No. 801,585. PATENTED OCT. 10, 1905.

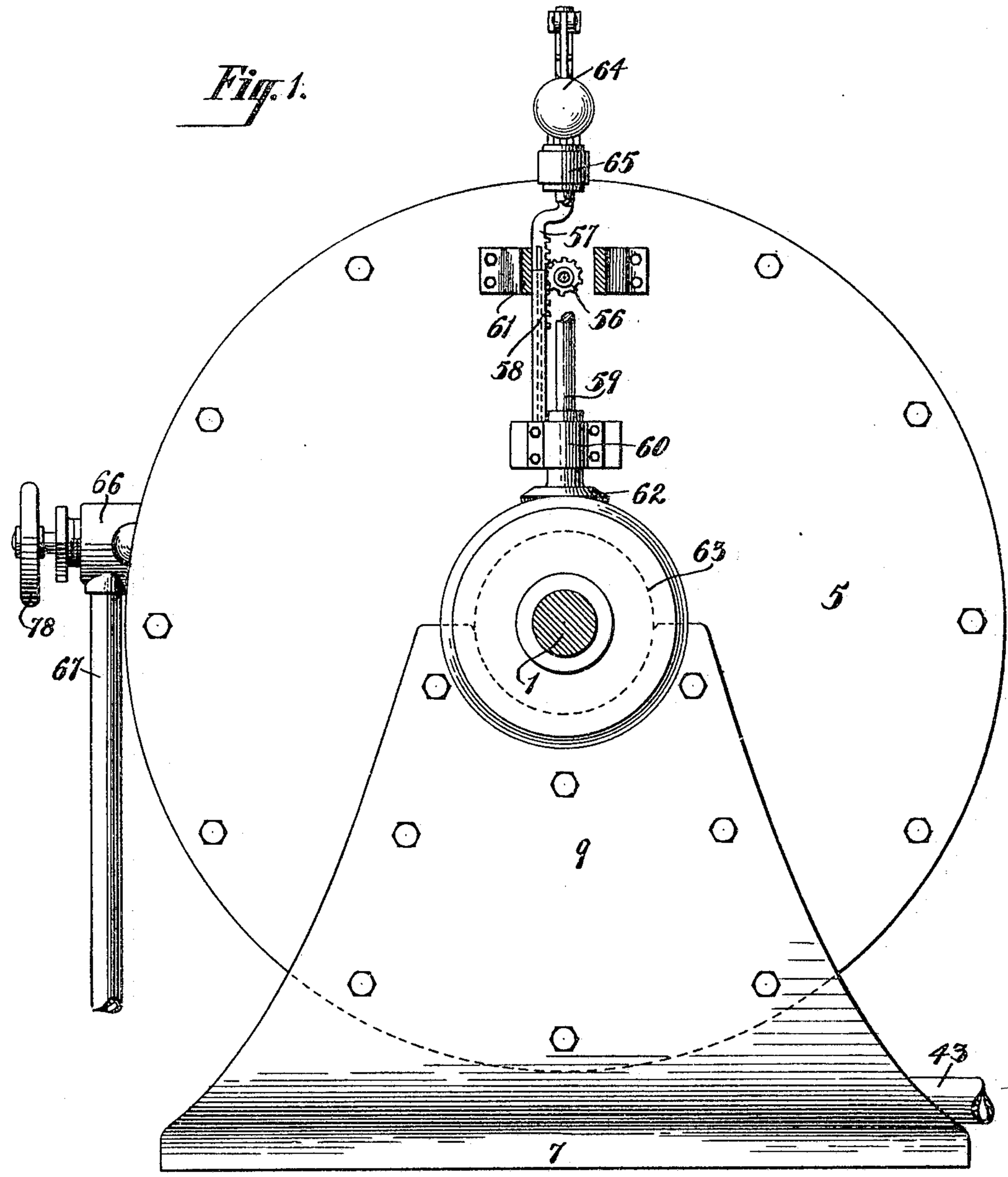
L. HACHENBERG.

TURBINE ENGINE.

APPLICATION FILED JULY 7, 1904.

4 SHEETS—SHEET 1.

Fig. 1.



