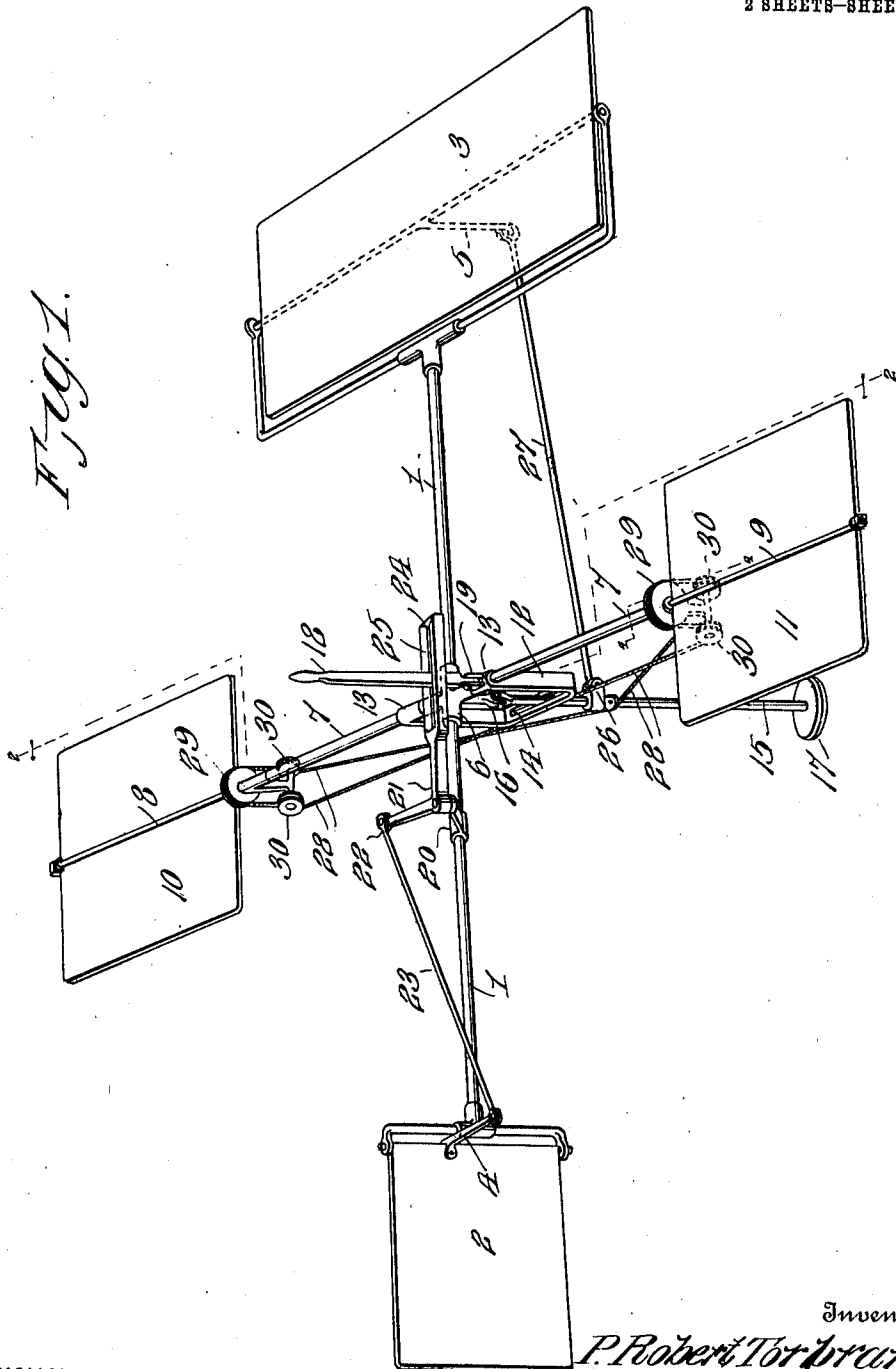


P. R. TORBRAND.
 FLYING MACHINE.
 APPLICATION FILED FEB. 25, 1910.

970,974.

