Feb. 6, 1940. A. SCHUT 2,189,553

AIRPLANE

Filed Sept. 2, 1938 3 Sheets-Sheet 1

Fig. 1.

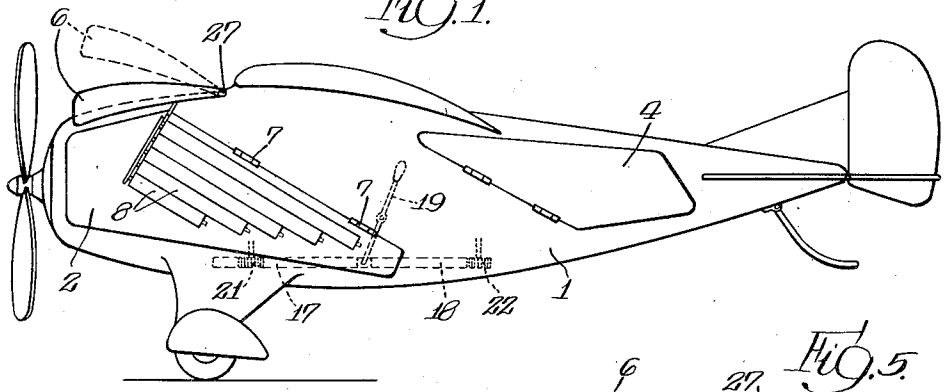


Fig. 5.

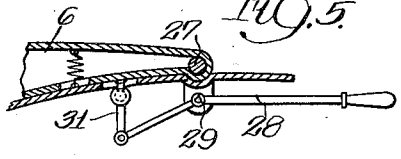


Fig. 2.

Fig. 4.

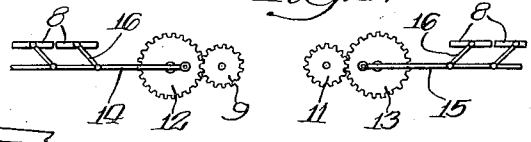
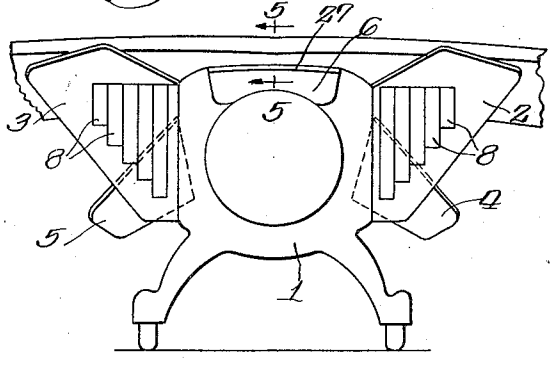


Fig. 3.



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Fig. 6.

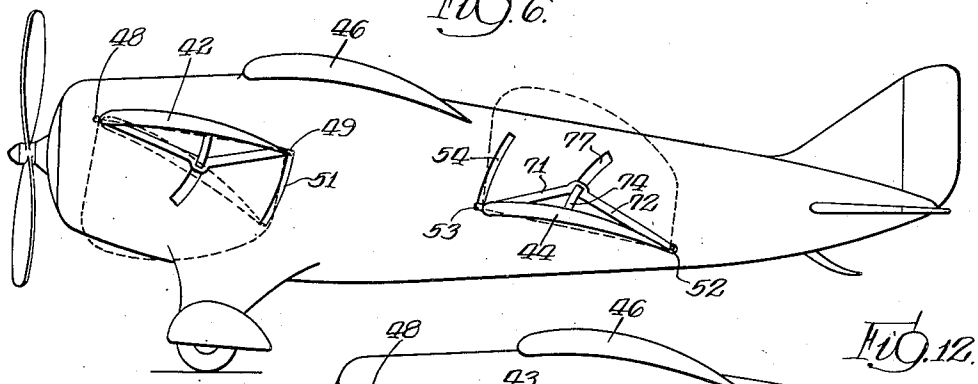


Fig. 12.