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ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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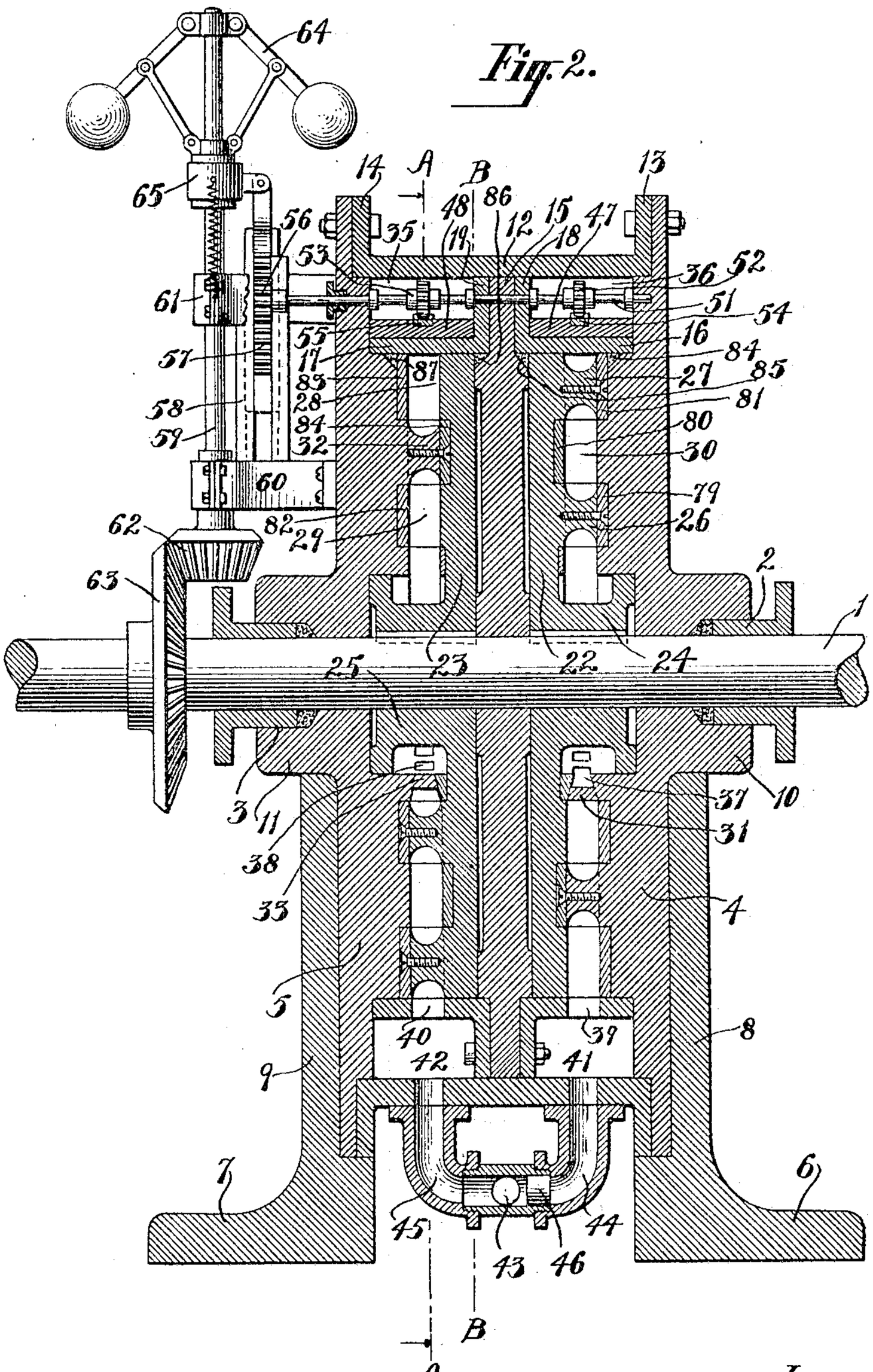
4 SHEETS—SHEET 2.

Fig. 2.



