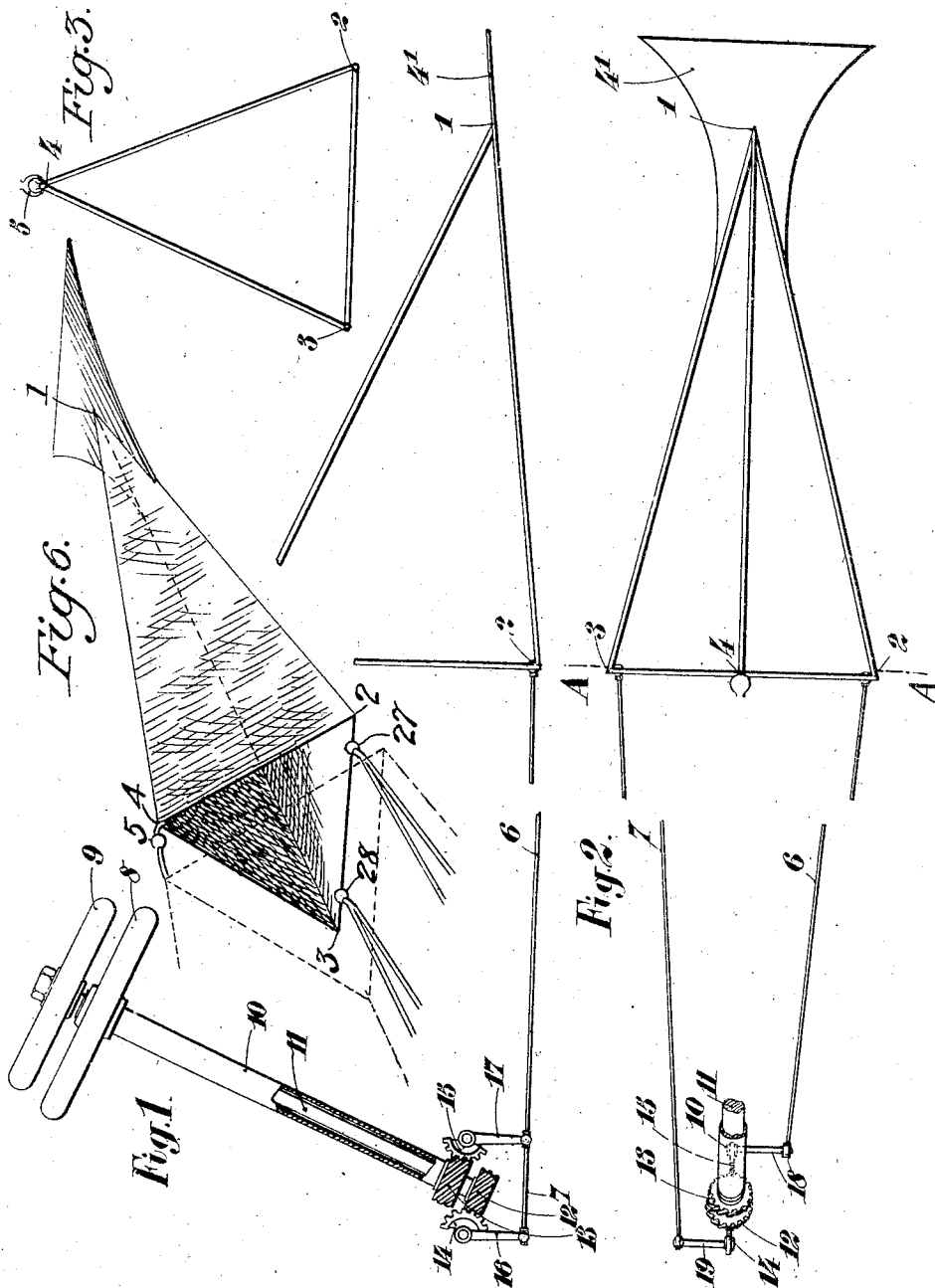


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STEERING GEAR FOR AEROPLANES.
APPLICATION FILED OCT. 23, 1911.

1,062,055.

Patented May 20, 1913

2 SHEETS—SHEET 1.



Witnesses.

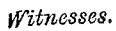
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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STEERING-GEAR FOR AEROPLANES.

1,062,055.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RENÉ TAMPIER, citizen of the French Republic, residing at Paris, Department of the Seine, in France, have invented certain new and useful improvements in Steering-Gear for Aeroplanes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to aerial apparatus and has for its object to provide an improved steering gear by which numerous movements of the rudder are obtained in a simple, novel and efficient manner.

