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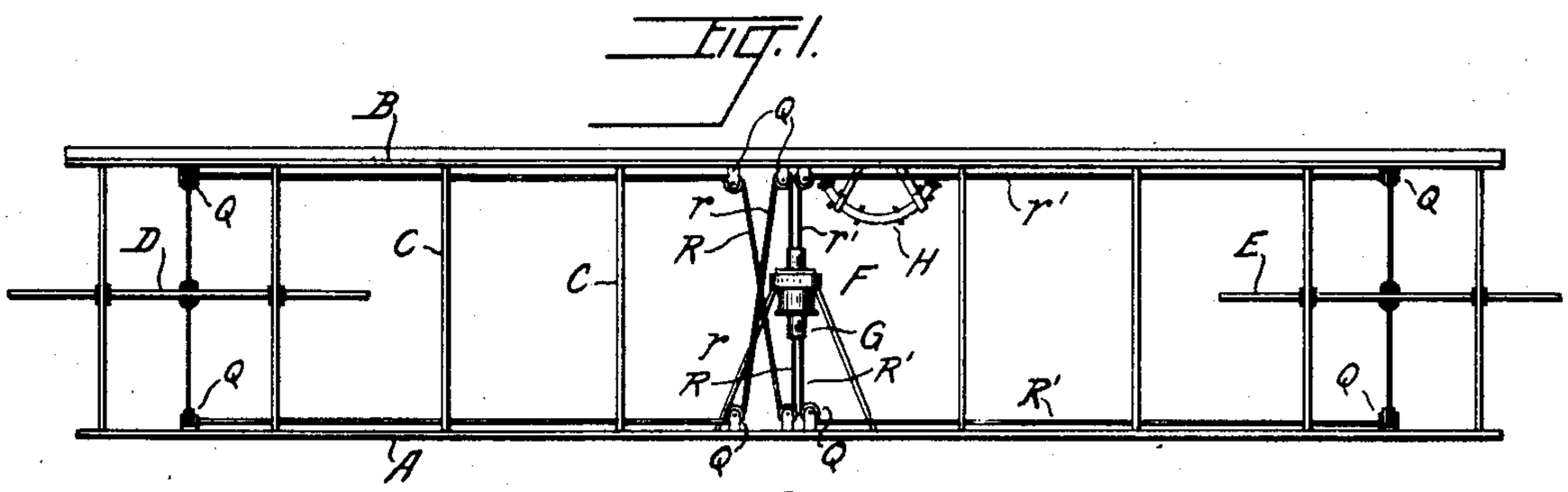
AUTOMATIC EQUILIBRATING DEVICE FOR AEROPLANES.

APPLICATION FILED MAR. 18, 1910.

999,012. **Patented July 25, 1911.**

Fig. 1.



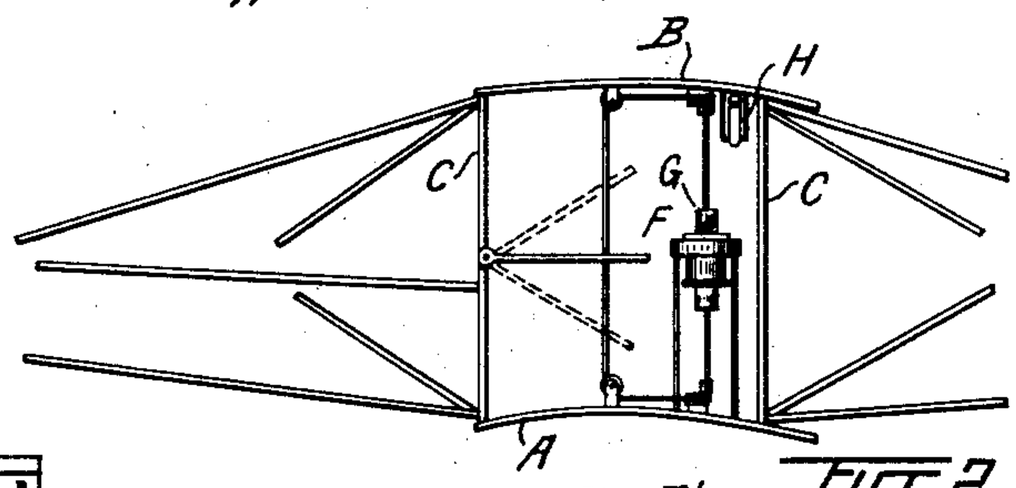


Fig. 2.

