No. 870,936. PATENTED NOV. 12, 1907.

B. CONNOLLY.

AERIAL MACHINE.

APPLICATION FILED APR. 1, 1907

Fig. 1.

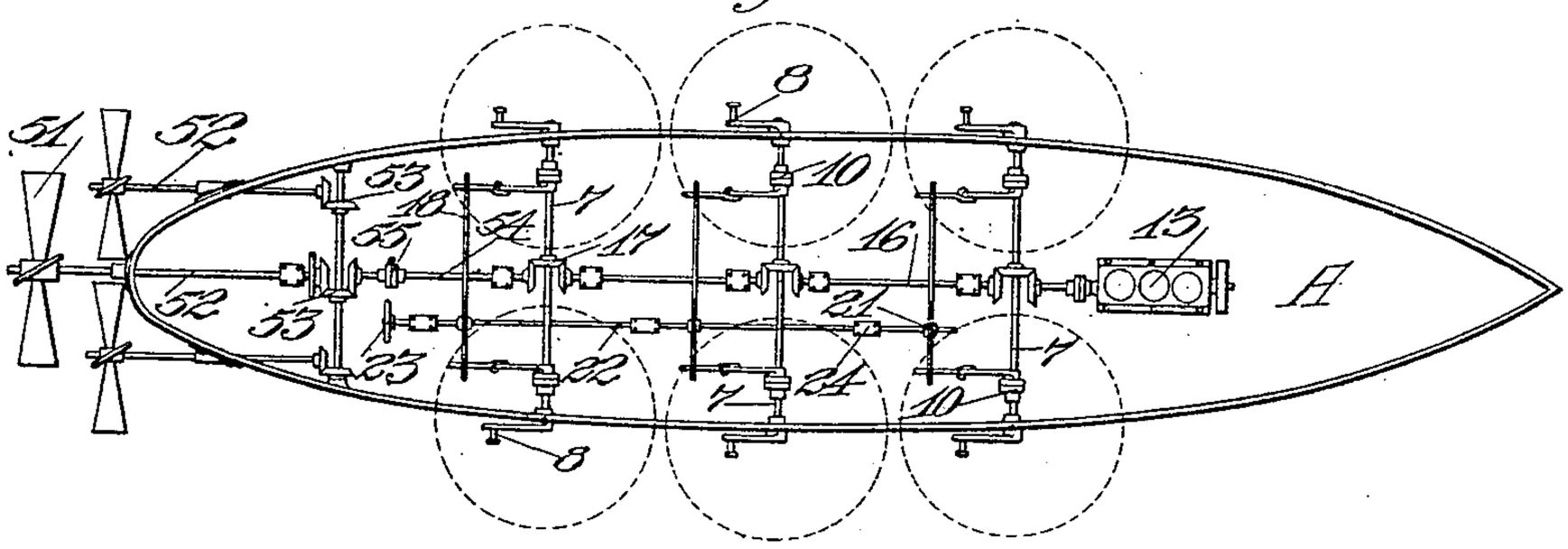


Fig. 2.

