Aircraft wings with aileron-supported ground speed spoilers and trailing edge flaps.

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References cited:
FR-A-1 059 747
US-A-1 504 663
US-A-2 152 974
US-A-3 120 935

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Description

The present invention relates to the combination of an aircraft wing and aileron-associated spoilers and trailing edge flaps for reducing approach speeds and decreasing runway lengths needed for landings by increasing the lift and drag on aircraft equipped with one or both of these devices. A combination as defined in the introductory part of claim 1 is known from FR-A-1 059 747. In this specification a lift increasing flap arranged at the underside of the aileron is shown. The invention however also relates to spoilers arranged at the upper side of the aileron, therefore spoilers and flaps embodying the principles of the present invention are collectively referred herein as "aerodynamic lifting or braking devices".

The lifting device as known from FR-A-1 059 747 in its stowed position, moves as unit with the aileron. When the flap is deployed, the angle relative to the wing varies with the position of the aileron. Therefore the effectiveness of this device is impaired.

The invention has for its object to provide a combination as defined above which is effective and also relatively uncomplicated.

This object is obtained with a device as having the characterizing features of claim 1. Herewith the aileron mounted flap or ground spoiler remains at essentially the same angle when deployed, despite up and down movement of the supporting aileron. The control of the aileron and the aileron supported flap or spoiler therefore are substantially independent. In the sub-claims preferred embodiments of the invention are characterized.

Other important objects and features and additional advantages of the invention will be apparent to the reader from the foregoing and the appended claims and as the ensuing detailed description and discussion proceeds in conjunction with the accompanying drawing.

Brief Description of the Drawings

In the drawing:

Figure 1 is a plan view of a jet aircraft wing which can be equipped with a lift or drag generating, aileron-associated aerodynamic lifting or braking device in accord with the principles of the present invention;

FIG. 2 is a vertical section through the wing of FIG. 1 showing the details of an aileron mounted, lift generating flap embodying the principles of my invention, the flap actuating mechanism and the system employed to operate the latter;

FIG. 3 is a view similar to FIG. 2 but with the flap in its extended position;

FIG. 4 is a plan view showing details of the flap actuating mechanism and the system employed to operate that mechanism;

FIG. 5 is a plan view of the wing's outboard panel showing more details of the system provided for operating the flap actuating mechanism;

FIG. 6 is a view similar to FIG. 2 of a wing as shown in FIG. 1, the wing being equipped with a drag generating ground spoiler in accord with the principles of the present invention;

FIG. 7 is a view similar to FIG. 6 but with the spoiler in its extended position; and

FIG. 8 is a view similar to FIG. 5 of the actuating mechanism and operating system for the spoiler.

Detailed Description of the Invention

Referring now to the drawing, FIG. 1 depicts a jet aircraft wing 20 equipped with an aileron-mounted, aerodynamic lifting device in accord with the principles of the present invention. In wing 20, this device is a split flap 22 which fits into a recess 23 on the lower side of aileron 24 when the flap is in its stowed (or retracted) position.

In addition to the novel aerodynamic lifting device just described, wing 20 includes, among other components: outboard leading edge slats 26, 28 and 30; inboard leading edge and Krueger flap installations 32 and 34; an inboard ground spoiler 36; an inboard flap installation 38; outboard ground spoilers 40 and 42 operated by the same hydraulic system as inboard ground spoiler 36; flight spoilers 44 and 46; an outboard flap installation 48; an aileron trim tab 50; fairings 52 and 54 housing tracks (not shown) on which the flaps in outboard flap installation 48 are extended and retracted; and an engine nacelle 56. These just-mentioned components of wing 20 are not part of the present invention and will accordingly not be described herein except as is necessary for an understanding of that invention.

Referring still to the drawing, FIGS. 2 and 3 depict, in more detail, aileron 24 and the novel aileron-mounted, split flap 22 incorporated into wing 20 to increase the lift on the aircraft with which the wing is fitted.

Flap 22 has a structural framework or core identified generally in FIGS. 2 and 3 by reference character 58. This core is surrounded by a metallic or other upper skin 60 and a similar lower skin 61.

Aileron 24 has an aerodynamic profile and, like flap 22, a core or structural framework 64, an upper skin 66, and a lower skin 67. With flap 22 stowed in recess 23, the lower skin 61 of the flap forms part of (or continues) the aerodynamic profile of aileron 24.

