No. 880,458.

PATENTED FEB. 25, 1908.

P. KRAUSE.

INTERNAL COMBUSTION TURBINE.

APPLICATION FILED APR. 10, 1907.

3 SHEETS—SHEET 1.

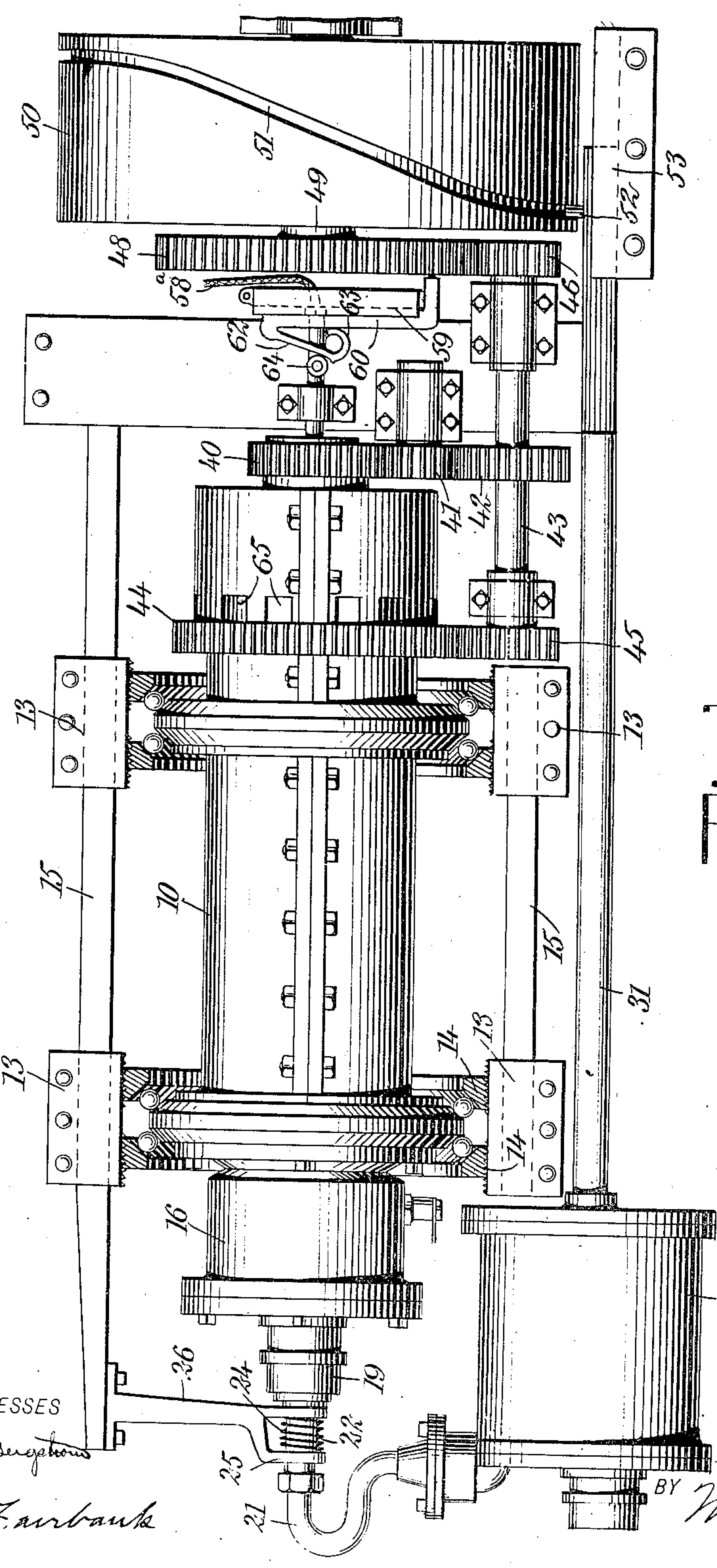

Fig. 1

