T. F. DUNN.

DIRIGIBLE AIRSHIP.

APPLICATION FILED APR. 21, 1909.

1,006,734.

Patented Oct. 24, 1911.

4 SHEETS—SHEET 1.

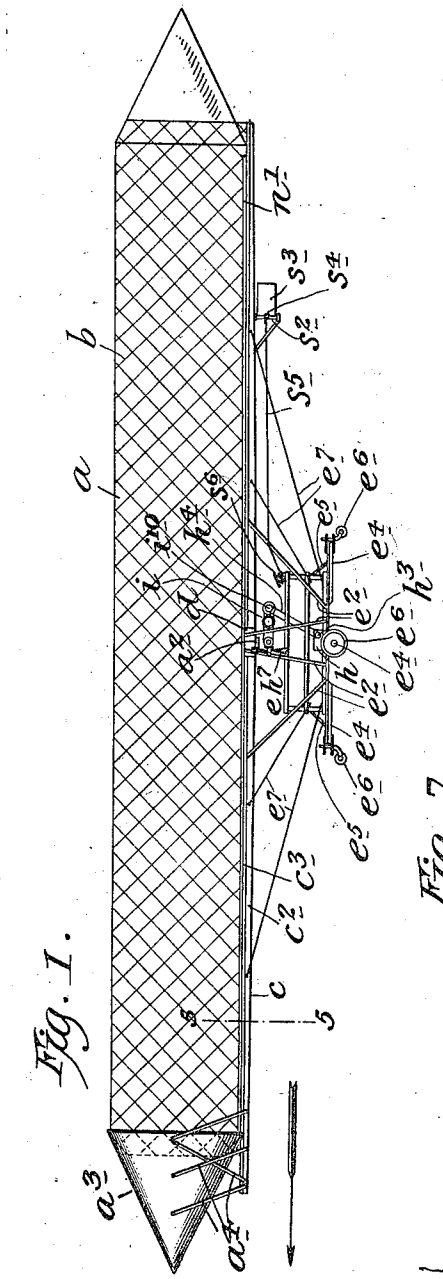

Fig. 1.

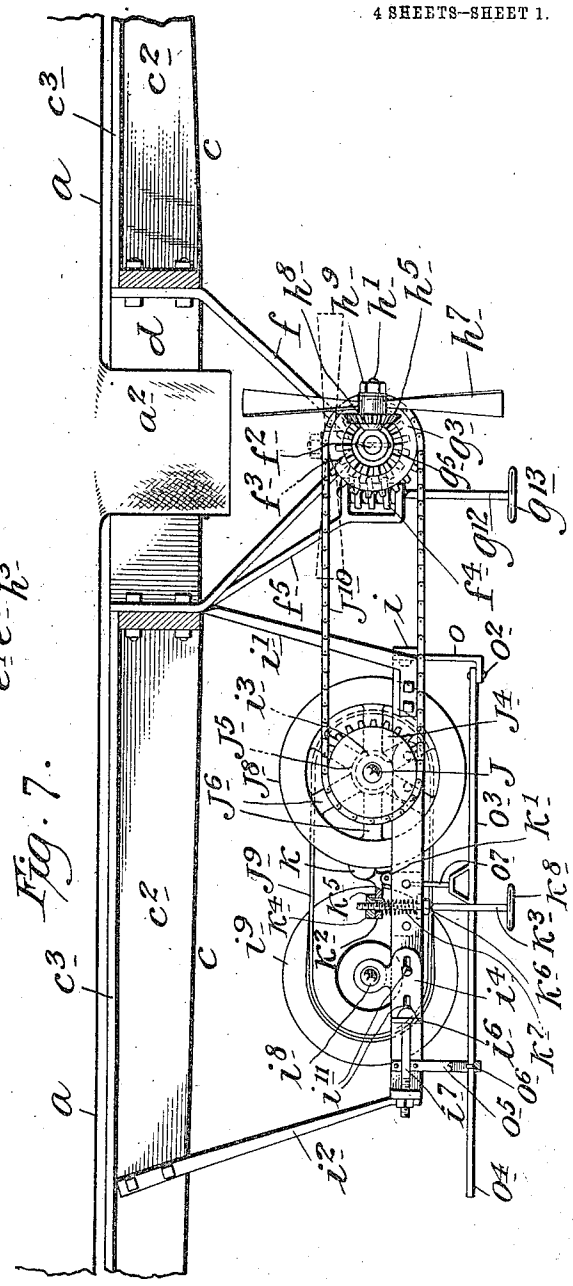

Fig. 7.