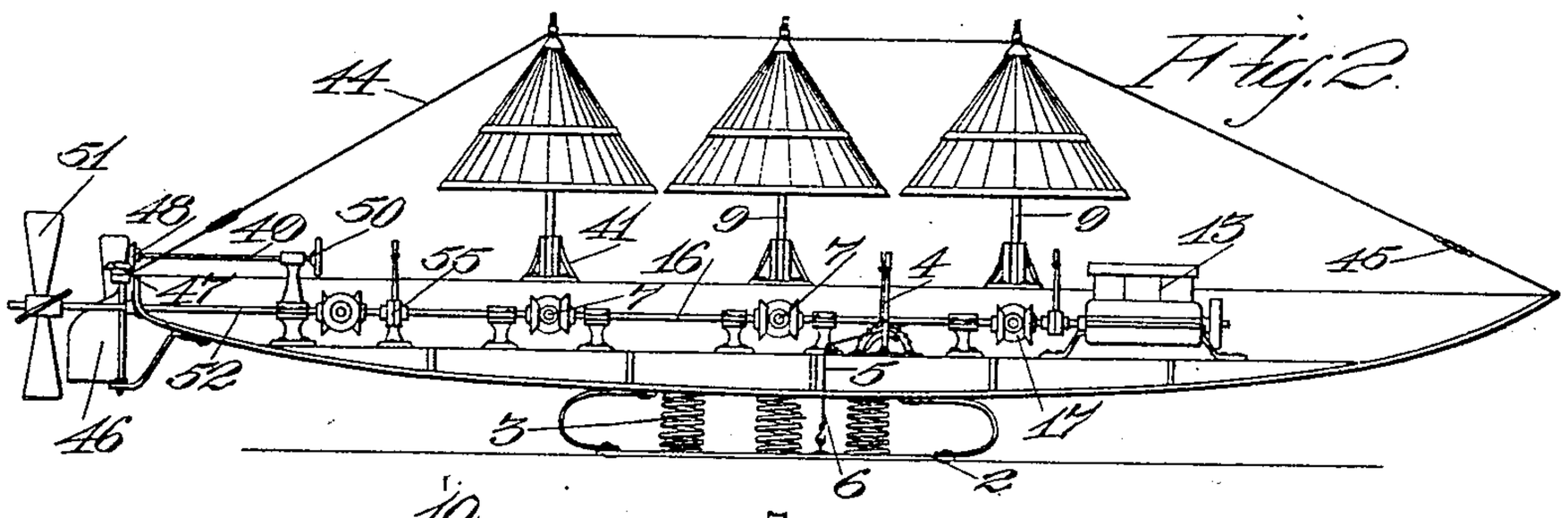


Fig. 3.

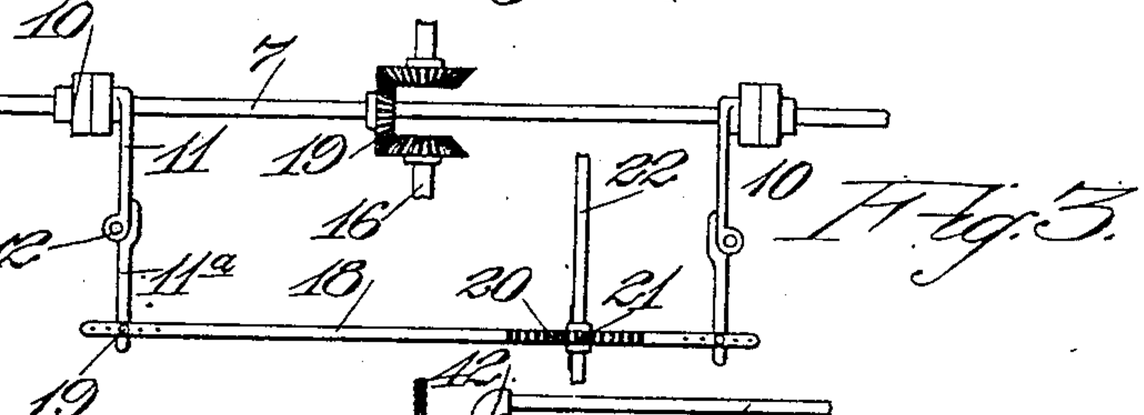


Fig. 4.