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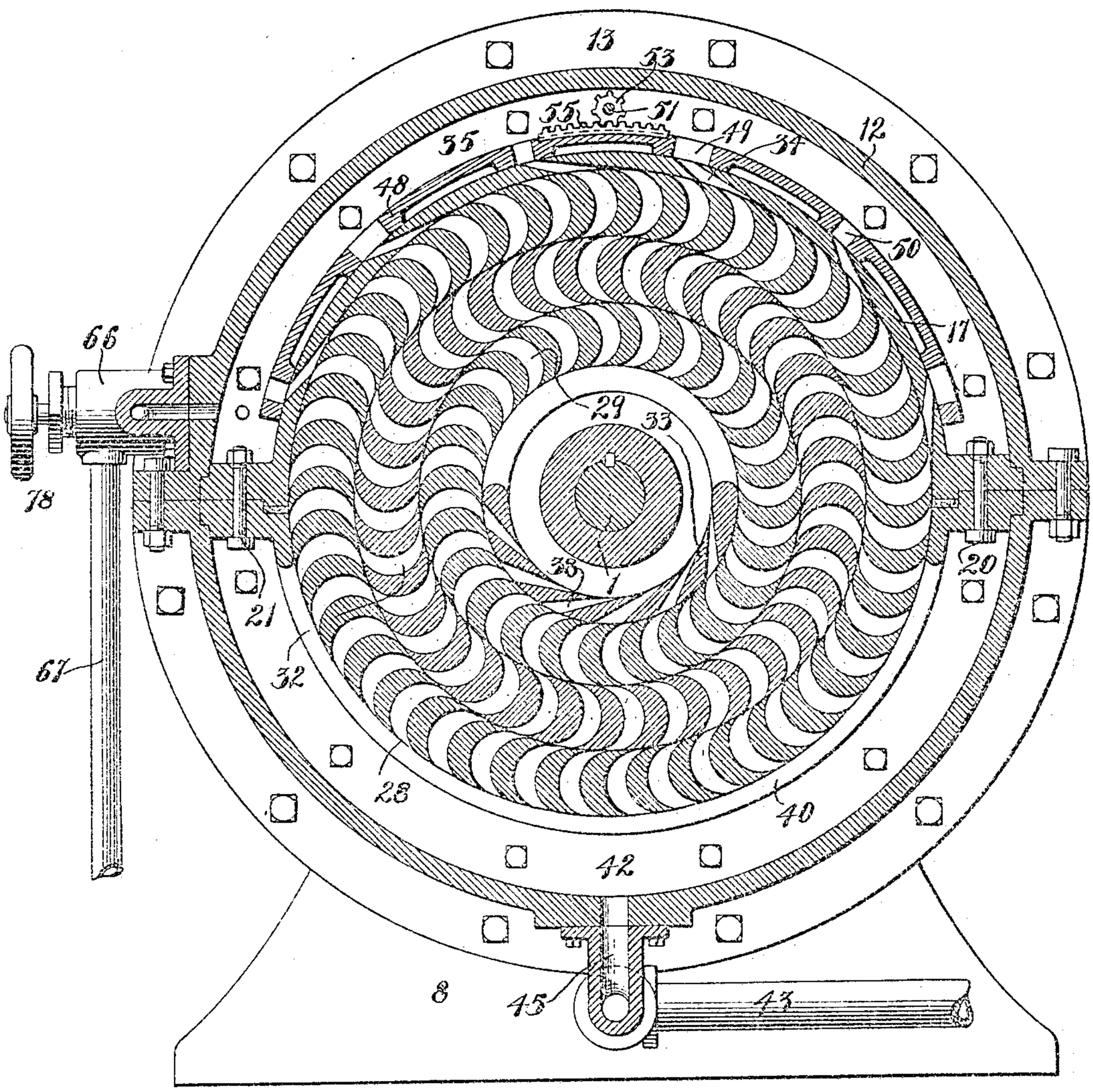
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

