

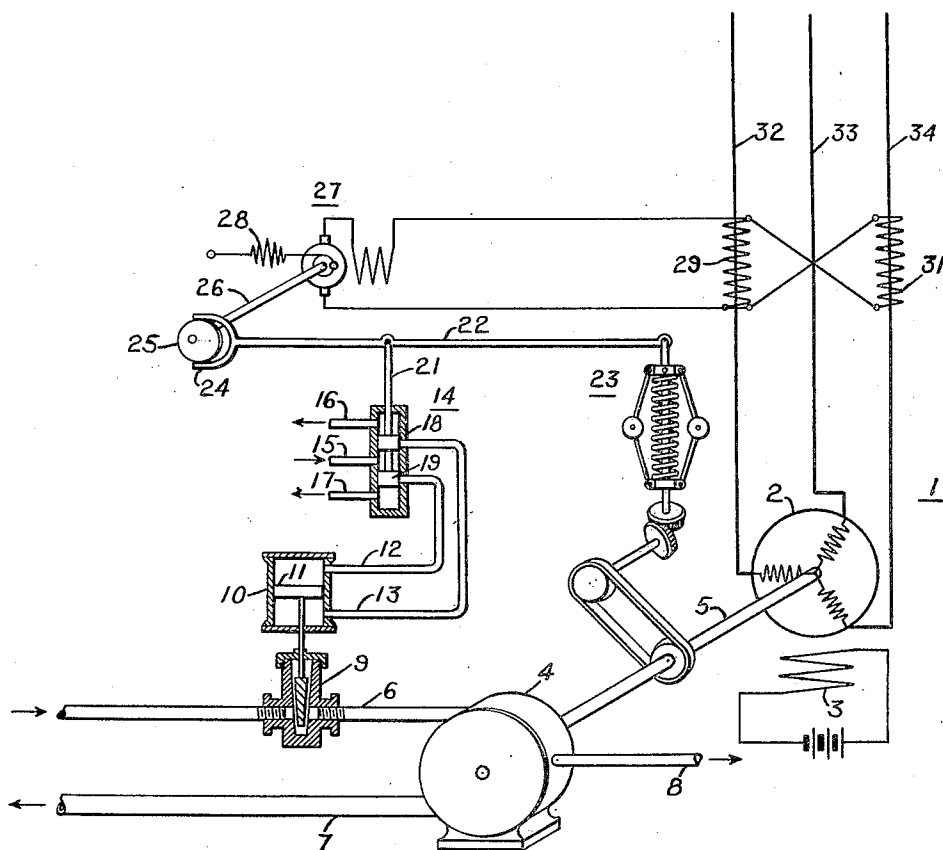
April 16, 1929.

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1,709,689

REGULATOR SYSTEM

Filed Oct. 10, 1925



WITNESSES:

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REGULATOR SYSTEM.

Application filed October 10, 1925. Serial No. 61,811.

My invention relates to regulator systems and more particularly to compensating means for the governor mechanism of bleeder turbines.

5 One object of my invention is to provide a bleeder turbine governor and bleeder mechanism with compensating means whereby a change in the amount of steam bled from the turbine will produce a corresponding change
10 in the control valve opening, whereby the turbine will continue to carry substantially the same load without an appreciable change in speed.

The term "bleeder turbine" is applied to
15 that type of steam turbine comprising a series of impulse blades for receiving the initial steam pressure and a series of reaction blades for receiving the steam at a lower pressure, and provided with a passage between the im-
20 pulse element and the reaction element for leading off steam from the turbine. This steam is led from or bled from the turbine at a comparatively low pressure for operating auxiliary apparatus or for process work, and
25 as the pressure in the bleeder pipe varies in accordance with a varying demand for use of the bled steam, a bleeder valve is operated to vary the amount of steam bled from the turbine, so as to maintain a substantially constant steam pressure in the bleeder supply at
30 the value for which it may be adjusted.

If a bleeder turbine drives an alternating-current generator that is operated in parallel relation to other generators of the system, the
35 turbine cannot appreciably change its speed unless the speed of the entire system changes, since the generators will normally remain in synchronism. As the bleeder turbine operates at a given load with a given amount of steam
40 being bled from the turbine, the steam required to pass through the turbine control or inlet valve will in that case be a fixed quantity, depending upon the power required by the turbine.

45 As the bleeder valve opens, taking more steam from the turbine, it is necessary, in order that the power output of the turbine may remain unchanged, that the turbine control valve should also open to supply a greater
50 quantity of steam to the turbine. It is obvious, therefore, that as the quantity of steam bled from the turbine is increased, the power output of the turbine will decrease, and, inasmuch as there is no appreciable change in
55 speed, the governor mechanism will not op-

erate to change the setting of the control valve. The phase angle of the generator and turbine will fall back sufficiently to decrease the electrical output of the generator by the proper amount.