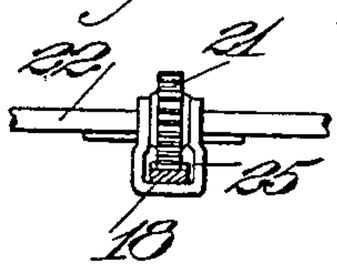
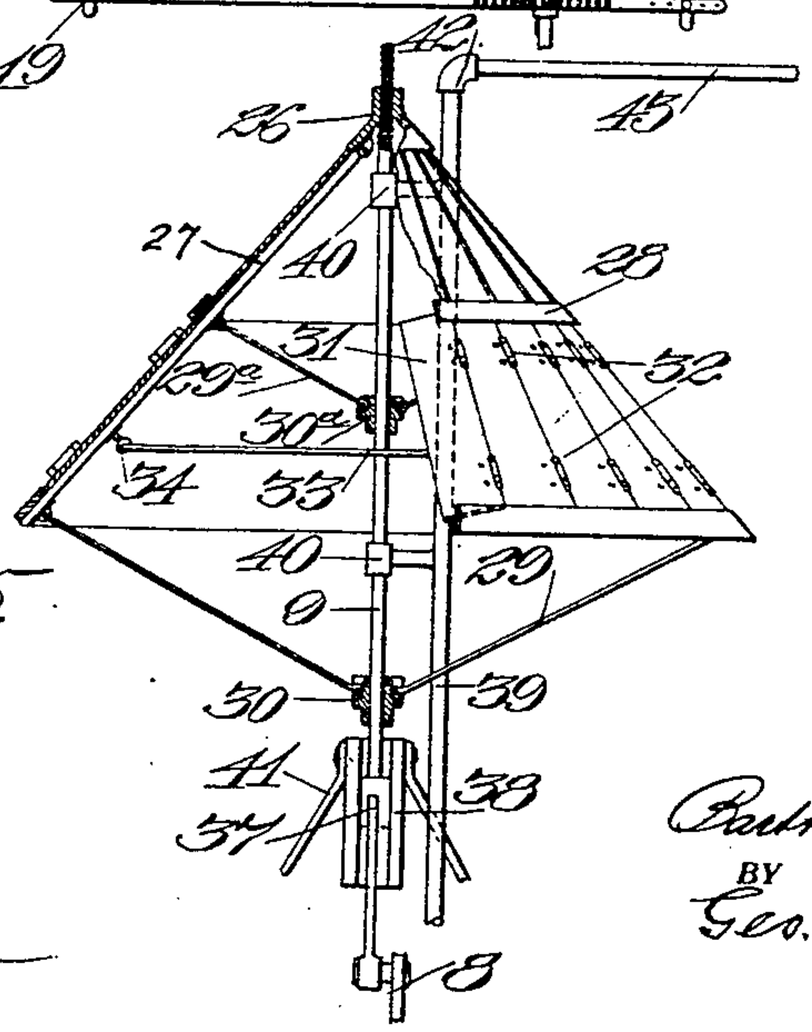


Fig. 5.



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AERIAL MACHINE.

No. 870,936. Specification of Letters Patent. Patented Nov. 12, 1907.

Application filed April 1, 1907. Serial No. 365,768.

To all whom it may concern:

Be it known that I, BARTHOLOMEW CONNOLLY, a citizen of the United States, residing at Tonopah, in the county of Nye and State of Nevada, have invented new and useful Improvements in Aerial Machines, of which the following is a specification.

My invention relates to improvements in apparatus designed to rise in and traverse the air.

It consists in the combination of parts and details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a plan view of my machine. Fig. 2 is a vertical longitudinal section of same. Fig. 3 is an enlarged view of controller shaft, and connecting mechanisms. Fig. 4 is another enlarged view of same. Fig. 5 is a partial section on an enlarged scale of one wing, showing its construction.

The apparatus consists of a body or frame-work of light construction which serves as a basis and support for the operating devices which comprise the structure. Such a frame-work may be made of aluminium and of any shape designed. It may have the general outline of a flat-bottomed boat, as at A, which will serve the purpose very well. Under this main frame-work, whatever may be its character, may be located a false bottom as at 2, and between this and the bottom of the frame-work or car A, are fixed a number of springs of any suitable character, such as shown at 3. These springs serve to relieve the parts of undue concussion when the machine alights.

4 is a lever suitably fulcrumed to the car and having a segmental end about which a chain or other connection 5 passes. The opposite end of the chain may be attached to the false bottom, as shown at 6, and by the proper movement of the latter, this false bottom will be raised toward the bottom of the structure A, and thus increase the tension of the springs, and their ability to resist the concussion.

When the apparatus is ready to start, by disengaging the lever the springs will be allowed to expand, and by this action the machine will be given an upward impetus which will assist in raising it in conjunction with the operation of those parts which are especially designed to raise and maintain it in the air.

Shafts 7 extend across the main frame-work at as many points as may be found desirable, and the ends of these shafts are provided with cranks, as at 8, which act to reciprocate the wings, as I have termed them, which wings guided and movable vertically, serve to raise the apparatus into the air while in motion. Any suitable motor, which is competent for the work may be employed, such as a light internal combustion engine. The wings are mounted on vertically slidable stems 9, and these stems are provided with cross-heads and guides which maintain them in proper direction. Suitable guys or braces are also employed to steady the stems, and prevent undue transverse vibrations.

