Aug. 21, 1928. 1,681,607

W. S. BOWEN

REACTION TURBINE

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Fig. 1

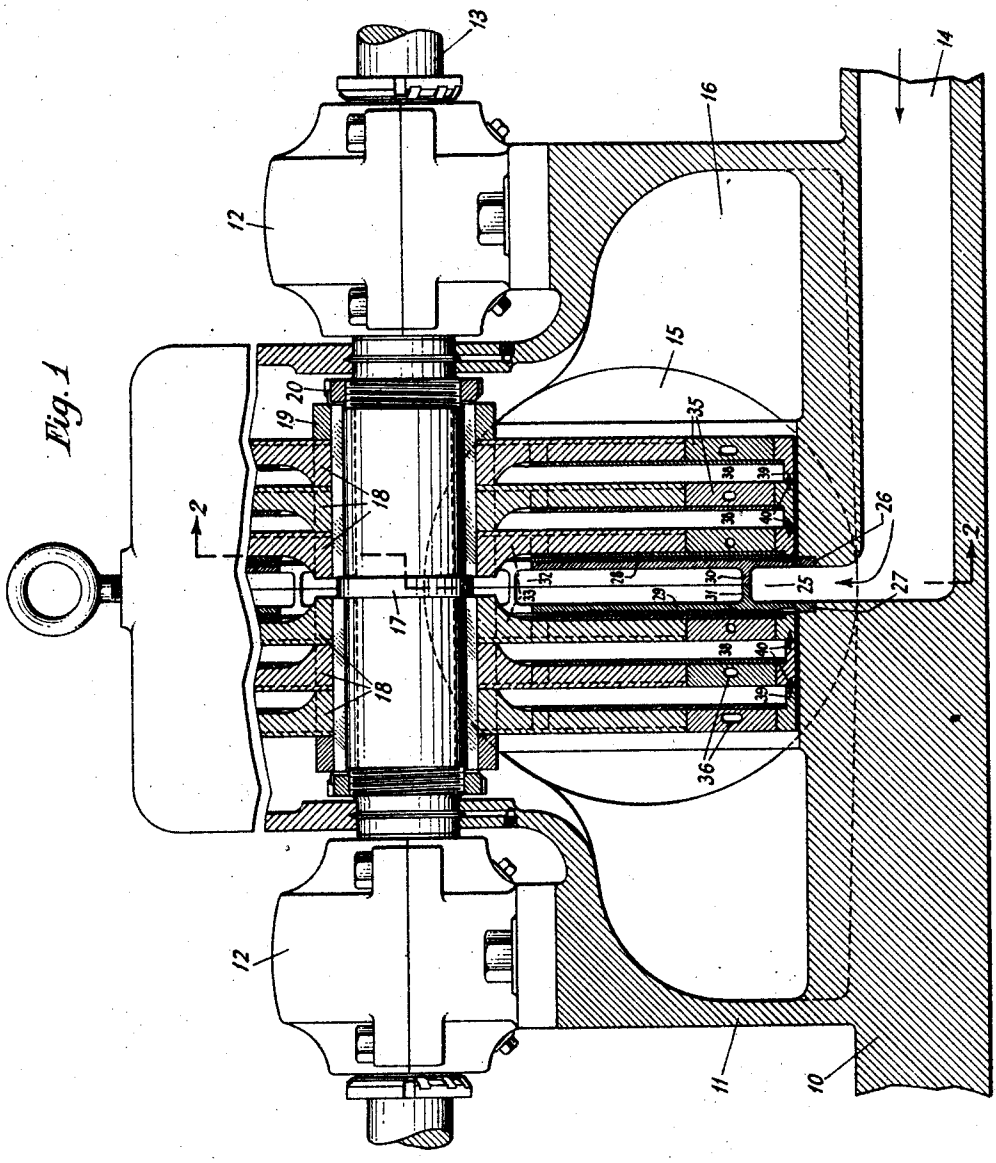

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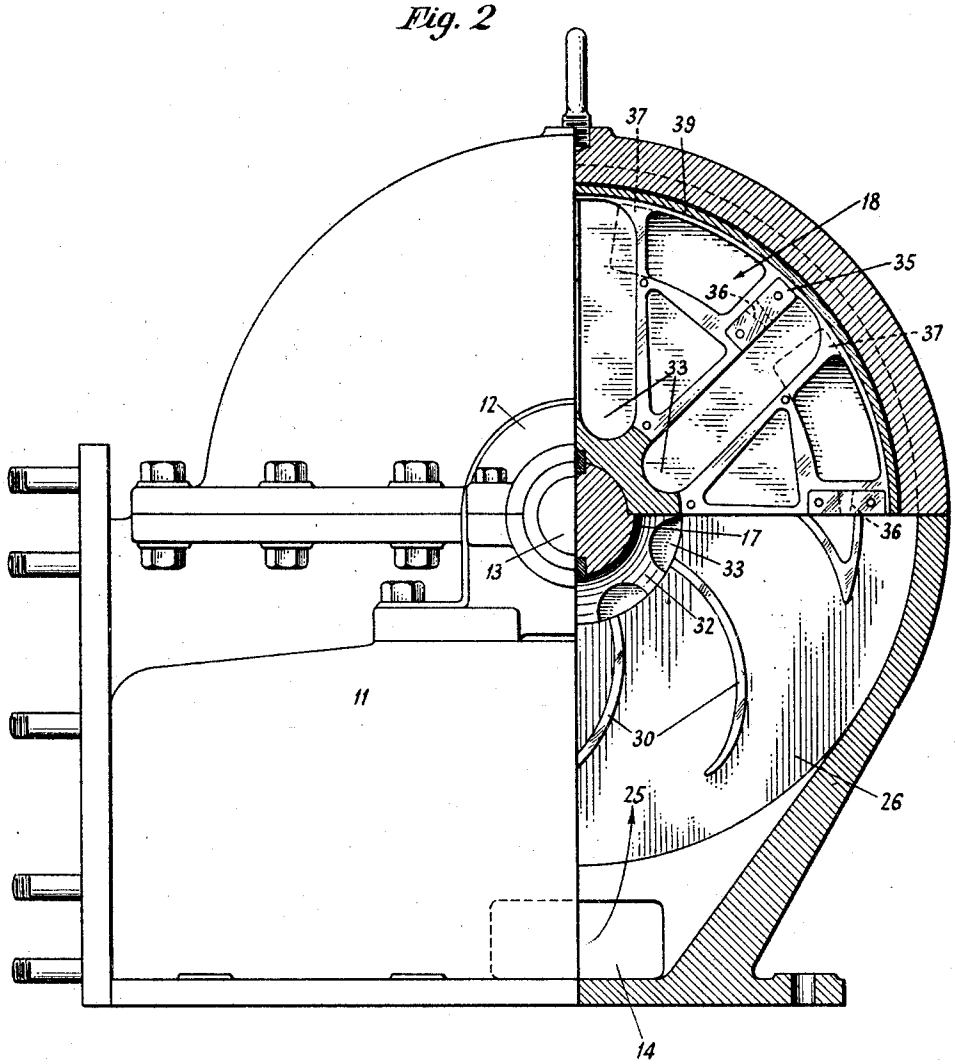
Fig. 2



