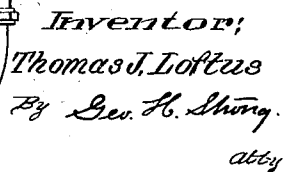


1,057,002.

2 SHEETS—SHEET 1.



T. J. LOFTUS.
ELASTIC FLUID TURBINE.
APPLICATION FILED DEC. 13, 1910.

1,057,002.

Patented Mar. 25, 1913.

2 SHEETS—SHEET 2.

Fig. 7.

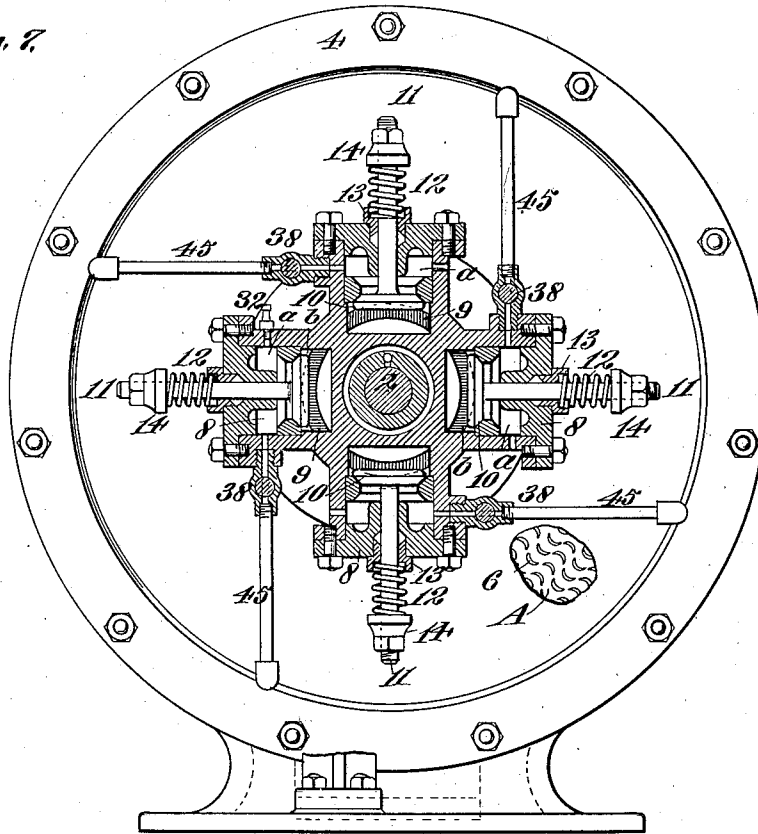


Fig. 8.

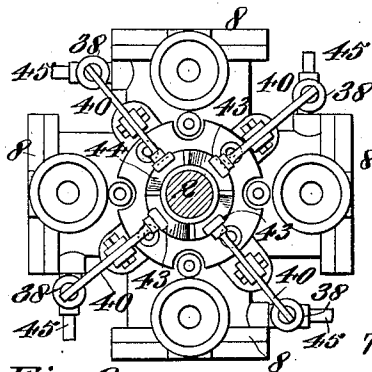
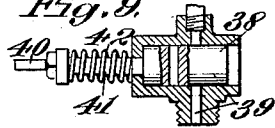


Fig. 9.



Witnesses.
Charles Rickles
R. S. Barry

Inventor:
Thomas J. Loftus

By Geo. H. Sheng.
atty

UNITED STATES PATENT OFFICE.

THOMAS J. LOFTUS, OF CASTELLA, CALIFORNIA, ASSIGNOR OF ONE-HALF TO HARMON BELL, OF OAKLAND, CALIFORNIA.

ELASTIC-FLUID TURBINE.

1,057,002.

Specification of Letters Patent.

Patented Mar. 25, 1913.

Application filed December 13, 1910. Serial No. 597,035.

To all whom it may concern:

Be it known that I, THOMAS J. LOFTUS, citizen of the United States, residing at Castella, in the county of Shasta and State of California, have invented new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to turbine motors, and particularly pertains to an automatic means for delivering fluid under pressure to turbine blades in consecutive explosive impulses.

