No. 828,827. PATENTED AUG. 14, 1906.

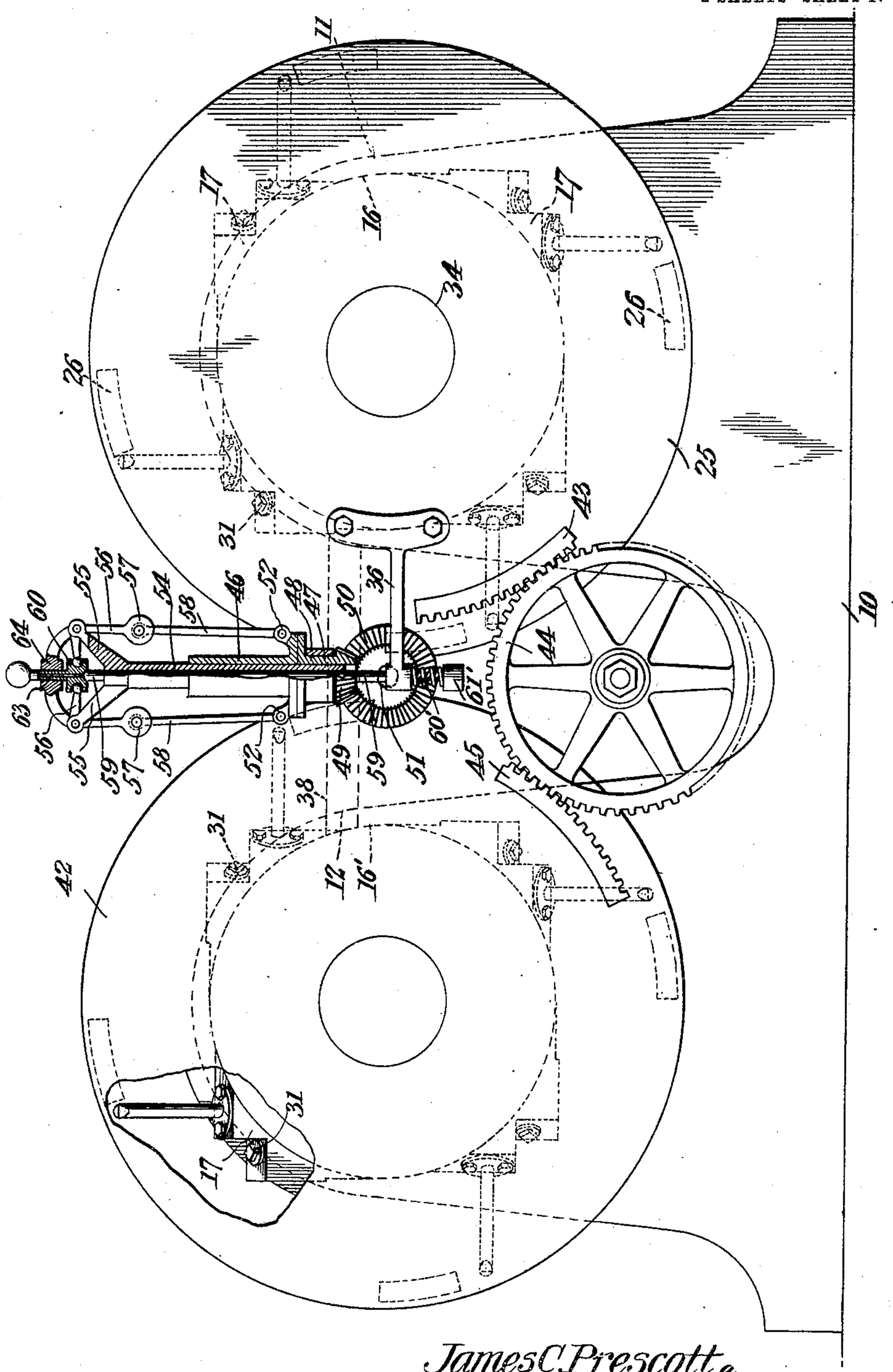
J. C. & H. A. PRESCOTT.

ELASTIC FLUID TURBINE.