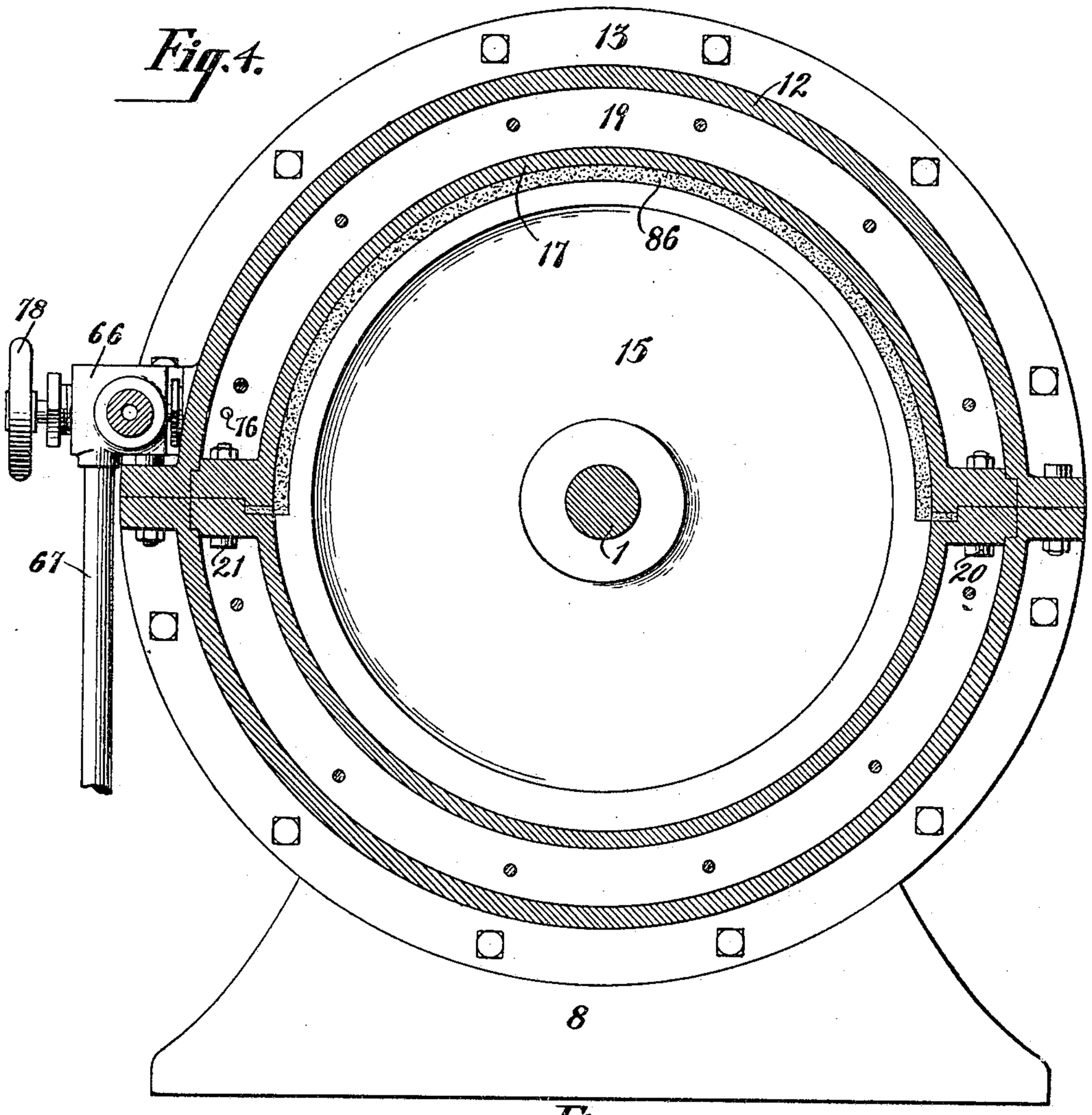


Fig. 5.

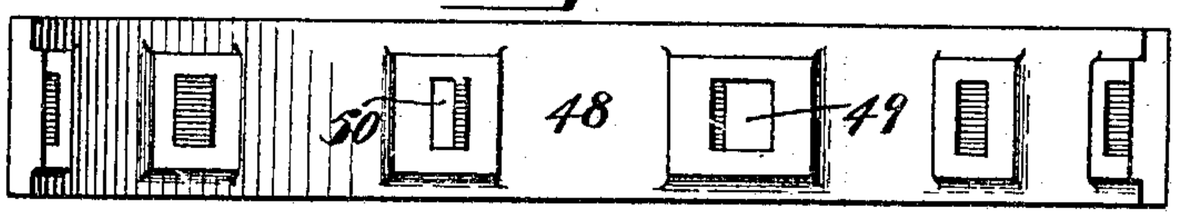
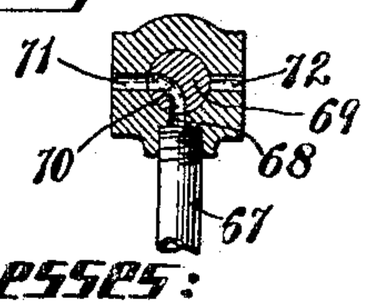


Fig. 7.