The invention is illustrated in the accompanying drawing, in which—

Figure 1 is a diagrammatic view of one form of the improved steering gear. Fig. 2 is a plan view of the same. Fig. 3 is a section on the line A—A in Fig. 2. Figs. 4 and 4^a represent a modification of the means for connecting the hand wheels with the tail. Fig. 5 is a plan of the device in Fig. 4. Fig. 6 is a perspective view of the rudder showing the manner of mounting the same on a framework and the relative locations of the actuating members.

The steering gear comprises broadly a movable rudder constituted by a rigid frame 1, 2, 3, 4, preferably presenting the form of a triangular pyramid the apex 1 of which is directed rearward. The frame 1, 2, 3, 4 forms the skeleton of the rudder and canvas or the like is stretched over all its faces in the usual manner. The pyramid 1, 2, 3, 4 ends at the rear in a supplementary surface 4'. This pyramid is suspended from the fuselage of the apparatus at 4 by a ball and socket joint 5 or the like. The two apexes 2 and 3 of the base 2, 3, 4 are connected with the operating gear by rigid rods 6 and 7 provided at their extremities with universal or ball and socket joints. In the construction illustrated by way of example the gear comprises two hand wheels 8, 9 arranged one above the other and carried by a tube 10 and by a tube 11 respectively, the tube 11 being arranged inside the tube 10. These tubes 10 and 11 may control the displacement of the rods 6 and 7 either directly or by the intermediary of reducing gear. In the latter case the following device may be employed: Worm pinions 12, 13 keyed upon the lower end of the tubes 10 and 11

mesh with toothed sectors 14 and 15 carrying levers 16 and 17 to which arms 18, 19 carrying the extremities of the operating rods 6 and 7 are attached.

The steering gear operates in the following manner: The rudder may be given movements which will correct the apparatus when it has been deflected from its running position by air currents by a variation of pressure or any other cause. The apparatus is then displaced in describing in the air a movement which approaches a helicoidal movement and which may be regarded as the resultant of three simple movements; the inclination of the longitudinal axis of the apparatus (pitching) oscillation around this axis (rolling) and deviation of the apparatus from its position which is termed stability of route. The steering gear described above permits of opposing displacement of the apparatus and of correcting it by imparting to the steering member movements opposite in direction to those to which the apparatus is subjected in entering the current. In this case the hand wheels are operated in the following manner. One of the hand wheels (the hand wheel 9 for example) is turned in the proper direction; the rod 7 is displaced forward and upward for example and the apex 3 of the rudder rotates in a plane perpendicular to 2, 4, the point 2 remaining fixed. The rudder will then be displaced laterally and at the same time directed upward, these effects being proportionate to the lengths of the sides of the triangle 3, 2 and 3, 4. This ratio can be determined in accordance with the characteristics of the apparatus. The hand wheels 8 and 9 can also be acted upon in the following manner. If simultaneously with the displacement of the hand wheel 9 the hand wheel 8 is also rotated in such a manner as to modify the position of the point 3 a helicoidal movement with variable characteristics will be given to the rudder. If the two hand wheels 8 and 9 be rotated through the same angle in the same direction the two rods 6 and 7 will be displaced equally in opposite directions one toward the front and the other toward the rear and the rudder 1, 2, 3, 4 will be displaced laterally in rotating about the joint 4. If the hand wheels 8 and 9 be rotated through the same angle in opposite directions the rods 6 and 7 will be displaced together toward the front or toward the rear the result being to displace it

upward or downward so that the apparatus will merely be caused to ascend or descend.

The steering gear which forms the object of the invention therefore comprises a rudder capable of movement either about a vertical axis of about a horizontal axis or about an oblique axis which is itself movable this tail being controlled in all its positions by the rotation in the same direction or in opposite directions of two hand wheels the columns of which are arranged one within the other by the rotation of one of these hand wheels only.

It is obvious that any form of rudder which will produce the desired steering effect may be used which can be mounted at three triangularly arranged points, as described.