APPLICATION FILED SEPT. 25, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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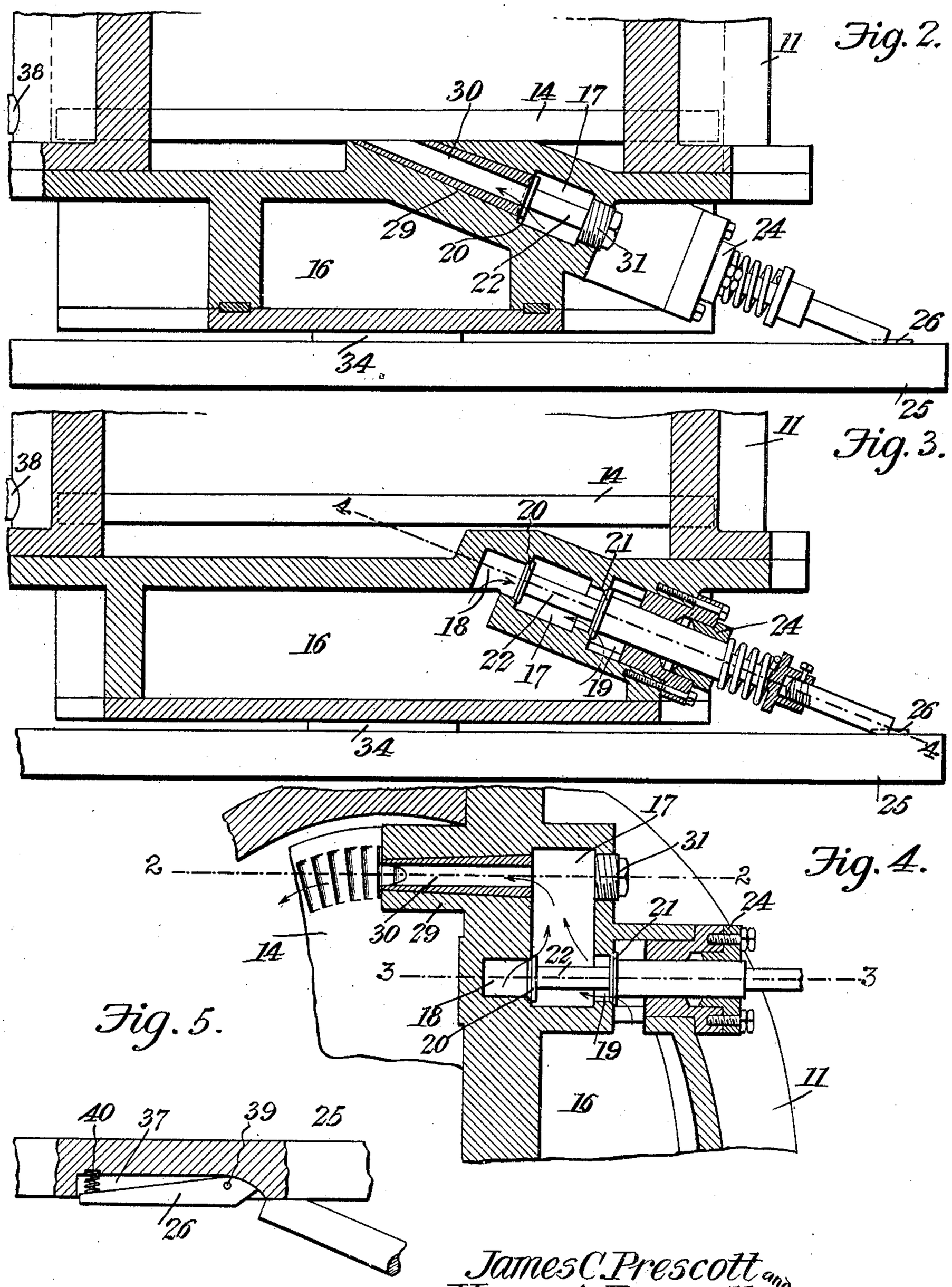

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

JAMES C. PRESCOTT AND HENRY A. PRESCOTT, OF PHILADELPHIA, PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

No. 828,827. Specification of Letters Patent. Patented Aug. 14, 1906.

Application filed September 25, 1905. Serial No. 280,015.

