

W. C. HURST.

AIRSHIP.

APPLICATION FILED DEC. 1, 1909.

994,104.

Patented May 30, 1911.

3 SHEETS-SHEET 1.

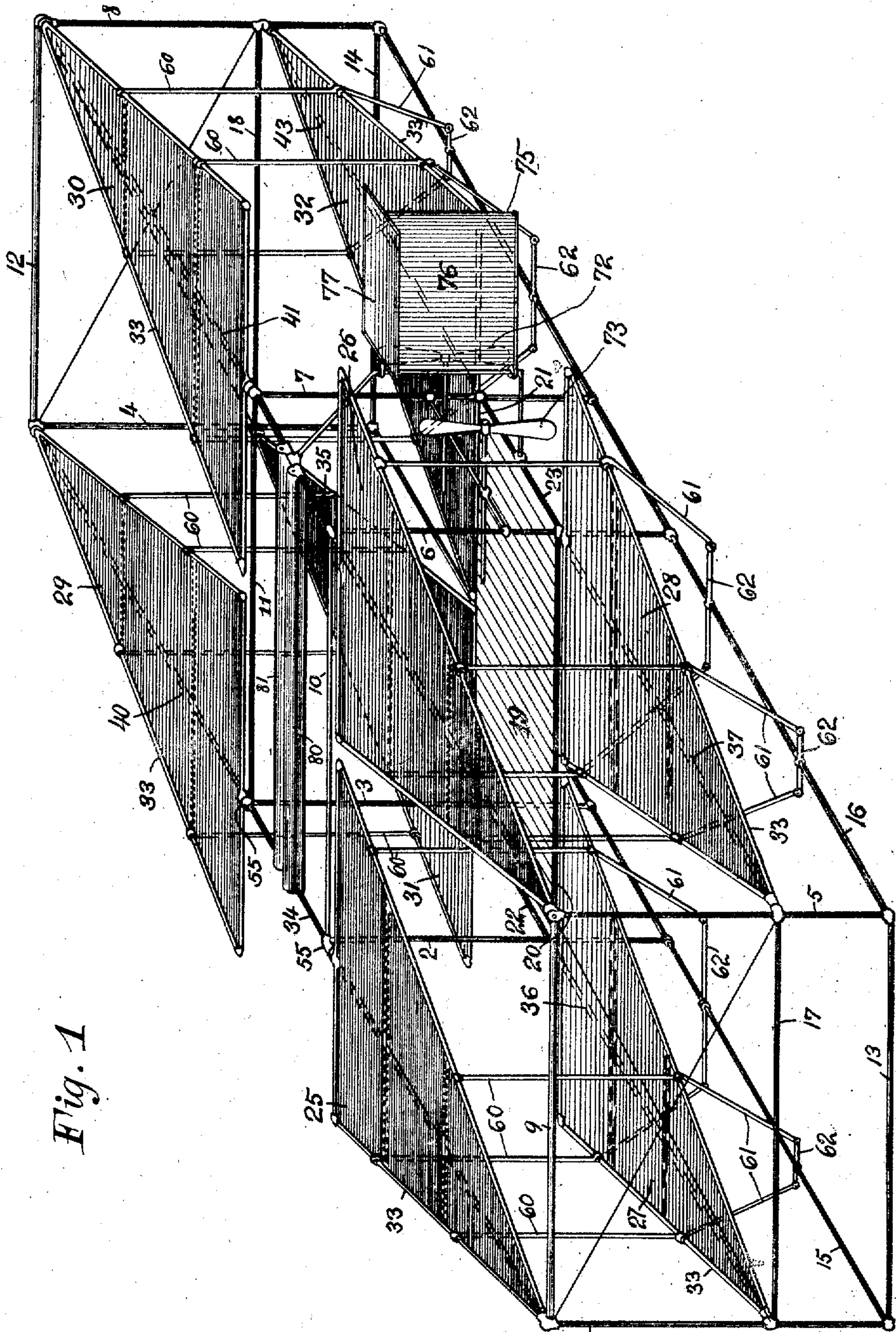


Fig. 1

Witnesses:
Harry J. Lucke
A. R. Schneider

Inventor
William C. Hurst
By his Attorneys
Edwards, Sagar & Wooster

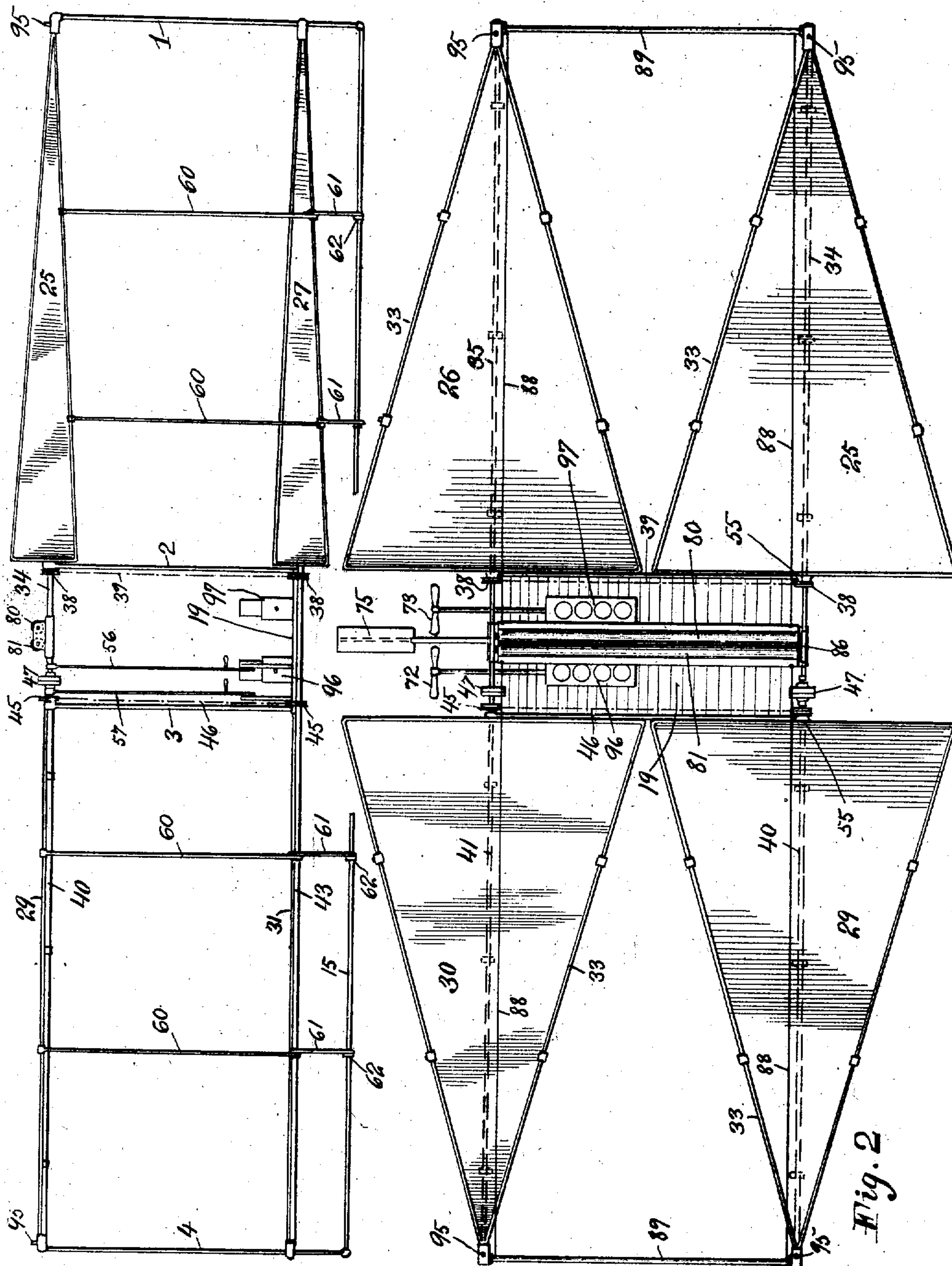
W. C. HURST
AIRSHIP.

APPLICATION FILED DEC. 1, 1909.

994,104.

Patented May 30, 1911.

3 SHEETS—SHEET 2.



Witnesses:
Henry J. Lucke
C. H. Schneider

Fig. 3

William C. Hurst Inventor
By his Attorneys
Edwards, Dager & Winter

W. C. HURST.

AIRSHIP.

APPLICATION FILED DEC. 1, 1909.

994,104.

Patented May 30, 1911.

