No. 843,537. PATENTED FEB. 5, 1907.

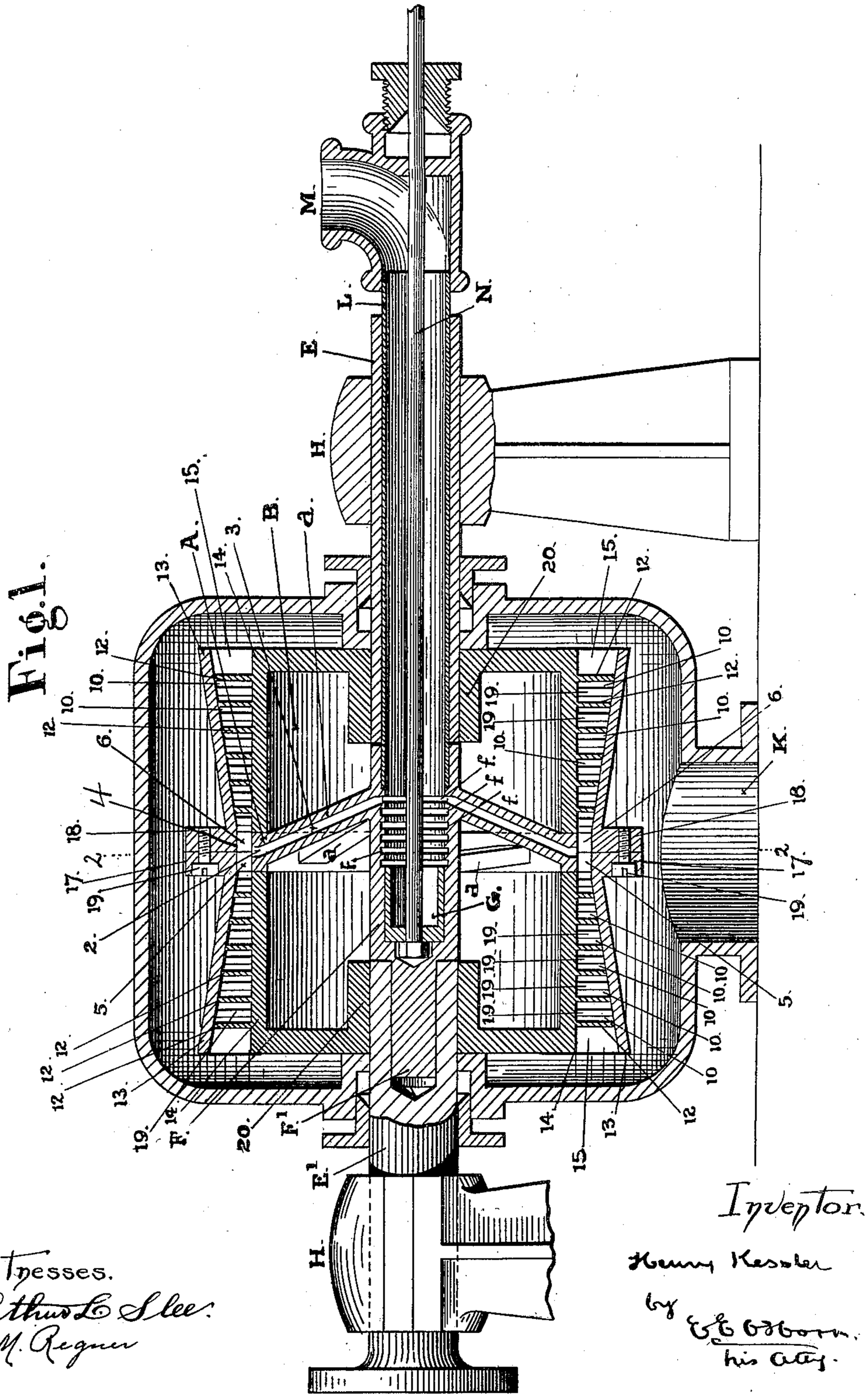
H. KESSLER.

STEAM TURBINE.

