L. B. SPERRY.

UNIVERSAL CONTROL HANDLE.

APPLICATION FILED FEB. 25, 1915.

1,239,837.

Patented Sept. 11, 1917.

2 SHEETS—SHEET 1.

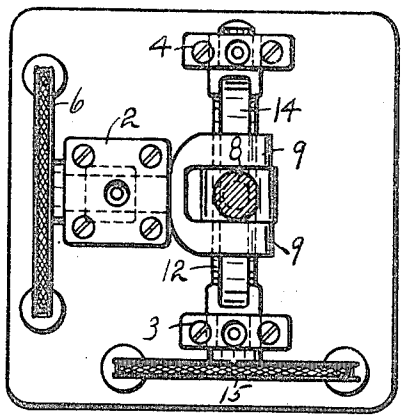


Fig. 3

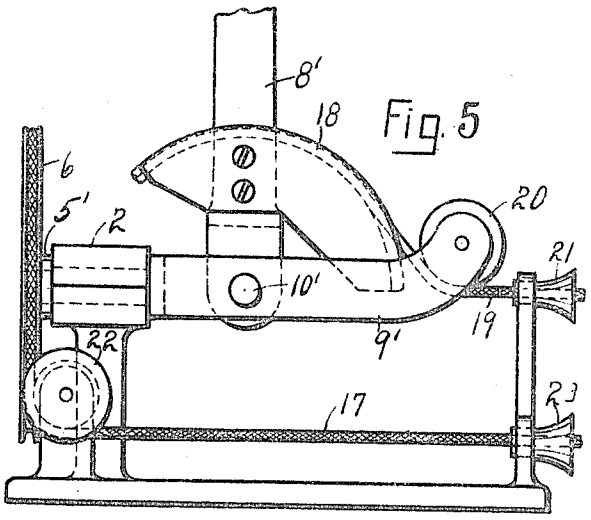


Fig. 5

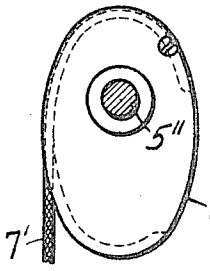


Fig. 4

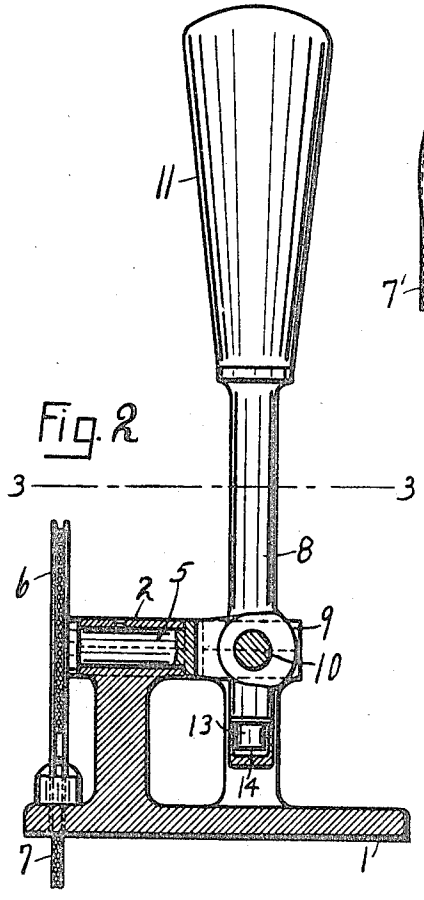


Fig. 2

Fig. 1.

