PUBLISHED	J. KSOLL	Serial No.
MAY 25, 1943.	AEROPLANE SUPPORTING PLANE	245,580
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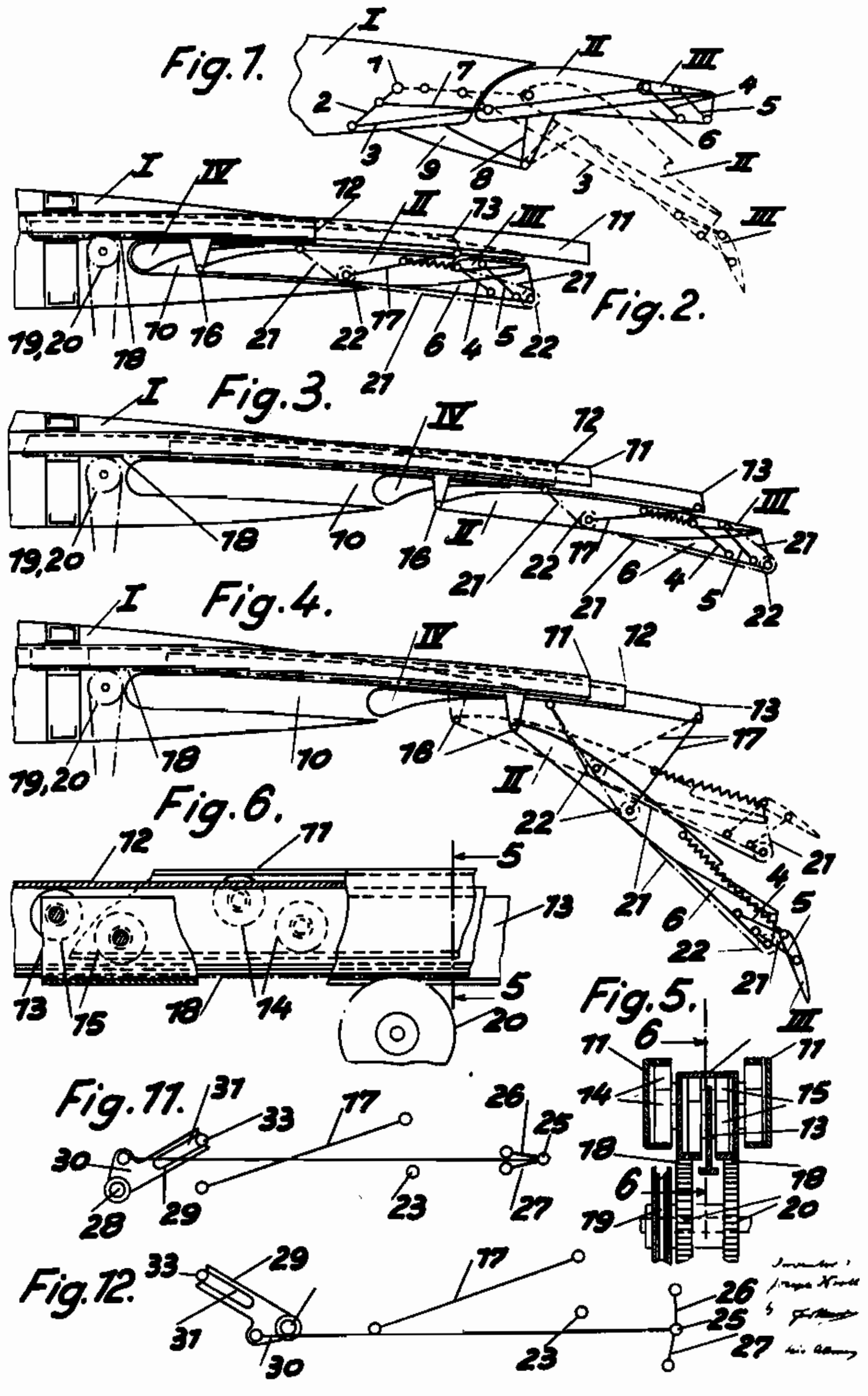

