

A. J. MACY.

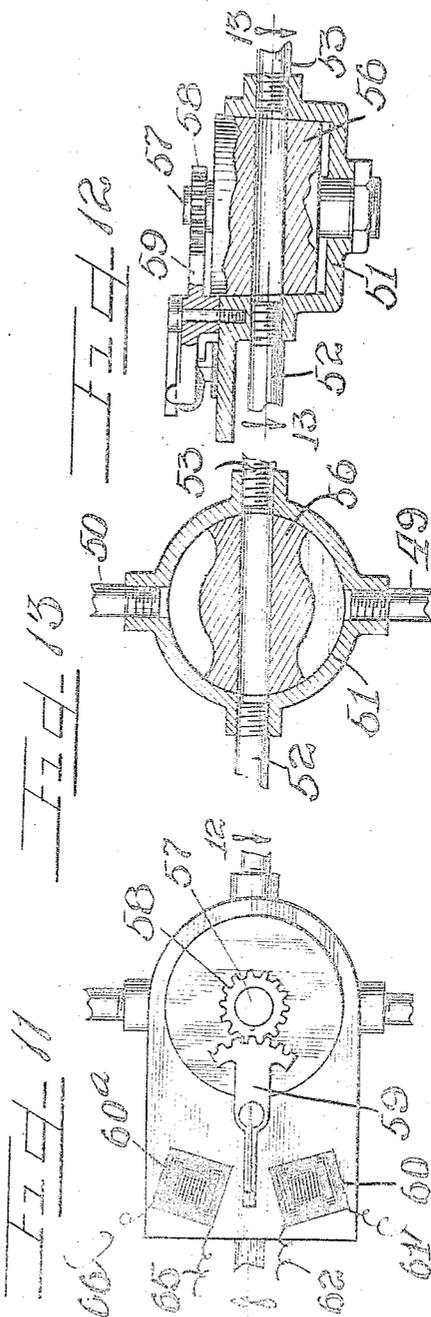
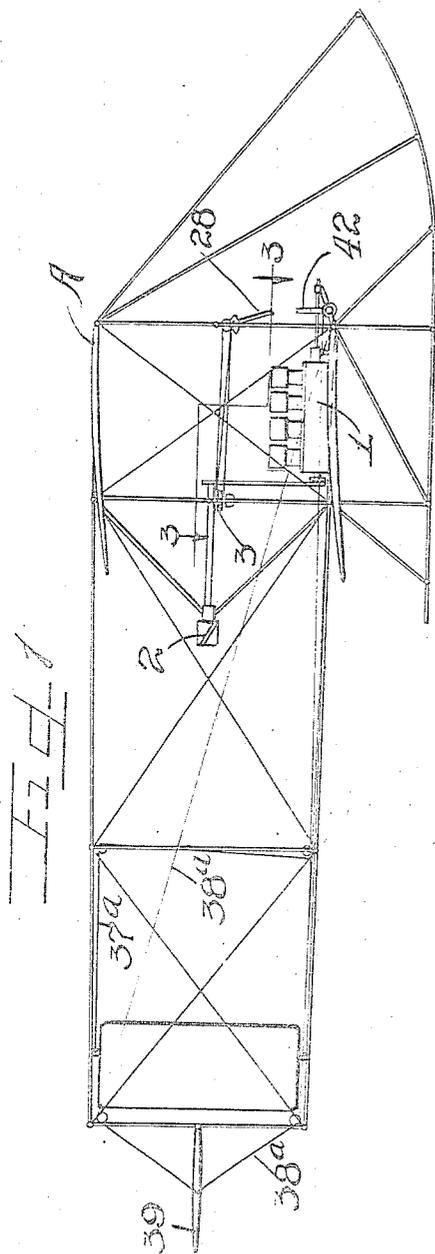
STABILIZER.

APPLICATION FILED JAN. 27, 1913.

Patented May 9, 1916.

4 SHEETS—SHEET 1.

1,182,025.