3 SHEETS—SHEET 3.

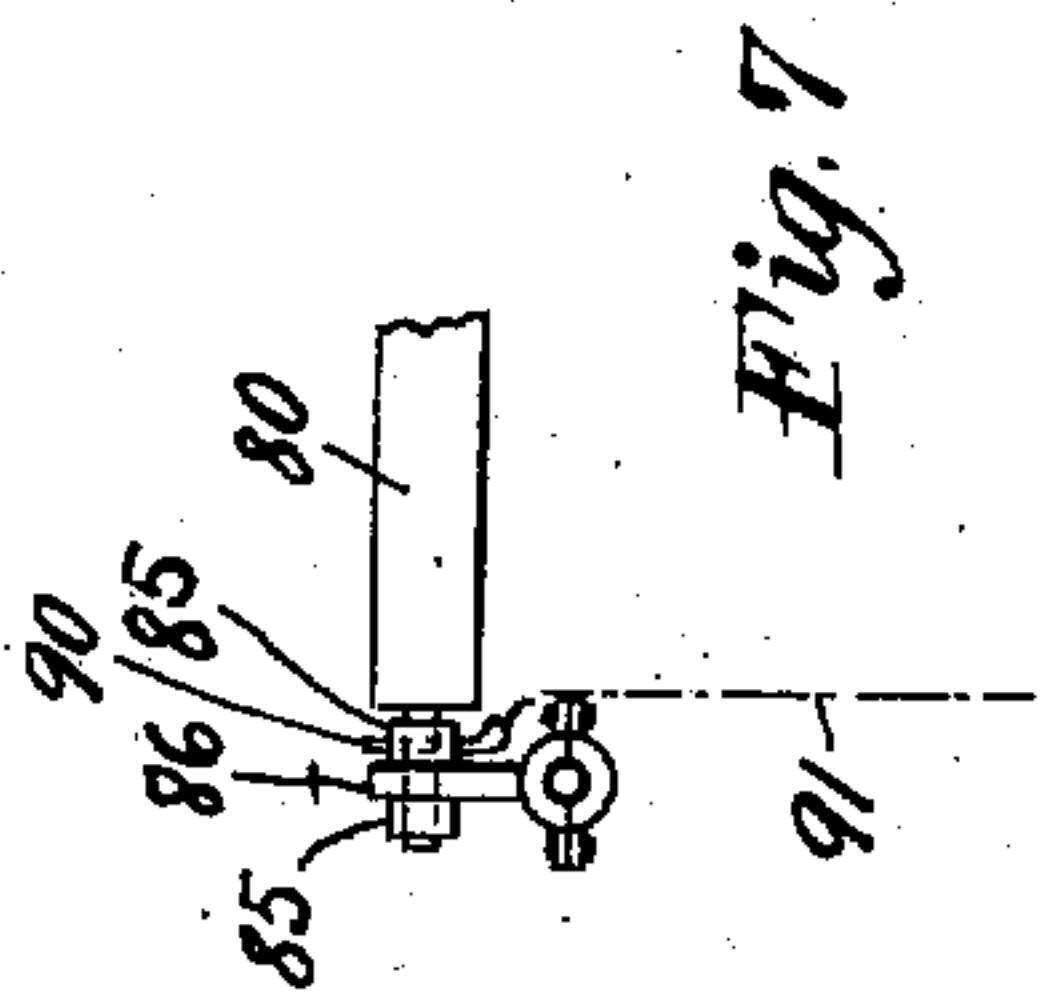


Fig. 7

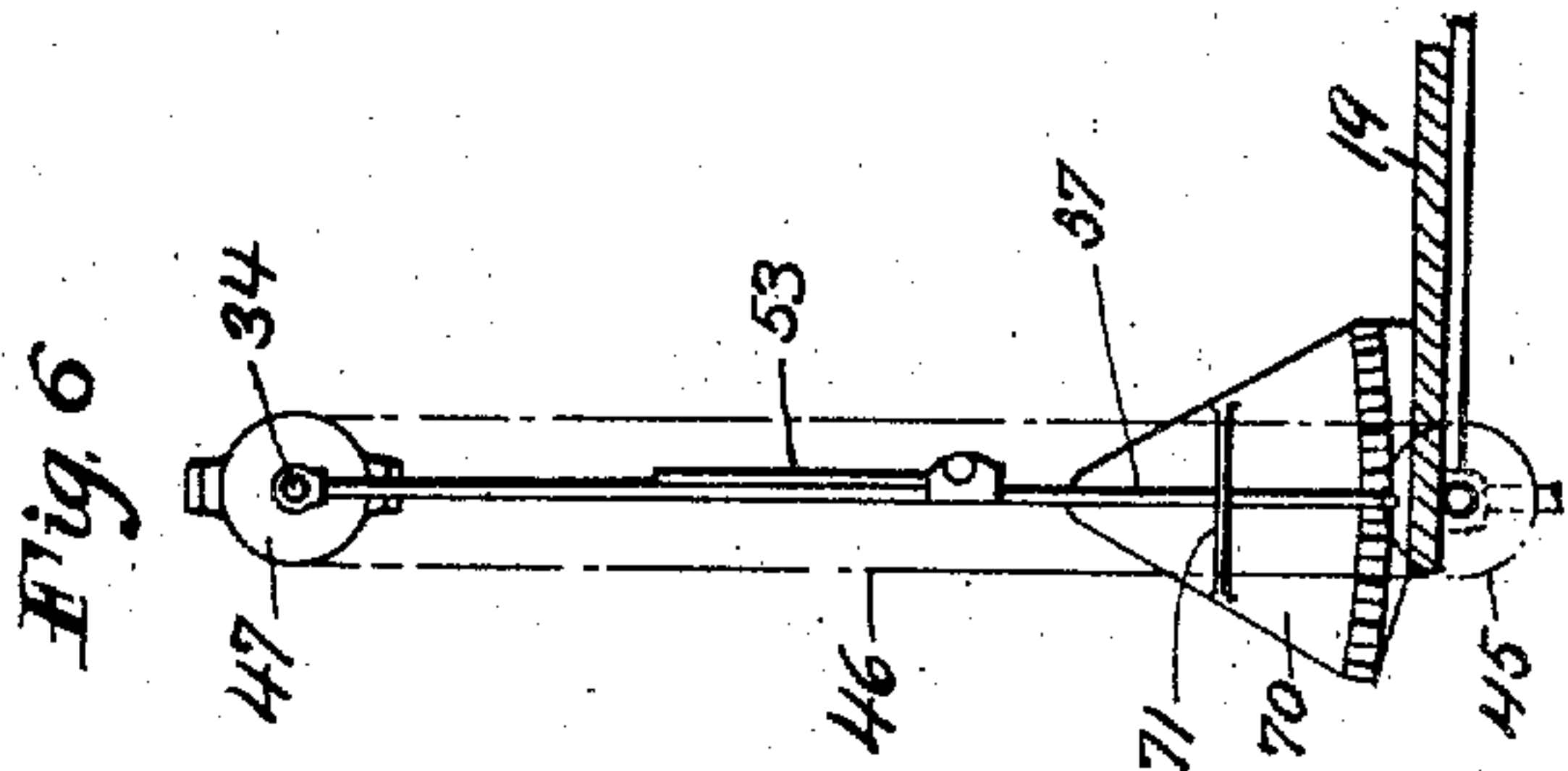


Fig. 6

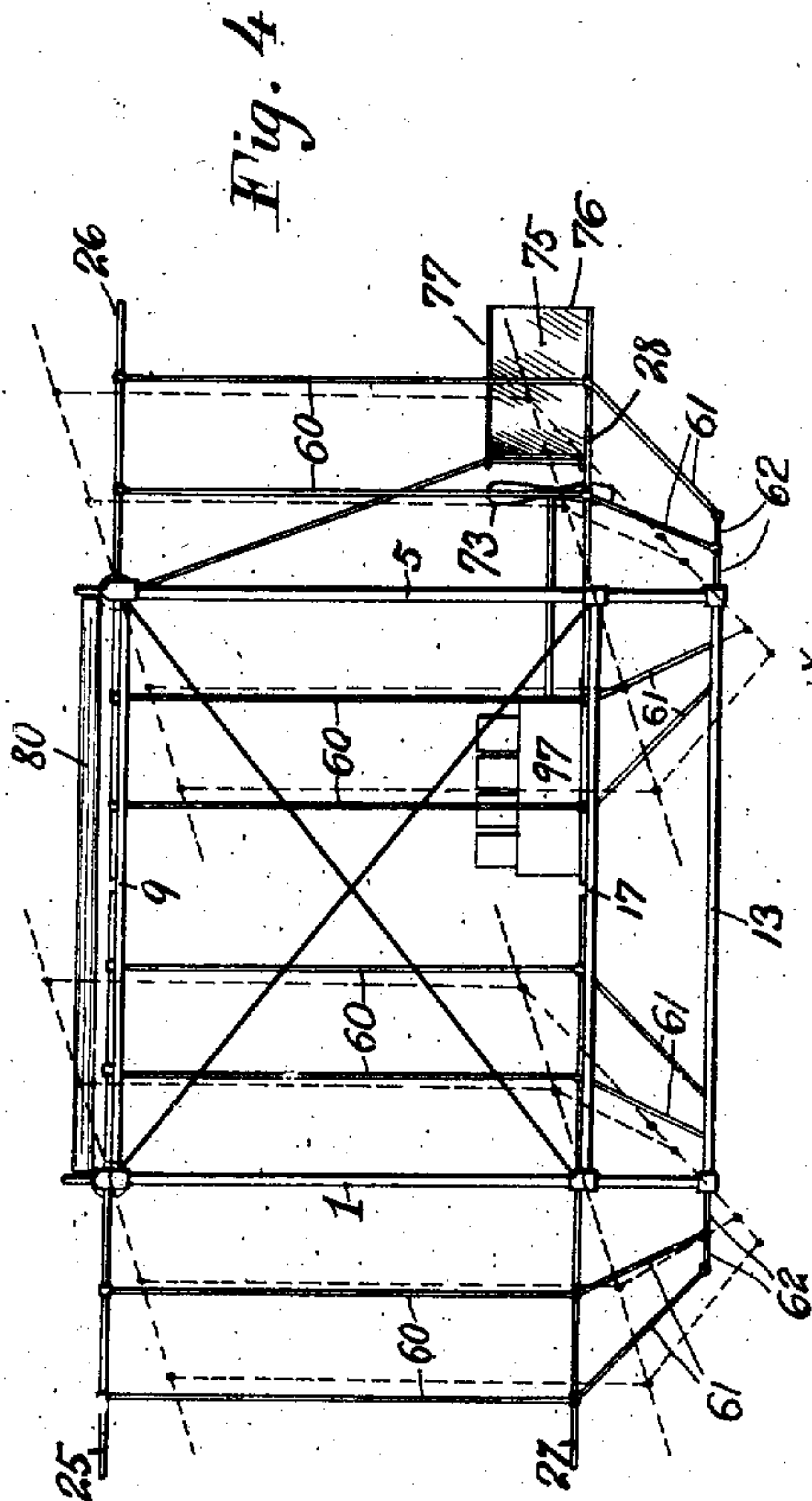


Fig. 4

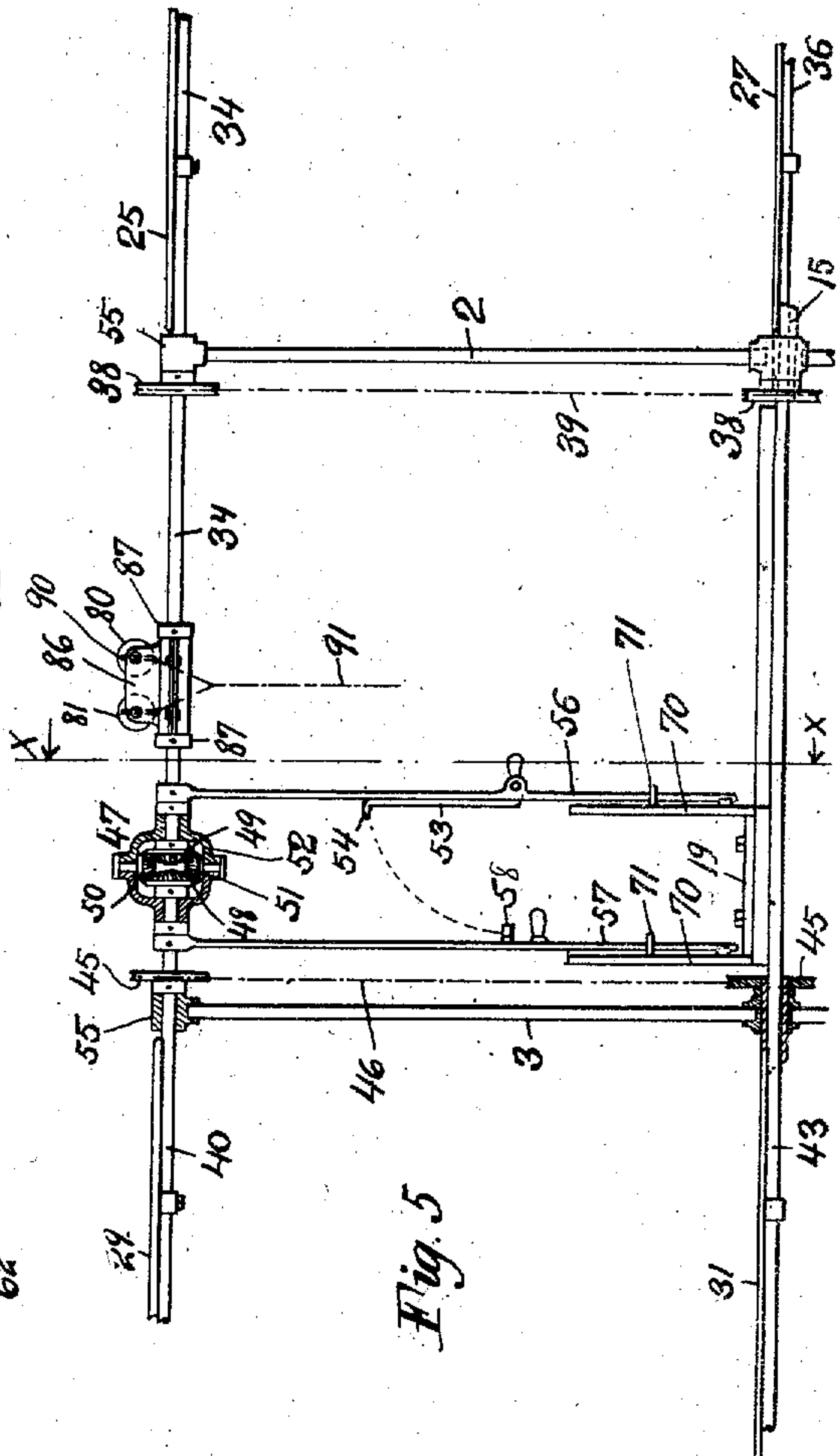


Fig. 5

Witnesses:
Henry J. Lucke
A. H. Schneider

William C. Hurst Inventor

By his Attorneys
Edwards, Sager & Wooten

UNITED STATES PATENT OFFICE.

WILLIAM CHARLES HURST, OF NEW YORK, N. Y.

AIRSHIP.

994,104.

Specification of Letters Patent.

Patented May 30, 1911.

Application filed December 1, 1909. Serial No. 530,716.

To all whom it may concern:

Be it known that I, WILLIAM CHARLES HURST, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Airships, of which the following is a full, clear, and exact specification.

This invention relates to air-ships, and relates more particularly to air-ships of the type known as "heavier than air", in which one or more aeroplanes are employed.

I am aware that prior to my invention, flying machines have been proposed in which one or more aeroplanes are flexed for a small portion at or near the ends of said aeroplanes, the main portion of said aeroplanes being intended to be substantially non-flexed; however, in view of the materials, usually wood for the framework and fabric for the planes, the main portions of the aeroplanes do not operate under conditions of flight as rigid planes, thus giving rise to conditions of great uncertainty in flying in such prior devices, and causing unnecessarily great hazard in aeronavigating.

According to this invention, my flying machine, whether of the soaring or of the self-propelled type, is provided with one or more aeroplanes, having at least one aeroplane disposed proximate to the end of the flying machine, the face of said aeroplane or aeroplanes being of less width at the end thereof more nearly to the end of the flying machine than at the opposite end thereof.

The aeroplanes of my device are constructed of suitable material which is substantially rigid under all normal conditions of aeronavigating or soaring, the material being of appropriate lightness; I prefer to construct the one or more aeroplanes of my device of aluminum, or aluminum alloys, or the like.

