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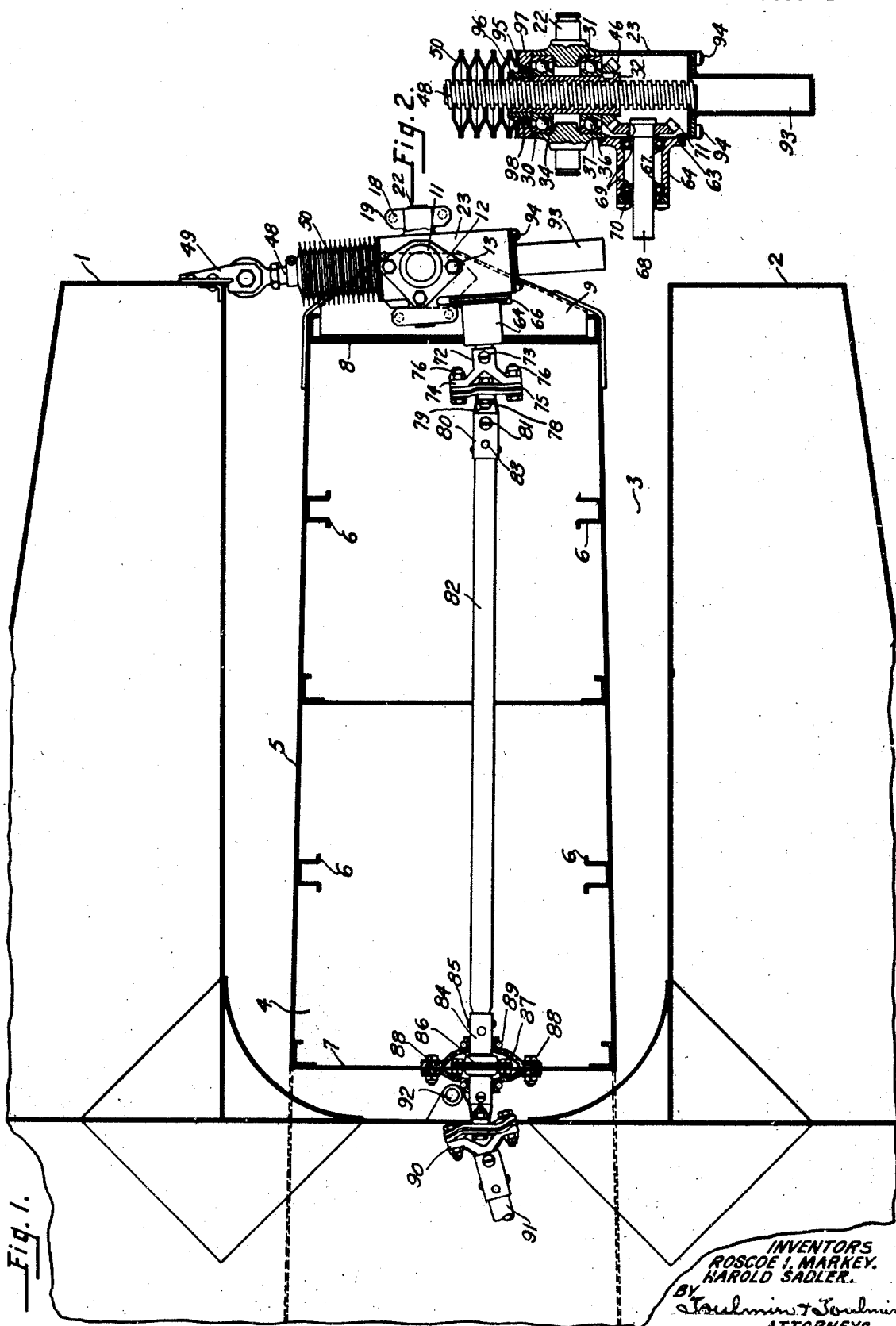
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2 Sheets-Sheet 1



