No. 881,871 PATENTED MAR. 10, 1908.

R. H. RICE.

REGULATING VALVE FOR TURBINES.

APPLICATION FILED JUNE 4, 1907.

FIG. 1.

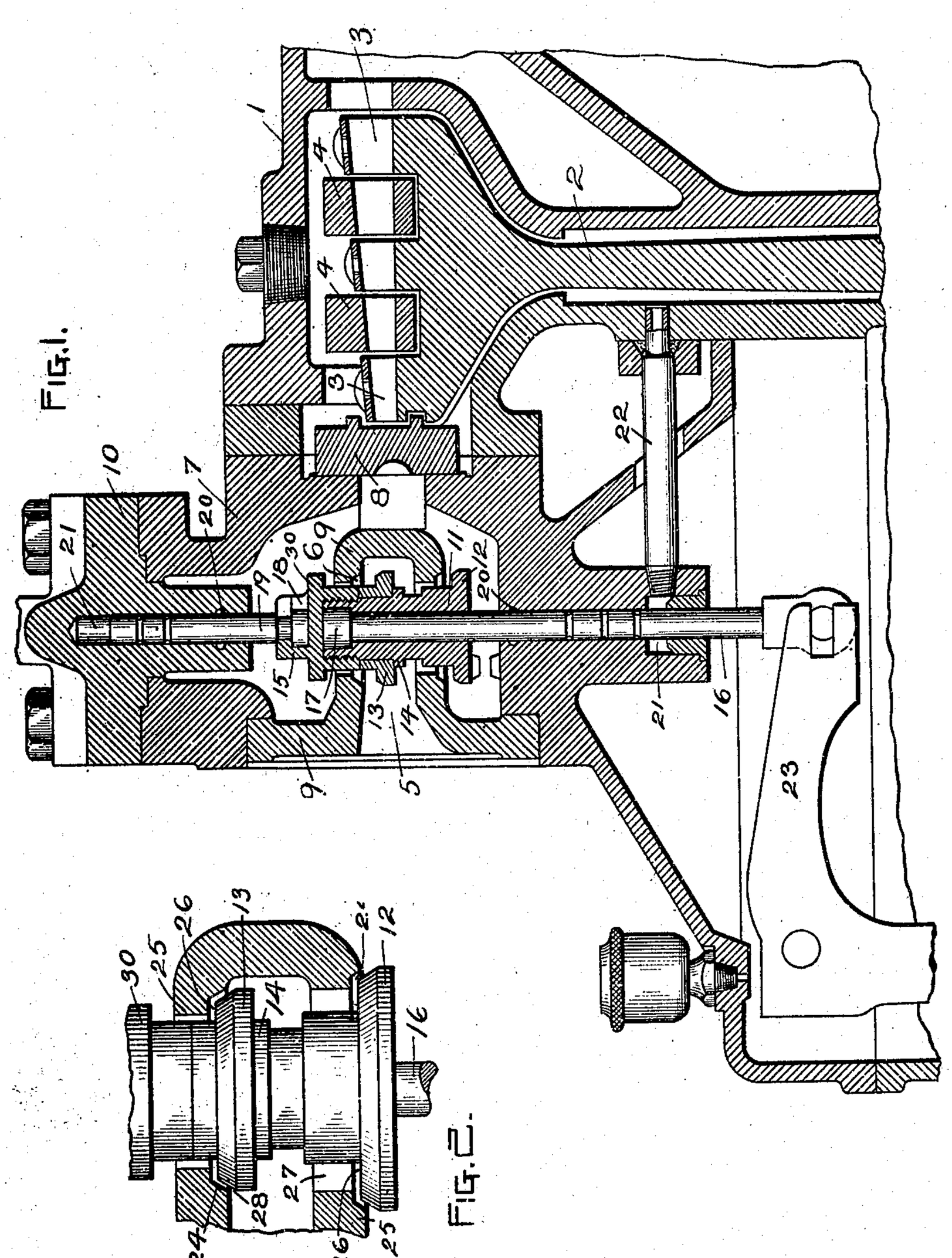

FIG. 2.

WITNESSES:
Robert B. Huggett
J. Ellis Glen.

