Feb. 5, 1952 J. I. SEAY, JR 2,584,298

ANTISTALL MECHANISM FOR AIRPLANES

Filed Sept. 23, 1947 2 SHEETS—SHEET 1

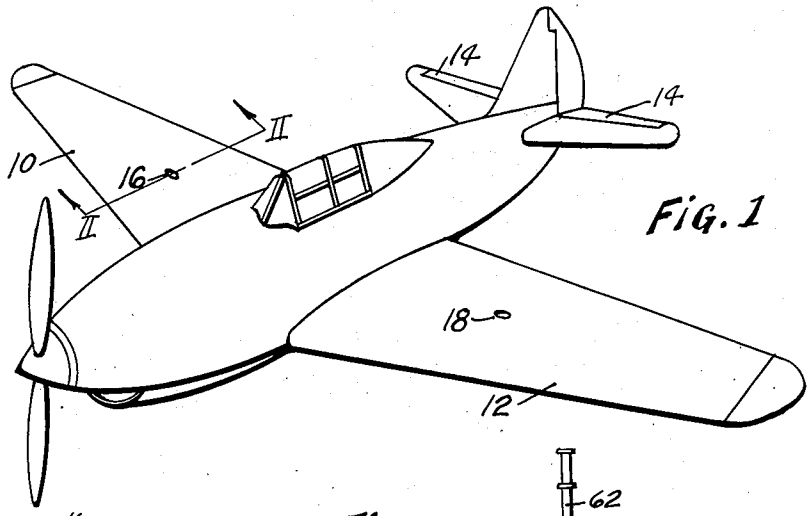


FIG. 1

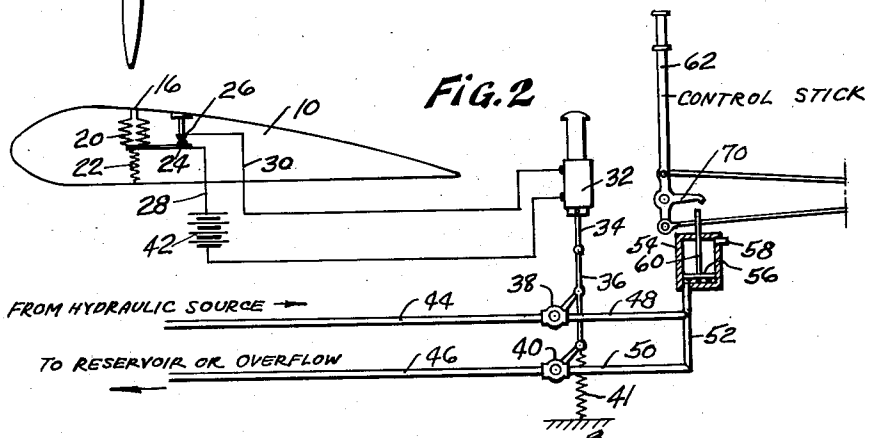