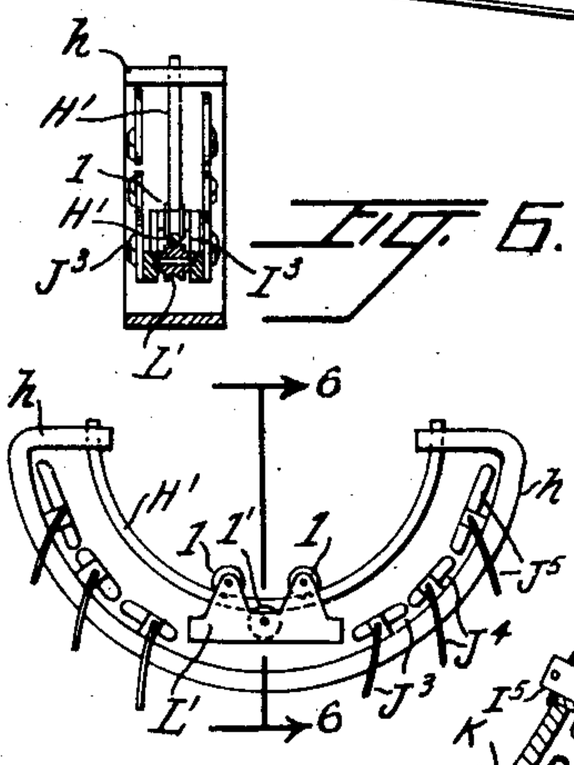


Fig. 6.

Fig. 5.

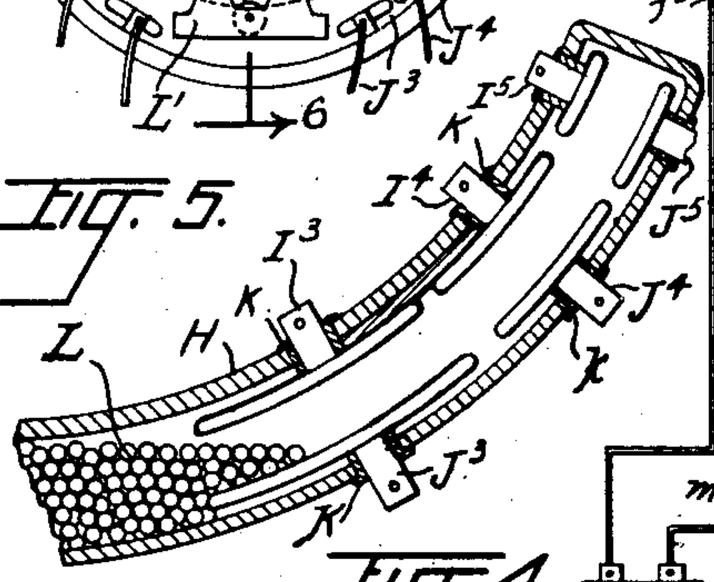


Fig. 4.

