June 3, 1924. 1,496,200

M. C. BAUMANN ET AL

AIRPLANE CONTROL

Filed Aug. 30, 1920 7 Sheets-Sheet 1

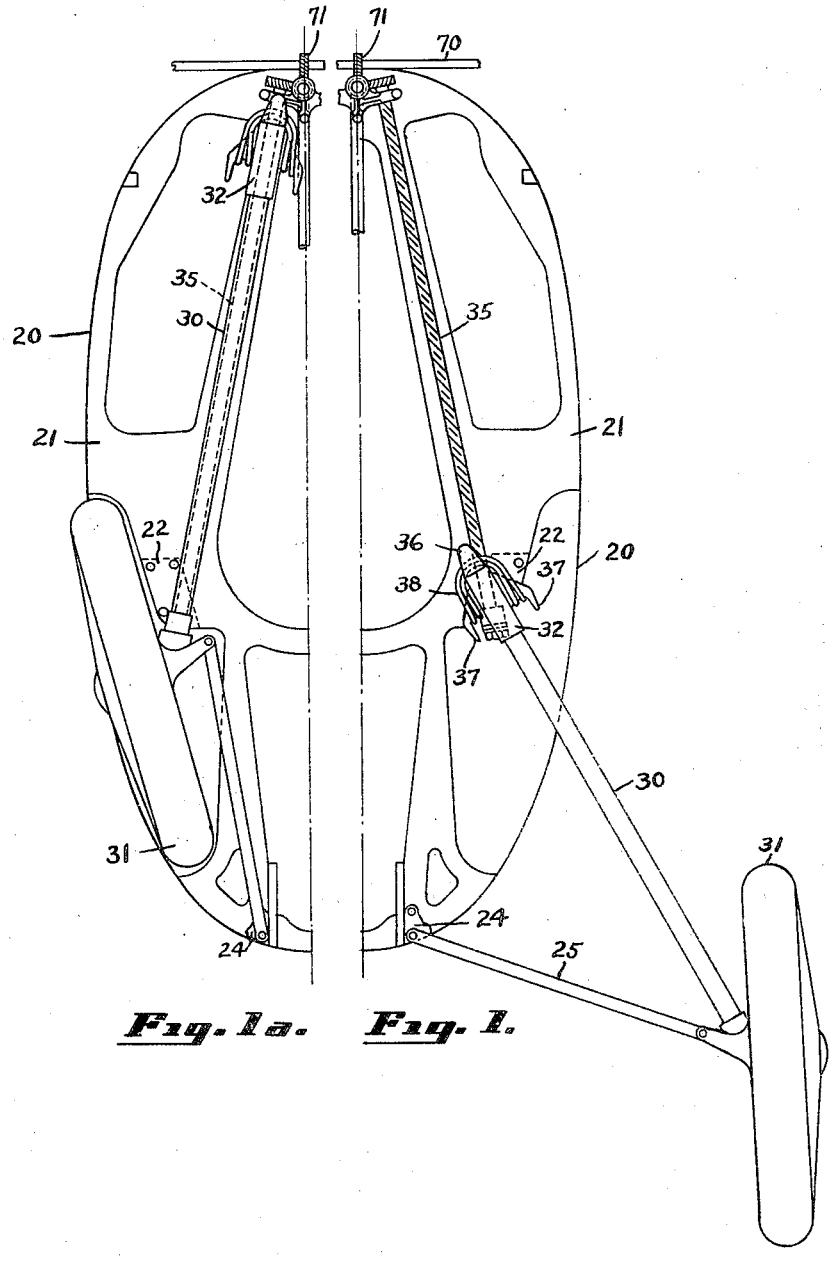

Fig. 1a. Fig. 1.

Witnesses
I. A. Greenwald
F. J. Hardman

Inventors
Milton C. Baumann
Howard M. Rinehart
By Francis D. Hardesty
Attorney

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M. C. BAUMANN ET AL

AIRPLANE CONTROL

Filed Aug. 30, 1920 7 Sheets-Sheet 2

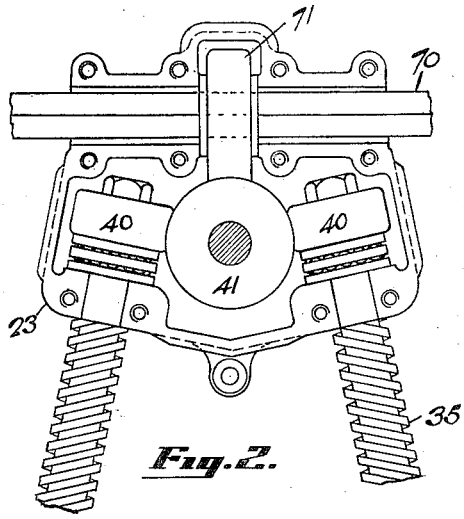

Fig. 2.