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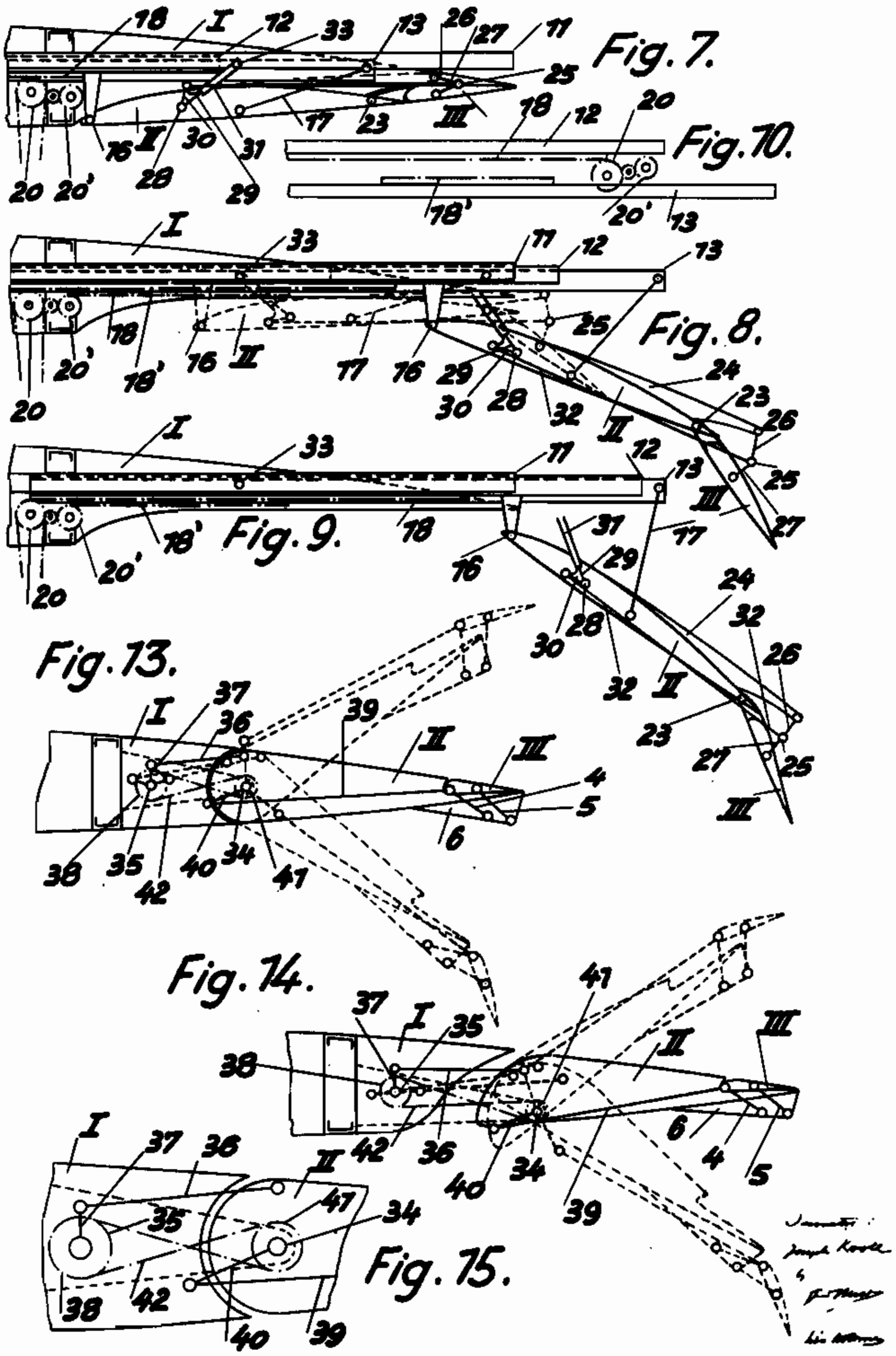

Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 13. Fig. 14. Fig. 15.

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ALIEN PROPERTY CUSTODIAN

AEROPLANE SUPPORTING PLANE

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This invention relates to an aeroplane supporting plane with two adjustable parts which in position of rest supplement the wings to form a wing of normal profile, these adjustable parts consisting of an aileron rotatable or rearwardly shiftable or both rotatable and rearwardly shiftable, and of a flap carried by the aileron and positively participating in the adjustment thereof. This flap, when the aileron is in its extreme position of adjustment, can assume a position positively set relative to the under side of the aileron and forming a gap therewith. In the known supporting planes of this type the flap is on the under side of the aileron even in the position of rest. As compared therewith the flap in the supporting plane according to the invention is arranged so that in its position of rest it is on a side other than the under side, for example on the upper or rear side of the aileron and can be swung about the rear edge of the aileron to be brought into the above mentioned extreme position of adjustment. This construction presents the advantage that for adjustment of the flap only relatively small operating means are necessary which do not considerably increase the weight of the aeroplane supporting plane and only give slight inducement to the formation of air resistances and eddy currents. At the same time the whole control mechanism becomes very rigid so that detrimental vibration of individual parts need not be feared.

