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CAM ACTUATED SPOILER

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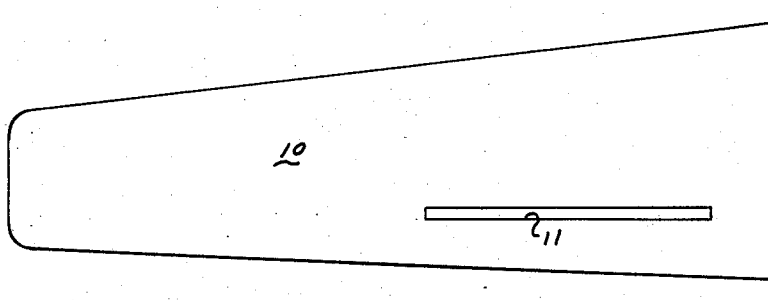


Fig-1

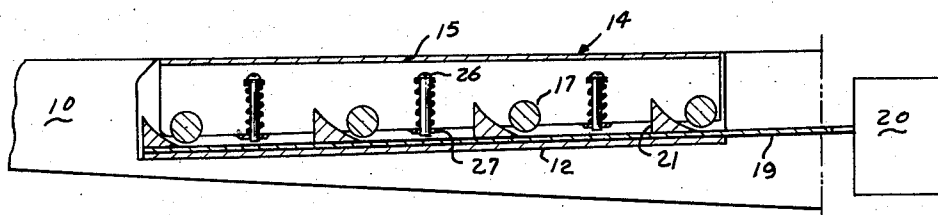


Fig-2

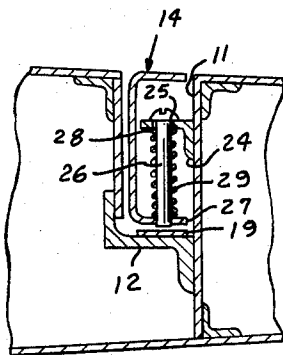


Fig-3

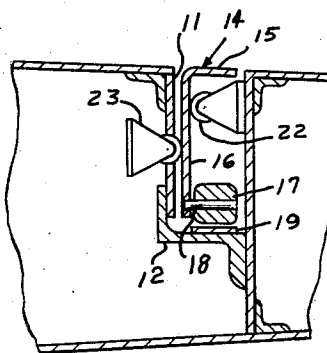


Fig-4

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## CAM ACTUATED SPOILER

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3 Claims. (Cl. 244—42)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to spoiler plates for airplanes and, more particularly, to spoiler plates that are movable only in a vertical direction.

Spoiler plates are employed on airplane wings to disrupt the airflow over the wing. When these spoiler plates are not in use, they are disposed within the wing. One method of lifting the spoiler plate from its position within the wing to its upright position where it affects the airflow over the wing is by a hinge type mechanism. However, the force acting against the spoiler plate increases as it is rotated about the hinge so that a relatively large force must be overcome by the hinge type mechanism when the spoiler plate nears its elevated vertical position.

This hinge type of spoiler plate is satisfactory when the plane operates at low speeds. However, it is difficult to employ hinge type spoiler plates where the speeds are relatively high as in jet aircraft since the force necessary to overcome the air load increases in direct proportion to the square of the air speed. Accordingly, the present invention provides a satisfactory means of using spoiler plates on high speed aircraft. By employing cams to lift the spoiler plate, the vertical movement of the spoiler plate may be varied as desired by changing the contour of the cams.

An object of the present invention is to provide a mechanism that moves the spoiler plate of an airplane in a vertical direction at any desired rate or varying rate.

Another object of this invention is to provide a mechanism that requires a small force to lift the spoiler plate to its extended vertical position.

Another object of this invention is to provide a mechanism for actuating a spoiler plate that permits satisfactory use of the spoiler plate on high speed aircraft.

Other objects of the invention will be readily perceived from the following description.

This invention relates to an airplane wing having a spoiler plate disposed therein with means for moving the plate in a vertical direction. Resilient means are employed for returning the plate to its retracted position within the wing.

The attached drawing illustrates the preferred embodiment of the invention, in which

Fig. 1 is a plan view of an airplane wing embodying the present invention;

Fig. 2 is an enlarged fragmentary sectional view of a portion of the wing of Fig. 1;

Fig. 3 is a cross-sectional view of Fig. 2 showing a portion of the present invention; and

Fig. 4 is a cross-sectional view of Fig. 2 showing another portion of the present invention.

Referring to the drawing, there is shown an airplane

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wing 10 having a recess 11 therein. The side walls of the recess 11 are joined together at the bottom by an angle member 12.

A spoiler plate 14 is disposed within the recess 11 for movement in a vertical direction. The spoiler plate 14 includes a horizontal portion 15 and a vertical portion 16 as shown in Fig. 4. A plurality of rollers 17 is attached to the lowermost portion of the vertical portion 16 of the spoiler plate 14 by shafts 18. A track member 19 is disposed above the angle member 12 and slides thereon when actuated by suitable mechanism 20 disposed outside of the recess 11. A plurality of cams 21 is mounted on the upper surface of the track member 19 for cooperation with the rollers 17. Thus, when the track member 19 is moved to the right, as viewed in Fig. 2, each of the cams 21 will contact its respective roller 17 and move the spoiler plate 14 in a vertical direction. The exact amount of vertical movement of the plate 14 depends on the distance the member 19 is moved and the contour of the cams 21.

