L. RUPPIN.

AERIAL DEVICE.

APPLICATION FILED FEB. 1, 1908.

927,815.

Patented July 13, 1909.

FIG. 1.

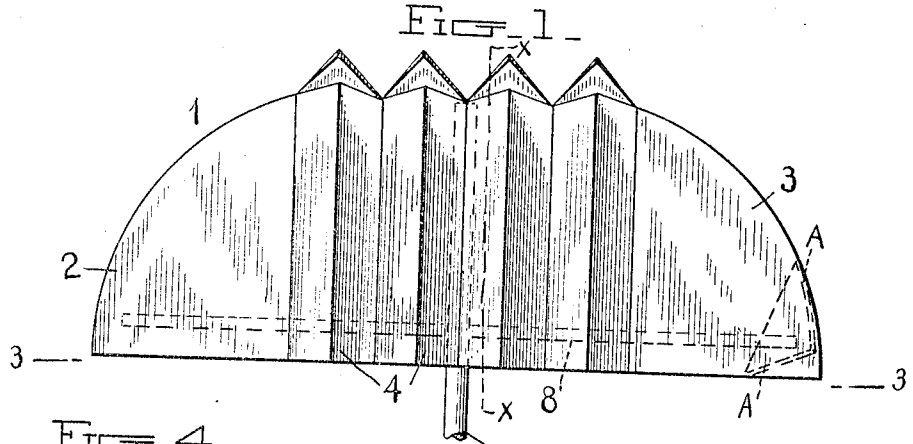



FIG. 4.

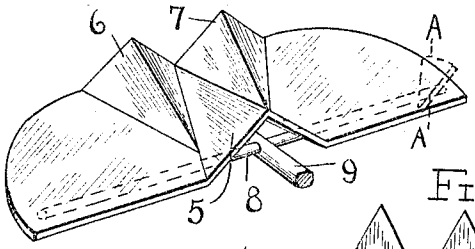



FIG. 7.

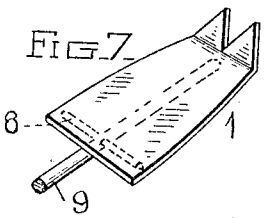



FIG. 2.

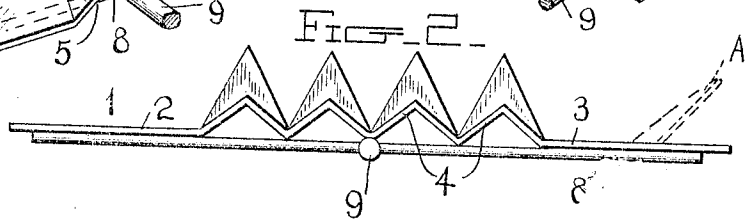
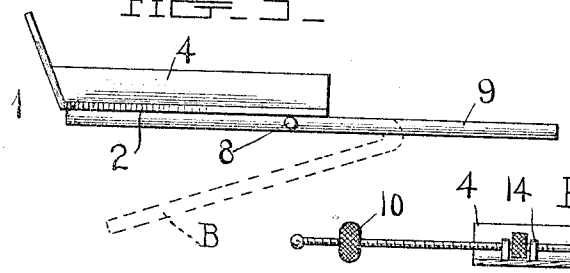
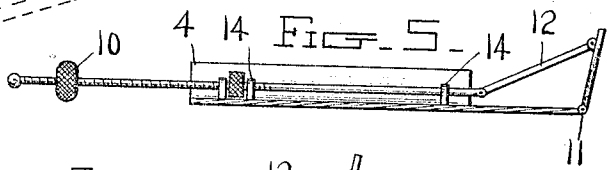
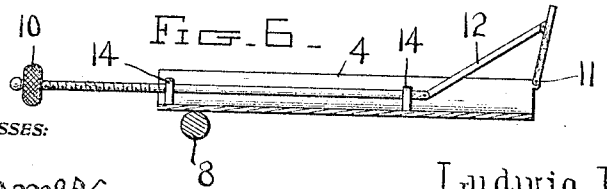



FIG. 3.




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## AERIAL DEVICE.

No. 927,815. Specification of Letters Patent. Patented July 13, 1909.

Application filed February 1, 1908. Serial No. 413,770.

*To all whom it may concern:*

Be it known that I, LUDWIG RUPPIN, a citizen of the United States of America, residing at Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Aerial Devices, of which the following is a specification.

This invention relates to aerial devices and particularly to devices of this general character adapted for use as toys or for advertising purposes.

The invention operates upon some of the principles of kites and aeroplanes, and consists in various features of construction subserving simplicity, certainty of flight, and control of direction and distance of flight, the necessary propulsive force being provided by dropping the device from a height, whereupon downward movement, because of the general design of the machine, will change the pure vertical movement thereof into a compound vertical and horizontal movement.

My invention consists of the elements, combinations, and arrangements of parts, all as hereinafter fully set forth, and succinctly defined in the annexed claims.