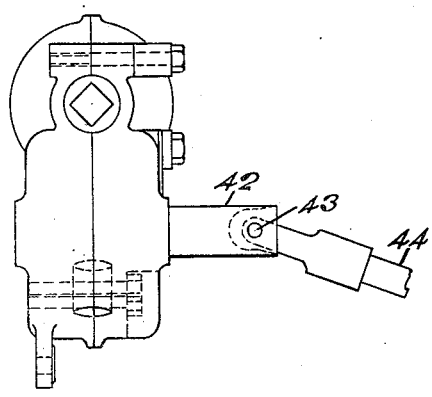

Fig. 3.

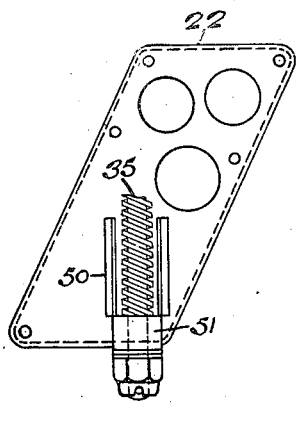

Fig. 4.

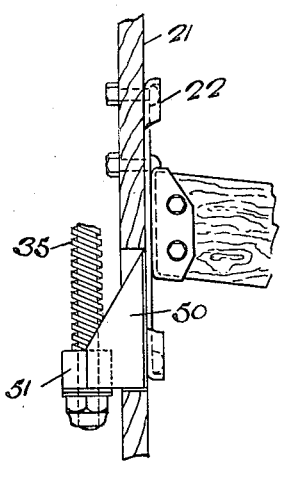

Fig. 5.

Witnesses
Spencer T. Hunt
L. Hale Emrick

By

Inventors
Milton C. Baumann
Howard M. Rinehart
Francis D. Hardesty
Attorney

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AIRPLANE CONTROL

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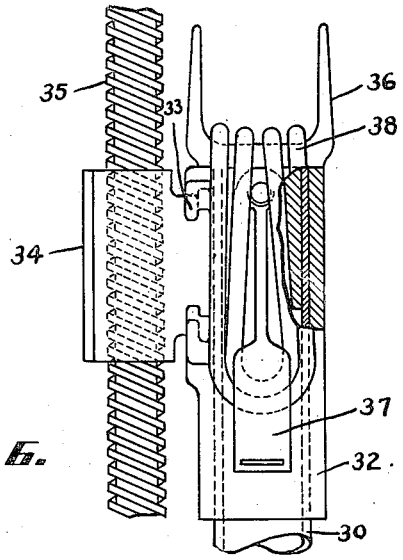

Fig. 6.

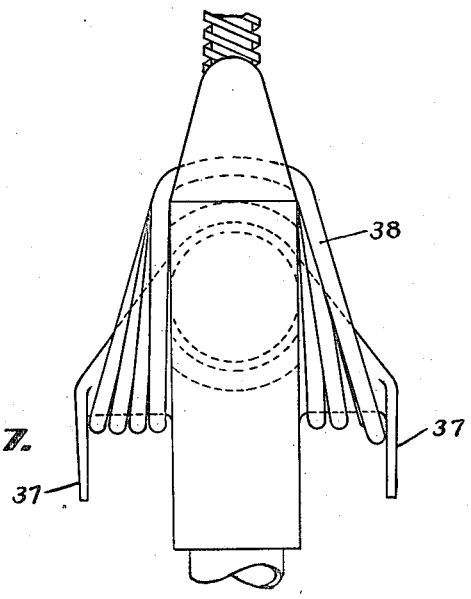

Fig. 7.

