W. F. & H. A. LEES & C. W. GRISE.

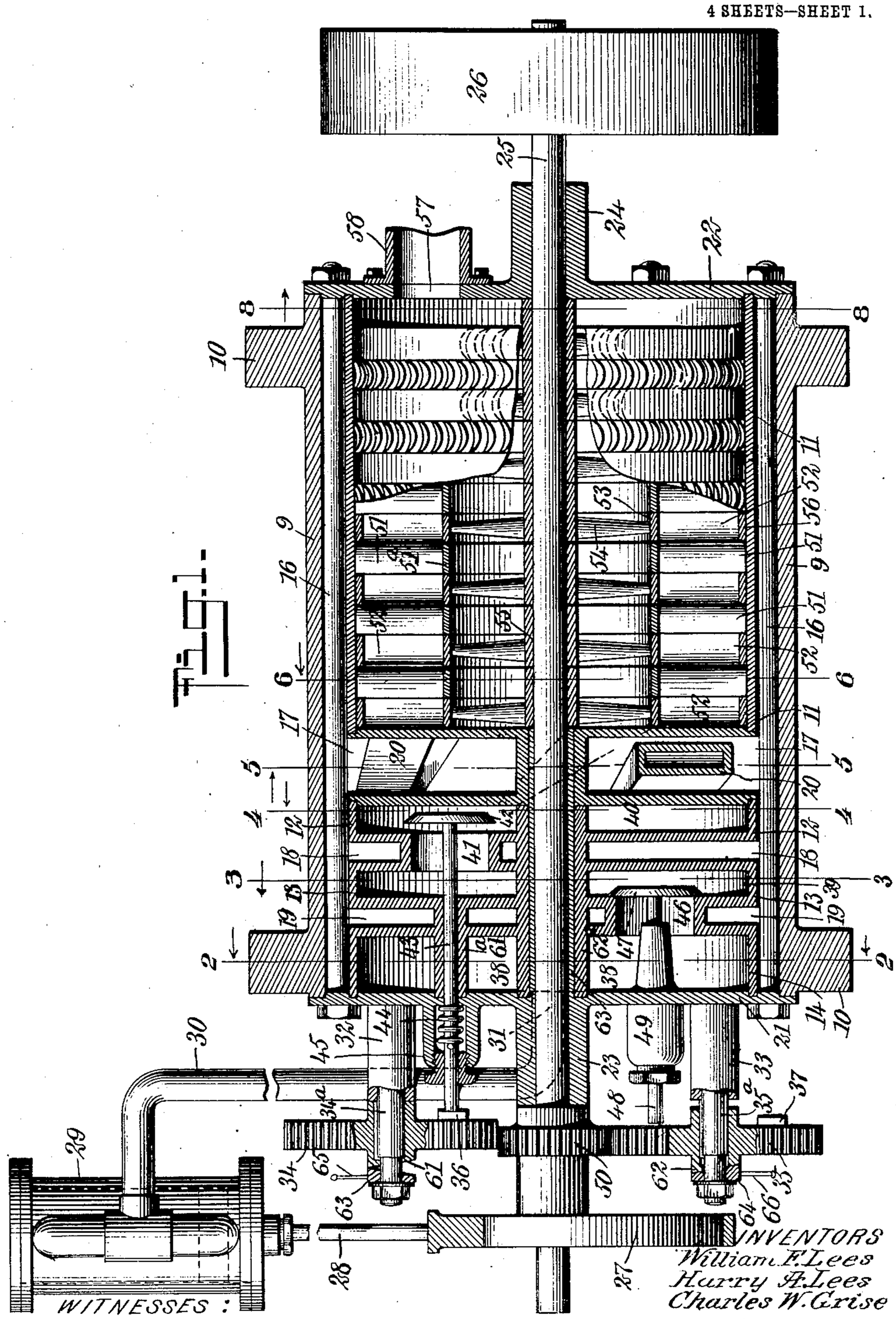
ELASTIC FLUID TURBINE.

APPLICATION FILED JULY 8, 1907.

898,753.

Patented Sept. 15, 1908.

4 SHEETS—SHEET 1.



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4 SHEETS—SHEET 2.

Fig. 2.

