

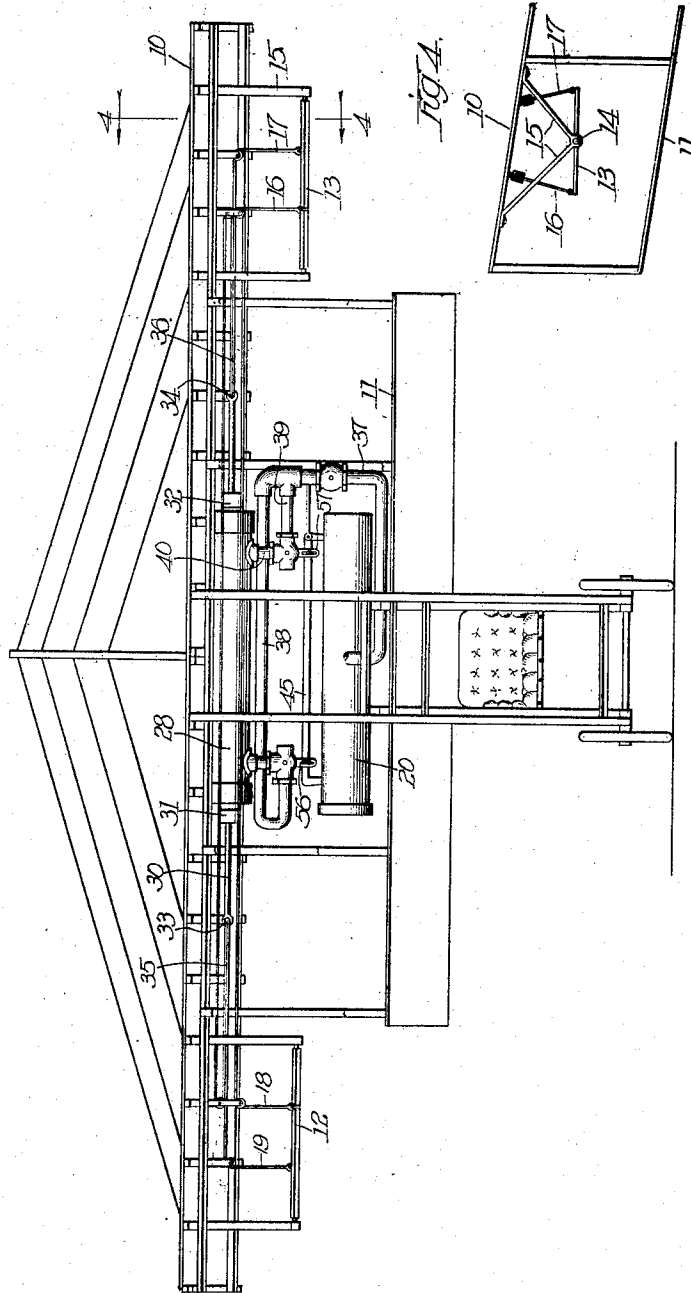
1,049,713.

W. F. HENSEL.
AEROPLANE STABILIZER.
APPLICATION FILED FEB. 17, 1912.

Patented Jan. 7, 1913.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
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2 SHEETS-SHEET 2.

