J. W. WADSWORTH.

AIRSHIP.

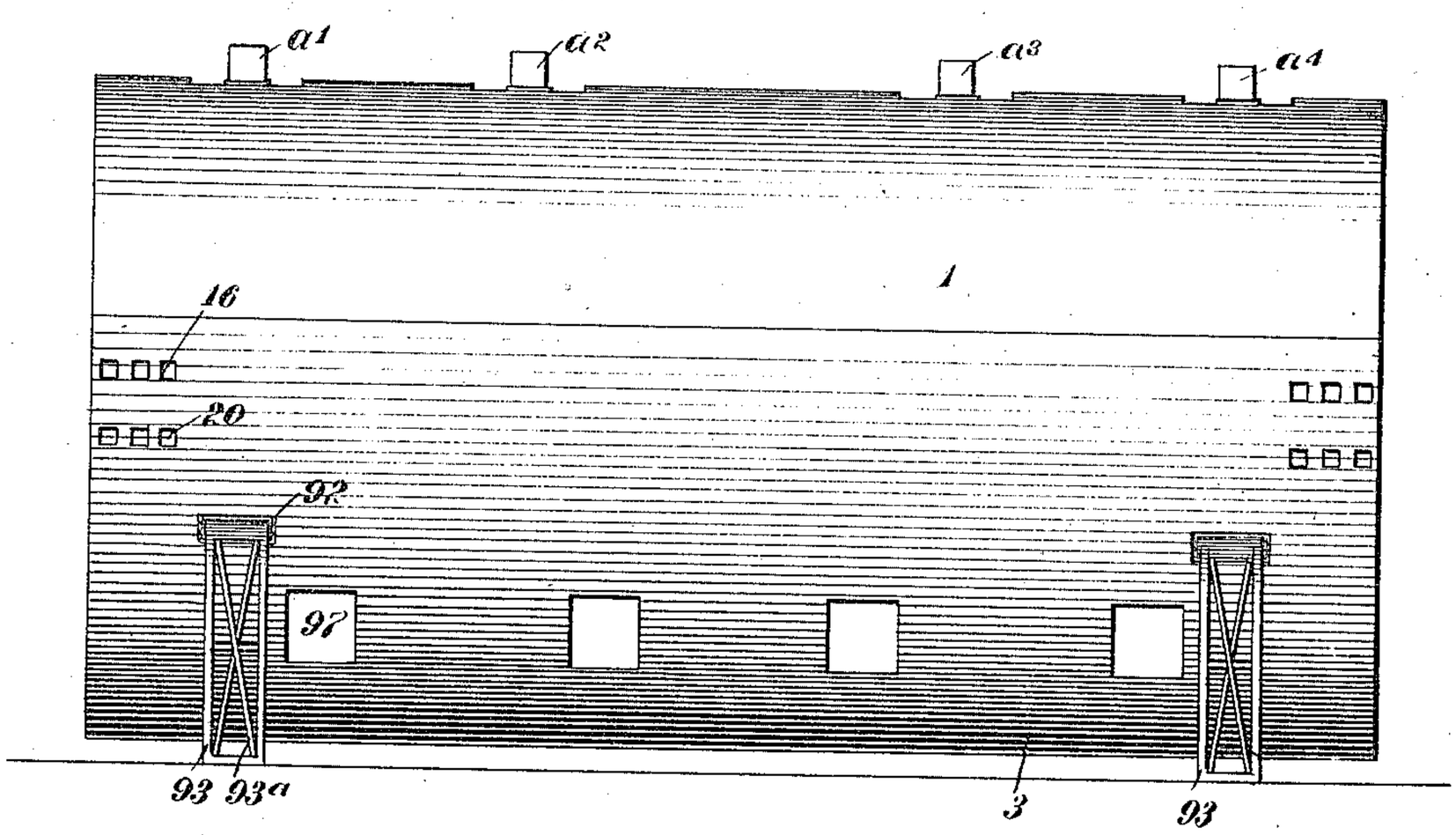
APPLICATION FILED AUG. 31, 1909.

989,455.

Patented Apr. 11, 1911.

11 SHEETS—SHEET 1.

Fig. 1.



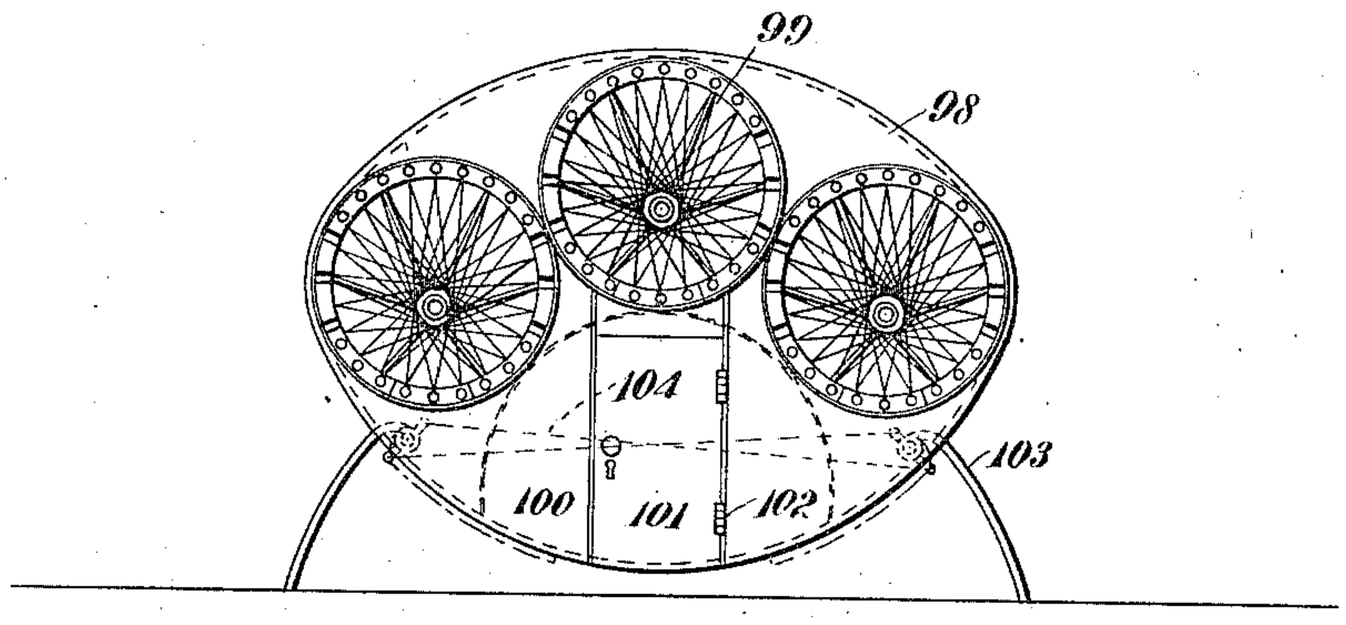


Fig. 17.

WITNESSES

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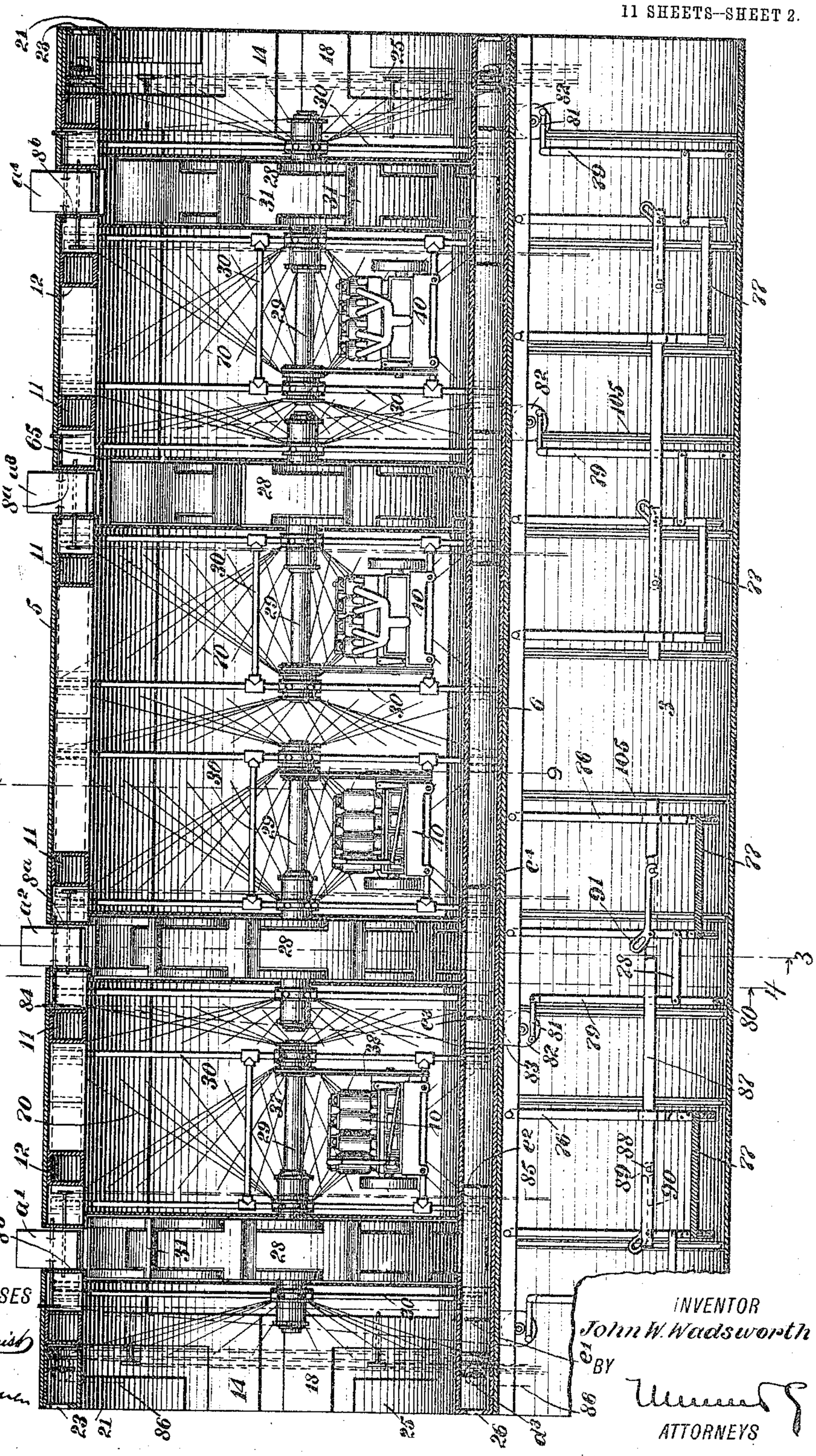
11 SHEETS—SHEET 2.