To all whom it may concern:

Be it known that we, JAMES C. PRESCOTT and HENRY A. PRESCOTT, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and useful Elastic-Fluid Turbine, of which the following is a specification.

This invention relates to elastic-fluid turbines, and has for one of its objects to provide a means for effectively controlling the speed and power of the turbine in accordance with the work which it is to perform.

A further object of the invention is to provide an elastic-fluid turbine having a plurality of nozzles for directing jets of fluid against the turbine vanes or blades and to employ means for cutting off the flow of fluid through one or more of such nozzles in accordance with the pressure of the fluid and the required speed of the engine.

A still further object of the invention is to provide in an engine of this type for cutting off of the nozzles in such manner as to retain a perfect balance of the turbine-disk.

A still further object of the invention is to provide a turbine-engine having an annular steam-chest and a plurality of jet-nozzles connected thereto, independent controlling-valves being placed between the chest and nozzles and said valves being arranged to be independently and successively closed by an automatic governing mechanism.

A still further object of the invention is to provide a valve and valve-operating device in which the valve is so perfectly balanced as to open and close with but trifling resistance and in which the valve-operating means is so arranged as to yield after the valve has been closed, so that in case of poor adjustment there will be no danger of straining or breaking any of the working parts.

A still further object of the invention is to provide a compound turbine in which the forces acting on the primary and secondary disk are automatically proportioned to each other, so that when the fluid-pressure actuating on one disk is increased or diminished the pressure actuating on the secondary disk will be correspondingly increased or diminished.

A still further object of the invention is to provide an elastic-fluid turbine with interchangeable nozzle members so arranged as to permit of a convenient removal of a nozzle of one diameter and the substitution of another nozzle of larger or smaller diameter, as required.

A still further object of the invention is to provide a novel form of governing mechanism wherein an extensive movement of the governor-stem may be obtained from a comparatively slight movement of the governor-arms.

With these and other objects in view, as will more fully hereinafter appear, the invention consists in certain novel features of construction and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportions, size, and minor details of the structure may be made without departing from the spirit or sacrifiicng any of the advantages of the invention.

In the accompanying drawings, Figure 1 is an elevation of a turbine constructed in accordance with the invention, parts being broken away in order to more clearly illustrate the construction. Fig. 2 is a sectional plan view through a portion of the engine, showing one of the inlet-tubes, the view being taken approximately on the plane indicated by the line 2 2 of Fig. 4. Fig. 3 is a similar view on the line 3 3 of Fig. 4. Fig. 4 is a vertical section on the line 4 4 of Fig. 3. Fig. 5 is a detail sectional view of one of the valve-stem-actuating cams.

Similar numerals of reference are employed to indicate corresponding parts throughout the several figures of the drawings.

The engine includes a base member 10, a primary cylinder 11, and a secondary cylinder 12. Extending through the ends of both cylinders are shafts on which are secured turbine-disks 14 of any approved construction. These cylinders and their valve-chests are so arranged that the steam or other fluid will first be directed into contact with the vanes or blades of the disk in the secondary cylinder.

In one head of the cylinder 11 is arranged an annular steam-chest 16, that is connected to a suitable source of fluid-pressure supply. The steam-chest is annular in form and may be placed in communication with steam-boxes 17 of any desired number. Commu-

nication between the steam-chest and the boxes 17 is established through two openings 18 and 19, formed in the walls of the box. These openings are provided with valve-seats for the reception of valves 20 and 21, that are carried by a valve-stem 22. While the diameter of the valve 21 is greater than the diameter of the valve 20, the pressure areas of both valves are equal, so that the valves may be moved to open or closed positions by mechanism of the most delicate character. The valve-stem extends through a stuffing-box 24, and its outer end, which projects beyond the outer wall of the steam-chest and cylinder, is arranged adjacent to a governor-controlled disk 25, said disk carrying valve-operating cams 26 of a number equal to the number of valve-stems.

The wall of each of the steam-boxes 17 is provided with a projecting lug 29, having a tapered opening for the reception of a nozzle member 30, and opposite the tapered opening the outer wall of the steam-box is provided with a removable plug 31 to permit the ready removal of one nozzle and the substitution of another nozzle of larger or smaller internal diameter. Owing to the fact that the nozzle-receiving opening is tapered, the nozzle will be firmly held in place by the pressure of the actuating fluid.