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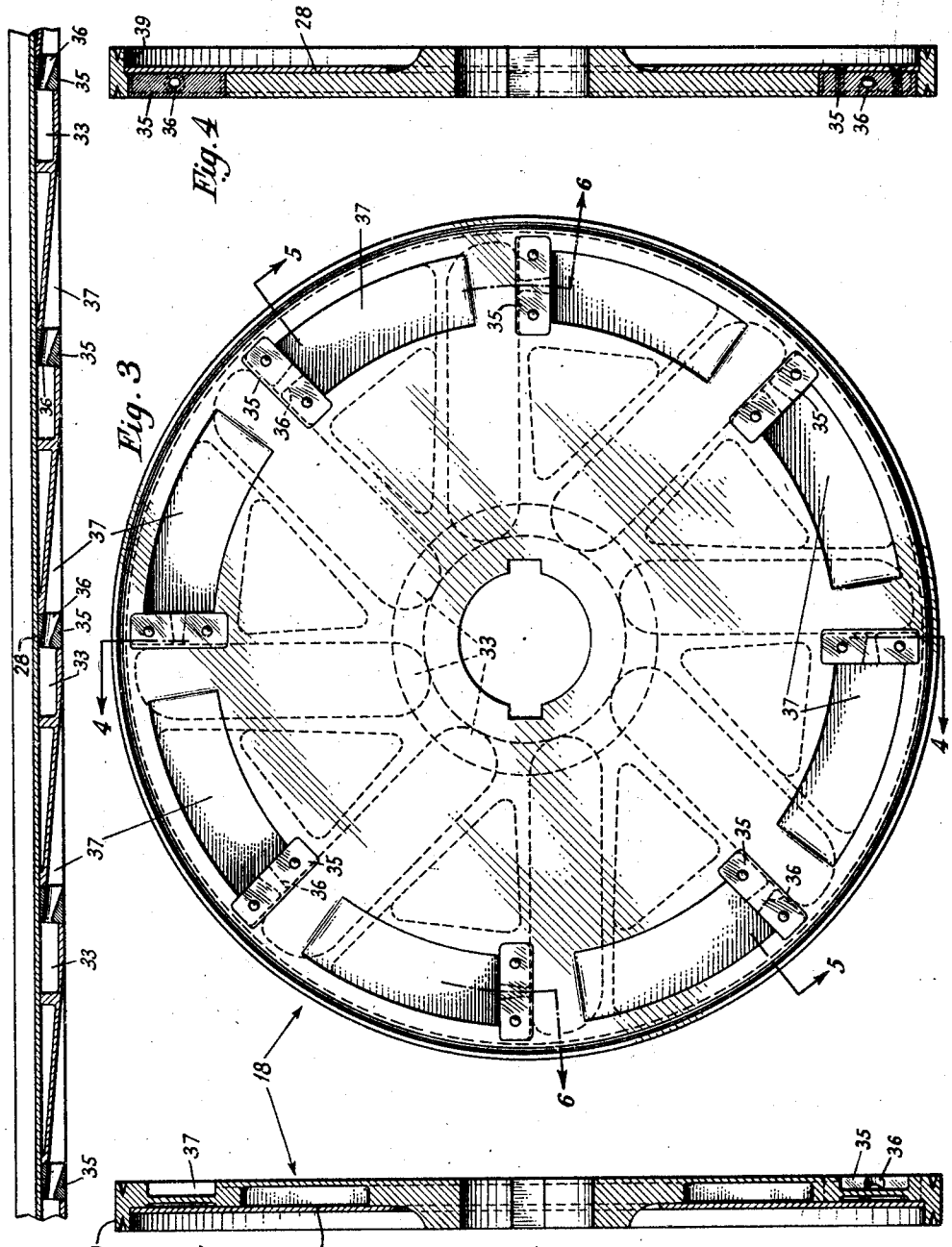

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REACTION TURBINE

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Fig. 7

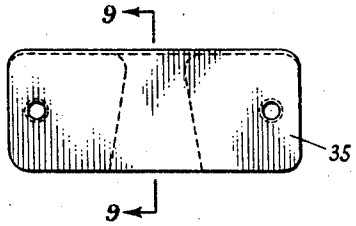


Fig. 9

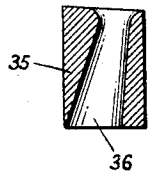


Fig. 8

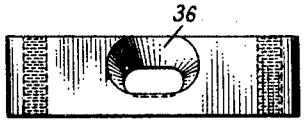
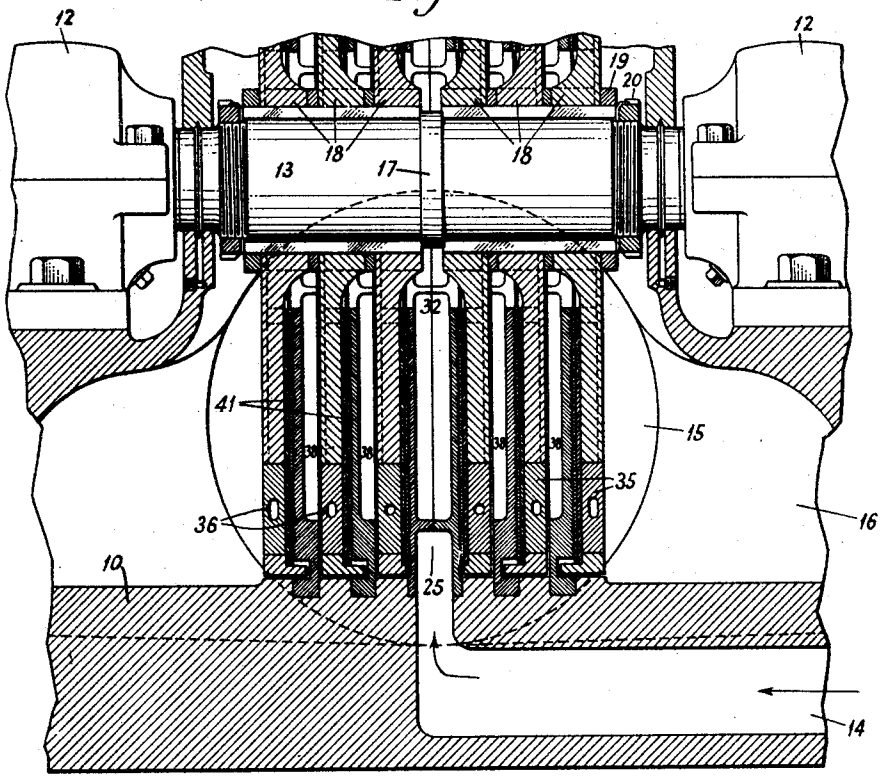


