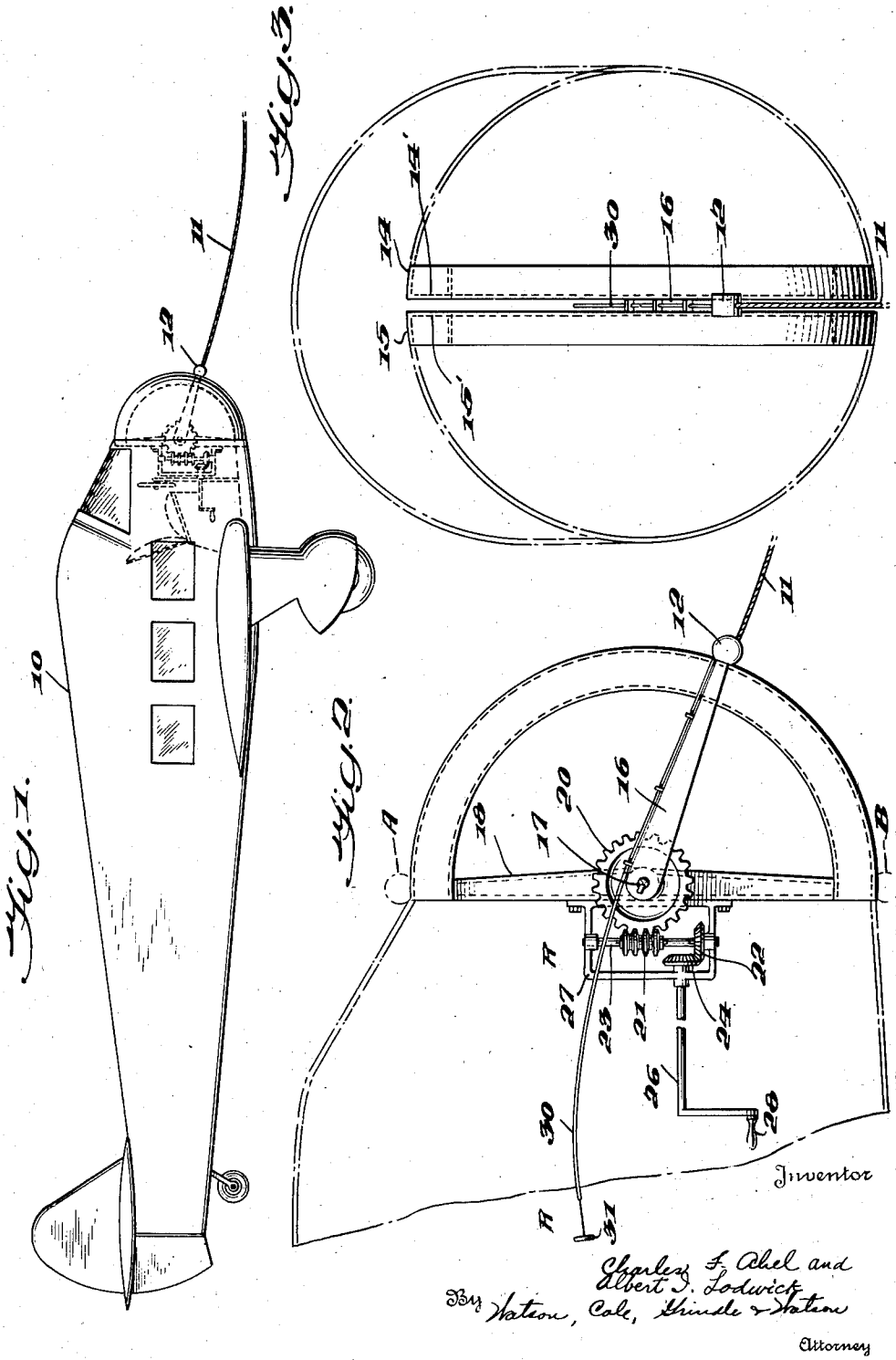
Oct. 30, 1945. C. F. ABEL ET AL 2,388,109

GLIDER

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GLIDER

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Fig. 6.

