O. JUNGGREN & E. D. DICKINSON.

GOVERNING MECHANISM FOR MIXED PRESSURE TURBINES.

APPLICATION FILED OCT. 13, 1910.

1,020,697.

Patented Mar. 19, 1912.

3 SHEETS—SHEET 1.

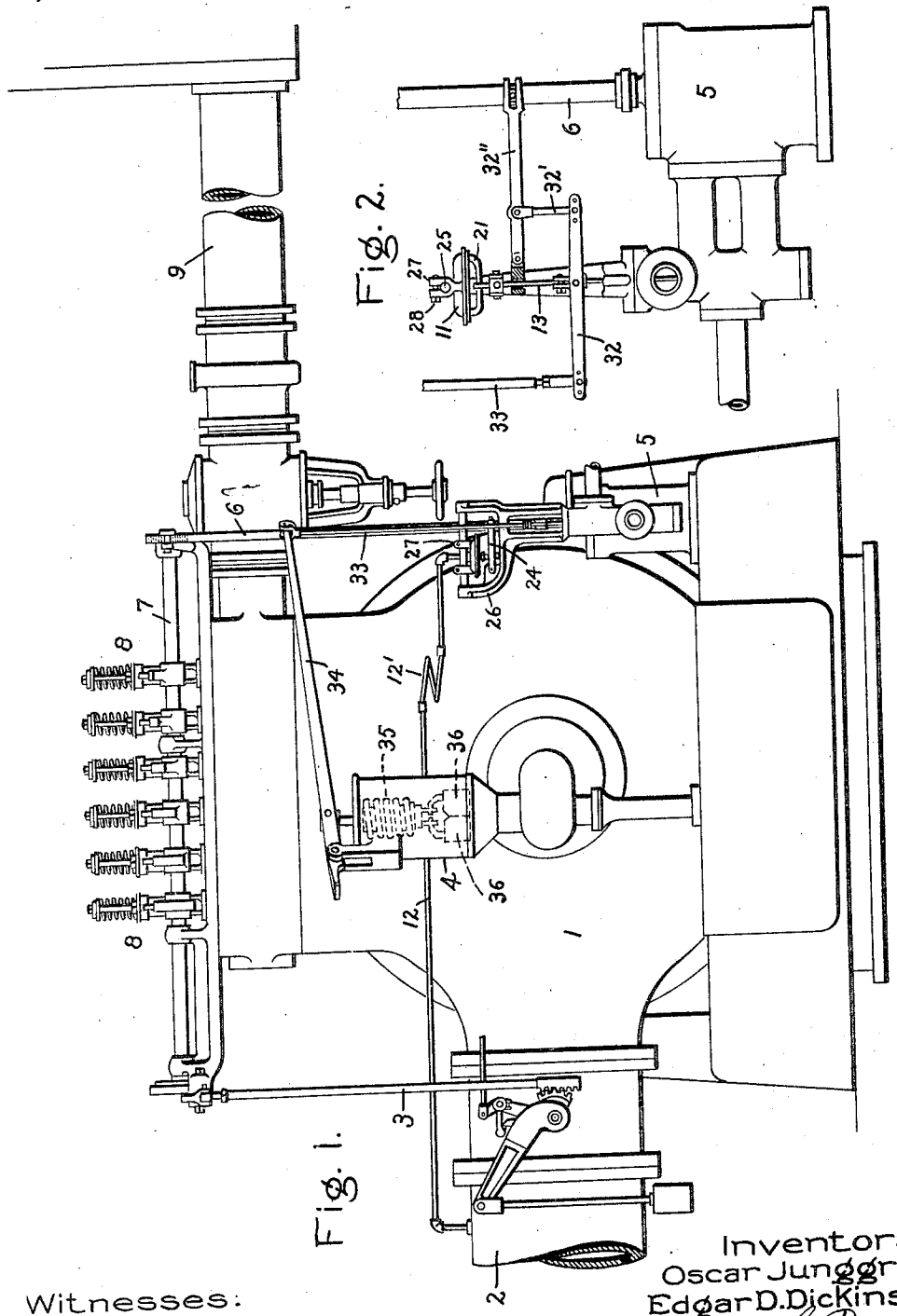

Fig. 2.

Fig. 1.