Fig. 10



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REACTION TURBINE

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Fig. 12

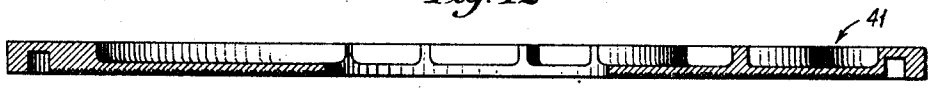
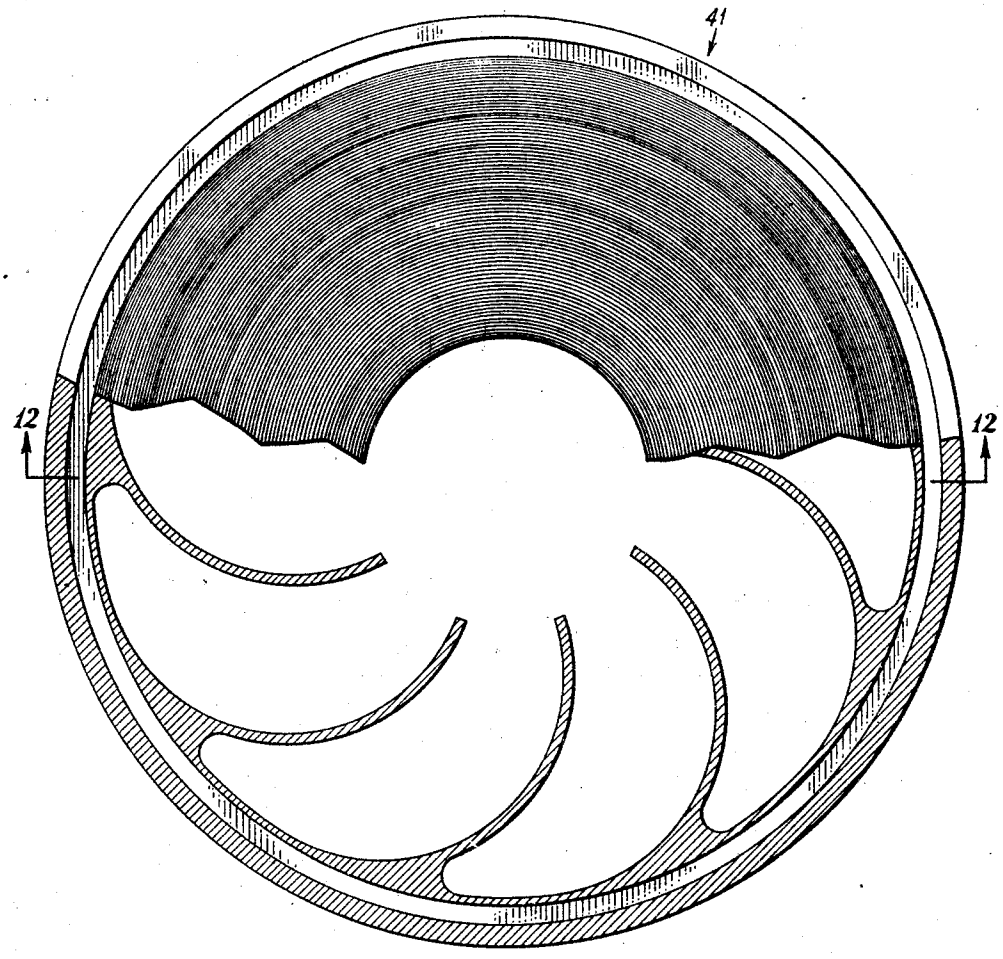


Fig. 11



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Patented Aug. 21, 1928. 1,681,607

UNITED STATES PATENT OFFICE.