WITNESSES

John A. Bergstrom

C. W. Fairbanks

INVENTOR

Paul Krause

BY Munn & Co

ATTORNEYS

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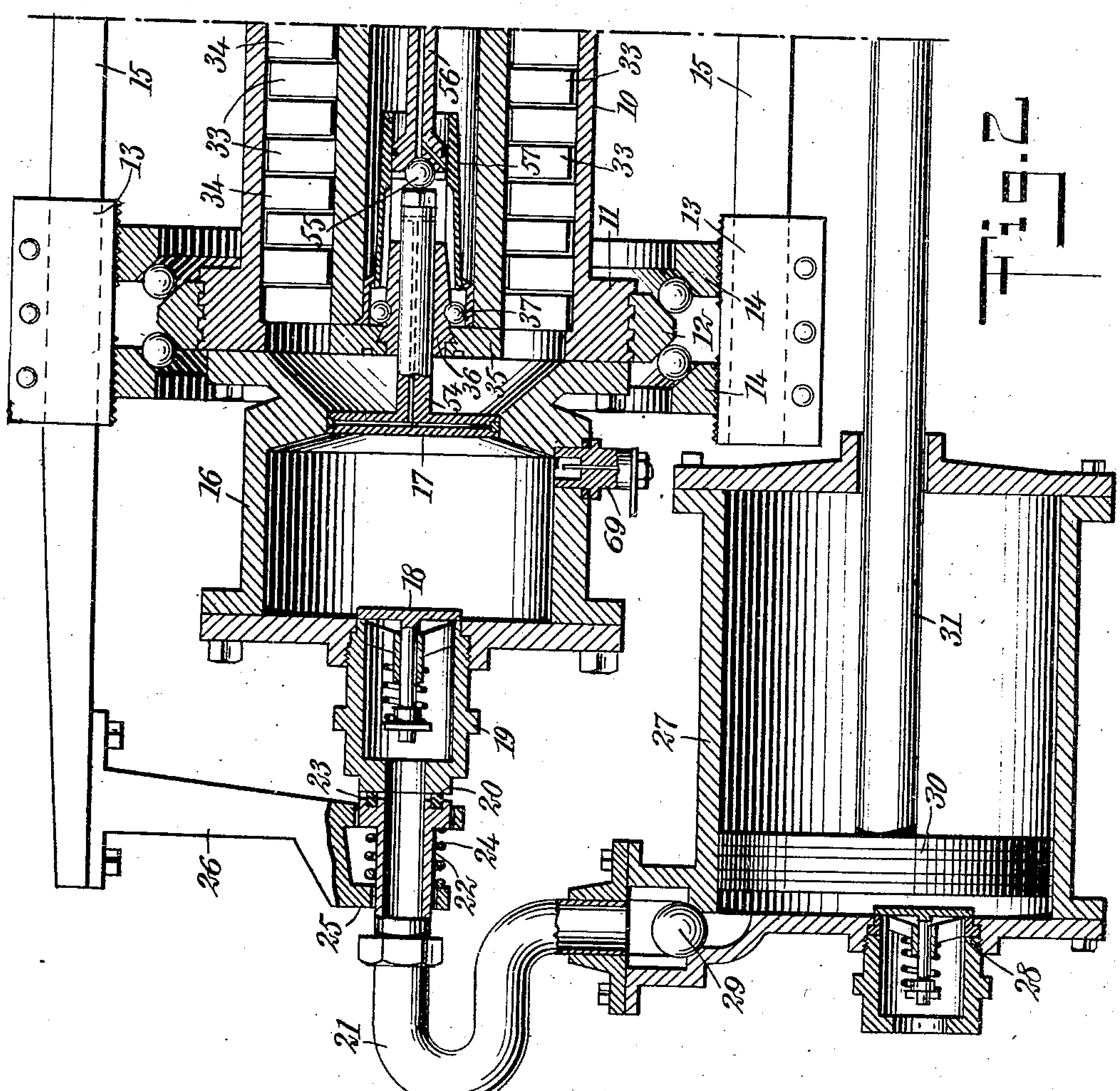