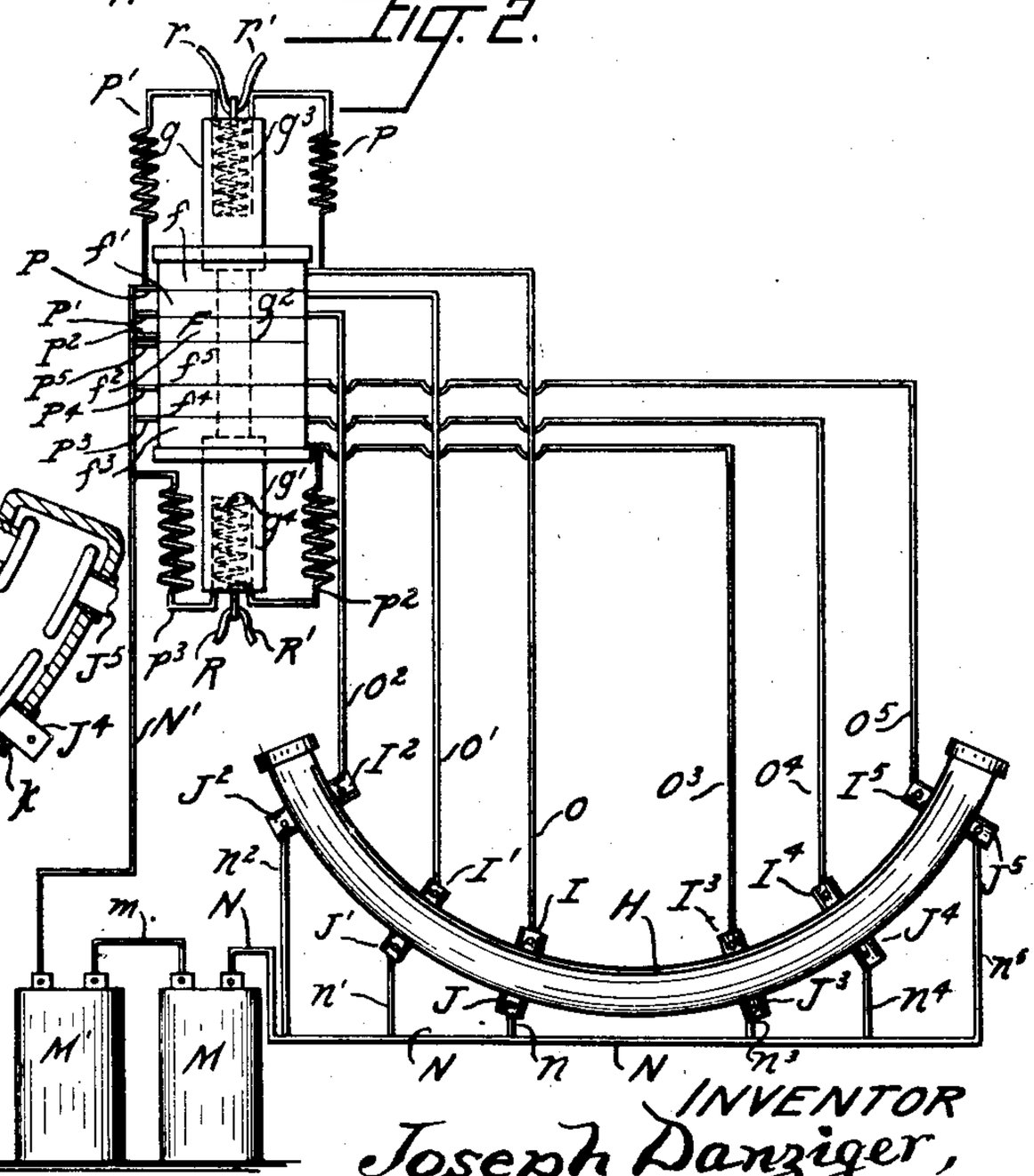


Fig. 3.

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AUTOMATIC EQUILIBRATING DEVICE FOR AEROPLANES.

999,012. Specification of Letters Patent. Patented July 25, 1911.

Application filed March 18, 1910. Serial No. 550,131.

To all whom it may concern:

Be it known that I, JOSEPH DANZIGER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Equilibrating Devices for Aeroplanes, of which the following, when taken in connection with the drawing accompanying and forming a part hereof, is a full and complete description, sufficient to enable those skilled in the art to which it pertains to understand, make, and use the same.

This invention relates to an attachment for aeroplanes of either the monoplane or multiplane type. And the object of the invention is to obtain a device which will be automatic in its operation, to return the aeroplane into a position with the opposite ends of the several planes in a horizontal plane, when from any cause the several planes are inclined, or at an angle to a horizontal plane.

A further object of the invention is to obtain a device which will be rapid in action, simple in construction, not liable to get out of order, and having but few parts.