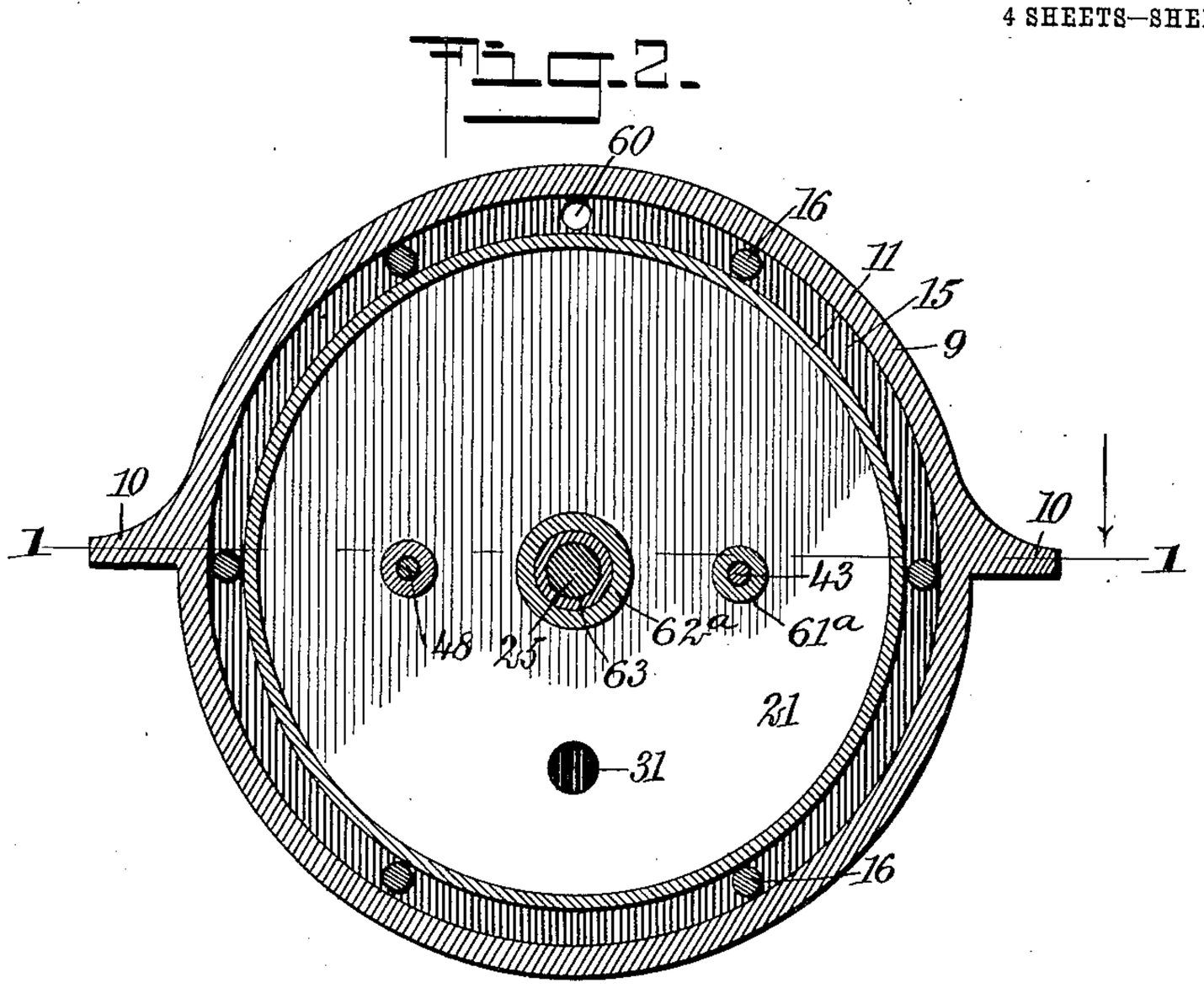