Fig. 2.



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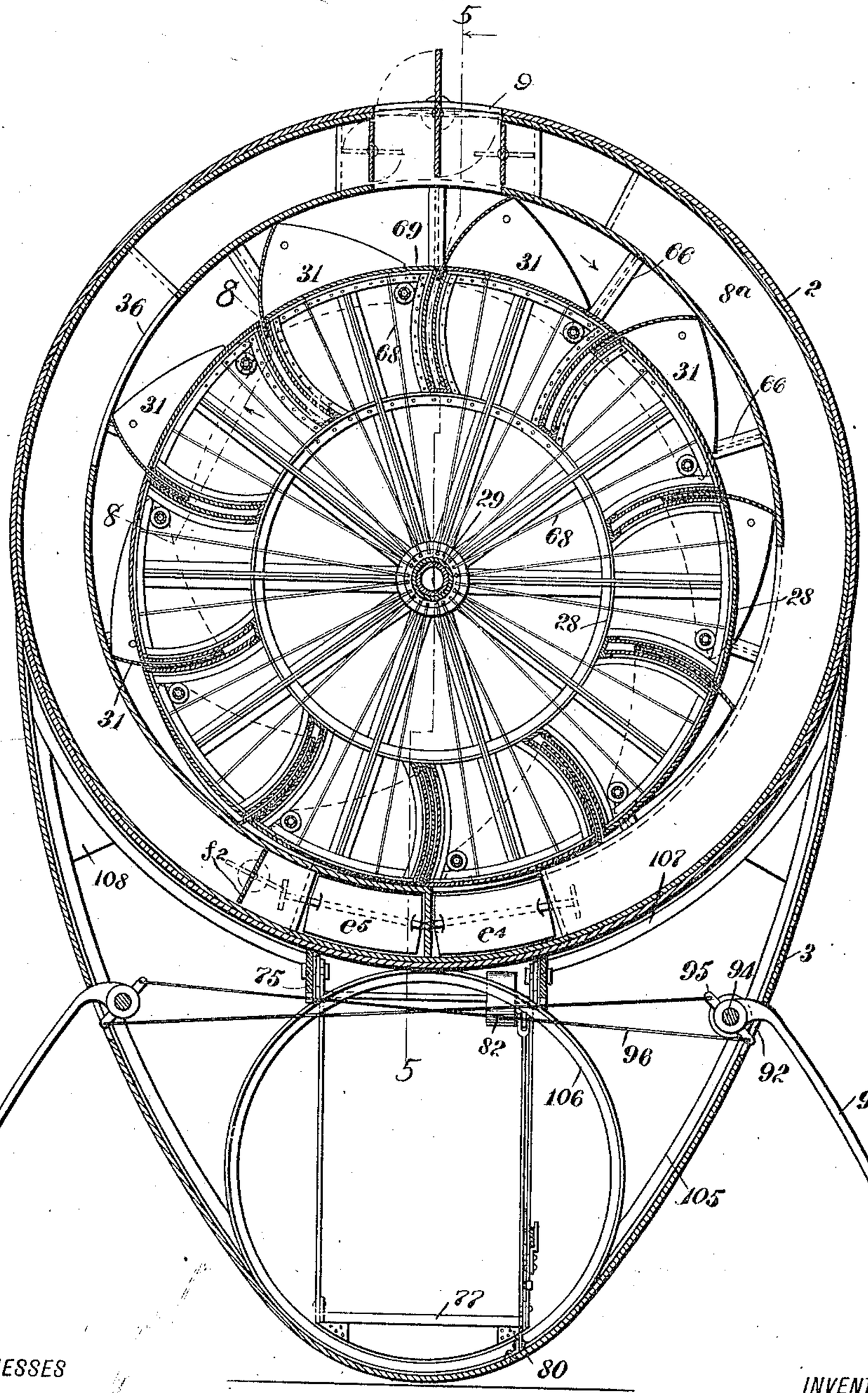
11 SHEETS—SHEET 3.

Fig. 3.



WITNESSES

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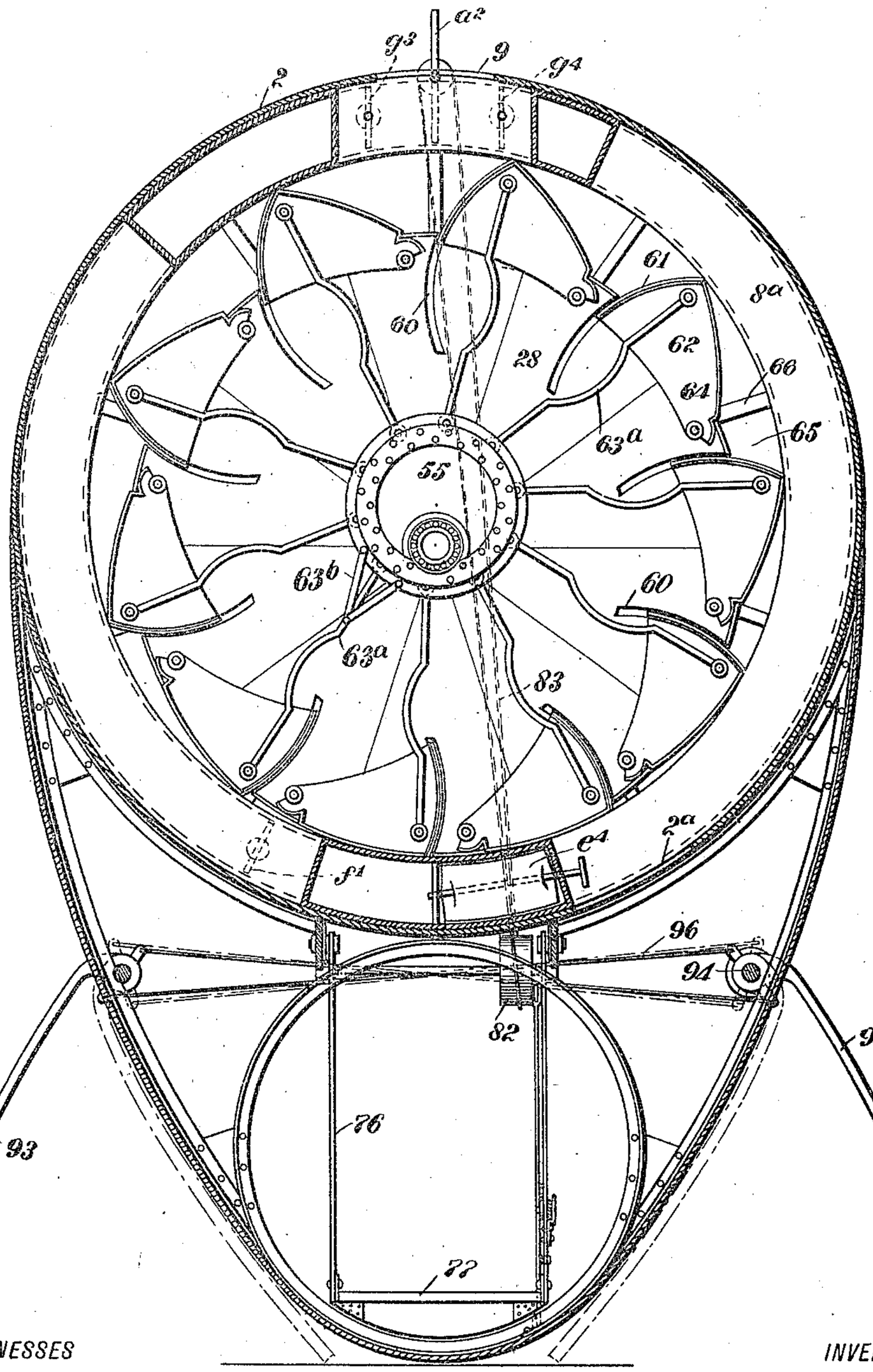
11 SHEETS—SHEET 4.

Fig. 4.



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11 SHEETS—SHEET 5.