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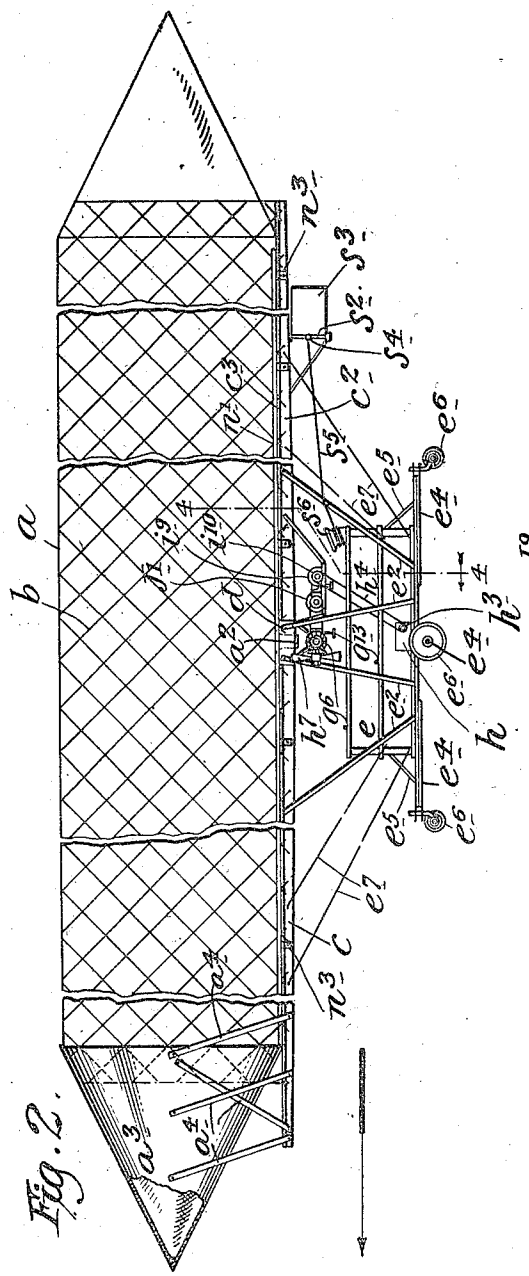

Fig. 2.

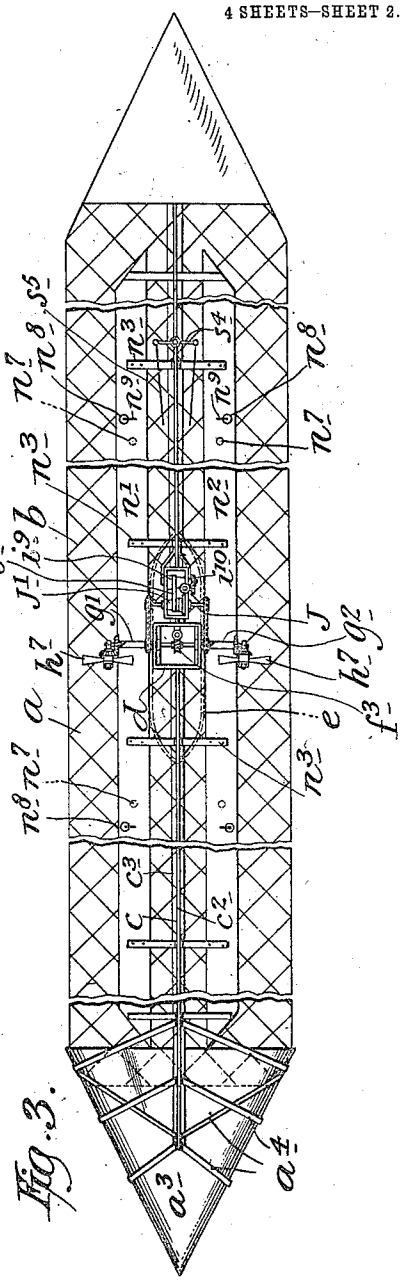

Fig. 3.