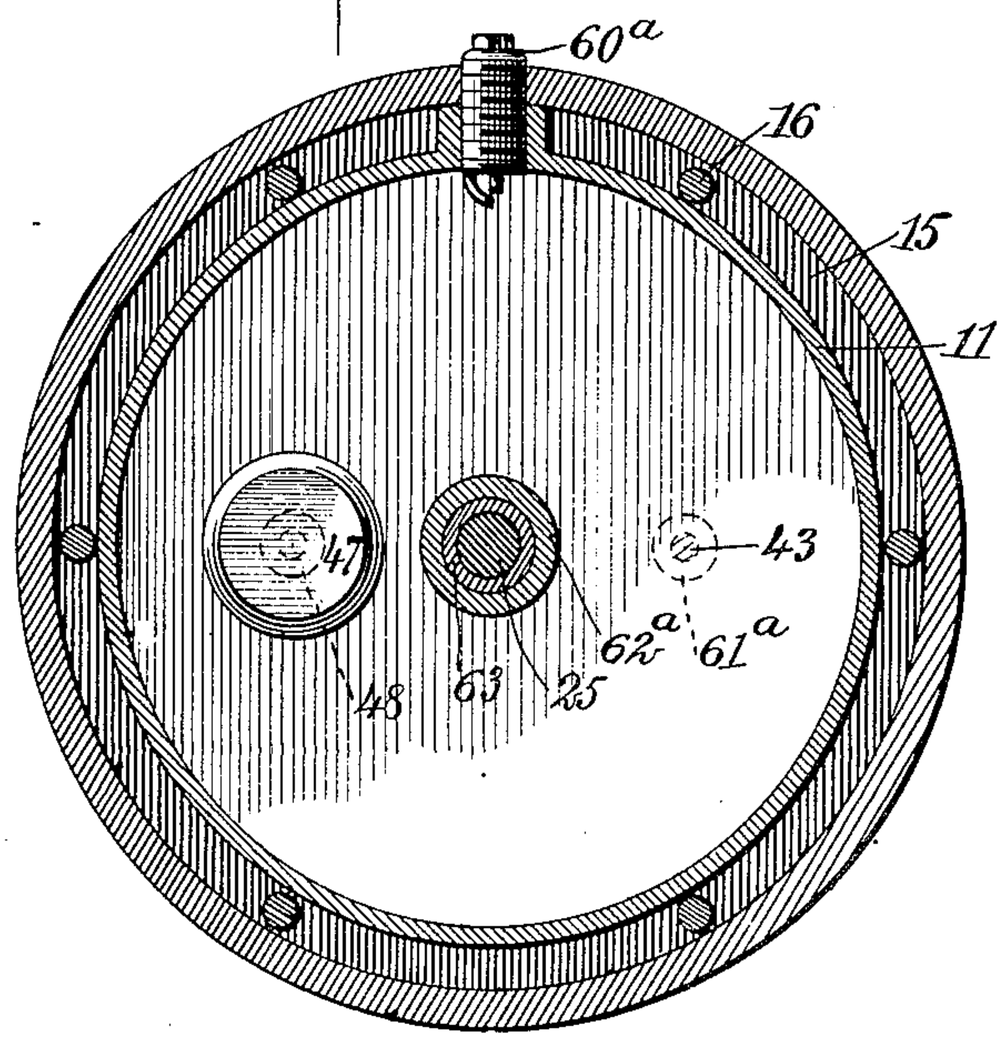