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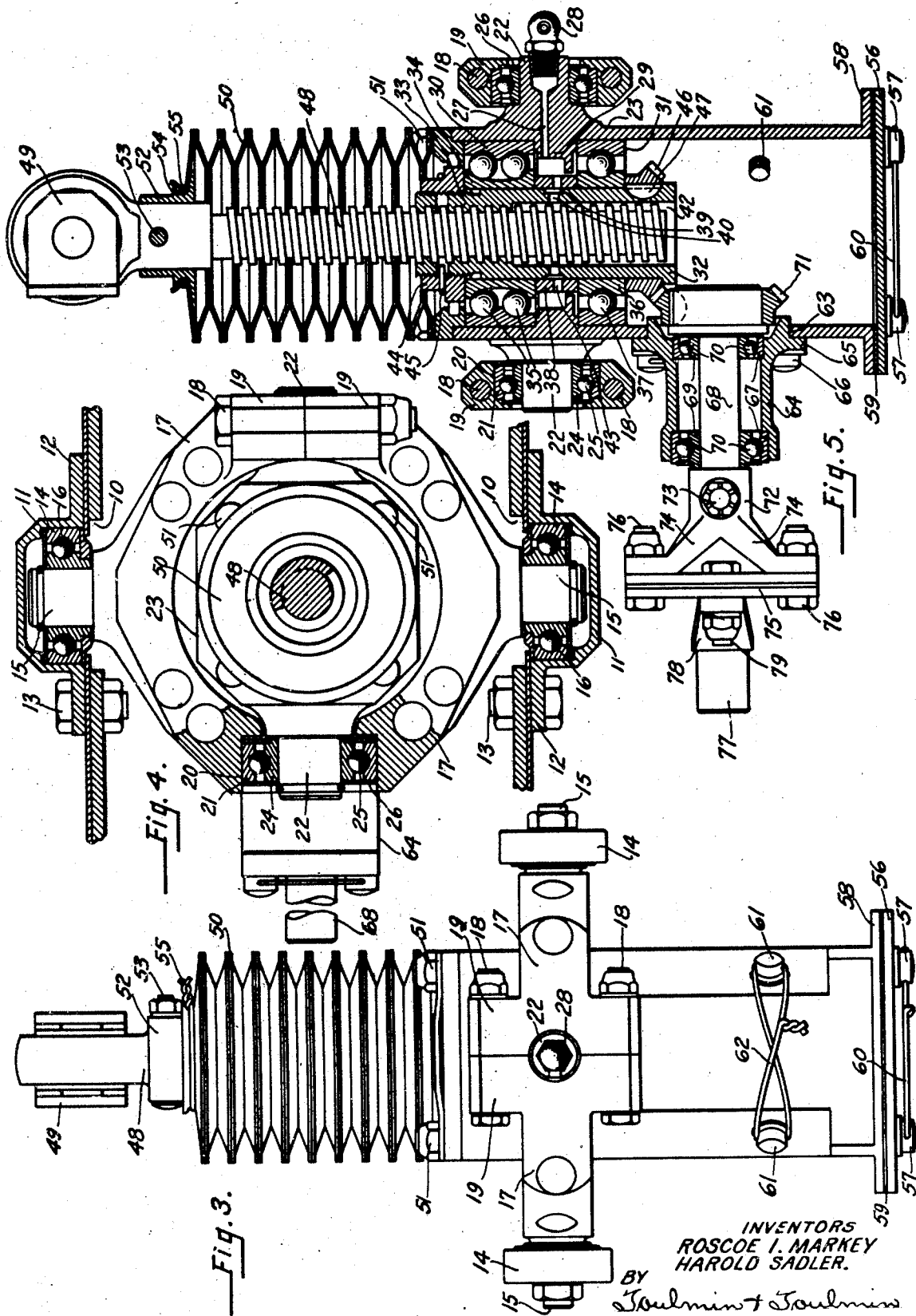
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UNITED STATES PATENT OFFICE

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AIRPLANE STABILIZER STRUCTURE

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23 Claims. (Cl. 244—29)

This invention relates to improvements in stabilizers for airplanes, and has for its object to provide an adjustable stabilizer, with means therein for adjusting the stabilizer.

5 It is also an object of this invention to provide a stabilizer that is adjustable and in which all of the adjusting elements except an adjusting screw move with the stabilizer.

10 It is also an object of this invention to provide, in connection with an adjustable stabilizer, means for adjusting the stabilizer and means for operating the adjusting means connected to the adjusting means by a universal joint construction so that any change in the angle of the stabilizer
15 will not interfere with the proper operation of the adjusting means.

20 It is a further object of this invention to provide a stabilizer which is so pivoted that its rear end will move up and down, with means attached thereto for properly moving the rear end up and down, said means comprising a casing or housing inclosing operating structures, and containing a
25 lubricant for operating all bearing parts.