Witnesses:
F. G. Hachenberg.
Henry Thieme.

Fig. 6.

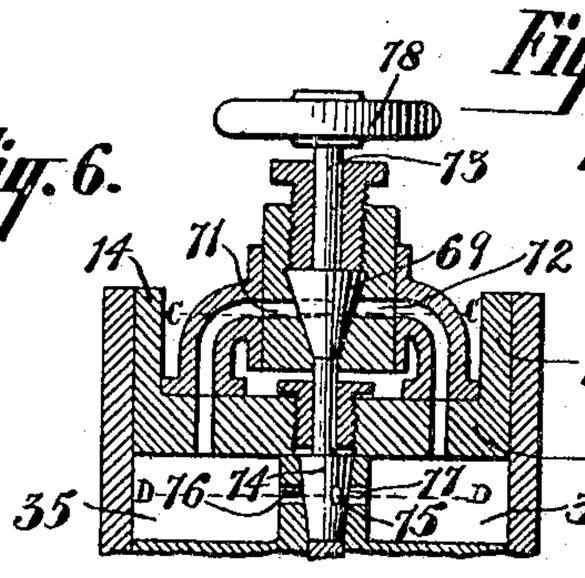
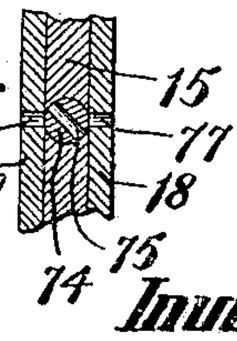


Fig. 8.



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UNITED STATES PATENT OFFICE.

LOUIS HACHENBERG, OF NEW YORK, N. Y.

TURBINE-ENGINE.

No. 801,585. Specification of Letters Patent. Patented Oct. 10, 1905.

Application filed July 7, 1904. Serial No. 215,604.

To all whom it may concern:

Be it known that I, LOUIS HACHENBERG, a citizen of the United States, and a resident of the borough of Bronx, in the city and State of New York, have invented new and useful Improvements in Turbine-Engines, of which the following is a specification.

This invention relates to improvements in turbine-engines, and has more particularly for its object to provide certain improvements in the construction, form, and arrangement of the several parts of an engine of this character whereby superior results may be accomplished with a predetermined supply of motive fluid and in which the speed of the engine may be accurately and automatically controlled.

A further object is to provide an engine of the above character which may be instantly reversed without undue strain upon the moving parts.

In the accompanying drawings, Figure 1 represents the engine in end elevation. Fig. 2 is a longitudinal vertical central section through the same. Fig. 3 is a transverse section taken in the plane of the line A A of Fig. 2 looking in the direction of the arrows. Fig. 4 is a transverse section taken in the plane of the line B B of Fig. 2 looking in the direction of the arrows. Fig. 5 is a top plan view of one of the sliding valves for controlling the admission of motive fluid to the turbine-rings. Fig. 6 is a detail sectional view through the valve for controlling the admission of motive fluid to the engine. Fig. 7 is a detail cross-section in the plane of the line C C of Fig. 6, and Fig. 8 is a detail cross-section taken in the plane of the line D D of Fig. 6.