Witnesses

S. A. Greenwald

F. J. Hardman

By

Inventors

Milton C. Baumann

Howard M. Finehart

Francis D. Hardesty

Attorney

June 3, 1924. 1,496,200

M. C. BAUMANN ET AL

AIRPLANE CONTROL

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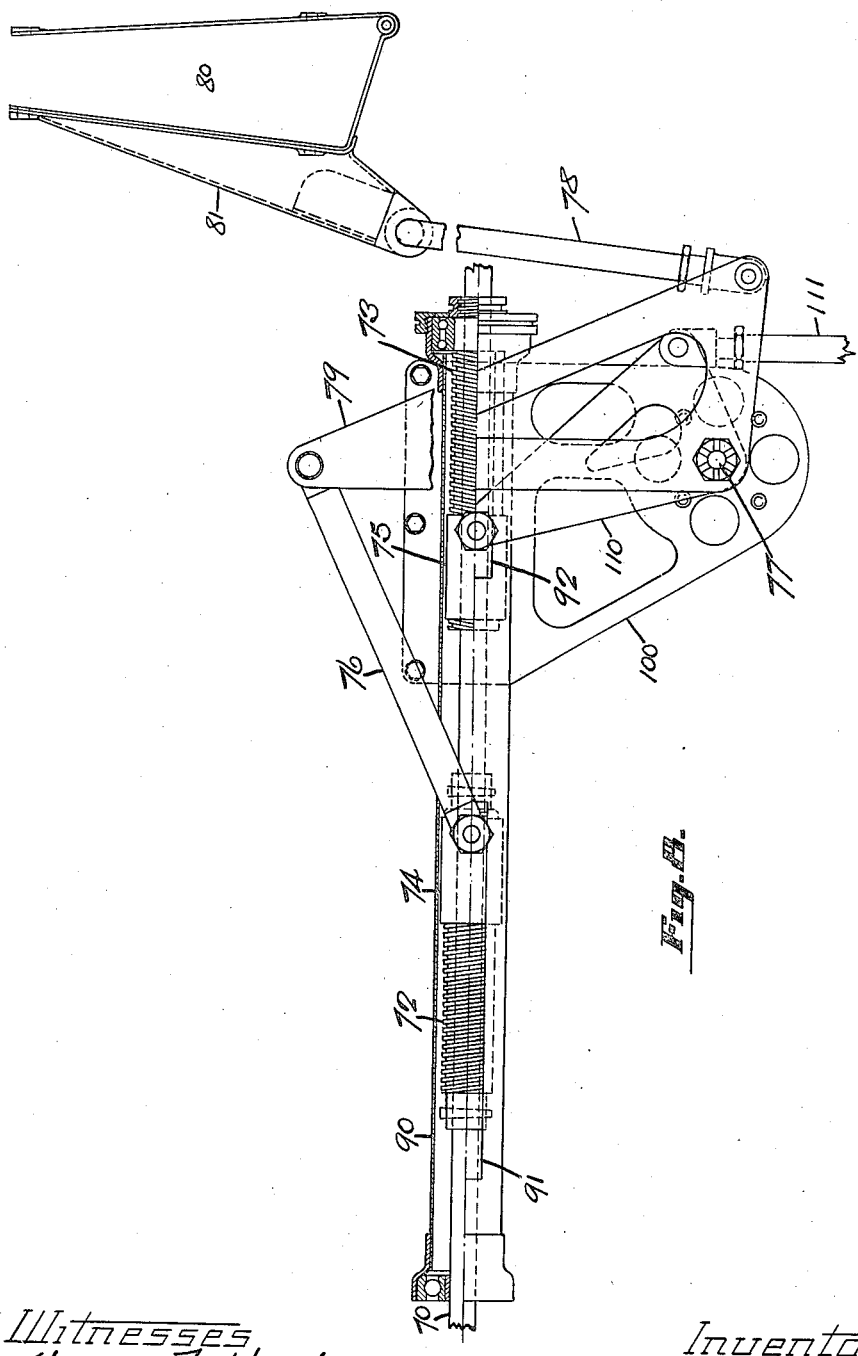

Fig. 4.