INVENTOR,
RICHARD H. RICE,
BY Albert G. Davis,
ATT'Y.

UNITED STATES PATENT OFFICE.

RICHARD H. RICE, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

REGULATING-VALVE FOR TURBINES.

No. 881,871. Specification of Letters Patent. Patented March 10, 1908.

Original application filed June 7, 1905, Serial No. 264,059. Divided and this application filed June 4, 1907. Serial No. 377,137.

To all whom it may concern:

Be it known that I, RICHARD H. RICE, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Regulating-Valves for Turbines, of which the following is a specification.

This application is a division of my pending application Serial No. 264,059 of June 7, 1905, and is filed in response to a requirement for division made by the United States Patent Office under the provisions of Rules 41 and 42 of office practice.

My invention relates to valves and more particularly to valves used to regulate the supply of motive fluid to prime movers, such for example, as elastic-fluid turbines. Its object is to improve the construction of the valve so that the parts are readily assembled and the pressures to which the valve as a whole is subjected are balanced when the valve is closed and also when it is open and steam is flowing, thus reducing the load upon the speed responsive device which controls the position of the valve, and to secure other advantages all as set forth in the following specification.

In the accompanying drawing illustrating one embodiment of my invention, Figure 1 is a section through the valve and adjacent portions of the turbine and Fig. 2 is an enlarged view of the valve and its seats.

The valve is shown as applied to an elastic-fluid turbine, but it may be used in connection with various other machines receiving a regulated or controlled supply of motive fluid. The casing 1 of the turbine incloses a bucket wheel 2 having one or more rows of peripheral buckets 3 against which the motive fluid is directed. When more than one row of wheel buckets are employed, as in the present illustration, stationary or movable intermediate buckets 4 are arranged between the rows extending partially or entirely around the wheel.

Steam or other elastic-fluid from some suitable source entering the passage or chamber 5 passes under the control of the valve 6 to the interior of the valve chest 7 and from thence it is directed against the buckets 3 by suitable discharge devices, such as nozzles or nozzle sections, arranged adjacent the periphery of the wheel in the plate 8 or other support. The valve chest 7 is attached to the casing 1. The annular member 9 having a U-shaped vertical section and containing the chamber 5 and the valve seats, is removably secured in a shouldered recess in one face of the valve chest. This arrangement permits the seats to be readily removed for inspection and regrinding and facilitates the assembling of the parts. A cover 10 closes the opening in the top of the chest.

The regulating valve 6 is of the balanced type. It comprises a sleeve 11 formed with an annular flange 12 at its lower end. This flange constitutes one valve disk and a collar 13 fitted around the sleeve and resting on the shoulder 14 serves as the other valve disk. The flange and the collar both have the same area exposed to the motive fluid on the inlet side. The collar 13 is secured in place by a cap 15 which screws on the externally threaded end of the sleeve. The valve stem 16 extends centrally through the sleeve and has at its upper end a shouldered portion 17, which may be a removable collar, in engagement with a counterbore at the upper end of the sleeve. This portion 17 and the cap 15 cooperate to prevent endwise movement of the valve on the stem. The cap 15 is provided with a transverse slot 18 and overhanging jaws which engage the end of the guide stem 19 mounted in the cover 10. The cap and stem may be disengaged by relative movement laterally. The stems 16 and 19 are provided with a number of annular grooves which collect the moisture escaping from the valve chest and form hydraulic packings. Lubricant for the stems is fed to small annular chambers 20 in the walls surrounding the stems and passes therefrom along the stem with the escaping fluid or moisture. At the outer ends of the stems are collecting chambers 21 for the condensed steam or moisture which escapes along the stems from the valve chest. These two chambers may be connected by a pipe so that the upper chamber may drain into the lower. From the lower chamber the water of condensation passes through a pipe 22 into the turbine casing. The lower end of the stem 16 is connected with one arm 23 of a lever which is actuated by a suitable speed responsive device to vary the position of the valve and thereby control the supply of motive fluid to the turbine.