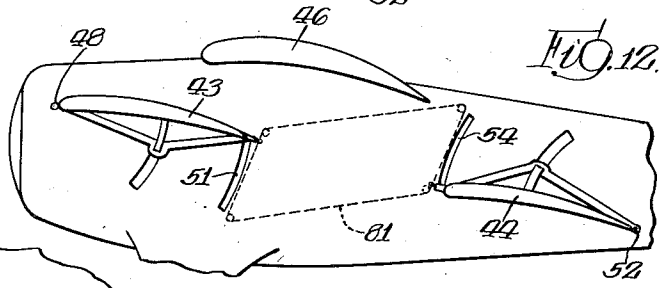
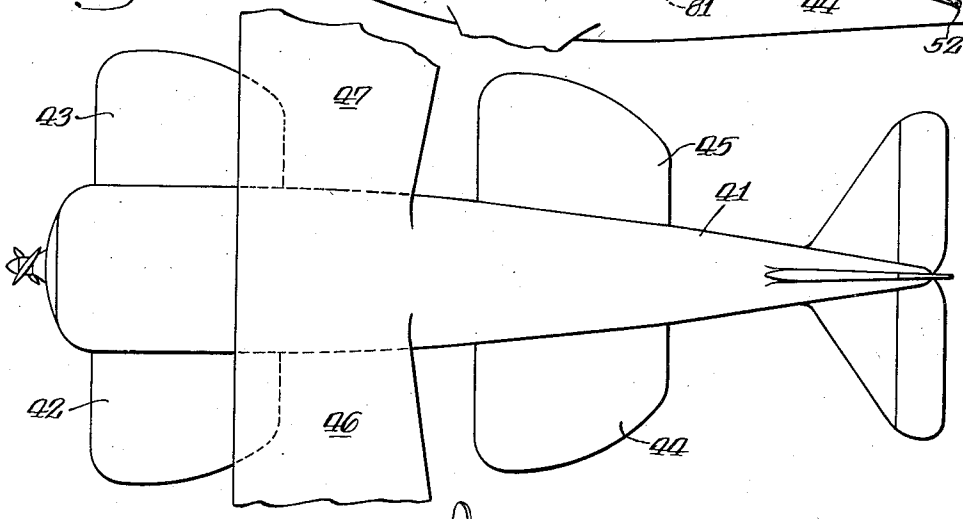


Fig. 7.



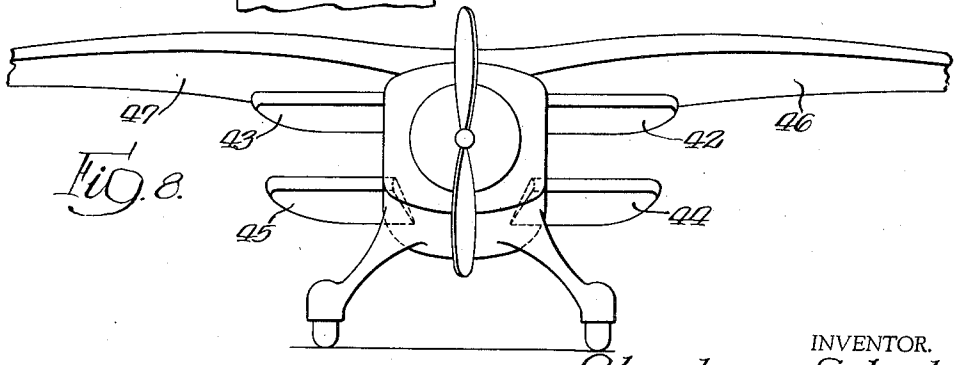


Fig. 8.

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Fig. 9.