WITNESSES

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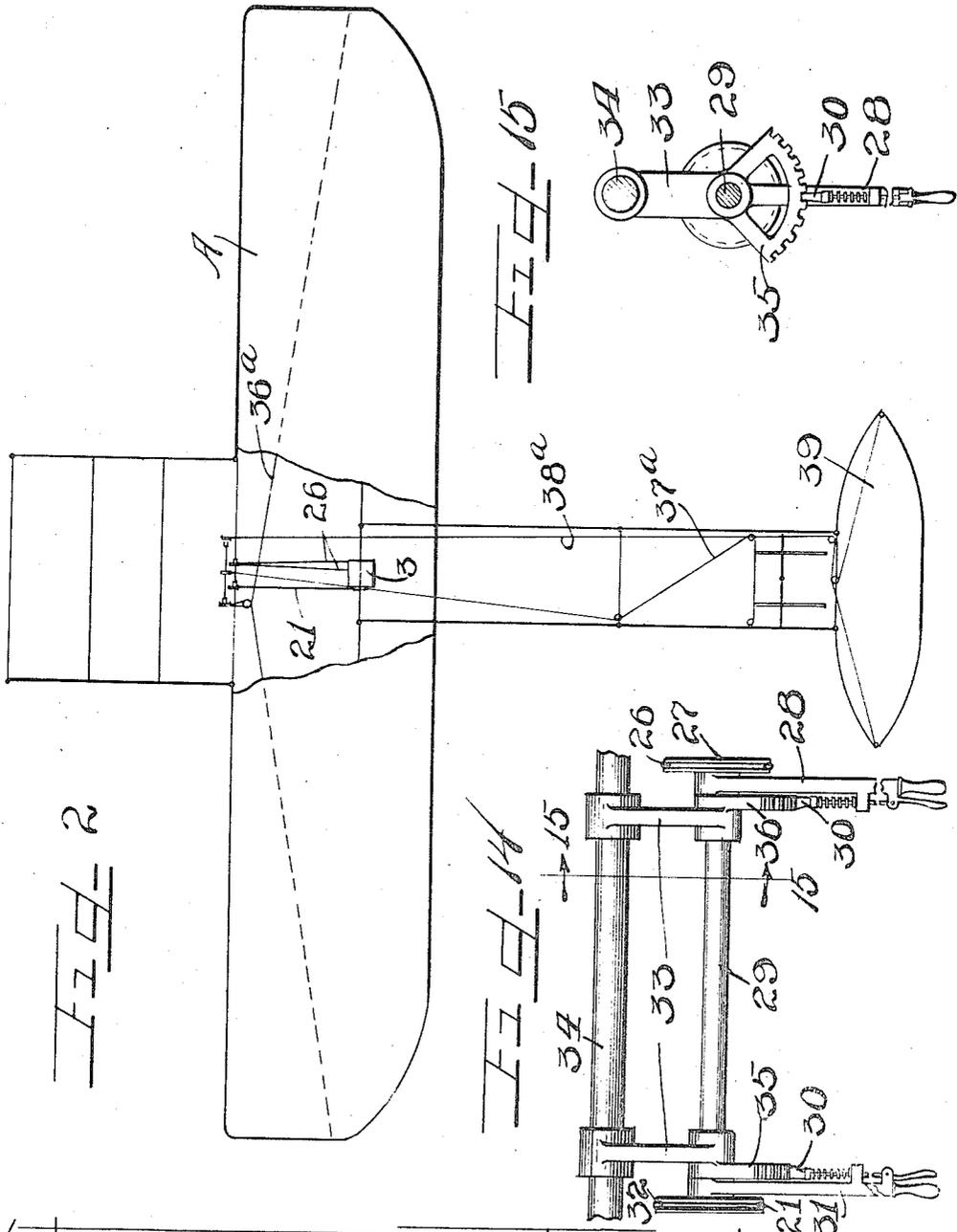
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