An essential feature of my invention is, that I provide means for moving one or more aeroplanes relative to the framework of my flying machine, whereby the weight of the machine, and passenger or passengers, is sustained by the reactions resulting when the machine is moved through the air either by the application of mechanical power or by the utilization of the force of gravity; furthermore, it is the object of this invention to provide means for maintaining the aeroplanes of my device rigidly in any po-

sition to which said aeroplanes may be moved.

Another feature of this invention is that the rudder or other guiding device necessary in cooperation with my movable aeroplanes for directing the flying machine vertically or horizontally is of much less length and weight than heretofore employed.

It will be understood that my invention contemplates constructing all the various parts of my flying machine so as to combine lightness, strength, convenience of construction, and facility of operation.

Other objects and advantages of my invention will be more fully understood from the following description and the accompanying drawings, in which—

Figure 1 is a perspective view of a flying machine embodying my invention, illustrated, however, merely diagrammatically, the driving, controlling and operating parts having been largely omitted for the purpose of presenting a clearer illustration; Fig. 2 is a plan of the device shown in Fig. 1, illustrating in addition the engine, and means for operating the several sets of aeroplanes independently of each other; Fig. 3 is a front elevation of the device shown in Fig. 2; Fig. 4 is an end view of the device shown in Figs. 2 and 3; Fig. 5 is a detail view of the operating and controlling levers and mechanism whereby each set of aeroplanes may be independently or simultaneously moved as may be desired by the operator; this figure also shows certain parts of my automatically opening parachute; Fig. 6 is a detail view on the line X—X of Fig. 5, showing one lever for operating the aeroplanes, and means for retaining the lever rigidly in any desired position; and Fig. 7 is a detail view of the means for causing the parachute to be set automatically in position.

Referring now to Fig. 1, the support of my device is constituted of an open framework comprising essentially vertical rods 1, 2, 3 and 4, positioned in the front thereof, and vertical rods 5, 6, 7, and 8, positioned in the rear thereof; said rods being joined at the top by horizontal rods 9, 10, 11, and 12, and at the bottom by horizontal rods 13, 14. Additional horizontal rods 17 and 18 may be provided at the ends of my flying machine intermediate the rods 9 and 13, and 12 and

14, respectively, for the purpose of giving greater strength and also for the support of other parts. In a practical embodiment of my invention the framework comprising the rods referred to above, will be suitably braced to withstand strains in all planes by means of a number of cross rods or ropes and other braces, as will be readily understood. The platform 19, for supporting the operator and passengers, is preferably disposed in the middle of my device, and is usually made of wood or other vegetable material of suitable likeness and strength, and supported on the horizontal side rods 20, 21, and the front and rear rods 22 and 23. When my flying machine is constructed of the type as shown in Fig. 1, the machine comprises eight aeroplanes, 25, 26, 27 and 28, and 29, 30, 31 and 32, the first four, namely, 25 to 28 inclusive, constituting one set and disposed on the right of the platform 19, and the remaining aeroplanes 29, 30, 31 and 32 constituting the second set and disposed to the left of said platform 19. In general, the form of the individual aeroplanes is such that the width of the face of the same at one end is less than at the opposite end, and as a specific example I have illustrated the individual aeroplanes as of a form having a substantially triangular face. It will be understood, however, that the form of the face of the individual aeroplanes need not necessarily terminate in an apex, but may be of any width less than the width of the opposite end of the face. The aeroplanes may be constructed of sheet aluminum, aluminum alloys, or the like, and may be further strengthened at the edges by rods 33 of similar material.

Various means for moving the aeroplanes of my device, and means for maintaining the aeroplanes in any desired position, may be employed; as shown in Fig. 2, and in greater detail in Fig. 5, my aeroplanes may be mounted on shafts and moved to a desired position by rotating such shafts. I have shown the shafts as fixed to the aeroplanes on an axis of symmetry of the same; however, it will be obvious that any aeroplane of my device need not be of symmetrical contour, and the shaft may be fixed to any aeroplane of any shape in any suitable relation to the contour of said aeroplane.

Referring to Fig. 2, the aeroplane 25 is mounted on the shaft 34, said shaft 34 being journaled in ball-bearings at its outer end, and passing through a ball-bearing 55 fixed to the framework of the machine. The aeroplane 26 is mounted in a similar manner on a similar shaft 35. On each of shafts 34 and 35 I dispose a sprocket 38 meshing with a chain 39. Aeroplanes 27 and 28 may be mounted on the shafts 36 and 37, respectively, said shafts 36 and 37 being similar to shafts 34 and 35; or, as shown in Fig. 5, the