The engine-shaft is denoted by 1, and it is mounted in suitable bearings 2 and 3 in the end plates 4 and 5 of the engine. These end plates are supported by bases 6 and 7, the uprights 8 and 9 of which extend upwardly along the outer faces of the end plates 4 and 5, so as to support the weight of the engine at the hubs 10 and 11 of the end plates. The end plates 4 and 5 are spaced apart a sufficient distance to provide two annular chambers between them. A ring 12 is provided at its ends with outwardly-extended flanges 13 14, which are bolted or otherwise secured immovably to the end plates 4 and 5. This ring 12 is made in two half-sections bolted or otherwise secured together at 13 14. An intermediate plate 15 has its periphery snugly engaging the inner wall of the ring 12. Two inner rings 16 and 17 are spaced from the outer ring 12 and have their outer ends in engagement with the end plates 4 and 5, respectively. The outwardly-extended flanges 18 and 19 of these rings are bolted or otherwise secured to the intermediate plate 15. Each of these rings is made in two half-sections secured together by bolts or other suitable fastening devices 20 21, which pass through flanges which serve to separate the spaces between the inner rings and the outer ring into upper and lower chambers. The upper chambers are used as motive-fluid-supply chambers, and the lower chambers are used as exhaust-chambers. Rotary pistons 22 23 are located between the end plates 4 and 5 and the intermediate plate 15, the hubs 24 25 of said pistons being fixed to rotate with the shaft 1. These pistons are of disk form, the thickness of the disk being considerably less than the width of the spaces in which the pistons are fitted to rotate. Each piston is provided with one or more annular series of piston-wings. In the present instance I have shown two annular series of wings, denoted, respectively, by 26 27 on the piston 22 and 28 29 on the piston 23. Between the annular series of wings 26 27 and in the same plane therewith I provide the end plate 4 with an annular series of stationary abutting wings 30. Between the annular series of wings 26 and the hub 24 and in the same plane with the wings 26 I provide a partition 31, which extends from the end plate 4 to the face of the piston 22 half-way around the same. The end plate 5 is provided with an annular series of stationary abutting wings 32 between and in the plane of the annular series of wings 28 29 of the piston 23. This end plate 5 is also provided with a partition 33 between the annular series of wings 28 and the hub 25 of the piston 23, which partition extends half-way around the said piston. A great number of wings are preferably provided in each of the series above referred to, which wings are of curved form, as shown. The wings in the two series 26 27 of the piston 22 are curved in one direction, and the wings of the series 28 29 of the piston 23 are curved in the opposite direction, so that when power is supplied to the piston 22 the shaft will be driven in one direction and when applied to the piston 23 the shaft will be driven in the reverse direction. The wings of the series 30 and 32 of the end plates 4 and 5 are curved in the reverse direction to their corre-

sponding series of wings on the pistons, thus presenting a tortuous channel for the motive fluid between the peripheries and central portions of the pistons. A series of ports 34 extend diagonally through the upper half of the inner ring 17 for feeding the motive fluid from the chamber 35 to the spaces between the wings of the outer series 29 of the piston 23.

It is to be understood that a similar plurality of ports leading in the opposite direction are provided through the upper half of the ring 16 for feeding power from the chamber 36 to the spaces between the wings of the series 27 of the piston 22.

An annular series of diagonal ports which flare outwardly are formed in the partitions 31 33, the ports in the partition 31 being denoted by 37 and those in the partition 33 by 38. It is to be understood that the ports in the partition 31 are in the reverse direction to the ports in the partition 33.

The lower halves of the inner rings 16 and 17 are provided with long circumferential ports 39 40, which open communication from the spaces between the wings of the outer series 27 29 and the exhaust-spaces 41 42.

43 represents a common outlet for the exhaust, and 44 45 represent branch outlets leading from the spaces 41 42 to the main outlet 43. A pocket-valve 46 is located in position to automatically open either the one or the other of the branch outlets 44 45 to the main outlet 43. Slide-valves 47 48 are fitted to the peripheries of the rings 16 and 17 within the spaces 35 36, which valves are provided with alternating wide and narrow ports 49 50, so arranged that when the valves are moved the narrow ports 50 will cut off communication from the motive-fluid chambers therethrough to their ports in the said rings 16 17.

The means which I have shown for automatically controlling the movements of the slide-valves, so that as the speed of the shaft increases the amount of motive fluid fed to the pistons may be decreased, is constructed, arranged, and operated as follows: A shaft 51 is in the end plates 4 and 5 and intermediate plate 15, which shaft is provided with pinions 52 53, meshing with racks 54 55, fixed to the slide-valves 47 48. The shaft 51 extends through the end plate 5 and is provided exterior thereto with a pinion 56, which meshes with a rack 57. This rack 57 is fitted to slide longitudinally in a guide 58. A governor-shaft 59 is mounted in suitable bearings in brackets 60 61, carried by the end plate 5. This governor-shaft has a bevel connection-gear 62 63 with the shaft 1. The governor is denoted by 64, and its movable collar 65 is connected to the rack 57.

