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2,387,526

AIRPLANE

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Fig. 1

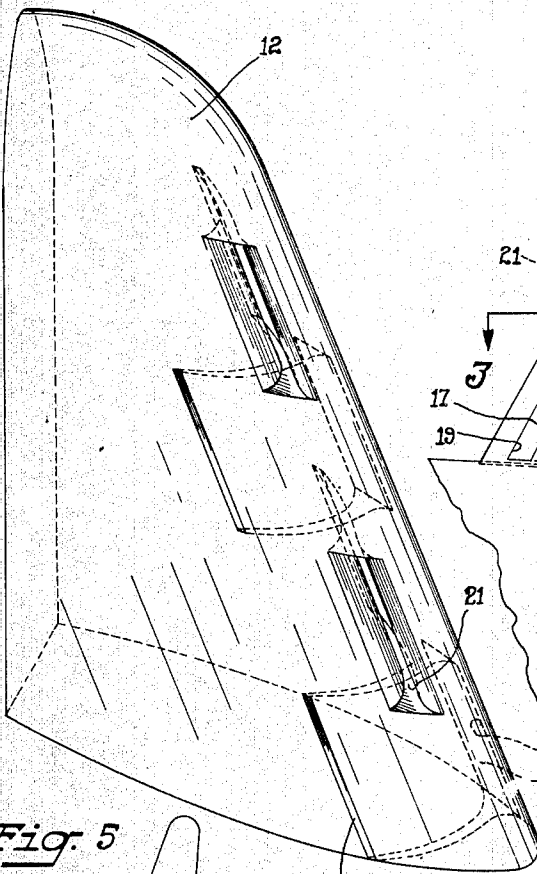


Fig. 2

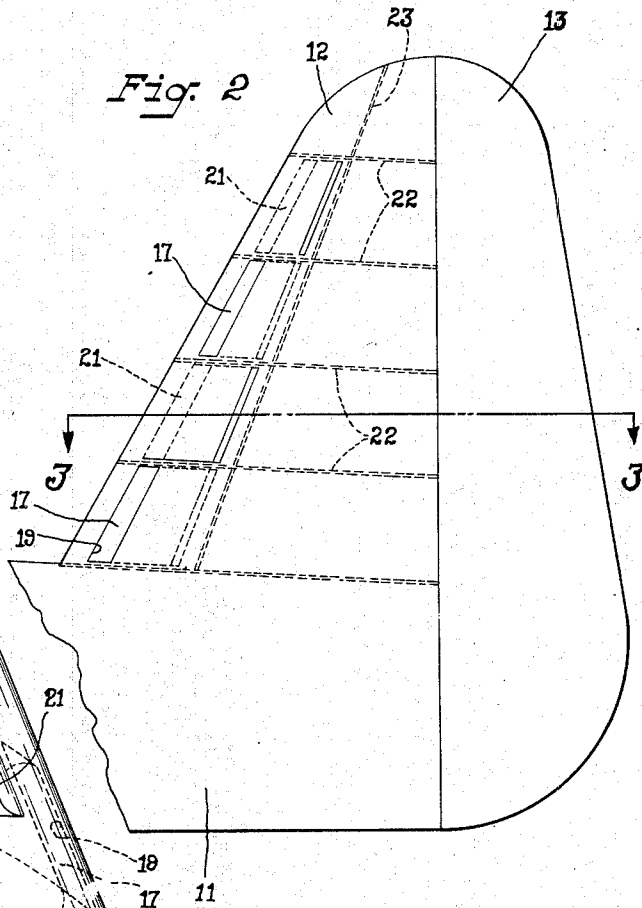


Fig. 5

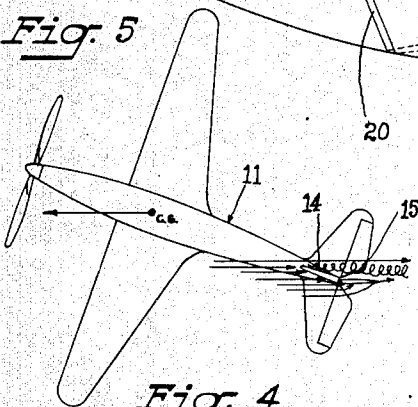


Fig. 3

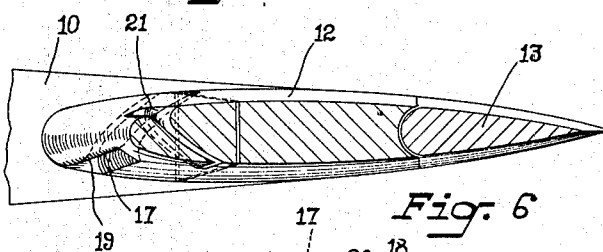


Fig. 4

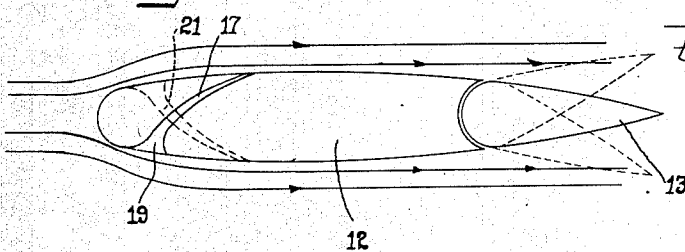
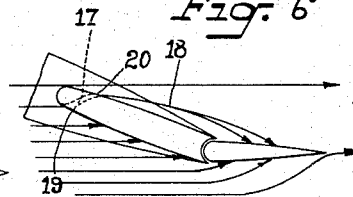


Fig. 6



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AIRPLANE

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5 Claims. (Cl. 244-40)

This invention relates to airplanes and more particularly to the control surfaces therefor.

With some airplanes there is a tendency for the rudder to become easily locked when angled to large angles as when the airplane is being side-slipped into an airport. The air flow becomes separated from the vertical stabilizer on the face opposite the direction into which the airplane is being forced and as a result pressure on the controls becomes such that the pilot is unable to cope with the same, the rudder thereby becomes locked, and the airplane gets completely out of control unless some immediate step is taken to overcome the situation. One known way of overcoming the situation is to speed up the propeller to provide more air over the surfaces, but this is not practical at times of landing.

It is, therefore, the object of the present invention to provide means which will automatically come into play as the airplane is angled to positively insure a flow of air over the stabilizer face opposite to the face receiving the major flow of the air.

It is another object of the invention to provide means for overcoming the tendency for the rudder to lock which is of simple construction and which is automatic in its operation.

According to the present invention, there has been provided in the forward portion of the vertical stabilizer, a series of alternately arranged nozzle-shaped slots extending from one side transversely to the other side of the stabilizer. These slots are nozzle-shaped in order that air entering the same will be given increased velocity and its flow therethrough stabilized for proper distribution of the air over the opposite side of the stabilizer. As the airplane is angled about its center of gravity to one side or the other, certain of the slots are so presented that air is taken in through the slot and delivered to the opposite side of the stabilizer and directed to the rudder face on that side of the stabilizer. In this fashion the air pressure on the opposite side of the rudder is increased and the differential of pressure between the two sides of the rudder is accordingly reduced. Should the airplane be turned and yawed in the opposite direction, the other slots entering from that side of the stabilizer will automatically come into play and air will be delivered to one side of the stabilizer. Such air is distributed over the rudder face on the latter side of the airplane and the pilot is given con-