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 4.

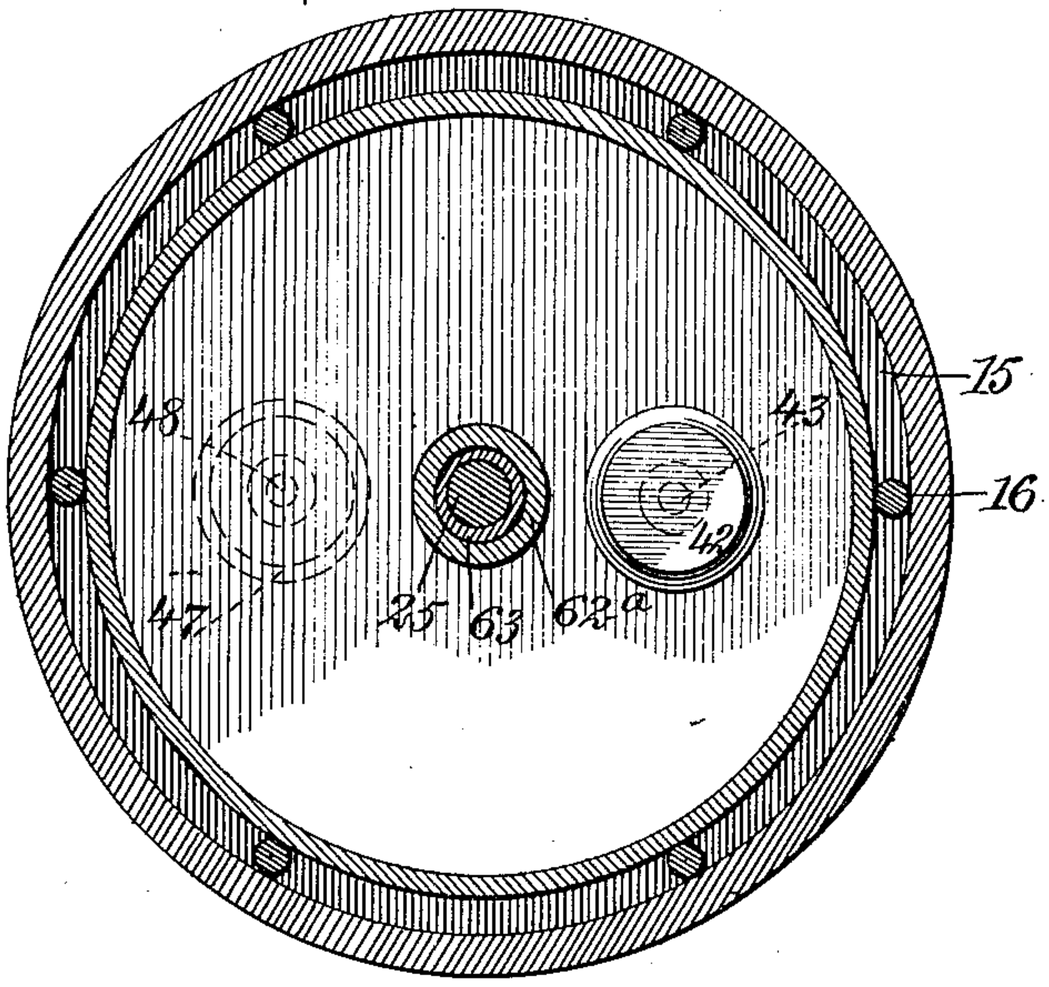
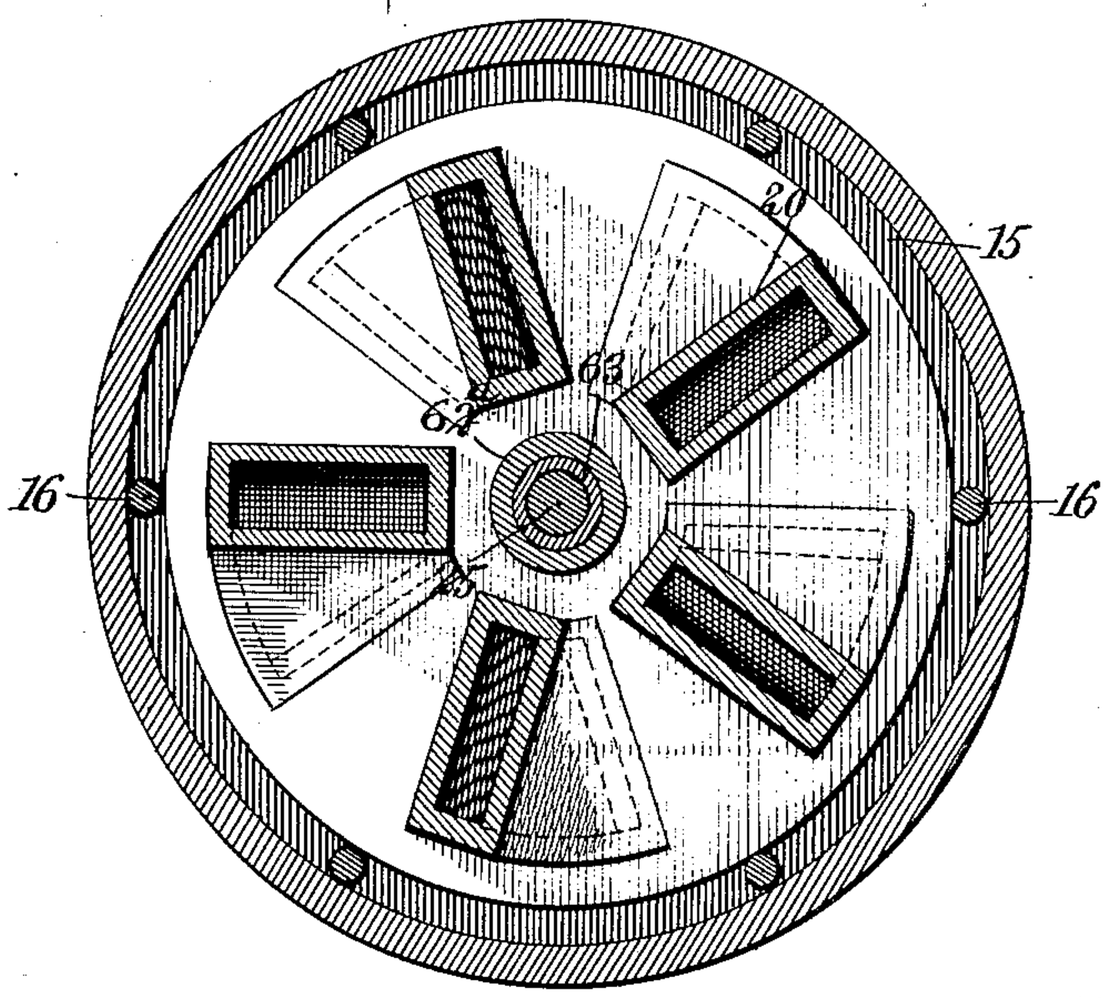


