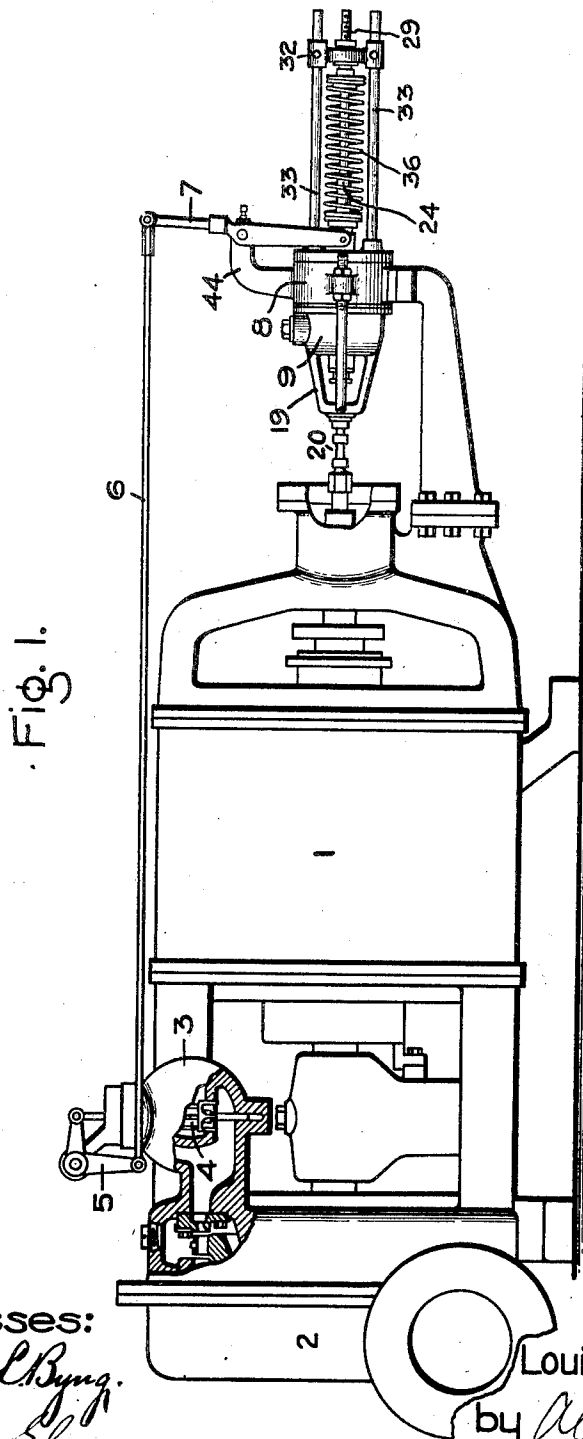


L. C. LOEWENSTEIN.
CENTRIFUGAL PRESSURE GOVERNOR.
APPLICATION FILED NOV. 4, 1911.

1,089,655.

Patented Mar. 10, 1914.

3 SHEETS—SHEET 1.



Witnesses:

Marcus L. Byng.
J. Ellis Elm.