Each crank shaft is provided with friction clutches of any suitable character. Such clutches are here indicated at 10, and each clutch is actuated by levers 11 having knuckle joints as at 12; and a means for operating the levers and clutches so that the operator may control the clutches allowing certain clutches to slip while others maintain their full driving power, so that if the machine is inclined to one side or the other, it may be restored to an equilibrium by varying the speed of movement of the wings upon the two sides of the apparatus; and it will be understood that by in the same manner varying the speed of the wings at either front or rear, the apparatus may be inclined with its head upwardly or downwardly so that the action of the propellers, driving it forward, will aid in raising or depressing the machine. Any suitable number of wings (not less than four) may be employed, dependent upon the size and weight of the apparatus, and the wings corresponding with the heavier portion of the machine, may preferably be placed nearer together than those at the ends where the apparatus is lighter. The crank shafts are turnable in suitable bearings at the ends, and preferably also at each side of the friction clutches. These clutches, as before described, regulate the speed of reciprocation of the wings, and are an important adjunct in preventing the tilting or turning over of the machine.

The lever of each friction clutch consists of two parts 11—11ª connected by means of the joint 12, as previously stated. This joint is of such a character, like a knuckle or elbow joint, that it may bend in one direction by a movement of the lever, and remain rigid in the opposite direction, so that it will serve to either hold the lever rigid, and provide sufficient power to force the clutch members strongly together, or it may yield sufficiently to allow a certain amount of slippage of these clutch members.

Power may be transmitted from the motor by a series of connecting shafts 16, and beveled gears at the ends of said shafts as at 17, or by belts and pulleys or other suitable mechanism. The arrangement of these gears will be such that all the transverse shafts will be turned in the same direction.

The friction clutch levers of the shafts 7 are connected by rods 18 having slotted ends through holes in which pins pass as at 19 to connect the two, and by making a series of holes, the pins may be changed so as to vary the position of the rods 18, and lengthen or shorten the distance between the clutch-operating levers; this representing a form by which such adjustment may be made, but it will be manifest that any of the well known or usual forms for such purpose may be employed, such as turn-buckles. These rods 18 have rack teeth as at

20, which teeth are engaged with pinions as at 21 upon a shaft 22, which I term the controller-shaft. This shaft extends fore and aft of the apparatus, and the pinions 21 engage the rack bars which control the levers and clutches of each of the transverse shafts 7, and by means of a wheel 23, or other suitable attachment, control of all the clutches is in the hands of the single operator. The pivot points 12 of the two part levers 11—11ª may be considered as fixed fulcrums, and the overlapping extensions of the parts 11ª will press against the inner sides of the parts 11, so that if both parts 11ª are drawn towards each other, they will act through the parts 11 to force the clutches into sufficient frictional contact to drive the connected parts. These levers are thus held to produce the necessary pressure by being pinned to the bar 18 at points 19 of Fig. 3. Now when by turning the pinion 21 which engages the rack 20 on the bar 18, this bar is moved in either direction, it will act to pull one of the parts 11ª, and by reason of the extension overlapping the joint 12, it will press the part 11 which is a continuation and lock the clutch more firmly. The part 11ª at the opposite end will turn loosely on its pivot and will thus relax the pressure on the part 11, because the overlapping extension will be moved away from the joint 12, and the clutch engagement will be relaxed enough to allow some slippage and a slowing up of the driven parts, by reason of the friction which will be sufficient to slip the clutch a little. The levers are long enough and have sufficient elasticity to allow the above movements which need not be very great. It will thus be seen that by turning this controller-shaft in one direction, the interlocking of the friction clutches upon one side may be maintained, while those upon the other side will be loosened or partially released, thus allowing a slippage which will decrease the sustaining power of the wings upon that side by lessening the number of reciprocations; and the comparative effectiveness of the wings upon the other side will be increased; thus the machine will be maintained in equilibrium if it shows any tendency to list to one side. There is a certain amount of play in the knuckle joints which will provide for the variation of the clutch engagements above described.