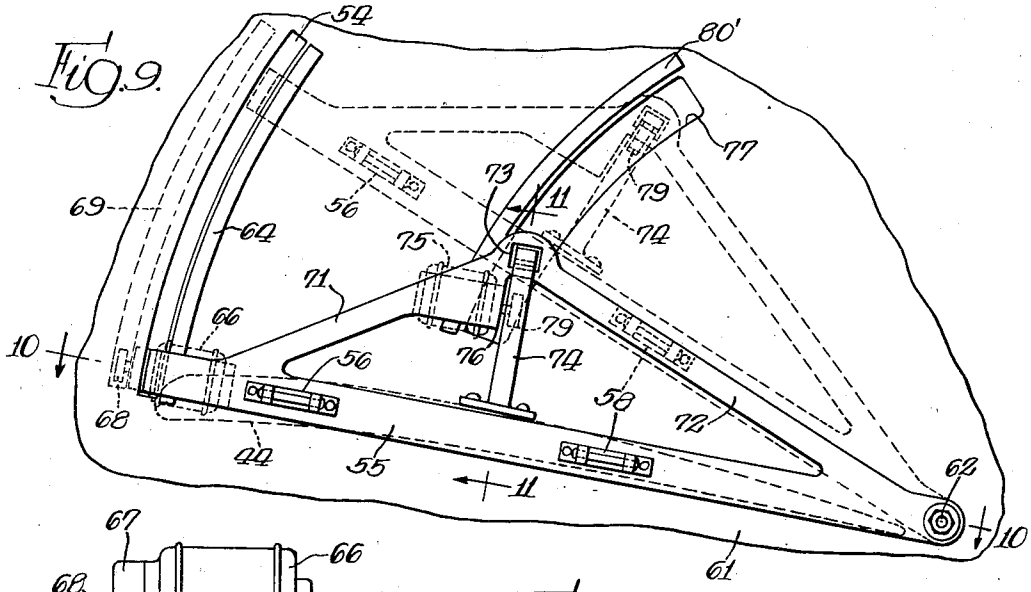


Fig. 10.

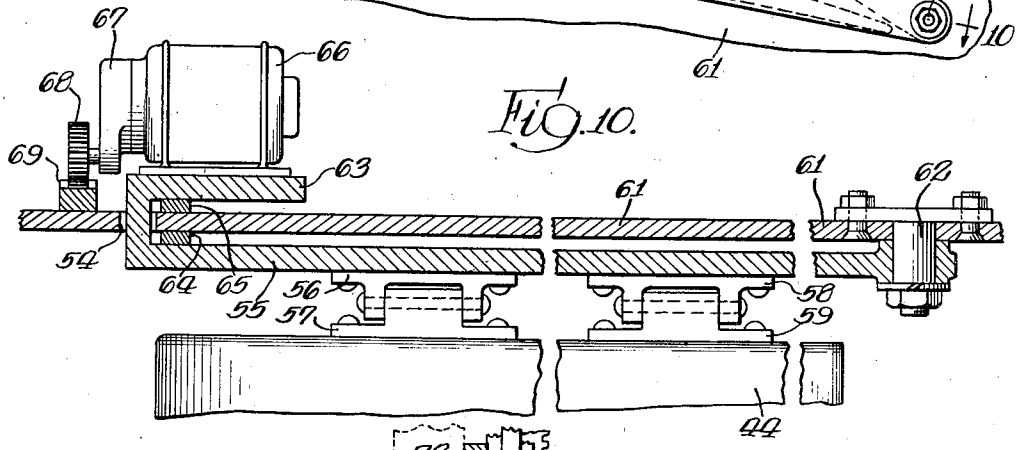
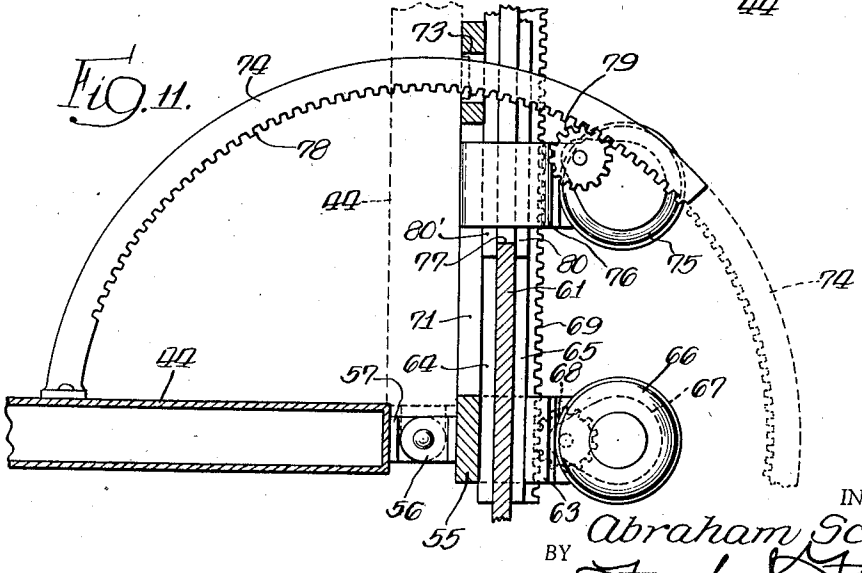


Fig. 11.