It is the object of this invention to provide a turbine motor capable of generating high speed and power and which is adapted to be operated either by the intermittent explosion of gases or by the constant flow of steam or water under pressure.

A further object is to provide means whereby the motive power may be introduced to a revoluble turbine disk from a point near its center and be discharged from its periphery after acting on a series of turbine blades, and which, when expansible fluids are employed, permits of a compound action on the turbine wheel as the fluids pass from the center of the disk outward.

Other objects will become apparent hereinafter.

The invention consists of the parts and the combination and construction of parts hereinafter more fully described and claimed having reference to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of the invention, partly in elevation. Fig. 2 is a vertical transverse section on the line X—X, Fig. 3. Fig. 3 is a view on the line Y—Y, Fig. 2, showing the starting and feed controlling mechanism in vertical longitudinal section. Fig. 4 is a detail in end view of the speed and feed governing device. Fig. 5 is a horizontal section on the line Z—Z, Fig. 4. Fig. 6 is a detail end elevation of the air and gasoline feed pipes. Fig. 7 is a sectional end elevation on the line W—W, Fig. 1. Fig. 8 is a detail end elevation showing the relief valves and their operating cam. Fig. 9 is a detail in section of a relief valve.

In the drawings A represents a turbine disk which is securely mounted on a drive shaft 2 supported in water-cooled oil bearings 3, formed on the face plates or heads 4—4' on the outer ends of a cylindrical tur-

bine housing 5. The disk A is provided with a number of concentric rows of curved or crescent shaped turbine vanes 6 which are mounted on each side of the disk A. These concentric rows of vanes 6 are adapted to extend between oppositely disposed curved vanes 7 mounted in concentric rows on the inside faces of the head plates 4—4'. The vanes 6 on the turbine disk 4 are disposed at a slight angle to the vanes 7 on the face plates 4—4' and are oppositely curved in relation thereto; the vanes 6 on opposite sides of the disk A being disposed in the same relation to each other.

Mounted upon the head 4 around the bearing 3 is a series of combustion chambers 8, in this case four in number and spaced equidistances apart. These combustion chambers 8 communicate with the interior of the turbine housing through passages 9 formed in the plate 4 and disposed near the center or middle portion of the turbine disk A. Each combustion chamber 8 is divided into two compartments *a* and *b* normally separated from each other by means of a valve disk 10 mounted on a stem 11 which extends through a bearing in the casing of the explosion chamber 8 to the exterior thereof. The disk 10 is normally retained in its seated position by means of a spring 12 which is coiled on the stem 11 and is disposed between a collar 14 on the outer end of the stem 11 and a gland 13 on the explosion chamber casing through which the stem 11 extends. The valve disks 10 are designed to move into the inner portion *b* of the explosion chamber, in opposition to the springs 12, so as to momentarily open the compartment *a* to the compartment *b*, as later described.

The compartment *a* of each explosion chamber 8 is connected to an air supply pipe 15 through a double seated disk-valve 16, and to a gasoline feed pipe 17 through a normally seated needle-valve 18. Air is supplied under pressure to the pipe 15 in any suitable manner, and the pipe 17 is connected to any suitable source of gasoline supply, which supply is delivered to the needle-valve 18 through the pipe 17 under pressure.

Disposed between the needle-valve 18 and the explosion chamber 8 is a ball check-valve 19, the purpose of which is to prevent back-fire into the pipe 17 when the valve 18 is

open; the ball 19 being designed to close a feed port leading from the needle-valve to the check-valve chamber. The gasolene feed valve 18 and the air feed-valve 16 are arranged to move in opposite directions to open or close their respective ports and are designed to be operated simultaneously to deliver air and gasolene into the explosion chamber 8 at stated intervals.