The controlling shaft is properly supported by a series of boxes or bearings as at 24, which are disposed at sufficient points in its length, and are properly supported upon the frame-work. These boxes allow the controller shaft to turn, and also permit it to move longitudinally so as to maintain the pinions 21 in engagement with the racks 20. This is necessary because the movement of the connecting bar 18, and the parts 11ª of the clutch levers changes their relative position so that from forming substantially the sides of a rectangle, these levers and connecting bar form a rhombus shaped figure, and there is a certain movement in the line of the controller-shaft caused by this change of position which requires the compensation above described.

In order to maintain the pinions in engagement with the racks, I have shown a yoke or inclosing device 25 which fits loosely around the controller shaft, and close up to the gear-wheel upon each side, and thence passes under the connecting bars 18. This insures the movement of the connecting bars and the shaft 22 in unison, and maintains the pinions and racks in gear. The controller shaft is slidable with relation to the pinions, and may either have a feather or be polygonal in section so that the pinions will be turned by the rotation of the shaft whatever the sliding movement of the latter may be.

The wings, as I have termed them, are in the form of cones, or umbrella-shaped. The crown piece 26 of each cone is fixed to the top of its stem 9, and ribs 27 radiate from the periphery of each crown piece, which may be screwed upon the upper end of the stem, threads being cut for that purpose. At the edge or periphery of the wing, two circular bands overlap each other, as at 28, and may be riveted or otherwise secured together, the ribs being clamped between the two bands, and thus held firmly together and in place. From the edges of the wing-bands, ribs 29 converge to the stem, and are interlocked with a collar 30, which is fixed upon the stem as shown; thus the ribs and the braces form a sufficiently stiff frame-work to prevent distortion of the wings, which thus retain their permanent conical shape.

The covering of the wings consists of two parts. From the crown-piece to about the middlle, or at the position of the uppermost first circular band 28, the covering may be made of strong silk, or other equivalent substance, which is formed to fit the outline of the frame. This covering is held in place by a secondary rib which overlaps and is clamped to the inner rib, the covering being locked between the two ribs, and so held in place. This second exterior rib extends only to the periphery of the first circular band 28. These circular bands thus serve to clamp the ribs and the edge of the covering and make a unitary structure. From the upper band to the lower band a single main rib extends, and the covering of this portion of the wing is in the form of doors or shutters 31, which are hinged to the ribs as shown at 32, so that these shutters may open inwardly when the wing is raised, thus allowing the air to freely pass through this portion of the wing which contains the largest area. When the wing is again drawn downwardly the shutters will be closed so as to form a large wing space with corresponding pressure upon the air, and the effect of which will be to raise the apparatus at each downward impulse of the wings, while the upward movement opens the shutters, and allows the air to pass freely through this portion of the wings. These shutters may be made of light sheet aluminium, and they are guided and prevented from opening too far inwardly by a circular wire brace 33 which extends around the periphery of the wing, and is held in place by means of I-bolts 34 which project inwardly from the ribs by which they are supported in any suitable manner. These I-bolts or braces are of such a length as to allow the doors to swing inwardly to form an angle of approximately 45 degrees so as to admit a free inrush of the air; but maintaining the doors in such a position that they will be readily and automatically closed by the opposite movement of the air during the down-stroke of the wing.

The doors are made sufficiently larger than the spaces between the ribs so that they will close fairly against the casing thus formed, and not be forced through the spaces during the down-stroke. These doors increase the resisting power of the wing on this

down-stroke, and in a sense correspond with the large feathers at the tip of a bird's wing.