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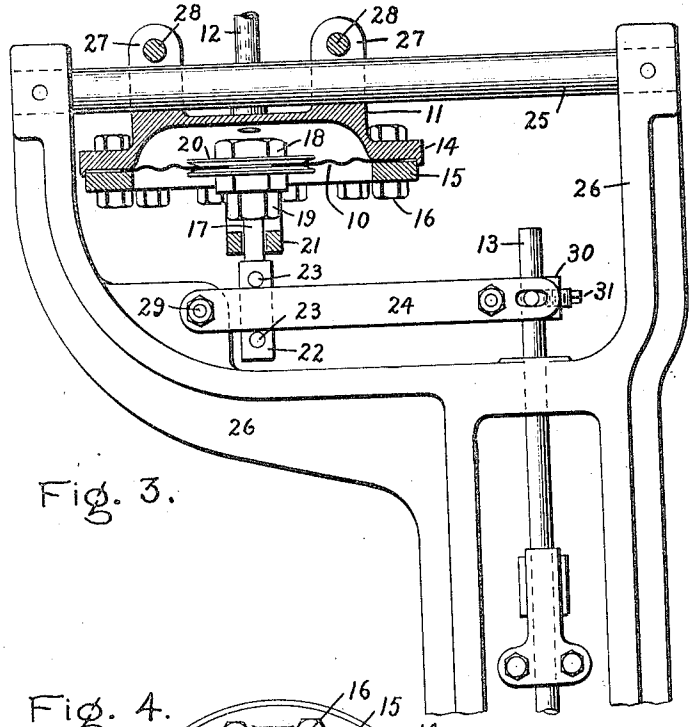


Fig. 3.

Fig. 4.

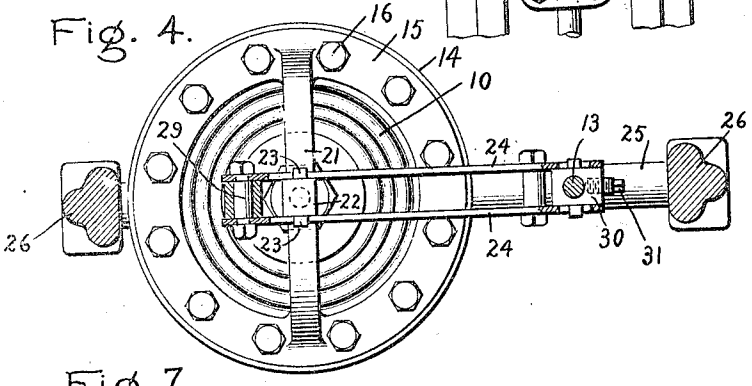
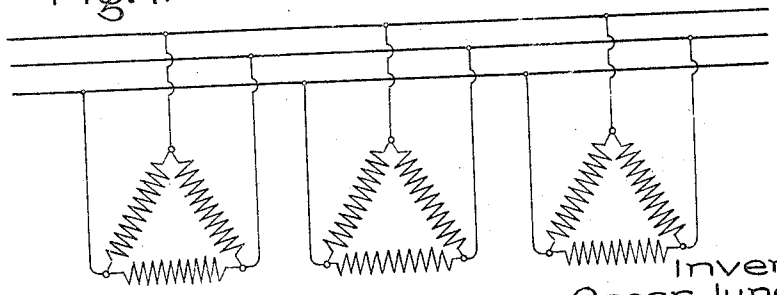


Fig. 7.



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3 SHEETS—SHEET 3.

Fig. 5.