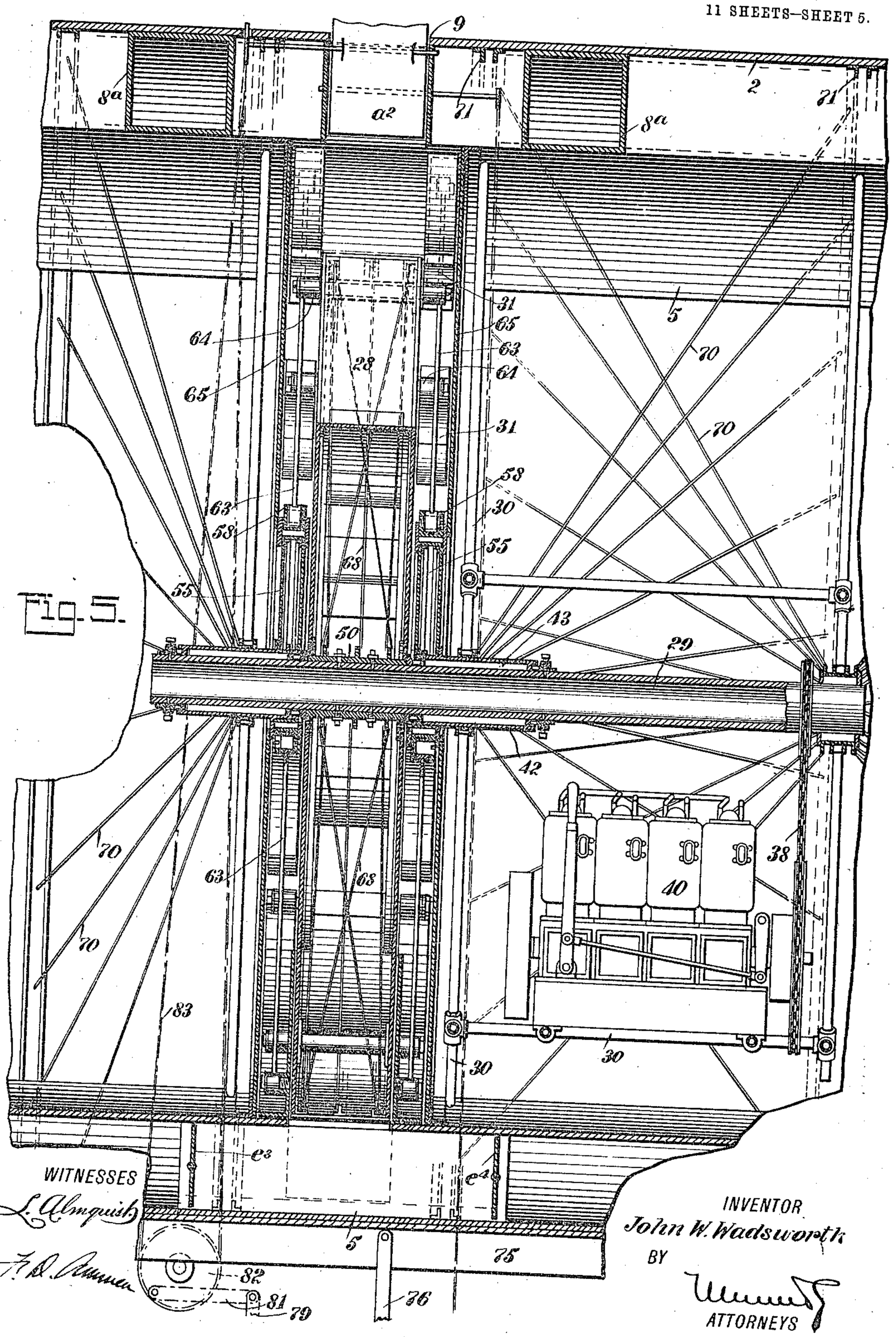

Fig. 5.

WITNESSES

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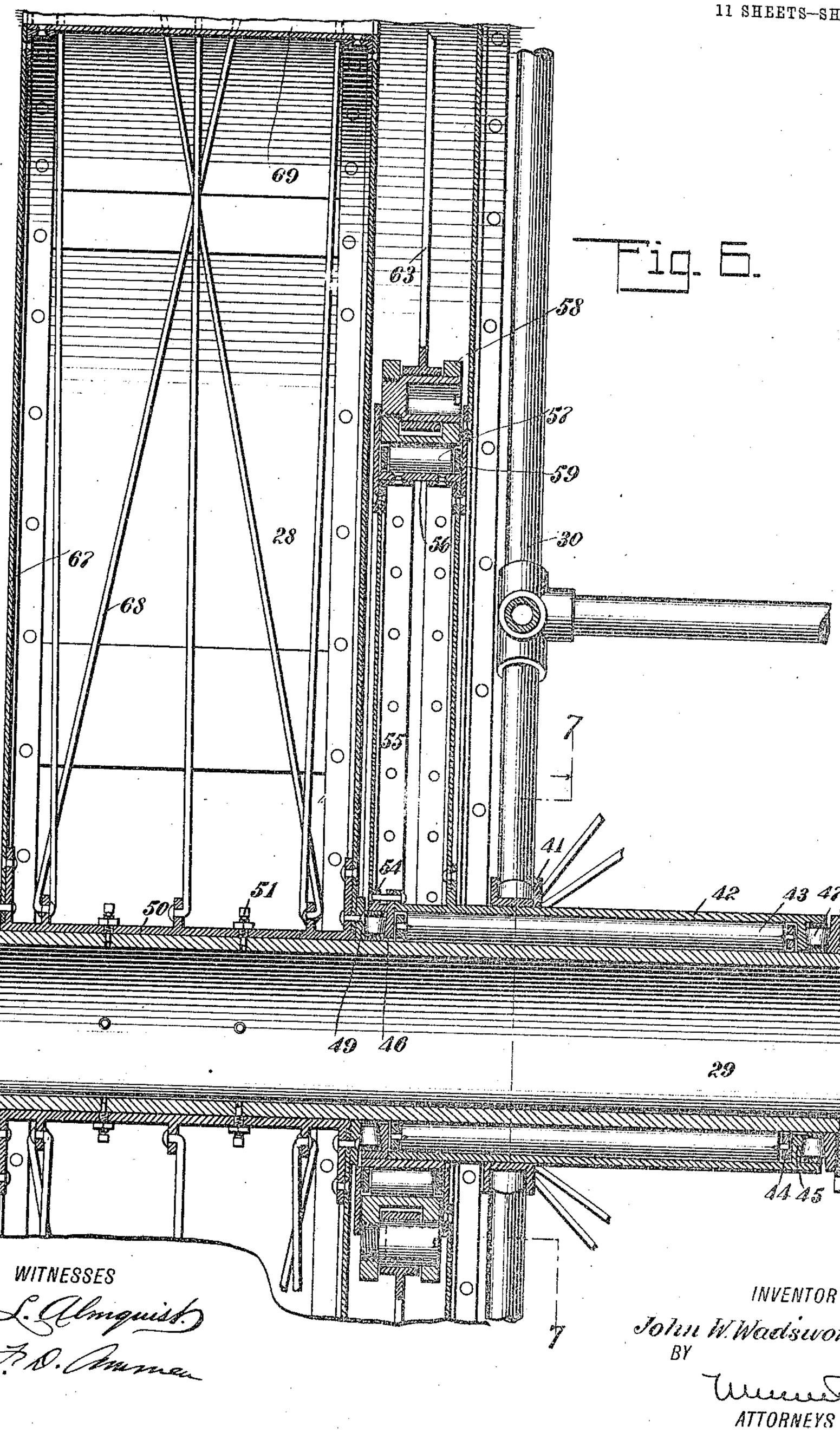
11 SHEETS—SHEET 6.

Fig. 6.



WITNESSES

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APPLICATION FILED AUG. 31, 1909.

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11 SHEETS—SHEET 7.

Fig. 6.