In very large wings, two sets of rib braces 29 may be necessary, the inner set being disposed intermediate between the ends of the ribs and the crown-piece, as at 29ª and approximately near the upper circular bands. These braces are in every way similar to the set previously described, and are secured to central cones 30ª which are fixed upon the stem 9. The circular bands 28 to which the ribs are secured, are preferably made with grooves or channels between which the ribs pass, and they may be secured by rivets or bolts passing through the ribs upon each side of these channels, as shown at 36. The stems 9 have cross-heads 37 slidable in vertically fixed guides 38. These guides may be made of aluminium formed into I-shaped bars which are fixed upright upon the frame-work and parallel with the stems 9. The flanges of these guides may be cut away on the side toward the wing, leaving only a sufficient amount to form the guide for the cross-head. On the inside of these flanges a seat is fixed in which the cross-head works. From the upper ends of the guides a light tube 39 extends parallel with the stem 9, and each of these tubes extends up through the covering of the wing. The upper part of the stem has guides 40 through which the tube passes, and these guides are freely slidable upon the tubes when the stems and wings are reciprocated. Braces 41 extend from the flanges of the guides to the frame-work, and thus steady the lower end of this portion of the structure. These guide rods 39 may be provided with elbows as at 42 above the upper ends of the wings, and these may be connected by light rods or pipes 43, which may extend across and also lengthwise of the apparatus. Thus any four of these top braces being connected, form a rectangle, and to further steady the apparatus, guys 44 are provided, these guys having turn-buckles, as at 45, by which any degree of tension may be produced.

The rudder 46 may be made by riveting a light sheet of aluminium to an inclosing and sufficiently stiff frame to hold the sheet in place. The rudder may be turned in any suitable manner. As here shown a pinion 47 is fixed upon the turning axis of the rudder, and a pinion 48 engaging with 47 is mounted upon a shaft 49, which is provided with a wheel 50 suitably placed for convenient use by the operator. If desired a second rudder may be placed at the front of the machine, and the two may be operated in unison by means similar to that just described.

The openings in the covering of the wings through which the tubular rods 39 pass may be inclosed and protected by metal bands riveted to the covering material, or to the ribs, and between which bands the covering material may be clamped.

Power to propel the apparatus after it has been raised from the ground, may be provided by screw propellers 51; these propellers being mounted upon shafts 52, and by means of bevel gears as at 53, the shafts are driven from a main shaft 54. This shaft has a friction clutch 55 within its length, operated by any suitable lever and connection between it and the position of the operator so that by disengaging this clutch, it is possible to concentrate all the power of the motor upon the operation of the wings until the apparatus has been lifted above the ground to such a height as desired; after which the wings still continuing their operation, the clutch of the propellers may be let in, and the latter commence their movement to drive the apparatus ahead.

The various clutches are important in the control of the apparatus: first, by disconnecting the propellers to allow the wings to operate and raise the apparatus to the desired elevation; then by engaging the clutch of the propellers, the latter may be set in motion; and if desired the clutches controlling the wing reciprocations may be allowed to slip sufficiently to reduce the elevating power, and just maintain the apparatus at a normal elevation, while the propellers act to drive it forward. Or, if desired, the wings may still be continued in full operation while the propellers are operated, so that the apparatus will be driven both forward and upward; and in a similar manner by reducing the reciprocations of the wings, the supporting power may be so reduced that the apparatus will gradually sink and may be at the same time propelled forwardly so that a favorable position for alighting may be reached before the apparatus actually reaches the ground.

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

1. In an aerial machine, a main frame having vertically guided and movable stems, wings carried upon the upper ends of the stems, said wings including upper closed cone-shaped structures, and a lower portion formed with opening and closing shutters, means for reciprocating said stems and wings, said means including crank shafts, connections between said shafts and the wing stems and a motor.

2. In an aerial apparatus, a main frame or structure, vertically guided and slidable stems, wings carried upon the upper ends of the stems, said wings consisting of cone-shaped ribs with a crown-piece, with which the upper ends of the ribs are connected, and bands to which the lower ends are connected, a closed covering for the upper portion of the cone, and hinged leaves or shutters forming a closure for the lower portion of the cone, said shutters being adapted to open and close by the reciprocations of the stems.

3. In an aerial apparatus, a main frame or structure, vertically guided reciprocating stems, wings carried at the upper ends of said stems, said wings composed of a permanently closed covering for the upper portion of the cone, and hinged shutters comprising the lower portion of the cone and capable of alternately opening and closing by the reciprocations of the stems.