Fig. 2

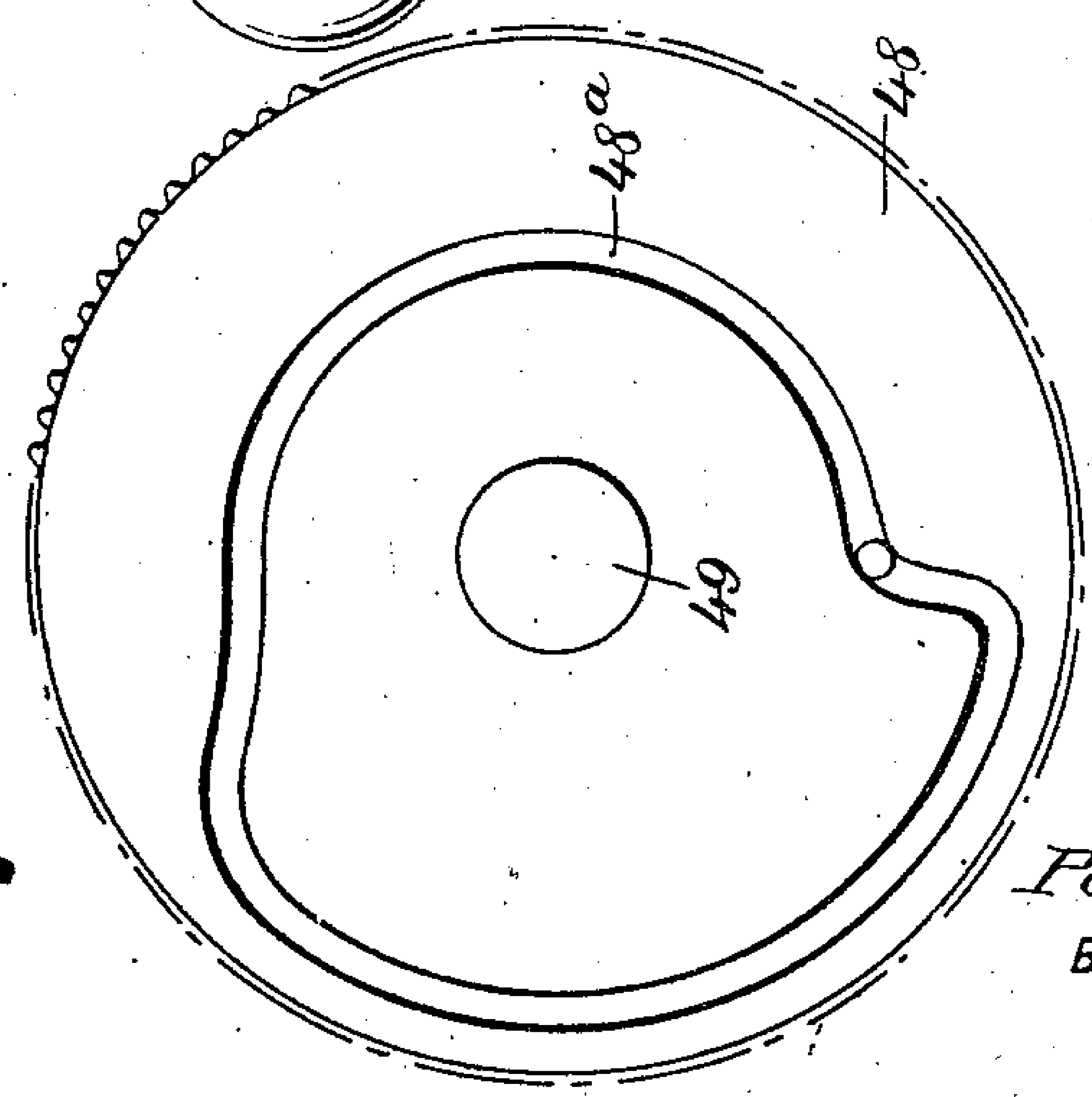

Fig. 4

WITNESSES

John A. Bergstrom

C. W. Fairbank

INVENTOR

Paul Krause

BY Munn & Co

ATTORNEYS.

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3 SHEETS—SHEET 3.