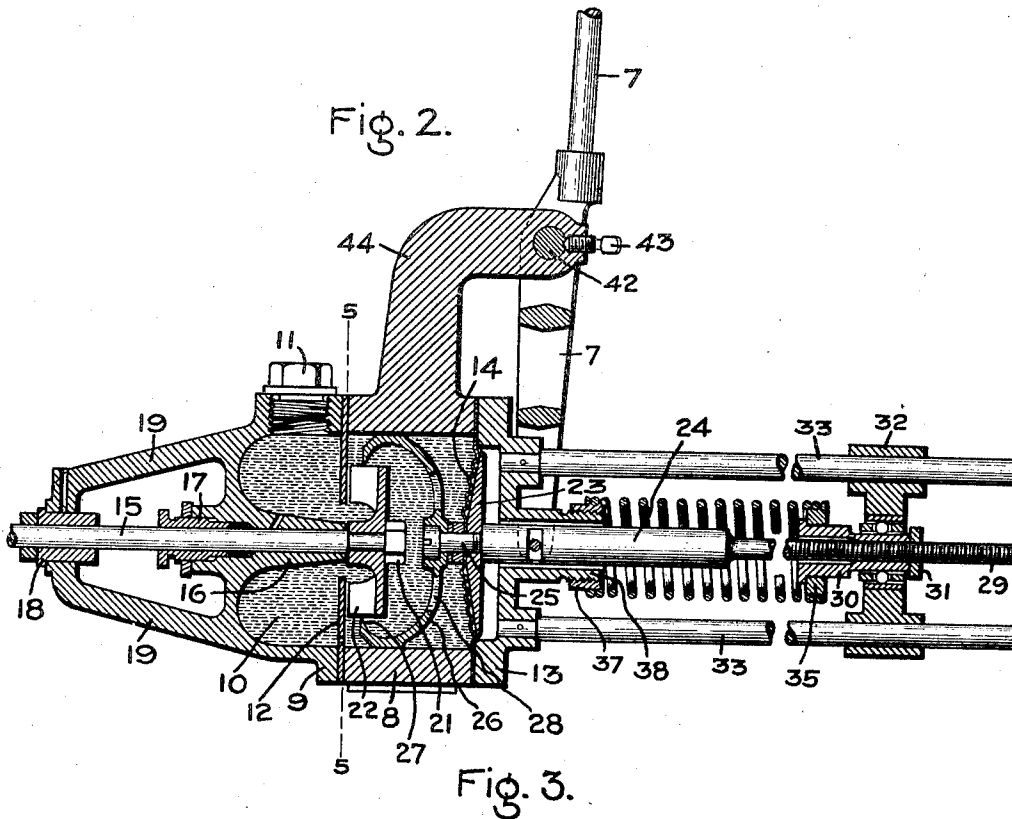
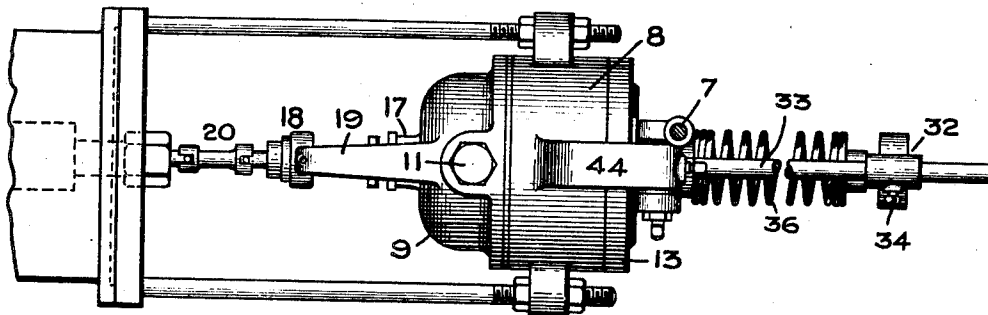
Inventor,
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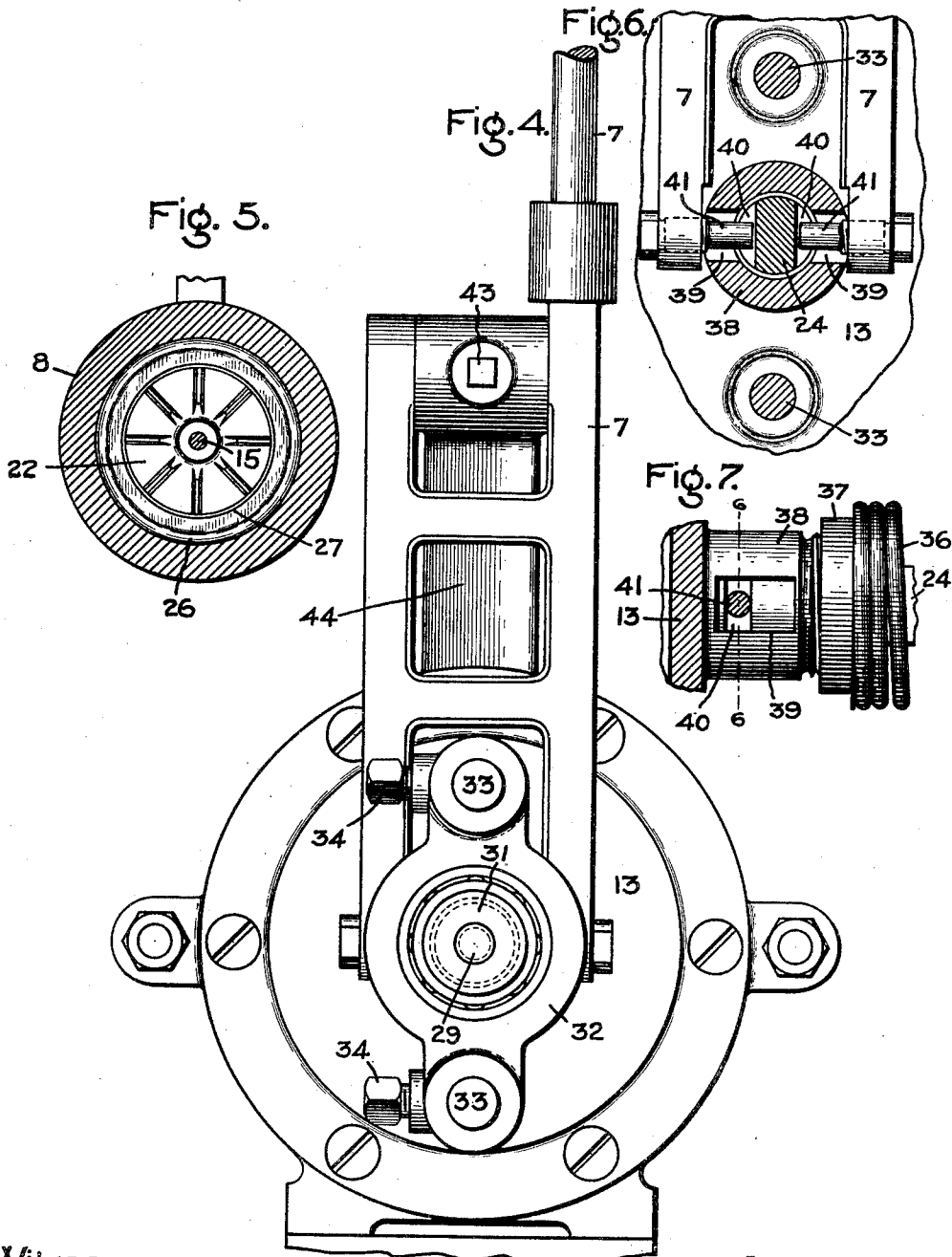
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UNITED STATES PATENT OFFICE.