Split flap 22 will typically have a constant chord and extend the length of aileron 24. At its leading edge, flap 22 is pivotally fixed to aileron 24 as by a conventional piano hinge 68.

Aileron trim tab 50 is also pivotally connected to aileron 24, in this case at the trailing edge of the latter. This wing component, which can be pivotally deflected both upwardly and downwardly, is employed to balance the forces on aileron 24 and thereby reduce the effort required to vertically deflect the aileron. As indicated above, the trim tab is not part of my present invention; I accordingly deem it unnecessary to describe this component further herein.

Referring now to FIGS. 2—5, the assembly of aileron 24, split flap 22, and aileron trim tab 50 is
supported from the trailing edge of wing 20 for up
and down angular movement (shown by arrows
72 and 74 in FIGS. 2 and 3) relative to the chord
plane 71 of the wing from an aileron hinge
support 76. The latter is mounted on the rear spar
78 of wing 20. A pin 89 (see FIG. 4) extends
through hinge support 76 and the hinge lug 82 of
the aileron (the aileron actuator and its support
mechanism are not shown). The hinge lug is
integrated with the core 64 of the aileron, and the
just-described pin 80 consequently affords the
wanted pivotal connection between aileron 24
and the wing 20 in which that aileron is incor-
porated.

With flap 22 in the stowed position (FIG. 2) the
pivot axis of aileron 24 relative to wing 20 is
directly above the pivot axis between split flap 22
and, aileron 24 provided by piano hinge 68.

As can best be understood by reference to
FIGS. 2—4, flap 22 is displaced between the
stowed position shown in FIG. 2 and the extended,
left creating position shown in FIG. 3 in which
it is displaced below and at an angle to the
chord plane 71 of wing 20 by a crank-and-rod
type, split flap actuating linkage or mechanism 83.
That linkage includes a crank 84 and a flap
support rod 85. At its free end, one arm 86 of
crank 84 is pivotably fixed to aileron hinge
support 76 by a pivot pin 88. The pin extends
through integral flanges 90 and 92 which are
integral parts of, and located at the trailing edge
of support 76 and on opposite sides of crank arm
86 (through which pin 88 also extends).

Crank 84 also includes a second, bifurcated arm
94. The forward end of split flap support rod 85 is
pivotably connected to crank 84 at the juncture
between that bifurcated arm and crank arm 86 by
a pivot member 96 best shown in FIGS. 2 and 3.

With flap 22 in the stowed position shown in
FIG. 2, the pivot axis afforded by pin 96 is
centered on (i.e., coincides with) the pivot axis for
aileron 24 provided by pivot member or pin 80.
Consequently, split flap 22 rotates as one with
aileron 24 as the latter is deflected upwardly and
downwardly through the paths indicated by
arrows 72 and 74.

To extend flap 22, crank 84 is rotated in a
clockwise direction about pivot member 88 from
the position shown in FIG. 2 to that shown in FIG.
3. This deflection of flap 22 downwardly through
an angle which will typically be a nominal 60° re-
tative to the chord plane 71 of wing 20.

In the extended position flap 22 will typically
remain within 3° of the nominal angle as aileron
22 is moved upwardly and downwardly. How-
ever, because of the piano hinge connection 68
between the split flap and the aileron, flap 22 will
translate to and fro as the aileron is moved.
Broken lines 98 and 100 in FIG. 3 show the
locations of the lower face or skin 81 of the flap
with aileron 24 in its maximum (20° down and 20°
up) positions.

Referring still to the drawings, FIGS. 2—5 depict
the operating system 101 utilized to rotate crank
84 about pivot member 88 and thereby deflect
split flap 22 between its stowed and extended
positions.

Split flap operating system 101 includes a
torque tube drive 102 which services the inboard
and outboard flap installations 38 and 48 of wing
20. The operating system is housed in, and near,
the trailing edge of wing 20.

An extension 104 of the torque tube drives a
reduction gear box 106 which is housed in wing
20 opposite split flap 22. As is best shown in FIGS.
2—4, a drum 107 with a cam track 108 formed in
its face 110 is secured to the output shaft 112 of
the gear box for rotation therewith.

In addition to the components just described,
the operating system 101 for split flap 22 includes
a cam follower 114 designed to follow track 108, a
double-armed crank 116 supported by a pivot pin
118 from the aileron hinge support 76 of wing 20,
and a push rod actuator 120.