Several embodiments of the invention are illustrated diagrammatically by way of example in the accompanying drawings, in which:

Fig. 1 shows a portion of a wing in side elevation,

Fig. 2 is a similar view of a second form of construction with the aileron and flap in inoperative position,

Fig. 3 is a similar view to Fig. 2 with the aileron and flap rearwardly displaced,

Fig. 4 is a similar view to Fig. 2 with the aileron and flap rearwardly displaced and swung down into the extreme adjusted position,

Fig. 5 shows the control mechanism in longitudinal section on line 5—5 of Fig. 6,

Fig. 6 is a cross-section on line 6—6 of Fig. 5,

Figs. 7 to 9 are similar views to Figs. 2 to 4 of a third form of construction,

Figs. 10 to 12 are diagrammatic views illustrating the operation of the aileron and flap,

Figs. 13 and 14 show two additional forms of construction in different adjusted positions,

Fig. 15 shows a detail of Fig. 13 on a larger scale.

In all forms of constructions I designates the wing, II the aileron, III the flap, the aileron II and flap III, when in their inoperative positions, supplement the wing to form a supporting plane of normal profile. Several similarly constructed control mechanisms must always be imagined as arranged side by side perpendicularly to the surface of the drawing.

In the form of construction illustrated in Fig. 1 the flap III is arranged within the profile of the aileron II in a recess in the upper side thereof. A control lever 2, rotatable about the axle 1 in the wing I, is connected by a link 3 with the nose of the flap III. This flap is supported by two links 4, 5 which are rotatably mounted in a plate 6 arranged on the under side of the aileron II. The control lever 2 is also connected at an intermediate point of its length to the nose of the aileron II by a link 7, and this aileron in its inoperative position bears without gap against the wing I and is rotatably mounted on a bottom bracket 9 of the wing I by means of an extension 8. If the control lever 2 is moved in clockwise direction into the extreme position illustrated in dot-dash lines, the flap III is swung about the trailing edge of the aileron II, and in this position the flap is positively set relatively to the under side of the aileron and a nozzle-like gap is formed between the two parts.

In the form of construction illustrated in Figs. 2 to 6 the flap III is also arranged within the profile of the aileron in a recess on the upper side thereof. The aileron II and the flap III, when in inoperative position (Fig. 2), are in a recess formed in the wing I at a distance from its upper and under side, from which recesses they can be rearwardly shifted into the position shown in Fig. 3. IV is a closing member arranged on the nose of the aileron II at a distance therefrom and closes the mouth of the recess 10 when the aileron II and the flap III are rearwardly shifted into the position illustrated in Fig. 3.

The control (Figs. 5 and 6) consist of two bars 11 of U-section fixed on the wing I with their open sides facing each other, a box-shaped bar 12 located between the bars 11 and having a longitudinal slot in its under side, and an inverted T-bar 13 whose web extends into the box bar through the longitudinal slot. The box bar 12 is longitudinally shiftable between the U-bars 11 and the T-bar 13 in the box bar 12. The box bar 12 is guided by rollers 14 on the inner walls of the U-bars 11 and the T-bar 13 by rollers 15 on the inner walls of the box bar 12. The closing member IV of the aileron II is fixed to the under side of the T-bar **13**. The box bar **12** carries on its under side the bearing for a transverse axle **16** about which the nose of the aileron II can oscillate. The aileron II is further connected by a link **17** with the end of the T-bar **13** projecting from the rear of the box bar **12**. The movement of the T-bar **13** in rearward direction is limited by an abutment (not shown) arranged on the U-bars **11** in its path or in that of its rollers **18**. The T-bar **13** and the box bar **12** are connected by a spring (not shown) which tends to move the T-bar **13** in rearward direction out of the box-bar **12**. The front end of the box bar **12** has two racks **18** on its under side meshing with two interconnected spur wheels **28** arranged on a common axle on the wing and adapted to be rotated by a srocket wheel **19** rotatable from the cockpit.

The flap III, as in the construction illustrated in Fig. 1, is carried by two supporting levers **4**, **5** which are rotatably mounted on a plate **6** fitted on the under side of the aileron II. At the nose end of the flap is attached one end of a rope which runs over two guide pulleys **22** mounted one on the rear end of the plate **6** and the other on the axle at the lower end of the link **17**, and whose other end is secured to the under side of the T-bar **13**. A spring between the aileron II and the flap III tends to retain the flap III in the recess in the aileron II.