In the drawing referred to I have illustrated a device embodying my invention attached to an aeroplane of the Herring-Curtiss type.

Figure 1 is a front elevation of the planes of an aeroplane, with the forward and rear attachments, and the operative mechanism removed, showing a device embodying my invention installed between said planes. Fig. 2 is an end elevation of the planes of an aeroplane, with the front and rear attachments and the operative mechanism removed, showing a device embodying the invention installed between the planes thereof. Fig. 3 is an elevation, on an enlarged scale, of a solenoid, an electric current supply and a runway forming elements of a device embodying the invention and a diagram of wires forming electric conductors. Fig. 4 is a vertical section of one end of the runway forming an element of the device embodying the invention. Fig. 5 is a modification of the runway of the device. Fig. 6 is a cross section on lines 6—6 of Fig. 5, viewed in the direction indicated by the arrows.

A reference letter applied to designate a given part is used to indicate such part throughout the several figures of the drawing wherever the same appears.

A is the lower plane of an aeroplane of the Herring-Curtiss type.

B is the upper plane thereof and C, C, the standards connecting planes A and B.

D and E are the ordinary equilibrating planes.

F is a solenoid consisting of a plurality of coils of insulated electric conducting wire, forming sections which are lettered, respectively, (for reference), f, f', f^2, f^3, f^4, and f^5.

G is the armature of coil F. Armature G is illustrated as made of soft iron portions g, g', connected by part g^2, (Fig. 3), of non-magnetic material.

g^3, g^4, are coils of insulated electric conducting wire set into suitable recesses in portions, g, g', of armature G.

H is a curved tube.

I, I′, I², I³, I⁴, I⁵, and J, J′, J², J³, J⁴, J⁵, are electric terminals set in the walls of the tube H. Tube H may be made of electric conducting material, in which case the terminals of the I and J series are insulated therefrom by nonelectric conducting material K, k.

L, (Fig. 4), is an electric conductor in tube H. I have illustrated electric conductor L as consisting of a number of metal balls.

When tube H is in the position illustrated in Fig. 3 the electric conductor L is not in contact with any of the terminals of the I, J, series, but said conductor will flow as a fluid in said tube and when the illustrated position of said tube (which I term its level position) is changed by raising or lowering one end thereof relative to the other end, and conductor will flow toward the lower end, and electrically connect the terminals of the I series which are located on the lowered side of tube H with the terminals of the J series which are located on said side.

Tube H is attached rigidly in place on the aeroplane and when one end of said aeroplane is lower than the other end, the corresponding end of said tube H is lower and the electric conductor L flows toward the lower end of said tube, as described. As the electric conductor flows toward one end the terminals I, J, and I′, J′, and I², J²,

are successively electrically connected, and as said electric conductor flows toward the other end of said tube the terminals I^3, J^3, I^4, J^4, and I^5, J^5, are electrically connected.

N, N′, are wires from the batteries M, M′.

n, n', n^2, n^3, n^4, n^5, are branch wires from wire N to corresponding terminals J, J′, J^2, J^3, J^4, and J^5.

O, O′, O^2, O^3, O^4, O^5, are wires from corresponding terminals I, I′, I^2, I^3, I^4, I^5, to corresponding coiled wire sections f, f', f^2, f^3, f^4, f^5, of the solenoid F.

P, P′, P^2, P^3, P^4, P^5, are wires from corresponding coiled wire sections f, f', f^2, f^3, f^4, f^5, to wire N′; forming branch connections from said wire to said sections.

p, p', are the ends of the wires forming coil g^3, and are attached to wires O, N′, respectively.

p^2, p^3, are the ends of coil g^4, and are attached to wires O^3 and N′, respectively. When conductor L electrically connects terminals I, J, a current may flow from the batteries M, M′, on wire N, branch wire n, terminal J, conductor L, terminal I, wire O, the coiled wire section f, and wires P and N′ back to the batteries, thus energizing coil f of the solenoid F. The coil g^3 is in shunt with the circuit established as above set out, and the said coil g^3 is energized thus magnetizing the portion g of the armature G. The coiled wire section f and the coil g^3 are wound with relation to each other so that magnetizing of the part g of the armature as described increases the traction between the solenoid and the armature. The coil g^4, in the same manner, is in shunt with the circuit established by the flow of electric conductor L, in tube H, to connect terminals I^3 and J^3.