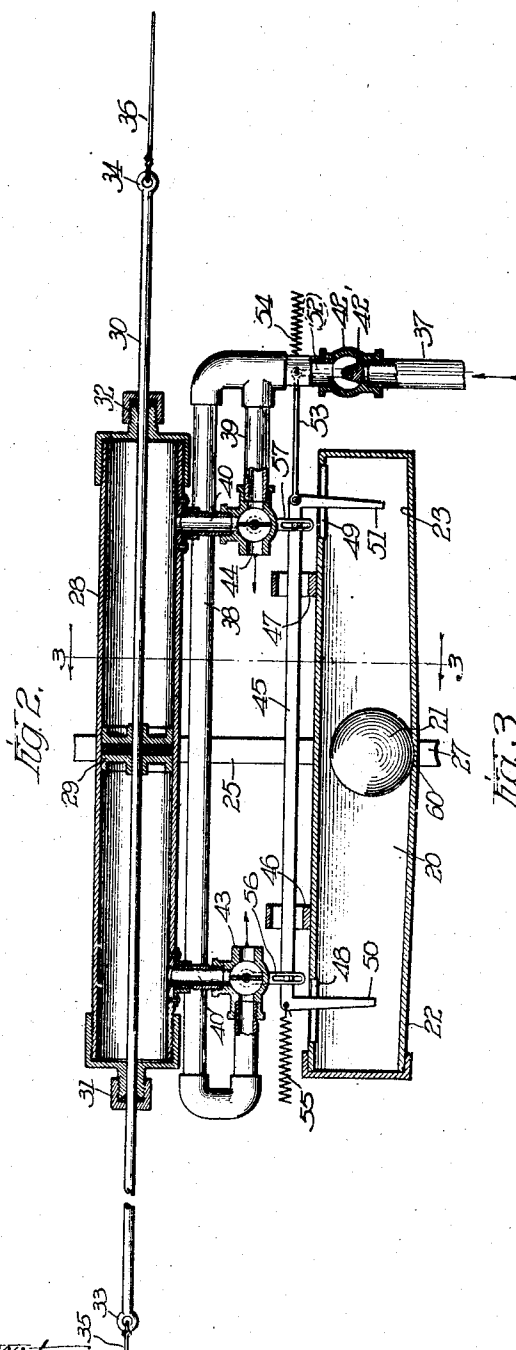


Fig. 2.

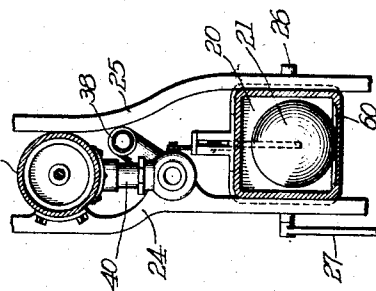


Fig. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM F. HENSEL, OF CHICAGO, ILLINOIS.

AEROPLANE-STABILIZER.

1,049,713.

Specification of Letters Patent.

Patented Jan. 7, 1913.

Application filed February 17, 1912. Serial No. 678,163.

To all whom it may concern:

Be it known that I, WILLIAM F. HENSEL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Aeroplane-Stabilizers, of which the following is a specification.

My invention relates to improvements in devices for establishing and preserving the equilibrium and stability of aeroplanes during flight.

One of the objects of my invention is to provide a device, of the character described, which is automatic in operation when influenced by gravity alone, and which is protected against extraneous influences such as air pressure due to air currents.

Another object of my invention is to provide a controlling device with means for manual operation in addition to the automatically operating means, said hand operating means being capable of operation independently of the automatically operating means.

Another object of my invention is to provide a device of the character described that will permit limited tilting of the plane or craft as a whole before the automatic gravity operated mechanism is brought into action.

Other and further objects of my invention will become readily apparent to those skilled in the art from a consideration of the following description taken in conjunction with the drawings wherein,

Figure 1 is a front view of a typical aeroplane with my device attached thereto, showing it in rather exaggerated proportion to other parts of the plane; Fig. 2 is a longitudinal and enlarged sectional view of the controlling device; Fig. 3 is a transverse section taken on lines 3—3 of Fig. 1; and Fig. 4 is a transverse section taken on lines 4—4 of Fig. 1.

In all the views the same reference characters are used to indicate similar parts.

In the exemplification of an aeroplane which I have shown for the purpose of disclosing my invention, 10 is the main plane located at the top of the machine and 11 is a similar but shorter plane located below the main plane and intermediate the ends of the two planes are two tilting planes 12 and 13, each plane being centrally pivoted, as at 14, to a bracket structure 15, secured to the upper plane 10. Ropes 16 and 17

are connected to the fore and aft ends of the tilting plane 13 and other ropes 18 and 19 are similarly connected to the tilting plane 12. These ropes will be referred to hereafter when the operation of the device is specifically described. Other portions of the aeroplane are not of present interest and will therefore not be specifically described.

As illustrative of the operation of my device with a craft which I have exemplified I will state that if the starboard side of the craft as a whole, or of the plane 10 be depressed and the port side elevated then to bring the craft to an even keel, it would be necessary to elevate the fore end of the starboard side tilting plane, when by this means the machine would immediately right itself or be brought to a horizontal position. By elevating the fore ends of the tilting planes 12 and 13 the craft as a whole will thereby be made to ascend, and by depressing the fore ends of these planes the craft will be caused to descend, so that by the proper manipulation of the tilting planes 12 and 13 the machine or craft may be brought to and maintained in a state of safe equilibrium in a horizontal position of its port and starboard side or with reference to its fore and aft ends. In so far as my invention is concerned other means than the tilting planes shown may be employed for producing this result.