Fig 3

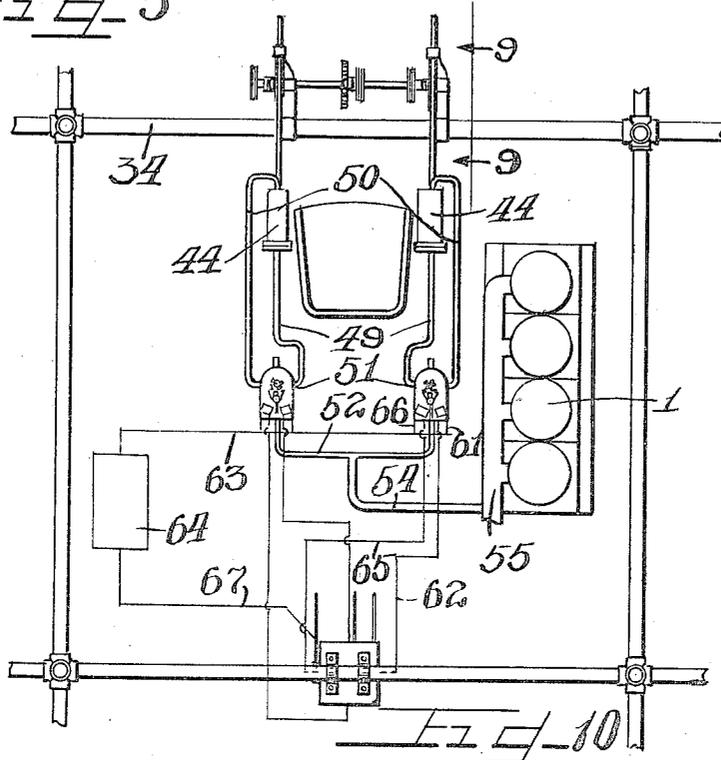
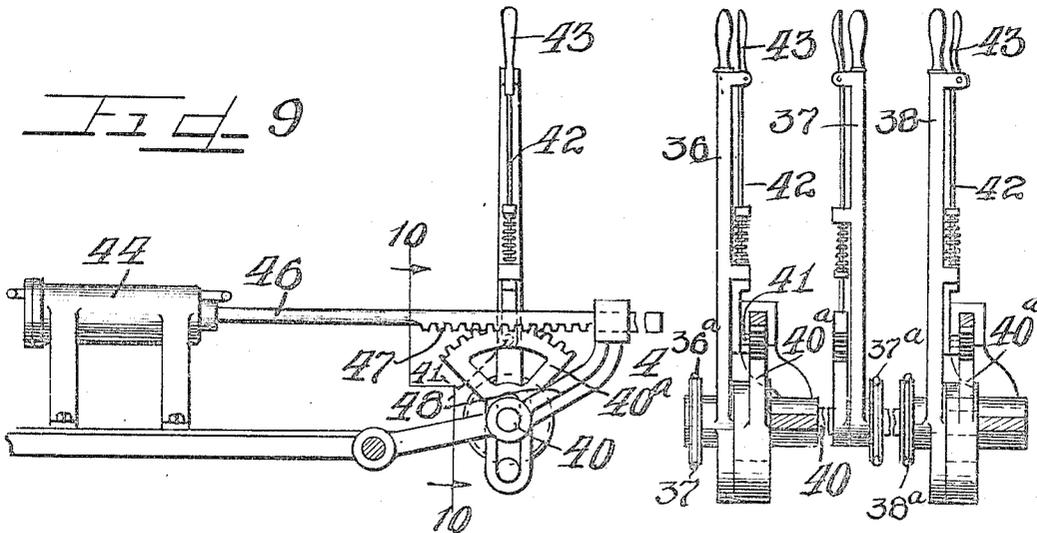


Fig 9



WITNESSES

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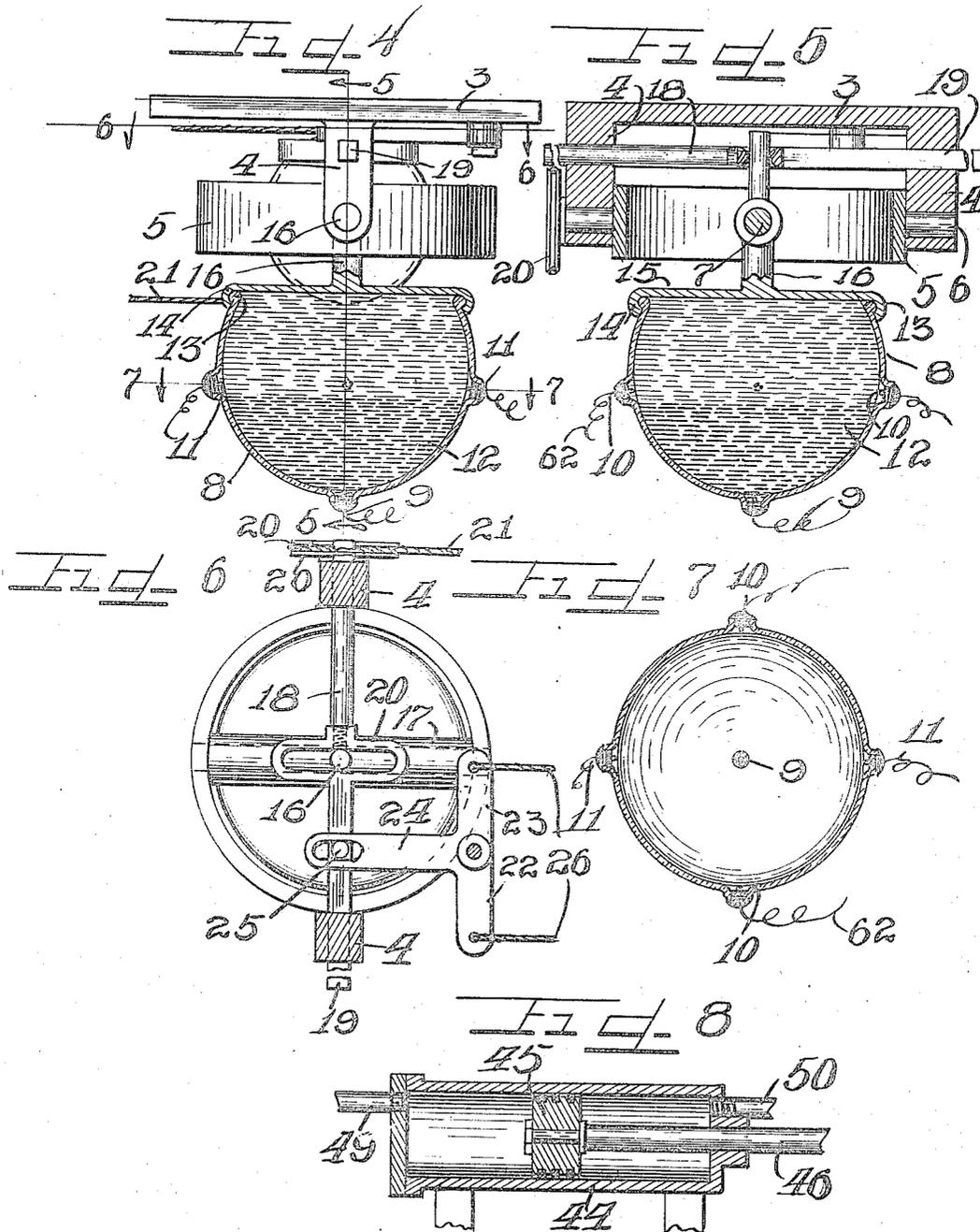
By Alfred J. Macy
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4 SHEETS—SHEET 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