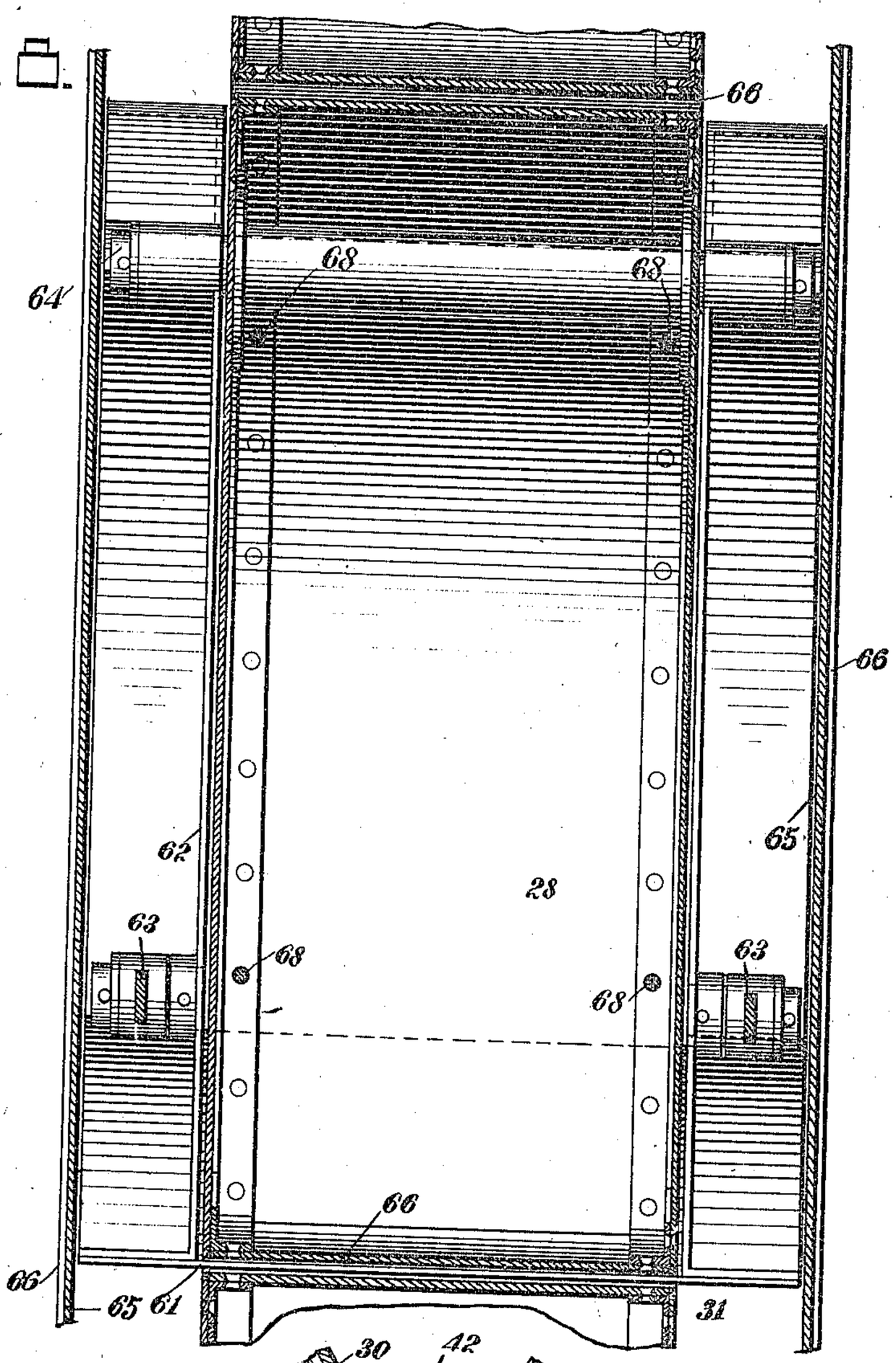
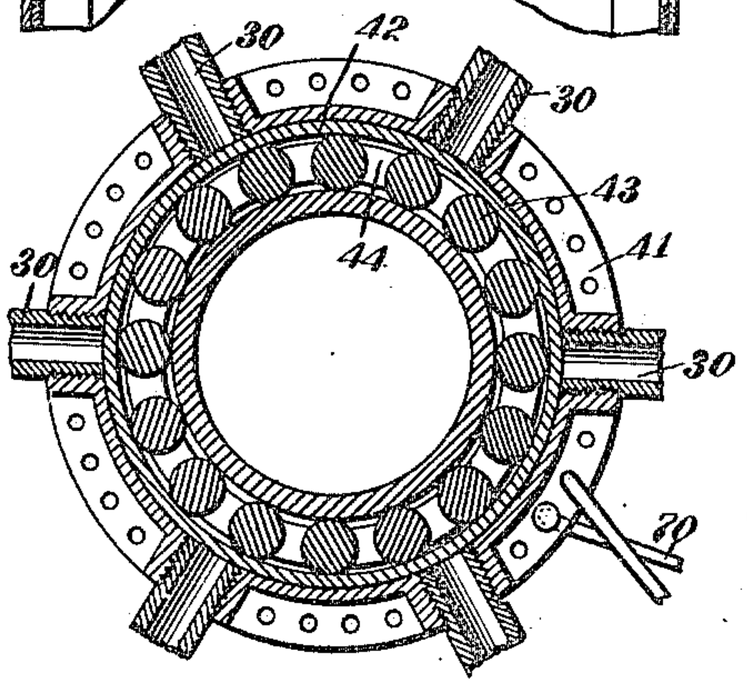


Fig. 7.



WITNESSES

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11 SHEETS—SHEET 8.

Fig. 10.

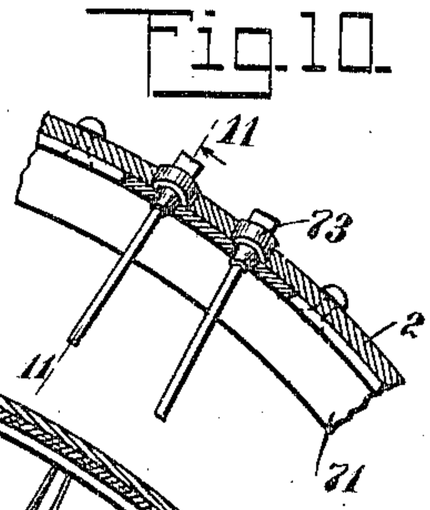
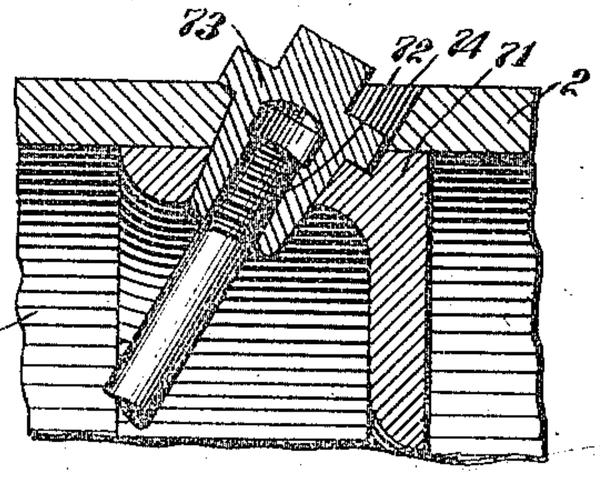


Fig. 9.

Fig. 11.



WITNESSES

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APPLICATION FILED AUG. 31, 1909.

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11 SHEETS—SHEET 9.

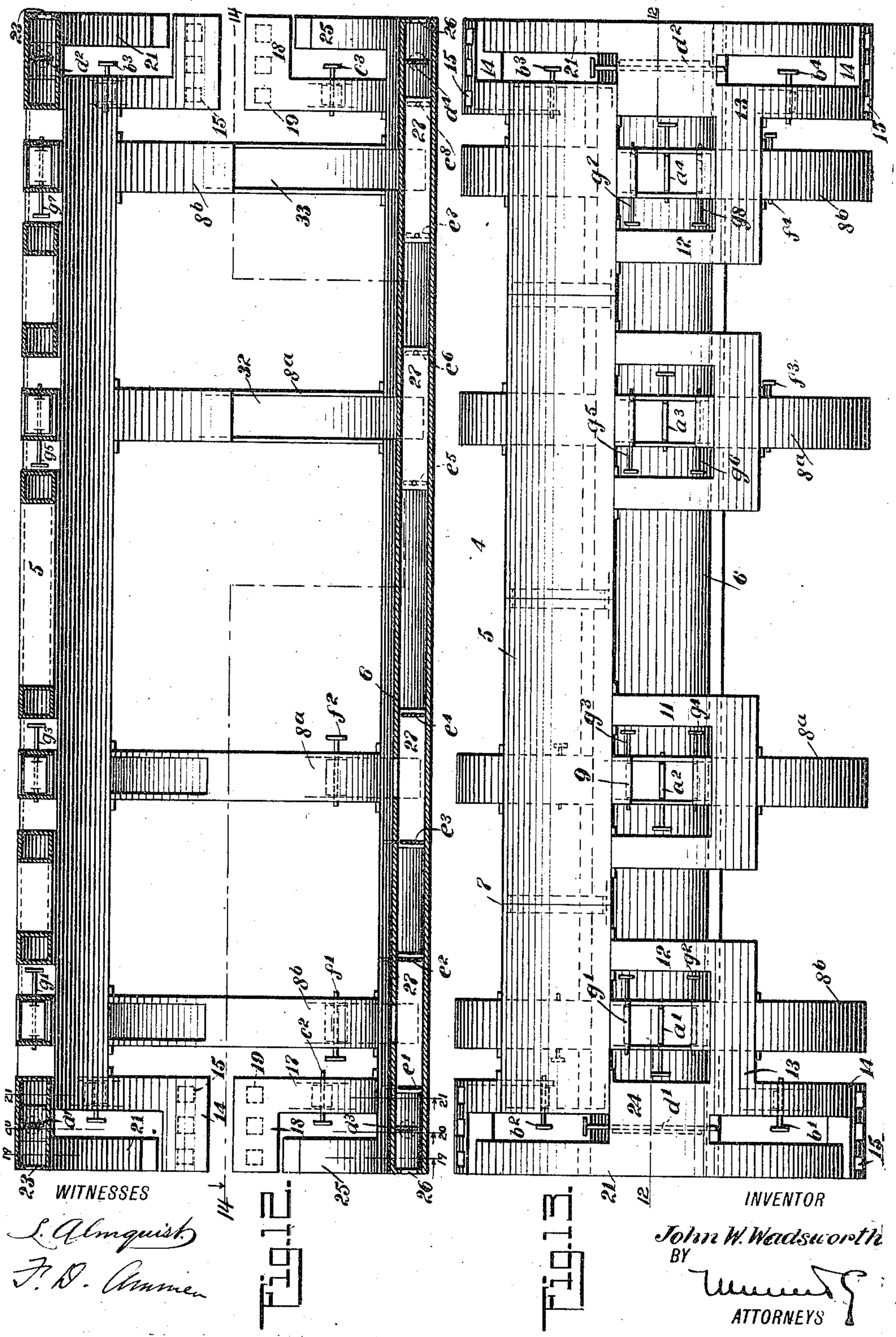

Fig. 12.

Fig. 13.

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11 SHEETS—SHEET 10.

