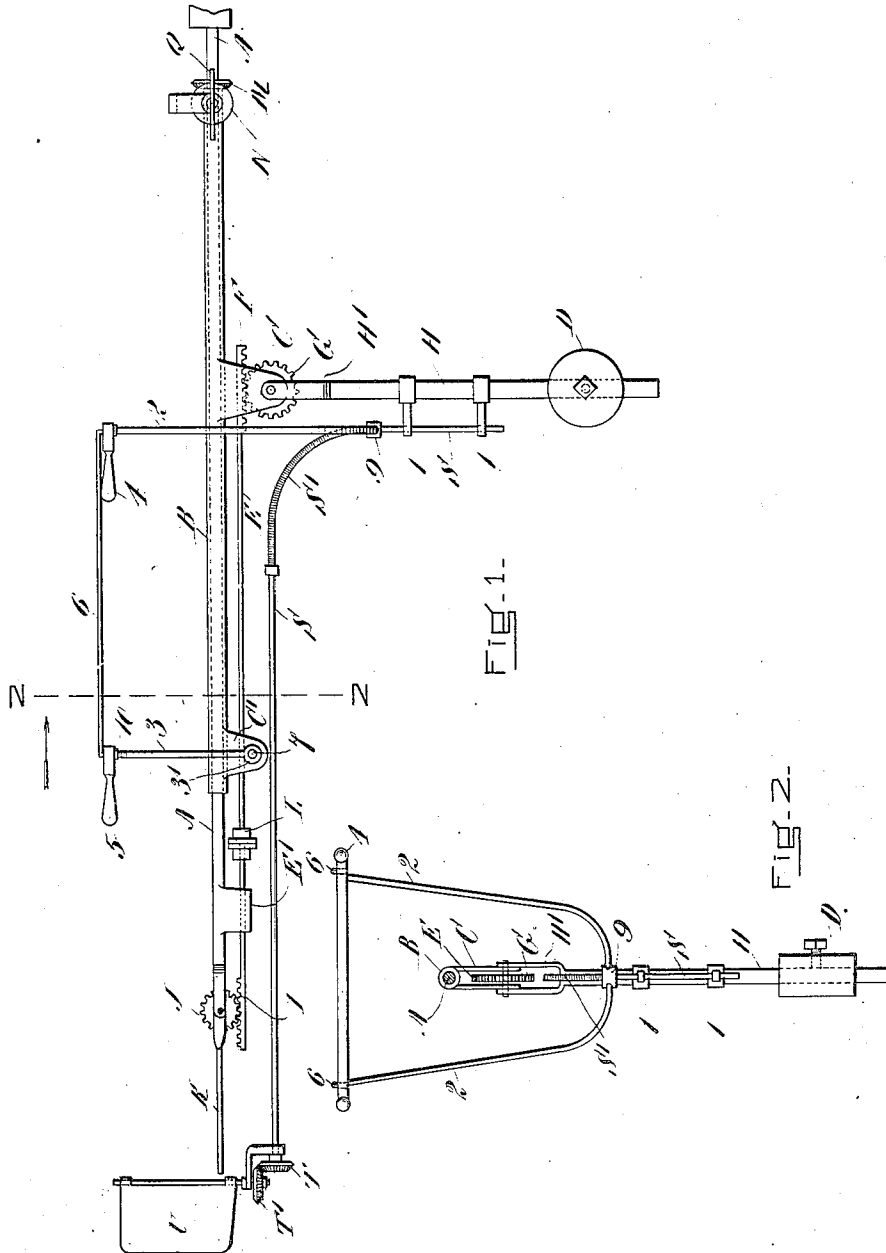


J. MEANS.
AERIAL NAVIGATION.
APPLICATION FILED MAR. 10, 1909.

943,120.

Patented Dec. 14, 1909.