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STABILIZER.

1,182,025.

Specification of Letters Patent.

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Application filed January 27, 1913. Serial No. 744,555.

To all whom it may concern:

Be it known that I, ALFRED J. MACY, a citizen of the United States, and a resident of the city of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Stabilizers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the numbers of reference marked thereon, which form a part of this specification.

This invention relates to improvements in devices for insuring stability and maintaining equilibrium of self-propelled devices, such, for example, as aeroplanes or flying machines of any type, or even submarine vessels and torpedo boats.

The invention (for convenience of illustration) is shown embodied and installed upon a biplane although it will be evident that it is applicable to many other devices and uses.

The operation of all flying machines has, of course, up to the present time, been accompanied with numerous dangers, both to the structure and the operator, to which other than air supported vehicles are not subjected. The loss of life in the last few years has been enormous among the operators and users of aeroplane devices in proportion to the number of men so employed. Accidents are frequent and numerous, and almost invariably are fatalities. These accidents are occasioned in various ways. Sometimes, it is true, by structural failure or the recklessness or inexperience of the operator, but more frequently they are occasioned from causes beyond his control to adequately guide and control the machine. Sometimes momentary faintness of the operator causes him momentarily to lose control of the machine with fatal results; sometimes fatigue, due to the excessive nervous and muscular strain necessary to maintain the stability and equilibrium of the machine causes a moment's lapse or release, with fatal results.

In numerous instances, the operator when in air, finds it necessary to effect some adjustment of the engine or some part of the

machine, but is unable to do so because unable to vary his position, or to release the controlling levers to permit him so to do, and in such cases, the operator is indeed fortunate who has within the range of volplaning flight, a landing place to which he may descend without destruction.

The object of this invention is to afford a device adapted to be set by the operator to determine and control the angle of inclination when ascending, or when volplaning in descent, and which, when once set, will act to positively hold and retain the angle of inclination determined upon by the operator until readjustment is effected by the operator.

It is also an object of the invention to afford a construction whereby the device may be set to afford a lateral adjustment either in wing warping or in adjusting the ailerons or the tail for spiral flight, the machine on such adjustment maintaining the desired inclination and lateral adjustment due to the automatic action of the stabilizing device.

It is a further object of the invention to afford operative means whereby the stabilizing mechanism may at the will of the operator, be released from control to permit the operator to control the machine manually as he sees fit, said stabilizing device, however, immediately coming into action again upon the operator releasing the controlling levers.

It is a further object of the invention to afford a construction whereby lateral stability is positively and automatically assured at all times, without the assistance of the operator by affording means for suitably warping the wings, operating the ailerons or other mechanisms for maintaining lateral stability without the aid of the operator, and which may be immediately thrown out of action by the operator when desired, to vary the flight.