It is also an object of this invention to provide
30 a stabilizer and means for adjusting it, in which all of the operating parts are supported by ball bearings immersed in a lubricant.

These and other advantages will appear from the following description taken in connection with
35 the drawings.

Referring to the drawings:

Figure 1 is a vertical, longitudinal section through the rear end of the fuselage and the stabilizer, and operating means attached thereto.

35 Figure 2 is a vertical, longitudinal section through one form of stabilizer operating means.

Figure 3 is a rear elevation of a slightly modified form of a stabilizer operating mechanism.

40 Figure 4 is a horizontal section through one end of the stabilizer, showing the manner in which the stabilizer operating means is attached to the stabilizer. This figure also shows the stabilizer operating means partly in section.

45 Figure 5 is a vertical section through the stabilizer operating means shown in Figure 3.

50 In Figure 1 there is shown the rear end of the fuselage, which is divided into an upper part 1 and a lower part 2, separated from each other by an intervening space 3 in which a stabilizer 4 is located. The part of the stabilizer located between the parts 1 and 2 is in the form of a box-like construction 5, which has therein longitudinally extending brace members 6 on both the top and the bottom for giving longitudinal rigidity
55 and strength to the stabilizer.

At the front end of the box-like construction is a vertically disposed member 7 which forms the front wall of the box-like part. At the rear is an end 8 which serves to support and space the upper and lower parts of the box. Extending rearwardly from the rear end of the box part are two
60 flanges 9, in each of which is a hole 10. These holes are in alignment, and each flange has thereon, over the hole, a cap 11 which is attached to the flange 9 by means of a laterally extending
65 flange 12 through the instrumentality of bolts 13.

In each cap 11 is a bearing member 14 which supports for rotation a trunnion 15 mounted on a ring member composed of two halves 17. Each trunnion is mounted upon one of the halves 17.
70 Around the trunnion and forming part of the bearing member are ball bearings 16. The two halves of the ring member are fastened together by means of bolts 18 through flanges 19, as clearly shown in Figure 3.

75 At the points where the flanges 19 unite are circular cavities 20, in each of which there is a bearing ring 21. Fitting within the ring is a cylindrical casing or housing 23, which has extending in opposite directions from the sides thereof, 80 trunnions 22. Each trunnion has thereon a bearing ring 24 which is in spaced relationship with one of the bearing rings 21. Between the bearing ring 21 and the bearing ring 24 are anti-friction balls 25.
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The outer surface of the ring member around each trunnion 22 is slightly enlarged and is provided with a grease shield 26 located between the outer wall of the cavity 20 and the bearing ring 24. This shield serves to hold the grease
90 around the bearing rings and the balls and prevents its escape out at the ends of the trunnions. Extending through one of the trunnions is a grease passageway 27 which has in its outer end a grease valve 28.
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On the interior of the cylindrical casing or housing 23 is an annular projection 29. The passageway 27 extends through this annular projection. Above the annular projection and supported thereon is a bearing ring 30, and immediately beneath the annular projection is a second bearing ring 31. Supported within the casing or housing is a nut 32, which is threaded at its upper end 33 to receive a screw 48. On the upper end of the nut 32 is a bearing ring 34 which
100 cooperates with the ring 30 to form runways for balls 35, which serve as anti-friction balls and provide for the free rotation of the nut.

On the lower end of the nut 32 is a bearing ring 36 which cooperates with the bearing ring 31 in
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forming a runway for anti-friction balls 37. Between the bearing ring 34 and the bearing ring 36 is a spacer ring 38, which forms one wall of an annular grease chamber 39 located in the periphery of the nut intermediate its ends.

Extending from this chamber are one or more holes 40 for the passage of a lubricant. These holes 40 pass into an enlarged part 42 of the nut, below the threaded part 33. In the spacer ring are holes 43 which lead from the grease chamber 39 into a cavity between the spacer ring and the projection 29. On the lower edge of the projection 29 is an annular ledge 41, which extends nearly to the spacer ring 38 and cooperates with this ring in forming a lubricant chamber into which the passageway 27 enters, and which is connected by means of the holes 43 with the grease chamber 39.