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

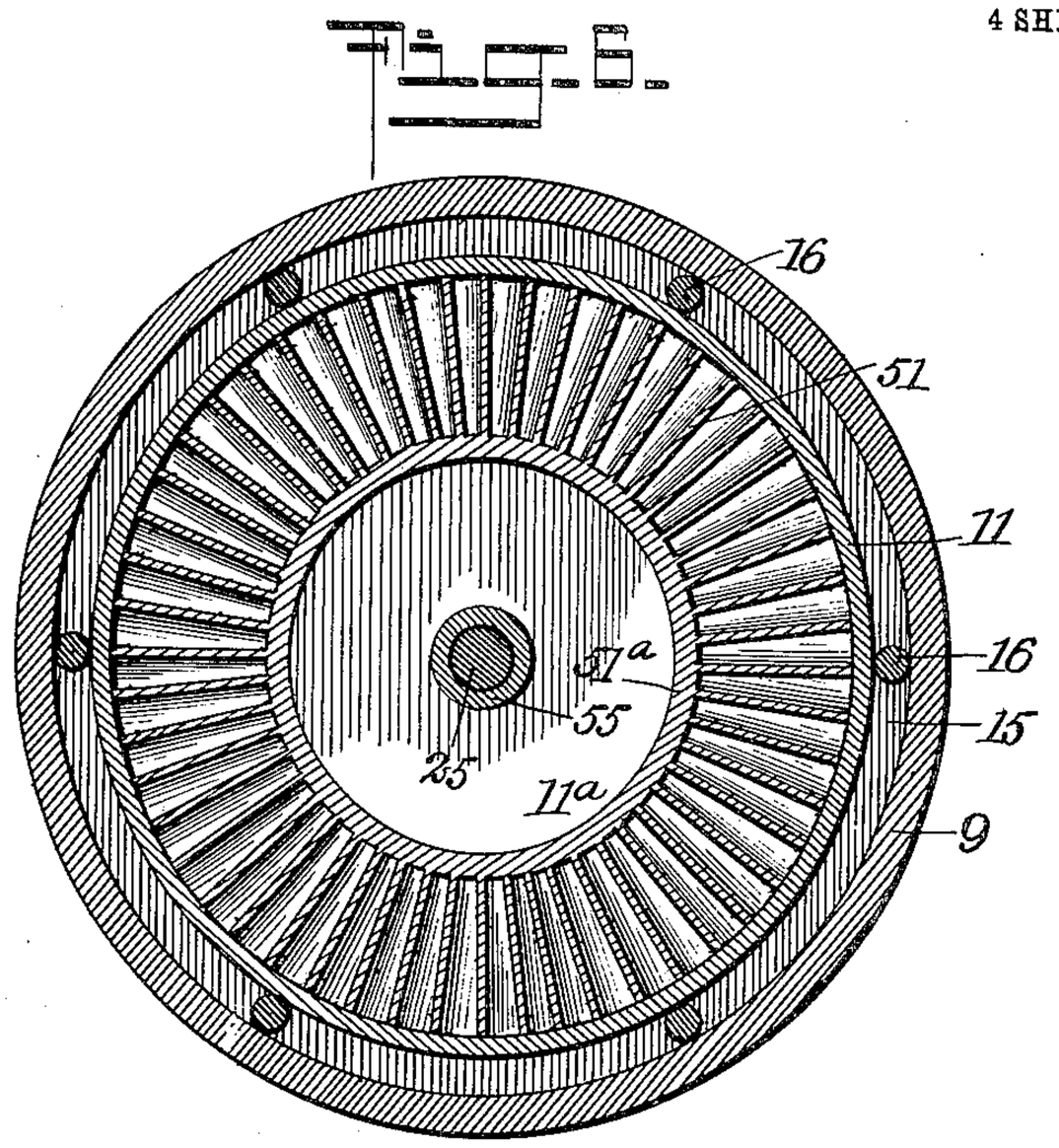


Fig. 7.

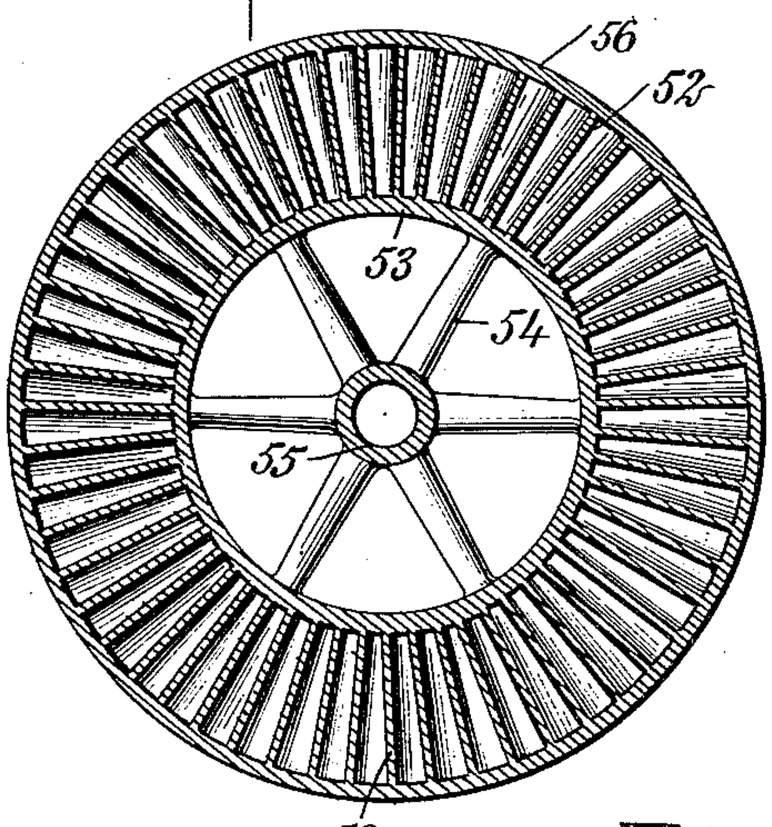


Fig. 8.