It is an object of the invention to afford a construction adapted for use in maintaining lateral and longitudinal stability automatically on any device or vehicle in which longitudinal and lateral stability is desirable.

It is an important object of this invention to enable the propelling motor or engine to actuate the controlling mechanisms either

directly or (if a steam engine or an internal combustion engine) indirectly through the exhaust, if desired.

It is to be understood that the object of the invention is to afford mechanism for regulating and controlling longitudinal inclination, and also lateral inclination for any vehicle requiring such control, for example, those movable in the air or upon or in the water.

The invention (in a preferred form) is illustrated in the drawings, and more fully pointed out and defined in the appended claims.

In the drawings: Figure 1 is a side elevation of a bi-plane equipped with mechanism embodying my invention. Fig. 2 is a diagrammatic top plan view thereof, with parts omitted. Fig. 3 is an enlarged section on line 3—3 of Fig. 1. Fig. 4 is an enlarged elevation, partly in section, of the stabilizing device, showing the same removed from the machine. Fig. 5 is a section on line 5—5 of Fig. 4. Fig. 6 is a section on line 6—6 of Fig. 4. Fig. 7 is a section on line 7—7 of Fig. 4. Fig. 8 is an enlarged, longitudinal section of the controlling cylinder and its piston. Fig. 9 is an enlarged section on line 9—9 of Fig. 3, illustrating a mounting of the controlling cylinder and its driving connections. Fig. 10 is a section on line 10—10 of Fig. 9. Fig. 11 is an enlarged top plan view of one of the controlling valves. Fig. 12 is a section on line 12—12 of Fig. 11. Fig. 13 is a section on line 13—13 of Fig. 12. Fig. 14 is an enlarged, fragmentary elevation of the adjusting levers for the stabilizer. Fig. 15 is a section on line 15—15 of Fig. 14.

As shown in the drawings: the invention merely for convenience of illustration, is shown embodied as a stabilizing device on a Wright bi-plane, indicated as a whole by A, although it is, of course, applicable for use with equal facility and utility on any air or water vehicle. The engine, or source of power, 1, for the vehicle, is shown as an internal combustion engine, driving through suitable connections the propellers 2, as usual.

Rigidly secured on the frame of the machine at any suitable point, is a frame plate 3, having on opposite sides depending, parallel bracket arms 4, between which is journaled the gimbal ring 5, upon gudgeons 6, which extend into the bracket arms. Extending through the gimbal ring at a right angle with the gudgeons thereof, is a shaft 7, and suspended freely on said shaft is the gravity and electrically operated stabilizing element. As shown, said stabilizing element comprises a receptacle or cup 8, preferably spherically concave in its interior and of non-conducting material such as glass or hard rubber, and connected in the bottom

thereof extending upwardly therein is a contact 9.

At about midway in the height of the cup 4, contact members are arranged ninety degrees apart and at the same level preferably, and project into the cup, two of these 10, being respectively on the forward and on the rear side of the cup, and the remaining two 11, being on the opposite sides of the cup. The cup is filled with mercury 12, shown in dotted lines in Figs. 4 and 5, nearly to the height of the contacts 10 and 11, and above the same, a non-conducting liquid such as oil or glycerin fills the cup to its top. A peripheral flange 13, is provided at the top of the cup, which engages and interlocks in flanges 14, of the cover 15, which hermetically seals the cup.

Extending upwardly from the center of the cover 15, is a stem 16, which is provided about midway in its length with a transverse sleeve 17, through which the shaft 7, extends, so that said cup may, unless otherwise controlled, swing on said shaft. Above the gimbal ring, and parallel the gudgeons thereof, is a slide bar 18, one end 19, of which is angular and fits in a complementary bore through one of the brackets 4. Said slide bar is extended at each side thereof at its middle, and transversely slotted to afford a relatively long slot directed at a right angle with the slide bar and directly above the shaft 7, and into which the upper end of the stem 16, of the stabilizing element extends. One of the gudgeons 6, is provided with a pulley 20, rigidly secured thereon and over which is trained a cable or chain 21, which is thence led around suitable idlers to one of a group of controlling levers hereinafter described. Pivotaly mounted upon the plate 3, is a bell crank, provided with arms 22, 23, and 24, of which the arm 24, is slotted and engages a lug 25, secured on the slide bar 18. A suitable line or cable 26, is connected at its ends in the arms 22, and 23, respectively, and thence led over suitable idlers to a pulley 27.