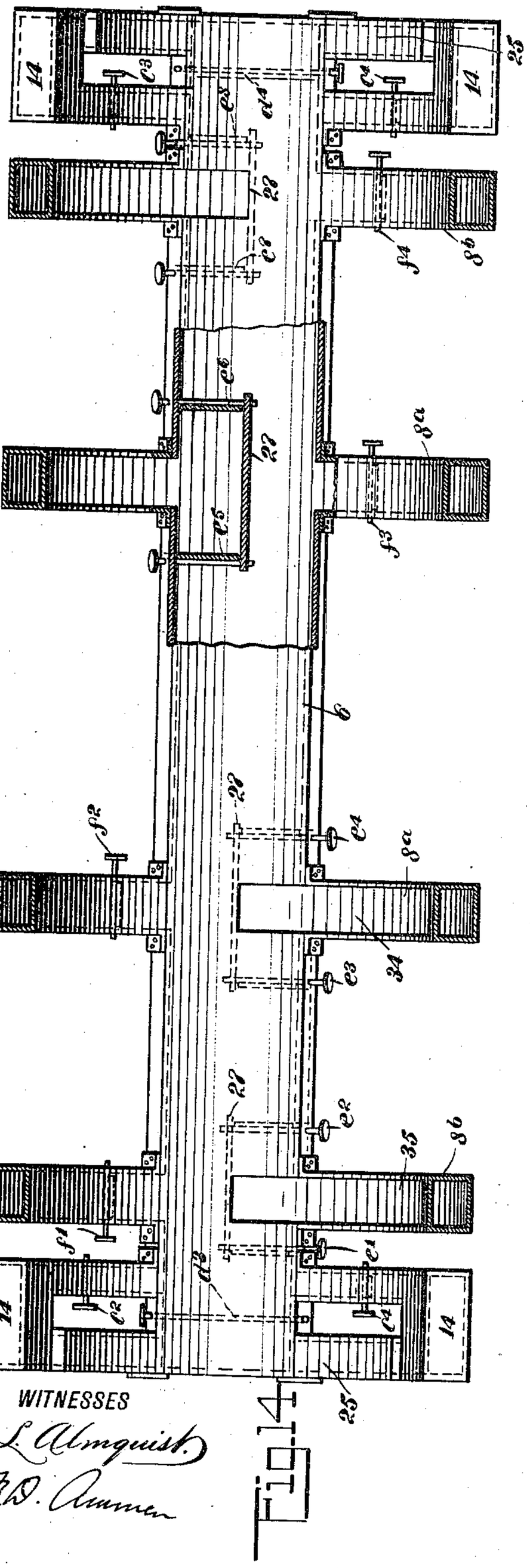

Fig. 14.

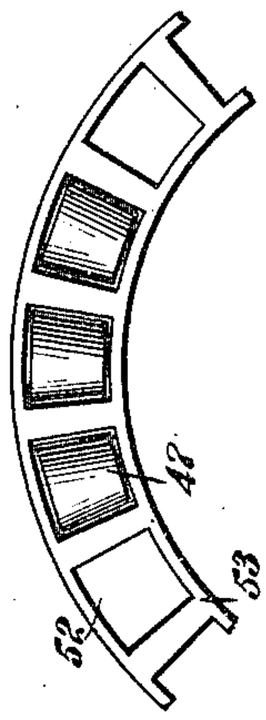

Fig. 16.

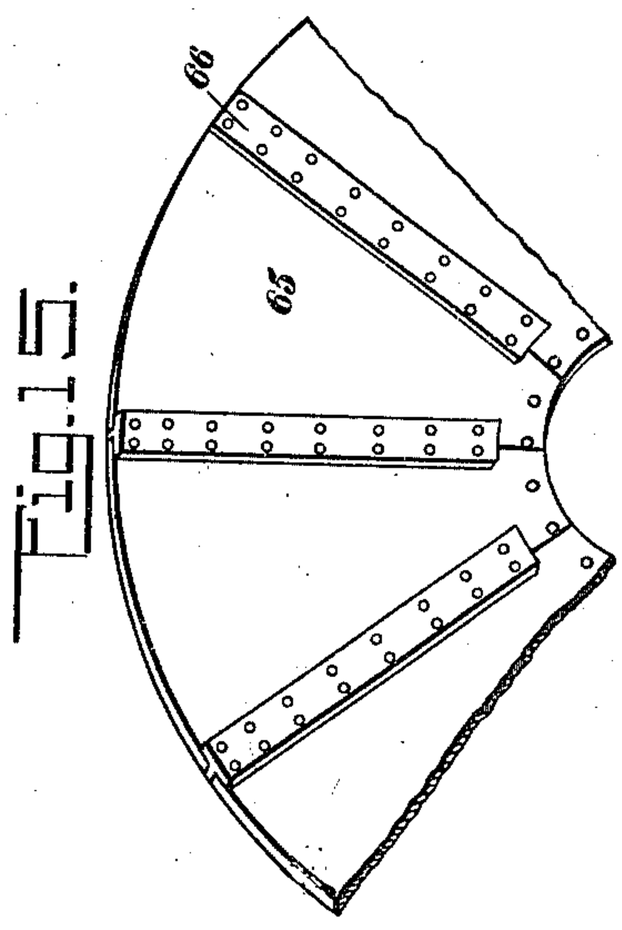

Fig. 15.

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APPLICATION FILED AUG. 31, 1909.

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11 SHEETS—SHEET 11.

Fig. 18.

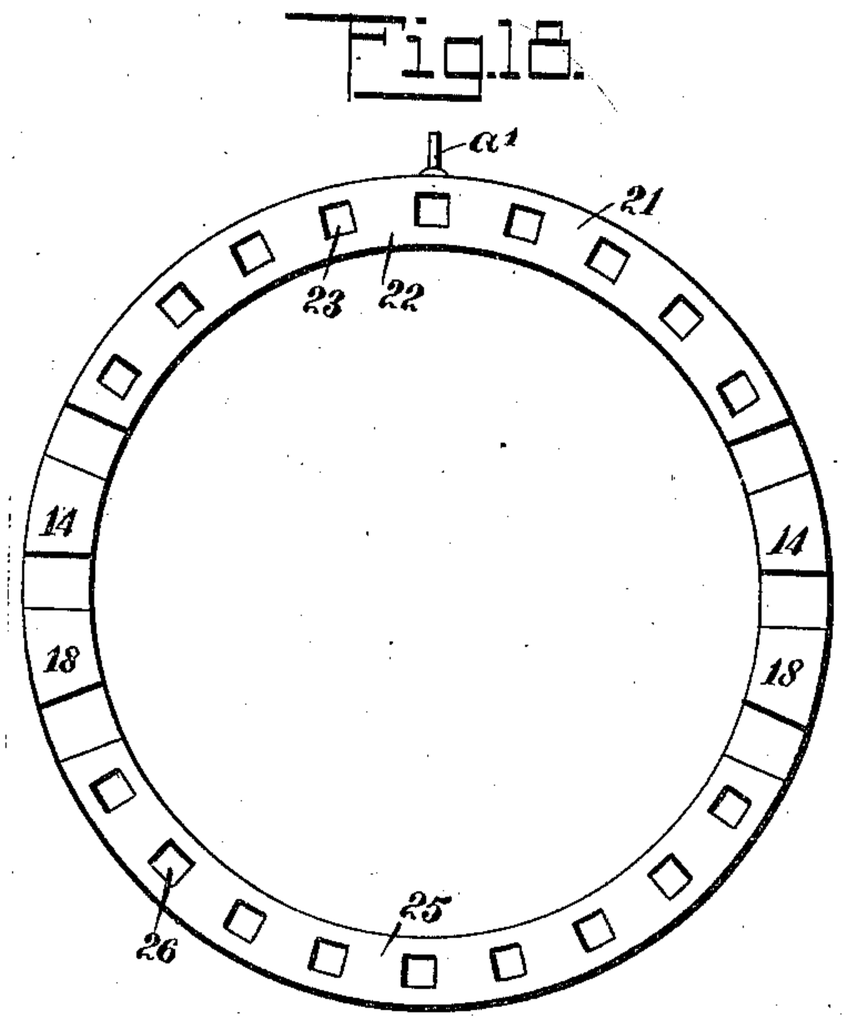


Fig. 19.

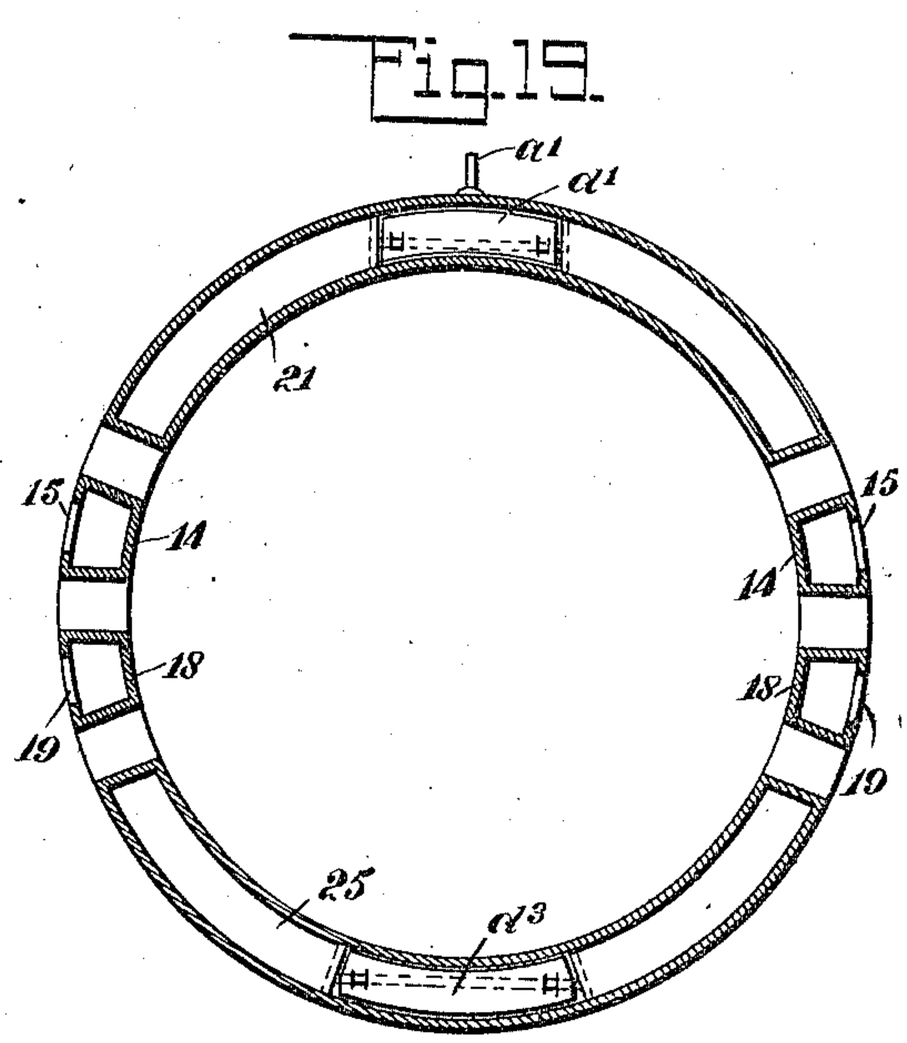


Fig. 20.