Witnesses
Spencer F. Hunt
L. Hale Emrick

By

Inventors
Milton C. Baumann
Howard M. Rinehart
Francis D. Hardesty
Attorney

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M. C. BAUMANN ET AL

AIRPLANE CONTROL

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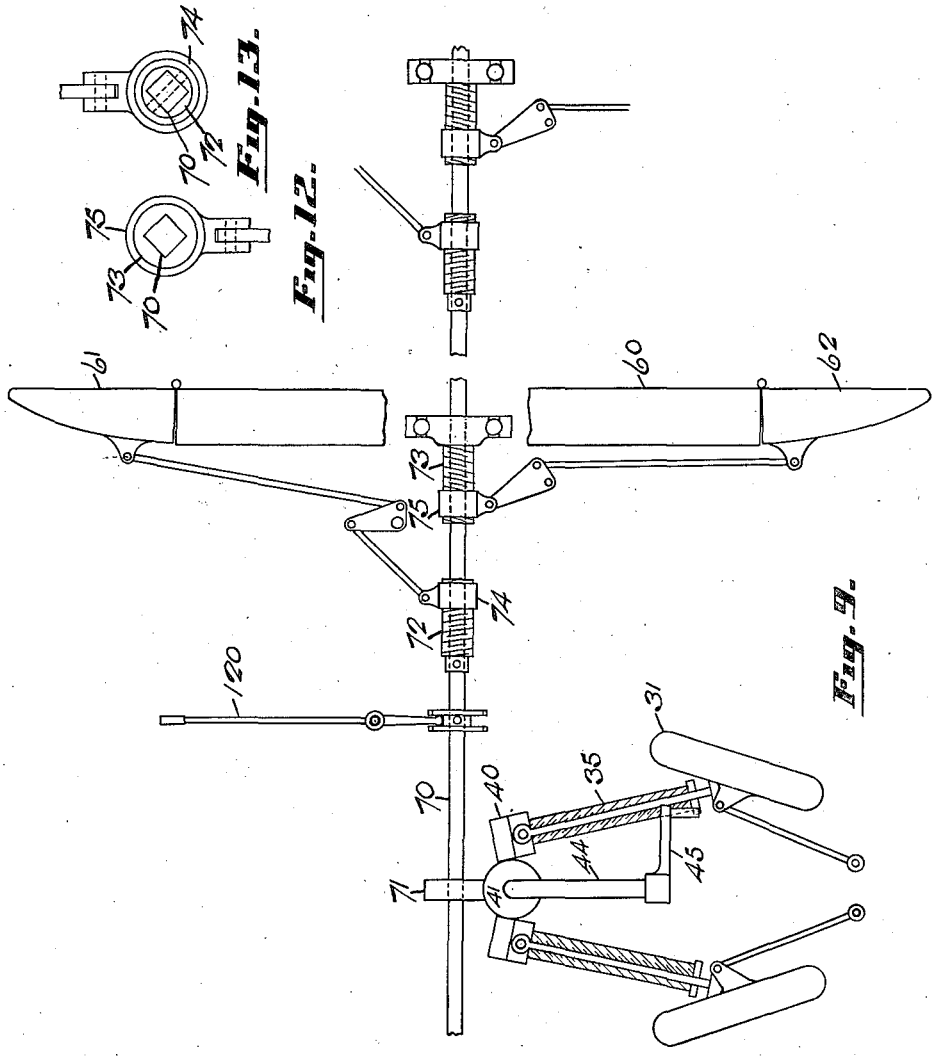

Fig. 13.

Fig. 12.

Fig. 9.

Witnesses
Spencer F. Hunt
L. Hale Emrick

By

Inventors
Milton C. Baumann
Howard M. Rinehart
Francis D. Hardesty
Attorney

June 3, 1924. 1,496,200

M. C. BAUMANN ET AL

AIRPLANE CONTROL

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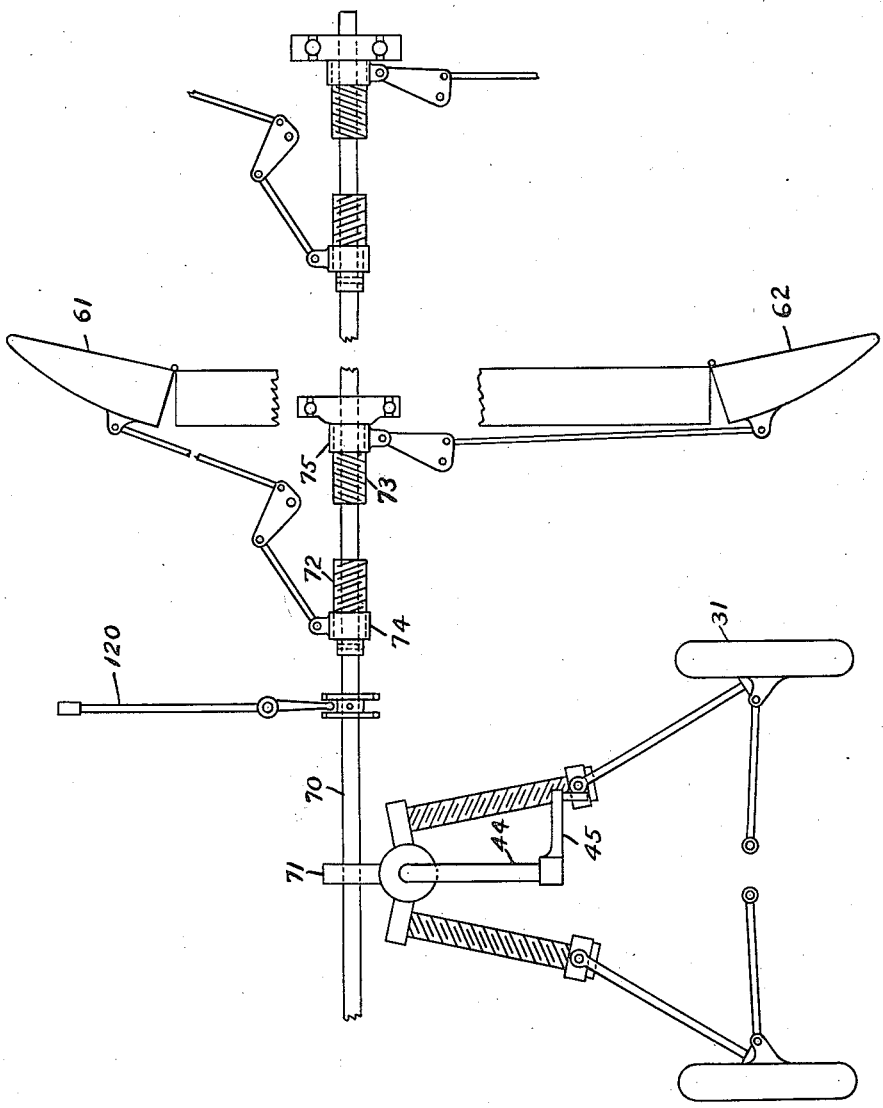