aeroplane 27 may be provided with straps to permit the same to be moved about the rod 36, said aeroplane 27 being fixed to a stud 15, rigidly connected to the sprocket 38, suitable ball-bearings being provided for journaling the stud 15. The aeroplane 28 may be mounted to permit rotation about the rod 37, said aeroplane 28 being fixed to a stud 15, connected to a sprocket 38. The chain 39 passes about the four sprockets 38, for the purpose of simultaneously moving the aeroplanes and for maintaining said aeroplanes in any desired position. The aeroplanes 29 and 30, are mounted in a similar manner to the arrangement of the aeroplanes 25 and 26. The aeroplanes 31 and 32 may be mounted to rotate about the rods 42 and 43 similar to the arrangement of mounting of the aeroplanes 27 and 28. The sprockets 45 are fixed to the shafts 40 and 41 similar to the arrangement of sprockets 38 on the shafts 35 and 36, the aeroplanes 31 and 32 being fixed to a stud on sprockets 45 mounted to turn about the rods 42 and 43, respectively, a chain 46 meshing with said four sprockets 45. The lever 56 is fixed to a shaft of one set, say shaft 34 of the right hand set, and a similar lever 57 is connected to a shaft of the other set, say shaft 40. I prefer to provide additional co-acting means for insuring the aeroplanes of one set to be simultaneously moved and maintained in position, such further means being described in greater detail in a later portion of this specification. In order to provide further bearing supports, and for preventing lateral movement of the aeroplane shafts, and at the same time to permit the shafts of the different sets of aeroplanes to be independently moved, a differential 47 is connected between the corresponding shafts, as shafts 34 and 40, shafts 35 and 41. It will be understood that when each aeroplane of each set is fixed to a shaft, a differential similar to the differential 47 will be required between each pair of corresponding shafts. The differential 47 is illustrated, specifically, of the type embodying four inter-meshing beveled gears, the gear 48 being fixed to the shaft 40, the gear 49 being fixed to the shaft 34, the intermediate smaller gears 50, 51 meshing with gears 48 and 49, preferably at diametrically opposite points; the gears 50, 51 are suitably mounted on studs journaled in the differential casing 52, suitable ball-bearings, or other anti-friction means being disposed between the collars of said casing 52 and the shafts 34 and 40, respectively. However, any other suitable type of differential may be employed to effect the desired results. As one means for simultaneously operating the levers 56 and 57 when so desired by the operator, I provide one of the operating levers, say the lever 56 with an arm 53 hinged thereto, said arm 53 having a

catch 54 coöperating with the locking means 58 disposed on the other lever 57.

I have referred above to additional co-acting means for insuring simultaneous operation and positioning of the aeroplanes of any one set; such means may comprise a plurality of substantially vertical links 60, connecting an aeroplane with the other aeroplane of the same set and in the same vertical plane, as aeroplanes 25 and 27, aeroplanes 26 and 28, aeroplanes 29 and 31, and aeroplanes 30 and 32; said links being preferably hinged by means of ball bearing joints, or similar anti-friction joints, and preferably at the edges or edge rods 33. Moreover, oblique links 61, arranged in pairs, may be hinged to each of the lower aeroplanes at opposite edges thereof, each pair of said oblique links 61 being connected by means of a rocker arm 62, journaled on the rods 15 and 16.

Any suitable means for detachably retaining the levers 56 and 57 in a desired position may be provided, as for example, a segment 70 having notches coöperating with teeth on the levers 56, 57, said segment 70 being fixed to the framework of the machine, as by positioning, bolting or screwing the same to the platform 19. I prefer to provide each segment 70 with a loop 71 to prevent any accidental displacement of the operating lever beyond the limits of the segment 70. It will be obvious that in the event it is desired to operate the levers 56, 57 by means of the feet of the operator instead of manual manipulation, such levers 56 and 57 will extend a proper length in the front of the flying machine, and suitable segmental or other retaining means positioned accordingly.

When my flying machine is propelled by mechanical power, I provide propeller blades and one or more engines for driving said propeller blades; said engine or engines, and said propeller blades being properly arranged on the platform 19. In the drawings, I have shown two four-cylinder engines 96, 97, disposed on the platform 19, the engine 96 driving the propeller blade 72, and the engine 97 driving the propeller blade 73. I prefer to have the driving means of the propeller 72 independent of the driving means of the propeller 73. The type of the engines, means for cooling the same, and other features as to supporting and arranging the same on the flying machine need not be treated in detail here, as such features will be readily understood by those skilled in the art. The flying machine is further provided with a rudder 75, of any approved arrangement, as for example, comprising a vertical blade 76, and a horizontal blade 77. I have not illustrated means for moving the rudder 75 about an axis parallel to the blades 76, for the reason

that I have omitted details of this nature for the sake of presenting clearer illustrations.

It will be understood that the relative weights of the parts of my flying machine and the positioning of the same, should be properly chosen to cause a substantial balance of the machine when in flight.