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UNITED STATES PATENT OFFICE

2,189,553

AIRPLANE

Abraham Schut, Chicago, Ill.

Application September 2, 1938, Serial No. 228,130

12 Claims. (Cl. 244—113)

This invention relates to improvements in airplanes and particularly to improvements in auxiliary flaps which may be used as landing flaps for retarding the forward speed of the planes when landing, and as auxiliary lifting surfaces when more lifting surface is required.

One of the objects of this invention is to provide auxiliary hinged flaps secured to the fuselage, rather than to the wings, which may be folded against the side of the fuselage when out of service, and extended outwardly from the fuselage at will by the pilot to serve the various functions herein described.

Another object of the invention is to provide flaps which are secured in pairs fore-and-aft of the middle of the fuselage so that their use may not seriously disturb the normal longitudinal balance of the plane in flight.

Another object of the invention is to provide pairs of flaps hinged to the fuselage and so constructed and arranged that the wind pressure which assists in opening one pair of flaps may be utilized to aid in opening the other pair of flaps, in order to decrease the amount of power required for operating the flaps.

Another object of the invention is to provide landing flaps on a plane, which may be positioned and utilized in such a manner that some lifting effect is provided in addition to the braking effect.

Another object of the invention is to provide hinged flaps on airplane fuselages which may be adjusted by the operator to provide additional lifting surfaces temporarily, or which may be adjusted to another position to provide braking surfaces.

Another object of the invention is to provide auxiliary flap surfaces which may be readily connected to airplanes already built and which may be so constructed that the normal balance of the plane will not be substantially altered by the addition of these auxiliary flaps.

Various other objects and advantages of the invention will be described hereinafter or will become apparent from a reading of this specification.

Referring now to the drawings, Figs. 1 to 5 inclusive show one form of the invention.

Fig. 1 is a side elevation showing an airplane equipped with auxiliary flap surfaces retracted snugly against the side of the fuselage.

Fig. 2 is a top plan view of the same plane showing the flaps in extended or operative position, the position of the main wings being shown only in dotted line.

Fig. 3 is a front elevation of the same plane showing the flaps in extended position.

Fig. 4 is a diagrammatic sketch of the operating mechanism for the shutters that are provided in the front flaps.

Fig. 5 is a detailed view of the operating mechanism for a top flap which may, if desired, be employed.

Fig. 6 is a side elevation showing another form of the invention, the view showing the flaps extended and positioned to constitute auxiliary lifting surfaces.

Fig. 7 is a top plan view of the plane shown in Fig. 6 with all four flaps extended.

Fig. 8 is a front elevation of the same plane.

Fig. 9 is a detailed view of the mounting and operating mechanism for the left rear flap which is shown in Figs. 6 and 7.

Fig. 10 is a sectional view on the line 10—10 of Fig. 9.

Fig. 11 is a sectional view on the line 11—11 of Fig. 9.

Fig. 12 shows a slight modification of that form of the invention which is shown in Fig. 6.

Referring now to Figs. 1 to 5, hinged to the fuselage 1 are a pair of forward flaps 2 and 3 and a pair of rear flaps 4 and 5 and the top flap 6.

The forward pair of flaps, similar in construction and mounted on opposite sides of the fuselage, will preferably have their centers of pressure forwardly of a transverse line, through the transverse center of lift of the wings. The rear flaps are positioned rearwardly of that center line. The forward flaps are hinged, as shown, to the vertical side walls of the fuselage by means of hinges such as 7; as many hinges being employed as is desirable, and any suitable construction and mode of attachment of these hinges to the fuselage framework being contemplated.