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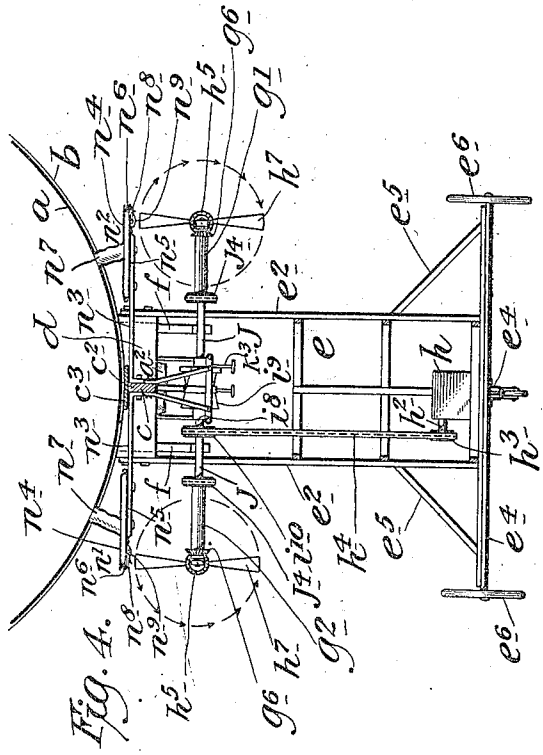

Fig. 4.

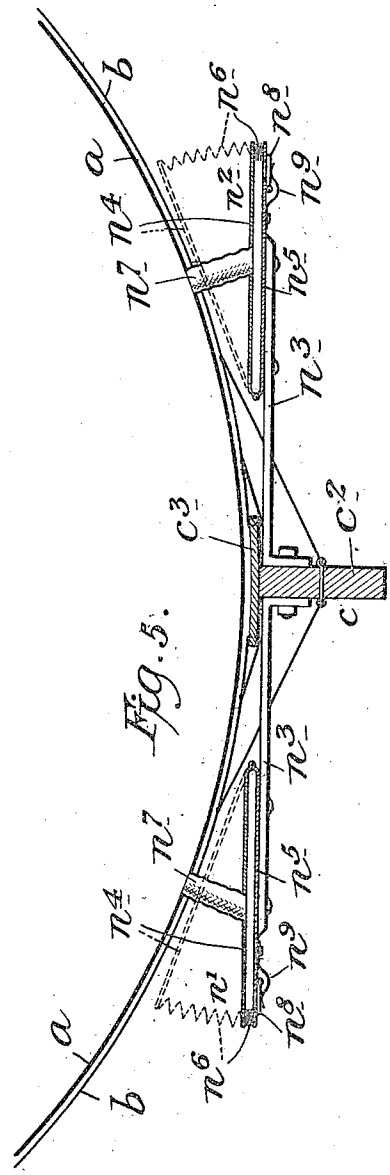

Fig. 5.

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4 SHEETS—SHEET 4.