When the sprocket wheel **19** is rotated, the box bar **12** and the T-bar **13** first move to the rear together until the T-bar or the rollers **15** of the same come into contact with the abutment (not shown). The aileron II, flap III and closing member IV located in the inoperative position (Fig. 2) in the recess **10** are then all together rearwardly shifted into the position shown in Fig. 3, in which the pivot axle **16** of the aileron II is outside the recess **10** and the closing member IV closes the rear mouth of this recess **10**. If the sprocket wheel **19** is turned further, while the T-bar **13** remains stationary, the box bar **12** alone continues to move in rearward direction, with the result that the aileron II is shifted beyond the position shown in dot-dash lines in Fig. 4 into the position shown in solid lines in this figure. Thus, a pull is exerted on to the rope **21** which results in the flap III being swung about the trailing edge of the aileron II into the position indicated in solid lines in Fig. 4 against the action of the spring between the flap III and the aileron II.

In the form of construction illustrated in Figs. 7 to 12 the aileron II and flap III are arranged the one behind the other in a recess provided in the under side of the wing.

As in the form of construction illustrated in Figs. 2 to 6 (see particularly Fig. 5) a box-shaped bar **12** movable between the U-bars **11** and a T-bar **13** movable in this box bar **12** are provided. The box bar **12** and the T-bar **13** are also in this form of construction connected by a spring (not shown) which tends to pull the T-bar out of the box bar and the aileron II can swing about a transverse axle **16** whose bearing is mounted on the box bar **12**. Moreover, the aileron II is connected to the T-bar **13** by a link **17**. The flap III is oscillatable about a transverse axle **23** arranged on the aileron II and connected to a jib **24** (Figs. 8, 9) on the aileron by means of two links **26, 27** connected by a pivot axle **25**, (See also Figs. 11 and 12). When the flap III is in its inoperative position, the links **26, 27** assume the position shown in Fig. 11 (folded position) and when the flap III is swung down they assume the spread position shown in Fig. 12. A spring (not shown) is between the jib **24** and the flap II and tends to pull the flap into its inoperative position and to thus return the links **26, 27** from their spread position (Fig. 12) into their folded position (Fig. 11).

In this form of construction not only the box bar **12** has a rack **18** in which a spur wheel rotatable from the cockpit meshes, as in the construction shown in Figs. 2 to 6 (see particularly Fig. 6), but also the T-bar **13** has a toothed portion **18'** (see also diagram of Fig. 10 in which for the sake of clearness the two bars are shown one below the other in the same plane). With this toothed portion **18'** meshes a small spur wheel **20** connected to the spur wheel **20** by intermediate wheels (only one of which is shown in the diagram), so that, when both the spur wheels **20, 20'** engage in their corresponding racks **18, 18'** and the spur wheel **20** is rotated, the box bar **12** moves more rapidly than the T-bar **12**. Furthermore, the two racks **18, 18'** (Fig. 8) are of different lengths and their mutual arrangement is such that when the aileron and flap being in inoperative position (Fig. 7) only the rack **18** and the spur wheel **20** but not the rack **18'** and the spur wheel **20'** are in engagement (Fig. 10) and the engagement between the two elements **18'** and **20'** only takes place when the T-bar **13** has been shifted to the rear a predetermined distance. On the other hand the rack **18** extends farther forward than the rack **18'** with the result that the box bar **12** can continue to move after the movement of the T-bar **13** has terminated.

The aileron II carries the pivot axle **28** of a bell crank lever **29, 30** (see also Figs. 11, 12) having a long arm **29** with a longitudinal slot **31** and a short arm **30** which, by a link **32**, is connected with the pivot axle **25** of the above mentioned lever **26, 27**. The slot **31** in the arm **29** is open at the extremity of this arm so that the arm **29** can cooperate in the following manner with a pin **33** fixed on one of the U-bars.

When the aileron II is in its inoperative position the lever arm **29** and pin **33** are in the position shown in Fig. 11, in which the pin **33** is standing just at the open end of the slot **31**. If the aileron II is then moved rearwards, the bell crank lever **29, 30** is actuated by the pin **33**, which moves first inwards and then outwards in the slot **31**, in such a manner that this lever **29, 30** is turned about its axle **28** out of the position shown in Fig. 11 into that shown in Fig. 12. In this position the pin **33** is once again at the open end of the slot **32** so that if the aileron II is moved farther in rearward direction the bell crank lever **29, 30** is not prevented from participating in this movement and from moving away from the pin **33** (Fig. 12 towards the ring). During the return movement of the aileron II, however, the arm **29**, provided the bell crank lever **29, 30** has not changed its angular adjustment in the meantime, again cooperates with the pin **33**, which then acts in the opposite sense to that in which it acted during the rearward movement of the aileron II, returns the bell crank lever **29, 30** into its initial position (Fig. 11). The above mentioned movement of the bell crank lever **29, 30** out of the position shown in Fig. 11 into that shown in Fig. 12 also results in the levers **26, 27** being shifted into the spread position shown in Fig. 12.