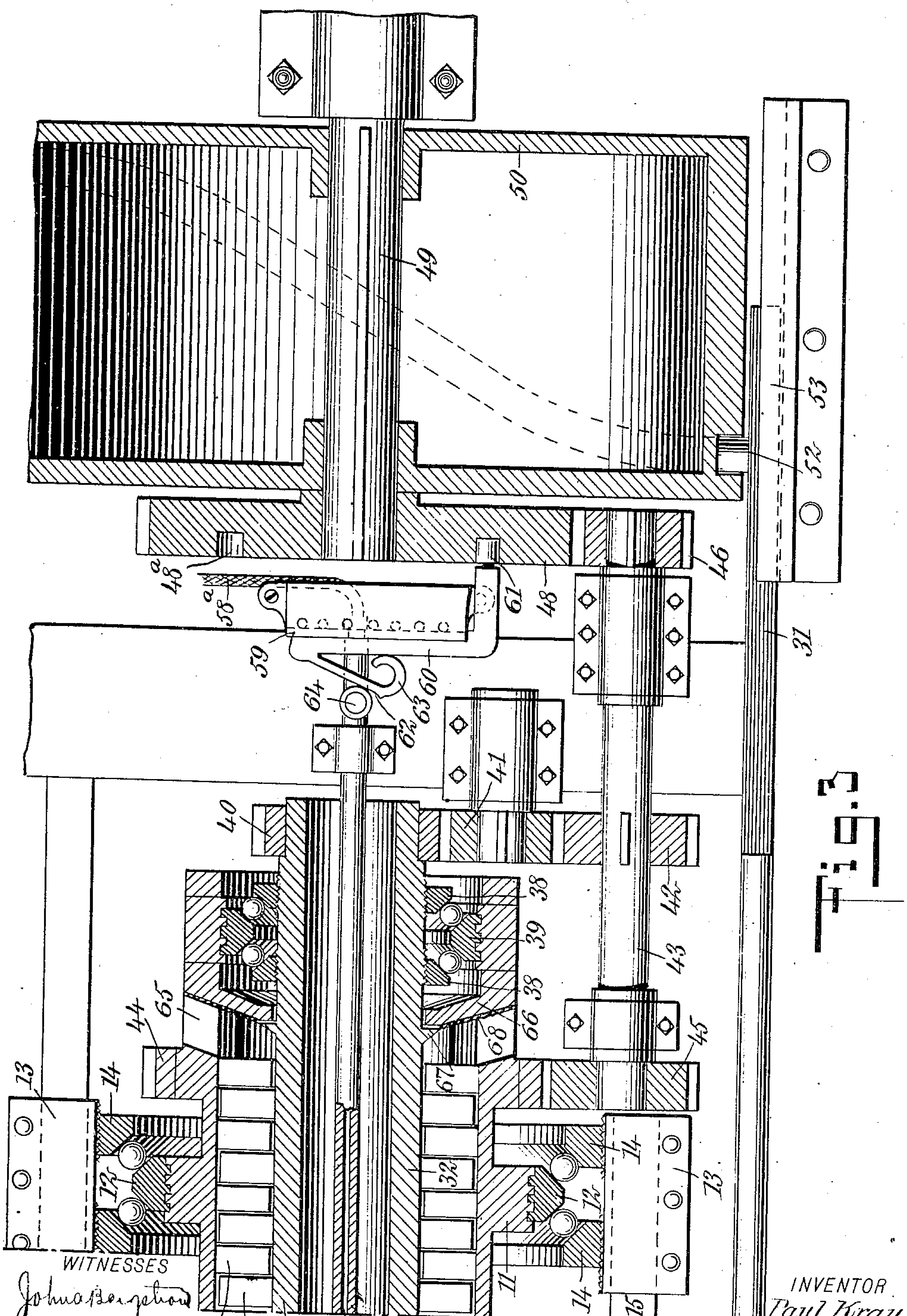

Fig. 3

WITNESSES

John A. Bergstrom

C. W. Fairbanks

INVENTOR

Paul Krause

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

PAUL KRAUSE, OF BABYLON, NEW YORK.

INTERNAL-COMBUSTION TURBINE.

No. 880,458. Specification of Letters Patent. Patented Feb. 25, 1908.

Application filed April 10, 1907. Serial No. 367,360.