On the upper end of the nut 32 is a locknut 44 locked in fixed adjusted position by means of a wire 45, which has its ends extending through the nut 44 into the nut 32. On the lower end of the nut 32 is a gear 46 which bears against the under surface of the bearing ring 36 and is held on the nut by means of a key 47. The screw 48 is threaded into the nut 32 and is moved longitudinally with respect to the nut and the housing by means of the gear 46.

The end of the screw which projects out of the housing or casing 23 has thereon a bracket 49, by means of which it is attached to some part of the fuselage so that the screw is practically stationary and the housing moves with relation to the screw and the part to which the screw is attached. For the purpose of protecting the exposed part of the screw there is provided an expansible casing composed of a plurality of rubberized fabric rings 50, united to form a bellows-like structure. The fabric ring adjacent the casing or housing 23 is attached to the casing or housing by means of bolts 51.

Near the free end of the screw is a collar or sleeve 52 fastened to the screw by means of a pin or bolt 53. This collar has around its periphery an annular groove 54, in which the upper fabric ring rests and is held by means of a wire 55 looped around the ring and around the collar. This construction is shown more fully in Figure 3. The bottom of the casing or housing 23 is closed by means of a closure plate 56. This plate is fastened to the housing by means of screws 57 which pass through the plate into flanges 58 on the lower end of the housing or casing.

Between the flange 58 and the plate 56 is a gasket 59. The screws used for fastening the plate to the housing have attached thereto wires 60 to prevent their rotation so that the plate cannot become easily detached from the housing. In the walls of the housing or casing 23 are holes, which are stopped by means of screw plugs 61. These plugs are connected by lock wires 62 to prevent their becoming detached.

In one side of the casing or housing 23 is a circular hole 63, into which one end of a sleeve 64 projects. Around this projecting end of the sleeve 64 is a flange 65, which abuts the side of the casing and is attached thereto by means of screws 66. In each end of this sleeve 64 is a bearing ring 67. Extending through the sleeve 64 into the housing is a shaft 68, which has thereon bearing rings 69. Between each bearing ring 69 and a bearing ring 67 are balls 70 so that this shaft is supported within the sleeve 64 by means of bearings, one in each end of the sleeve, so that

the shaft is supported by the sleeve for free rotation.

On the inner end of the shaft 68 is a gear 71 which meshes with the gear 46 on the lower end of the nut 32. On the outer end of the shaft 68 is a sleeve 72 attached thereto by means of a bolt 73, or similar instrumentality. This sleeve has two diverging arms 74, to the outer ends of which are attached discs 75 by means of bolts 76. A plug 77 has a pair of diverging arms 78 thereon. These arms are attached by means of bolts 79 to the discs 75 so that there is provided between the plug 77 and the sleeve 72 a universal joint connection.

On the plug 77, as shown in Figure 1, is a sleeve 80 attached thereto by means of a screw 81. In this sleeve there is also a shaft 82, attached to the sleeve by means of rivets, bolts, or other suitable means 83. In the front end of the box part 5 of the stabilizer is a shaft 84 attached to the shaft 82 by means of rivets 85. The shaft 84 is supported by bearings 86 attached to the wall 7. Attached to each side of the wall 7, that is the inside and the outside, is a felt disc 87. These discs are held to the wall 7 by means of bolts 88.

Through the center of each disc is a hole to receive the shaft 84. The part of the disc around the hole is fastened to the shaft 84 by means of wires 89, as clearly shown in Figure 1. These discs serve to protect the bearing 86 and the associated parts from dust, dirt and other foreign matter.

On the outer end of the shaft 84 is a universal joint construction 90, similar to that described in connection with the shaft 68. This universal joint connection serves to connect the shaft 84 with an operating shaft 91, which extends forwardly through the fuselage of the airplane to some suitable point so that by rotating the shaft 91 the stabilizer may be adjusted through the operation of the nut 32, whereby the screw 48 is moved longitudinally.

The stabilizer is pivoted to the fuselage of the airplane at the point 92. This pivot point is near the front end of the stabilizer, or at least between the rear end of the fuselage and the front end of the stabilizer. The adjusting mechanism for adjusting the stabilizer is located at the rear end of the stabilizer and moves with the stabilizer during the adjusting operation, the only part of the stabilizing mechanism that is stationary being the screw which is operated by the structure attached to the stabilizer.