Journaled on the shaft 29, and rigidly connected with the pulley 27, is a lever 28, which is provided with a spring pressed detent 30. Also journaled on the shaft 29, is a similar lever 31, to which is rigidly secured a pulley 32, and about which is trained the aforesaid cable or chain 21. Said shaft 29, is rigidly supported in depending brackets 33, which are secured on one of the cross strut members 34, of the vehicle frame.

The adjusting levers for the stabilizer are thus in position in front of the operator and above the usual controlling levers for manipulating the machine. However, the applicant does not limit his invention to the specific positioning of the elements of the

device, as this is obviously open to wide variation.

Integral with the brackets 33, depending below the shaft 29, are the notched segments 5 35, adapted to be engaged by the spring pressed detents 30, connected on the levers 28 and 31, respectively, affording means whereby the same may be held in any desired adjustment independently of each 10 other. Suitably mounted in the usual position on the vehicle, are the control levers 36, 37 and 38, of which 36, is connected to the ailerons or warping mechanism controlling the lateral inclination of the machine, and 15 to 38 are connected means for controlling the longitudinal inclination of the machine, while to 37, is connected the steering mechanism to guide the vehicle in a horizontal plane.

20 As shown in Figs. 1 and 2, the line or cable 36^a, connected to the warping tips of the planes, is led around a pulley 37, rigidly connected with the lever 36. Likewise a line 37^a, is connected to the vertical rudder 25 or horizontal steering mechanism, and the line 38^a, leads to the usual elevating mechanism, in this construction designated as the rear elevator 39.

Slidably mounted upon the shaft 40, affording the support for the levers 36, 37, and 38, respectively, are the slidable gear segments 40^a, provided with an elongated slot through which the shaft 40, extends. Said 30 segments are permanently, but movably connected to the respective levers 36 and 38, by means of a lug 41, secured at one end of the rod 42, which extends upwardly along the side of the lever to the handle and is there 35 connected to one arm of the pivoted grip 43, adapted to be engaged by the hand of the operator. It will thus be seen that the segment 40^a, is normally held upwardly relative the shaft 40, but by actuation of the grip 43, and the consequent downward 40 movement of the rod 42, the segment is moved downwardly for a purpose hereinafter described.

Mounted at a convenient position on the frame work of the aeroplane, or other machine on which the device is attached, is a 50 cylinder 44, provided with a piston 45, to which is rigidly connected a piston rod 46, that is provided with teeth affording the rack 47. Rigidly mounted on the shaft 40, is a bracket arm 48, through which the outer 55 end of the piston rod 46, is adapted to slide to maintain the same in alinement in the cylinder.

Communicating in opposite ends of the 60 cylinder 44, are the pipes 49 and 50, respectively, which connect in opposite sides of a four way valve indicated as a whole by 51. Also communicating in the valve 51, in alinement with one another and at substan-

tially right angles with the entering pipes 65 49 and 50, are the pipes 52, and 53, respectively, of which the pipe 53, affords a free opening to the atmosphere, and the pipe 52, of which is joined with a similar pipe leading from another cylinder 44 forming a part 70 of a duplicate mechanism to that described in the foregoing. The two similar branches of the pipes 52, one from each of the duplicate mechanisms, are connected to the pipe 54, which, as shown in Fig. 3, is connected in 75 the exhaust manifold 55, of the engine.

The four way valve 51, is provided with an apertured rotatable element 56, and which is recessed on each side of the aperture such that a one eighth revolution from 80 the position shown in Fig. 13, in a counter-clockwise direction will bring the pipes 50 and 52, into communication, and the pipes 49 and 53 likewise. This operation will admit gas under pressure to one end of the 85 cylinder 44 on one side of the piston and open the opposite side of the piston to the atmosphere, thus allowing the gases on one side of the piston in the cylinder to be expelled with the consequent movement of the 90 piston due to the admission of gas under pressure on the other. This valve is operable from the stabilizer element containing the mercury. For this purpose the rotatable element 56, is provided with a stem 57, 95 on which is keyed a small pinion 58.

Pivotaly mounted on the upper side of an extension of the casing of 51, is a lever 59, one end of which is composed of magnetic material, and the other end of which is 100 provided with a gear segment adapted to mesh with the pinion 58. Symmetrically disposed on each side of the magnetic end of the lever 59, when in central position, are the electro-magnets 60 and 60^a respectively. 105 When either one of the electro-magnets 60 or 60^a, is energized, the lever 59, will be moved about its pivot rotating the pinion 58, and adjusting the valve element 56, accordingly. 110

Connected with the electro-magnet 60, are the electric wires 61 and 62, of which the lead 61, is connected to a main feed wire 63, which is in turn connected to a suitable 115 source of electro-motive force 64, shown in this case as a storage battery. As shown in Fig. 3, the wire 62, is connected to one of the side electrical contact points numbered as 10. Likewise, referring to the electro-magnet 60^a, the feed wire 66, is connected 120 to the main feed wire 63, and the lead 65, is connected to the other of the side terminals numbered as 10, in the mercury bowl.