Fig. III.

Witnesses
I. A. Greenwald
F. J. Hardman

By

Inventors
Milton C. Baumann
Howard M. Rinehart
Francis D. Hardesty
Attorney

June 3, 1924. 1,496,200

M. C. BAUMANN ET AL

AIRPLANE CONTROL

Filed Aug. 30, 1920 7 Sheets-Sheet 7

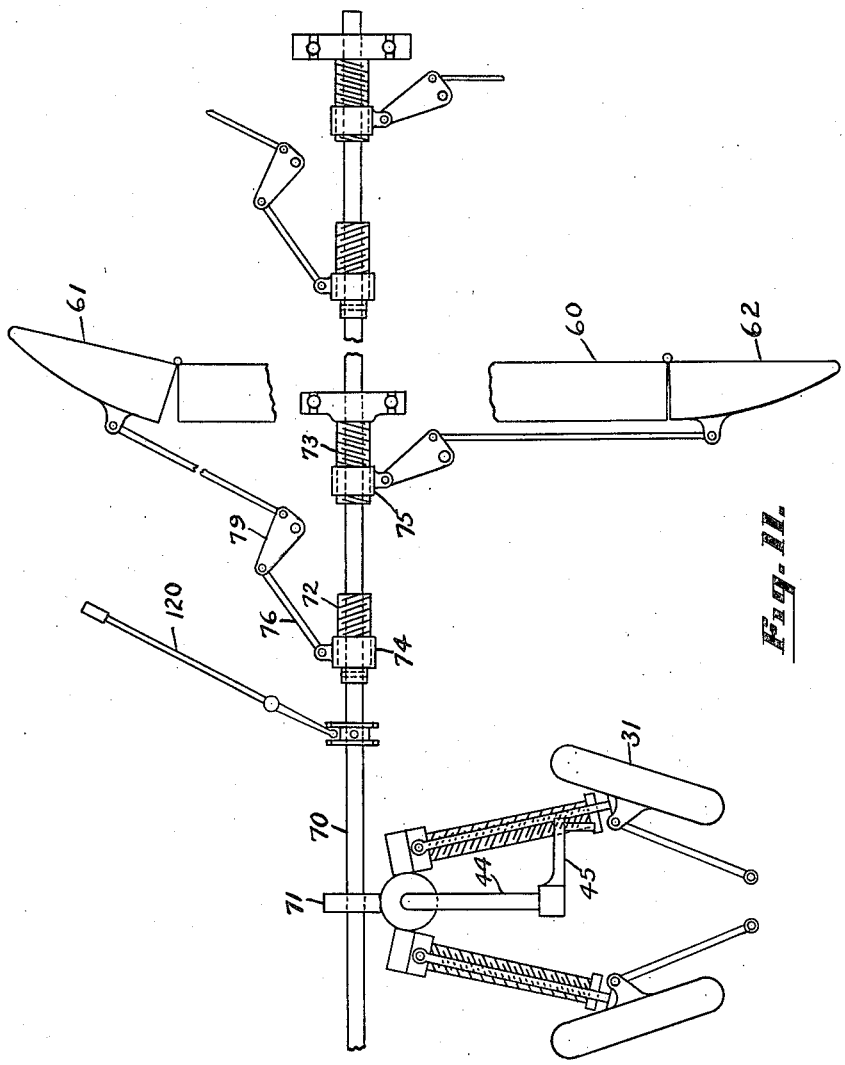

Fig. 11.