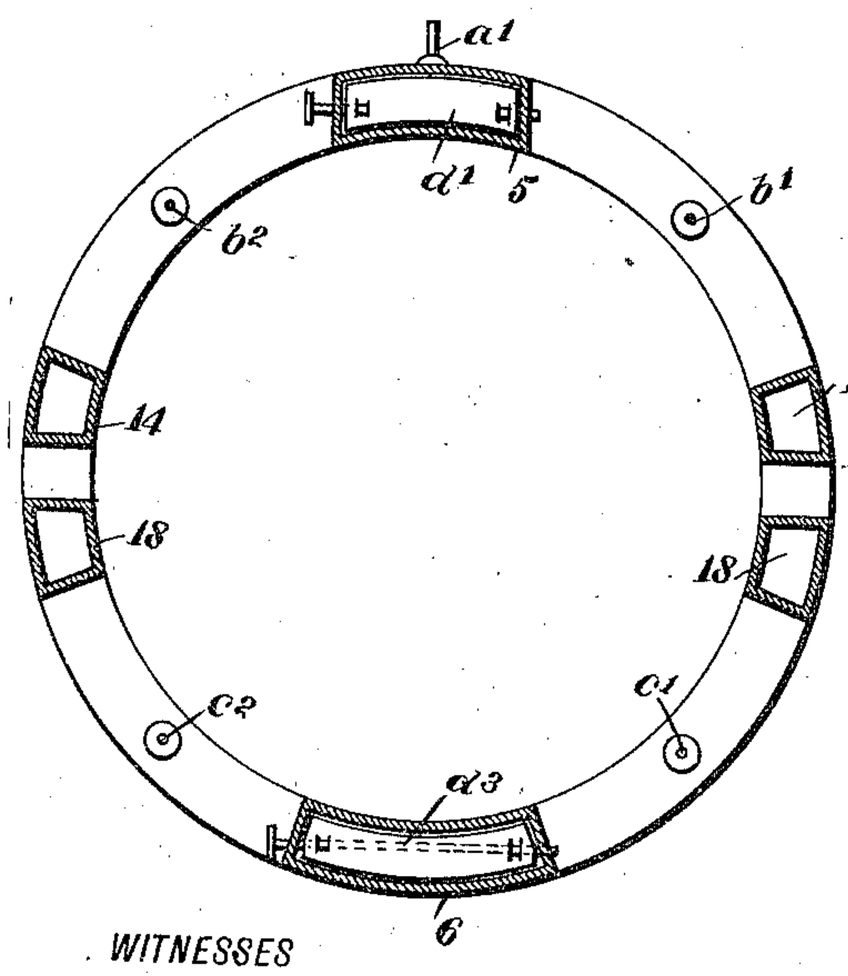
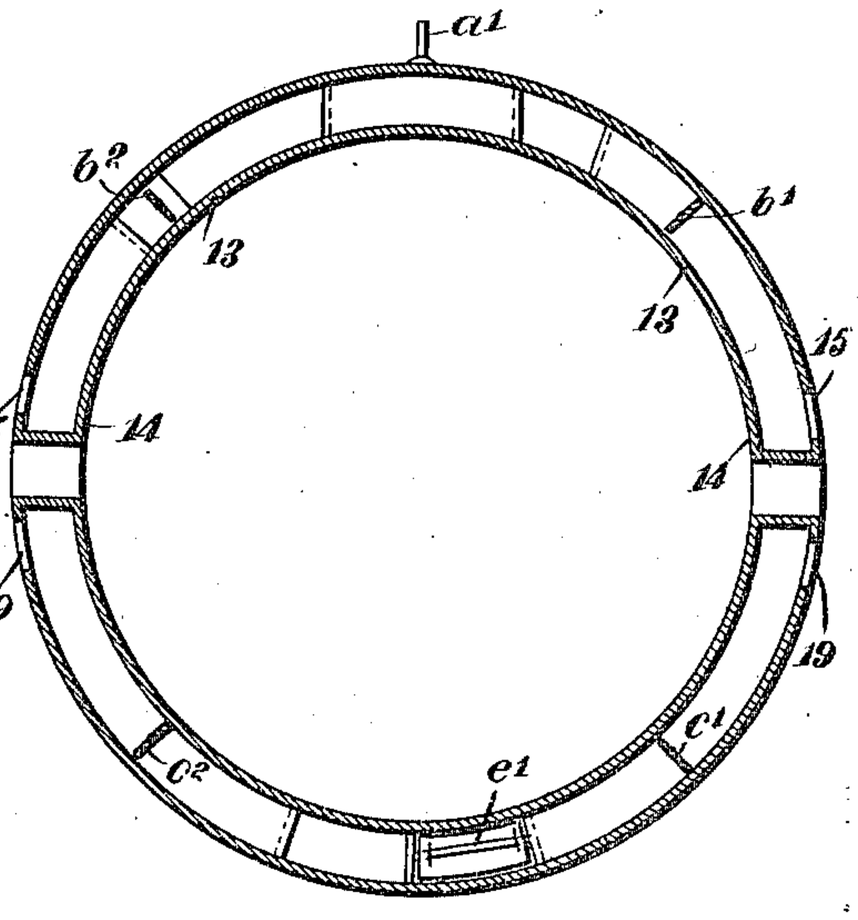


Fig. 21.



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UNITED STATES PATENT OFFICE.

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989,455. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed August 31, 1909. Serial No. 515,444.

To all whom it may concern:

Be it known that I, JOHN W. WADSWORTH, a citizen of the United States, and a resident of Leetsdale, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Airship, of which the following is a full, clear, and exact description.

This invention relates to air ships, and particularly to the heavier-than-air type.

The object of the invention is to produce an air ship which will have a high degree of buoyancy and dirigibility.

In its general construction the air ship comprises a body in which a plurality of rotatable wheels are mounted. In rotating, these wheels draw in air and the air is guided in suitable ducts to different points of the body of the air ship from which it will be discharged. The direction of advance of the air ship is controlled by controlling the flow of the air in the ducts referred to above.

The invention concerns itself also with the details of construction of the air ship, and with the means for controlling the valves.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the air ship, representing the same as though at rest upon a supporting surface; Fig. 2 is a longitudinal vertical section through the air ship, a portion of which is broken away; Fig. 3 is a vertical cross section of the air ship taken on the line 3—3 of Fig. 2; this view passes through one of the wheels referred to, which draw in the air and which advance the air so as to direct the movements of the ship: Fig. 4 is also a vertical section on the line 4—4 of Fig. 2, but this view is taken at the side of one of the wheels referred to above; Fig. 5 is a vertical longitudinal section upon an enlarged scale and taken on the line 5—5 of Fig. 3, certain parts being broken away; Fig. 6 is a vertical section taken through one of the bearings of the shaft and particularly illustrating the details of this bearing and the details of certain eccentrics which control the operation of the buckets carried by the wheels; Fig. 7 is a cross section taken on the line 7—7 of Fig. 6 and further illustrating the details of the main bearings; Fig. 8 is a section taken through a part of one of the wheels and illustrating the details of its construction and the details of the means for attaching the buckets; Fig. 9 is a vertical cross section taken through the upper part of the body of the air ship and showing the general construction of the interior thereof, certain parts of this view being broken away; Fig. 10 is a detail section of the wheels showing the means for securing the body stays to the shell of the body; Fig. 11 is a section upon an enlarged scale taken on the line 11—11 of Fig. 10 and further illustrating the details of connection between the body stays and the shell of the body; Fig. 12 is a vertical section through the pipe system of the air ship taken on the line 12—12 of Fig. 13 and illustrating the valve arrangement; Fig. 13 is a plan of the pipe system representing it as though removed from the body of the air ship, this view also illustrates the valve arrangement; Fig. 14 is a horizontal section taken on the line 14—14 of Fig. 12 and further illustrating the pipe system and the valve arrangement; Fig. 15 is a perspective showing a portion of one of the side plates adjacent to the wheels and illustrating the manner in which the side plates are built of sections; Fig. 16 is a side elevation showing a portion of a roller ring with rollers, and illustrating the details of the main bearings; Fig. 17 is an end elevation showing a modified form the invention may take; Fig. 18 is an end view of the pipe system; Fig. 19 is a cross section through the pipe system taken on the line 19—19 of Fig. 12; Fig. 20 is also a cross section through the pipe system taken on the line 20—20 of Fig. 12; and Fig. 21 is a cross section through the pipe system taken on the line 21—21 of Fig. 12.