To all whom it may concern:

Be it known that I, PAUL KRAUSE, a citizen of the United States, and a resident of Babylon, in the county of Suffolk and State of New York, have invented a new and Improved Internal-Combustion Turbine, of which the following is a full, clear, and exact description.

This invention relates to certain improvements in internal combustion engines, and more particularly to means whereby direct rotary motion may be obtained by the combustion of explosive charges.

The object of the invention is to provide a device operating upon the same principle as the common form of steam turbine, but connected directly to a combustion chamber, whereby mixtures of air and a combustible fluid may be ignited and the products of the combustion delivered directly to the blades of the turbine.

A further object of the invention is to so construct a turbine that that portion commonly known as the stator is mounted to rotate in a direction opposite to the direction of rotation of the rotor, whereby all of the blades are rendered movable and the utmost efficiency obtained.

The invention consists in certain features of construction and combination of parts, all of which will be fully set forth hereinafter and particularly pointed out 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, and in which

Figure 1 is a side elevation of an engine embodying my invention; Figs. 2 and 3 taken conjointly illustrate a central longitudinal section through the engine; and Fig. 4 is an elevation of the gear wheel serving to operate the valve mechanism.

In my improved engine I employ an outer casing and an inner casing, both rotatably mounted and each having blades similar to the blades of the common form of turbine. Connected to the outer casing is a combustion chamber having inlet and outlet valves, and directly connected to the combustion chamber is suitable mechanism for mixing and compressing the explosive charge, said compressing means being operatively connected to a moving part of the engine.

The specific form of the engine illustrated in the accompanying drawings, comprises an outer casing 10 supported adjacent each end thereof by a set of rollers or ball bearings. The casing is provided with collars 11 integral therewith, and secured to the outer circumference of each collar are annular bearing rings 12, each having oppositely disposed bearing faces. Rigidly supported within suitable frames 13 are bearing members 14 having inclined bearing surfaces disposed adjacent the bearing surfaces of the bearing rings 12, and adapted to hold a series of balls adjacent each inclined face of each of the bearing rings 12. The bearing rings are secured to the casing in any suitable manner, as, for instance, by bayonet joints or screw threads, and all of the bearing members 14 are longitudinally adjustable within the supporting frames 13 by screw threads or other suitable form of connection. The frames 13 are connected by longitudinally disposed braces 15, which braces serve not only to hold the frames rigid in respect to each other, but prevent any longitudinal movement of either of them.

Adjacent one end of the casing 110 and rigidly secured thereto by bolts or other suitable means, is a combustion chamber 16, into which the explosive mixture is admitted under pressure and ignited. The communication between the combustion chamber and the interior of the casing is controlled by a suitable valve 17, and a second valve 18 is provided for controlling the admission of the explosive charge to the chamber. The combustion chamber being rigidly secured to the casing 10 rotates therewith, and in order to supply the charge to the combustion chamber, I provide a valve casing 19 in alinement with the axis of rotation and having a smooth outer face 20. The inner end of the casing 19 is provided with a valve seat for the spring-pressed valve 18 and is provided with an interior guideway for the valve stem, whereby upon removing the valve casing 19, the valve and valve seat are removed without affecting the adjustment of one in respect to the other. For delivering the explosive charge to the valve casing 19, I provide a conduit 21 terminating in a tube 22 supported in alinement with the axis of rotation of the casing and the combustion chamber. The end of the tube is provided with a suitable packing 23 normally contacting with the end face 20 of the casing and held in engagement therewith by a coil spring 24 co-acting with a terminal flange on the tube and one bearing 25 of the depending supporting bracket 26. The bracket serves to non-rotatably support the tube 22 and hold the same in engagement with the end of the valve casing, whereby gas may be delivered from any suitable source through the conduit 21, past the valve 18 into the combustion chamber 16. For delivering the gas to the conduit 21, I preferably provide a suitable pump chamber 27 mounted adjacent the combustion chamber 16 and having a suitable inlet valve 28 leading from the carbureter or other source of explosive mixture and delivering past a ball valve 29 to the conduit 21. Within the cylinder is mounted a piston 30, the piston rod 31 of which extends to a point adjacent the opposite end of the engine, and is adapted to be operated thereby. As illustrated this pumping mechanism is single-acting, one end of the cylinder being in open communication with the outside atmosphere through the opening in the cylinder head through which the piston rod 31 passes.