My invention consists in the automatic and manual motor means for either automatically or manually operating the planes for bringing about this desired end, and has no connection whatever with the particular arrangement of the craft employed to accomplish this result.

The mechanism by which my invention is carried into effect is shown in Figs. 2 and 3 wherein 20 is a tube, preferably of rectangular form throughout and closed at both ends. Within the tube is a ball 21, which may be made of steel, lead, or other heavy material. The floor of the tube, preferably slants from each end toward its longitudinal center as at 22 and 23 so that when the craft or aeroplane is on a perfectly even keel, either fore and aft, or starboard and port direction the ball will remain in the center of the tube, and I preferably provide a depression in the center of the tube in which to receive the ball so that it will require some material slanting or tilting of the tube 20, in order

that slight variations of inclination in the operation of the craft will not cause the ball to shift unnecessarily within the tube. It will be observed that the ball, being protected by the closed tube 20, is perfectly shielded thereby from atmospheric influences and also from the effect of winds or extraneous air, thereby rendering the ball effective only by the influence of gravity. The tube 20 is mounted in a frame composed of side members 24 and 25, the tube being freely pivoted near its center in the said frame on the trunnion 26. To one of the projecting ends of the trunnion is attached a helm handle 27 for the purpose of causing the ball 21 to roll toward one end or the other of the tube 20.

At a convenient place on the craft is located a power cylinder 28 having a reciprocable piston 29 mounted upon the rod 30. The rod 30 passes through stuffing boxes 31 and 32 so that it may be reciprocated freely through the opening of the cylinder 28 without leaking the pressure fluid by means of which the piston is moved within the cylinder. To the ends 33 and 34 of the rod 30 are connected ropes or wires 35 and 36. These wires or ropes are connected to the planes of the aeroplane, such as 12 and 13, the movement of which will change the course or position of the craft.

A pipe 37 is connected to a source of fluid power supply such as a tank containing air or steam under pressure. It is also connected to pipes 38 and 39 that communicate with the respective ends of the cylinder 28 by pipes 40 and 41. A valve 42 controls the admission of the motive fluid into the pipes 38 and 39 and valves 43 and 44 control the admission of the motive fluid into each end of the cylinder 28. These also serve as means for controlling the exhaust of the motive fluid from the opposite side of the piston when the motive fluid under pressure is admitted into the cylinder on the other side of the piston.

A rod 45 is guided in bearings 46 and 47 of the tube 20 and it may be freely moved therein, the bearings being slotted vertically in such manner as to permit considerable vertical displacement between the respective ends of the rod 45 and the tube 20, as in the act of tilting the tube. The tube is slotted at each end as at 48 and 49 for admission of the bent ends 50 and 51 of the rod 45. These bent ends of the rod 45 project into the tube 20 and lie in the path of the ball 21. An arm 52 is connected to the valve proper 42' and in turn is connected by arm 53 to the rod 45 so that when the rod 45 is reciprocated the valve 42' is opened or closed as the case may be. To the end of the arm 52 is connected a spring 54 and to the other end of the rod 45 is connected another similar spring 55. These springs serve to retain the rod 45 in

the central position shown in full lines in Fig. 2 in which position the valve 42 is closed shutting off the admission of the motive fluid to the pipes 38 and 39. The valves 43 and 44 are connected to the rod 45 by means of slotted arms 56 and 57 so that when the rod 45 is reciprocated to one side or the other the respective valves are shifted so as to admit the motive fluid under pressure, on one side of the piston while the other valve is shifted to such a position as to permit the fluid on the other side of the piston to be exhausted whereby the piston 29 may be driven from one end of the cylinder 28 to the other.