APPLICATION FILED APR. 3, 1906.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
Arthur L. Slee.
M. Regner

Inventor.
Henry Kessler
by E. G. Osborn.
his Atty.

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2 SHEETS—SHEET 2.

Fig. 2.

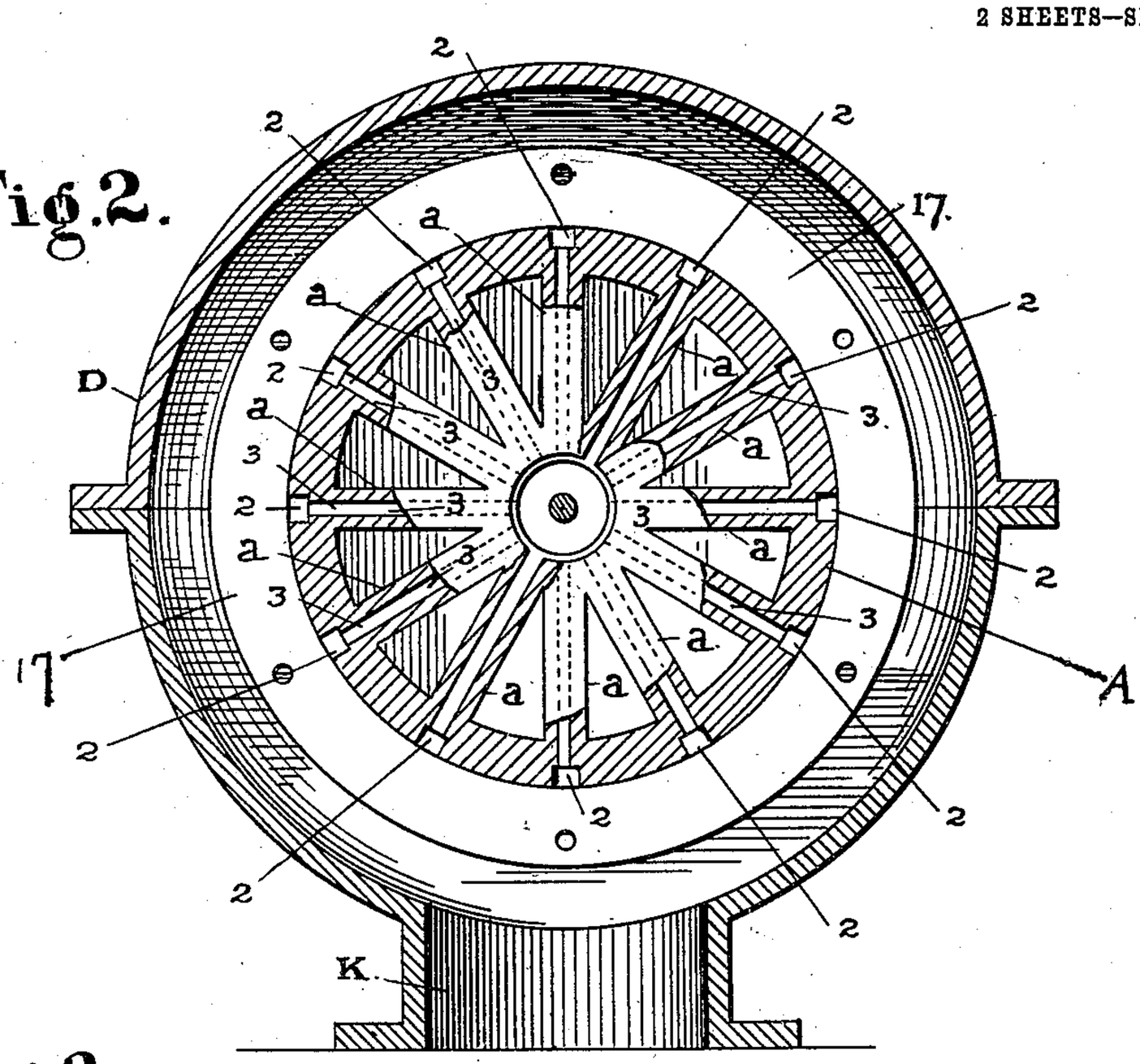


Fig. 3.