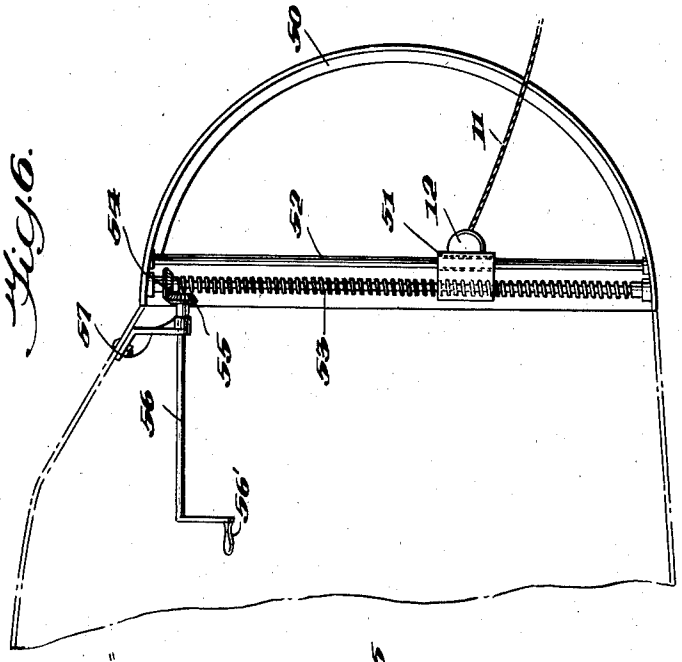


Fig. 5.

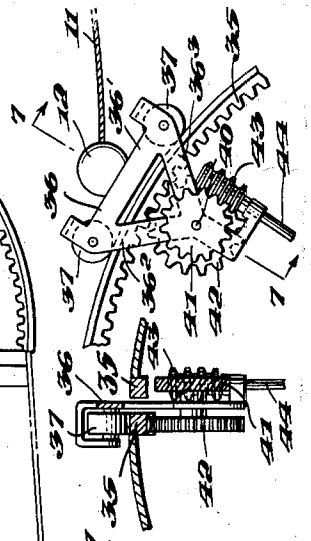


Fig. 4.

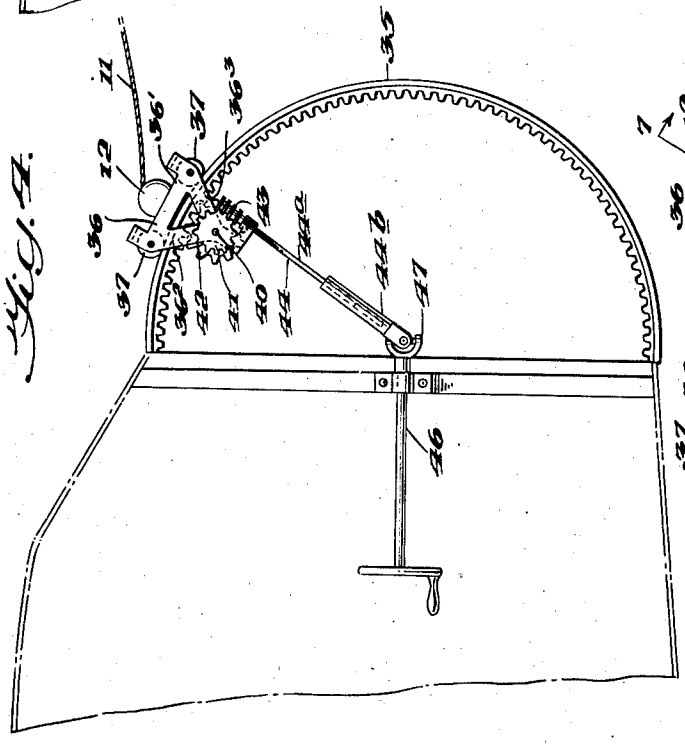
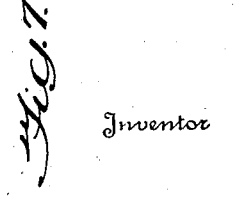


Fig. 7.



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GLIDER

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Application August 23, 1943, Serial No. 499,700

8 Claims. (Cl. 244—3)

The present invention relates to gliders and particularly to towing mechanisms for gliders of the type primarily intended to be used in the transportation of men and materials for substantial distances, and which are detachably secured to towing planes by ropes or cables for substantial periods of time.