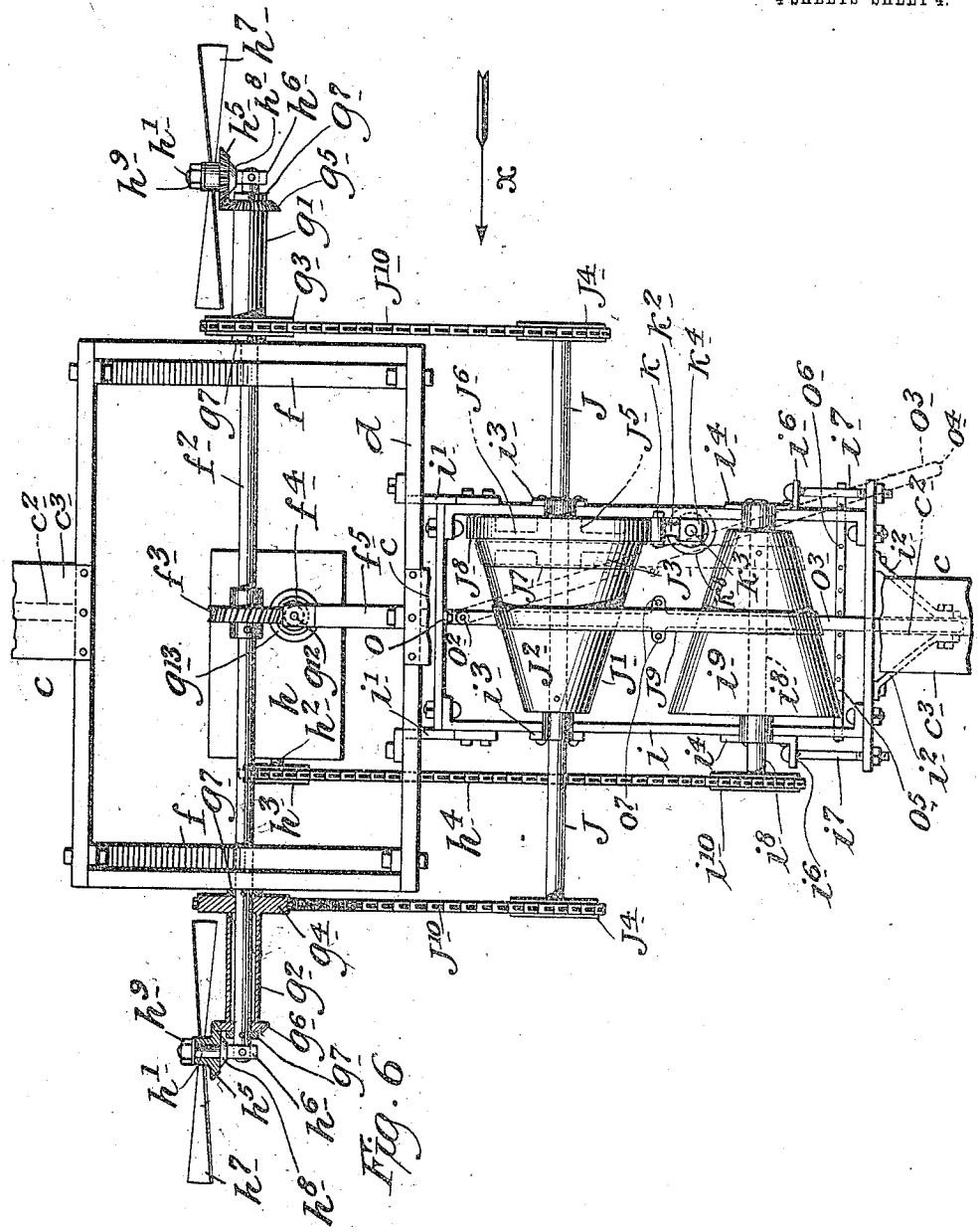

Fig. 6

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UNITED STATES PATENT OFFICE.

THOMAS F. DUNN, OF NEW YORK, N. Y.

DIRIGIBLE AIRSHIP.

1,006,734. Specification of Letters Patent. **Patented Oct. 24, 1911.**

Application filed April 21, 1909. Serial No. 491,266.

To all whom it may concern:

Be it known that I, THOMAS F. DUNN, a citizen of the United States, and residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Dirigible Airships, of which the following is a specification, such as will enable those skilled in the art to which it appertains to make and use the same.

This invention relates to dirigible airships, and the object thereof is to provide an improved machine of this class which involves an oblong tapered balloon or gas container of the usual form and which constitutes the chief carrying power, and which also involves a novel wind shield, gas magazines, cones giving variable speed and comechanism, and by which the propelling mechanism is stopped while the engine is running; and with these and other objects in view the invention consists in a dirigible air-ship constructed as hereinafter described and claimed.

The invention is fully disclosed in the following specification, of which the accompanying drawings form a part, in which the separate parts of my improvement are designated by suitable reference characters in each of the views, and in which:—

Figure 1 is a side view of my improved air-ship, Fig. 2 a side view of my improved air-ship on an enlarged scale, Fig. 3 a bottom plan view of the same, parts of the construction being omitted, Fig. 4 an enlarged view in cross section on the line 4—4 of Fig. 2, Fig. 5 an enlarged view in cross section on the line 5—5 of Fig. 1 showing keel and gas magazines and manner of supporting gas magazines from keel, also manner of attaching cords of net to keel, Fig. 6 an enlarged plan view of the driving mechanism, parts of the construction being omitted, and;—Fig. 7 a side view of Fig. 6 looking in the direction of the arrow *x*.

In the practice of my invention, I provide a balloon or gas container *a* which, in the form of construction shown, is tapered at both ends and from which is suspended a cage or car and the propelling and operating parts of the machine.