FIG. 2

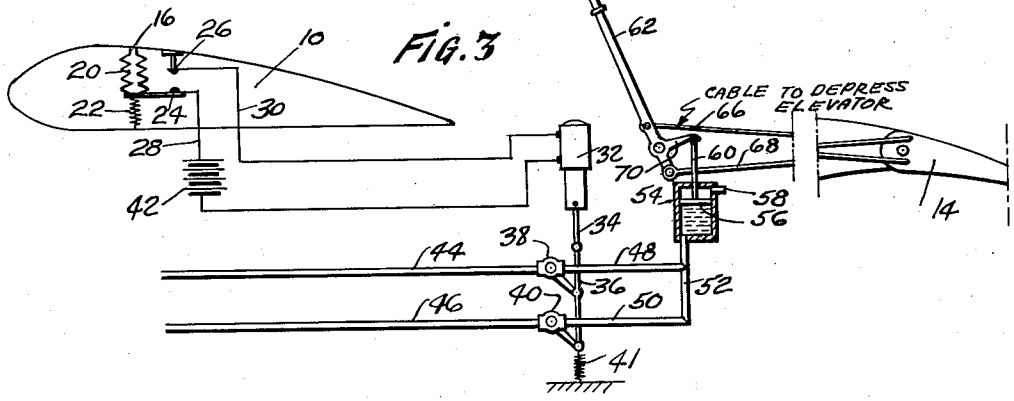


FIG. 3

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FIG. 5

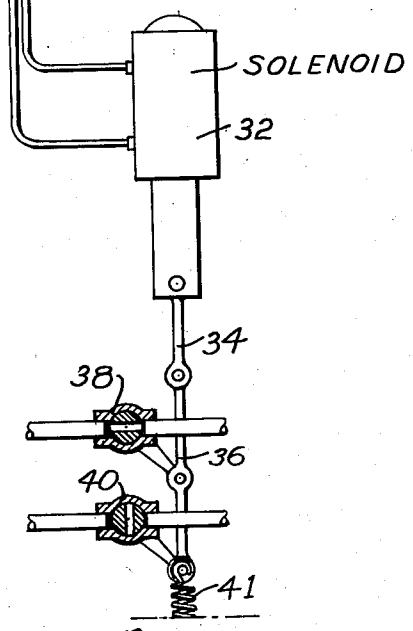
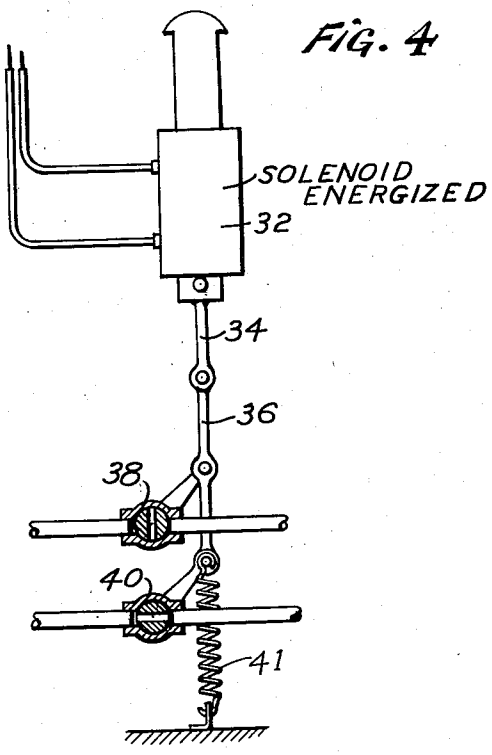