Referring to the duplicate apparatus for 125 controlling the inclination of the machine by means of the rear elevator 39, it will be seen that the feed wires from the respective electro-magnets are also connected to the main

feed line 63, and the other terminals thereof are led around and connected to the longitudinally disposed terminals 11, in the mercury bowl. Thus it is readily seen that when the vehicle at any time assumes an angle other than that for which it is intended to move, the mercury will serve to connect one of the terminals 10, or 11, with the base terminal 9, which is connected to the source of electro-motive force by means of the lead 67, and the electric circuit being thereby completed, one of the two electro-magnets on either or both of the two valves shown, will be energized, thus actuating the valve and permitting gas under pressure to flow into the actuating cylinder.

The operation is as follows: Referring to Figs. 9 and 10, it will be seen that a positive connection is afforded between the piston rods 46, and the respective levers 36 and 38, which are directly connected to the lateral and longitudinal controlling mechanisms of the aeroplane, thus permitting said controlling mechanisms to be actuated either by the cylinders through the agency of the stabilizer or permitting them to be manually adjusted by the operator. If it is desired to operate the controlling mechanisms of the vehicle independently of the stabilizing means, as in the case of an emergency, the operator closes his hand about the grips 43, as well as the handle of the levers 36 and 38, depending whether one or both of the two mechanisms are to be operated, whereupon the gear segments 48, through the agency of the spring pressed rods 42, are depressed and thrown out of engagement with the racks 47, thus permitting actuation of the controlling mechanisms instantaneously and directly and independently of the stabilizing mechanism. However, the operation of the stabilizing mechanism is in nowise affected by manual manipulation of the levers, and although the gear segment 40^a, may be rotated through an angle due to a certain adjustment effected by the operator, the toothed rack on the piston rod 46, due to the action of the stabilizing mechanism governing the pressure cylinder, will also move in the same direction as the toothed rack, due to the change in the inclination of the vehicle effected by the operator, and accordingly the intermeshing elements, although out of train, will assume the same relative position, so that release of the handle grip 43, permitting engagement of the segment and rack, will allow the same to engage one another in the proper relation. When the machine is at rest upon the ground, and the operator desires to ascend, the stabilizing bowl is adjusted by means of the proper lever to cause the machine when once off the ground, to

assume a certain climbing angle of inclination. Having left the ground and assumed the proper climbing angle, should, for any reason, due to a gust of wind, or air pocket, or other disturbing influence, the machine be caused to change its angle of inclination, either in an upward or downward direction, such change in inclination will immediately cause the mercury in the stabilizing bowl to complete one of the electric circuits, thereby throwing into operation the piston operating the elevating mechanism, causing the controlling elements to be so disposed as to immediately cause the machine to be restored to the angle of inclination for which the stabilizing bowl is set. When a certain altitude has been reached, the operator adjusts the depending levers in front of him to a position, for instance, to maintain the machine in a straight line of flight. If for any reason, the machine is diverted therefrom, even momentarily, further deviation is immediately counteracted by means of the controlling mechanism actuated by the cylinder due to the closure of certain electrical contacts within the stabilizing bowl. When it is desired to descend, as for a landing, the levers operating the controlling mechanism are actuated exclusively by hand, and although the stabilizing elements are also operating, they are disconnected from the levers due to the disengagement of the notched segment and the piston rod rack and the machine may be guided at will, as usual in landing, by the operator

Of course, it is to be understood that although I have shown the pressure cylinders actuated by the exhaust from the motor, obviously any source of pressure or means of producing a difference in pressure in the cylinders to move the pistons, may be used. While I have described the invention with reference to an aeroplane or a heavier than air flying machine, the device is particularly appropriate and applicable to a submarine device or torpedo boat and may even be utilized to assist in preventing lateral and longitudinal rolling and plunging of a vessel at sea. Of course, when so installed, the particular mechanism operated by the stabilizing device will vary in accordance with the character of the installation, that is to say, the invention when installed on a flying machine, is connected to operate the wings or the elevators or tail, while upon marine installation, for example, submarine vessels, the mechanism would vary, and lateral and longitudinal stabilizing propellers or rudders would be controlled thereby. I have not, however, deemed it necessary to illustrate all the manifold and various purposes to which my invention may be applied,

inasmuch as its utility for such various purposes will be readily understood. I have therefore illustrated but a preferred form of my embodiment of the invention, and I do not purpose limiting the patent granted on this application, otherwise than necessitated by the prior art.