The balloon or gas container *a* is provided with a net work of cords *b* in the usual manner, and placed longitudinally of and beneath the balloon or gas container *a* is a T or keel bar *c* composed of a bottom or web member c^2 and a top member c^3, both members being tapered from the middle portion thereof toward both ends and, in practice, the cords *b* are arranged diagonally in opposite directions around the balloon or gas body *a* as clearly shown in Figs. 1 and 2, and are connected with the top member c^3 of the T-bar *c* and with the web portion of said bar as clearly shown in Fig. 5, and as indicated in Fig. 2, the alternate cords in each direction being alternately connected with the web member c^2 of said bar and with the top member c^3 thereof. It will be noticed, Fig. 5, that this manner of attaching the cords at nearly right angles on each side of the keel bar in connection with the cables e^7 and braces e^2 on the bottom, hereinafter described, serves to brace and reinforce the keel and keep it from buckling.

The T-bar *c* extends approximately the full length of the balloon or gas container *a*, and in the form of construction shown, said bar is composed of two equal parts rigidly connected with a central transversely arranged box *d* the opposite side walls of which, or the front and back walls of which are concave so as to correspond with the shape of the bottom of the balloon or gas container in cross section when said balloon or gas container is inflated, and the top portion c^3 of the T-bar *c* is also concave in cross section.

The box *d* is open at the top and bottom, and the balloon or gas container *a* is provided centrally of the bottom thereof with a neck a^2, Figs. 1, 2 and 7 which extends downwardly into said box and through which the said balloon or gas container may be filled with the required gas, and the said neck may be closed when desired by an ordinary draw cord or in any preferred manner.

Extending along the bottom of the gas container for substantially its whole length, Figs. 2 and 4, one on each side, are the gas magazines n^1 and n^2 supported by arms n^3 which are attached to and project from the keel bar *c*. The top n^4 and bottom n^5 of the gas magazines are made of rigid or semi-rigid material and the sides n^6 of balloon cloth or other gas proof flexible material which is made to fold up like a bellows when the magazines are empty. The bottoms of these magazines are fastened to the arms n^3, and the tops thereof are hinged to them at the back, and the fronts thereof formed in the manner of a pair of bellows. Con-

nected with and extending from the bottom of the gas container or balloon to the top of the gas magazines are two or more flexible pipes or tubes n^7 through which the gas may flow freely from one into the other.

On the bottom of each magazine are two or more hinged valves n^8 that open outward, and these valves are kept closed by the springs n^9 which are tensioned so that the pressure of the gas when it reaches a certain point will overcome the power of the springs and open the valves to let out the gas if necessary.

Under ordinary conditions, when a balloon enters warmer air the gas expands so that more or less of it has to be allowed to escape to prevent the balloon from bursting, and when it enters colder air the gas contracts and ballast has to be thrown out to prevent descending. This has to be repeated until the gas or ballast is exhausted and the balloon has to land. With my improvement, when the gas expands the pressure of the gas forces it through the pipes n^7 into the magazines, and when the gas contracts and the pressure is reduced the weight of the covers of the magazines forces the gas back into the gas container or balloon. By this means the necessity of letting gas escape or throwing over ballast is obviated and the air-ship can remain longer in the air, make longer voyages and can carry more freight or passengers instead of the needless ballast.

On the front end of the gas container I put a wind shield a^3 of rigid or semirigid material in the form of a hollow cone, fitting over and around the front end of the gas container and extending outwardly beyond its sides and which is rigidly attached to the T or keel bar c by braces a^4. By this means the main pressure of the air induced by the forward movement of the air ship is borne by the wind shield and T-bar c and being made of rigid material it can be made more elongated and thus reduce the air pressure. I also provide a cage or car e which is rigidly connected with the box d and the T-bar c, and suspended therefrom by means of stays or braces e^2 at each side of said cage or car and at each side of the box d and T or keel bar c. Projecting from the bottom of the car e on each end and from each side at the center thereof are poles or axles e^4, on which are mounted wheels e^6 similar to ordinary bicycle wheels, and which will form a support for the machine when resting on the ground, and permit of its being freely moved forwardly or backwardly or into any desired position. The axles are strengthened by the braces e^5.

Connected with the front and back ends of the cage or car e are cables e^7 which are also connected with the extended end portions of the T-bar c as clearly shown in Fig. 1, and said cables form a martingale and in connection with the stays or braces e^2 serve to rigidly support the cage or car e and also brace and reinforce the T-bar c. I also provide a suitable gasolene or other motor h which, in the form of construction shown, is placed centrally in the cage or car e, and the shaft h^2 of this motor is provided with a sprocket wheel h^3 on which is mounted a drive chain h^4 which also passes around a larger sprocket wheel i^{10} mounted on a main drive and cone shaft i^8.