I have provided means for feeding the motive fluid to the one or the other of the chambers 35 36 to drive the engine in the one or the other direction and also have provided means for opening up communication between the two chambers for equalizing pressure to stop the engine. This means is constructed, arranged, and operated as follows: A valve is located exterior to the outer ring 12, the valve-casing being denoted by 66.

The main fluid-inlet pipe is denoted by 67, which pipe communicates with a port 68, communicating with the face of the outer valve 69. This outer valve 69 is provided with a bridge-port 70, arranged to bring the port 68 into communication with a port 71, leading to the chamber 35, or into communication with a port 72, leading to the chamber 36. The valve-stem 73 is further provided with an inner valve 74, having a through-port 75, arranged to be brought into and out of alinement with ports 76 and 77, leading to the chambers 35 36. The valve-handle is denoted by 78.

I have provided the following arrangement to confine the pressure of the motive fluid to the part being operated upon for eliminating the friction from side thrust. Rings 79, 80, and 81 are secured around the ends of the annular series of wings 26, 27, and 30. Rings 82, 83, and 84 are secured around the ends of the annular series of wings 28 29 32.

The portions of the end plates and intermediate plate which are located in the inlet half of the engine are provided with packing-rings 84 85 86 87 for preventing the leakage of the motive fluid between the end plates, intermediate plate, and pistons.

In operation the main motive-fluid-inlet valve is turned in position to admit the power into the one or the other of the chambers 35 36—as, for instance, the chamber 35. The slide-valve 48 being in its intermediate or open position, the motive fluid will exert its full force first against the wings of the outer series 29 of the piston 23, then against the stationary series of abutting wings 32, and then against the inner series of piston-wings 28. From thence the power will pass into the central chamber around the hub 25. From thence the motive fluid will pass through the ports 38 in the partition 33, where it will operate expansively, first against the series of wings 28, then against the stationary abutting wings 32, and finally against the outer series of wings 29. From thence the fluid will pass into the exhaust-chamber 42 through the port 40. As the exhaust passes through the branch outlet 45 to the main outlet 43 it will force the valve 46 beyond the main outlet 43, and thereby close communication through the branch outlet 44. By turning the main fluid-inlet valve into an intermediate position the motive fluid may be caused to flow from the chamber 35 into the chamber 36, thus equalizing pressure in the two chambers and causing the engine to stop. By turning the valve still further the motive fluid may be cut off from the chamber 35 and fed wholly to

the chambers 36, thus causing the engine to rotate in the reverse direction. As the speed of the engine increases the amount of motive fluid fed to the engine is cut down by the movement of the slide-valve under the control of the governor.

It will be seen from the above description that the motive fluid is caused to pass in a tortuous channel first from the periphery of the piston to its central portion and then is again utilized by passing it from the central portion of the piston out to its periphery. This feature is extremely important in the use of steam as a motive fluid, where the steam may be used first as a force irrespective of its expansive properties and finally used expansively to assist in the operation of the engine. It is to be understood that a greater or lesser number of these annular series of wings may be provided, and it is also evident that various changes might be made in the construction, form, and arrangement of the several parts without departing from the spirit and scope of my invention. Hence I do not wish to limit myself strictly to the structure herein set forth; but

What I claim is—

1. In a turbine-engine, a rotary shaft, a piston fixed thereto having an annular series of wings, a stationary cylinder having an annular series of wings in the plane of the annular series of piston-wings and means for directing the motive fluid from the periphery of the cylinder to the center and from thence outwardly to the periphery in engagement with the said piston and cylinder wings.

2. In a turbine-engine, a rotary shaft, a plurality of pistons fixed thereto each having an annular series of wings, a stationary cylinder having an annular series of wings in the plane of each of the annular series of piston-wings and means for directing the motive fluid from the periphery of the cylinder to the center and from thence outwardly to the periphery in engagement with a group of piston and cylinder wings.