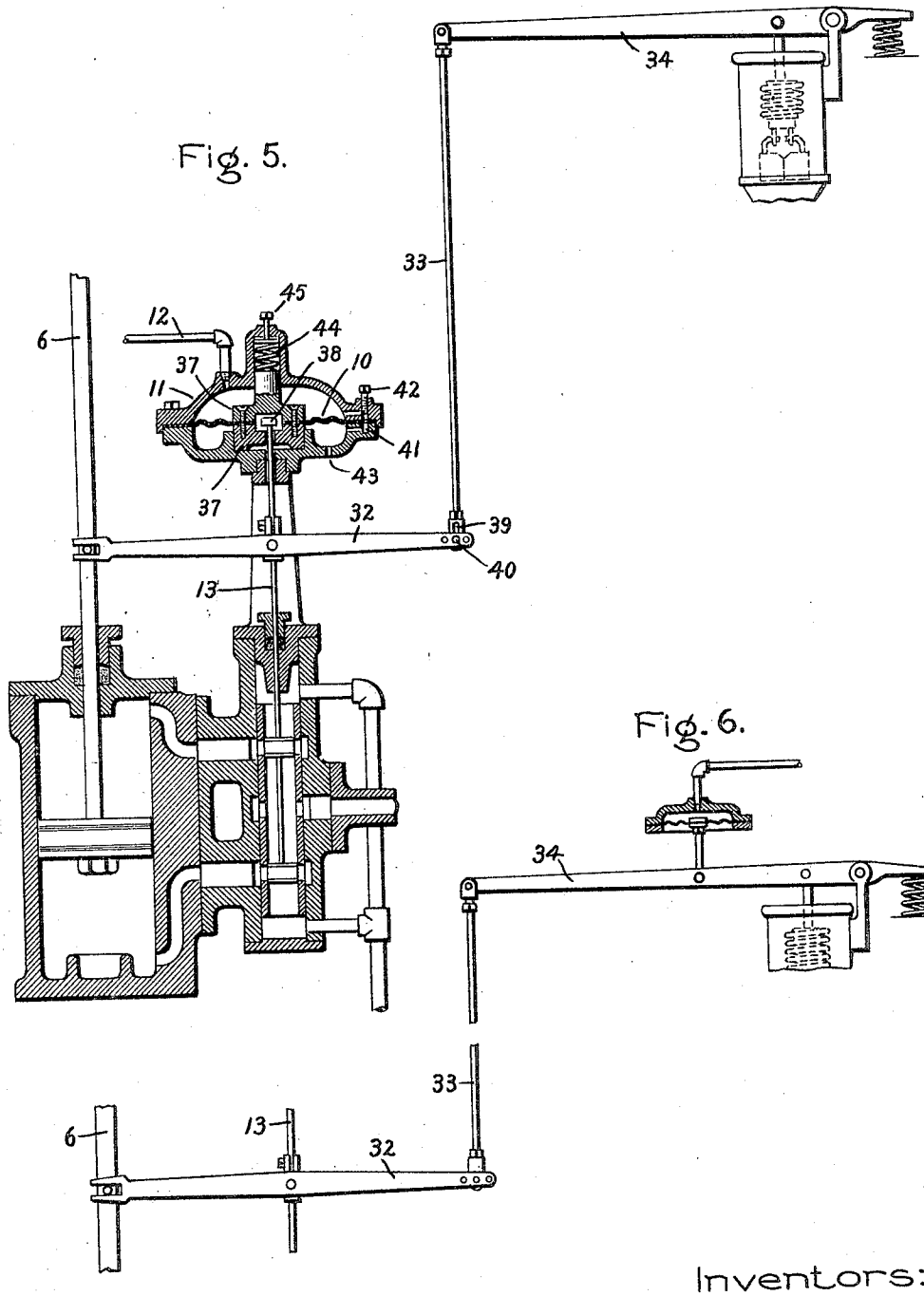

Fig. 6.

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UNITED STATES PATENT OFFICE.

OSCAR JUNGGREN AND EDGAR D. DICKINSON, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR MIXED-PRESSURE TURBINES.

1,020,697. Specification of Letters Patent. Patented Mar. 19, 1912.

Application filed October 13, 1910. Serial No. 586,906.

To all whom it may concern:

Be it known that we, OSCAR JUNGGREN and EDGAR D. DICKINSON, citizens of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Governing Mechanisms for Mixed-Pressure Turbines, of which the following is a specification.

This invention relates to systems of operating a turbine with elastic fluid at different pressures and from different sources. An ordinary instance of this kind of mixed pressure turbine, so called, is when the turbine is driven normally by the exhaust steam from a reciprocating or other high pressure engine, and is also arranged to be fed with steam at boiler pressure whenever there is a failure of the low pressure supply, or in case greater power is demanded from the turbine than it can produce with low pressure steam. In such installations the regulating devices first open more and more the low pressure valve or valves, and if the necessity arises the high pressure valve or valves will then be opened. Under some conditions a speed-responsive device may be used to control these two sets of valves, opening them in succession as the speed of the turbine drops off either from a lessened supply of low pressure steam or from an increasing load on the turbine. But when the turbine is used to drive an alternating current generator coupled in parallel with one or more similar generators driven by independent engines, it is desirable to supplement the control of the speed governor by means responsive to the pressure of the low pressure steam supply. The reason for this is that the generators tend to keep in step, so that the one driven by the mixed pressure turbine will not slow down on an increase of load but will run as a synchronous motor, robbing current from the bus bars and driving the turbine wheels. There is thus no opportunity for the speed governor to slow down, and without slowing down it will not open the live steam valves.