The details of construction of the forward flaps do not constitute a part of this invention, excepting for the provision of shutters in their surfaces whereby upon opening of the shutters the air may be permitted to flow therethrough to relieve pressure on these forward flaps. The shutters 8 are of the same nature as the well-known window shutters long in use on houses, being pivotally mounted to rotate through an angle of ninety degrees to permit or prevent the passage of air therethrough.

Fig. 4 shows diagrammatically one method of operating these shutters, the pinion gears 9 and 11 being mounted substantially at the center line of the forward flap hinges, while the gears 12 and 13 may be carried on the respective flaps 2 and 3. By means of ordinary links such as 14 and 15, pivotally connected eccentrically with gears 12 and 13 and also connected with arms such as 16, secured to the shutters, the latter may be rotated through an angle of ninety degrees to open or closed position. The mechanism for rotating the gears 9 or 11 to bring both sets of shutters either to open or closed position simultaneously is not shown, it being obvious that any simple mechanism may be employed for

that purpose, the exact design of which must necessarily vary in accordance with the position of the cockpit and other apparatus carried in the fuselage. The power employed may be manual, if desired, and for the construction shown herein, manual power is entirely feasible. However, it is contemplated that pneumatic power, operated by engine suction or compressed air or electrical power may be used to open and close the shutters.

Fig. 2 indicates somewhat diagrammatically how the forward and rear flaps may be opened and closed by means of a unitary operating mechanism, consisting of rack bars 17 and 18, rigidly connected together and reciprocated by means of a hand lever 19. The rack bars cause the rotation of the gears 21 and 22, which through suitable links such as 23 and 24 connected with bell cranks such as 25 and 26 will enable the pilot simultaneously to extend or retract the pair of forward flaps and the pair of rear flaps.

It is apparent that when an attempt is made to open out the rear flaps, the wind pressure will resist that movement. However, the wind pressure does assist in opening the forward flaps, hence it will tend to overcome the resistance which opposes the opening of the rear flaps. Ordinarily it will be convenient to make the forward flaps larger than the rear flaps, hence the pressure opposing the closing of the forward flaps would be much in excess of the pressure which would assist in closing the rear flaps. It is apparent, therefore, that the pilot may regulate the shutters to vary the total resistance offered by the forward flaps. After opening the shutters, the forward flaps may be closed more easily.

In order to utilize the shutters to the fullest advantage, it is contemplated that the rear flaps and front flaps might be so constructed that when the shutters in the front flaps are open the rear flaps, either by reason of their size, shape or angular position, will then afford greater resistance to the air stream than the front flaps. Thus, when all four flaps are extended and the shutters are then opened by the pilot, the superior air pressure on the rear flaps will tend to close all of the flaps. Conversely, when the pilot desires to open all of the flaps he may rotate the shutters to a partly closed position, by any suitable mechanism for operating the gears 9 and 11, and as the front flaps are being extended the greater wind pressure on the front flaps will assist in opening the rear flaps.

The top flap 6 may also be provided on the plane as an additional landing flap. It may be hinged at 27 and opened and closed by any suitable mechanism. As an illustration, I have shown a bell crank lever 28, pivoted at 29 and connected with the flap 6, by means of a ring 31. By means of this operating mechanism, the flap 6 may be raised to the dotted line position shown in Fig. 1, to provide additional resistance when the plane is landing.

The forward and rear flaps are hingedly connected with the fuselage on inclined axes which, for the purposes of affording resistance when the plane is landing, may be disposed at an angle of perhaps 30 to 45 degrees to the line of flight or longitudinal axis of the plane. However, if it be desired to use these flaps to provide additional lifting surface when the plane is taking off, the inclination of the axis of the hinges may be reduced to some angle between 18 and 25 degrees in order that a substantial lift may be imparted by the flaps without too much resistance. If the flaps are to be used both for landing or taking off, their angle of inclination will then be a compromise between the positions which are best suited for the two purposes.

Naturally, the shape, size and longitudinal position of the forward and rear pairs of flaps are subject to considerable variation and will be determined in accordance with the various characteristics of each particular design of plane, that is, with reference to the distribution of longitudinal balance in the plane, so that the balance will not be too greatly disturbed when the flaps are applied for landing or opened for taking off. If the flaps be employed also for providing auxiliary lifting surfaces for taking off, it will be desirable to construct them with the usual airfoil design, but if used merely for landing flaps, that design may be dispensed with.