Referring to the accompanying drawings, which are to be taken as a part of this specification, and in which I have illustrated a merely preferred form of embodiment of the invention: Figure 1 is a plan view of one form of embodiment thereof; Fig. 2 is an edge view, looking in the direction of the arrow of Fig. 1 at the line 3—3; Fig. 3 is a section on the line *x*—*x* of Fig. 1; Fig. 4 is a perspective of a modification; Figs. 5 and 6 are sectional views similar to Fig. 3, of further modifications; and Fig. 7 is a modification showing the simplest form of the device in perspective.

Referring to the numerals on the drawings, 1 indicates the generally flat body of the device, preferably made, in the toy embodiment shown, of paper or thin light metal, such as aluminum, and providing outer end portions or wings 2 and 3. Intermediate said wings the body is preferably formed with means for insuring horizontal movement of the device in a straight line and maintaining the equilibrium thereof. In Figs. 1, 2, 3, 5 and 6 such means are exemplified by parallel corrugations 4 in the medial portion of the body, beneath and against the sides of which the air surges in the flight of the device, bringing about the aeroplane effect, and maintaining its equilibrium, and at the same time having a directional effect as stated. In Fig. 4 the same result is brought about by forming the body with a corrugation 5 at its front end, whose walls converge, and the common line of whose walls angles downwardly from front to rear of the machine; and corrugations 6 and 7 on each side of the corrugation 5, whose walls angle and converge respectively in a direction opposite from that of corrugation 5. Consequently, the air enters beneath corrugation 5 to produce the aeroplane effect, and thence beneath corrugations 6 and 7 for the directional effect. The arrangement of these corrugations in respect to front and rear may be reversed with the same result. By reason, also, of the inclination of the median lines and the walls of said corrugations 6 and 7, another effect is produced, to be hereinafter referred to.

Toward the front end of the device, and extending longitudinally thereof, is a rod 8, which serves the purpose of a strengthening rib and is the approximate *locus* of the center of gravity, considering the front and rear of the device. To counterbalance the device, another rod 9, is fixed thereto, preferably to the rod 8, and extends beyond the front end of the device to such an extent as may be necessary or desirable to provide the horizontal adjustment of the device as a whole when in flight. Such counterbalancing rod may be fixed, as in Figs. 1, 2, 3 and 4, or the rod, as shown in Figs. 5 and 6, may be provided with a weight 10 adjustable toward and from the front end of the device.

At the rear end of the device, I provide means for controlling the assumption, by the machine of the horizontal position in flight, comprising in Figs. 1, 2 and 3, rudder blades, so called, attached at or near the ends of the corrugated portion of the device. According to the angle of the inclination of these blades relatively to the body of the device, the rapidity with which it reaches the horizontal position in flight will be affected, in conjunction, of course, with the adjustment of the counterbalance at the opposite side of the device.

In Fig. 5 I have shown the angle of inclination of the rudder blades as controllable, providing a hinged connection 11 of

said rudders with the body, and a link connection 12 between said rudders and a longitudinally adjustable rod, thumb-nut controlled, as in Fig. 5, or freely movable, as in Fig. 6, and mounted in suitable bearings 14 in the body. This rod may be the counterbalancing rod, as shown in Figs. 5 and 6; and the adjustment of the counterbalancing weight and of the rudders may be separately and manually performed as in the form shown in Fig. 5, or, as in Fig. 6, the adjustment of the counterbalance alone need be made, the rod itself being free to move longitudinally, and hence permitting free self adjustment of the rudders. In the form of Fig. 6, particularly, great sensitiveness results in the gradual self-adjustment of the machine to the horizontal, because of the intimate relations between the automatic rudder regulation and the regulation (to a degree also automatic) of the counterbalance.

In the embodiment of Fig. 4 the effect of the rudders shown in the other figures is accomplished by the corrugations 6 and 7, because of the angling and convergence of their walls with respect to each other and the corrugation 5, as heretofore described. It will be apparent that besides the regulation accomplished by the adjustment of inclination of the rudders, much may be effected by changes in the relative area of said rudders; also that the effects of the rudders and the counterbalance on the flight of the device are inter-dependent reciprocally coacting in the form of Fig. 6, and that by reason of the construction shown in said figure, the adjustments are never fixed, and consequently the flight of the device through the air will not be in the line of a constant inclined plane, as in the other forms, but motion will be undulatory, in keeping with the varying automatic adjustments and readjustments.

The action of the so-called rudder blades and the corrugations shown in Fig. 4 is identical as far as the maintenance of horizontal equilibrium is concerned; the blades being in effect when set at an angle as described reverse or depressing aeroplanes, and the rear corrugation or corrugations as the case may be being also in effect depressing aeroplanes, the effect in either case being (by their depressing action when the machine is in flight) to raise the counterbalance rod or weight to a horizontal position; by using the supporting (or resisting) power of the air, at the approximate center of gravity of the device, as the fulcrum of the lever thus formed. The action of all the corrugations described is also twofold, first for the keeping of a direct line of flight, and second for maintaining transverse equilibrium. For keeping the direct line of flight the effect is that of their traveling in a resisting body of air on both sides of the corrugations. For maintaining transverse equilibrium their effect is that of one or more aeroplanes. When one side of the device is lower than the other lateral movement of the whole device in the direction of the depression naturally ensues. In any such ensuing lateral movement the sides of said corrugations, besides acting as a check to a certain extent to such lateral movement, act also as aeroplanes to raise the depressed side, and to check its further depression, the other side then gradually sinking to a level with it.