Cam follower (or roller) 114 is rotatably
supported from the end of one integral crank arm
122 on a post 124; and the forward end of push
rod 120 is pivotably fixed to the second, integral
arm 128 of the crank by pivot member 127. A
pivot member 128 fixes the opposite, trailing end
of the push rod to the bifurcated arm 94 of the flap
actuating crank 84.

To extend flap 22, the flap operating system 101
is actuated, causing drum 107 to rotate in a
clockwise direction as shown in FIGS. 2 and 3. As
this occurs, cam follower 114 travels along track
108 and causes crank 116 to rotate in a counter-
clockwise direction from the position shown in
FIG. 2 to that shown in FIG. 3. This rotation of
crank 116 displaces push rod 120 rearwardly,
rotating flap actuating crank 84 in a clockwise
direction about pivot member 88 to deflect flap 22
downwardly to its extended position (flap 22 has
no intermediate positions, only fully extended
and stowed). Similarly, rotation of torque tube
extension 104 in the opposite direction effects a
reversal of these motions and, as a consequence,
deflection of the flap from the extended, FIG. 3
position to the stowed, FIG. 2 position.

As suggested above, the aeronautical lifting or
braking device incorporated in the wing illus-
trated in FIG. 1 may be a ground speed spoiler
instead of a split flap. A braking device of that
character is illustrated in FIGS. 6—8 and identified
by reference character 130.

In many cases, the aircraft components and
structure shown in FIGS. 6—8 duplicate what is
shown in FIGS. 1—5. To the extent that this is
ture, like reference characters have been
employed for like purposes.

Turning again to the drawing, FIGS. 6 and 7
deeply, in detail, the novel aileron-mounted
ground speed spoiler 130 which may be incor-
porated into wing 20 to increase the drag on the
aircraft with which the wing is fitted.

Spoiler 130 has a structural framework or core
identified generally in FIGS. 6 and 7 by reference
character 132. This core is surrounded by a
metallic or other upper skin 134 and a similar
lower skin 136.
In its stowed position (FIG. 6), ground speed spoiler 130 is housed in a recess 138 in the upper side of aileron 24. With spoiler 130 thus stowed in recess 138, the upper skin 134 of the flap forms part of (or continues) the aerodynamic profile of aileron 24.

Ground speed spoiler 130 will typically have a constant chord and extend the length of aileron 24. At its leading edge, spoiler 130 is pivotally fixed to aileron 24 as by a conventional piano hinge 140.

Referring now to FIGS. 6—8, an assembly of aileron 24, spoiler 130, and aileron trim tab 50 is supported from the trailing edge of wing 20 for up and down angular movement (shown by arrows 72 and 74 in FIGS. 2 and 3) relative to the chord plane 71 of the wing from an aileron hinge support 142 which is much like the hinge support 76 described above. Hinge support 142 is mounted on the rear spar 78 of wing 20. A pin 144 (see FIG. 8) extends through hinge support 142 and the hinge lug 146 of the aileron (the aileron actuator and its support mechanism are not shown). The hinge lug is integrated with the core 64 of the aileron, and the just-described pin 144 consequently affords the wanted pivotal connection between aileron 24 and the wing 20 in which that aileron is incorporated.

With spoiler 130 in the stowed position (FIG. 6) the pivot axis of aileron 24 relative to wing 20 is directly below the pivot axis between spoiler 130 and aileron 24 provided by piano hinge 140.

As can best be understood by reference to FIGS. 6—8, spoiler 130 is displaced between the stowed position shown in FIG. 6 and the extended, aerodynamic, ground speed braking position shown in FIG. 7 in which the spoiler is deployed above and at an angle to the chord plane 71 of wing 20 by a crank-and-rod type, spoiler actuating linkage or mechanism 148. That linkage includes a crank 150 and a spoiler support rod 152. At its free end, one arm 154 of crank 150 is pivotally fixed to aileron hinge support 142 by a pivot pin 156. The pin extends through integral flanges 158 and 160 at the trailing edge of support 142 and on opposite sides of crank arm 154 (through which pin 156 also extends).

Crank 150 also includes a second, bifurcated arm 161. The forward end of ground speed spoiler support rod 152 is pivotally connected to crank 150 at the juncture between that bifurcated arm and crank arm 154 by a pivot member or pin 162 best shown in FIGS. 6 and 7.