The frame i, Figs. 6 and 7, is rigidly suspended from the box d and T-bar c by the braces i^1 and i^2, and stand bearings i^3, i^4 are attached to its sides. The stand bearings i^4 have slotted bolt holes through which are passed pins or bolts connected with the frame i as shown at i^{11}, and the bearings i^4 are also provided with projecting lugs i^6, and by means of bolts i^7 which connect said lugs and the back of the frame, the stand bearings i^4 may be drawn backward of the frame so as to keep the cone belt J^9 hereinafter described tight.

The back cone shaft i^8 is mounted in the stand bearing i^4, and the cone i^9 and the sprocket wheel i^{10} are rigidly fastened to it. The front cone shaft J is mounted in the stands i^3, and the part J^2 of the cone J^1 is rigidly fastened to it and sprocket wheels J^4 are rigidly attached one to each end thereof. The part J^3 of the cone J^1 is arranged to answer the purposes of a loose pulley and brake wheel, and it is composed of the hub J^5, the spokes J^6, the part J^7 that is used for a loose pulley and the part J^8 that is used for a brake wheel, and when not in use it runs loose on the shaft. The front cone shaft J is driven from the back cone shaft i^8 by the belt J^9 running on the cones i^9 and J^1, and when the belt is on the part J^2 of the cone J^1 which is rigidly attached to its shaft, it drives the machinery to propel the air ship, and when the belt is shipped on to the part J^3 or loose pulley the propelling machinery is stopped and only the loose pulley and back cone shaft i^8 and the engine are running.

A brake K is pivoted in brake stand K^1 rigidly attached to the frame i so that it can swing back and forth and has a backwardly extending arm K^2 which is slotted at its outer end, and a screw shaft K^3 is passed through it. The shaft K^3 is threaded at its upper end to engage a nut K^4, and a pin K^5 projects upward into the nut from the arm K^2 and prevents the nut from turning. A collar or shoulder K^6 is rigidly attached to the shaft K^3 and bearing against the brake stand K^1 keeps the shaft from rising. When the shaft K^3 is turned into the nut K^4 it draws it down bringing the arm K^2 of the brake with it thereby lifting the brake from the brake wheel, and when the shaft K^3 is turned in the opposite direc-

tion it allows the nut and arm to be pressed upward by the spring K^7 and the brake to be applied to the brake wheel; and the shaft K^3 is operated by means of a wheel K^8.

It will be noticed that by means of the cones and cone belt J^9 a great variation of speed may be obtained and by shipping the belt onto the part J^3 of the front cone as shown in Fig. 6 the propelling machinery may be stopped without stopping the engine.

Suspended from the box *d* are hangers *f* in which is mounted a main transverse shaft f^2 the ends of which project well beyond the box *d*, and mounted on the end portions of said shaft are sleeves g^1, g^2 which are adapted to rotate on said shaft and which are kept in place on said shaft by collars g^7.

The sleeves g^1, g^2 are provided with beveled gear wheels g^5 and g^6 on their outer ends and with sprocket wheels g^3 and g^4 on their inner ends, and to lessen friction the sleeves g^1, g^2 bear on the shaft f^2 at their ends only. The sprocket wheels J^4 on the ends of the cone shaft J drive the sprocket wheels g^3 and g^4 by means of the drive chains J^{10}.

To the outer ends of the shaft f^2 are rigidly attached at right angles thereto supplementary shafts h^1 which by turning the shaft f^2 are made to revolve around its axis, and beveled gears h^5 are mounted on and revolve on the supplementary shafts h^1, and propellers h^7 that propel the air ship are rigidly attached to the hubs of these gears. A worm gear f^3 is fastened on the middle of the shaft f^2 and is operated by a worm f^4 which is supported by a brace f^5 attached to the box *d*. The worm f^4 is provided with a downwardly projecting shaft g^{12} on the lower end of which is attached a wheel g^{13} by means of which it may be turned, and by means of the worm gear f^3 and worm f^4 in connection with the shaft g^{12}, the shaft f^2 can be turned in either direction and is at all times held securely locked in the position it is turned to. The supplementary shafts h^1 have sleeves h^6 which fit over the ends of the shaft f^2 and by means of which they are fastened to it, and said supplementary shafts are also provided with projecting shoulders h^8 extending around their circumference and which act as bearings for the hubs of the gears h^5, and the ends of said shafts are threaded to engage nuts h^9 which keep the gears and propellers on said shafts.