Figs. 4 and 5 show a modified form of gear for controlling the rudder. This arrangement affords a perfectly rigid control of the movable rudder of the apparatus such that the lateral thrusts of the wind which might cause the rudder to oscillate around its joint exert no action upon the controlling gear. The steering gear comprises broadly in its preferred form a pyramidal movable tail 1, 2, 3, 4 suspended from the framework at 4 by a ball and socket joint 5 or the like. The side 2—3 of the base 2, 3, 4 is connected with the levers 18, 19 which are respectively controlled by the hand wheels 8 and 9 by means of rigid triangular transmissions 20, 22, 27 and 21, 23, 28. These connecting triangles are connected by their apexes 20, 21 and 27, 28 respectively to the levers 18, 19 and to the base 2—3 by means of Cardan or ball and socket joints. Similarly the apexes 22, 23 are mounted by the intermediary of ball and socket joints upon levers 24, 25 ending in collars loose upon a fixed shaft 26 rigid with some convenient part of the apparatus. It will be readily seen that this method of mounting prevents any lateral displacement of the rudder as a result of gusts of wind acting upon one of its faces while at the same time permitting of all displacements of the rudder by means of the operating hand wheels. If the hand wheels 8 and 9 be rotated through the same angle and in opposite directions the levers 18 and 19 move in the same direction and the levers 23 and 24 rotate around the shaft 26 in the same direction. If the hand wheels 8 and 9 be rotated in the same direction the levers 18 and 19 on the one hand and 23 and 24 on the other hand move in the opposite direction. If a single lever (the lever 18 for example) be displaced in the direction indicated by the arrow the extremity 27 of the operating triangle moves to the left downward and in front of the plane of the figure because this extremity rotates around fixed lines 4, 28 of the base of the triangle of the rudder. The apex 22 of the

operating triangle having to move in a similar manner the upper collar of the lever 24 owing to a certain play that it has describes a helicoidal movement on the shaft 26 so that the apex 22 moves toward the left downward and in front of the position that it occupied. It should also be noted that the connection of the two operating triangles permits of giving any desired displacement to the collars of the levers 24, 25 upon the shaft 26 without the tail being able to move otherwise than as controlled by the steering wheels.

In the construction described a third hand wheel 29 has been shown; this wheel acts by the intermediary of a tube 30 concentric with the other tubes upon a worm pinion 31. By means of an appropriate system of levers 33, 34, 35 this pinion controls the displacement of two wheels similar to the front wheels of an automobile thereby enabling the apparatus to be steered on the ground.

In order to prevent the tubes 10, 11 from accidentally influencing each other these two tubes may be separated by an intermediate concentric tube not shown.

I claim:

1. Steering mechanism for aeroplanes and the like comprising a rudder mounted at three triangularly arranged points, said rudder adapted to be actuated bodily about one of said points and adapted to be actuated about axes formed by said point and either of the remaining points.

2. Steering mechanism for aeroplanes and the like comprising a rudder mounted for universal movements about one point, means to actuate the rudder bodily about said point, said means connected to the rudder at two points forming with the first-named point a triangle, the rudder being movable about axes formed by said first-named point and either of the last-named points.

3. Steering mechanism for aeroplanes and the like comprising a rudder flexibly mounted at one point, independently movable members for actuating said rudder bodily about said point, said members connected to the rudder at two points forming with the first-named point a triangle, and said rudder adapted to be actuated by either of said members about an axis formed by said first-named point and the point of connection of the other member.

4. A steering gear for aeroplanes and the like comprising a rudder mounted for universal movements at one point, independently movable actuating members connected to said rudder at two other points, said members being held against lateral movements to prevent the rudder from being actuated by wind forces.

5. A steering gear comprising a rudder

- mounted for universal movements at one point, means to actuate the rudders about said point comprising independently movable actuating members connected to the rudder at two points forming with said first named point a triangle, each of said actuating members being mounted for pivotal movements about a point intermediate the ends thereof.
- 10 6. A steering gear comprising a rudder mounted for universal movements at one point, means to actuate the rudders about said point comprising independently movable actuating members connected to the
- 15 rudder at two points forming with said first named point a triangle, each of said actuating members comprising a triangular frame pivoted at one apex for pivotal movements thereabout.
- 20 7. A steering gear comprising a rudder

mounted for universal movements at one point, means to actuate the rudders about said point comprising independently movable actuating members connected to the rudder at two points forming with said first named point a triangle, each of said actuating members comprising a triangular frame, a fixed shaft intermediate the ends of said frame from which one apex of the frame is suspended, said frames being pivotally movable about said shaft but limited in lateral movements thereon.

In testimony whereof I affix my signature, in presence of two witnesses.

RENÉ TAMPIER.

Witnesses:

H. C. COXE,
LOUIS HORN.