Rotatably mounted within the casing 10, I provide an inner casing 32 rotating in the opposite direction to the outer casing 10. This inner casing is provided with a plurality of rows of radially disposed blades or vanes 33, preferably slightly crescent-shaped in cross section and secured in place in any suitable manner. The outer casing 10 is provided with a similar series of rows of vanes or blades 34 extending inward radially therefrom, each row of the blades carried by the other casing lying between two adjacent rows of vanes of blades carried by the inner casing. Further description of the particular form of blades, their arrangement, and the manner of securing them in place, is thought to be unnecessary, inasmuch as any construction common in steam turbines may be readily employed.

For rotatably mounting the inner casing, I provide the outer casing 10 adjacent the combustion chamber 16 with a suitable spider 35 having openings therethrough leading from the annular chamber containing the vanes or blades to the inlet valve 17. This spider or perforated wall 35 carries an inwardly directed hub 36 having a ball raceway in its outer circumference, within which are mounted balls 37 forming a bearing for the end of the casing. At the opposite end of the inner casing 32, I provide two annular bearing rings 38 having inclined faces forming raceways for two sets of balls held against an annular bearing ring 39 secured to the interior of the end of the outer casing 10. The inner casing extends a short distance beyond the end of the outer casing and is provided with a gear wheel 40 intermeshing with an idler 41 mounted on a short stub shaft and communicating the power to a gear wheel 42 mounted on a shaft 43. The outer casing 10 adjacent one end thereof is provided with a circumferential gear 44 intermeshing with a small gear 45 also mounted upon the shaft 43. It will thus be seen that the rotation of the outer casing in one direction and the rotation of the inner casing in the opposite direction causes a rotation of the shaft 43, and it will be further noted that the two casings are caused to rotate simultaneously. The shaft 43 may be employed as the main drive shaft, if desired, but is preferably provided with a gear 46 intermeshing with a large gear 48 on a main drive shaft 49, from which the power generated may be conveyed to any suitable point of application. The shaft 49 is provided with a large pulley or drum 50 serving as a fly wheel and serving also as means whereby the pump or compressor piston 30 may be operated. As shown, the drum is provided with a cam groove 51 in its circumferential surface receiving a pin 52 carried by the end of the piston rod 31, said piston rod being held from lateral movement by suitable guides 53, and is preferably flattened upon its opposite sides to afford firmer engagement with said guides. As the drum rotates the engagement of the cam groove with the pin 52 causes the longitudinal movement of the piston rod and the consequent working of the compressor 27. The speed of the compressor may be gaged in any desired ratio to the rotation of the drum, whereby the piston may be caused to make any even number of strokes for each revolution. As shown in the drawings, the groove is of such a form that one rotation of the drum causes a forward stroke and a return stroke of the compressor piston.

For controlling the admission of the gas from the combustion chamber 16 to the annular chamber between the two rotatable casings, I provide the valve 17, previously referred to, and provide mechanism for operating the same at the proper time. The valve is carried by a valve stem 54 longitudinally mounted within the hub 36 also previously referred to, and forms with said hub a sufficiently tight joint to prevent the escape of the explosive or burned gases into the interior of the inner casing. The valve stem 54 terminates a short distance inside the inner end of the hub 36 and engages with a ball 55 fitting in a socket in the end of a longitudinally movable valve operating rod 56. The inner end of this rod is held within a sleeve 57 and is preferably provided with packing rings, whereby a tight engagement therewith is secured. The valve operating rod 56 is non-rotatably mounted, and by means of the ball 55 the resistance to the rotation of the valve stem 54 is materially reduced. The valve 17 is preferably provided with an outer cylindrical wall fitting within a cylindrical recess constituting a valve seat, and in order that a tight joint may be secured, the valve 17 is provided with a packing ring surrounding the outer circumference thereof. In order to properly lubricate this packing ring and the ball bearings 37 which support the inner end of the inner casing, I provide the valve operating rod 56 with a longitudinal passage 58 having its outer end connected to an oil delivering tube 58ª, and extending to the recess forming the seat for the ball 55, and having a branch terminating in engagement with the inner wall of the sleeve 57. The valve stem 54 is provided with a longitudinal pasage connecting with radial passages in the valve 17, whereby oil may be forced through the valve operating rod 56 into the interior of the sleeve to lubricate the ball bearings 37, and also through the valve stem 54 to lubricate the packings of the valve 17.