The flight of a glider which is being towed is, as is well known, facilitated when it is perfectly "trimmed" for level flight. This may be, and commonly is, effected by manipulating the various flight-controlling instrumentalities, the glider pilot making suitable changes in these instrumentalities by the means provided for that purpose. When this is done, however, the effectiveness of the glider is reduced, sometimes substantially, particularly when the adjustments made require a substantial increase in the lifting effect of the tail of the machine. A practical way to "trim" the glider during flight so as to maintain at all times its maximum aerodynamic effectiveness is to change the position of the line of thrust or pull of the tow rope or cable with respect to the center of gravity of the body of the glider.

The present invention relates particularly to a means for facilitating change in this thrust or pull angle of the tow rope with respect to the body of the glider, whereby the trim of the glider may be maintained at all times during flight, regardless of changes in speed of the machine through the air, and changes in loading, changes in loading being sometimes actually effected during flight. By means of the improved mechanism which comprises the subject matter of this application a cable attachment member may be so mounted upon the forward end or nose of the glider that it may be quickly and easily adjusted vertically with respect to the glider body at any time, the pilot being thus able to vary at will the line of thrust or pull of the tow rope with respect to the center of gravity of the glider so as to be able to maintain the glider in perfect flying trim without necessitating the manipulation of the other flight control instrumentalities provided, the aerodynamic effectiveness of the glider being thus maintained at a maximum.

Preferably, the glider is provided with a releasable cable attachment member of standard type, to which the trailing end of the tow rope may be detachably secured. This cable attachment member is not, however, rigidly secured in fixed position to the forward end of the glider in the manner heretofore commonly employed, but is supported upon a mechanism of special character whereby it may be raised and lowered with respect to the glider body, and rigidly maintained in any desired position of adjustment, all under the close control of the operator, the arrangement being such that this adjustment can be made at any time during flight, as well as when the glider is motionless on a landing field.

The invention contemplates the use of various mechanisms for adjustably supporting the standard cable releasing member and, in the accompanying drawings, a number of these adjusting and supporting mechanisms are disclosed by way of example. One skilled in the art will appreciate that further types of adjustable cable release member supports may be employed and that the arrangement and precise design of the several elements of the mechanism may be considerably varied in adapting the invention to gliders of various types.

In the drawings:

Figure 1 is a side elevation of a typical glider to which the invention has been applied, one form of the novel cable release supporting and adjusting mechanism being indicated in dotted lines;

Figure 2 shows, on a larger scale, the nose portion of the glider shown in Figure 1, the wall of the glider being broken away to show more clearly the design of the cable release member supporting and adjusting mechanism;

Figure 3 is a front view of the nose of the glider shown in Figures 1 and 2;

Figure 4 is a view similar to Figure 2, a modified form of cable release member supporting and adjusting mechanism being illustrated;

Figure 5 is an enlarged side elevation of a detail of portion of the mechanism shown in Figure 4;

Figure 6 is a view similar to Figures 2 and 4, a further modification of the cable release member supporting means being shown; and

Figure 7 is a section on line 7—7 of Figure 5.

The glider body is generally indicated in Figure 1 by the numeral 10 and the towing rope or cable at 11. A standard cable attachment member is indicated at 12, the trailing end of the cable 11 being shown to be attached to the member 12. The details of the cable attachment member 12 are not shown and it will be understood that any standard device of this type now known may be employed. It should, of course, provide a staunch attachment means for the cable 11 and at the same time be so constructed that it may be actuated by the pilot of the glider to release the cable

and whenever it is deemed desirable to effect such release.

In the form of the cable attachment member supporting mechanism shown in Figures 1, 2 and 3, the glider nose is provided with two arcuate members 14 and 15, channel-shaped in cross section and the manually facing webs 14' and 15' of which are disposed in closely spaced parallel planes, which planes are parallel to the longitudinal axis of the glider, as can be most clearly perceived in Figure 3. The members 14 and 15, therefore, define a slot and through this slot projects an arm or element 16, upon the outer end of which the standard cable attachment member 12 is rigidly mounted. The inner end of arm 16 is fixed upon a short shaft 17, the ends of which are rotatably supported in aligned bearings mounted upon parallel vertical members 18 the upper and lower ends of which are preferably rigidly attached to the ends of the slot-defining members 14 and 15, respectively. The axis of shaft 17 is coincident with the centers of curvature of the arcuate members 14 and 15 so that, as radial arm 16 swings angularly about shaft 17 the member 12 mounted upon the outer end of the arm will lie at all times just outside of the slot-defining members 14 and 15. There is provided an operating means for causing the arm 16 to swing through an arc of substantially 180° whereby member 12 may be moved to the position indicated at A in Figure 2, or to position B, or to any position intermediate positions A and B.