FIG. 4



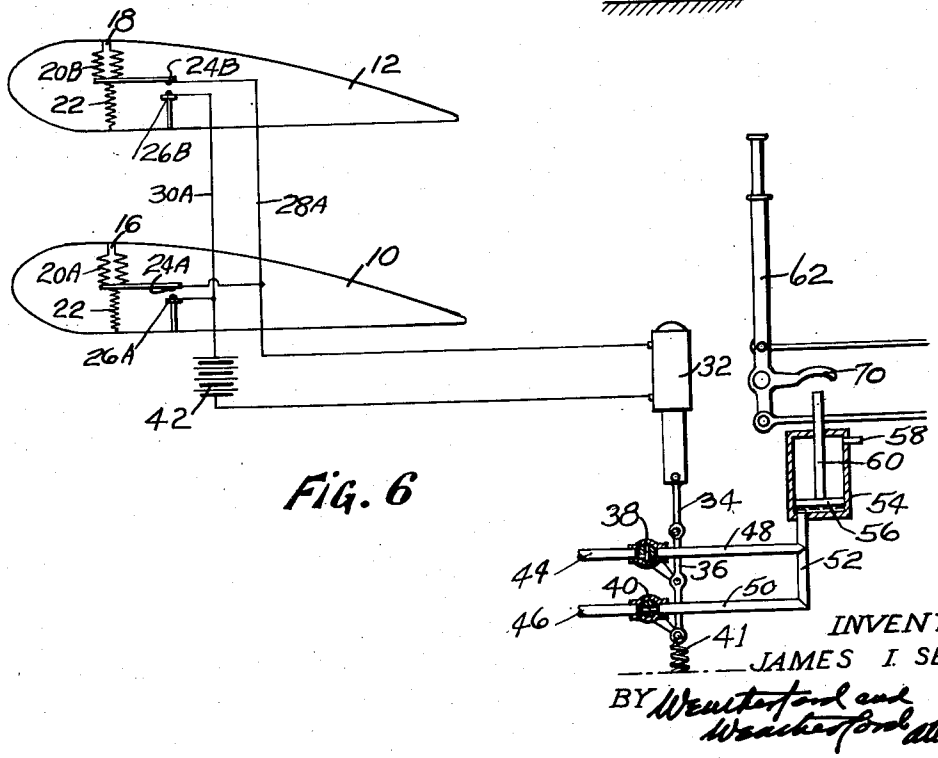


FIG. 6

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ANTISTALL MECHANISM FOR AIRPLANES

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3 Claims. (Cl. 244—78)

This invention relates to devices for automatically minimizing stalling in airplanes, and particularly relates to a device in which the loss of lifting power of the air flowing over an airplane wing, when the plane slows down in flight below proper speed, actuates related mechanisms operably coupled to the elevators of the plane to depress the elevators and cause the plane to dive and reestablish proper speed.

Airplanes in flight are held up by the air flowing past over and under the wings, some two-thirds of the lifting power of the air being exerted through a vacuum action on the upper surface of the wings and the balance by pressure action. Every plane has an air speed below which the lift is insufficient to properly support the plane. Loss of air speed when the plane is in flight is variously set up by attempting to climb too fast, by sharp banking, or in level flight by engine failure.

The pilot of the plane is often unaware that the plane has slowed down until the plane has seriously lost altitude and it is too late to make correction and save himself and the plane, and often in his frantic efforts to make correction, particularly after banking, puts the plane into a spin from which he is unable to make recovery.

Planes are equipped with a control lever or some variation of this lever which is pushed forward by the pilot when he wishes to dive, or pulled back when he wishes to climb, and is moved to right or left in banking, with which latter three movements of the stick the present invention is not concerned.

The stick is connected through suitable linkage, usually cables, in desired manner with elevators located in the tail of the plane. The forward movement of the stick depresses these elevators causing the tail to lift and the plane to dive.

The objects of the present invention are primarily to cause these elevators to be automatically depressed and the plane to dive whenever the lift of the wings decreases below the amount necessary to sustain the plane in the air;

To provide means responsive to the decrease in vacuum on the upper side of the wings through which depression of the elevators is accomplished; and

To provide mechanism responsive to a predetermined drop in lift of the air on the wings for accomplishing automatically forward shift of the control stick and the depression of the elevators coupled to the stick, as the lift is becoming insufficient, and thereby decrease the rate of climb to

an amount where the power of the plane is insufficient to cause the speed of the plane to pick up, or to cause the plane to dive and pick up speed.

The means through which the foregoing and other objects are accomplished, and the manner of accomplishment, will readily be understood from the following specification in reference to the accompanying drawing in which:

Fig. 1 is perspective view of a single motored plane indicating positioning of the controls along the wings.

Fig. 2 is a diagrammatic view showing the mechanism in inactive position, the view including a diagrammatic cross-section of a wing on the line II—II of Fig. 1.

Fig. 3 is a similar view showing the action of the mechanism responsive to a drop in lift.

Fig. 4 is an enlarged diagrammatic view of the control valves and actuating mechanism with the pressure valve closed as in Figs. 2 and 6.

Fig. 5 is a similarly diagrammatic view with the pressure valve open as in Fig. 3; and

Fig. 6 is a diagrammatic view showing the control mechanism connected for actuation to both wings, the mechanism being in inoperative position as in Fig. 2.

In Figs. 2 and 3, an electric circuit is shown which is closed to maintain closed position of the pressure valve and inactive position of the control during flight whereas in Fig. 6 an open circuit is employed at such time.