WILLIAM SPENCER BOWEN, OF WESTFIELD, NEW JERSEY.

REACTION TURBINE.

Application filed September 2, 1927. Serial No. 217,146.

The invention relates to prime movers, more particularly to turbines of the reaction type utilizing an expansible fluid as the actuating medium.

The invention has for its object a turbine of the aforesaid type and in which the expansion is effected entirely within a single rotor unit composed preferably of a plurality of specially designed turbo-elements adjacently disposed axially along a common shaft.

A further object of the invention resides in the novel construction whereby leakage between stages is obviated and in which there is no relative motion between the rotating elements comprising the successive stage members, the walls of the said rotating elements affording surface ducts for the expansible fluid for conducting it from substantially the center thereof to the periphery of a said wall, and being further provided substantially at the periphery with orifices or nozzles therethrough for conveying the fluid from one stage to the next through channels on the opposite face.

A still further object of the invention resides in the arrangement of said orifices or nozzles whereby the jet of fluid delivered therethrough maintains constant angularity at all speeds of the rotor.

One embodiment of the invention comprising two series of three stages each is set forth in the accompanying drawings, in which:

Fig. 1 is a front elevation, partly in longitudinal section, of the improved turbine.

Fig. 2 is an end view, and half vertical section of the turbine taken on the line 2—2, Fig. 1.

Fig. 3 is an elevation of one of the turbine rotor disks.

Figs. 4, 5 and 6 are transverse sections taken respectively on the lines 4—4, 5—5, and 6—6, Fig. 3 of the drawings.

Fig. 7 is a plan of the nozzle member; Fig. 8 is a front elevation thereof; and Fig. 9 is a transverse section through the nozzle taken on the line 9—9, Fig. 7.

Fig. 10 is a fragmentary longitudinal section through the turbine and illustrates a modification therein.

Fig. 11 is a front elevation and part vertical section of the stationary plates associated with the rotor disks of a modified form of turbine.

Fig. 12 is a horizontal section taken on the line 12—12, Fig. 11 of the drawings.

Referring to the drawings, 10 designates a suitable supporting base for the turbine structure which comprises an enclosing casing 11 and suitable bearing blocks 12 upon opposite sides of said casing for supporting a turbine shaft 13. An inlet conduit 14 is provided in the base for delivering to the turbine a suitable expansible fluid under the desired pressure, for example, steam or products of combustion from a suitable explosive mixture; and an exhaust conduit 15 communicates with the exhaust chamber 16 of the casing for discharging the spent fluid medium.

The said shaft 13 is provided intermediate its bearings with a circular enlargement or boss 17 affording a shoulder for the various turbo-elements or rotor disks 18 which are suitably keyed thereon, two sets of three disks each being indicated as thus mounted upon the shaft and the disks of one series being reversed with respect to the other so that their supply port surfaces face the corresponding surfaces of the disks of the other series, as will hereinafter be more fully set forth. In order to secure these series of disks against endwise movement on the shaft, suitable collars 19 and nuts 20 threaded over reduced portions of the shaft may be provided.

As set forth, a multiplicity of turbo-elements 18 are secured on the shaft to afford a multi-stage turbine, each turbo-element being constructed in a novel manner and adapted to discharge the expansible medium from the one element to the adjacent one—in the two-series arrangement herein set forth, the streams of expansible fluid thus moving in opposite directions from the central distributing point.

In effecting the distribution of the expansible medium to the two sets of turbo-elements, steam or other expansible fluid is admitted through the inlet conduit 14 to the space 25 formed between two oppositely disposed stationary annular plate members 26 and 27 at the initial stage of the respective sets of turbo-elements. These plate members are fixedly secured at the circumference to the casing wall 10; and on their outer faces are provided with the labyrinth type of packing engaging the outer or cover plate members 28 and 29 of a turbo-element, while along their inner faces they are provided with vanes 30 and 31 for minimizing eddying of the fluid medium in the space 25. The said stationary plate members, moreover, terminate at the center in an annular distributing space 32 which, in turn, is adapted to com-

municate with radially disposed passageways or ports 33 in the one face of a turbo-element or disk members 18, said ports being covered, except at the extreme inner ends, by a cover plate 28 or 29.