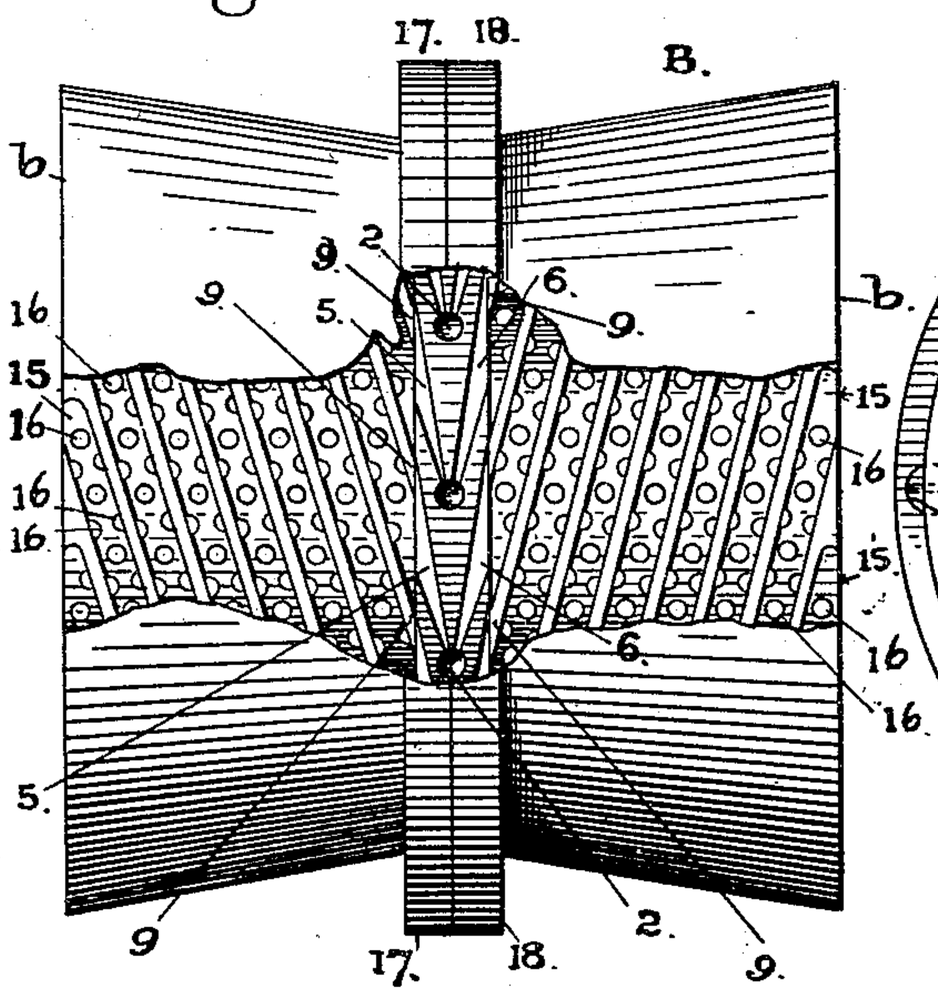
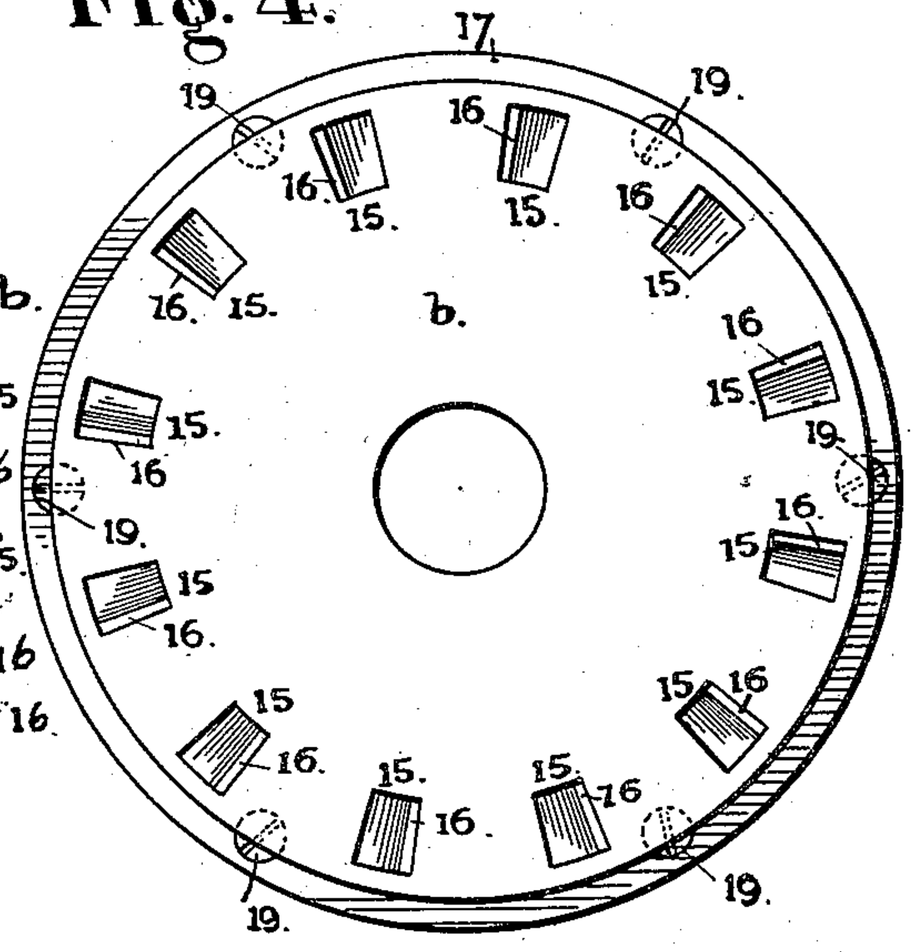