Referring now to the drawings in which various parts of the mechanism are indicated by numerals: 10 and 12 are the wings of the plane, and 14 the elevators; 16 and 18 indicate openings through the upper surfaces of the wings 10 and 12 respectively, these openings being preferably positioned laterally outward beyond the slip stream of the propeller. Two of these openings may be used as shown, although ordinarily one only is sufficient, and the instant description will be confined first to a single opening type of the mechanism as shown in Figs. 2 and 3, and reference later be made to Fig. 6 in which the dual type is shown.

In Figs. 2 and 3 the opening 16 leads into a collapsible bellows 20, which is normally extended by its own resilience or may be extended as by a tension spring 22, and is collapsed by vacuum action during flight of the plane. The bellows 20 carries a contact 24 which cooperates with a fixed contact 26 positioned above the bellows carried contact and in contact therewith when the bellows is collapsed by vacuum action

during flight. Leads 28 and 30 extend from the contacts 24 and 26 to an electrical unit 32 which may be a solenoid. This unit is operatively coupled as through links 34 and 36 to a pressure valve 38 and a drain valve 40 for concurrent closing of the one and opening of the other when the bellows is collapsed, and, when the bellows is extended and the unit deenergized, allowing a spring 41 to open the drain valve 40 and close the pressure valve 38.

The circuit is energized by an available energy source as a battery 42.

The pressure valve 38 is connected by a pipe 44 with a source of hydraulic energy such as is usually available on planes and is not here shown, and the valve 40 through a pipe 46 to overflow either into the reservoir of the hydraulic system or elsewhere. Both valves are connected through pipes 48 and 50 and a joint pipe 52 into a cylinder 54 in which is mounted a piston 56. The cylinder is provided above the piston and adjacent its upper end with an air vent 58 permitting unrestraining upward and downward movement of the piston, and with the pressure valve 38 closed and the overflow valve 40 open is freely movable. From the piston, a piston rod 60 projects through the top of the cylinder and is guided thereby no stuffing box is being needed.

62 is the usual control stick of the plane, which is connected in usual manner to the control surfaces of the plane, these surfaces including the elevators 14, which are connected to the stick as by cables 66 and 68, and respectively depress the elevators when the stick is pushed forward and raise them when the stick is pulled back. The central stick is provided with a bell crank arm 70 which projects laterally therefrom. The cylinder 54 is positioned and rigidly supported with the upper end of the piston rod 60 spaced sufficiently below the arm 70, to allow the stick to be manually retracted and the elevators raised during flight.

In Fig. 6 operating bellows 20A and 20B, having the openings 16 and 18 respectively thereinto, are located in the opposite wings of the plane, as indicated by the openings 16 and 18 of Fig. 1. The bellows respectively carry contacts 24A and 24B which cooperate with fixed contacts 26A and 26B, and are connected through joint leads 28A, 30A, to the electrical unit 32. The bellows carried and fixed contacts are held in contact when the bellows are extended, and are spaced apart in flight by vacuum collapse of the bellows.

The unenergized unit 32 is coupled through links 34, 36 to the closed pressure valve 38 and open drain valve 40 in such manner that energization will open the pressure valve 38 and close the drain valve 40, as did the unit 32 and linkage 34, 36, when the unit 32 was deenergized. The contacts in the dual type of Fig. 6 must be open during normal flight of the plane so that closure of either will complete the circuit. In Figs. 2 and 3 a circuit which is closed during normal flight is shown but in that form it will be clearly seen that the open type of circuit might as readily be employed if desired.