Patented Sept. 20, 1910.

2 SHEETS—SHEET 1.



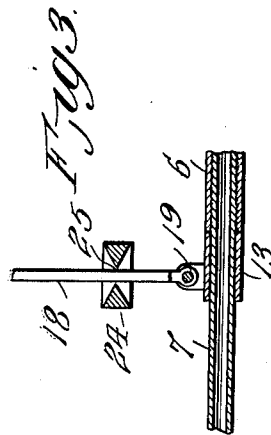
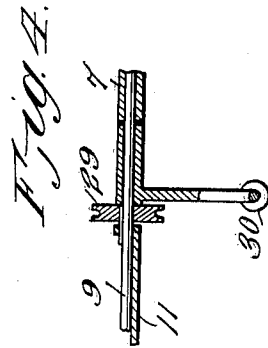
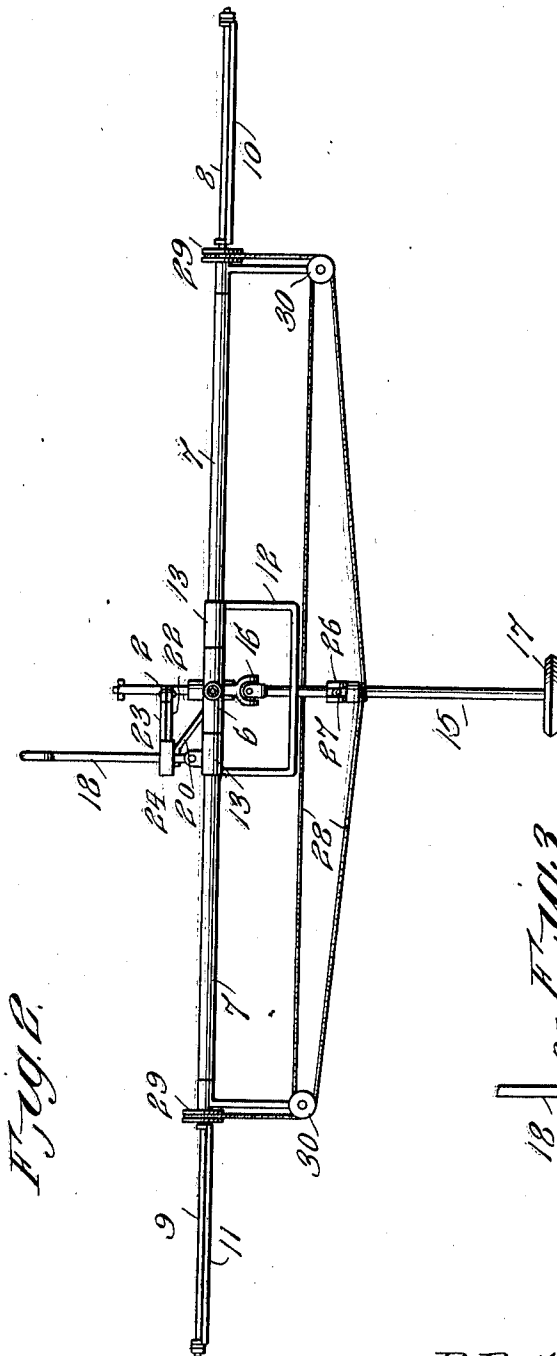
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UNITED STATES PATENT OFFICE.

PETER ROBERT TORBRAND, OF DENVER, COLORADO.

FLYING-MACHINE.

970,974.

Specification of Letters Patent. Patented Sept. 20, 1910.

Application filed February 25, 1910. Serial No. 545,910.

To all whom it may concern:

Be it known that I, PETER ROBERT TORBRAND, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented new and useful Improvements in Flying-Machines, of which the following is a specification.

This invention relates to flying machines, and particularly to improvements in means for steering the same horizontally and vertically and automatically correcting the tendency of the machine to tilt unduly in any direction, so as to maintain the balance or equilibrium of the machine.

The object of the invention is to provide simple and effective steering and balancing means under control of the operator for normal steering purposes and automatically operative to restore the equilibrium of the machine when the latter tilts in any direction to an excess degree.