4. In an aerial machine, vertically reciprocating and guided stems having conical crowns fixed in the upper ends, ribs divergent therefrom and rings disposed in pairs around the lower periphery and intermediate between said periphery and the crown, said rings being assembled in pairs adapted to clamp and secure the ribs between them, a permanently closed covering between the crown and the first of the rings, shutters hinged to the ribs between the intermediate and lower rings, stops secured to the ribs against which stops the shutters are closable when the wings are drawn downwardly, said shutters being opened automatically when the wings are moved upwardly, and stops limiting the opening movement of the shutters.

5. In an aerial apparatus, a main frame, a motor, transversely journaled shafts driven from the motor, said shafts having cranks upon the outer ends, vertical stems having cone-shaped wings carried upon the upper ends, cross-heads carried by the stems, guides for said cross-heads, said guides consisting of I-shaped flanged bars fixed vertically to the frame and in line with the reciprocation of the stems.

6. In an aerial apparatus, a main frame, vertically guided and reciprocating stems, conically shaped wings

carried by said stems and having a permanent covering for the upper part of the cone, and hinged opening and closing shutters for the lower part, tubular rods extending upwardly parallel with the stems, sleeves or guides carried by the stems, and openings in the closed covering through which the rods pass, transverse rods connected with said vertical rods above the line of movement of the wings, and guys or braces extending therefrom to the main structure.

7. In an aerial machine, a main frame having revoluble crank shafts journaled transversely thereon, said shafts having cranks at the outer ends, vertically guided reciprocable stems having conically shaped wings carried thereon, with opening and closing shutters, a motor, longitudinally journaled shafts with beveled gearing whereby the transverse shafts are revolved in unison and in one direction, clutches within the length of the transverse shafts and upon each side of the central driving shaft, means whereby said clutches may be engaged or partially disengaged to vary the rate of speed of the wings upon either side of the apparatus.

8. In an aerial machine, a main frame, transverse crank shafts journaled thereon, vertically guided and reciprocable stems connected with the crank shafts, cone-shaped wings carried by said stems and operable thereby, a driving shaft extending centrally and longitudinally through the apparatus and gears by which it is connected to drive the crank shafts, clutches within the crank shafts upon each side of the driving shaft, means for engaging or disengaging the clutches, said means including levers connected with one member of the clutch, said levers having knuckle joints, connections between said levers and an operating mechanism whereby the levers may act to engage and disengage the clutches at either end of the shafts.

9. In an aerial machine, a frame and vertically guided reciprocable wing-carrying stems, crank shafts journaled upon the frame and operatively connected with the wing stems, mechanism by which the said crank shafts are revolved in unison, friction clutches in the crank shafts upon either side of the center, knuckle-jointed levers connecting with the clutch members to disengage one and engage the other, a longitudinally journaled shaft having pinions thereon, bars connecting the knuckle-jointed levers having racks thereon engaged by the pinions of the turnable shaft whereby the clutches upon one side may be partially or wholly disengaged, and the clutches upon the other side maintained in engagement.

10. In an aerial machine, a frame or body, raising and propelling mechanism carried thereby, a means for relieving the shock of alighting, said means including a sub frame, springs interposed between it and the main frame, means for elevating the sub-frame to cause it to compress the springs and thereby increase the ability of the springs to resist compression, said springs adapted to expand and impart an upward impetus to assist in raising the machine.

11. In an aerial apparatus, a main frame, raising and propelling apparatus carried thereby, an elastic sub frame, means for increasing the tension of the sub-frame and its ability to resist concussion, said sub-frame adapted to expand and give an upward impetus which will assist in raising the machine from the ground.

12. In an aerial machine, a main frame, raising and propelling mechanism carried thereby, an elastic sub frame, ...ns for increasing the tension of the said frame and its ability to resist concussion, said means consisting of a lever fulcrumed upon the main frame, a segment carried by the lever, and a flexible connection between the segment and the bottom of the sub frame.

13. In an aerial machine, a main frame with raising and propelling apparatus carried thereon, an elastic sub frame, a lever fulcrumed to the main frame, a segment carried by said lever, a flexible connection between the segment and the bottom of the elastic frame whereby the latter may be compressed, a holding latch, and means for disengaging said latch to allow the elastic frame to act in unison with the raising mechanism of the apparatus.

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

BARTHOLOMEW CONNOLLY.

Witnesses:
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W. E. HIGHMAN, Jr.