When the plane is taxiing along the ground and until it picks up flight speed there is insufficient lift on the upper and under surfaces of the wings to lift the plane clear of the runway, and the vacuum along the upper surface of the wing is insufficient to collapse the bellows 20 or 20A to close the circuit of the type shown in Figs. 2 and 3, or to open the circuit of the type shown in Fig. 6. The linkage coupling the electrical unit 32 to the valves 38 and 40 in either case holds the pressure valve 38 open and the drain valve 40 closed and through the cylinder-piston assembly 54—56, and the bell crank arm 70 forces the stick forward and holds the elevators 14 depressed unless the pilot by sufficient pull overcomes the pressure of the piston on the stick and pulls it back, and so long as this condition exists keeps him fully advised that there is insufficient lift to get off the runway and that it is inadvisable for him to try to start to climb. When the plane reaches the speed at which the lift is sufficient to raise the plane, the air flowing over the top of the wing, or wings, exhausts air through the opening 16 or the openings 16 and 18 and collapses the bellows 20 and 20A, closing the contacts 24 and 26 of Fig. 2 or opening the contacts 24A, 26A of Fig. 6, setting up in Fig. 2, a circuit from the energy source 42 through the leads 28 and 30 to the electrical unit 32 energizing this unit, or in Fig. 6 opening the circuit to deenergize the unit, in either case closing the supply valve 38 and opening the drain valve 40 thus cutting off hydraulic flow into the cylinder 54 below the piston and allowing the fluid in the cylinder to drain out and freeing the piston to drop and release pressure on the stick. Subsequently, so long as flow of air over the wings exerts the normal lifting vacuum on the upper surfaces of the wings and within the bellows, no action of the piston takes place, and control of the stick by the pilot is in no way hampered. However, should the speed of the plane in flight be reduced to an extent where there is insufficient lift, exhaust action within the bellows is decreased and the resiliency of the bellows or the action of the spring 22 again extends the bellows, opening the contacts 24 and 26, Fig. 3, and deenergizing the electrical unit 32, and through the links 34 and 36 opens the pressure valve 38 and concurrently closes the drain valve 40, allowing the hydraulic fluid to flow into the cylinder 54, raise the piston 56, and force the stick 62 forward depressing the elevators and causing the plane to dive and pick up speed or reducing the elevator lift in climbing so that the speed may pick up under the available engine power, and continue to thus hold the stick and elevators until the speed of the plane again picks up.

In the form of the device shown in Fig. 6 decrease in speed as before decreases vacuum action, allowing extension of the bellows. This action, however, closes the contacts 24A, 26A and energizes the electrical unit 32A and by direct action through the linkages 34, 36 opens the pressure valve 38 and closes the drain valve 40 accomplishing the actuation of the stick 62 and releases this action by opening of the circuit. In certain cases as a side slip, or if for other reasons, as in banking, the fuselage blanks air flow across a portion of one wing, vacuum on that wing becomes insufficient to maintain collapse of the related bellows either 20A or 20B, as the case might be, and the contacts carried by the released and extended bellows close the circuit and effect the desired action.

It will be understood that the detail shown and described is illustrative only and may be varied from without departing from the intent and disclosure of my invention, and shall not be read into any claim unless specifically therein set out.

I claim:

1. In an airplane having wings, elevator means depressible to cause said plane to dive, manual means for operating said elevator means, anti-stall means carried by said plane, including control means responsive to air flow, carried by at least one of said wings, and elevator depressing means responsive to said control means; said depressing means including a cylinder, a piston therein having a protruding rod extending toward actuating contact with, but not coupled to said elevator operating means, a source of hydraulic pressure, a feed pipe connecting said source and said cylinder, said pipe including a normally closed cut off valve, a drain pipe leading from said cylinder and including a normally open drain valve, linkage coupling said valves and compelling concurrent action thereof, means operatively responsive to said control means, including a spring and an oppositely acting solenoid coupled to said linkage, a source of electric energy and circuits, each circuit including circuit completing contacts, one of said contacts in each circuit being carried by said control means whereby to interconnect said energy source and said solenoid, for opening said cut off valve and closing said drain valve on decrease of said air flow below a plane supporting speed and advancing said piston rod into elevator-depressing-contact with said elevator operating means, and for closing said pressure valve and opening said drain valve to release said depressing action, on re-establishing of said air flow.

2. Elevator depressing means in accordance with claim 1 in which said circuit is normally an open circuit and is closed by action of said control means, and said feed and drain valves are respectively opened and closed by energization of said solenoid, and oppositely actuated by said spring de-energization of said solenoid.

3. Elevator depressing means in accordance with claim 1 in which said circuit is normally a closed circuit and is opened by action of said control means, and said feed and drain valves are respectively opened and closed by action of said spring on de-energization of said solenoid and oppositely actuated by energization thereof.

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