Fig. 4.



Witnesses.
Arthur L. Slee.
M. Regner

Inventor.
Henry Kessler
by E. G. Goodwin
his atty.

UNITED STATES PATENT OFFICE.

HENRY KESSLER, OF SAN FRANCISCO, CALIFORNIA.

STEAM-TURBINE.

No. 843,537. Specification of Letters Patent. Patented Feb. 5, 1907.

Application filed April 3, 1906. Serial No. 309,624.

To all whom it may concern:

Be it known that I, HENRY KESSLER, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Steam-Turbines, of which the following is a specification.

The present improvements in steam-turbines comprise a novel construction and combination of stationary circular abutment within a revolving cylindrical piston and containing live-steam ports and passages arranged at intervals apart around the circumference and at an angle to the plane of rotation of the piston; also, a rotary piston of novel construction inclosing and revolving upon a stationary abutment and having in its periphery a plurality of steam grooves or channels of novel arrangement in being divided into two sets on opposite sides of the plane in which the stationary abutment is situated; also, the combination of a stationary abutment and rotary piston of such character or construction with other parts and mechanism producing an improved steam-turbine.

The nature of the said invention and the manner in which I proceed to construct, produce, and carry out the same are explained at length in the following description in connection with the accompanying drawings, forming part of this specification.

In the drawings, Figure 1 is a longitudinal sectional view of a steam-turbine embodying my invention. Fig. 2 is a transverse section of Fig. 1 through the section-line 2 2. Fig. 3 is a side view of the rotary piston with the outer shell broken away in part to expose the live-steam ports and passages in the stationary abutment and the helical steam-grooves in the piston. Fig. 4 is an end view of Fig. 3 taken from the left side.

In this engine the steam is directed against the piston obliquely to the axis of rotation in a number of separate jets so arranged or disposed in two sets on opposite sides of a central plane passing through the piston perpendicular to its axis that the force or impact of the jets is applied and directed outwardly from the center toward the ends of the piston and at a number of points all around the circumference, those in the set on one side of the plane having a corresponding oblique direction to those in the set on the opposite side.