Another form of the invention is shown in Figs. 6 to 11 inclusive, this form being distinguished from the form shown in Figs. 1 to 5 in that the hinge for each flap is itself shiftable so that when any flap is extended more or less perpendicularly to the side of the fuselage, its angle to the air stream may be varied for the purpose of increasing the lifting function of the flap or decreasing it in order to use the flap as a braking element.

Referring now to Fig. 7, the fuselage is indicated as 41 and there is secured thereto a pair of front flaps 42 and 43, and a pair of rear flaps 44 and 45. The right and left halves of the monoplane wing are indicated as 46 and 47. Each of these flaps is secured to the fuselage side by means of a hinge which permits the flap to be folded snugly against the fuselage wall or extended outwardly as shown in Fig. 7.

Referring now to Fig. 6, it will be noted that the front end of the hinge for flap 42 is pivoted at 48, while the rear end of the hinge 49 may be swung upwardly along the arcuate slot 51. Conversely, the rear flap 44, being hinged to the fuselage wall, has the rear end of its hinge pivoted at 52, while the forward end 53 of the hinge may be swung upwardly along the arcuate slot 54.

The positions which the forward flaps and the rear flaps occupy when folded against the fuselage wall are shown in dotted lines. It is contemplated that the flaps shown in this modified form of the invention will be greatly used as auxiliary lifting surfaces, for temporarily carrying additional loads, or for temporarily affording the plane additional lifting surface when it is taking off or being landed.

Referring now to the rear flap shown in Figs. 6, 9, 10 and 11, the flap 44 may be hinged to a hinge bar 55, by means of brackets 56, 57, 58 and 59. This hinge bar itself is pivotally secured to the fuselage wall at the pivot post 62. The end of the hinge bar may be formed, as shown in Fig. 10, with a portion extending through the slot 54 and having a rearwardly extending portion 63. Bearing strips 64 and 65, as shown, will keep the forward end of the hinge bar from vibrating. Portion 63 of the hinge bar which extends inside of the fuselage wall may be utilized as a support for a small electric motor 66, which, operating through a gear reduction box 67, causes a small pinion gear 68 to follow the rack 69 carried on the inside of the fuselage wall. Thus it may be seen that if a switch (not shown) be closed by the pilot, the motor 66, being preferably a reversible motor, will raise the movable end of the hinge bar upwardly or downwardly through the slot 54, to change the function of

the rear flap either from a lifting flap to a braking flap, or vice versa.

The hinge bar 55 has two extensions 71 and 72, which lie outside of the fuselage wall, which at their juncture provide a guide slot 73 for an arcuate brace 74, whose outer end is secured to the upper surface of the flap 44 and whose inner end extends at all times some distance through the slot 73 and through the fuselage wall 61 to a position where another motor and pinion gear may be used to cause the arcuate brace 74 to be retracted into the fuselage body or extended outwardly therefrom. For this purpose, a reversible motor 75 is mounted on a bracket 76, which is integral with the leg 71 of the hinge bar frame. This bracket extends through the slot 77 in the fuselage wall and, as the hinge bar frame is moved upwardly or downwardly by means of the motor 66, the motor 75 is of course carried right along with it. The inside surface of the arcuate brace 74 is provided with a rack 78, which engages with the pinion gear 79, which is driven through suitable reduction gears by the motor 75.

Bearing strips 80 and 80', secured on the outside and inside of the fuselage wall, furnish a snug slideway for the leg 71 and its inturned portion 76, so that the brace 74 may hold the flap securely when extended and prevent vibration.

It now may be understood that the operation of the motor 75 will serve to pull the flap 44 snugly up against the fuselage wall no matter to what position the motor 66 may previously have rotated the flap. Likewise, the motor 55, acting on the brace 74, will extend the flap outwardly from the fuselage whether the flap be sharply inclined to act as a braking member or only slightly inclined toward the air stream to act as a lifting member.

Obviously, with the construction thus described, the angle assumed by any flap toward the air stream may be made to vary within such limits as 15 degrees up to 45 degrees.