The mechanism for accomplishing the simultaneous operation of the valves 16 and 18 is constructed as follows: A cam 20 is rigidly mounted on a sleeve 21 which is revoluble upon a fixed bearing shaft 22. Formed on the sleeve 21 is a collar 23 having clutch teeth on one edge which normally engage corresponding teeth on the side of a pinion 24, loosely mounted and revoluble on the sleeve 21. This pinion 24 is designed to be constantly in mesh with a pinion 25 on a horizontally disposed shaft mounted in a bearing 25'; the other end of which shaft carries a pinion 26 which is engaged by a gear 27 mounted on the end of the drive shaft 2. The gears 27, 26, 25 and 24 are so proportioned in relation to each other that one revolution of the drive shaft 2 will rotate the gear 24, sleeve 21 and cam 20, two revolutions. The cam 20 has two oppositely disposed cam faces which are designed to actuate a lever 28 fulcrumed at 29, on a suitable support, the outer end of which lever is pivotally connected to the stem 30 of the double seated disk valve 16 in such manner that when the lever 28 is rocked by the action of the cam 20, a reciprocal movement will be given the corresponding stem 30 to unseat the valve-disks 16.

The needle-valve 18 is opened simultaneously with the valve 16 by means of a lever 31 fulcrumed at 31'. One end of the lever 31 is engaged by the stem 30 of the valve 16, while the opposite end engages a collar on the outer end of the valve stem 18 in such manner that as the stem 30 moves inwardly to unseat the valve disks 16, the stem 18 will be moved outwardly to open its valve port. A spring 18' wound on the stem 18 between a collar on the stem and the valve casing tends to normally retain the valves 18 and 16 in their seated positions, the cam 20 operating these valves in opposition to the spring 18'. As there are four levers 28 to operate corresponding feed valves spaced equidistances apart around the cam 20 it will be seen that one complete revolution of the cam 20 will operate each set of feed valves 16—18 twice, the valves on opposite sides of the shaft 2 operating simultaneously.

The operation of the invention so far disclosed is as follows: The valves 16 and 18 being opened as just described, to admit a charge of air and gasolene into the outer compartment, *a* of the explosion chamber 8,

the gaseous mixture thus formed is exploded by means of an electric spark through a spark plug 32; this explosion taking place the moment the valves 16 and 18 are closed. The explosion of the gases in the outer compartment of the explosion chamber 8 forces the valve head 10 out of its seat in opposition to the spring 12 so as to permit the gases to enter the compartment *b* from whence they are delivered to the interior of the turbine housing through the opening 9. The moment the force of the explosion in the compartment *a* on the upper sides of the valve disk 10 has been expended, the valve 10 is re-seated by means of the spring 12 lifting upward on the stem 11. The gases on entering the turbine housing pass into an annular space 33 on one side of the turbine disk A, and a portion of the gases thence passing through annular openings in the disk A to an annular space 35 on the opposite side thereof. By this construction the gases are delivered to both sides of the turbine disk A simultaneously at a point near its center from whence they pass outwardly between the turbine vanes 6 and 7. The outward flow of the expanding gases between the concentric rows of vanes 6 and 7 causes the turbine disk A to be revolved in one direction by reason of the gases deflected from the fixed vanes on the heads 4—4' being impinged upon the vanes 6 on the movable disk A to rotate the latter in a manner common in turbine construction.

It will be seen that by delivering the expanding gases to both sides of the disk A that the pressure upon the disk A falling equally upon each side thereof, the disk A becomes virtually balanced upon the drive shaft 2, that is to say, there will be no strain on the out portions of the disk A to exert a longitudinal strain on the shaft 2. The gases after passing between the vanes 6 and 7 enter an annular space 36 between the outer edge of the disk A and the housing 5 and are then carried off through an exhaust port 37 disposed in the bottom of the housing 5.

Means are provided for scavenging the burnt gases entrapped in the compartment *a* of the explosion chamber 8, said means consisting of a valve 38 disposed in an exhaust port 39 leading from the explosion chamber 8, as shown in Fig. 7. This valve 38 is designed to be opened the moment the valve 10 is re-seated and prior to the delivery of another charge into the explosion chamber 8. This is accomplished automatically by means of a lever 40, one end of which normally contacts the outer end of the stem 41 of the valve 38, as shown in Fig. 9. The valve 38 is normally closed by means of a spring 42 mounted on the stem 41, which spring also acts to retain the inner end of the lever 40, which is provided with a roller

43, in contact with a cam surface 44 mounted on the drive shaft 2. This cam 44 has oppositely disposed cam surfaces which act upon the rollers 43 to rock the lever 40 in opposition to the spring 42, to open the valve 38 and permit the scavenged gases in the explosion chamber 8 to escape into a pipe 45, the outer end of which opens to the annular chamber 36 in the turbine housing 5.