With spoiler 130 in the stowed position shown in FIG. 6, the pivot axis afforded by pin 162 is centered on (i.e., coincides with) the pivot axis for aileron 24 provided by pivot member or pin 144. Consequently, spoiler 130 rotates as one with aileron 24 as the latter is deflected upwardly and downwardly through the paths indicated by arrows 72 and 74 (FIG. 6).

To extend ground speed spoiler 130, crank 150 is rotated in a counterclockwise direction about pivot member 156 from the position shown in FIG. 6 to that shown in FIG. 7. This deflects spoiler 130 upwardly through an angle which will typically also be a nominal 60° relative to the chord plane 71 of wing 20.

In the extended position spoiler 130 will typically remain within 3° of the nominal angle as aileron 24 is moved upwardly and downwardly. However, because of the piano hinge connection 140 between spoiler 130 and aileron 24, the spoiler will translate to and fro as the aileron is moved. Broken lines 163 and 164 in FIG. 8 show the locations of the upper face or skin 134 of the spoiler with aileron 24 in its maximum (20° down and 20° up) positions.

Referring still to the drawings, FIGS. 6—8 depict the operating system 166 utilized to rotate crank 150 about pivot member 156 and thereby deflect ground speed spoiler 130 between its stowed and extended positions. This system includes a hydraulic cylinder 168 with its forward end 170 pivotally fixed to the rear spar 78 of wing 20 by support 179 and by pivot member 171.

Hydraulic lines 172 and 174 connect hydraulic cylinder 168 to the hydraulic power supply (not shown) for outboard ground spoilers 40 and 42, allowing the deflection of ground speed spoiler 130 to be coordinated with the deflection of these just-mentioned spoilers.

Cylinder 168 includes the usual rectilinearly displaceable piston rod 176. The trailing end of this rod is pivotally fixed to the free end of bifurcated spoiler actuating linkage crank arm 161 by a pivot pin or member 178. Consequently, admission of hydraulic fluid to the forward end of hydraulic cylinder 168 will result in: (1) piston rod 178 moving rearwardly; (2) crank 150 rotating in a counterclockwise direction from the position shown in FIG. 6 to that shown in FIG. 7; and (3) spoiler support rod 152 deflecting the ground speed spoiler 130 from its stowed position (FIG. 6) to its extended position (FIG. 7) Conversely, the subsequent reversal of the pressure in cylinder 168 will result in the reversal of the motions of the just-described actuating linkage and operating system components and the deflection of spoiler 130 to its stowed position.

Claims

1. The combination of: an aircraft wing (20); an aileron (24) with an airfoil shape extending along the trailing edge of said aircraft wing; stationary aileron (24) support means (76) fixed to said wing; first pivot means (80) toward the leading edge of the aileron for pivotably fixing said aileron to said stationary aileron support means; an aerodynamic lifting or braking means (22) which can be deployed by rotatably actuating means (101) at an angle to the chord plane of said wing, said lifting or braking means (22) having a stowed position in which it fits into said aileron (24) as to continue the airfoil shape of the aileron; second pivot means (68) at the leading edge of said lifting or braking means to said aileron for displacement between the stowed position and the deployed position, said actuating means (101)
comprising a crank (84) pivotally fixed to said wing (20), one arm (86) of said crank (84) being pivotally connected to one end of a link (85), the other end of said link (85) being pivotally connected to said lifting or braking means (22), the crank (84) and the link (85) being dimensioned such that in the stowed position the pivotable connection of the one crank arm (86) with the link (85) is axially aligned with the axis of the first pivot means (80), characterized by the axis of said second pivot means (68) being vertically aligned with the axis of the first pivot means (80) when said lifting or braking means (22) is stowed; and said actuating means (101) further being dimensioned such that in the deployed position of the lifting or braking means, the link (85) extends substantially vertically.

2. The combination defined in claim 1, wherein said lifting or braking means is a lifting means (22) and is a split flap which fits into the lower side of the aileron (24) when the flap is in its stowed position and wherein, with the flap in that position, the axis of said second pivot means (68) lies directly below the axis of the first pivot means (60).

3. The combination defined in claim 1, wherein said lifting or braking means is a braking means and is a ground speed spoiler (130) which fits into the upper side of the aileron (24) when the spoiler is in its stowed position and wherein, with the spoiler in that position, the axis of said second pivot means (140) lies directly above the axis of the first pivot means (144).

4. The combination defined in one of the preceding claims, wherein said actuating mechanism (101) comprises a push-pull actuator and means pivotably connecting one end of said actuator to the crank (84) at the end of a second arm thereof.