Witnesses
I. A. Greenwald
F. J. Hardman

By

Inventors
Milton C. Baumann
Howard M. Rinehart
Francis D. Hardesty
Attorney

Patented June 3, 1924. 1,496,200

UNITED STATES PATENT OFFICE.

MILTON C. BAUMANN AND HOWARD M. RINEHART, OF DAYTON, OHIO, ASSIGNORS TO DAYTON-WRIGHT COMPANY, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

AIRPLANE CONTROL.

Application filed August 30, 1920. Serial No. 406,765.

To all whom it may concern:

Be it known that we, MILTON C. BAUMANN and HOWARD M. RINEHART, citizens of the United States of America, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Airplane Controls, of which the following is a full, clear, and exact description.

The present invention relates to airplanes and particularly to controls therefor.

In airplanes designed and built for speed rather than weight carrying, one of the limiting factors is the landing speed. Many attempts have been made to overcome this difficulty by various means but with only a small measure of success. This objection is readily understood when it is noted that with some very fast airplanes, a landing speed of a hundred miles an hour or more is necessary.

Among the objects of the present invention therefore is to overcome this difficulty by materially decreasing the landing speed but at the same time permit very high flying speed.

Another difficulty encountered with fast airplanes is the air resistance offered by the landing gear, wheels, etc. And it is another object of the present invention to substantially eliminate this air resistance.

Other objects and advantages of the present invention, will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawings:

Figure 1 indicates one half of a bulkhead of an airplane, carrying the landing gear mechanism and showing the wheel in the landing position.

Fig. 1ª is a corresponding view of one half of an airplane showing the wheel in flight position.

Fig. 2 shows a gear box at the top of the retracting worm, with the rearward cover and certain other parts removed.

Fig. 3 is a side elevation of the gear box showing the universal joint in position.

Fig. 4 shows the plate carrying the bearing for the lower end of the retracting worm.

Fig. 5 shows this plate in position upon the bulkhead illustrated in Figs. 1 and 1ª.

Fig. 6 is a detail of the swivel connecting the top end of the wheel-carrying rod with the retracting worm.

Fig. 7 is an elevation from the right hand side of the detail shown in Fig. 6.

Fig. 8 is a plan view with parts in section and parts removed of the mechanism for changing the camber of the wing.

Fig. 9 is a diagrammatic representation showing the relation of the several elements of the entire mechanism when in flight position.

Fig. 10 is a similar diagrammatic representation showing the parts in landing position.

Fig. 11 is another diagrammatic representation showing the method of operating the ailerons independently of the mechanism for changing the camber.

Figs. 12 and 13 are details of Figs. 9 to 11 inclusive.

In the drawings and descriptive matter following, there is described in some detail a particular form of retractible landing gear which has been found to be satisfactory for airplanes and which admits of easy and effective combination with the mechanism for changing the camber. However, the invention relates more particularly to the means for changing the camber and the combination between such means and a retractible landing gear.

The claims will be drawn to this camber mechanism and the combination between it and a retractible landing gear, as the latter forms the subject matter of an application which is being filed contemporaneously herewith.

In the drawings, in Figs. 1 and 1ª, 20 indicates the shell of an airplane fuselage built up upon a bulkhead 21. This bulkhead 21 carries the mechanism of the landing gear, which mechanism is securely attached thereto by means of plates 22, gear box 23 (in Figs. 1 and 1ª the gears are shown without the gear box for sake of clearness), and plate 24.

The mechanism for the landing gear comprises a rod or spindle member 30 which carries at its lower end a spindle for the wheel 31, the upper end of this member 30 forming a sliding joint within a sleeve 32 which carries one member of the swivel joint 33, the other member of the swivel being upon an internally threaded sleeve 34 co-

operating with threads upon a rotatable worm 35.

Member 30 is provided at its top with a fork 36 and the sleeve 32 is provided with oppositely extending fork members 37 for the retention of elastic cord 38 acting to prevent free sliding of member 30 within sleeve 32 and also acting as a shock absorber when the plane is about to land.

The retracting worm 35 is provided with suitable bearings in plate 22 and gear box 23 and is in fixed position with respect to the airplane and landing gear, being rotatable by means of a spiral gear 40 fixed to its upper end and coacting with spiral gear 41. This spiral gear 41 is also within gear box 23, and is rotatable through its shaft 42, universal joint 43 and rod 44. Rod 44 extends to the instrument board and is provided at its end with a crank 45 as indicated in Figs. 9, 10 and 11.