The stationary abutment A, containing the delivery ports and passages, consists of a ring of rectangular shape in cross-section, the top face and side faces of which are fitted to the corresponding faces of an annular groove or seat in the piston B, that incloses or surrounds the abutment, so as to secure a close joint without excessive friction.

A number of hollow radial arms *a*, connecting the ring A of the abutment with a central tubular hub F, form a support for the ring A and furnish also separate passages connecting the delivery-ports 2 in the ring A with the tubular hub. The passage 3 through each arm terminates in the peripheral face of the ring in the opening 2, from which oppositely-diverging channels 5 6 continue to the sides of the ring in two separate nozzles. The sides and bottom of these ports 5 6 are formed by the metal of the ring A and the top or remaining side by the bottom face 4 of the groove in the body of the piston, in which the ring is seated.

The inner ends of the piston-body cover the side faces of the ring and are perforated at intervals all around the circumference of the seat by the ports or apertures 9, from which the grooves 10 in the body of the piston run obliquely to the axis and in a helical direction around the axis and continue out to the ends of the piston. These grooves 10 between the inner wall 12 and the outer wall 13 of the piston-body are formed by obliquely-set partitions 14, that divide the space into a plurality of channels or grooves having their inlet-ports 9 in the side walls of the groove containing the abutment and their outlet-ports 15 in the heads or outer ends *b* of the piston. Running in an oblique direction around the axis from the inner ends of the abutment-seat to the ends of the piston in this manner, the partitions 14 receive the initial impact and force of the steam as it issues from the nozzles in the abutment; but by virtue of the length and the oblique position of these grooves with relation to the steam-nozzles all around the circumference of the piston the steam confined in and carried through them continues to receive the repeated impulses of the live steam as the inner ends of the grooves are carried across the nozzles by the rotation of the piston.

The impulsive force of the steam against the partitions is augmented by small abutments or obstructions set in the grooves, such

as pins or posts 16, fixed in the top and bottom walls in staggered rows. The same effect can be secured also by giving the side walls an irregular form or making the grooves with abrupt turns, so as to present angular projections in the path of the steam.

By increasing the cross area of the grooves from the initial point of application of the steam-jets to the outlet ends in the head of the piston room for expansion of the steam is provided, and in the present construction this increase in area is obtained by elevating the outer wall 13 of the piston-body at an angle to the longitudinal axis with a gradual increase in the diameter of the outer wall over the inner wall 13 from the middle of the piston outwardly to the heads or ends of the piston.

The channels 10 in the piston have a continuous increase in area from the inlet to the discharge end to allow for the expansion of the steam in its travel through the piston, and to that end the outer shell or wall 13 of the piston is elevated at an angle to the longitudinal axis from the inner end of each half or section of the piston to the outer end or head *b*, so as to give the channels a regular increase in cross-section from end to end.

The two parts or sections into which the piston-body is divided for convenience in placing them in position around the stationary abutment are united by flanges 17 18 on the inner ends of the sections, and screws 19, inserted through holes in one and into threaded holes in the other flange. Being separable on this contact-line, the piston is readily set in place or removed without removing or disturbing the abutment or its connection with the steam-supply pipes.

To support the abutment in position within the piston, a stationary tube on the inside of the rotary piston-shaft E is fitted in one end of the hub F of the abutment, and the opposite end of the hub is set into the adjoining end of the other section E′ of the piston-shaft, the end of the hub being reduced in diameter to form a spindle F′, for which a socket is provided in the end of the shaft. The piston is fixed on its shaft by means of a hub 20 on the head or end of each piston-section, the two parts E E′ of the shaft thus being rigidly connected together by the piston itself, so that while the intermediate hub F of the abutment is stationary the two-part shaft rotates in its bearings H, provided in the pedestals outside the casing. Stuffing-boxes of well-known character in the stationary casing D secure steam-tight joints at the points where the piston-shaft passes out through the ends of the casing, and an outlet K for the steam is carried to the outside through the base.