The regulating valve 6 is so constructed

that a suitable throttling action is secured and the impact and reactive effects of flowing steam do not disturb the balanced condition of the valve when it is open. The throttling action is due to the beveled portion of the disks 12 and 13 and the corresponding portions 24 of the seat-containing walls 25. Thus when the horizontal surfaces 26 of the seats and the corresponding surfaces of the disk are separated by a given distance, the width of the annular flow space between the beveled surfaces will be but substantially one-half of that distance. When closed the pressure tending to force the valve against the upper seat 24, 26 is equal but opposite to that which tends by its action on the disk 12 to move the valve away from its lower seat: When open, steam flowing from the annular region 27, Fig. 2, impinges on the horizontal surface of the lower valve disk tending to move it downward. Similarly steam issuing from the annular region 28 passes over the surfaces 24 and 26 and flowing upward impinges on the annular surface of the flange 30 formed on the cap 15 for this purpose and balances the action just described. Hence the balanced condition of the valve is not disturbed by the impact of the flowing steam when moved from its balanced closed position to its open position. Steam flowing from the region 28 over the surface 24 will impinge against the valve seat which is stationary. In issuing at high velocity from the space between the valve and its seat into the region of low velocity in the chest, the steam will also react against the surface of the seat but not against the valve. The same remarks apply to the steam issuing in the other direction from the region 27 and flowing into the region of low velocity in the valve chest.

With the mechanism described, the normal load changes are taken care of by the regulating valve, which with variation in the rotative speed, has a slight reciprocating or to-and-fro movement whereby the admission of motive fluid to the turbine nozzles is increased with decreased speed of the turbine and decreased as the speed increases. If for any reason the speed rotation should become excessive, the emergency governor shown in my pending application Serial No. 264,059 referred to above, is called into play and cuts off the entire supply of motive fluid to the turbine.

While a turbine of the well known Curtis type has been described, it is obviously within the scope of my invention to employ it with other prime movers or with any other type of turbine whether the same be of the axial or radial flow type or a combination of both types.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The combination of a stem, a balanced valve mounted on the stem, seats for the valve, and a flange on the valve against which the stem impinges when the valve is opened to keep it balanced under the action of the flowing steam upon it.

2. The combination of a valve having two disks, seats engaged by the disks and having a chamber between them which receives the steam and from which it flows outward in opposite directions over said seats when the valve is open, and a flange on the valve beyond one of the seats on which the flowing steam impinges and balances the impinging action of the steam upon the valve disk which is adjacent the other seat.

3. The combination of a valve comprising a sleeve having an annular flange which forms a valve disk, a valve seat above the disk, a collar mounted on the sleeve which forms a second valve disk, a valve seat above the second disk, a chamber between the valve seats from which the steam flows outward in opposite directions over them, a cap which secures the collar in place, and a flange on the cap above the last named seat against which the steam impinges as it flows outward over it.

4. A balanced valve comprising a sleeve having an annular flange which forms a valve disk, a collar mounted on the sleeve which forms a second valve disk, and a cap which secures the collar in place.

5. The combination of a valve stem, a sleeve on the stem having a valve disk at one end, a shoulder on the sleeve, a collar engaging the shoulder, a valve disk on the collar, a cap screw-threaded to the end of the sleeve beyond the collar which secures the sleeve to the stem and holds the collar against the shoulder, jaws upon the cap, and a guide stem with which the jaws engage.

6. The combination of a stem having a collar secured to it at one end, a sleeve through which the stem passes, the sleeve being provided with a counter-bore at one end which receives the collar, valve disks on the sleeve having beveled edges, beveled seats with which the disks coöperate, a removable cap on the end of the sleeve which secures it to the stem, a guide stem, and a connection between the cap and the guide stem.

7. The combination of a stem having a collar secured to it at one end, a sleeve through which the stem passes, the sleeve being provided with a counter-bore at one end to receive the collar, valve disks on the sleeve,

seats with which the disks coöperate, a cap screw-threaded to the end of the sleeve to attach it to the stem, a flange on the cap beyond the seat, a guide stem, and a connection between the cap and the guide stem which permits them to be disconnected by a relative movement laterally.

In witness whereof, I have hereunto set my hand this first day of June 1907.

RICHARD H. RICE.

Witnesses:
JOHN A. McMANUS, Jr.,
PHILIP F. HARRINGTON.