Q, Q, are rotatably mounted pulleys.

R, r, R′, r', are flexible connections which are respectively attached to planes E, D, and armature G and arranged over pulleys Q, Q, so that movement of the armature moves the planes. Connections R, r, control the movements of plane D, and connections R′, r', control the movement of plane E. When the rear edge of plane D is raised, by the raising of armature G from the position thereof illustrated in Figs. 1 and 2, (drawing connection R and paying out connection r) the rear edge of plane E is depressed by the drawing in of connection R′ and the paying out of connection r' and when said armature is depressed the opposite movement is imparted to said planes D, E.

The modification of runway H which is illustrated in Figs. 5 and 7 comprises the curved rod H′ in frame h in place of a curved tube, and the modification of the electric conductor L and terminals of the I and J series, comprises the mounting of a carriage L′ on said curved rod and the mounting the terminals of said series on frame h so that as the carriage moves between any two of said series an electrical connection is established.

l, l, are rollers pivoted in carriage L′ to support said carriage and l' is a roller pivoted in carriage L′ to hold rollers l, l, on rod H′. When the ends of the curved rod H′ are at different levels the carriage or conductor L will automatically run toward the lower end, the same as conductor H flows to the lower end of tube L.

The operation of the device is as follows;—When planes A, B, are horizontal none of the terminals of the I and J series are in electrical connection. When planes A, B, become inclined or moved out of a horizontal plane, (say the left hand ends thereof, (Fig. 1) are lower than the right hand ends) the conductor L (or L′) will move toward the left in curved tube H, (or on rod H′) and terminals I^3 connected by said conductor. The section f^3 of the solenoid F will be energized and the armature G will be raised. Raising of armature G depresses the rear edge of plane D and raises the rear end of plane E. Said position of planes D and E tends to return planes A and B into horizontal planes. Should the assumed tilt of said planes A, B, be sufficient to move the conductor to connect terminals I^4, J^4, sections f^3 and f^4 are successively energized and considerable depression of the rear edge of plane D with corresponding raising of the rear edge of plane E is quickly effected. When planes A, B, tilt in the opposite manner that is, when the right hand ends (Fig. 1) are lower than the left hand ends the conductor L (or L′) moves to the right in tube H (or on rod H′), and the opposite movement is automatically given to the rear edge of planes D, E, (that is the rear edge of plane D is moved up and the rear edge of plane E is moved down.)

The several ways of controlling and determining the path of the movable conductor have in view the obtaining of an arc in which the said conductor will be at all times at the lowest point from the effect of gravity. In such construction when the ends of the arc are moved out of a horizontal plane as by the raising and lowering of opposite ends of the main planes of an aeroplane, travel of the movable conductor is obtained by gravity, and the terminals provided therefor are alternately electrically connected and disconnected.

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

1. An aeroplane, movable planes on said aeroplane, electric conductor and a curved runway co-acting with said conductor to control the position of the conductor and determine its path of movement, in combi-

nation with electric terminals positioned in the path of movement of the conductor, an electromagnetic coil, an armature to said coil, means to connect said armature to said movable planes, an electrical supply and additional electric conductors in electric connection with the electric terminals, the electromagnetic coil and the electrical supply, respectively.

2. A movable electric conductor and a curved runway co-acting with said conductor to control the position of the conductor and determine its path of movement, in combination with electric terminals arranged in pairs which are positioned in the path of movement of the conductor, said conductor arranged to electrically connect pairs of said terminals when in position between them, an electromagnetic coil forming a solenoid, an electrical supply and additional electric conductors in electric connection with the electric terminals, the electromagnetic coil and the electrical supply, respectively, an armature to co-act with the solenoid, pivoted planes, and flexible connections between said planes and the armature, with guide rollers for said flexible connections.