This means for effecting swinging movement of arm 16 under control of the operator, and holding this arm rigidly in any position to which it may be adjusted, preferably comprises an irreversible gearing which includes a wormwheel 20 fixed on shaft 17, a worm 21 the teeth of which are in constant engagement with those of the wormwheel, and means for rotating worm 21 in either direction, comprising a bevel gear 22 fixed upon the worm shaft 23 and a bevel gear 24 fixed upon the end of the horizontally disposed operating shaft 26. The ends of the worm shaft 25, and the operating shaft 26, are rotatably supported in bearings fixed upon a supporting frame 27 which is mounted upon the uprights 18. Shaft 26 is provided with an operating handle 28 accessible to the pilot of the glider while the glider is in flight so that he may at any time elevate or depress the cable attachment member 12. Conventional means for effecting cable release is provided one form of such means including the flexible tube 30 extending from the vicinity of the member 12 to the vicinity of the pilot's seat, the forward section of this tube being attached to the arm 16, the tube constituting a guide for the operating wire, the handle of which is indicated at 31. It is clear that the addition of the mechanism just described to the glider does not materially increase its weight and that this mechanism, being wholly enclosed, does not increase the resistance of the glider to movement through the air.

In the form of the invention illustrated in Figures 4, 5 and 7 the annular channel members 14 and 15 of Figures 1, 2 and 3 are replaced by parallel spaced arcuate members one of which at least is internally toothed so as to be able to function as a curved rack, such a curved rack member being indicated at 35. The standard cable attachment member 12 is shown to be mounted upon a frame generally indicated at 36, the frame being substantially triangular with the base member 36' thereof, upon which the member 12 is fixed, lying without members 35 and being provided at its ends with rollers 37 engaging the outer face of one of arcuate members 35. The inwardly projecting sides of the triangular frame 36, indicated at 36^2 and 36^3, respectively, support, at their point of intersection, a rotatable shaft 40 upon which are fixed a wormwheel 41 and a pinion 42, the teeth of pinion 42 being in mesh with the teeth of internal gear 35. Meshing with the teeth of wormwheel 41 are those of a worm 43, fixed upon the outer end of a worm shaft 44. Worm shaft 44 is telescopic, its outer end 44*a* being preferably solid and its inner end 44*b* being preferably tubular, the aperture in tube 44*b* being square in cross section and the end of section 44*a* which enters section 44*b* being squared so that the two sections of shaft 44 will rotate together at all times. The outer section 44*a* of the worm shaft is rotatably supported in a bearing which comprises an extension of the frame 36 and the inner end of this shaft is connected to an operating shaft 46, extending axially of the glider, by means of a universal joint 47.

It is clear that, when shaft 46 is rotated, worm shaft 44 will be likewise rotated and that the frame 36, with the affixed cable attachment member 12, will be moved along the circular rack 35 in one direction or the other depending upon the direction of rotation of the shaft 46. Because of the telescopic nature of the shaft 44 it is not necessary to exactly center the circular rack 35 about the transverse axis of the universal coupling 47 in order that an adequate driving connection between the operating shaft 46 and the pinion 42 be maintained. With this form of the invention, therefore, there may be wide variations in the shape of the nose, in vertical section, without requiring change in the operating means or elevating or depressing the cable attachment member 12. The mechanism is likewise entirely enclosed, save only for the portion 36' of the cable attachment member supporting frame, and the associated rollers 37. Wind resistance is, therefore, not increased.

In the form of the invention shown in Figure 6 the cable attachment member 12 is disposed within the nose of the glider, the cable 11 extending through a slot which may be defined by suitable arcuate members 50 disposed in parallel planes. Members 50 of Figure 6, likewise parallel arcuate members 35 of Figure 4, and 14 and 15 of Figures 1, 2 and 3, take up any wide thrust imposed on the body of the glider when the glider is horizontally turned, whether the side thrust be communicated to the glider directly from the towing cable, as in the case of the form of the invention in Figure 6, or through a frame such as indicated at 36 in Figure 4, or through an operating arm such as indicated at 6 in Figure 2.

