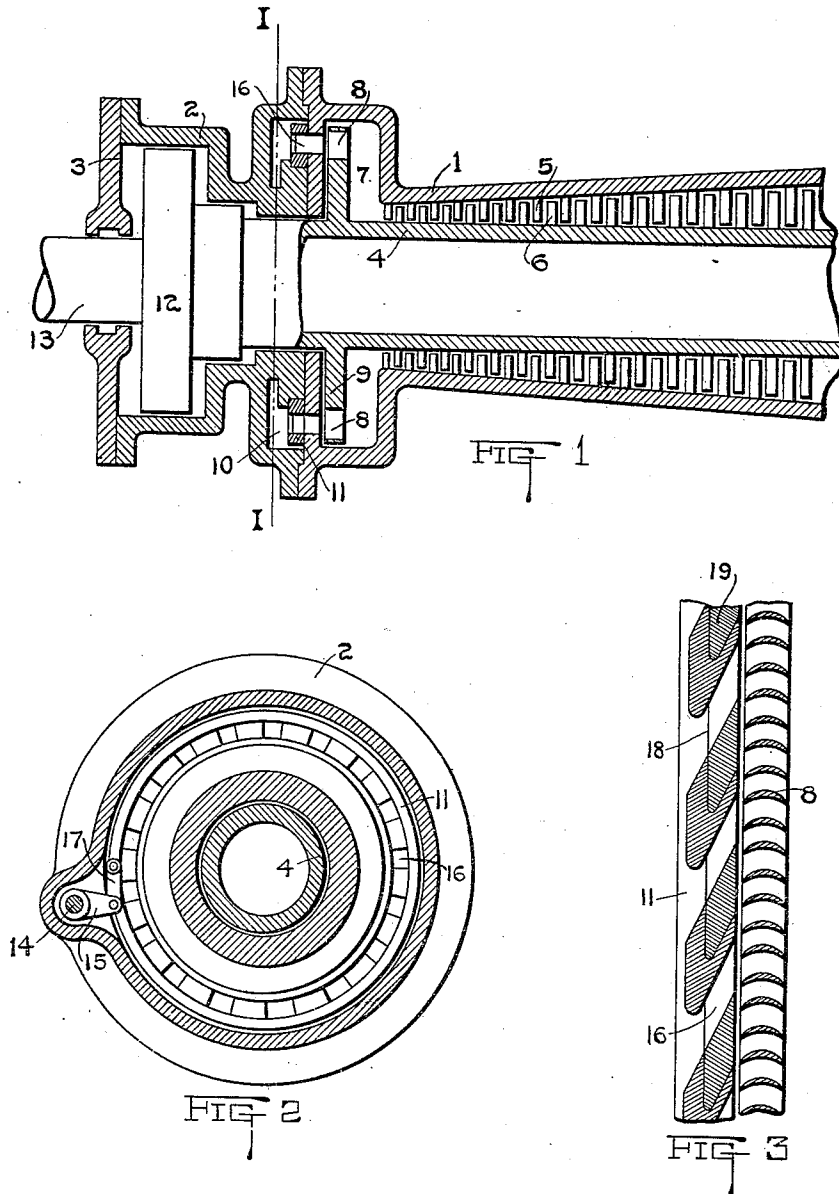


J. F. M. PATITZ.
REACTION TURBINE.
APPLICATION FILED MAR. 1, 1909.

961,087.

Patented June 7, 1910.



WITNESSES:

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REACTION-TURBINE.

961,087.

Specification of Letters Patent.

Patented June 7, 1910.

Application filed March 1, 1909. Serial No. 480,528.

To all whom it may concern:

Be it known that I, JOHANN FRIEDRICH MAX PATITZ, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Reaction-Turbine Regulation, of which the following is a specification.

This invention relates to improvements in regulating devices for the reaction type of steam turbines.

The object of the invention is to obtain a more efficient method of regulating the steam supply to the Parsons type of turbine.

The method now used to regulate the steam supply between maximum and minimum loads is by throttling the steam in a suitable valve. The objection to this method of regulation is the wire drawing of the steam in the valve and the loss of the greater part of the energy of the steam given up during its reduction from high to low pressure. Only a small part of this energy is utilized in superheating the steam by giving an increased volume to the working medium, but the greater part is not available in the turbine.

In the present invention it is proposed to admit boiler pressure steam directly to the nozzle means of a first wheel from which it will be exhausted into the steam chamber of the turbine proper. The nozzle means may be adjusted in cross section either by varying the individual nozzle sections or by cutting out one or more entire nozzles. This first wheel which also operates to drive the turbine shaft receives the steam through a regulating device, that shown is disclosed in U. S. Patent 863,210, and consists of a series of nozzles which can be controlled to admit the desired amount of steam, thus forming a regulation for varying loads.

Referring to the accompanying drawings, life reference characters denote like parts in different views.

Figure 1 is a fragmental central vertical section of a Parsons turbine. Fig. 2 is a section along the line I, I, of Fig. 1. Fig. 3 is a fragmental circumferential development of the nozzle walls about the lower part of the first wheel.

The spindle 4 and balancing piston 12 carried upon the shaft 13 operate within the casings 1, 2 and the end wall 3. Upon the spindle 4 are located the blades 6 which

rotate with the spindle 4 and pass between the series of sets of stationary blades 5 which are attached to the casing 1. The spindle 4 also forms the hub of the first wheel 9 which supports a series of blades 8 upon its periphery, see Figs. 1 and 3. This wheel 9 is preferably of the action type. The first wheel 9 is located within the steam chamber 7 from which the series of blades 5, 6, are supplied.