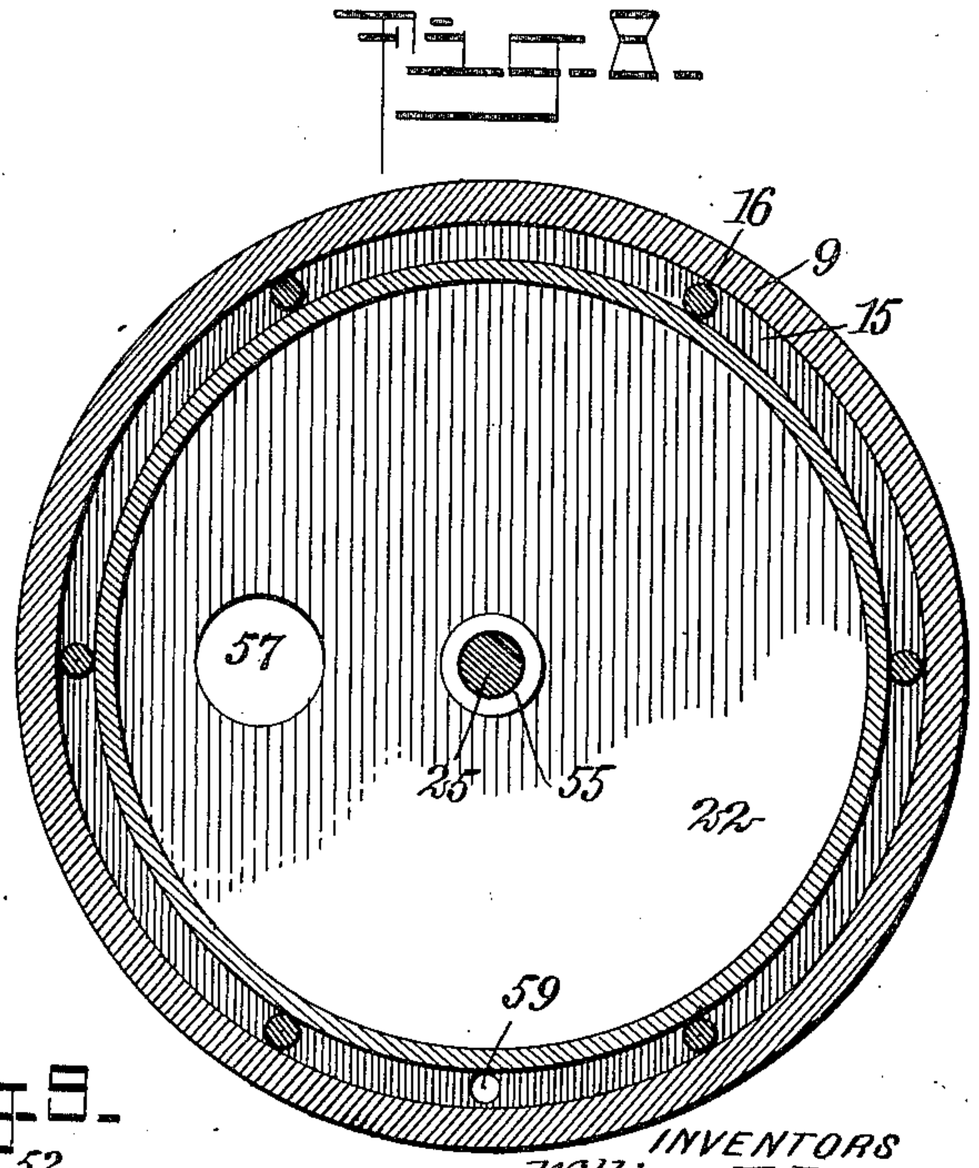
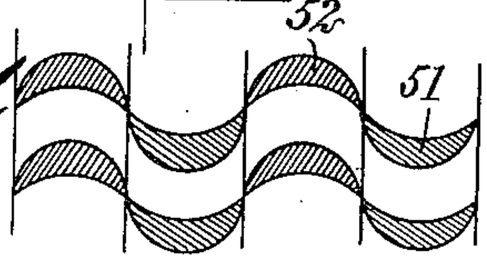


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM FRANKLIN LEES, HARRY AUGUSTINE LEES, AND CHARLES WESLEY GRISE, OF SAN DIEGO, CALIFORNIA.

ELASTIC-FLUID TURBINE.

No. 898,753. Specification of Letters Patent. Patented Sept. 15, 1908.

Application filed July 8, 1907. Serial No. 382,580.