Projecting from the end of the steam-chest is a circular boss 34, on which is mounted a disk 25, and to the disk is secured an arm 36, the outer end of which is connected to a suitable governing mechanism. The disk 25 controls the opening and closing of the valves, and thus regulates the speed and power of the engine. The inner face of the disk is provided with recesses 37 of a number equal to the number of valves, and in each recess is arranged a valve-operating cam 26, pivoted on a pin 39 at one end and normally held outward by a yieldable compression-spring 40. That end of the cam which is arranged to engage the end of the valve-stem is tapered or inclined, and as the disk is turned the cam gradually forces the valve-stem inward and closes the valve. Should the parts be imperfectly adjusted and the valve moved to closed position before the valve-stem has reached the end of the cam-surface, the cam is free to move backward, so that binding or breaking of the parts is prevented.

The several cams are so arranged as to act on the valve-stems at widely-separated points with a view of preserving the balance of the turbine-disk. When the governor-disk is rotated to an extent sufficient to close one valve and then is rotated for the purpose of closing the second valve, the said second valve is rotated at a point diametrically opposite the valve first closed, and the third and fourth valves will be similarly rotated, it being desirable to shut off the jets in this manner rather than stop the flow at successive nozzles all located at one part of the turbine-disk.

After the steam has acted on the turbine-disk of the primary cylinder it passes through a pipe 38 to the steam-chest 16′ of the second cylinder and there acts in a similar manner on the secondary turbine-disk. The jet-nozzles leading from the secondary chest are of a number equal to the jet-nozzles leading from the primary chest, and the flow of fluid through these nozzles is controlled by a governor-actuated disk 42 of a construction similar to the disk 25. The disks are connected for mutual movement by means of gearing, the disk 25 carrying a rack 43, that intermeshes with a gear 44, the teeth of which engage with the teeth of a rack 45, carried by the disk 42.

The governing mechanism is supported by a stationary bearing 47, carried by the fixed frame of the engine and provided with an opening for the passage of a sleeve 48, that is provided at its lower end with a bevel-gear 49, intermeshing with a bevel-gear 50 on a shaft 51, the latter receiving motion from one or other of the piston-carrying shafts. To the upper flanged end of the sleeve 48 is secured a revoluble sleeve 46, that is provided with a pair of diametrically-opposed pivot-lugs 52. This sleeve 46, as well as the sleeve 48, is provided with an opening for the passage of a hollow shaft 54, that is free to revolve and to move in the direction of its length. The upper end of the shaft 54 is provided with laterally-extended arms 55, to which are pivoted bell-crank arms 56, provided with counterweights 57, and the weighted ends of the arms are connected by links 58 to the pivot-lugs 52. Extending through the hollow shaft 54 is a longitudinally-movable governor-stem 59, on the upper end of which bears a collar 60, provided with recesses for the reception of the approximately horizontal portions of the arms 56. The collar is provided with an upwardly-extended hollow stem 63, having an upper bearing in a yoke 64, which connects the upper ends of the arms 55. The passage in the stem 63 permits the ready lubrication of the upper portion of the governor. The lower end of this stem rests on top of the arm 36, projecting from the governor-disk 25, said arm being normally held in elevated position by a helical compression-spring 60′, extended between the lower edge of the arm and a fixed lug 61 on the frame. In the operation of this portion of the mechanism outward movement of the counterweighted ends of the bell-crank arms will result in downward movement of the hollow shaft 54 and downward movement of the stem 59. As a result of the downward movement of the fulcrum-

points of the bell-crank arms the movement transmitted to the governor-stem is materially increased, and the governor-disks may be revolved to considerable extent by a comparatively slight variation in the speed of the engine.

With a machine constructed in accordance with this invention the quantity of steam employed, as well as the speed and power of the engine, may be accurately controlled and the relative proportions of steam volumes and pressures used in the primary and secondary cylinders will remain constant.