I claim as my invention:

1. A stabilizing mechanism comprising equilibrium governing means, engine exhaust pressure operated power cylinders adapted to actuate the same, and means acting automatically to bring said cylinders into operation.

2. In a device of the class described, electrically controlled valves, and engine exhaust pressure cylinders operated thereby adapted to actuate controlling mechanism of a vehicle.

3. In a device of the class described, an engine, balancing mechanism, fluid controlling electrically operated valves, and power mechanism actuated from the exhaust of the engine through said valves, adapted to operate the balancing mechanism of the device.

4. In a device for vehicles, a stabilizer comprising a fluid controlling electrically operated valve, engine exhaust power mechanism controlled by said valve, and connections between said mechanism and the guiding means for the vehicle to govern the movement of the same.

5. A stabilizing mechanism for vehicles comprising a fluid controlling electrically operated valve, pressure cylinders, means operating the same by the power plant exhaust of said vehicle, connections between the cylinders and the guiding mechanism of the vehicle to operate said guiding mechanism, and means manually operatable to operate said guiding mechanisms independently of the stabilizing mechanism.

6. In a stabilizing device of the class described, a mercury filled bowl having a plurality of longitudinal and transverse contacts therein, said bowl, when tilted, adapted to close certain of said contacts by the mercury, a plurality of double acting power cylinders, piping connections between the same and the exhaust of an engine, a source of electrical energy, a plurality of electromagnets in circuit therewith and with the contacts in said mercury bowl, and a valve operated by said electromagnets to control the flow from the engine exhaust to said power cylinders.

7. In a power driven vehicle, an engine, exhaust connections for said engine, means to govern the movement of the vehicle, and operative connections between said means and the engine exhaust whereby said means are operated from said exhaust.

8. In a device of the class described, a ve-

hicle, a power plant therefor to drive the same, mechanism for controlling the movement of the vehicle, and means operated from the exhaust of said power plant to actuate said controlling mechanism.

9. In a device of the class described for a vehicle, a mercury filled bowl, electrical contacts therein, and means driven by the exhaust of the vehicle power plant for governing the movement of the vehicle and brought into operation due to the closure of certain of said contacts by the mercury.

10. In a device of the class described for attachment to a power driven vehicle, automatically and manually operatable controlling mechanism therefor, said automatically operated mechanisms driven by the exhaust of the power plant of the vehicle, and means automatically disconnecting said automatically operated controlling mechanism when the manually operated controlling mechanism is actuated.

11. In a device of the class described, a mercury cup, electrical contacts therein, a gimbal mounting for said cup, means retaining said mercury cup inclined at any angle, power cylinders adapted to actuate the controlling mechanism of an aeroplane, a valve adapted to control the operation of said cylinders, electromagnets adapted to be energized to operate said valve when the contacts in said mercury cup are closed, and means operating the controlling mechanism of said aeroplane independently of said mercury cup control.

12. In a device of the class described, a mercury cup, electrical contacts therein, a gimbal mounting for said mercury cup, means locking said mercury cup inclined in any position, mechanism adapted to be thrown into operation by the closure of said electrical contacts in said mercury cup to operate the guiding mechanism of an aeroplane, and manually operatable means adapted to automatically disconnect said mercury controlled mechanism when said manually operatable means are actuated.

13. In a device of the class described, controlling mechanism for an aeroplane, double acting power cylinders operated by the exhaust from the aeroplane power plant adapted to actuate said controlling mechanism, a two way valve adapted to connect one end of each of said cylinders with the source of pressure and the other with the atmosphere for exhaust, and automatically acting electrically controlled means for actuating said valves with a tilting of the aeroplane.

14. The combination with an aeroplane and guiding means therefor, of double acting pressure cylinders operated from the exhaust of the aeroplane power plant for actuating said guiding means, an adjustably

mounted mercury cup mounted on said aeroplane, and electrical means adapted to be thrown into closed circuit by said mercury cup to operate said pressure cylinders with a tilting of the aeroplane.

5
10 15. In a stabilizing device for vehicles, the combination with the power plant and exhaust of said vehicle, of operating means connected to said exhaust, and a plurality of guiding devices for said vehicle connected

to said means for automatic operation thereby.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

ALFRED J. MACY.

Witnesses:

LE ROY D. KILEY,
GEORGE R. MOORE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."