The front end of the frame *i* is provided with a hanger *o* to which is pivoted at o^2 a shipping lever o^3 which ranges backwardly and the free end o^4 of which is supported in a transverse stirrup o^5 the bottom of which is provided with pins o^6 between which the lever o^3 is adapted to rest.

The lever o^3 is provided centrally thereof with upwardly directed fingers o^7 which straddle the belt J^9, and by means of this construction, by manipulating the lever o^8 the said belt may be shifted from the position shown in full lines in Fig. 6 to the position shown in dotted lines in said figure and back again whenever desired, or said belt may be shifted on the driving cone i^9 and the part J^2 of the cone J into any desired position so as to increase or decrease the speed of the shaft J^2 and the propellers h^7 as will be readily understood.

Toward the rear end of the ship is pivoted a rudder or steering shaft s^2 provided with a rudder or steering device s^3, and the shaft s^2 is provided with laterally directed arms s^4 with which is connected a cord or cords s^5 which are carried forwardly and passed around a grooved hand wheel s^6 mounted on or connected with the cage or car *e*, and by manipulating the cord or cords s^5 the rudder or steering device may be manipulated as will be readily understood to control the movement of the machine horizontally or forwardly or backwardly.

With my improved air ship construction, as herein shown and described, it will be seen that the center of gravity of the apparatus taken as a whole will be approximately under the transverse shaft f^2, and said shaft is arranged transversely of the middle of the balloon or gas container, and the keel or T-bar *c*, and this serves to perfectly balance the machine at all times.

From the foregoing description, it will be seen, that the T-bar *c* forms a keel for the balloon or gas container *a* and tends to hold the same in proper form and to make said balloon or gas container steady in the operation of the machine, and the said T-bar and cage or car *e* being rigidly connected in the manner described and braced and stayed by the martingales e^7 and the braces and stays e^2 are made rigid and firm and the operation of the machine and especially the propelling mechanism as hereinafter described made possible, and the parts thereof held in proper condition without danger of displacement or breakage in actual use.

The operation will be readily understood from the foregoing description, when taken in connection with the accompanying drawings and the following statement thereof: With the propellers h^7 in the position shown in Figs. 6 and 7, the machine will be propelled forwardly or backed as will be readily understood, but by turning the gear f^4 by means of the shaft g^{12} connected therewith the supplementary shafts h^1 which carry the propellers h^7 may be turned so that the propellers h^7 will be in and revolve in a horizontal plane as shown in dotted lines in Fig. 6, and with the propellers in this position the machine may be raised or lowered as will be readily understood.

In the drawings forming part of this

specification, the shafts h^1 are secured to the shaft f^2 in the same position and project in the same direction, and with this construction the propellers h^7 revolve in opposite directions, and this aids in balancing the machine and in the operation thereof.

It may sometimes be necessary or desirable for testing or other purposes to stop the machinery or the propelling mechanism without stopping the motor, and in order to do this, the cone belt J^9 is shifted into the position shown in dotted lines in Fig. 6, or onto the part J^3 of the cone J^1, which part operates as a loose pulley and brake wheel, and when said belt is in this position the brake K may be applied to the brake wheel so as to give the motor the same load that it would have if the propelling mechanism were in operation, and this will prevent the engine from running free or racing, and the propelling mechanism may be again thrown into operation by shifting belt J^9 back into the position shown in full lines in Fig. 6 and releasing the brake K.

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

1. A dirigible airship provided with a propeller mechanism involving two parallel shafts provided with reversed cone pulleys the base portion of one of said pulleys being formed separately therefrom and being rotatable on the corresponding shaft and adapted to serve as a loose pulley and brake wheel, and a brake device operating in connection therewith.

2. A dirigible airship provided with a propeller mechanism involving two parallel shafts provided with reversed cone pulleys the base portion of one of said pulleys being formed separately therefrom and being rotatable on the corresponding shaft and adapted to serve as a loose pulley and brake wheel, a brake device operating in connection therewith, a driving belt mounted on said cone pulleys, and means whereby said belt may be shifted onto the different parts of said cone pulleys.