Referring more particularly to the parts, and especially to Figs. 1 to 4, inclusive, 1 represents the body of the air ship which is of tubular form, the axis of the body being horizontal. The upper portion of the body is in the form of a cylindrical shell 2, as illustrated in Fig. 3, and from this shell a lower body or hold 3 extends downwardly. In cross section the air ship presents substantially the outline of an egg, having its

point disposed downwardly, the longitudinal axis thereof being vertical. Within the cylindrical shell 2 a pipe frame or pipe system 4 is mounted, the construction of which is most clearly illustrated in Figs. 12, 13, and 14. This pipe system comprises an upper trunk 5 consisting of a duct which extends longitudinally of the shell on the upper side thereof, and a lower duct 6 which extends longitudinally of the shell 2 on the under side thereof. The trunk 5 is preferably formed in sections connected together at the joints 7. The upper trunk 5 is connected with the lower trunk 6 by a plurality of air rings or ring ducts, which are indicated collectively by the numeral 8, extending completely around the inner side of the shell, as shown in Fig. 3. On the upper side of each ring 8, adjacent to the duct 5, an inlet opening 9 is formed, and in these openings 9 valves are mounted, indicated by the letters a', a^2, a^3, a^4. These valves are of the damper type, as shown in Fig. 3, and are adapted to close or open openings 9 which are formed on the upper side of the shell, as indicated in Fig. 3. As illustrated, I have shown four of these rings, two of the rings being disposed near the ends of the air ship, with two of the rings disposed intermediate. The two intermediate rings 8^a are provided with by-pass pipes 11 which connect them with the trunk 5 around the openings 9. Similar by-pass pipes 12 are provided on the inner sides of the end rings 8^b. Opposite the point of connection of the by-pass pipes 12 with the rings 8^b, side pipes 13 are provided which are connected with the rings, and the bodies of these side pipes extend around through substantially a quarter-circle. At their lower ends the curved portions of these side pipes are formed with horizontal extensions or headers 14 which have openings 15 in the outer side wall thereof. These openings 15 register with similar openings 16 formed in the sides of the air ship, as shown in Fig. 1. In the curved portions of the side pipes 13, valves are provided, referred to collectively by the letter b, and indicated specifically by the letters b', b^2, b^3, and b^4. From the lower trunk 6 similar side pipes 17 extend around upwardly, and the upper ends of the curved portions of these pipes connect with horizontal headers 18, and on the outer sides, these headers 18 have openings 19 which register with similar openings 20 formed through the wall of the air ship, as shown in Fig. 1. These side pipes are provided with valves which may be referred to collectively by the letter c, and indicated specifically by the letters c', c^2, c^3, and c^4. At the ends of the trunk 5, upper tails 21 are connected. The bodies of these tails are curved, as shown in Fig. 18, so as to conform to the curvature of the shell of the air ship, and on their outer or side faces 22 they are provided with a plurality of openings 23. Each tail is provided with a neck 24, by means of which the connection is made to the trunk 5, and these necks are also connected with the side pipes 13, as shown in Fig. 13. In the necks 24, valves are provided, indicated by the letters d' and d^2.

Referring to Fig. 14, the trunk 6 is provided at its ends with tails 25 which are similar to the tails 21, except that they are on the under side of the shell 2. They are curved, as shown, so as to conform to the curvature of the shell, and on their outer side faces are provided with a plurality of openings 26, as shown in Fig. 18. Adjacent to these tails 25, the trunk 6 is provided with damper valves d^3 and d^4, which may completely close off the tails from communication with the trunk 6, as indicated in Fig. 14. As indicated in Fig. 14, opposite the rings 8, the trunk is provided with longitudinally disposed partition walls or baffle plates 27, and at the ends of these plates, valves e', e^2, e^3, e^4, e^5, e^6, e^7, and e^8 are provided. These valves are of the damper type, and when swung into their open position, open communication between the interior of the rings and the interior of the trunk 6. When they they are closed, they close off communication, as indicated in cross section in Fig. 14. In the opposite sides of the rings 8, near their point of connection with the trunk, valves f', f^2, f^3, f^4, are provided. As indicated in Fig. 14, the valves e^5, e^6, e^7, and e^8 are disposed on one side of the trunk, while the valves e', e^2, e^3, and e^4 are disposed on the opposite side. The valves f' and f^2 are disposed opposite to the valves e' and e^4, whereas the valves f^3 and f^4 are disposed opposite to the valves e^5 and e^8. While I have shown this particular arrangement of valves, instead of arranging them as shown, I may arrange them alternating individually instead of in pairs, as set forth.

Referring now especially to Figs. 2 and 3, opposite each of the rings 8, a wheel 28 is mounted. These wheels are rigidly secured to tubular shafts 29 which are mounted in frames 30 built up of tubular bars on the interior of the body. These wheels are adapted to rotatively and eccentrically operate in the direction of the arrow indicated in Fig. 3, and they are provided with buckets 31 which are mounted thereupon and which pass under the openings 9. As indicated in Fig. 12, the right-hand ring 8^a is provided with an opening 32 which extends along the inner side thereof from a point near the level of the axis, and extends down to the lower trunk 6. A similar opening 33 is formed in the ring 8^b. On the opposite side of the other ring 8^a, a similar opening 34 is provided, and another opening 35 is provided in the ring 8^b at the other end of

the trunk. In each ring opposite to these openings 32, 33, 34, and 35, small openings 36 are provided on the inner side of the ring, which open communication between the ring and the space surrounded by the ring, as indicated in Fig. 3. In the upper portion of the rings 8, damper valves g', g^2, g^3, g^4, g^5, g^6, g^7, and g^8 are provided, and these valves are disposed near the openings 9, referred to above, and they may close off communication from the interior of the ring with these openings.

Referring again to Fig. 2, each of the shafts 29 is provided with a sprocket wheel 37 over which passes a chain 38, said chain being driven by a gas engine 40, or similar motor. These engines or motors 40 are supported in the lower parts of the frames 30, as indicated most clearly in Fig. 9. The details of this arrangement are very clearly shown in Fig. 5. Each frame 30 is provided with a bearing ring 41, as illustrated in Fig. 6, and these bearing rings are rigid with bearings 42, said bearings being in the form of sleeves, in which rollers 43 are mounted. The ends of these rollers are rotatably mounted in rings 44, as shown. Beyond the rings 44, each bearing 42 is formed with flanges 45 and 46. These flanges present conical faces on their outer sides and receive conical rollers 47, the outer sides of which bear against a ring 48 at one end of the bearing, and against a wearing ring 49 at the other end of the bearing, said wearing ring being attached to the aforesaid wheels 28. These wheels have hubs 50 in the form of sleeves which are rigidly attached to the tubular shafts 29 by means of studs 51, as indicated.

As shown most clearly in Fig. 16, the conical rollers 47 are mounted in pockets 52 which are formed in the roller ring 53, as indicated. The flanges 46 are not made integral with the sleeves or bearings 42, but are formed of rings 54, as shown in Fig. 6, and to these rings and to the sleeves adjacent thereto, large eccentrics 55 are attached, said eccentrics presenting running faces 56 which constitute raceways for rollers 57, said rollers being arranged between the face of the eccentric and the strap 58 thereof. It should be understood that the eccentrics 55 are rigid with the frame, while the straps 58 turn freely thereupon, the rollers being employed so as to reduce the friction. These rollers 57 are mounted between rings 59 which turn with them, as will be readily understood.

As shown most clearly in Figs. 4 and 5, the wheels 28 are provided in their edges with curved slots 60, and these slots receive the curved wings or plates 61 of the aforesaid buckets 31. These buckets have side plates 62 to which eccentric rods 63 are pivotally attached, the inner ends of the said eccentric rods being pivotally attached to the eccentric straps 58, as indicated in detail in Fig. 6. One of these eccentric rods 63^a, on each side of the wheel is made rigid by braces 63^b as shown in Fig. 4. The buckets 31 are pivoted by pins 64 on the wheels, and the slots 60 are struck on a radius from these pins 64 as a center. As indicated most clearly in Fig. 4, the eccentrics 55 are arranged so that they project upwardly from the shaft, and as the wheels rotate, the eccentric rods 63 will extend the buckets from the wheel, as indicated. In this way the outer edges of the buckets are maintained near the inner faces of the rings 8^a, so that as the wheels rotate the buckets may take in air through the openings 9, and carry the air down into the openings 32, 33, 34, or 35. At the sides of the wheels, bulkheads 65 are provided which extend completely across the interior of the shell 2. On the outer sides of these bulkheads which are disposed toward the wheels, I provide radially disposed battens 66 which connect the segments of the bulkhead, as indicated in Figs. 4 and 15.

Referring again to Fig. 6, it will be noted that each wheel is built up of side plates 67 and braces 68 which connect the face plate or rim 69 of the wheel with the hub 50 thereof. As indicated in Fig. 3, the bodies of the buckets present the outline of curved scoops which project in the direction of rotation, and these scoops are adapted to scrape along on the inner side of the air ship, as will be readily understood.

As indicated most clearly in Fig. 9, the bearings 42 are connected by a plurality of braces 70 with the shell 2. At the point where these braces are attached to the shell, reinforcing rings 71 are provided in the shell, and the ends of the braces or stays 70 are provided with threads 72 which are received in nuts 73 seating in the counterbored openings 74 formed in the shell. In this way the shafts of the wheels are held centrally in the body of the air ship.