It will be understood as is clearly indicated in Figs. 1, 1ª and 2, that there is provided for each of the two wheels of the landing gear a member 30, and a retracting worm 35 with its gear 40, these worms being operated by a single gear 41 through rod 44 and crank 45.

It will also be understood that while a single brace rod 25 has been shown extending from the lower side of the fuselage toward the wheel, any suitable number of these brace rods may be used and in the construction that we have found satisfactory two of such rods were employed, these rods intended for and serving to take shocks upon the wheel longitudinal of the fuselage when the plane is running upon the ground.

In Figs. 4 and 5 there is shown in detail the plate carrying the lower end of the retracting worm. As will be noted this plate is securely fastened to one side of the bulkhead 21 and is provided with a stirrup 50 brazed to plate 22 and extending through a suitable slot in the bulkhead. This stirrup carries a suitable bearing 51 for the lower end of the retracting worm 35.

While as mentioned above this landing gear has been described in detail, it will be readily understood that any form of retractible landing gear may with minor modifications be combined with the mechanism for changing the camber which will now be described.

The form of airplane wing to which the present invention is most suitable is indicated in Figs. 9, 10 and 11 at 60. This wing comprises a central portion 60 which is fixed with reference to the remainder of the airplane and two hinged edges 61 and 62. Of these movable edges, the edge 61 is the trailing edge and is operable as an aileron while the edge 62 is the entering or forward edge of the plane and is operable only through the camber changing mechanism.

The camber changing mechanism comprises a longitudinal shaft 70 upon which is a worm gear 71 located within the gear box 23 and operated by gear 41. This shaft may extend a suitable distance either way from the gear box and carry the camber changing mechanism and be slidable as a whole within gear 71, or there may be a short section of the shaft fixed within gear 71, the slidable portions of the shaft, described later, being attached to the short central portion by means of slip joints.

Whichever of these two structures is used, the portion of shaft 70 operating the camber changing mechanism is of angular cross section, preferably square, and carries at a suitable distance from the central line of the fuselage two worms 72 and 73 shown clearly in Fig. 8. Of these two worms, the former, 72, is pinned to the shaft and the latter, 73, is slidable thereon but in fixed position with relation to the central portion 60 of the airplane wing.

Carried upon these two worms 72 and 73 and coacting therewith are two internally threaded sleeves 74 and 75. To sleeve 74 is attached a bell crank 79 through link 76. This crank 79 is pivoted at 77 and operates the aileron indicated at 80 through link 78 attached to its other arm or corner. The aileron 80 is provided with a suitable mast 81 for attachment of the link 78. In Fig. 8 the elements 72 to 74 inclusive, are indicated as being within a casing or tube 90 provided with two slots 91 and 92 permitting the operation of the sleeves 74 and 75, and their attachments. Also in this figure the aileron 80 is indicated as operating in a plane at right angles to the actual plane of operation.

The pivot point 77 for crank member 79 is represented as upon a side plate or attaching plate 100 for the casing 90. Also attached at this pivot point 77 is another crank member 110 operating in fashion similar to crank member 75 but attached through link 111 to the entering edge of the plane (not shown).

The mechanism shown in Fig. 8 will be duplicated for both wings, there being as many of these units as may be necessary, depending upon the wing spread.

The operation of this device for controlling the camber of the wings, it is thought will be quite obvious from the description and drawings but the following should be noted.

Worms 72 and 73 are provided with oppositely pitched threads. As shown in Fig. 8, worm 72 is indicated as having a right hand thread and 73 as having a left hand thread. The effect of this is to draw the sleeves 74 and 75 together or push them apart upon rotation of shaft 70. By this means, rotating the shaft 70 in one direction will change the camber of the wing

from flight position to landing position and rotation of the shaft in the other direction will change the camber from landing position to flight position.

In Figs. 9, 10 and 11 are three diagrammatic views showing the several elements in flying position, landing position and flying position with the aileron down, respectively. The operation of the combined mechanisms is clearly indicated in these three figures and is as follows:

When the machine is in flight, the wheels will be retracted and in the position indicated in Figs. 1ª, 9 and 11. In this position also the entering edge of the plane 62 will be in the position indicated in Figs. 9 and 11, and the aileron 61 will be in the position indicated in Fig. 9.

While in flight, in order to utilize the ailerons for control, suitable mechanism is provided whereby the shaft 70 may be moved longitudinally of the wings as by lever 120 as indicated in Fig. 11, carrying with it, the worm 72 and the sleeve 74 and operating through crank member 79 to move the aileron either up or down depending upon the desire of the operator. In this operation the worm 73 which is in fixed position longitudinally, through its bearing and casing 90, remains in position and retains in flight position the entering edge 62 of the plane.