3. In a turbine-engine, a rotary shaft, a piston fixed thereto having an annular series of wings, a stationary cylinder having an annular series of wings arranged to coact with the piston-wings, inner and outer rings forming between them fluid admission and exhaust chambers, ports leading from the admission-chamber through the inner rings at intervals into the piston-chamber for admitting fluid to the wings and a port leading through the inner ring from the piston-chamber to the exhaust-chamber for permitting the escape of the motive fluid.

4. In a turbine-engine, a rotary shaft, a piston fixed thereto having an annular series of wings, a cylinder having an annular series of wings arranged to coact with the piston-wings and inner and outer rings forming between them a fluid-admission chamber, ports leading through the inner ring at intervals to the piston-chamber and a longitudinally-sliding valve for controlling the opening and closing of the said ports.

5. In a turbine-engine, a rotary shaft, a piston fixed thereto having an annular series of wings, a cylinder having an annular series of wings arranged to coact with the piston-wings, inner and outer rings forming between them a motive-fluid-admission chamber, ports leading therefrom through the inner ring at intervals to the piston-chamber and a longitudinally-sliding valve under the control of the speed of the shaft for controlling the opening and closing of the said ports.

6. In a turbine-engine, a rotary shaft, a governor connected thereto, a piston fixed to the shaft having an annular series of wings, a cylinder having an annular series of wings arranged to coact with the piston-wings, inner and outer rings forming between them a fluid-admission chamber, ports leading therefrom through the inner ring at intervals to the piston-chamber and a longitudinally-sliding valve connected to the governor for controlling the opening and closing of the said ports.

7. In a turbine-engine, a rotary shaft, a plurality of pistons fixed thereto, each having an annular series of wings, a cylinder having an annular series of wings arranged to coact with each series of piston-wings, inner and outer rings forming between them fluid-admission chambers, ports leading therefrom through the inner rings at intervals to each piston, longitudinally-sliding valves for the ports and means for admitting the motive fluid to the one or the other of the admission-chambers for driving the shaft in the one or the other direction.

8. In a turbine-engine, a rotary shaft, two pistons fixed thereto, each having an annular series of wings, a cylinder having an annular series of wings arranged to coact with each series of piston-wings, admission-chamber and exhaust-chambers, a common outlet for the two exhaust-chambers and an automatic valve for opening communication from the one or the other of the exhaust-chambers and closing communication from the other chamber.

9. In a turbine-engine, a rotary shaft, two pistons fixed thereto, a cylinder, admission and exhaust chambers for the pistons, a valve for opening and closing communication from the motive-fluid supply to one or other of the admission-chambers, a valve for opening and closing communication between the admission-chambers and a common valve-stem for the two valves.

10. In a turbine-engine, a rotary shaft, two pistons fixed thereto, a cylinder, admission and exhaust chambers for the pistons and means for opening and closing communication from

the motive-fluid supply to the one or the other of the admission-chambers and for opening and closing communication between the admission-chambers.

11. In a turbine-engine, comprising intermediate and end plates, inner and outer rings forming fluid-admission chambers, piston-chambers and exhaust-chambers.

12. In a turbine-engine, a cylinder comprising intermediate and end plates, separable inner and outer rings combined to form fluid-admission chambers, piston-chambers and fluid-exhaust chambers.

13. In a turbine-engine, a cylinder comprising two end plates, an intermediate plate, two inner rings and an outer ring combined to form two fluid-admission chambers, piston-chambers and exhaust-chambers.

14. A cylinder-ring for turbine-engines comprising two members, one member having a plurality of diagonal ports therein.

15. A cylinder-ring for turbine-engines comprising two members, one member having a plurality of diagonal ports therein and a valve having a plurality of ports of different sizes arranged to coact with the diagonal ports in the said member.

16. In a turbine-engine, a cylinder comprising end plates, inner and outer rings and partitions dividing the annular space between the rings into a plurality of motive-fluid supply and exhaust chambers.

17. In a turbine-engine, a cylinder comprising end plates, inner and outer rings, an annular partition and longitudinal partitions dividing the annular space between the rings into a plurality of motive-fluid supply and exhaust chambers.

18. A cylinder-ring for turbine-engines comprising two members one having a plurality of diagonal ports and the other having a single elongated port therethrough.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 5th day of July, 1904.

LOUIS HACHENBERG.

Witnesses:

FREDK. HAYNES,

HENRY THIEME.