I prefer to equip my flying machine with parachutes, preferably of the type which are automatically set in position. The parachute device illustrated generally in Figs. 1 and 2, and more specifically in certain details thereof in Figs. 5 and 7, comprises essentially two sheets of suitable fabric which normally are wound on rods or rollers inclosed in suitable casings, as casings 80, 81. In Figs. 2 and 7 is shown one arrangement of the casings 80, 81, the rollers being mounted on studs journaled in the bearings 85 of the plate 86, said plate 86 being supported on the shaft 40 by means of an anti-friction bearing collar 87. To the free ends of the parachute sheets are attached wires 88, or similar means, see Fig. 2, the other ends of said wires 88 being connected to the spring-wound reels 89, disposed preferably adjacent the extreme upper left hand and right hand ends of the flying machine. I have not shown the reels 89 in Fig. 1, but it will be obvious that such reels may be positioned immediately above the rods 9 and 12, respectively, or said rods 9 and 12 removed and the reels 89 put in their place instead. When the parachute sheets are wound on their respective rods in the casings 80, 81, such manipulation will be carried out by doing work on the springs of the reels 89, 89. For holding the parachute in closed position, pins 90 are inserted in suitable openings in the bearings 85, and through an opening in the stud of the roller of the parachute curtain, registering with said openings in the bearing 85, thus permitting the parachute curtains to be held in a closed position by the spring reels 89, 89. When it is desired to open the parachute curtains, the pins 90 may be pulled out of the openings in the bearing 85 by means of a chain or rope 91, whereby the reels 89 bring the parachute sheets to an open position. The reels are preferably provided with ratchets for maintaining the parachute sheets in open position; or in substitution for such ratchets or in addition thereto, fixed lugs 95 (see Fig. 2) may be disposed on the upper ends of the rods 1 and 4 coöperating with openings or projecting hooks on the parachute sheets.

It will thus be seen that my flying machine is provided with a plurality of sets of aeroplanes, each set being capable of being moved to, and held in, any desired position independently of the remaining sets. Referring to Fig. 4, the solid lines denoting

the aeroplanes 25, 26, 27 and 28, show the same in a horizontal position, and the dotted lines show the position assumed by said aeroplanes when moved to a forward downward position.

I wish it to be understood that my flying machine comprises more than two sets of aeroplanes, and that two or more aeroplanes may be included in each set. It will also be clear that my flying machine may comprise planes which are fixed to the support of the flying machine, said fixed planes being preferably at or near the middle of the machine, and two or more sets of aeroplanes of the nature described above may be disposed at any suitable location proximate to the ends of the machine.

It will be understood that wherever relative movement between the parts of my flying machine takes place, ball-bearings, or similar anti-friction means, are provided.

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

1. In a flying machine, the combination with a central body portion and right-hand and left-hand lateral body portions, of propelling means carried by said central body portion, a group of movable aeroplanes of non-flexible material supported by said right-hand body portion, a group of movable aeroplanes of non-flexible material supported by said left-hand body portion, the aeroplanes of each of said groups being arranged one vertically above another and parallel to one another, said aeroplanes having faces whose width toward the central body portion is greater than its width outwardly, and means for simultaneously moving the upper and lower aeroplanes of each group while maintaining parallelism of the same and independently of the aeroplanes of the other group.

2. In a flying machine, the combination with a central body portion and right-hand and left-hand body portions, of propelling means carried by said central body portion, a group of movable aeroplanes of non-flexible material supported by said right-hand body portion, a group of movable aeroplanes of non-flexible material supported by said left-hand body portion, said aeroplanes having substantially triangular faces, the aeroplanes of each group being parallel to one another and arranged in a plurality of horizontal planes, means for simultaneously moving the aeroplanes of each group while maintaining parallelism and independently of the aeroplanes of the other group, and means for simultaneously operating said movable means of both groups.

3. In a flying machine, the combination

with a central body portion and right-hand and left-hand body portions, of propelling means carried by said central body portion, a group of rotatable aeroplanes of non-flexible material supported by said right-hand body portion, a group of rotatable aeroplanes of non-flexible material supported by said left-hand body portion, the aeroplanes of said groups having faces of greater width toward said central body portion as compared with the outward width of the same, said aeroplanes in each group being arranged in pairs one vertically above another and parallel thereto, shafts secured to certain of said aeroplanes, and means for simultaneously rotating the shafts through equal angles secured to the aeroplanes of one group and independently of the aeroplanes of the other group.

4. In a flying machine, the combination with a central body portion, propelling means carried by the same, a right-hand body portion, a group of rotatable aeroplanes supported by said right-hand body portion, a left-hand body portion, a group of rotatable aeroplanes supported by said left-hand body portion, the aeroplanes of said groups being of non-flexible material and of substantially triangular shape with the apices disposed outwardly, means for rotating through equal angles the aeroplanes of one group independent of the aeroplanes of the other group, said means comprising operating members disposed at distributed points on the faces of said aeroplanes.

5. In a flying machine, a central body portion, propelling means carried by said central body portion, a right-hand body portion, a group of aeroplanes supported by said right-hand body portion, a left-hand body portion, a group of aeroplanes supported by said left-hand body portion, said aeroplanes being of non-flexible material and of substantially triangular shape with the apices disposed outwardly, said aeroplanes of each group being arranged parallel to one another and in a plurality of horizontal planes, and means for rotating said right-hand and said left-hand groups of aeroplanes through equal angles while maintaining parallelism either independently of each other or at the same time as desired, said means comprising a plurality of actuating elements secured at distributed points to the face of each aeroplane.

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

WILLIAM CHARLES HURST.

Witnesses:

HENRY J. LUCKE,
GEO. N. KERR.