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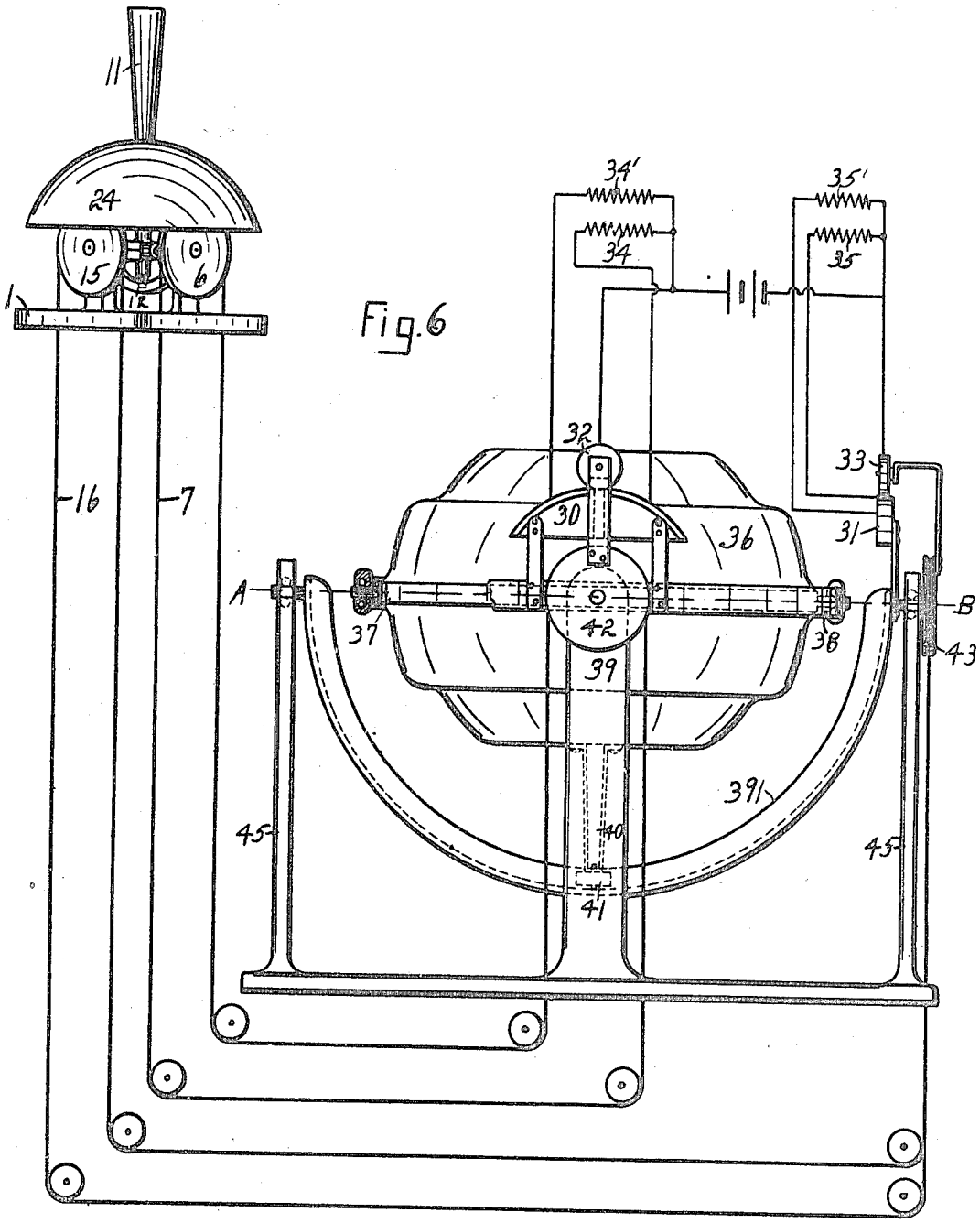


Fig. 6

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UNITED STATES PATENT OFFICE.

LAWRENCE B. SPERRY, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE SPERRY GYROSCOPE COMPANY, OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

UNIVERSAL CONTROL-HANDLE.

1,239,837. Specification of Letters Patent. Patented Sept. 11, 1917.

Application filed February 25, 1915. Serial No. 10,457.

To all whom it may concern:

Be it known that I, LAWRENCE B. SPERRY, a citizen of the United States of America, residing at Brooklyn, New York, have invented certain new and useful Improvements in Universal Control-Handles, of which the following is a specification.