2 SHEETS-SHEET 1.



WITNESSES:
Geo. Woodworth
Patrick J. Conroy

INVENTOR:
James Means

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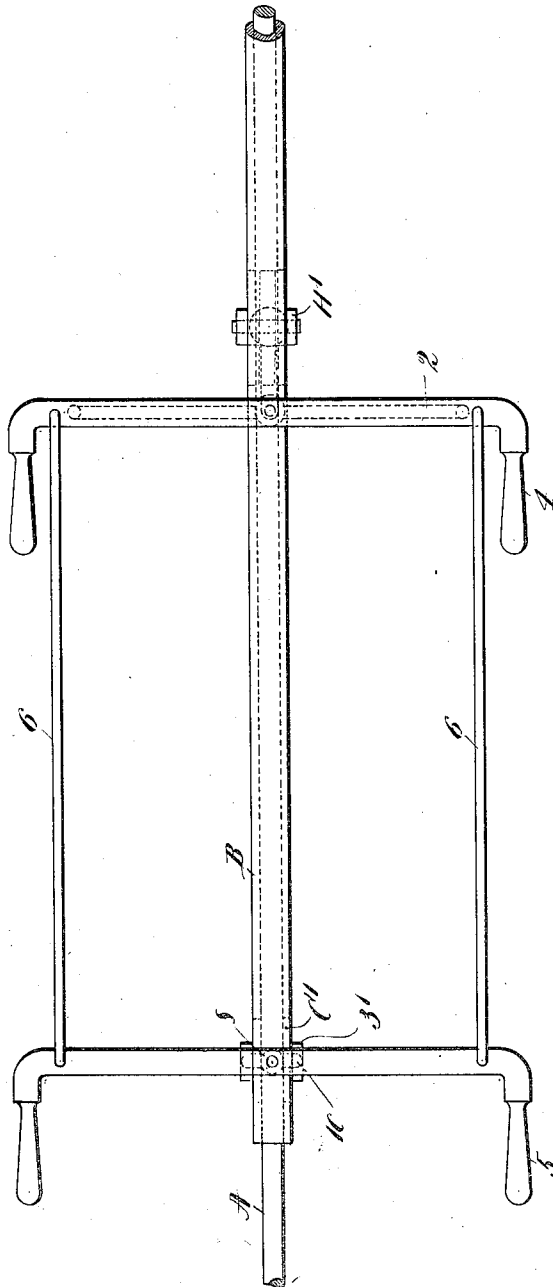


FIG. 3.

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JAMES MEANS, OF BOSTON, MASSACHUSETTS.

AERIAL NAVIGATION.

943,120.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JAMES MEANS, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Aerial Navigation, of which the following is a specification.

My invention relates to aerial navigation, and more especially to apparatus for controlling and maintaining the longitudinal and lateral stability of flying machines and for steering the same to port and starboard.

The object of my invention is to provide certain improvements in apparatus for operating a flying machine as hereinafter more fully set forth.

My invention, which is an improvement on the controlling apparatus described in my application Serial No. 418,679, filed March 2, 1908, will be described in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of one embodiment of my invention; Fig. 2 is a section taken on the line 2—2 of Fig. 1; and Fig. 3 is a plan view on an enlarged scale of a portion of the controlling apparatus.

In that particular embodiment of my invention selected for illustration for the purpose of more fully disclosing the principle thereof, A is a rod or tube secured in any suitable manner to the frame of a flying machine and placed parallel to the direction of flight indicated by the arrow.

C is a fork integral with the tube B which surrounds the rod A and H is a lever terminating in the fork H' which is pivoted to the fork C and to which the gear G is rigidly connected. The lever H may be weighted in any suitable manner such for example as by the vertically adjustable bob D, in which case the lever operates as a pendulum. As hereinafter more fully explained, my invention contemplates the use of said lever as a lever operated manually or as a pendulum operated partly automatically and partly manually.

The rod E which is carried by the support E' is connected with the pendulum H and the longitudinal rudder K through the gear and rack G and F in the one case and the gear and rack J and I in the other. The rod E preferably is divided into two parts connected by the loose coupling L. The lateral rudders Q, only one of which is

shown in Fig. 1, are actuated by the rotary movement of the tube B through the beveled gears M and N, the gear M being secured to the tube and each rudder Q being connected with a gear N.