Suspension for a time in the air is accomplished substantially as follows: the device is held at about a foot above the height of the operator's head by extending the arms upward, the device being held with the counterbalance end down. Upon releasing the device it falls about three to four feet, the rudder blades acting to keep the fall from being perpendicular and the device gradually during this fall tends to approach a horizontal position. The momentum acquired by the fall above referred to is sufficient to drive it forward for some distance, and the pressure or resistance of the air against the rudder blades, or rear corrugations, as the case may be, depresses the rear end of the device, and tends to present the body of the device at a more or less correct aeroplane angle to the air. The necessary aeroplane effect thus acquired, and the acquired momentum, in connection with said aeroplane angle, are sufficient to support it for a time in the air. When the said momentum is expended or exhausted, the tendency of the device is to again dip downward; and if the device is allowed to fall from a greater height than mentioned above, a series of such motions ensues until the device reaches the ground.

A striking feature of the device is that if launched upside down in either a perpendicular or a horizontal position it will turn to its correct position before assuming its so called flight.

The functions of the counterbalancing rod or weight may be further explained as follows: If said rod or weight be removed, the device, on being launched in the manner described, tends to sway backward and forward in the air, or else to revolve on its longitudinal center (the axis of said revolution being an imaginary line near the center of the device, said line being parallel with the rear and front edges), in both cases gradually sinking to the ground. Upon the rod or weight being applied the revolving motion is stopped, and also the backward swaying, and both the tendencies are converted into a forward motion, substantially as above described. The counterbalancing rod or weight also has a further functional effect, because in the lever action hereinbe-

fore referred to it forces the corrugation against the air, thus aiding the corrugations in their directional effect.

The operation of the device is thought to be clear from the foregoing. The device is allowed to fall from a height, counterbalance end down. The force of the air against the rudders throws the device gradually into a position approaching the horizontal with relation to its center of gravity, instead of the vertical position with which the flight begins. The extent of the horizontal movement resulting from a given vertical fall may be controlled by the area and inclination of rudders and adjustment of the counterbalance. The counterbalancing rod 9 may be bent back under its main body at an angle as indicated by the dotted lines B, Fig. 3, with substantially the same result as when rod 9 is straight.

The device may be caused to turn in any desired direction during flight by bending the tip of either wing at a slight angle, as illustrated by the dotted lines A, A, Figs. 1, 2 and 4. When bent as illustrated, the device will turn during flight toward that side. If the other wing is bent, the direction would of course be vice versa. The same object may be attained by rudders hinged at an angle to the wing tips, as indicated by the dotted lines A, A, aforesaid, but not parallel to the line 3, 3, Fig. 1. The desired inclination of these wing rudders may be controlled by the mechanism shown in Fig. 5 for controlling the rear rudders, the area, and inclination of said wing rudders when raised, and the angle at which they are set to the line 3—3 Fig. 1 determining and effecting the rapidity and angle of the deflection from the original line of flight; the rudder when raised acting as a drag upon that side of the device upon which it is situated, the angle to the longitudinal center at which the rudder blades are set, also determining and affecting the angle and rapidity of the deflection. When not in use the rudders lie flat, so the surface is even.

It is to be understood that, I do not limit myself herein to the toy embodiment of the invention here shown; but that I contemplate any embodiment of the principles of the invention falling within the appended claims; also that materials, sizes and relations are unessential, except as they may be necessary to the operativeness of the devices claimed.

What I claim is:

1. In an aerial device of the character described, a medially transversely corrugated body member acting as an aeroplane, a counterbalancing weight at one side of the center of gravity thereof, and a rudder blade at the other side of said center.

2. In an aerial device of the character described, an aeroplane member, a counterbalance, and a rudder, said counterbalance and rudder being connected and automatically adjustable.

3. In an aerial device of the character described, an aeroplane member having at one end a corrugation whose walls converge, and the common line of whose walls angles downwardly from one end to the other of the device; and a corrugation on each side of said first-named corrugation, whose walls angle and converge respectively in a direction opposite to that of said first-named corrugation.

4. In an aerial device of the character described, an aeroplane member having at one end a corrugation whose walls converge, and the common line of whose walls angles downwardly from one end to the other of the device; a corrugation on each side of said first-named corrugation, whose walls angle and converge respectively in a direction opposite to that of said first-named corrugation, and a weight at one side of the center of gravity of said body member.

5. In an aerial device of the character described, an aeroplane member, a longitudinally movable rod thereon, and a counterbalancing weight adjustable on said rod.

6. In an aerial device of the character described, an aeroplane member, a rod mounted for movement thereon, means for adjusting the position of the rod with respect to the aeroplane member, and a counterbalancing weight adjustable on said rod.

In testimony whereof I affix my signature in presence of two witnesses.

LUDWIG RUPPIN.

Witnesses:
LEON K. PAXSON,
CHAS. E. LONG.