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FOREIGN TECHNOLOGY DIVISION

AIRCRAFT WITHOUT RIVETS

by

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ABSTRACT

Is it possible to construct aircraft without riveted joints? This question has been answered in the affirmative on the basis of the experience of many countries in aircraft construction. At present, in constructing supersonic aircraft, a new method of joining metal parts has been extensively used - welding and high-strength cementing. Under these circumstances, the skin is not fastened to a stressed skeleton composed of stringers, wing ribs, and angle material; it is fastened to a special metallic honeycomb by the new method. The honeycomb structural material is made into the same airframe for the outer profile and airfoil and joined together by many metal stiffeners. From this airframe are formed the wing, tail and fuselage. When the smooth metal skin is welded or cemented onto this kind of airframe, there will not be a single rivet on the aircraft's surface. The airstream flowing past the aircraft from the front is very stable, and drag is not great. When the skin is made of hard aluminum it is cemented to a hard aluminum honeycomb airframe. If it is a highly supersonic aircraft, the skin is then made of stainless heat-resistant alloy steel, and the skin is welded onto a honeycomb airframe made of steel. The use of the honeycomb structure can reduce the aircraft's weight and increase its strength by 15-30%. Cementing (with a plating action) can also increase the component's ability to resist corrosion. Further, labor can be saved in aircraft construction.

SMOKE WIND TUNNEL AND WATER TUNNEL

In designing the shape of an aircraft the designer must first know the characteristics of the air flow around the aircraft at supersonic speeds. For example, a vortex appears at the trailing edge, while drag increases rapidly and speed decreases. All these phenomena must be known before making a design. How is this to be done?

By making test . Study of the conditions of airflow past an aircraft requires detailed study of a model in a wind tunnel. If air is blown through the tunnel, the airflow condition still cannot be seen with the eye, because air is transparent. Hence in recent years many countries have blown smoke past the model in the wind tunnel. The smoke is passed through a comb-shaped device to form long, slender, white streamlines. When these white streamlines pass over the model, the eye can see clearly the condition of the airflow movement around the model.

AVIATION BRIEFS

AIRCRAFT WITHOUT RIVETS

Author Unknown

A modern metal aircraft has nearly a million connecting rivets.

Rivet heads projecting on the skin surface produce a large increment of drag when the aircraft is flying at high speed. Hence countersunk-head rivets without any head projecting on the skin are used for high-speed aircraft. However, such joints give engineers and technicians much trouble. Because vibration of aircraft components weakens the countersunk-head rivets, joints of the skin and stressed components do not remain firm. Thus the aircraft gradually loses its reliability and requires repair.

It is possible to construct aircraft without riveted joints! This question has been answered in the affirmative on the basis of the experience of many countries in aircraft construction. At present, in constructing supersonic aircraft, a new method of joining metal parts has been extensively used – welding and high-strength cementing. Under these circumstances, the skin is not fastened to a stressed skeleton composed of stringers, wing ribs, and angle material; it is fastened to a special metallic honeycomb by the new method.

The honeycomb structural material is made into the same airframe for the outer profile and airfoil and joined together by many metal stiffeners. From this airframe are formed the wing, tail, and

fuselage. When the smooth metal skin is welded or cemented onto this kind of airframe, there will not be a single rivet on the aircraft's surface. The airstream flowing past the aircraft from the front is very stable, and drag is not great.

When the skin is made of hard aluminum it is cemented to a hard aluminum honeycomb airframe. If it is a highly supersonic aircraft, the skin is then made of stainless heat-resistant alloy steel, and the skin is welded onto a honeycomb airframe made of steel.

The use of the honeycomb structure can reduce the aircraft's weight and increase its strength by 15-30%. Cementing (with a plating action) can also increase the component's ability to resist corrosion. Further, labor can be saved in aircraft construction.

Smoke Wind Tunnel and Water Tunnel

In designing the shape of an aircraft the designer must first know the characteristics of the air flow around the aircraft at supersonic speeds. For example, a vortex appears at the trailing edge, while drag increases rapidly and speed decreases. All these phenomena must be known before making a design. How is this to be done? By making tests.

Study of the conditions of airflow past an aircraft requires detailed study of a model in a wind tunnel. If air is blown through the tunnel, the airflow condition still cannot be seen with the eye, because air is transparent.

Hence in recent years many countries have blown smoke past the model in the wind tunnel. The smoke is passed through a comb-shaped device to form long, slender, white streamlines. When these white streamlines pass over the model, the eye can see clearly the condition of the airflow movement around the model.

The top picture of Fig. 1 shows a wing-streamline diagram when smoke is supplied continually. The bottom picture shows a wind-streamline diagram when smoke is supplied intermittently.

Further, water can be used to aid in testing. During tests, the water passes through a tunnel with transparent walls, that is, a water tunnel. In order to use the weight of the water to increase the fluid velocity, the water tunnel is built vertically.

During tests a colored liquid is ejected from a small hole in the model, which can aid in observation and facilitate photographing of the streamline characteristics of the model. Figure 2 shows a photograph of a triangular wing being tested in a water tunnel.

This method of studying aerodynamics can shorten the aircraft design process.