Our invention provides improved means whereby the lessening of the pressure of the exhaust steam will at a predetermined point open the live steam valves, so that the turbine will be enabled to carry its share of the load; that is to say, its generator will continue to supply its proportionate share of current to the bus bars instead of robbing them of current supplied by the other generators.

The invention will be better understood from the following detailed description, reference being had to the accompanying drawings in which—

Figure 1 is an end view of a mixed pressure turbine equipped with our improved regulating devices; Fig. 2 is a view of a portion of the mechanism, taken at right angles to Fig. 1; Fig. 3 is a side elevation of the pressure responsive device on a larger scale, and partly in section; Fig. 4 is a bottom plan view of the same; Fig. 5 is a view, largely in section, of a modification; Fig. 6 shows a further modification, and Fig. 7 is a diagram of electrical circuits showing three polyphase generators connected in parallel to a set of bus bars.

The turbine 1 receives low-pressure steam through the conduit 2, which is controlled by a valve operated by the rod 3. A speed governor 4 driven by the turbine is connected with said rod by a customary form of hydraulic motor 5, whose piston rod 6 rocks the cam shaft 7. Upon an increase of load, causing a slowing down of the turbine, the motor causes the shaft 7 first to actuate the rod 3 to open the low-pressure valve, to its fullest extent if necessary, and then to open the high pressure valves 8, one after the other, to admit live steam to the turbine from the main 9. Upon a decrease of load, the reverse action takes place. Our improvements have reference to certain additional mechanism whereby this operation of opening the valves will be effected by a lessening pressure of the low-pressure steam, irrespective of the speed of the turbine, whereby said turbine will be enabled to carry its share of the load when driving an alternating current generator connected in parallel with one or more similar generators independently driven, as indicated in the diagram, Fig. 7. To accomplish this, a movable abutment, preferably a flexible diaphragm 10, is arranged as one wall of a casing 11 which is connected by a pipe 12 with the low-pressure steam conduit. This abutment is mechanically connected with the stem 13 of the pilot valve of the hydraulic motor.

In Figs. 1, 2, 3 and 4, the edge of the diaphragm is clamped between a flange

14 on the casing 11 and a ring 15 secured to said flange by bolts 16. A short stem 17 is secured to the center of the diaphragm, preferably by nuts 18, 19, acting upon opposite sides of packing washers 20 clamping the edge of a central hole in the diaphragm through which the stem passes. A yoke 21 on the ring 15 serves as a guide for the stem 17, whose lower end carries a block 22 provided with opposite lugs 23 engaging a lever 24. We prefer to construct this lever of two parallel bars, as shown, between which the block 22 has a sliding fit, so that its point of connection with said lever can be shifted by moving the casing 11. For this purpose we prefer to mount said casing on a bar 25 held in a frame 26. The casing has split lugs 27 receiving said bar and provided with screws 28 by which they can be tightened upon said bar after the casing has been adjusted. The object of moving the casing and shifting the relative lengths of the arms of the lever 24 is to enable the apparatus to be adjusted to operate at different steam pressures in the low pressure conduit. This adjustment can be made for any given machine before the pipe 12 is connected, or the pipe may have a flexible coil 12′ to permit of the movement of the casing 11. The lever 24 is fulcrumed at 29 to the frame 26, and its free end is pivoted to a block 30 secured to the stem 13 of the pilot valve by means of a set screw 31. Upon a lowering of the pressure in the conduit 2 beyond a predetermined limit, the atmospheric pressure on the underside of the diaphragm lifts it, and with it the stem 13. The farther the block 22 is from the fulcrum 29 the higher will be the conduit pressure at which the diaphragm will operate, because the atmospheric pressure will operate at a greater leverage. When the pull of the diaphragm lifts the stem of the pilot valve, it also lifts the floating lever 32, pivoted at its middle to said stem and connected at one end to the piston rod 6, by the link 32′ and the lever 32″. The other end of the lever 32 is pivoted to the rod 33 which is attached to the lever 34 of the speed governor. Inasmuch as the piston rod 6 is held stationary by the liquid in the cylinder of the motor 5, the rod 33 will be pushed up by the lifting of the diaphragm 10, thus compressing the spring 35 of the speed governor and forcibly changing the position of the weights 36. The upward movement of the pilot valve admits fluid pressure above the piston of the motor 5, so that the piston rod 6 will be drawn down and the first one or two high pressure valves 8 will be opened. The follow-up devices restore the pilot valve to its mid-position and the motor comes to rest in its new position. If now the vacuum in the low-presure conduit increases, the diaphragm will be lifted again by the atmospheric pressure against the tension of the speed governor spring, and the motor piston will take a still lower position, opening more of the live steam valves 8. Upon a restoration of pressure in the conduit 2, the diaphragm will be depressed, and the motor will close the high pressure valves in reverse order to that in which they were opened.