The radial passages 3, connecting the abutment A with the steam-conducting tube L, are arranged around the circle of the abutment at regular intervals apart, with the outlet-ports 2 all lying in the same plane. At the inner ends where they spring from the hub F their ports are situated in different planes along the axis, so as to space the outlet ports at intervals apart along the hub, and thereby afford ample area for each outlet, but chiefly to enable those ports to be controlled by a single slide-valve G. This last-named part consists of a cylinder fitted to slide in the hub F and fixed on one end of a valve-rod N, the other end of which is carried out through a stuffing-box of ordinary character on the end of the steam-inlet pipe for setting the valve from the outside. By moving this valve across the outlet-ports a greater or less number of conducting-passages are readily brought in or thrown out of communication with the steam-supply pipe, and the number of jets brought into service can be varied accordingly.

No special means for moving the valve-rod is shown in the drawings, as the rod may obviously be connected with a governor, and thus the valve acted on through variations in the speed of the engine in the usual manner, or the valve may be set by hand.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-turbine a stationary circular abutment having a plurality of delivery ports or nozzles in its circumference adapted to deliver propelling-jets at an angle to the axis of rotation and divergently outward from a central plane perpendicular to said axis toward the ends of the piston, in combination with a rotary piston having steam-grooves in its periphery arranged in two sets on opposite sides of and separated by the stationary abutment at an angle to the axis of rotation, the grooves composing the set on one side of the abutment being disposed on the periphery of the piston at equal but opposing angles with relation to the axis to those composing the other set.

2. In a steam-turbine a rotary piston having helically-set grooves in its periphery arranged in two sets on opposite sides of a central plane passing through the piston perpendicular to the axis of rotation and extending from said plane outward to the ends of the piston at opposing angles, in combination with a stationary abutment centrally situated between the said sets of grooves and having correspondingly divergent delivery ports and passages in two sets adapted to deliver propelling-jets in the direction of the helically-set grooves on opposite sides of the abutment.

3. In a steam-turbine, a rotary piston formed with helically-arranged grooves in two oppositely divergent sets extending from the center outward to the ends of the piston and on its periphery, in combination with a stationary circular abutment inclosed by and

around which the piston is adapted to rotate, said abutment having delivery ports and passages at intervals apart around the circumference adapted to deliver propelling-jets against the piston in the general direction of the helical grooves and from the center outward to the ends of the piston at equal angles to the axis.

4. In a steam-turbine, a casing, a rotary piston mounted therein, a tubular shaft extending through the casing on which the piston is fixed, said piston having helically-arranged steam-grooves in its periphery in two sets extending from the center of the piston-body outward to the ends thereof all around the circumference at equal but opposing angles, a stationary circular abutment centrally supported within the piston having delivery-ports and divergently-set passages extending from the ports through the sides of the abutment and adapted to deliver propelling-jets against the piston-grooves, means connecting said ports with a source of steam outside through the tubular shaft, and means for controlling the passage of the steam to the ports in the abutment.

5. In a steam-turbine, a cylindrical piston having helical grooves in its periphery and formed of two separable sections united by flanges, the grooves in one section of the piston-body extending from the inner end to the outer end thereof at equal but opposing angles to the grooves in the other section, in combination with a stationary abutment-ring containing delivery ports and passages interposed between the two sets of grooves and around which the piston-body is adapted to rotate.

6. In a steam-turbine a casing, a hollow cylindrical piston rotatably mounted therein, a stationary circular abutment within the piston having steam-passages leading from the center radially to the circumference and each terminating in separate and oppositely-diverging ports which are adapted to deliver propelling-jets against the piston at an angle to the axis of rotation, a shaft comprising a tubular middle section forming a support for the stationary abutment and rotatable sections at opposite ends of the middle section having the piston secured thereon, one of said rotatable outer sections being a tubular continuation of the middle section to the outside of the casing, means for connecting the said tubular shaft-section with a source of steam outside the casing, and a valve in the middle section for controlling the communication between the passages in the abutment with the tubular shaft-section.

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

HENRY KESSLER.

Witnesses:

HARRY J. LASK,

EDWARD E. OSBORN.