At the outer end of each of the radial passageways or ports 33 of a disk member is mounted, as by setting the same in said disk, a nozzle block member 35 which may be secured in position as by being screwed to the said cover plate, the latter in turn being likewise screwed to the disk member. Each of the nozzle members 35 is provided with an expanding nozzle 36 which is adapted to communicate between the one face of a disk member, as at the outer end of a port 33, and the opposite face, discharging at said face into a circumferential channel 37 of diminishing cross-sectional area opening into a chamber 38 formed by the spacing flanges 39 of the adjacent disk, this arrangement being continued for successive disks, and a suitable packing 40 being provided between succeeding flanges to prevent leakage. It is preferred to provide the nozzle member substantially of the nature indicated in Figs. 7 to 9 of the drawings, each nozzle throughout the system being similarly constructed though of increasing cross-sectional area with each stage.

As a stream of fluid is discharged from a nozzle, its reaction on a disk member will serve to effect rotation of the same and, through the latter, of the turbine shaft 13 from which power may be derived in any suitable manner.

In Figs. 10 to 12 a modification in the arrangement of the sealing has been indicated in the provision of an intermediate stator element, a separate and individual sealing annulus 41 for each of the several turbo-elements being provided to this end and secured in the casing of the turbine. In this instance, each of such stationary annuli is provided on its face contacting with the cover plate of a turbo-element with a labyrinth type of packing formed on the surface of an annulus, the arrangement of the transfer of fluid from one stage to the next otherwise being precisely similar to that hereinbefore described.

I claim:

1. In a reaction turbine, embodying a plurality of stages: a shaft, a rotor member comprising a plurality of disks secured to the shaft having radially directed ports over one face and circumferential channels on the opposite face, the outer ends of the individual ports discharging into the said channels, and an annular cover plate secured to the first-named face of a disk.

2. In a reaction turbine, embodying a plurality of stages: a shaft, a rotor member comprising a plurality of disks secured to the shaft having radially directed ports over one face and circumferential channels on the opposite face, nozzle members carried by a said disk and affording communication between the outer end of a radial port and a channel, and an annular cover plate secured to the first-named face of a disk.

3. In a reaction turbine, embodying a plurality of stages: a shaft, a rotor member comprising a plurality of disks secured to the shaft having radially directed ports over one face and circumferential channels on the opposite face, expanding nozzle members carried by a said disk and affording communication between the outer end of a radial port and a channel, and an annular cover plate secured to the first-named face of a disk.

4. In a reaction turbine, embodying a plurality of stages: a shaft, a rotor member comprising a plurality of disks secured to the shaft having radially directed ports over one face and circumferential channels on the opposite face, the outer ends of the individual ports discharging into the said channels, and means to afford a peripheral seal between the disks.

5. In a reaction turbine, embodying a plurality of stages: a shaft, a rotor member comprising a plurality of disks secured to the shaft having diametrically opposed radially directed ports over one face and circumferential channels on the opposite face, and nozzle members carried by a said disk and affording communication between the outer end of the radial ports and the corresponding channels and oppositely directed to effect a couple for rotating a disk.

6. In a reaction turbine, embodying a plurality of stages: a shaft, a rotor member comprising a plurality of disks secured to the shaft having radially directed ports over one face and circumferential channels on the opposite face of progressively diminishing cross-sectional area, the outer ends of the individual ports discharging into the said channels.

7. A reaction turbine, embodying two oppositely disposed series of rotor members, each member comprising a rotatably mounted disk having radially directed supply ports over one face and circumferential channels on the opposite face into which the outer ends of the respective individual ports discharge, and an annular cover plate secured to the first-named face of a disk, the disks of one series of the rotor members being located on the shaft of the turbine with their supply port surfaces facing the corresponding surfaces of the disks of the other series of rotor members.

8. In a reaction turbine: a turbo-element comprising a rotatably mounted disk having radially directed ports over one face and circumferential channels on the opposite face, the outer ends of the individual ports discharging into corresponding channels, and

an annular cover plate secured to the first-named face of the disk.

9. In a reaction turbine: a turbo element comprising a rotatably mounted disk having radially directed ports over one face with openings at the inner end for a fluid and discharge outlets therefor at the outer end, with circumferential channels on the opposite face into which corresponding outlets discharge, and an annular cover plate secured to the first-named face of the disk.

In testimony whereof I affix my signature.

WILLIAM SPENCER BOWEN.