Fig. 5 shows a modification designed to prevent too delicate a response of the diaphragm, so that small fluctuations of low pressure steam will not affect the valve-operating motor. The center of the diaphragm is perforated, and surrounding the perforation and on opposite sides of the diaphragm are two recessed plates 37 forming a chamber in which is received a head 38 on the upper end of the pilot valve stem 13. There is more or less play between said head and the top and bottom of said chamber, so that the diaphragm can move up and down within certain limits before it engages the head and actuates the valve. When it does so engage, the floating lever 32 can be instantly lifted by reason of a slight lost motion in the joint between said lever and the rod 33 of the speed governor; said lost motion being provided for preferably by a slot 39 in the rod 33 through which a pin 40 on the lever passes. The loss of motion is so small, however, that it does not seriously interfere with the control exercised by the speed governor. In order to provide for adjustment to meet varying normal degrees of pressure in the low pressure conduit, and thus vary the pull of the diaphragm, a small by-pass 41 is formed in the casing, regulated by a screw valve 42. Atmospheric pressure has access to the under side of the diaphragm by a small port 43; through which also can escape any steam leaking through the by-pass. A spring 44 acting upon the diaphragm and adjustable by means of a screw 45 affords a further means of regulating the action of the diaphragm.

In Fig. 6 the diaphragm is connected directly to the lever 34 of the speed governor, instead of to the stem of the pilot valve. The operation, however, is the same as in the other form illustrated.

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

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

1. The combination with a mixed pressure turbine having a low pressure supply

conduit, a high pressure supply conduit, and valves controlling the same, of a motor for actuating said valves, a pilot valve for the motor having a stem, a speed responsive device controlling said valve and motor, and means responsive to the pressure in the low pressure conduit that engages said stem and controls said valve and motor independently of the speed responsive device under certain conditions.

2. The combination with a mixed pressure turbine having a low pressure supply conduit, a high pressure main, and valves controlling the same, of a motor for actuating said valves, a pilot valve admitting fluid pressure to said motor, a speed governor for operating said pilot valve, a diaphragm exposed on one side to the low pressure steam and on the other to the atmosphere, and operative connections between said diaphragm and said pilot valve.

3. The combination with a mixed pressure turbine having a low pressure supply conduit, a high pressure main, and valves controlling the same, of a motor for actuating said valves, a pilot valve admitting fluid pressure to said motor, a speed governor for operating said pilot valve, a diaphragm exposed on one side to the low pressure steam and on the other to the atmosphere, operative connections between said diaphragm and said pilot valve, and means for adjusting the pull of said diaphragm.

4. The combination with a mixed pressure turbine having a low pressure supply conduit, a high pressure main, and valves controlling the same, of a motor for actuating said valves, a pilot valve admitting fluid pressure to said motor, a speed governor for operating said pilot valve, a diaphragm exposed on one side to the low pressure steam and on the other to the atmosphere, a lever connected to said diaphragm and to said pilot valve, and means for adjusting the point of connection of said diaphragm with said lever.

5. The combination with a mixed pressure turbine having a low pressure supply conduit, a high pressure main, and valves controlling the same, of a motor for actuating said valves, a pilot valve admitting fluid pressure to said motor, a speed governor for operating said pilot valve, a diaphragm exposed on one side to the low pressure steam and on the other to the atmosphere, a frame on which said diaphragm is adjustably mounted, a lever pivoted to said frame and to the stem of said pilot valve, and a stem attached to said diaphragm and provided with a block slidable along said lever.

In witness whereof, we have hereunto set our hands this 12th day of October, 1910.

OSCAR JUNGGREN.
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Witnesses:
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