Referring to Fig. 3, on the inner side of the shell 2, I provide longitudinally extending keelsons 75, and from these keelsons, links 76 hang downwardly and support platforms 77, as indicated in Fig. 2. The links of these platforms are connected by connecting rods or links 78 with levers 79 pivotally attached at 80 at the bottom of the hold 3. The upper ends of the levers 79 are connected by means of connecting rods 81 with wheels 82, respectively, and these wheels have endless cords 83 passing thereabout; said cords pass upwardly and around wheels 84 on the stems of the valves a', a^2, a^3, and a^4. As further indicated in Fig. 2, the valves g', g^2, etc., and b', b^2, etc., are provided with pendent cords 85, by means of which the valves may be opened or closed

when desired. Similar cords 86 are provided for the valves d', d^2, d^3, and d^4. At the sides of the links 79, a series of bars 87 are provided, and these connecting bars are provided with pins 88, as shown. Owing to the unusual length of the bars 87, as will be seen in Fig. 2, it is preferably found to be of great advantage to connect several pieces of material to form one bar, thus constituting a series of connected bars. These pins 88 are adapted to be engaged by hooks 89 formed upon locking levers 90, which levers are provided with handles 91 for connecting and disconnecting them, as will be readily understood. It should be understood that the upper ends of the links 76 are pivotally attached to the keelsons 75 so that a person on the platform can swing the platform toward the front or rear of the air ship when desired. In doing so the lever 79 will be operated through the links 78 so as to partially rotate the wheel 82 and set the valve connected therewith in any position desired.

In order to support the air ship in an upright position before flight commences, I provide the sides of the hold 3 with openings 92, and through these openings 92, legs 93 project, said legs being rigidly attached to short shafts 94 disposed in a horizontal position at the sides of the hold, as indicated in Fig. 3. The hubs of the legs 93 are provided with oppositely projecting arms 95, and these arms are connected by crossed cords 96, so that when one of the legs is moved inwardly, the other will move likewise, and vice versa. When the air ship rises, these legs 93 fold against the sides of the hold, as will be readily understood. These legs 93 are in the form of open frames, as indicated in Fig. 1, said frames being rendered more rigid by diagonal braces 93^a.

In the sides of the hold 3, a plurality of windows 97 are provided, for admitting light and air, as indicated in Fig. 1.

In Fig. 17, I illustrate a modified form of the invention, in which the body 98 is preferably rounded on its upper and lower sides, and in which the wheels 99 are arranged in groups, there being three wheels in each group, as indicated. The ends of this body are closed by heads 100, and each head is provided with a door 101 adapted to swing open on hinges 102. As in the preferred form, this body 98 is provided with legs 103 which are adapted to support it, as indicated. These legs 103 are connected by a crossed cord 104, as in the form shown in Fig. 3, so as to enable the legs to be folded against the under side of the body when the air ship rises, all of which is indicated by the dotted lines in Fig. 17.

In the preferred form, in order to give the hold rigidity, I provide downwardly extending frames 105, and the lower parts of these frames connect with frame rings 106, the upper edges of which rest against the under side of the shell 2, as shown. The upper ends of the frames 105 are connected with bow frames 107 which extend down on the under body of the shell 2. At the point of connection between the frames 105 and 107, gusset plates 108 are provided.

In making ready to rise, the valves a', a^2, a^3, a^4, e', e^2, e^3, e^4, e^5, e^6, e^7, and e^8, should be open, also the avlves f', f^2, f^3, f^4,. The air then enters through the openings 9 and is caught by the buckets and carried down into the air rings 8, passing into the rings through the openings 32, 33, 34, and 35. The air then circulates through the rings and passes out of the rings into the space above the wheels through the openings 36. When a high enough speed of rotation has been attained, the valves d^3 and d^4 are opened, and the valves f', f^2, f^3, and f^4 are gradually partly closed. Opening the valves d^3 and d^4 permits the air to escape at the ends of the trunk 6. The closing of the valves f', f^2, f^3 and f^4, stops the circulation through the air rings 8, and the air then passes through the valves e', e^2, etc., into the trunk 6, whence it passes toward the ends of the trunk where it finds exit. In order to advance, one of the valves a', a^2, a^3, a^4, should be closed, as, for instance, the valve a^3. If the valve a^3 should be closed, then the valves g^5, g^6, and d' should be open and the valves d^3 and f^3 should be closed tight. The air then enters through the openings 23 at one end of the air ship, passes the valve d', enters the trunk 5, passes through the valves g^5 and g^6, through the wheel at this point, then through the valves e^5 and e^6 into the trunk 6 where it mixes with the air from the other wheel, and then passes out through the valve d' and through the openings 25 at the right end of the air ship. This will advance the air ship so that its left end as viewed in Fig. 12 is forward. The direction of the air ship can be controlled by regulating the valves b', b^2, etc., and c', c^2, etc. For instance, if it is desired to guide the air ship toward the right, the valves b^2 and c^3 can be opened so that air will flow in at the forward openings 15 on the right side, will pass rearwardly within the trunks 5 and 6, and will pass out through the openings 19 at the rear of the air ship and on the right side. This will tend to move the stern of the air ship toward the left.

In the operation of the wheels, certain ones of the wheels may be used to advance the air ship, while the others may be used to give the air ship buoyancy, that is, the action of some of the wheels may support the air ship in the air. Whenever any of the valves f', f^2, f^3 and f^4 are closed they evidently prevent circulation in the air rings and the air which is brought in to the air ship by the wheels can then be made to pass directly into

the trunks 6, and can be forced in either direction, depending on the position of the valves e', e^2, etc. If the valves e', e^3, e^5 and e^7 are open, the air will, of course, tend to move toward the left end of the air ship, and the reaction developed when it finds exit at this end of the ship, will tend to advance the air ship toward the right.

The lower side of the shell 2 is provided with an opening 2^a which opens communication between the hold and the interior of the shell, and which enables the crew of the air ship, or passengers, to pass up into the interior of the shell so as to reach the machinery.

When the wind wheels 28 are employed to advance the ship the connecting links 78 should be disconnected from the links 76, and it should be remembered that when a wind wheel 28 is operated to advance the ship, the valve a is closed, although the swinging platform 77 is connected to the connecting bar 78, by the locking lever 90. This operation is performed to retain as much weight as possible to act as a pendulum for operating the valves, collectively indicated by a.

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

1. An air ship having a body with a plurality of openings in the upper side thereof, a trunk extending longitudinally of said body, a plurality of air rings in communication with said trunk, a plurality of wheels rotatably mounted at said air rings and adapted to draw air in through said openings and deliver the same to said air rings, and valves in said trunk corresponding to said air rings and adapted to direct the air toward either end thereof.

2. An air ship having a body with a plurality of openings therein, a pipe system having an upper trunk and a lower trunk, said trunks extending longitudinally of said body, air rings connected with said trunks, wheels rotatably mounted in said body at said air rings and adapted to draw atmospheric air into said rings, valves in said rings, and valves in said trunks controlling the flow of air, said trunks having tails at the ends thereof with openings therethrough, through which the air may escape.

3. An air ship having a pipe system comprising an upper trunk and a lower trunk, air rings connected with said trunks, valves controlling the flow of air within said rings, wheels rotatably mounted in said rings and adapted to draw air into the same, valves controlling the flow of air between said rings and said lower trunk, tails connected with said trunks at the ends thereof having openings adapted to deliver the air at the ends of the air ship, valves controlling the flow to said tails, headers at the sides of said air ship having openngs through which the air may flow from said trunks, and valves controlling the flow to said headers.

4. An air-ship having a body with a series of air-rings having openings therein, wheels operatively mounted in said air rings and adapted to create a partial vacuum and compressing air to control the ship, buckets on said wheels, means for controlling said buckets, valves mounted in the said openings, and adapted to control the inward flow of air, valves controlling the flow of air from the said openings into the said rings, and means in the body for directing the air from the said rings to the ends and sides of the said body.

5. An air-ship having a body with air rings formed therein, valves for controlling the flow of air in the said rings, a pipe system having an upper trunk and a lower trunk and connected with said air rings, headers at the sides of said air-ship, having openings through which the air may flow from the trunks, valves in the trunks for controlling the air flowing therethrough, and means connected with the said valves for controlling the same.

6. An air ship having openings in the side wall thereof, legs passing through said openings and rotatably mounted within said body adjacent to said openings, and mechanism connecting said legs for moving the same in unison, said legs being adapted to fold against the sides of said body and being adapted when extended to rest upon the ground and support said body in air erect position.

7. In an air ship, in combination, a substantially tubular body having openings in the upper side thereof, air rings within said body at said openings, a plurality of wheels mounted eccentrically in said air rings, buckets carried by said wheels, eccentrics controlling the position of said buckets and adapting them to draw the air in through said openings, ducts in the wall of said body affording means for directing the air toward the ends and sides thereof, and valves for controlling the flow of the air in said ducts.

8. In an air ship, a substantially tubular shell, a plurality of wheels rotatably mounted in said shell and adapted to draw the air into the same, ducts at the wall of said shell for directing the air to the ends and sides thereof, valves controlling the flow of air in said ducts, a swinging platform supported under said shell, and means for controlling said valves by the swinging movement of said platform.

9. In an air ship, in combination, a body presenting a substantially tubular shell, wheels rotatably mounted in said shell and adapted to draw air into the interior thereof, ducts on the interior of said shell adapted to direct the air toward the ends and the sides of said body, valves controlling the admis-

sion of air to said wheels, swinging frames suspended under said shell, pulleys connected with said swinging frames and adapted to be rotated thereby when said frames swing, and means connecting said pulleys with said valves for controlling the same.

10. An air ship having a plurality of air rings having openings in the upper sides thereof, a plurality of wheels rotatably mounted respectively in said air rings and adapted to draw the air in through said openings, means for directing the air to the sides and ends of said air ship, valves in said air rings adjacent to said openings for closing said air rings against circulation, a trunk extending longitudinally of said air ship, and by-pass pipes connecting said rings with said trunk around said valves.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN WASHINGTON WADSWORTH.

Witnesses:
JOSEPH HARPER,
JOHN MINICH.