For manipulating the valve 17 at the proper time, I provide the gear wheel 48 with a cam groove 48ª in one face thereof, as indicated in section in Fig. 3 and in elevation in Fig. 4. Mounted adjacent the gear wheel and longitudinally movable within guides 59 is a bar 60 having one end thereof extending at right angles and supporting a roller 61 extending into said groove 48ª. To facilitate the free movement of the bar 60, the guides 59 may be provided with suitable ball bearings or rollers, as indicated in dotted lines in Fig. 3. Carried by the bar 60 at the opposite end thereof is a branch 62 of spring metal and having an inclined face. This branch terminates in a curved portion 63 also of spring metal and in engagement with the surface of the bar 60. The inclined surface of the branch 62 normally engages with a lateral projection 64 on the valve operating rod, as is clearly indicated in the drawings. The cam groove 48ª is of such a form that the roller 61 remains at the same distance from the center of rotation of the gear wheel during nearly one-half of each revolution, and remains at a different but uniform distance during a larger portion of the remaining half of the revolution. Thus the bar 60 remains in either one of two definite positions during the major portion of each revolution of the gear wheel. When the bar 60 is in one of its limiting positions, the valve operating rod 56 is held in the position indicated in the drawings and the valve 17 remains closed, while with the bar 60 in its opposite limiting position, the valve operating rod 56 may move longitudinally and permit the valve 17 to open.

To permit of the escape of the exhaust gases from the working chamber between the two casings, I provide the outer casing with a series of perforations 65 intermediate the gear wheel 44 and the ball bearings of the inner casing. To deflect the gases outward and prevent their passing into engagement with the bearing, I preferably provide an inwardly directed inclined flange 66 extending from the outer casing to the rear side of a short flange 67 carried by the inner casing. These inclined flanges receive the gas as it emerges from the last of the vanes or blades, and direct the same outward through the perforations. To prevent undue heating of the flange 66 and the parts adjacent thereto, I preferably provide said flange with a lining plate 68 of asbestos or other similar material.

In the operation of my improved internal combustion turbine, the valve 28 of the compressor is connected to any suitable carbureter or source of explosive mixture, and as the drum 50 rotates it causes the gas to be drawn into the compressor and then discharged into the combustion chamber 16. The degree of compression may be readily controlled by varying the relative sizes of the compressor cylinder and the combustion chamber. At the time the piston 30 reaches the end of its compression stroke and the gases have been transferred to the combustion chamber 16, the cam groove 48ª of the gear wheel 48 withdraws the rod 60 to permit the valve 17 to open, and the explosive mixture is simultaneously ignited by any suitable form of igniter, as, for instance, a spark plug 69. The gases are prevented from passing backward through the conduit 21 by the closing of the valve 18, and to escape they pass longitudinally through the annular chamber between the casings and into contact with the several rows of vanes or blades carried by the inner and outer casings. The gases attain a high velocity as they leave the chamber 16, and as they pass through among the vanes or blades act upon them in a manner well known in the steam turbine art. The action and re-action against these vanes cause the inner casing to rotate in one direction and the outer casing to rotate in the opposite direction, both of which motions are imparted to the shaft 43, and the power generated may be used for any purpose desired. The exhaust gases upon reaching the flange 66 pass outward through the perforations 65 to the atmosphere or to an annular chamber surrounding the casing and provided with an exhaust pipe. Meanwhile, the piston 30 has been drawn to the opposite end of its cylinder to take in a fresh charge, and at the time that the piston starts upon the compression stroke the bar 60 moves upward to force the valve 17 into place. The return of the piston 30 then compresses the charge and delivers it to the compression chamber where it is ignited and permitted to flow into contact with the vanes or blades.