3. A movable electric conductor and a curved runway coacting with said conductor to control the position of the conductor and determine its path of movement, in combination with a plurality of pairs of electric terminals positioned in the path of movement of the conductor and electrically connected by said conductor when it moves into contact with them, an electromagnetic coil forming a solenoid, an electrical supply, and additional electric conductors in electric connection with the electric terminals, the electromagnetic coil and the electrical supply, respectively, an armature to co-act with the electromagnetic coil, said armature comprising soft iron ends joined by a nonmagnetic bar positioned in the coil, pivoted planes and means to connect said armature to said planes.

4. A movable electric conductor and a curved runway co-acting with said conductor to control the position of the conductor and determine its path of movement, in combination with a plurality of pairs of electric terminals positioned in the path of movement of the conductor and electrically connected when in contact therewith, an electromagnetic coil wound in sections, an armature to said coil, pivoted planes and means to connect said armature to said planes, an electrical supply, and additional electric conductors in electric connection with the electric terminals, the sections of the electromagnetic coil and the electrical supply, respectively, and said movable conductor being of sufficient size to be in electric contact with a plurality of said pairs of terminals when sufficient depression of one end of the runway below the other end is obtained and said pairs of terminals positioned so that when the ends of said runway are in a horizontal plane said movable conductor is not in electric connection with any pair of said terminals.

5. A movable electric conductor and a curved runway co-acting with said conductor to control the position of the conductor and determine its path of movement, in combination with a plurality of pairs of electric terminals positioned in the path of movement of the conductor, an electromagnetic coil, an electrical supply, and additional electric conductors in electric connection with the electric terminals, the electromagnetic coil and the electrical supply, respectively, and said movable conductor in electric contact with a plurality of said pairs of terminals when sufficient depression of one end of the runway below the other end is obtained and said pairs of terminals being positioned so that when the ends of said runway are in a horizontal plane said movable conductor is not in electric connection with any pair of said terminals, and an armature, to co-act with the electromagnetic coil, pivoted planes, and flexible connections between said planes and the armature, with guide rollers for said flexible connections.

6. A movable electric conductor and a curved runway co-acting with said conductor to control the position of the conductor and determine its path of movement, in combination with a plurality of pairs of electric terminals positioned in the path of movement of the conductor, said pairs of terminals being electrically connected when said conductor moves into contact with them, an electromagnetic coil comprising a plurality of sections, an electrical supply, and additional electric conductors in electric connection with the electric terminals, the respective sections of the electromagnetic coil and the electrical supply, respectively, and said movable conductor being in electric contact with a plurality of said pairs of terminals when sufficient depression of one end of the runway below the other end is obtained, and said pairs of terminals being positioned so that when the ends of said runway are in a horizontal plane said movable conductor is not in electric connection with any pair of said terminals, pivoted planes, an armature to co-act with the electromagnetic coil, said armature comprising soft iron ends joined by a nonmagnetic bar positioned in the coil and means to connect said armature to said planes.

7. The combination of an aeroplane provided with a plane the ends whereof are normally level, with a base, a movable electric conductor on said base and means to attach

said base to said plane, whereby the position of the movable conductor may be changed by the tilting of the ends of the plane in opposite directions, and a plurality of pairs of electric terminals positioned so that the members of a pair are electrically connected by contact with said conductor, an electromagnetic coil comprising a plurality of sections, an electrical supply, and additional electric conductors in electric connection with the electric terminals, with corresponding sections of the electromagnetic coil and the electrical supply, respectively, and said movable conductor being in electric contact with a plurality of said pairs of terminals when moved into determined position by the tilting of the ends of the plane out of a horizontal plane and said pairs of terminals being positioned so that when the ends of said plane are in a horizontal plane said movable conductor is not in electric connection with any pair of said terminals, an armature to co-act with the electromagnetic coil, additional and pivoted planes, and flexible connections between said pivoted planes and the armature, with guide rollers for said flexible connections.

JOSEPH DANZIGER.

In the presence of—
CHARLES TURNER BROWN,
CORA A. ADAMS.