To all whom it may concern:

Be it known that we, WILLIAM FRANKLIN LEES, HARRY AUGUSTINE LEES, and CHARLES WESLEY GRISE, all citizens of the United States, and residents of San Diego, in the county of San Diego and State of California, have invented a new and Improved Elastic-Fluid Turbine, of which the following is a full, clear, and exact description.

Our invention relates to elastic fluid turbines and admits of general use, our more particular object being to produce a turbine operated by the expansive force of gases, such as are produced by the explosion of heavy or light crude oil, petroleum refuse, anthracite and bituminous gases, water and coal gases, benzin, gasolene, ethylene, marsh gas, natural gas, acetylene gas, semi-water gas, producer gas, various hydrocarbon gases not specifically mentioned, and alcohol.

Our invention further relates to certain improvements in construction whereby an explosive aeriform mixture is received into a suitable compartment, conducted thence in definite charges to the firing chamber, thence allowed to flow periodically into the expansion chamber, and distributed from there to the turbine vanes from which it is allowed to escape.

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 substantially horizontal section on the line 1—1 of Fig. 2, looking in the direction of the arrow, through our improved turbine, showing the arrangement of the pumping mechanism, the valves, the gearing for operating the latter, the arrangement of the various chambers, and the several vanes; Fig. 2 is a vertical section upon the line 2—2 of Fig. 1, looking in the direction of the arrow, and showing the cylindrical compartment used as a water jacket and also showing various details including the inlet for the explosive mixture; Fig. 3 is a vertical section upon the line 3—3 of Fig. 1, looking in the direction of the arrow and showing the valve for preventing retrogression of burned gases from the explosive chamber, this view also showing the spark plug for igniting a charge within the explosion chamber; Fig. 4 is a vertical section upon the line 4—4 of Fig. 1, looking in the direction of the arrow, and showing the valve used for periodically establishing communication between the explosion chamber and the expansion chamber. Fig. 5 is a vertical section upon the line 5—5 of Fig. 1, looking in the direction of the arrow, and showing the spiral nozzles for directing the expansive medium against the vanes; Fig. 6 is a section upon the line 6—6 of Fig. 1, looking in the direction of the arrow, and showing a circle of stationary vanes; Fig. 7 is a vertical section through one of the revoluble disks, each of which is provided with a circle of vanes; Fig. 8 is a section upon the line 8—8 of Fig. 1, looking in the direction of the arrow, and showing the rear head of the turbine casing together with the exhaust port 57; and Fig. 9 is a diagrammatic section showing the relation of the movable and fixed vanes.

A cylindrical casing 9 is provided with lugs 10 whereby it may be supported. Mounted within the cylindrical casing 9 are cylinders 11, 12, 13, 14. Disposed outside of the cylinders last mentioned and inside of the casing 9 are tie rods 16 spaced equidistant and extending through a cylindrical compartment 15. The cylinders 11, 12, 13, 14 are separated by annular compartments 17, 18, 19 merging into the cylindrical compartment 15. The parts are so arranged that water may be circulated through these compartments in order to prevent their destruction by excessive heat. In other words, the cylinders are all water-jacketed.

The cylinders 11, 12 are connected together by spirally disposed nozzles 20, so arranged as to direct the expansible medium at suitable angles. The front casing head is shown at 21 and the rear casing head at 22. Integral with the front casing head 21 is a sleeve 23 serving as a bearing. A similar sleeve 24 is integrally connected with the rear casing head 22. A revoluble shaft 25 is journaled within these bearings and mounted upon this shaft is a fly-wheel 26. An eccentric 27 is likewise mounted upon this shaft. This eccentric is connected by an eccentric rod 28 with a pump 29. The outlet pipe 30 of this pump is connected with the inlet 31 (see Fig. 2) of the turbine. Cylindrical bearings 32, 33 are mounted upon the front casing head 21 and projecting from them are studs 34^a, 35^a upon which are splined two supporting gear wheels 34, 35. These gear

wheels are provided respectively with cams 36, 37, each cam having substantially the conformity of a wedge. The cylinders 12, 13, 14 are provided with compartments 38, 39, 40. The cylinders 12, 13 are connected together by a passage 41 which is normally closed by a valve 42. This valve is mounted upon a stem 43, the latter being engaged periodically by the cam 36. A spring 44 is mounted within a spring box 45 and tends to force the stem 43 toward the left, according to Fig. 1. The cylinders 13, 14 are connected by a passage 46 which is normally closed by a valve 47 mounted upon a valve stem 48 and passing through a spring box 49 similar to the spring box 45. The valve 47 and its stem 48 are similar in their action to the valve 42 and its stem 43. The cam 37 periodically trips the valve stem 48 and thus momentarily opens the valve 47. A gear wheel 50 is journaled upon the shaft 25 and meshes with the gear wheels 34, 35 so as to confer motion upon the latter whenever the shaft 25 is rotated. A number of sleeves 51ª are concentric to the cylinder 11 and connecting each sleeve 51ª with this cylinder are a number of stationary vanes 51 disposed radially around the shaft 25 as a center.

