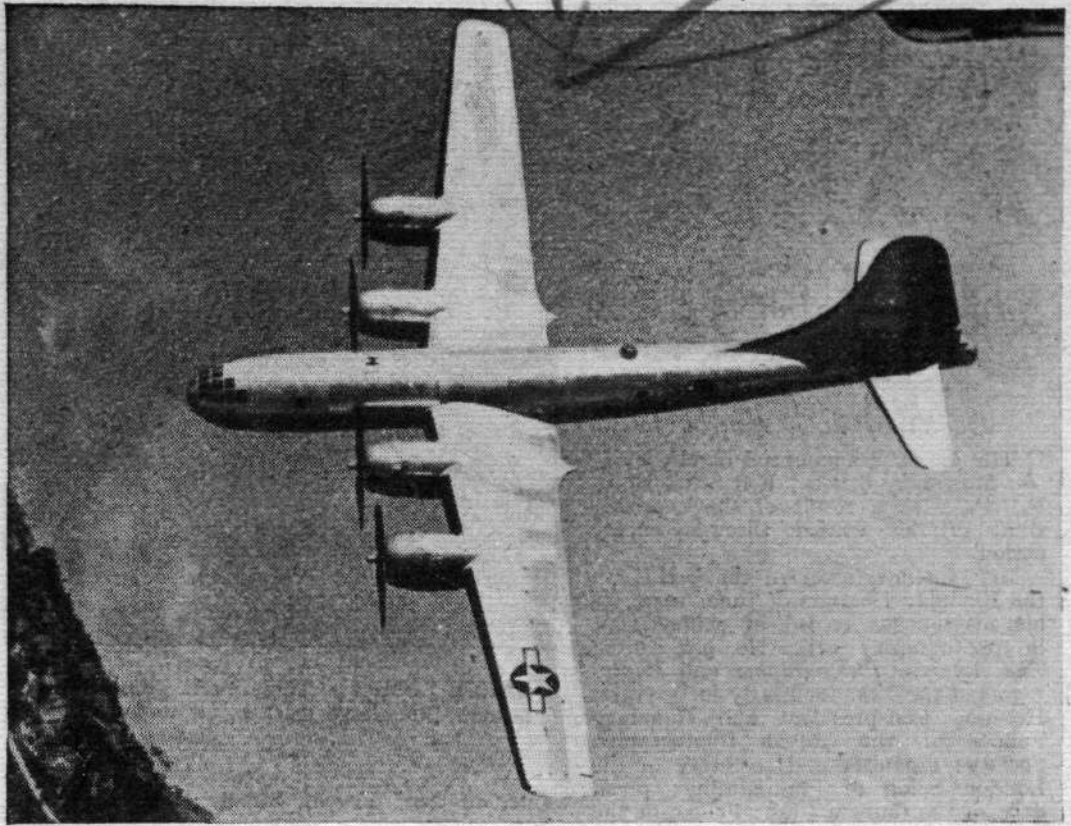
Extending the Bomb Bay

As designed originally, the bomb bay would carry a certain amount of bombs, but only in large sizes. If the bomb bay was elongated, which would mean that the aircraft would have to be lengthened, could not additional bombs of smaller size be carried?

Boeing engineers began redesign of the bomb bay, reporting that if 37 in. were added to the length of the fuselage, as great a weight in small bombs could be loaded as in large bombs.

The B-29 is equipped with a tricycle landing gear, design of which was a sizeable undertaking. The problem of nose-wheel operation is one of geometry—that of getting the proper relationship of the nose wheel ahead of the main wheels to assure proper steering and handling. Because of the B-29's great weight, a dual nose wheel was essential. Nobody ever had designed a dual nose wheel for an aircraft. Those wheels are of 3ft. diameter. The design was accomplished successfully and provision made for their retraction.

There was another problem of retracting the main gear into the nacelles. Striving for aerodynamic perfection, Boeing engineers wished to retract them completely rather than permit them to protrude slightly as in the case of previous planes. How to squeeze the main wheels, 4ft. 8in. in diameter and with dual tyres, into the nacelles was not an easy problem. Further, to streamline this section com-



ASPECT RATIO 11.5: That is the achievement of Boeing engineers in the Superfortress. Since the span is given as 141.2 ft. the wing area, from span ²/area, should be 1,734 sq. ft.

pletely, doors had to be installed to close behind the wheels.

To test their own theories on design of the nose wheel gear, Boeing engineers first constructed a scaled-down model which was installed on a Douglas A-20 at Wright Field. Trials proved that the gear operated satisfactorily even if one tyre blew out.

The Boeing B-29 Superfortress has been referred to often as the most tested aircraft ever built. This is due to the fact that construction of the experimental B-29s was started before detailed designs were finished and that the enormous bomber was ordered into large-quantity production long before the first XB-29 was completed. Many portions of the control system, including all tail surfaces of the Superfortress, actually were flight-tested before any of the bombers had taken to the air.

In the autumn of 1940, various B-29 control surfaces, scaled to the size of the smaller B-17, were flight tested on a B-17C Flying Fortress which was assigned to this test work. During the next spring, scaled-down B-29 ailerons were tested on the B-17. The object of the latter tests was to develop an aileron which was both lighter in control forces than that of the B-17 and at least 50 per cent. more effective. Later the Army made available a B-17E Fortress on which was tested a scaled model of the B-29 tail surface. These flights confirmed the correctness of the design.

Structural Testing

Structural strength tests began during the time the first XB-29 was taking form. All major components of the airframe, built in full scale and complete form, were tested to destruction to determine beyond any doubt the accuracy of designed strength calculations.

This testing to destruction has three phases: (1) the testing of component parts while the parts are held in special testing jigs, (2) the testing of component parts in relation to others after they have been installed on the airplane, and (3) the testing of the entire airplane. The complete airplane tested is not one of the experimental models but rather the complete airframe without engines or other such equipment. Boeing hastily constructed a special building, which was dubbed "The Cathedral"

(Concluded on page 151.)