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

1. In combination, an outer casing, an inner casing forming therewith an annular space, blades or vanes carried by said casings and extending into said annular space, a combustion chamber rigidly secured to the outer casing and adapted to deliver gases under pressure into contact with said vanes or blades, a valve for controlling the flow of said gases, a valve operating rod extending through the inner casing, and means adjacent the outer end of said rod for intermittently moving said rod longitudinally.

2. In combination, two casings, each having vanes or blades carried thereby, and extending into proximity to each other, a combustion chamber adapted to deliver the products of combustion against said vanes or blades, a valve controlling the flow of said products, a valve operating rod extending through one of the casings and movable longitudinally thereof and having an oil passage therethrough, and means in engagement with the outer end of said rod for intermittently moving said rod to open the valve.

3. In combination, two concentric casings adapted to rotate in opposite directions and having an annular space therebetween, vanes or blades carried by said casings and extending into said annular space, a combustion chamber adjacent one end of said casings and adapted to communicate with the annular space, a valve adapted to control said communication, said valve being rotatable in one of the casings, a valve stem supporting said valve, and a non-rotatable longitudinally movable valve-operating rod extending through the inner casing and into engagement with the end of said valve stem.

4. In combination, two concentric casings adapted to rotate in opposite directions and having an annular space therebetween, vanes or blades carried by said casings and extending into said annular space, a combustion chamber adjacent one end of said casings and adapted to communicate with the annular space, a valve adapted to control said communication, said valve being rotatable in one of said casings, a valve stem supporting said valve, and a non-rotatable longitudinally movable valve-operating rod extending through the inner casing and into engagement with the end of said valve stem, said valve stem and valve operating rod each being provided with an oil passage extending longitudinally thereof.

5. In combination, two concentric casings having an annular space therebetween, vanes or blades extending into said annular space, a combustion chamber adjacent one end of said casings and adapted to communicate with the annular space, a valve for controlling said communication, a longitudinally movable valve-operating rod concentric with one of said casings and unattached to said valve, and a longitudinally movable bar having a resiliently supported cam surface adapted to engage with said rod adjacent the end thereof for intermittently moving said rod longitudinally to operate the valve.

6. In combination, two casings having an annular space therebetween, rows of radially disposed vanes or blades extending into said annular space, means for delivering a fluid under pressure into engagement with said vanes or blades, one of said casings being provided with a circumferential row of openings adjacent one end thereof, and a flange carried by one of said casings and terminating adjacent the other casing for directing the exhaust fluid through said openings.

7. In combination, two casings having an annular space therebetween, rows of radially disposed vanes or blades extending into said annular space, means for delivering a fluid under pressure into engagement with said vanes or blades, one of said casings being provided with a circumferential row of openings adjacent one end thereof, a flange carried by one of said casings and terminating adjacent the other casing for directing the exhaust fluid through said openings, and a heat non-conducting facing plate for said flange.

8. In combination, a skeleton frame, a casing rotatably mounted therein, ball bearings intermediate said frame and said casing and adapted to support the latter and prevent longitudinal movement thereof, a second casing within the first mentioned casing and forming therewith an annular chamber, vanes or blades carried by said casings and extending into said annular space, a combustion chamber adjacent one end of said casings and adapted to communicate with the annular space, and means operatively connecting said casings, whereby they rotate simultaneously in opposite directions.

9. In combination, a skeleton frame, a casing rotatably mounted therein, a second casing within said first mentioned casing and forming therewith an annular space, vanes or blades carried by said casings and extending into said annular space, a combustion chamber rigidly secured to the end of the first mentioned casing and adapted to communicate with the annular space, a non-rotatable conduit adapted to deliver an explosive mixture to said combustion chamber, means for supporting said conduit adjacent the end of said combustion chamber, and resilient means for holding it in engagement therewith.

10. In combination, a combustion chamber, means for admitting an explosive mixture thereto, a movable member adapted to be operated by the gaseous products of combustion, a valve controlling the escape of

said gases from the combustion chamber to said movable member, and means for operating said valve, said means including a valve rod and a longitudinally movable member having a resiliently supported cam surface in engagement with said valve rod.

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

PAUL KRAUSE.

Witnesses:
JOSEPH COVERT,
HENRY KRAUSE.