3. In a dirigible airship, a transverse shaft, rotatable sleeves mounted on the opposite end portions thereof and provided at their inner ends with sprocket wheels and at their outer ends with beveled gears, supplemental shafts rigidly connected with the ends of said transverse shaft and at right angles thereto, propellers mounted on said supplemental shafts and geared in connection with said beveled gears, two cone shafts mounted in parallel position, cone pulleys secured to said shafts and in reversed positions the base portion of one of said cone pulleys being formed independently thereof and being rotatable on the corresponding shaft and adapted to serve as a loose pulley and brake wheel, a brake device operating in connection with said brake wheel, a driving belt mounted on said cone pulleys, means for shifting said belt into different positions on said pulleys, the shaft of the divided cone pulley being connected by sprocket chains with said sleeves, and the shaft of the other cone pulley being connected by a sprocket chain with a motor, and means for rotating the transverse shaft.

4. A dirigible airship provided with a transversely arranged shaft, the end portions of which project from the opposite sides of the frame work of the ship, rotatable sleeves mounted on the opposite end portions of said shaft outside of the frame work of the ship, said sleeves being provided with beveled gears on their outer ends, short supplemental shafts rigidly secured to the outer ends of the transverse shaft and at right angles thereto, supplemental beveled gears mounted on said supplemental shafts and meshing with the beveled gears on the outer ends of said rotatable sleeves, said supplemental beveled gears being also provided with hubs, a power transmission and brake mechanism provided with a shaft parallel with the transversely arranged shaft and geared in connection with said rotatable sleeves, hand-operated devices for turning said transversely arranged shaft independent of said rotatable sleeves, and a motor geared in connection with the power transmission and brake mechanism.

5. A dirigible airship provided with a transversely arranged shaft, the end portions of which project from the opposite sides of the frame work of the ship, rotatable devices mounted on the opposite end portions of said shaft outside of the frame work of the ship, said rotatable devices being provided with beveled gears at their outer ends, short supplemental shafts rigidly secured to the outer ends of the transversely arranged shaft and at right angles thereto, supplemental beveled gears mounted on said supplemental shafts and meshing with the beveled gears on the outer end of said rotatable devices, said supplemental beveled gears being provided with hubs, propellers mounted on said hubs, a power and brake mechanism provided with a cone shaft which is parallel with the transversely arranged shaft and geared in connection with said rotatable devices, said cone shaft being provided with a cone which forms a part of said power and brake mechanism, and means for turning the transversely arranged shaft independently of said rotatable devices.

6. In a dirigible airship, a transverse shaft, rotatable sleeves mounted on the opposite end portions thereof and provided at their inner ends with sprocket wheels and at their outer ends with beveled gears, supplemental shafts rigidly connected with the

ends of said transverse shaft and at right angles thereto, propellers mounted on said supplemental shafts and geared in connection with said beveled gears, two cone shafts mounted in parallel position, cone pulleys secured to said shafts and in reversed positions the base portion of one of said cone pulleys being formed independently thereof and being rotatable on the corresponding shaft and adapted to serve as a loose pulley, a driving belt mounted on said cone pulleys, means for shifting said belt into different positions on said pulleys, the shaft of the divided cone pulley being connected by sprocket chains with said sleeves, and the shaft of the other cone pulley being connected by a sprocket chain with a motor, and means for rotating the transverse shaft.

7. A dirigible airship provided with a transversely arranged shaft, the end portions of which project from the opposite sides of the framework of the ship, rotatable sleeves mounted on the opposite end portions of said shaft outside of the framework of the ship, said sleeves being provided with beveled gears on their outer ends, short supplemental shafts rigidly secured to the outer ends of the transverse shaft and at right angles thereto, supplemental beveled gears mounted on said supplemental shafts and meshing with the beveled gears on the outer ends of said rotatable sleeves, said supplemental beveled gears being also provided with hubs, a power transmission mechanism provided with a shaft parallel with the transversely arranged shaft and geared in connection with said rotatable sleeves, hand-operated devices for turning said transversely arranged shaft independent of said rotatable sleeves, and a motor geared in connection with the power transmission mechanism.

In testimony that I claim the foregoing as my invention I have signed my name in presence of the subscribing witnesses this 20th day of April 1909.

THOMAS F. DUNN.

Witnesses:
C. E. MULREANY,
H. R. CANFIELD.