Having thus described the invention, what is claimed is—

1. In an elastic-fluid turbine, a turbine-disk, a steam-chest, nozzles for controlling steam from the chest against the disk, independent valves for controlling the flow of steam through the nozzles, and a governor-controlled disk having valve-actuating cams so arranged as to successively close valves that are spaced from each other in successive order and thus preserve the balance of the engine.

2. In an elastic-fluid turbine, a turbine-disk, a steam-chest, a plurality of nozzles leading from the steam-chest, independent valves for the said nozzles, and a governor-controlled cam-carrying disk having yieldably-mounted cams for engaging the stems of said valves.

3. In an elastic-fluid turbine, the combination with a turbine-disk, of a steam-chest, a plurality of steam-boxes having ports in its opposite walls for communication with the steam-chest, a pair of valves for closing said ports, the pressure areas of the valves being equal, a stem carrying each pair of valves, a governor-controlled means for actuating the stems, and nozzles leading from the steam-boxes.

4. In an elastic-fluid turbine, the combination with a turbine-disk, of a steam-chest, a plurality of steam-boxes, the walls of each box having a pair of alining ports for communication with the chest, a valve-stem, a pair of valves carried by the stem and arranged to close the ports, said valves having equal pressure areas, a governor-controlled disk having cams for engaging said valve-stems and nozzles leading from said boxes.

5. In an elastic-fluid turbine, a turbine-disk, a steam-chest, nozzles for directing steam from the chest against the disk, independent valves for controlling the flow of steam to the nozzles, stems carrying said valves, a governor-actuated disk and a plurality of cams carried by said disk, said cams being pivoted at one end adjacent to their stem-engaging faces, and being free at their opposite ends to permit yielding in case of imperfect adjustment of the parts.

6. In a compound turbine-engine, a pair of turbine-disks, nozzles for directing jets of steam or other fluid against said disks, the nozzles acting on the disks being equal in number, and the steam utilized in propelling the first disk being directed through the nozzles to act on the second disk, independent valves for controlling the flow of steam through the nozzles, and a governor-controlled means acting on said valves and serving at all times to maintain an exact proportion between the nozzles and the first disk and the nozzles and the second disk.

7. A compound turbine including a pair of turbine-disks, independent steam-chests one of which receives the exhaust-steam and the other high-pressure steam, nozzles for directing the steam from the chests against the disks there being an equal number of nozzles acting on both disks, independent valves for controlling the flow of steam through the nozzles, a pair of valve-disks having cams for actuating said valves, gearing connecting said disks for mutual movement, a governor, and means for connecting one of the disks to the governor.

8. In an elastic-fluid turbine, a governor means comprising a revoluble sleeve, a hollow revoluble shaft arranged therein and provided at its upper end with outwardly-projecting arms, an endwise-movable governor-stem passing through the shaft, bell-crank levers pivoted to the arms and having their inner or approximately horizontal portions engaging the stem, the vertical arms of said levers being counterweighted and links connecting the counterweighted arms to the revoluble sleeve.

9. A governing device comprising an endwise-movable shaft, an endwise-movable stem arranged therein, and counterweighted arms connecting the shaft and stem and arranged on outward movement to effect endwise movement of the shaft and stem in the same direction.

10. A governing device comprising a longitudinally-movable governor-stem, a hollow shaft surrounding the same, counterweighted arms supported by the shaft, means for connecting the arms to a relatively fixed point, and means for transmitting movement of the arms to the stem, the shifting of the fulcrum-points of the arms due to movement of the hollow shaft increasing the effect in range of movement of the stem.

11. The combination with a governor, of a revoluble collar, a hollow shaft mounted therein, arms carried by the shaft, a bell-crank lever fulcrumed on said arm, counterweights carried by the approximately vertical arms on said bell-crank levers, links connecting the counterweighted arms to the collar, a governor-stem extending through the hollow shaft, a spring tending to receive downward movement of the stem, a yoke connecting

the fulcrum-arms, a stem having a bearing in the yoke, a collar or plug carried by the stem and arranged to bear on the upper end of the governor-stem, said collar or plug having recesses for the reception of the approximately horizontal arms of the bell-crank levers.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

JAMES C. PRESCOTT.
HENRY A. PRESCOTT.

Witnesses:
JNO. E. PARKER,
FRANK S. APPLEMAN.