trol of the airplane when being angled in this direction.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawing, in which

Fig. 1 is a perspective view of a vertical stabilizer of an airplane with the nozzle-shaped slots of the present invention extending there-through.

Fig. 2 is an elevational view of the tail portion of the airplane with the vertical stabilizer incorporating the features of the present invention thereon.

Fig. 3 is a cross sectional view taken through the stabilizer and rudder and along the line 3-3 of Fig. 2.

Fig. 4 is a diagrammatic view of a stabilizer and rudder and illustrating the path of the air over the same when the airplane is running true to its course.

Fig. 5 is a diagrammatic plan view of an airplane in a yawed position about its center of gravity and illustrating the path of the air over the tail surfaces when no slots are employed.

Fig. 6 is an enlarged diagrammatic view of the tail surfaces when the airplane is angled in the position shown in Fig. 5 and showing the manner in which the air is received by the slots provided according to the present invention and delivered to the opposite side of the stabilizer and to the rudder.

Referring now particularly to Figs. 1, 2, and 3, there is shown a tail portion 10 of an airplane 11 having a vertical stabilizer 12 projecting upwardly therefrom. To this stabilizer is connected a rudder 13 adapted to pivot about a vertical axis thereon.

When the airplane 11 is angled about its center of gravity to the position shown in Fig. 5, the air flow over the vertical stabilizer is such that separation of the air on the face of the stabilizer opposite to the face being presented to the air flow, is separated at a point 14 and considerable turbulence 15 of the air from then on out to the end of the rudder takes place. This turbulence reduces considerably the amount of air pressure on that side of the rudder, thereby causing the rudder to be swung further to the right and out of control of the pilot.

In order to alter this situation, there has been provided, according to the present invention, a nozzle- or funnel-shaped slot 17 extending from

one side of the stabilizer to the opposite side thereof in order that the air may be directed thereover as indicated by the arrows 18, to the rudder. By means of this slot, sufficient air may be maintained on the opposite side of the stabilizer such that the flow thereof may not separate and whereby a balancing force will be provided on the rudder. This slot 17 being of nozzle-shape has a large entrance 19 and a small outlet 20, whereby the velocity of the air leaving the slot 20 is increased and will be greater than the velocity of the air entering at 19.