Vanes 52 project radially outward from sleeves 53 carried by spokes 54, the latter radiating from hubs 55. Bands 56 integral with the vanes 52 encircle the latter, as indicated in Fig. 7, the whole of these parts constituting a wheel, several such wheels being shown in Fig. 1. An outlet port is shown at 57, being merely a hole in registry with the exhaust pipe 58. At 59 (see Fig. 8) and 60 (see Fig. 2) are holes for supplying the water jacket with water.

The gears 34, 35 are provided with hubs 61, 62 integral therewith and having an inclined face (see Fig. 1). Cams 63, 64 are mounted upon the outer ends of the studs 34ª, 35ª, the latter being reduced for this purpose. Handles 65, 66 are connected rigidly with the cams 63, 64 and are used for turning the same. If desired, spiral springs may be introduced intermediate the cylindrical bearings 32, 33 on the one hand, and the hubs of the gears 34, 35 on the other hand, for the purpose of normally pressing the gears 34, 35 to the left. By turning the handles 65, 66 of the cams 63, 64, the gears 34, 35 or either of them, may move to the right or left without disconnecting them from their fittings. In this manner the valves 42, 47 may be maintained closed as long as desired, and this action is necessary in order to enable the pump 29 to compress the aeriform body to a predetermined degree. For instance, if it is desired to have a pressure of seventy-five pounds of mixed gas, this can be readily accomplished before the machine starts. The cylinder 14 is provided with a bearing sleeve 61ª in which the shaft 43 turns and with a hub 62ª, in which is received an extension of the sleeve 23 which encircles the shaft 25.

Our invention is used as follows: The rotation of the shaft 25 operates the pump 29, which is connected with a source of supply of an aeriform explosive mixture. The operation of the pump compresses this aeriform body in the compartment 38. The degree of pressure attained may vary with the proportions of the several parts. The apparatus being started, each revolution of the shaft 25 causes the cam 37 to engage the valve stem 48 and open the valve 47. This allows an excess of the aeriform body to go through the passage 46 into the explosion chamber 39, the valve 47 instantly closing and preventing retrogression of the explosive charge. The charge within the explosion chamber 39 is now exploded by aid of a spark plug 60ª (see Fig. 3) or equivalent means. The pressure in the explosion chamber 39 is now greater than before and has more or less tendency to open the valve 42. Since, however, the spring 44 is pretty strong, the valve is not opened until the cam 36 engages the valve stem 43. This opens the valve 42 and a portion of the gases of combustion passes out through the passage 41 into the compartment 40 which we designate as the expansion chamber.

It will be noted that the opening of the valve 42 does not occur at the same instant as the opening of the valve 47. This prevents abruptness in allowing the explosive charge to reach the movable parts of the turbine. Within the expansion chamber 40 the variations in pressure are less pronounced than in the explosion chamber 39. The gases of combustion now pass through the spiral nozzles 20 and impinge against the first set of vanes 52, these vanes being movable. The gases proceed onwardly through the machine, passing first through a circle of fixed vanes, next through a circle of movable vanes, next through a circle of fixed vanes, and so on, finally making their escape through the port 57 and exhaust pipe 58.

The movable vanes confer rotary motion upon the shaft 25 which furnishes power for operating the pump and for turning the various gears. For convenience we designate the revoluble vanes and their accompanying parts as the movable element of the turbine, and fixed vanes and their accompanying parts being by analogy designated as the fixed member of the turbine.

Having thus described our invention, we claim as new and desire to secure by Letters Patent:

1. The combination of a receptacle for holding an explosive aeriform body under pressure, an explosion chamber, a valve for opening and closing communication between said receptacle and said explosion chamber,

an expansion chamber connected by a passage with said explosion chamber, a second valve for opening and closing communication from said explosion chamber to said expansion chamber, turbine mechanism connected with said expansion chamber and driven thereby, stems connected to both of said valves for actuating them, and means for actuating said stems alternately.

2. The combination of a receptacle for holding an explosive aeriform body under pressure, an explosion chamber, a valve for opening and closing communication between said receptacle and said explosion chamber, an expansion chamber connected by a passage with said explosion chamber, a second valve for opening and closing communication from said explosion chamber to said expansion chamber, turbine mechanism connected with said expansion chamber and driven thereby, stems connected with said valves for actuating the same, and means controllable by said turbine mechanism for actuating said stems alternately.

3. The combination of an explosion chamber, a valve located therein, a gear provided with means for opening and closing said valve, a mounting for said gear, and means controllable at will for shifting the position of said gear relatively to said mounting for the purpose of varying the degree of control of said gear relatively to said valve.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM FRANKLIN LEES.
HARRY AUGUSTINE LEES.
CHARLES WESLEY GRISE.

Witnesses:
HOWARD S. CAPWELL,
WILSON S. SMITH.