Means are provided for governing the amount of air and gasolene delivered to the explosion chamber 8 through the valves 16 and 18, which are here shown in Fig. 1 as comprising a piston 46 mounted in a cylindrical casing 47, which is open to the inner compartment *b* of the explosion chamber 8 below the valve 10. This piston 46 is designed to be reciprocated backward by an excess of pressure in the chamber *b* so as to actuate a link 48 which connects with one end of a lever 49. The opposite end of the lever 49 is provided with upwardly projecting pins 50 which extend on each side of a flange 51 formed on a sleeve 52 loosely mounted in a channel on the sleeve 21. An excess of pressure in the chamber *b* moves the piston 46 backward in the cylinder 47 to rock the lever 49 through the link 48 so as to move the sleeve 21 on the shaft 22 thereby moving the faces of the cam 20 away from the inner ends of the levers 28 to shorten the length of the throw of the latter and correspondingly shortening the stroke of the valves 16 and 18, thus lessening the quantity of air and gasolene delivered to the explosion chamber 8.

A means is provided for opening a pair of the valves 16 and 18 to deliver the initial charge of explosive mixture to the explosion chamber 8 in starting the motor. This means consists of a lever 53 pivoted at 54 on lugs formed on the sleeve 52, which lever 53 is adapted to be thrown into frictional engagement with the sleeve 21 so as to rotate the latter on the bearing shaft 22 independent of the pinion 24, so as to rotate the cam 20 to actuate the valves 16 and 18. In turning the sleeve 21 with the lever 53 the teeth on the collar 23 ride over the corresponding teeth on the gear 24, moving the latter rearward on the sleeve 21 in opposition to the spring 24' disposed on the sleeve 21 between the gear 24 and a flange on the cam 20. The gear 24 is of such width as to remain constantly in mesh with the pinion 25 as the teeth of the former slide through the teeth of the latter on the backward movement of the gear 24, so that the moment the explosion takes place in the explosion chamber 8 to rotate the turbine disk A and shaft 2, the pinion 25 will rotate the gear 24; which, as soon as the lever 53 is released and returned to its normal

position will be returned into engagement with the toothed collar 23 by means of the springs 24', so as to operate the cam 20, as before described.

It is manifest that a series of disks A may be mounted on the shaft 2 if desired and incased in separate casings, in which case the exhaust 37 or annular space 36 of one turbine would connect with the passage 9 of the adjacent casing.

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

1. A turbine engine comprising a casing, a shaft extending therethrough, a disk fixed upon the shaft, vanes fixed upon the inner faces of the casing and upon each side of the disk, passages through the disk and through the casing, chambers communicating with said passages, mixing chambers, valves opening from said mixing chambers into the first-named chambers, valves which gasolene and air are admitted into the mixing chambers, a cam carried by said shaft, and levers actuated by said cam to open the last-named valves.

2. In a gasolene turbine engine, a casing and means for supplying successive, explosive, impelling charges thereto, said means comprising double chambers spaced around the casing, a valve in each of said chambers adapted to separate one part thereof from another, air and gasolene conduits and valve chambers therefor adapted to communicate with the first-named chambers, valves controlling the communication between the first-named chamber and said valve chambers, a shaft, a cam rotatable and slidable on said shaft, and levers actuated by said cam to open the valves which control the admission of air and gasolene to the first-named chambers.

3. In an engine of the character described, the combination with a casing having air and gasolene conduits and valves controlling the same, of means for supplying initial charges to start the engine, said means comprising a shaft, a cam thereon, a lever movable to make frictional contact to rotate said cam and open the air and gasolene controlling valves, a gear slidably mounted on said shaft, a second shaft and a gear thereon constantly in mesh with the slidable gear, and a spring acting upon the slidable gear to return it to normal position when said lever is released.

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

THOMAS J. LOFTUS.

Witnesses:

JAS. M. LOFTUS,

JESSE A. BELL.