U is a vertical rudder for steering the machine to port and starboard, and is connected through the gears T T' and the rod S, a portion of which as shown at S' is flexible, with the handle or handles 4, 5. The lower portion of the rod S is secured to the lever H by the arms 1, 1, and the fork 2, 2 is connected with said rod S through the head 9 by which the flexible portion S' of said rod is connected to the lower portion thereof. The fork terminates in a handle which may be similar in construction to the usual form of bicycle steering handles at a point above the pivot or point of suspension of the lever H. A plurality of such handles may be employed if desired and in the present instance I have shown two such handles connected in tandem by the rods 6 6. The auxiliary handle 5 may be pivoted as shown at 7 to the fork C' which is integral with the tube B. In this case the fork 3 which terminates in the boss 3' extends upwardly and terminates in a cross-piece 10, and the handle 5 is pivoted as shown at 8 to said cross-piece.

The operation is as follows: Assuming the wholly automatic operation of the controlling means by the weighted lever or pendulum, the relative movement between the machine and the pendulum caused by the pitching or rolling of the machine will effect such movement of the longitudinal and lateral rudders as to steer the machine back into a horizontal position. If the front part of the machine pitches downward, a clockwise rotation of the rudder K will be produced through the intermediary of the gear and rack J and I and the rudder will receive the greatest air pressure on its upper side thereby steering the machine into a longitudinal course. In like manner, if the front part of the machine pitches upward, a counter-clockwise rotation of the rudder K will be produced and the rudder will receive the greatest air pressure on its under side thereby steering the machine into a horizontal course. If the lateral stability of the machine is disturbed, the weighted lever or pendulum will swing transversely to the direction of flight of the machine and the tube

B will make a partial revolution around the rod A thereby turning the lateral rudders Q in opposite directions and correcting the disturbance in lateral stability.

The operator or operators will be seated in such manner that the handle 4 or the handles 4 and 5 can be conveniently grasped and will learn the art of maintaining the stability of the flying machine through the movements imparted to said handles by the pendulum. For this purpose the pendulum bob may be constructed to have just sufficient weight to make the necessary motion, and the operator profiting by the indication made by the pendulum will check any tendency to erratic movement by means of the manually-operated device. By experience, the movements of the handle necessary to maintain the stability of the machine will become instinctive in much the same manner that the experienced bicyclist maintains the upright stability of his machine instinctively and without thought. Therefore when the operator has learned to balance a flying machine, the weight may be removed from the lever H, so that the same will no longer operate as a pendulum. It is advantageous to use the device H as a lever and not as a weighted pendulum because the weight of the pendulum, although necessary for automatically effecting the relative movement necessary to actuate the lateral and longitudinal rudders may tend to accentuate the pitching or the rolling of the machine.

The salient feature of my invention resides in the position of the operating handle or handles 4, 5, at a point above the pivot of the lever H, because when so located the movement thereof is opposite to that of said lever and is in the direction toward which the operator instinctively moves when the balance of the machine is affected. For instance, when the machine pitches forward, the operator instinctively leans backward, and if the manually operated device is so located that its backward movement will produce a clockwise rotation of the rudder K, the machine may be more readily righted than if the operator, whose tendency is to lean backward when the machine pitches forward, were obliged to grasp the lower part of the lever H and push the same forward. In like manner when the machine rolls toward the operator's right his tendency is to lean toward the left, and it will be seen that if he moves the handle 4 to the left, thereby creating a counter-clockwise rotation of the tube B, the lateral rudders Q will assume positions tending to restore the machine to horizontality.

One of the objects in employing two or more tandem-connected manually-operated devices is to enable an experienced operator to teach an inexperienced one the art of balancing a flying machine, and another ob-

ject of this construction is that more even and graceful flight will be effected if all the persons carried by the machine simultaneously assume the same positions and make the same motions and by their combined weights assist in preserving the equilibrium of the machine.

In order to steer the machine to port and starboard, the vertical portion of the rod S is arranged to turn in supports 1, 1 and the rotation of said rod which is effected by the handle 4 is communicated to the rudder U through the gears T T'. Through the rods 6, the handle 5 is turned about its vertical pivot 8 in correspondence with the movement of the handle 4 about the centers of the bearings 1, 1.

It will be understood that the particular apparatus hereinbefore described may be subjected to a wide range of variation by those skilled in the art without departing from the spirit of my invention.