In the form shown in Figures 1 and 2 the housing 23 does not extend very far beyond the sleeve 64 from the nut 32. In the form shown in Figures 1 and 2 the lower end of the housing has attached thereto a well 93, by means of screws 94 or other similar means. The well is adapted to contain a lubricant, and provides a space in which the screw 48 is housed when it is withdrawn into the housing.

In this form there is provided at the upper end of the housing and around the nut 32 a ring 95 fastened to the nut by means of rivets 96. Around this ring 95 and resting upon the upper end of the housing 23 is a ring 97, which has between it and the ring 95 a packing member 98 to prevent the escape of oil, grease or lubricant out at the upper end of the housing.

When it is desired to adjust the stabilizer the shaft 68 is rotated through the operation of shafts 91 and 82. The operation of the shaft 68 will cause the nut 32 to rotate, thereby moving the screw 48 longitudinally. Since the free end of

the screw is stationary the housing to which the rear end of the stabilizer is attached moves with relation to the free end of the screw, thereby adjusting the stabilizer.

5 Rotating the shaft 68 in one direction will cause the screw to move longitudinally in one direction, whereas the rotation of the shaft 68 in another direction will cause a longitudinal movement of the screw 48 in another direction. The shield or
10 protector, composed of the rings 50, protects the screw, as clearly shown in Figure 5, from dirt, grit and any other foreign material which may be circulating in the air.

It will be observed from an examination of
15 Figure 5 that all bearing parts are thoroughly lubricated and are provided with anti-friction ball bearings. Applicants' construction is also self-locking. Any adjustment that may be effected will be maintained though all of the
20 parts are thoroughly lubricated because of the nature of the screw 48 and the nut therefor.

It will be understood that it is desired to comprehend within this invention such modifications as come within the scope of the claims and the
25 invention.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. In an airplane, in combination, an adjustable stabilizer having end walls and having its
30 rear end free to move up and down, means to move said rear end up and down, and actuating means therefor including a shaft extending longitudinally through and supported by the stabilizer.
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2. In an airplane, in combination, an adjustable stabilizer having its rear end free to move up and down, and means including a ring member attached at opposite sides to the stabilizer and
40 a screw connected to the ring to move its rear end up and down.

3. In an airplane, in combination, an adjustable stabilizer having its rear end free to move up and down, a housing and a ring member
45 pivotally attached at opposite sides to the rear end of the stabilizer, and means in the housing operatively connected to the ring to move the rear end of the stabilizer up and down.

4. In an airplane, in combination, an adjustable stabilizer having its rear end free to move up and down, a housing and a ring member pivotally attached at opposite sides to the rear end of the stabilizer, screw means in the housing operatively connected to the ring to move the rear
50 of the stabilizer up and down, and means to operate said means.

5. In an airplane, in combination, an adjustable stabilizer having its rear end free to move up and down, a housing member and a ring member pivotally attached at opposite sides to the rear end of the stabilizer, a housing pivotally supported by said member, and means in the housing operatively connected to the ring to move the rear end of the stabilizer up and down.
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6. In an airplane, in combination, an adjustable stabilizer having its rear end free to move up and down, a ring member pivotally attached at opposite sides to the rear end of the stabilizer, a housing in the ring and pivotally supported thereby, screw means in the housing to move the rear end of the stabilizer up and down, and means
70 extending through the stabilizer to operate the screw.

7. In an airplane, in combination, an adjustable stabilizer having end walls, and means on
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the stabilizer having means extending through one end of the stabilizer to adjust it.

8. In an airplane, in combination, an adjustable stabilizer, a housing pivoted to the stabilizer, and means in the housing to adjust the stabilizer, said means having means extending through the stabilizer for operating said first named means.
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9. In an airplane, in combination, an adjustable stabilizer, a housing pivotally attached to the stabilizer, means in the housing to adjust the stabilizer, and means remote from the stabilizer and extending through the stabilizer to operate said means.
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10. In an airplane, in combination, an adjustable stabilizer, a housing pivotally attached to the stabilizer, a screw in the housing to adjust the stabilizer, a gear for moving the screw, and a shaft supported by the stabilizer and having a universal joint connection with the gear for rotating the gear and moving the screw.
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11. In an airplane, in combination with a fuselage having at its rear end an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a housing pivotally attached to the end of the stabilizer, a screw in the housing connected at one end to the fuselage, and means on the housing engaging the screw for operating it.
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12. In an airplane, in combination with a fuselage having at its rear end an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a ring member pivoted to the stabilizer, a housing in the ring pivotally supported thereby, means in the housing connected to the fuselage to adjust the stabilizer, and means
100 in the stabilizer to operate said means.