When the operator desires to land it becomes necessary for him to extend the landing gear and at the same time increase the camber of the wings so as to decrease the landing speed of the plane. This is readily accomplished by rotating the crank 45 upon the instrument board, thus operating gears 41 and 40, worms 35 and the coacting parts to lower the wheels 31 to landing position. At the same time the shaft 70 is rotated by gear 71 causing the worms 72 and 73 to push apart the sleeves 74 and 75, thus operating the crank members 79 and 110 and lowering the entering edge and aileron 62 and 61 respectively into the position shown in Fig. 10.

An alternative arrangement of the camber operating mechanism and aileron control involves the fixing of the pivot point for crank member 79 by means of the aileron operating lever. In such construction the crank member 79 is attached to sleeve 74 at one corner, to the link 78 operating the aileron at a second corner, and at the third corner is attached to a cable or other suitable means; which cable is movable longitudinally by the operating lever in the cock pit of the plane. This arrangement permits the operation of the two edges simultaneously upon rotating the shaft 70 and in such case the crank 79 travels around its connection with the cable attachment as a pivotal point. On the other hand, when the aileron is operated alone, the crank member 79 will travel around its connection with the sleeve 74 as a pivotal point.

While there has been described a specific embodiment of the invention and a form of construction which has been found entirely satisfactory and operable in actual practice, nevertheless, it should be noted that many of the details herein described and shown may be varied without materially increasing or decreasing the effectiveness of the mechanism and it is contemplated that any such changes might be made. However, the form of embodiment shown and described is the preferred one and has been chosen for the purpose of description.

While the present invention has been specifically described as applied to airplanes built and designed for speed rather than weight carrying, it should be noted that the application of the invention to any type of plane whether for speed or weight carrying, will materially increase the efficiency of the plane and safety in landing.

While the form of mechanism herein shown and described, constitutes a preferred form of embodiment of the present invention, it is to be understood that other forms might be adopted, all within the scope of the claims which follow.

What we claim is as follows:

1. In an airplane, means for retracting the landing gear, means for decreasing the camber of the supporting planes, and common means for simultaneously operating both said first and second named means.

2. In an airplane, a retractible landing gear in combination with means for automatically changing the camber of the planes to correspond with the position of the landing gear.

3. In an airplane, a retractible landing gear, means for operating said gear, and means coacting with the operating means for changing the camber of the planes.

4. In an airplane, a retractible landing gear, operating means for said gear, means cooperating with said operating means to change the camber of the planes.

5. In an airplane, means for changing the camber of the plane comprising a rotatable and slidable shaft extending longitudinally of the plane, means operable by rotating the shaft for changing the camber of both entering and trailing edges of the plane, and means operable by sliding the shaft longitudinally of the plane for changing the camber of only the trailing edge of the plane.

6. In an airplane, a wing comprising a medial portion fixed relative to the fuselage, entering and trailing edges movable relative to the medial portion, a rotatable and slidable shaft mounted within the medial portion and extending longitudinally therewith, means operable by one motion of said shaft

for changing the position of both entering and trailing edges of the plane, and means operable by the other motion of said shaft for changing the position of the trailing edge only.

7. In an airplane, a wing comprising a medial portion fixed relative to the fuselage; entering and trailing edges hinged thereto; means, mounted upon the medial portion for raising or lowering both said edges while in flight, and a retractible landing gear, the means for operating the latter, cooperating with the means for raising and lowering the said edges.

8. In an airplane having variable camber wings, in combination, a retractible landing chassis, means for varying the camber of said wings, and a rotatable shaft operable for retracting the chassis and for varying the wing camber.

9. In an airplane having a variable camber wing and an aileron for banking, in combination, a shaft extending longitudinally of said wing and having means for independently giving it a rotary or sliding movement, means operable by rotating said shaft for changing the camber of said wing, and means operable by sliding said shaft for changing the position of the aileron.

10. In an airplane having a variable camber wing and an aileron for banking, in combination, a shaft extending longitudinally of said wing and having means for independently giving it a rotary or sliding movement, means operable by one of said movements of said shaft for changing the camber of said wing, and means operable by the other of said movements of said shaft for changing the position of said aileron.

In testimony whereof we hereto affix our signatures.

MILTON C. BAUMANN.
HOWARD M. RINEHART.

Witnesses:
ROBERT E. SMITH,
ALVINA LEHMAN.