In order to insure that the spoiler plate 14 moves in the vertical direction, suitable guide means are provided within the recess 11. The guide means include a plurality of rollers 22 mounted on brackets 23, which are secured to portions of the wing. As shown in Fig. 4, one of the rollers 22 and its bracket 23 are disposed entirely within recess 11 while the other roller 22 extends through a wall of the recess with the bracket being mounted on suitable support structure in the wing. This, of course, is necessitated by the location of the spoiler plate in the recess. Obviously, if the vertical portion 16 of the spoiler plate was disposed a sufficient distance from one of the walls of the recess, all of the brackets 23 could be mounted within the recess, if desired.

It will be noted that the removal of the cams 21 from contact with the rollers 17 will not necessarily result in the spoiler plate returning to its position within the recess 11. This would be especially true if the plane were flying upside down at such a time. Thus, resilient means are provided to urge the spoiler plate to return to its position within the recess 11 when the cams 21 are withdrawn from contact with the rollers 17. This resilient means also serves to retain the spoiler plate within the recess 11 when the plane is flying upside down, for example. Preferably, the resilient means includes a plurality of spaced bracket members 24 secured to one of the walls of the recess. Each of the bracket members 24 has an aperture 25 through which a guide pin 26 extends. The lower end of each of the pins 26 passes through one of a plurality of spaced tabs 27 extending from the vertical portion 16 of the spoiler plate 14. The guide pin 26 is prevented from moving by a nut 28 threaded on the guide pin 26 adjacent the bracket 24 (see Fig. 3). A spring 29 extends about each of the pins 26 between the tab 27 and the nut 28. Thus, the pin 26 serves as a guide for the spring 29. Any vertical movement of the plate 14 tends to compress the spring 29, which is always urging the spoiler plate to return to its position within the recess 11. While the resilient means serves both as a means for retaining the spoiler plate within the recess when the plane is upside down, for example, and as a means for returning the spoiler plate to its position within the recess after the cams 21 are moved from contact with the rollers 17, it will be understood that the cams 21 could be provided with a surface for returning the spoiler to its position within the recess so that the resilient means could be eliminated.

It will be understood that the contour of the cams 21 may be varied as desired to provide any rate of vertical movement of the spoiler plate 14. The mechanism

20, which actuates the track member 19, may be automatic or manual as desired. It will also be understood that the rigid track member 19 could be replaced by an endless belt of flexible steel, if desired. If it were desired to seal the spoiler plate 14 when it is disposed within the recess 11, suitable rubber strips could be employed to cooperate between the top of the spoiler plate and the recess walls.

An advantage of this invention is that the contour of the cams may be varied as desired to provide any rate of movement of the spoiler plate with respect to the control mechanism. One result of the varying of the contour of the cam is to give any desired relation between the position of the stick, which actuates the mechanism 20, and rolling moment. Thus, a large rolling moment may be provided for a small stick movement or a small rolling moment may be provided for a large movement of the stick. Another advantage of this invention is that the spoiler plate's retention within the wing surface aerodynamically clean.

For purposes of exemplification, a particular embodiment of the invention has been shown and described according to the best present understanding thereof. However, it will be apparent that changes and modifications in the arrangement and construction of the parts thereof may be resorted to without departing from the true spirit and scope of the invention.

I claim:

1. An airplane wing having a spoiler plate disposed therein, roller means mounted on the spoiler plate, cam means mounted in the wing to cooperate with the roller means to move the spoiler plate in a vertical direction, and resilient means to urge the plate to return to its position within the wing comprising a plurality of spaced brackets rigidly positioned within the wing adjacent to and intermediate the ends of said spoiler plate each having an apertured portion and a guide pin in rigid engagement therewith at one end of said guide pin, a plurality of spaced tabs extending from a vertical portion of said spoiler plate each having an aperture in slidable engagement with said guide pin at the other end of said guide pin, and a plurality of springs positioned in surrounding relation to each of said guide pins between said tabs and said brackets.

2. An airplane wing including a recess therein, a spoiler plate disposed for vertical movement within the

walls forming the recess including a horizontal portion and a vertical portion having a plurality of spaced, parallel stub shafts affixed thereto adjacent the lowermost surface thereof, a plurality of rollers mounted on said plurality of stub shafts adjacent the lowermost portion of the vertical portion of said plate, an elongated, slidably mounted track member disposed above the bottom surface of the recess, a plurality of contoured cams mounted on the upper surface of said track member within the recess adjacent to said plurality of rollers for cooperation therewith to move the plate in a vertical direction on slidable movement of the track member, means resiliently urging the plate to return to its position within the recess, and guide means adjacent the walls of the recess to guide the plate in its vertical movement comprising a plurality of brackets mounted in the recess on opposite sides of the vertical portion of said spoiler plate, and a plurality of guide rollers mounted on said brackets in slidable contact on opposite sides of the vertical portion of said spoiler plate.

3. An airplane wing including a recess therein, a spoiler plate disposed within the walls of the recess, cam means disposed within the walls of the recess to cooperate with said spoiler plate, means disposed outside of said recess to actuate said cam means to move said spoiler plate in a vertical direction, and resilient means connecting said spoiler plate and one of the walls of the recess to return the plate to its position within the recess when the cam means are retracted from the cooperating position with the spoiler plate including a plurality of projecting members extending from a predetermined part of said spoiler plate in spaced relation, and a resiliently mounted, relatively elongated guide member positioned between one of the recess walls and each of the projecting members normally urging said spoiler plate to its recessed position.

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