13. In an airplane, in combination with a fuselage having at its rear end an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a pair of brackets on the stabilizer, a ring member pivoted to and between the brackets, a housing pivoted to and in the ring member, a nut rotatably mounted in said housing, a screw in said nut, said screw having one end attached to the fuselage and its other end
105 in the housing, and means in the stabilizer to rotate the nut.

14. In an airplane, in combination with a fuselage having at its rear end an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a pair of brackets on the stabilizer, a ring member pivoted to and between the brackets, a housing pivoted to and in said ring member, a nut in said housing, a ball bearing between the nut and the walls of the housing at one end of the housing, a screw in the nut, one end of said screw being attached to the fuselage and the other end adapted to project into the other end of the housing, and means to rotate the nut.
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15. In an airplane, in combination with a fuselage having at its rear end an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a pair of brackets on the stabilizer, a ring member pivoted to and between the brackets, a housing pivoted to and in said ring member, a nut in said housing, a ball bearing between the nut and the walls of the housing at one end of the housing, a screw in the nut, one end of said screw being attached to the fuselage and the other end adapted to project into the other end of the housing, and means to rotate the nut, said means including a gear on the nut and a shaft having thereon a gear engaging the nut gear.
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16. In an airplane, in combination with a fuse-
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- lage having an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a pair of brackets on the stabilizer, ball bearings in each bracket, a ring member having trunnions thereon in said ball bearings, a housing pivoted to and in said ring member, a nut rotatably mounted in said housing, a screw in said nut, one end of said screw being attached to the fuselage and the other end in the housing, and means to rotate the nut to move the screw.
17. In an airplane, in combinations with a fuselage having an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a pair of brackets on the stabilizer, ball bearings in each bracket, a ring member having trunnions thereon in said bearings, said ring member having therein a pair of ball bearings, a housing in the ring having trunnions in the ball bearings of the ring, a nut rotatably mounted in the housing, means to rotate the nut, and a screw in the nut, said screw having one end attached to the fuselage.
18. In an airplane, in combination with a fuselage having an upper part and a lower part, a stabilizer pivoted to the fuselage between said parts, a pair of brackets on the stabilizer, ball bearings in each bracket, a ring member having trunnions thereon in said bearings, said ring member having therein a pair of ball bearings, a housing in the ring having trunnions in the ball bearings of the ring, a nut rotatably mounted in the housing, means to rotate the nut, a screw in the nut, said screw having one end attached to the fuselage, and an expansible shield for the screw attached to the fuselage end of the screw and to the housing.
19. In an airplane, a fuselage, a stabilizer pivoted thereto, means adjustably connecting the free end of the stabilizer to the fuselage, and means carried by the stabilizer adapted to adjust said connection.
20. In an airplane, a fuselage, a stabilizer pivoted thereto, means adjustably connecting the free end of the stabilizer to the fuselage, means carried by the stabilizer adapted to adjust said connection, and means in said fuselage connected to said adjusting means in the stabilizer for actuating it.
21. In an airplane, a fuselage having a slotted end, a stabilizer pivotally mounted in the slot in said end, means connecting the free end of the fuselage to the free end of the stabilizer, and operating means in the stabilizer for adjusting said connection to move the stabilizer about its pivot.
22. In an airplane, a fuselage having a slotted end, a stabilizer pivotally mounted in the slot in said end, means connecting the free end of the fuselage to the free end of the stabilizer, means in the stabilizer for adjusting said connection to move the stabilizer about its pivot, and means remotely actuated in said fuselage adapted to adjust said stabilizer at a remote point in the fuselage from the stabilizer.
23. In an airplane, a fuselage having a slotted end, a stabilizer pivoted in said slot between the bifurcated portions of the slotted end of the fuselage, means on the end of one of said bifurcated portions of the fuselage pivotally connecting the stabilizer thereto, means on the stabilizer for adjusting said pivotal connection, an actuating shaft connecting said adjusting means and mounted in said stabilizer, means in said fuselage adapted to remotely actuate said actuating means in the stabilizer, and means for universally connecting said last named means to permit of the movement of the stabilizer.
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