5. The combination defined in one of the preceding claims, wherein said actuating mechanism (101) comprises a second crank (116), means (118) supporting said crank (116) for rotation about an axis parallel to the pivot axis provided by the first pivot means (80); a rotatable cam member (117) a cam follower (114) rotatably fixed to an arm (122) of said second crank (116) and cooperable with said cam follower to rock said crank about said parallel pivot axis (118) as said cam member (117) is rotated; and means for pivotally connecting the opposite end (127) of the push-pull actuator (120) to an arm (126) of said second crank.

6. The combination defined in claim 4, wherein said aerodynamic braking or lifting means is a braking means (130) and wherein the means for operating said aerodynamic braking means further comprises a hydraulic cylinder (168), said push-pull actuator being integrated with the piston rod (176) of the hydraulic cylinder.

**Patentansprüche**

1. Die Kombination von: einem Flugzeugflügel (20); einem Hilfsflügel (24) mit einer Tragflächenform, der sich entlang der Hinterkante des Flugzeugflügels erstreckt; eine stationäre Hilfsflügel-(24) -halteeinrichtung (76), die an den Flügel befestigt ist; eine erste Dreheinrichtung (80) nach der Vorderkante des Hilfsflügels zu zum drehbaren Befestigen des Hilfsflügels an der stationären Hilfsflügelhalteeinrichtung; eine aerodynamische Abheb- oder Bremsseinrichtung (22), die mittels einer Antriebsantriebn (101) in einem Winkel zu der Sehenebene des Flügels drehebbar entfaltet werden kann, wobei die Abheb- oder Bremsseinrichtung (22) eine verstaute Position hat, in der sie so in den Hilfsflügel (24) eingelegt ist, daß sie die Tragflächenform des Hilfsflügels fortsetzt; einer zweiten Dreheinrichtung (68) an der Vorderkante der Abheb- oder Bremsseinrichtung zu dem Hilfsflügel für die Verlagerung zwischen der verstaute Position und der entfalteten Position, wobei die Antriebsantriebn (101) eine Kurbel (84) umfaßt, die drehbar an dem Flügel (20) befestigt ist, wobei ein Arm (86) der Kurbel (84) drehbar mit einem Ende eines Glieds (85) verbunden ist, während das andere Ende des Glieds (85) drehebar mit der Abheb- oder Bremsseinrichtung (22) verbunden ist, wobei die Kurbel (84) und das Glied (85) derart dimensioniert sind, daß die drehbare Verbindung des einen Kurbelarms (86) mit dem Glied (85) in der verstauten Position axial mit der Achse der ersten Dreheinrichtung (80) fluchtet, dadurch gekennzeichnet, daß die Achse der zweiten Dreheinrichtung (68) vertikal mit der Achse der ersten Dreheinrichtung (80) fluchtet, wenn die Abheb- oder Bremsseinrichtung (22) verstaust ist; und daß die Antriebsantriebn (101) weiter derart dimensioniert ist, daß sich das Glied (85) in der entfalteten Position der Abheb- oder Bremsseinrichtung im wesentlichen vertikal erstreckt.

2. Die Kombination gemäß Anspruch 1, worin die Abheb- oder Bremsseinrichtung eine Abheb- oder Bremsseinrichtung (22) ist, und eine geteilte Klappe, die in die untere Seite des Hilfsflügels (24) hineinpaßt, wenn die Klappe in ihrer verstaun Position ist, und worin, wenn die Klappe in dieser Position ist, die Achse der zweiten Dreheinrichtung (68) direkt unter der Achse der ersten Dreheinrichtung (80) liegt.

3. Die Kombination gemäß Anspruch 1, worin die Abheb- oder Bremsseinrichtung eine Bremsseinrichtung ist und ein Bodengeschwindigkeits-spoiler (130) ist, der in die obere Seite des Hilfsflügels (24) hineinpaßt, wenn der Spoiler in seiner verstaun Position ist, und worin die Achse der zweiten Dreheinrichtung (140), wenn der Spoiler in dieser Position ist, direkt ober der Achse der ersten Dreheinrichtung (144) liegt.

4. Die Kombination gemäß Ansprüche 1 und 2, worin der Antriebsmechanismus (101) einen Druck-Zug-Antrieb und eine Einrichtung umfaßt, die ein Ende des Antriebs mit der Kurbel (84) an dem Ende eines zweiten Arms davon drehbar verbindet.