When the airplane is angled in an opposite direction to that shown in Fig. 5, another slot 21 will come into play. This slot 21 is identical in shape to the slot 17 and the air is similarly distributed to the opposite face of the stabilizer and acts upon the rudder on that side thereof in the same manner. These slots 21 are alternated with the slots 17 to provide pairs, one above the other, and throughout the height of the stabilizer there are two pairs of these slots. It will be apparent that operating mechanism incorporating movable parts is not necessary in order to present these slots to the air flow to receive the air, and that the operation of the same is entirely automatic, one of the slots of a pair coming into play when the airplane is angled to one direction and the other slots of a pair coming into play when the airplane is angled in the opposite direction. The slots 17 and 21 are preferably located in the stabilizer between ribs 22 and forwardly of a spar 23.

These slots may be formed in the stabilizer in any manner which may seem practical to the designer. One such means which can be applied to a completed airplane without great difficulty would be the insertion of a plastic member hollowed out to provide a nozzle opening there-through and adapted to be fitted into prepared openings cut into the faces of the stabilizer.

While various changes may be made in the detailed construction, it shall be understood that such changes shall be made within the spirit and scope of the present invention as defined by the appended claims.

I claim as my invention:

1. In an airplane, a fuselage having a tail section, a vertical stabilizer carried by said tail section, a rudder hingedly connected to the trailing edge of said stabilizer, and a plurality of slots formed in said stabilizer adjacent the leading edge thereof and each extending between an entrance and an exit which are located at opposite sides of said leading edge, at least one of said slots having an entrance at one side of said leading edge and at least one other of said slots having an entrance at the opposite side, said slots being inclined from their entrances to said exits generally in the direction of said rudder so that at least one of said slots will receive air and deliver it to the low-pressure side of said rudder regardless of the angular direction of yaw, whereby to counteract rudder lock.

2. In an airplane, a fuselage having a tail section, a vertical stabilizer carried by said tail section, a rudder hingedly connected to the trailing edge of said stabilizer, and a plurality of slots formed in said stabilizer adjacent the lead-

ing edge thereof and each extending between an entrance and an exit which are located at opposite sides of said leading edge, alternate of said entrances being located at one side of said leading edge and the intermediate entrances being located at the opposite side of said leading edge, said slots being inclined from their entrances to their exits in the direction of said rudder so that certain of said slots will receive air and deliver it to the low-pressure side of said rudder regardless of the angular direction of yaw, whereby to counteract rudder lock.

3. In an airplane, a fuselage having a tail section, a vertical stabilizer carried by said tail section, a rudder hingedly connected to the trailing edge of said stabilizer, and a plurality of slots formed in said stabilizer adjacent the leading edge thereof, each of said slots extending between an entrance and an exit which are located at opposite sides of said leading edge and tapering from the entrances in the direction of the exits, at least one of said slots having an entrance at one side of said leading edge and at least one other of said slots having an entrance at the opposite side, said slots being inclined from their entrances to said exits generally in the direction of said rudder so that at least one of said slots will receive air and deliver it to the low-pressure side of said rudder regardless of the angular direction of yaw, whereby to counteract rudder lock.

4. In an airplane, a fuselage having a tail section, a vertical stabilizer carried by said tail section, a rudder hingedly connected to the trailing edge of said stabilizer, and a plurality of slots formed in said stabilizer adjacent the leading edge thereof, each of said slots extending between an entrance and an exit which are located at opposite sides of said leading edge and tapering from the entrances in the direction of the exits, alternate of said entrances being located at one side of said leading edge and the intermediate entrances being located at the opposite side of said leading edge, said slots being inclined from their entrances to their exits in the direction of said rudder so that certain of said slots will receive air and deliver it to the low-pressure side of said rudder regardless of the angular direction of yaw, whereby to counteract rudder lock.

5. In an airplane, a fuselage having a tail section, a stabilizer carried by said tail section, a control surface hingedly connected to the trailing edge of said stabilizer, and a plurality of slots formed in said stabilizer adjacent the leading edge thereof and each extending between an entrance and an exit which are located at opposite sides of said leading edge, at least one of said slots having an entrance at one side of said leading edge and at least one other of said slots having an entrance at the opposite side, said slots being inclined from their entrances to said exits generally in the direction of said control surface so that at least one of said slots will receive air and deliver it to the low-pressure side of said control surface regardless of the angular direction of yaw, whereby to counteract control surface lock.

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