The invention consists of the features of construction, combination and arrangement of parts hereinafter fully described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a perspective view of a steering and balancing mechanism embodying my invention. Fig. 2 is an irregular vertical transverse section thereof, on the line 2—2 of Fig. 1. Fig. 3 is a vertical transverse section through the slotted arm of the bell crank lever and adjacent portion of the frame. Fig. 4 is a detail section on the line 3—3 of Fig. 1.

Referring to the drawings, 1 designates a supporting rod or bar forming a portion of the frame of a flying machine, only so much of which is shown as is necessary to illustrate the construction and principle of operation of my invention. Pivotally mounted to swing on a vertical axis at the rear of this rod or bar is a rudder or steering plane 2, for laterally steering the machine. Horizontally mounted to swing on a vertical axis at the forward end of the rod or bar is a rudder 3 for steering the machine in a vertical plane. These rudders or their shafts are respectively provided with crank arms 4 and 5, for a purpose hereinafter described.

The rod or bar 1 preferably consists of two sections united by a four-armed coupling 6, which connects therewith a fixed hollow transverse rod 7, in the opposite ends of which are journaled rods or shafts 8 and 9,

respectively, carrying stabilizing balancing or leveling planes 10 and 11, the construction being such that the two planes may be oscillated in a vertical direction by the rotary movements of the shafts 8 and 9.

A U-shaped bracket or hanger 12 is arranged below the coupling 6 and is provided with sleeves 13 loosely engaging the shaft 7 on opposite sides of said coupling, and in the horizontal or cross portion of said bracket is formed a longitudinal slot 14. A stem 15 projects vertically through the slot 14 and is connected at its upper end by a universal joint 16, to the coupling 6 and carries at its lower end a head or weight 17, which normally occupies a horizontal position and preferably consists of a disk having its edge beveled to reduce its resistance to the atmosphere.

The stem and its head form a pendulum arranged in line with the center of gravity of the machine and adapted by its connection with the bracket 12 to swing in a fore and aft direction with said bracket, and to swing laterally in the slot 14 independently of the bracket.

An operating lever 18, arranged in practice adjacent to the aviator's seat, is pivoted at its lower end, as at 19, to one of the sleeves 13, the pivotal connection being such as to permit the lever to swing transversely or laterally only independently of the bracket, the lever being also movable in a fore and aft direction longitudinally parallel with the rod 1 to swing the bracket 12 accordingly. Mounted upon the rod 1 adjacent to and in rear of the lever is a bearing 20, upon which is fulcrumed a bell crank lever 21, one of the arms 22 of which is pivotally connected by a rod 23 with the crank arm 4 of the vertical steering rudder 2. The other arm 24 of the bell crank lever is provided with a longitudinal slot 25 through which the lever 18 extends, and which slot is of proper length to permit of the fore and aft movement of the lever without influencing said bell crank lever and the vertical rudder. The side walls of the slot 25 are V-shaped in cross section to permit the lever 18 to assume different angular lateral positions, the construction being such that the lateral movement of said lever in one direction or the other will cause a corresponding movement of the rudder 2. The stem 15 is pivotally connected at one end,

as at 26, with a rod 27, which is pivotally coupled at its opposite end to the crank arm 5 of the horizontal steering rudder 3 from which it will be seen that the pendulum or gravity-controlled member forms a connection between the lever 18 and the rudder 3 by which said rudder will be tilted up or down through a fore and aft movement of the lever, which, through the bracket 12, transmits corresponding motion to the pendulum.