If the spur wheel **20** is rotated when the parts are in the inoperative position shown in Fig. 7, first only the box bar **12** will be shifted but, owing to the spring, (not shown) inserted between the box bar **12** and the T-bar **13**, the T-bar **13** will be shifted in the same direction. Therefore, the box bar **12** and the T-bar **13** move rearwardly together, the aileron II and the flap III participating in this movement. During this displacement of the bars **12**, **13** and of the aileron II and flap III the bell crank lever **29**, **30** is swung out of the position shown in Fig. 11, in the manner described, into that shown in Fig. 12. During this movement the link **32** presses the levers **26**, **27** gradually into the spread position Fig. 12, so that the flap III is swung downwards about the trailing edge of the aileron and positively set relative to the rear end thereof. The aileron and the flap are then in the position indicated in dot-dash lines in Fig. 8. In this position the engagement between the spur wheel **20'** (Fig. 10) and the rack **10'** on the T-bar **13** commences so that, from this moment onwards, this bar will also be rearwardly shifted but more slowly than the box bar **12**. The pivot axle **16** of the nose of the aileron II therefore approaches the upper point of articulation of the link **17** connecting the aileron to the T-bar **13**, so that the aileron II commences to swing downwards and passes into the position shown in solid lines in Fig. 8. This position is reached when the two bars have moved back so far that the front end of the rack **18'** stands opposite the spur wheel **20'**. At this moment the sliding movement of the T-bar **13** which is possible is ended by an abutment (not shown) in the path of the T-bar **13** or of the guide rollers **15** (Figs. 5, 6) of the same, so that further rotation of the spur wheel **20** merely leads to additional rearward displacement of the box bar **12**, which results in a further turning of the aileron II in the positive sense into the position shown in Fig. 9.

During the whole of the displacement of the aileron from the position shown in Fig. 8 into that shown in Fig. 9 the flap III remains in the positively adjusted position relatively to the trailing edge of the aileron. The bell crank lever **29**, **30** cannot turn automatically about its axle **28** because, on the one hand, the arm **30** of this bell crank lever **29**, **30** is below the dead centre position of this lever arm determined by the position of the link **32** and, on the other hand, the above mentioned, now tensioned spring (not shown) which is introduced between the jib **24** of the aileron II and the flap III, and also the air pressure acting on the flap III in the same direction as this spring, tend to move the arm **30** of the bell crank lever **29**, **30** still further away from its dead centre position, instead of closer thereto. Consequently, the above mentioned condition is established namely that during the return movement of the aileron II into its initial position the bell crank lever **29**, **30** is swung back about the pin **32** out of the position shown in Fig. 12 into that shown in Fig. 11.

Figs. 13 and 14 show two modifications of a form of construction similar to that illustrated in Fig. 1. In one instance (Fig. 13) the aileron bears without gap against the wing, and in the other instance there is always a nozzle-like gap between the wing I and the aileron II when the aileron II is in its inoperative, swung down position.

The aileron II is oscillatable about a transverse axle **34** mounted on wing I. As in the construction illustrated in Fig. 1, the flap III is arranged within the profile of the aileron in a recess in the upper side thereof. The flap III is also in this instance supported by two links **4**, **5** which are pivotally mounted in a plate **6** on the under side of the aileron II.

A control lever **37** connected to the aileron II by a link **36** and a sprocket wheel **38** or a rope pulley are keyed on a common axle **35** in the wing I. A lever **40** connected with the nose of flap III by a connecting rod **39** and a sprocket wheel **41** (or rope pulley) connected with the opposite larger sprocket wheel **38** (or rope pulley) by a crossed chain gear **42** (or rope gear) sit loosely on the pivot axle **34** of the aileron II but are coupled the one with the other. If the control lever **37** is swung in clockwise or anti-clockwise direction the aileron II is swung downwards or upwards and at the same time the flap III is adjusted relatively to the aileron II through the intermediary of the lever system **39**, **40** in such a manner that a nozzle-like gap is formed between the aileron and flap.

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