In order to overcome this difficulty in the operation of a bleeder turbine, I propose to compensate for changes in load upon the turbine, caused by variations in the quantity of steam bled from the turbine, by changing
60 the setting of the control valve in accordance with changes in load upon the generator. I make use of a small torque motor that is energized in accordance with the electrical load of the generator for operating a floating
65 lever of the governor mechanism.

My invention will be better understood by reference to the accompanying drawing, in which

The single figure is a diagrammatic view
70 of apparatus comprising a preferred form of my invention.

A three-phase generator 1 is provided with an armature winding 2 and a field winding 3, and is driven by a bleeder turbine 4 by suitable means such as a shaft 5. The turbine 4 is provided with a steam supply pipe 6, an exhaust pipe 7 and a bleeder pipe 8. The supply pipe 6 is provided with a control or inlet valve
80 9 that is operated from a pressure cylinder 10 in accordance with movements of a piston 11. Pressure is supplied to the cylinder 10 by means of pipes 12 and 13, in accordance with the operation of a pilot valve 14.

The pilot valve 14 is provided with a pressure inlet pipe 15 and pressure outlet pipes 16 and 17, and with pistons 18 and 19 that are controlled by a rod 21 to control the pressure that is supplied by the pipes 12 and 13 to the opposite sides of the piston 11.

95 The pilot valve rod 21 is pivotally connected to a floating lever 22, one end of which is controlled by a fly-ball governor 23 that is driven in accordance with the speed of the turbine 4. The opposite end of the floating lever 22 is provided with bifurcations 24 that are adapted to engage opposite sides of a cam member 25 that is connected by a shaft 26 to a torque motor 27. The torque motor is normally urged or biased to a definite position
100 by means of a spring member 28, and operates to oppose the spring member, in accordance with current that is supplied from current transformers 29 and 31. This current is proportional to the electric load of
110

the generator 1, by reason of the connection of the current transformers to the three-phase supply-circuit conductors 32, 33 and 34 for the generator.

5 The operation of the system is as follows: Assume that the bleeder turbine 4 is operating at a given load and that a certain quantity of steam is being bled from the turbine through pipe 8. As a greater demand for
10 bled steam occurs, the turbine will tend to fall off in speed but, on account of its being synchronized with the power system, it will do so only to the extent of decreasing its phase angle with respect to the system, and,
15 consequently, the electrical output of the generator. This reduction in load output of the generator causes a movement of the torque motor 27 by the spring 28 in a counter-clockwise direction thereby raising the pistons 18
20 and 19 and permitting pressure to flow from pipe 15 through pipe 13 to the under side of the piston 11 so as to open the control valve 9, thereby furnishing the necessary amount of steam to the turbine to maintain substantially the former load.

Similarly, in case there is a decreased demand for bled steam, the turbine will tend to take on more load, thereby causing the generator to deliver a greater electrical load.
30 This change in load on the generator will cause an angular movement of the torque motor in such direction as to partially close the control valve 9, thereby reducing the turbine load to substantially its former value.
35 It will be apparent then that the governor mechanism is so compensated that changes in the quantity of steam bled from the turbine will not result in changes in load upon the turbine.

40 Many modifications in the apparatus and arrangement of parts may be made within the spirit of my invention, and I do not wish to be limited other than by the scope of the appended claims.

45 I claim as my invention:—

1. In combination, a bleeder turbine, a speed governor for said turbine, means for bleeding steam from said turbine, and means responsive to changes in the power output
50 of said turbine for changing the setting of

said governor to compensate for power losses occasioned by the bleeder action.

2. In combination, a bleeder turbine, an electric generator driven by said turbine, a speed governor for controlling the flow of
55 motive fluid to said turbine, and means responsive to changes in the electric output of said generator for changing the setting of said governor to vary the input to said turbine in the reverse direction from the varia-
60 tion in generator output.

3. In combination, a bleeder turbine, an electric generator driven thereby, a speed governor for controlling the flow of motive fluid to said turbine, and electro-responsive
65 means for varying the setting of said governor to maintain a substantially constant generator load irrespective of the amount of motive fluid bled from said turbine.

4. In combination, a bleeder turbine, an
70 electric generator driven thereby, a speed governor for controlling the flow of motive fluid to said turbine, and electro-responsive means for changing the setting of said governor to compensate for power losses occasioned by
75 the bleeder action.

5. In combination, a bleeder turbine, a valve for governing the flow of motive fluid to said bleeder turbine, an electric generator driven
80 by said turbine, a speed governor for controlling said valve, and electro-responsive means for effecting the operation of said valve in accordance with the output of said turbine to maintain a substantially constant generator load, irrespective of the amount of mo-
85 tive fluid bled from said turbine.

6. In combination, a bleeder turbine, a valve for governing the flow of motive fluid to said bleeder turbine, a pilot valve for controlling
90 the first named valve, an electric generator driven by said turbine, a speed governor for controlling said pilot valve, and electro-responsive means for actuating said pilot valve in accordance with the output of said turbine to compensate for power losses occasioned
95 by the bleeder action.

In testimony whereof, I have hereunto subscribed my name this 24th day of September, 1925.

STEPHEN A. STAEGE.