The steam is admitted to the chamber 7 through a series of nozzles 16 which pass through a wall of the casing 1 and emerge therefrom in line with the blades 8 of the first wheel 9, thus allowing no passage to the chamber 7 except through the nozzles 16 and blades 8. A part of the walls of the nozzles 16 are formed in the ring 11. This ring 11 is attached to the casings 1, 2, so that it can be shifted for a short distance about the spindle 4, the shifting taking place in a groove in the casing 2. This shifting can be accomplished by turning the shaft 14 which supports the crank 15. The crank 15, being connected by means of the link 17 to the ring 11, will transmit any motion given to it to the ring 11. If the crank 15 is swung down, it will pull the ring 11 in an anti-clockwise direction, thus restricting the openings of the nozzles 16. The clockwise motion of the ring 11 is limited by the lugs 19 of the casing 1, the nozzles 16 being full open when the ring 11 takes the position shown in Fig. 3. The sliding of the ring 11 upon the casing 1 takes place upon the surface 18.

In the device shown, the first wheel 9 is of the action or velocity type, this type being best adapted to be controlled by varying the opening of a series of nozzles.

In operating the turbine, steam is admitted to the chamber 10. From here it passes through the nozzles 16, from which it is discharged against the blades 8 of the first wheel 9. During its passage through this first wheel 9, the steam gives up part of its energy in the form of velocity which is effective in performing work upon the spindle 4. By regulating the nozzles 16, the amount of steam necessary to operate the turbine as well as the pressure necessary in chamber 7, can be easily attained. The steam in the chamber 7 will not be superheated at all or to such a great extent during time of light loads as heretofore common in throttling,

but the amount of work utilized in the wheel 9 will greatly exceed the amount gained due to superheating such as occurs in throttling.

It is to be particularly noted that at full 5 load the nozzles are fully open so that there is practically no drop in pressure there-through and substantially no velocity is developed therein. The small amount of velocity that is actually developed at full load 10 is only sufficient to cause the fluid to flow through the nozzles. This being the case, at full load the wheel 9 will develop no work and will be running idle, while the pressure in chambers 10 and 7 will be practically the 15 same, that is, full fluid pressure. These features constitute a radical departure from the regulation of nozzles of action turbines. In such a turbine the nozzle may be adjusted for more or less capacity of fluid flow, but in 20 any adjustment of such nozzle there will be and there is intended to be developed a substantial velocity, otherwise the wheel would run idle and there would be no work developed.

The nozzles have been shown as parallel sided or "straight" nozzles. This will be the kind used when the drop in pressure through the nozzles is less than 42 per cent. of the initial pressure absolute, and this condition will prevail when the turbine is run 30 near its normal maximum output. If, however, the turbine is run for light loads or at only a small fraction of its normal maximum output, the drop in pressure necessary for regulation will be great and if more than 35 42 per cent. of the initial pressure absolute, it will be better to use divergent or "expanding" nozzles in order to get the highest velocity economically. It will not be well to 40 use expanding nozzles with the drop in pressure therethrough less than 42 per cent. of the initial pressure absolute because of losses in the nozzle itself, as in such case the pressure falls in the nozzle itself to a value much 45 below the leaving pressure and these extra and compensating conversions, or conversion and reconversion, cause additional losses appearing as heat which cannot be used any more here than in the case of the prior art 50 where throttling is used.

If the drop in pressure through the nozzle is considerable and the velocity developed high, it may be desirable to use returns and pass the fluid through the action wheel a 55 plurality of times or to use stage translation in a plurality of wheels.

The nozzle means has been shown as a series of nozzles annularly arranged. A sin-

gle nozzle if of sufficient capacity would suffice. Or the nozzle means could be adjusted 60 as is common by cutting out one or more entire nozzles. In either case the nozzle means would be adjusted in cross section.

It should be understood that it is not desired to be limited to the exact details of 65 construction shown and described, for obvious modifications will occur to a person skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. The combination of a set of reaction blades, a set of action blades delivering to said reaction blades, nozzle means at low loads developing velocity delivering to said action blades, and means for widely opening 75 the nozzle means at high loads to develop only sufficient velocity to cause the fluid to flow through said nozzle means at substantially the same pressure.

2. The combination of an admission chamber for fluid under initial pressure, means for developing velocity in said fluid at low loads and directing same from said chamber, a wheel on which said fluid is directed, means for adjusting said developing and directing means to vary the quantity of fluid 85 passing therethrough so that at high loads the fluid flows therethrough at substantially the same pressure, and a second wheel for developing work from the pressure remaining during low loads in the fluid after leaving said first wheel. 90

3. The combination of a shaft, a reaction turbine thereon, an action turbine thereon delivering fluid to said reaction turbine, nozzle means delivering fluid to said action turbine, and means for adjusting the nozzle means in cross-section whereby said nozzle means for high loads develops no substantial velocity and the action wheel becomes 100 idle.

4. The combination of a reaction turbine, an action turbine delivering fluid thereto, nozzle means delivering fluid to said action turbine, and means for varying the capacity 105 of said nozzle means whereby said nozzle means for high loads develops no substantial velocity and the action wheel becomes idle.

In testimony whereof, I affix my signature 110 in the presence of two witnesses.

J. F. M. PATITZ.

Witnesses:

H. C. CASE,
G. F. DE WEIN.