This invention relates to control devices for vehicles in unstable or indifferent equilibrium about two or more axes. More particularly, the invention relates to the control of aeroplanes about both horizontal axes, the object of the invention being to so construct a single control lever that it may be used to govern either directly or indirectly the stability of the aeroplane about both the longitudinal and transverse axes. Further objects of the invention are to improve upon the details of construction of control devices and to provide a device suitable for use in governing and adjusting automatic stabilizing apparatus such as disclosed in the pending application of Elmer A. Sperry, Ser. No. 851477 for aeroplane stabilizers, filed July 17th, 1914.

Referring to the drawings:—

Figure 1 is a front elevation of one form of my improved control device.

Fig. 2 is a vertical section thereof on line 2—2 of Fig. 1.

Fig. 3 is a plan view thereof, the top portion of the handle being broken away on line 3—3, Fig. 2.

Fig. 4 is a detail of a modified form of pulley for the transmission cords or wires.

Fig. 5 is a side elevation of a modified form of control device.

Fig. 6 is a diagrammatic representation of the device used in connection with an automatic stabilizing apparatus.

In the embodiment shown, my device comprises a base 1, on which are mounted in any suitable manner bearing blocks 2, 3 and 4. A shaft 5 is journaled in bearing 2 and is provided adjacent one end with means for transmitting the rotational movements of the shaft to the mechanism for controlling, either directly or indirectly, the stability of the aeroplane on which it is mounted about one of its two horizontal axes. A simple means for effecting this result is to provide the shaft with a pulley wheel 6 around which a cord or flexible wire 7 is placed. Adjacent the other end of the shaft 5 is pivoted a lever 8 on an axis preferably at right angles to the axis of said shaft. For this purpose the end of the shaft may be forked, as at 9, and the lever provided with trunnions 10, journaled in the forks. The lever 8 may serve as the means by which the operator controls the device, by providing it with a handle 11.

Bearings 3 and 4 serve to pivotally support a swinging member or loop 12 on an axis preferably perpendicular to both the axis of shaft 5 and lever 8, when in its normal position. This axis should also lie in the same plane as the axis of trunnions 10. The downward extension 13 of lever 8 is arranged to engage loosely in a groove 14 in loop 12, so that the loop will respond only to movements of the lever about trunnions 10 and will not interfere with movements about the axis of shaft 5. Means are also provided to transmit the oscillations of the loop to mechanism for controlling the stability of the aeroplane about the other horizontal axis, such means being shown as a pulley 15, and a cord 16 similar to pulley 6 and cord 7.

The control cords or wires may either be double, as shown in Figs. 1, 2 and 3, or single, as shown in Figs. 4 and 5. If single cords are employed, it will be understood that the control mechanism to which the cord runs should be provided with a spring to move it when the tension on the cord is lessened.

Fig. 5 shows a modified form of control device. According to this form, only one bearing 2 is used. The shaft 5′, supported in said bearing, carries a grooved wheel 6, to which is secured the flexible cord or wire 17. Shaft 5′ is forked, similarly to shaft 5, at 9′. Between the forks, a lever 8′ is supported on trunnions 10′, so as to oscillate about an axis preferably perpendicular to the axis of shaft 5′. Instead of using a loop 12 to transmit the motions of lever 8′ about 10′, I use in this instance a grooved sector 18, which receives directly the cord 19. A pulley 20, rotatably secured to the forks 9′ and a guide 21 may be used to guide the cord onto sector 18. A similar pulley 22 and guide 23 may be used for cord 17. A bell shaped cover 24 may be provided for

the device as indicated in dotted lines in Fig. 1 and in Fig. 6. The operation of a device constructed in accordance with the general principles of my invention is as follows:

The device is designed to be set up so that the lever 8 is approximately vertical when in its normal position and so that the two axes of rotation of the lever are parallel to the two principal axes of the aeroplane. The connections are then preferably so arranged that a movement of the aeroplane will be produced in the direction in which the handle is pushed. That is, by moving the handle to the right for instance, the right side of the aeroplane will be lowered, while by pushing it forward, away from the operator, the machine will be set for descent. The control cords may be connected directly with the ailerons, rudders or other stabilizing devices, or to contacts or valves controlling servo motors, which perform the actual work of moving the stabilizing devices. As noted above, the device is especially well adapted to adjust the position of the shiftable contacts on an automatic stabilizing apparatus, such as shown in the application of Elmer A. Sperry, referred to above. In such apparatus, diagrammatically represented in Fig. 6, a pair of reversing contact sectors, 30 and 31, are stabilized, one about each axis of the aeroplane. The stabilizing means is represented as inclosed in a casing 36 and is mounted on the inner ring 37 of a pair of gimbal rings, the outer ring, 38, being pivoted on supports 39. Sector 30 is secured directly to ring 38, while in order to communicate the oscillations of ring 37 to sector 31, a channel shaped swinging loop 391, pivoted on uprights 45 is employed, to which sector 31 is secured. An extension 40 on the bottom of casing 36 serves to communicate oscillations about axis A—B to loop 391, while oscillations about the other horizontal axis have no effect, being taken care of by the loose fit of a roller 41 on extension 40 within the channel groove in loop 391. A pivoted brush, or trolley, (32 and 33), which is free to move with the aeroplane, rests on each sector so that, by means of servo motors governed by the brush and sector, the stability of the aeroplane is maintained. Such motors are represented by solenoids 34, 34′, and 35, 35′. In case, however, the sectors become displaced for any reason, from their stabilized position, or in case it is desired to ascend or descend or to bank the machine in turning, it becomes necessary to provide means to move the brushes at will. It is for this purpose that my invention may be used, the one lever 8 serving to control both brushes through the cords 7 and 16. For this purpose pulleys 42 and 43 are provided for the cords, to which the trolley frames are operatively connected in any manner. When the device is being so used, it serves the double purpose of adjustment and steering.

Since a much greater degree of accuracy is required in adjusting the contacts so that the machine flies at the correct angle, than when turning the machine up or down or banking it and since a much larger angular adjustment is required in the latter case, I prefer to design the apparatus so that movements of the handle 11 when near the vertical position will transmit less movement to the brushes than a corresponding movement when the handle is set at a considerable angle. Fig. 4 shows one method of achieving this result by making the pulley wheel 6″ cam shaped, so that initial angular movement will move cord 7′ less than a corresponding subsequent angular movement.

In accordance with the provisions of the patent statute, I have herein described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

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

1. In a control device for aeroplanes, a pair of contacts, the relative position of which is shifted by tilting of the aeroplane about one axis, a second pair of contacts shifted by tilting about the other axis, means for governing the stability of the aeroplane controlled by said contacts, a hand control device for adjusting the position of both pairs of contacts comprising a handle supported so as to be turned about both of said axes, and means connecting said handle and contacts whereby rotation of the device about either axis will cause tilting of the aeroplane about such axis.

2. In a control device for aeroplanes, a pair of contacts the relative position of which is shifted by tilting of the aeroplane about one axis, means for governing the stability of the aeroplane controlled by said contacts, a control handle, a cam like member connected to said handle, and transmission means connecting said member and one of said contacts, whereby the amount of relative movement transmitted to the contact is less when the two contacts are near the same position.

3. A control device for aeroplanes comprising a shaft journaled for rotation, a control

handle pivoted on said shaft at an angle to the axis of the shaft, a swinging loop journaled on an axis lying in the same plane as the pivotal axis of said handle, said loop being only responsive to movements of said handle at an angle to said plane, a cam like member connected to said shaft, a second cam like member connected to said loop, transmission means connecting said members with means for controlling the aeroplane about its respective axes, whereby the relative amount of movement transmitted to said means is dependent upon the position of the handle.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 23rd day of February 1915.

LAWRENCE B. SPERRY.

Witnesses:

EVERETT M. ROEDER,

ALBERT W. STRINGHAM.