I claim:

1. In a flying machine, the combination with independently operable lateral and longitudinal rudders of a pivoted lever having universal movement, operating-connections from said rudders to said lever, and a manually-operated device for actuating said lever, said device being secured to said lever at a point below the pivot thereof and terminating in a handle at a point above said pivot.

2. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pivoted lever having universal movement, operating-connections from said rudders to said lever and a plurality of tandem-connected manually-operated devices for actuating said lever, one of said devices being secured to said lever at a point below the pivot thereof and each terminating in a handle at a point above said pivot.

3. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pivoted weighted-lever having universal movement, operating-connections from said rudders to said lever, and a manually-operated device for actuating said lever, said device being secured to said lever at a point below the pivot thereof and terminating in a handle at a point above said pivot.

4. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pivoted weighted-lever having universal movement, operating-connections from said rudders to said lever and a plurality of tandem-connected manually-operated devices for actuating said lever, one of said devices being secured to said lever at a point below the pivot thereof and each terminating in a handle at a point above said pivot.

5. In a flying machine, the combination

with independently-operable lateral and longitudinal rudders of a vertical rudder, a pivoted lever having universal movement, operating-connections from said lateral and longitudinal rudders to said lever, a manually-operated device for actuating said lever, said device being secured to said lever at a point below the pivot thereof and terminating in a handle at a point above said pivot, and operating-connections from said vertical rudder to said device.

6. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a vertical rudder, a pivoted lever having universal movement, operating-connections from said lateral and longitudinal rudders to said lever, a plurality of tandem-connected manually-operated devices for actuating said lever, one of said devices being secured to said lever at a point below the pivot thereof and each terminating in a handle at a point above said pivot, and operating-connections from said vertical rudder to said device.

7. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a vertical rudder, a pivoted weighted-lever acting as a pendulum and arranged to swing in a plurality of planes, operating-connections from said lateral and longitudinal rudders to said lever, a manually-operated device for actuating said lever, said device being secured to said lever at a point below the pivot thereof and terminating in a handle at a point above said pivot, and operating-connections from said vertical rudder to said device.

8. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a vertical rudder, a pivoted weighted-lever acting as a pendulum and arranged to swing in a plurality of planes, operating-connections from said lateral and longitudinal rudders to said lever, a plurality of tandem-connected manually-operated devices for actuating said lever, one of said devices being secured to said lever at a point below the pivot thereof and each terminating in a handle at a point above said pivot, and operating-connections from said vertical rudder to said device.

9. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pendulum so constructed and arranged as to simultaneously actuate said rudders for correcting disturbances of the lateral and of the longitudinal stability of the machine, and a manually-operated device mounted on said pendulum

below the point of suspension thereof and terminating in a handle above said point.

10. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pendulum arranged to swing in a plurality of planes for simultaneously actuating said rudders to correct disturbances of the lateral and of the longitudinal stability of the machine, and a manually-operated device mounted on said pendulum below the point of suspension thereof and terminating in a handle above said point.

11. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pendulum for simultaneously actuating said rudders to correct disturbances of the lateral and of the longitudinal stability of said machine, a manually-operated device mounted on said pendulum and terminating in a handle above the point of suspension thereof, a vertical rudder and operating-connections from said vertical rudder to said device.

12. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pivoted lever constructed and arranged to operate the same, and a plurality of tandem-connected manually-operated devices, one of said devices being secured to said lever and each terminating in a handle at a point above the pivot of said lever.

13. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pivoted weighted-lever acting as a pendulum and arranged to swing in a plurality of planes for actuating said rudders, and a manually-operated device mounted on said pendulum and terminating in a handle above the point of suspension thereof.

14. In a flying machine, the combination with independently-operable lateral and longitudinal rudders of a pivoted weighted-lever acting as a pendulum and arranged to swing in a plurality of planes for actuating said rudders, and a plurality of tandem-connected manually-operated devices, one of said devices being secured to said lever and each terminating in a handle at a point above the pivot of said lever.

In testimony whereof, I have hereunto subscribed my name this 9th day of March, 1909.

JAMES MEANS.

Witnesses:

PATRICK J. CONROY,
GEO. K. WOODWORTH.