The standard cable attachment member 12 shown in Figure 6 is mounted directly upon a block 51 which in turn is slidably mounted upon vertically disposed guide rod or rods 52 which rods are disposed substantially vertically when the plane is in horizontal flight. Parallel to guide rod or rods 52 is a threaded rod 53 this rod having threaded engagement with the inner wall of a bore or recess extending through block 51 so that, when the rod 53 is rotated, the block 51 will be raised or lowered. Fixed upon the upper end of the threaded rod 53 is a bevel pinion 54 the teeth of which are in constant mesh with those of a bevel pinion 55 mounted upon the forward end of an operating shaft 56 supported in a bearing carried by a bracket 57 affixed to the frame of the glider. The operating handle 56' of the op-

erating rod 56 is within convenient reach of the glider pilot and the pilot is thus enabled at any time to raise or lower block 51 and the attached cable attachment member 12. In the case of each form of the invention the operating means is of irreversible type and the cable attachment member 12 is, for that reason, positively held in any position to which it may be adjusted.

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

1. In a glider, in combination, a member at the forward end of the glider body to which the trailing end of a tow-line may be attached, and means mounted on the glider body for supporting said member in such manner that it may be adjusted vertically with respect to said body and maintained in any desired position of adjustment, said means including an element upon which said member is fixed, and manually operable gearing for adjusting said element and elevating or depressing said member.

2. The combination set forth in claim 1 in which said gearing includes an irreversible gear to adjust the position of said member with respect to the glider body.

3. In a glider, in combination, a nose section provided with a vertical slot disposed centrally thereof, means associated with said nose section for releasably engaging a towing cable, and means carried by and operable from within said nose section for adjusting said cable-engaging means longitudinally of said slot for altering the altitude of said means with respect to the glider body, said cable, cable-engaging means and adjusting means together constituting a connection between said glider and a towing means, said connection extending through said slot.

4. In a glider, in combination, a nose section provided with a vertical slot disposed centrally thereof, means associated with said nose section for releasably engaging a towing cable, and means carried by and operable from within said nose section for adjusting said cable-engaging means longitudinally of said slot for altering the altitude of said means with respect to the glider body, said adjusting means comprising a rigid member extending through said slot and carrying said cable-engaging means, and means for adjusting said rigid member relative to said slot.

5. In a glider, in combination, a nose section provided with a vertical slot disposed centrally thereof, means associated with said nose section for releasably engaging a towing cable, and means carried by and operable from within said nose section for adjusting said cable-engaging means longitudinally of said slot for altering the altitude of said means with respect to the glider body, said adjusting means comprising a rigid member extending through said slot and carrying said cable-engaging means, and self-locking means for adjusting said rigid member relative to said slot.

6. In a glider, in combination, a nose section provided with a vertical slot disposed centrally thereof, means associated with said nose section for releasably engaging a towing cable, and means carried by and operable from within said nose section for adjusting said cable-engaging means longitudinally of said slot for altering the altitude of said means with respect to the glider body, said adjusting means comprising a rigid member extending through said slot and carrying said cable-engaging means, and means including a worm and wormwheel for adjusting said member relative to said slot.

7. In a glider, in combination, a nose section provided with a vertical slot disposed centrally thereof, means associated with said nose section for releasably engaging a towing cable, and means carried by and operable from within said nose section for adjusting said cable-engaging means longitudinally of said slot for altering the altitude of said means with respect to the glider body, said adjusting means comprising a rigid member pivotally mounted within said nose section and extending through said slot, said rigid member carrying said cable-engaging means, and means for moving said rigid member about its pivot.

8. In a glider, in combination, a nose section provided with a vertical slot disposed centrally thereof, means associated with said nose section for releasably engaging a towing cable, and means carried by and operable from within said nose section for adjusting said cable-engaging means longitudinally of said slot for altering the altitude of said means with respect to the glider body, said adjusting means comprising a rigid member pivotally mounted within said nose section and extending through said slot, said rigid member carrying said cable-engaging means, and means for moving said rigid member about its pivot, said last means including a wormwheel operatively connected to said rigid member, a worm meshing with said wormwheel, and means for rotating said worm.

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