The hinge mounting and motor operated mechanism for the front flaps need not be shown here, as it will be, of course, the same as that shown in Figs. 9 to 11 inclusive, but reversed as to position in order to cause the downward closing of the front flaps.

It will be understood that when the reversible motors are stopped in any position, the associated trains of reducing gears will suffice to lock the mechanism in such position.

Referring now to Fig. 12, there is shown diagrammatically, by means of the dotted line 81, a continuous cable which may be secured to the rear end of the hinge bar frame for the front flap on each side, and the forward end of the hinge bar frame for the rear flap on the same side, so that as the front flap is swung downwardly the rear flap must swing upwardly. A similar continuous cable may be provided on each side of the fuselage to connect the rear and front flaps on each side. This device of course serves the purpose of balancing the change of pressure on the front flaps against the change of pressure on the rear flaps, similar in purpose to the operating mechanism shown in Fig. 2.

Where separate electric motors are employed and the rear and front flaps are secured by the fuselage as shown, whenever greater pressure is required to swing the front flaps downwardly less pressure will be required to swing the rear flaps upwardly, so that at no time will the maximum load be exerted on all four of the motors simultaneously.

It is further contemplated that, instead of electric motors, air pressure motors may be used, or some other form of motive power, including manual operation, may be employed.

The auxiliary flaps shown in the drawings may be utilized to provide an airplane with auxiliary lifting surfaces equal to 15% to 30% of the original lifting surface of the plane, and in fact even somewhat more. Obviously, the amount of braking effect which these flaps can provide is adequate for all normal requirements. In no case is any strain placed upon the main wing structures, the fuselage frame itself being caused to carry all of the weight and stress resulting from the use of these flaps.

It is contemplated that when an installation is made, streamlining of the flaps and their supports to cut down wind resistance when they are closed against the fuselage body will be then undertaken, the exact details of such normal precautions not being a part of this invention. Hence provisions of that character are not shown in the drawings.

It should be understood that the drawings show, for the purpose of illustrating the invention, only certain embodiments which are at present preferred and that many variations in the details of construction may be employed without departing from the spirit and scope of the invention defined in the following claims.

Having shown and described my invention, I claim:

1. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of the fuselage on opposite sides thereof on inclined axes constructed to swing forwardly and downwardly when closing against the fuselage, and another pair of flaps hinged to the rear portion of the fuselage on opposite sides thereof on inclined axes and constructed to swing rearwardly and upwardly when closing against the fuselage.

2. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of the fuselage on opposite sides thereof on inclined axes constructed to swing forwardly and downwardly when closing against the fuselage, another pair of flaps hinged to the rear portion of the fuselage on opposite sides thereof on inclined axes and constructed to swing rearwardly and upwardly when closing against the fuselage, and means for rotating said flaps including means for connecting the forward pair of flaps with each other and with each of the rear flaps whereby all flaps will open and close simultaneously.

3. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of the fuselage on opposite sides thereof on inclined axes constructed to swing forwardly and downwardly when closing against the fuselage, another pair of flaps hinged to the rear portion of the fuselage on opposite sides thereof on inclined axes and constructed to swing rearwardly and upwardly when closing against the fuselage, and means for opening and closing all of said flaps connected with the flaps in such a manner that the wind pressure exerted against the forward flaps during opening and closing movements is counter-balanced to some extent by the wind pressure exerted against the rear flaps.

4. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of

the fuselage on opposite sides thereof along inclined axes lying snugly against the fuselage side when in inoperative position and opening upwardly and rearwardly to operative position, means for operating said flaps in unison, shutters mounted in each flap for rotation to one position to permit passage of air therethrough and to another position to provide a substantially imperforate surface on said flaps, means for operating said shutters irrespective of the position of the flaps, a pair of flaps hinged to opposite sides of the rear portion of the fuselage along inclined axes lying snugly against the fuselage side when in their inoperative positions and rotating downwardly and forwardly to operative position, and means for operating all of said flaps in unison constructed and arranged whereby the wind pressure on the forward flaps counter-balances to some extent the wind pressure on the rear flaps.

5. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of the fuselage on opposite sides thereof along inclined axes lying snugly against the fuselage side when in inoperative position and opening upwardly and rearwardly to operative position, means for operating said flaps in unison, shutters mounted in each flap for rotation to one position to permit passage of air therethrough and to another position to provide a substantially imperforate surface on said flaps, means for operating said shutters irrespective of the position of the flaps, a pair of flaps hinged to opposite sides of the rear portion of the fuselage along inclined axes lying snugly against the fuselage side when in their inoperative positions and rotating downwardly and forwardly to operative position, means for operating all of said flaps in unison constructed and arranged whereby the wind pressure on the forward flaps counter-balances to some extent the wind pressure on the rear flaps, and an additional landing flap mounted on top of the fuselage forward of the wing and hinged for swinging upwardly from its rear edge.

6. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of the fuselage on opposite sides thereof on inclined axes at their rear edges swinging forwardly and downwardly to closed position against the fuselage sides and rotatable outwardly at such an angle to the line of flight of the plane that the flaps will provide substantial resistance to the passage of the plane through the air and also a material increase to the total lifting effect of the plane, and means for operating said flaps in unison.

7. In combination with an airplane fuselage, a pair of flaps hinged to the fuselage on opposite sides thereof along inclined axes, the hinged connection of each flap to the fuselage being constructed and arranged for rotation relatively to the fuselage to vary the inclination of each hinged axis relatively to the longitudinal axes of the fuselage, means for rotating said flaps in unison about their hinged axes, and means for rotating said hinged connections to vary the inclination of said axes.

8. In combination with an airplane fuselage, a pair of flaps and means for hingedly connecting them to the fuselage on opposite sides thereof along inclined axes, said hinged connection being further constructed and arranged for rotation to vary the inclination of the hinged axis of each flap relatively to the longitudinal axis of the fuselage whereby in one position of inclination the flaps will provide additional lifting surface for the plane and in another position of inclination will have a diminished lifting effect but increased braking effect to serve as landing flaps.

9. In combination with an airplane fuselage, a pair of flaps hingedly connected to the fore portion of the fuselage on opposite sides thereof, another pair of flaps hingedly connected to the rear portion of the fuselage on opposite sides thereof, said hinged connections for all said flaps being constructed and arranged to provide a variable inclination of the hinged axis of each flap relatively to the longitudinal axis of the fuselage whereby when the flaps are rotated outwardly from the sides of the fuselage they may be caused to assume variable angles of inclination relatively to the line of flight of the plane, means for rotating said flaps about their hinged axes, and means for rotating the hinged connections to vary the inclination of said axes.

10. In combination with an airplane fuselage, a pair of flaps hinged to the forward portion of the fuselage on opposite sides thereof on inclined axes constructed to swing forwardly and downwardly when closing against the fuselage, another pair of flaps hinged to the rear portion of the fuselage on opposite sides thereof on inclined axes and constructed to swing rearwardly and upwardly when closing against the fuselage, and means for hinging said flaps to the fuselage constructed and arranged for movement relatively to the fuselage for varying the inclination of said axes for increasing the lifting effect of the flaps as the axes more nearly approach parallelism with the longitudinal axis of the fuselage, and for increasing the braking effect of the flaps as their axes are rotated away from said parallelism.

11. In combination with an airplane fuselage, a pair of flaps hinged to the fuselage on opposite sides thereof along inclined axes at their inner edges and arranged to swing forwardly and downwardly to retracted position against the fuselage sides, said flaps being rotatable outwardly and upwardly to such an angle to the normal line of flight of the plane that the flaps will provide substantial resistance to the passage of the plane through the air and also a material increase to the total lifting effect of the plane, and means for rotating said flaps to retracted or operative positions.

12. In combination with an airplane fuselage, a pair of flaps hinged to opposite sides of the fuselage, means for rotating said flaps downwardly to retracted position against the fuselage sides or upwardly and outwardly to operative position, said hinged connection of each flap to the fuselage being constructed and arranged to provide a hinged axis of variable inclination relatively to the longitudinal axis of the fuselage whereby when the flaps have been rotated outwardly to operative position their hinged connection with the fuselage may be angularly varied to cause the flaps to assume selectively any of various angles of inclination relatively to the normal line of flight of the plane whereby the braking and lifting effects of the flaps may be increased or decreased at will.

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