It will thus be understood from the foregoing description that the aviator by swinging the lever 18 in a lateral direction may operate the vertical steering rudder 2 and by swinging said lever in a fore and aft direction may operate the horizontal steering rudder 3, without in any manner affecting the balancing and leveling planes 10 and 11, which are automatically controlled by the pendulum to maintain the lateral balance of the machine. In order to effect the actuation of these planes from the movement of the pendulum, or, more strictly speaking, the movement of the machine relative to the pendulum, a rope or cable 28 is fastened at each end to the stem of the pendulum and, thence, extends in opposite directions and passes around actuating pulleys 29 fixed to the shafts 8 and 9 of the planes, the stretches of the cable also passing adjacent each actuating pulley around suitable guide pulleys 30 mounted on the ends of the main shaft 7. It will thus be understood that if the machine should tilt to an excess extent forwardly or rearwardly in one direction or the other, the front rudder 3 will be automatically adjusted to correct the tilting tendency, while if the machine should tilt to an undue extent laterally, motion will be transmitted through the cable to reversely swing the planes 10 and 11, the balancing plane on the high side being drawn downwardly and the balancing plane on the low side swung upwardly, so that the pressure of the air against the surfaces of these planes will restore the machine to a normal position.

Having described the invention, I claim:—

1. A flying machine including a horizontal rudder, a vertical rudder, lateral balancing planes, a fore and aft swinging element, a gravity-controlled universally-movable member operatively connected with said horizontal rudder and balancing planes, said member being movable in a fore and aft direction with said swinging element to control the horizontal rudder and movable laterally independent of said swinging member to control said balancing planes, and a manually operable device movable in one direction to jointly operate said swinging element and gravity-controlled member

and in a different direction independent of said element and member for operating the vertical rudder.

2. A flying machine comprising a frame, vertical and horizontal rudders mounted upon the frame, tilting laterally balancing planes mounted upon the frame, a yoke bracket pivoted to the frame for a fore and aft swinging movement and having a slot therein extending transversely of the frame, a pendulum universally jointed to the frame, said pendulum being movable laterally in said slot independent of the bracket and movable in a fore and aft direction with the bracket, operating connections between the pendulum and the horizontal rudder and between said pendulum and the balancing planes, a bell crank lever mounted upon the frame and having a longitudinally slotted arm, a connection between the vertical rudder and other arm of said lever, and an operating lever pivotally connected for lateral movement upon the bracket and extending through the slotted arm of the bell crank lever, said operating lever being movable fore and aft in said slotted arm to swing the bracket laterally of the shaft and bell crank lever without affecting said bracket.

3. A flying machine including vertical and horizontal steering rudders, lateral balancing planes, a pendulum, an operating connection between the pendulum and the horizontal rudder, operating connections between the pendulum and the balancing planes for simultaneously adjusting the latter in opposite directions, and a lever operatively connected with the pendulum for adjusting the horizontal rudder without affecting the balancing plane and operatively connected with the vertical rudder for adjusting said rudder without affecting the horizontal rudder or balancing planes.

4. A flying machine including a frame member extending in a fore and aft direction, a second frame member extending transversely, a fore and aft swinging element mounted upon said second frame member, horizontal and vertical steering rudders mounted upon the first-named frame member, a swinging pendulum movable in a fore and aft direction with said swinging element and laterally independent of said element, a connection between the pendulum and horizontal rudder for adjusting the latter through the fore and aft swinging movement of said pendulum, lateral balancing planes upon the second-named frame member, operating connections between the pendulum and said planes for adjusting the latter in reverse positions upon the lateral swinging movements of said pendulum, an operating lever movable in a fore and aft direction to swing said swinging element and movable laterally independent of said element, and means controlled by the lateral

movement of the lever for adjusting the vertical rudder.

5 A flying machine including a frame structure, vertical and horizontal rudders, a bracket pivoted for a fore and aft movement upon the frame structure, lateral balancing planes, a pendulum movable in a fore and aft direction with said bracket and in a lateral direction independently thereof, a
10 connection between the pendulum and horizontal rudder for adjusting the latter upon the fore and aft movements of the pendulum, connections between the pendulum and the balancing planes for simultaneously
15 moving said planes in opposite directions upon the lateral swinging movements of the

pendulum, a lever having a fore and aft movement to operate said bracket and a lateral movement independent of said bracket, and operating connections between the lever 20 and the vertical rudder including a slotted link adapted to permit independent fore and aft movement of the lever and to transfer motion to said rudder upon the lateral movement of the lever. 25

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

PETER ROBERT TORBRAND.

Witnesses:

J. F. VAUGHN,
A. B. OLSON.