The operation of the device is as follows: So long as the tube 20 remains in a substantially horizontal position the ball 21 will be located and retained in a position near the center of the tube. Should however the tube be tilted, either by means of the tilting of the craft upon which it is located, or by means of the handle 27, in a manual manner, the ball 21 will immediately roll to the depressed end of the tube and striking the arm 50 or 51, as the case may be, will cause shifting of the valves 42, 43, and 44. Assuming that the tube be tilted so that the end to the left is depressed the ball will move toward the arm 50 and its weight and momentum will cause the rod 45 to be moved to the left thereby forcing the valve 42 to open position and permitting the fluid under pressure to pass into the pipes 38 and 39. By this operation the valve 43 is opened so that fluid under pressure will pass through the pipe 38 into the left hand side of the cylinder 28 through valve 43 causing the piston 29 to be moved over to the right, and at the same time the valve 44 is opened so that air or gases within the cylinder 28 and between the piston 29 and the right hand end of the cylinder will be exhausted through the pipe 41. The movement of the piston 29 from its central position will cause the rod 30 to move in a corresponding direction thereby deflecting the planes 12 and 13 of the craft through the operation of the ropes 35 and 36 causing a change of direction, either by elevating the fore end of the craft and depressing the lower end or by raising either the starboard or port side of the craft so that it will be returned to a more horizontal and retained in a more stable position. When the craft is reaching its restored position the ball 21 will roll down the incline 22 toward the central part of the tube and will thereby be slowly restored to its normal position. The incline 23 on the right hand side of the tube will prevent its momentum from carrying it too far to the right and striking the arm 51. The indentation 60 made in the tube near the center thereof will serve as a means of retaining the ball in this position

when it has reached it thereby making it more stable and not affected by slight variations of inclination. If now the left hand end of the tube 20 be raised and the right hand end be depressed the ball will move toward the right hand end and the operation will be repeated in a manner similar to that described in regard to the left hand end and the piston 29 will be caused to move in an opposite direction thereby warping, or distorting or tilting suitable planes in a desired manner for the purpose of changing the position of the craft. It is evident if the tube 20 is not disturbed by means of the handle 27 that when the craft has moved into such a position that the tube 20 no longer occupies a horizontal position, the ball will automatically be caused to approach one end or the other of the tube 20 that may be depressed and operate the valves and motor mechanism in the manner heretofore described, and when the craft has by operation of the power mechanism righted itself the ball will then be returned to its normally inoperative position located near the center of the tube.

One of the especial features of my invention consists in the fact that the ball is entirely protected from extraneous influences and the same mechanism by which the course or position of the craft is changed in an automatic manner solely through the effect of gravity is a means by which it may be also similarly changed by manual operation.

It will be evident that it is not essential that the pipes and valves be arranged precisely as I have shown in the drawings as any other equivalent means of arrangement may be adopted without departing from the spirit of the appended claims.

Having described my invention what I claim and desire to secure by Letters Patent is:

1. In a balancing means for an aeroplane having pivoted balancing planes, means automatically to operate said planes comprising two closed parallel tubes, a piston in the center of one of said tubes movable by pressure toward either end, a ball in the center of the other tube movable by gravity toward either end, a pipe leading to each end of the first said tube, an arm extending within both ends of the second said tube, and a valve for each said pipe, both valves having connection to said arm for operation thereby.

2. In a balancing means for an aeroplane having pivoted balancing planes, a tube, a

piston therein having suitable connection with said planes, a single pipe leading to each end of said tube, a valve in each pipe movable to two positions one to connect the pipe to a source of pressure supply and the other to open said pipe to the atmosphere, an arm connecting said valves, the ends of said arm being bent downwardly, a tube slotted near its ends to receive said bent ends of the arm, and a ball in said slotted tube for abutment against said bent ends of the arm.

3. In a balancing means for an aeroplane having pivoted balancing planes, a tube, a piston therein having suitable connection with said planes, a single pipe leading to each end of said tube, a valve in each pipe movable to two positions one to connect the pipe with a common supply pipe and the other to open said pipe to the atmosphere, an arm connecting said valves for movement of one thereof to one of its positions while the other valve is moved to the other position, a common supply pipe leading to said valves, a valve in said supply pipe, connections between said valve in the supply pipe and said arm to close said valve in the supply pipe when the arm is in mid-position and to open said valve in the supply pipe when the arm is in either position to operate the valves for said tube, laterally projecting end members for said arm, a tube slotted to receive said projecting end members, and a ball in said tube to abut against said end member and move said valve-operating arm as described.

4. In a device of the character described, for application to an aeroplane having balancing planes, pressure-responsive means to operate said planes, and means to control said pressure-responsive means comprising a tube, a ball therein, and abutments at the ends of said tube, said tube being shaped in its bottom to respond to tilting beyond a certain limit but not to respond to tilting or less extent, said bottom comprising slanting surfaces (22—23) and a ball receiving indentation (60) at the center where said slanting surfaces meet, whereby slight tilting of an aeroplane incident to its flight does not disturb the position of said ball, said ball upon greater tilting of the aeroplane rolling quickly along said slanting surfaces after escape from said indentation.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

WILLIAM F. HENSEL.

In the presence of—
W. LINN ALLEN,
MARY F. ALLEN.