5. Die Kombination gemäß einem der vorhergehenden Ansprüche, worin der Antriebsmechanismus (101) folgendes umfaßt: eine zweite Kurbel (116), eine Einrichtung (118), welche die Kurbel (116) zur Drehung um eine Achse hält, die parallel


**Revendications**

1. Combinasion comprenant une aile (20) d’aé- ronef, un aileron (24) ayant une configuration à profil aérodynamique disposé le long du bord de fuite d’aile de l’aéronef, un dispositif fixe (76) de support d’aileron (24) fixé à l’aile, un premier dispositif à pivot (80) placé vers le bord d’attaque de l’aileron et destiné à fixer l’aileron au dispositif fixe de support d’aileron afin qu’il puisse pivoter, un dispositif aérodynamique de portance ou de freinage (22) qui peut être déployé en rotation par un dispositif de manœuvre (101) afin qu’il fasse un certain angle avec le plan de la corde de l’aile, le dispositif de portance ou de freinage (22) ayant une position rangée dans laquelle il se loge dans l’aileron (24) de manière qu’il prolonge la configura- tion du profil aérodynamique de l’aileron, un second dispositif (68) de pivotement placé au bord antérieur du dispositif de portance ou de freinage afin qu’il soit articulé sur l’aileron et se déplace entre la position rangée et la position déployée, le dispositif de manœuvre (101) comprenant un levier coudé (84) articulé sur l’aile (20), un premier bras (86) du levier coudé (84) étant articulé sur une première extrémité d’une bielle (85) dont l’autre extrémité est articulée sur le dispositif de portance ou de freinage (22), le levier coudé (84) et la bielle (85) ayant des dimensions telles que, dans la position rangée, l’articulation du premier bras (86) de levier coudé sur la bielle (85) est alignée axialement sur l’axe du premier dispositif pivotant (80), caractérisée en ce que l’axe du second dispositif pivotant (68) est aligné verticalement sur l’axe du premier dispositif (80) lorsque le dispositif de portance ou de freinage (22) est rangé, et le dispositif de manœuvre (101) a en outre des dimensions telles que, dans la position déployée du dispositif de portance ou de freinage, la bielle (85) est disposée en direction pratiquement verticale.

2. Combinasion selon la revendication 1, dans laquelle le dispositif de portance ou de freinage est un dispositif de portance (22) et constitue un volet divisé qui se loge aux côtés inférieurs de l’aileron (24) lorsque le volet est dans la position rangée, et dans lequel, lorsque le volet est dans cette position, l’axe du second dispositif pivotant (68) se trouve juste au-dessous de l’axe du pre- mier dispositif pivotant (80).

3. Combinasion selon la revendication 1, dans laquelle le dispositif de portance ou de freinage est un dispositif de freinage et constitue un volet de freinage au sol (130) qui se loge à la face supérieure de l’aileron (24) lorsque le volet est dans sa position rangée et, lorsque le volet est dans cette position, l’axe du second dispositif pivotant (140) se trouve juste au-dessus de l’axe du premier dispositif pivotant (144).

4. Combinasion selon l’une des revendications précédentes, dans laquelle le mécanisme de manœuvre (101) comporte un organe de manœuvre par poussée et traction et un dispositif d’articulation d’une première extrémité de l’organe de manœuvre sur le levier coudé (84) à l’extrémité de son second bras.

5. Combinasion selon l’une quelconque des revendications précédentes, dans laquelle le mécanisme de manœuvre (101) comporte un second levier coudé (116), un dispositif (118) de support du levier coudé (116) afin qu’il tourne autour d’un axe parallèle à l’axe de pivotement formé par le premier dispositif pivotant (80), un organe rotatif à came (107), un touche de came (114) fixé afin qu’il puisse tourner sur un bras (122) du second levier coudé (116) et coopérant avec le touche de came afin qu’il fasse tourner le levier coudé autour de l’axe parallèle de pivotement (118) lorsque l’organe à came (107) tourne, et un dispositif d’articulation de l’extrémité oppo- sée (127) de l’organe de manœuvre (120) par poussée et traction sur un bras (126) du second levier coudé.

6. Combinasion selon la revendication 4, dans laquelle le dispositif de freinage ou de portance aérodynamique est un dispositif de freinage (130), et le dispositif de commande du dispositif de freinage aérodynamique comporte en outre un vérin hydraulique (168), l’organe de manœuvre par poussée et traction étant intégré à la tige (176) de piston du vérin hydraulique.