LOUIS C. LOEWENSTEIN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL PRESSURE-GOVERNOR.

1,089,655.

Specification of Letters Patent.

Patented Mar. 10, 1914.

Application filed November 4, 1911. Serial No. 658,524.

To all whom it may concern:

Be it known that I, LOUIS C. LOEWENSTEIN, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Centrifugal Pressure-Governors, of which the following is a specification.

This invention relates to speed governors for elastic fluid turbines or other machines, and especially for turbo-generator sets of small size which run at high speeds.

The object of the invention is to produce a sensitive governor of improved construction which can be adjusted so as to hold the turbine or other machine at any certain speed throughout a wide range of available speeds.

The governor is directly connected to the end of the engine shaft and runs at the same speed as the engine. It comprises a rotary impeller working in a chamber filled with liquid, preferably oil. When this impeller is rotated rapidly, it throws the oil from its periphery by centrifugal force, causing the oil to exert a pressure upon a flexible diaphragm incorporated in one wall of the chamber. An adjustable spring exerts a yielding pressure upon said diaphragm in opposition to the oil pressure. When adjusted for a certain normal speed at which it is desired the engine shall run, the tension of the spring just balances the pressure on the diaphragm. A lever in contact with said diaphragm is connected with the throttle valve of the engine or other controller, and so long as the diaphragm remains stationary the steam admission will not vary. But if the speed of the engine varies, because of a change of load or otherwise, the pressure of the oil will vary also, and the diaphragm will be deflected and shift the throttle valve to change the admission of steam in accordance with the new conditions, and so as to bring the engine back to normal speed.

In prior mechanisms in which a rotary impeller has been used to produce a variable pressure against a diaphragm, the results have not been satisfactory owing to the fact that the diaphragm will give correct readings only over a very short range of deflection. To overcome this difficulty and also render the governor more sensitive, I have devised a regulator which in the present embodiment of my invention

consists of a bowl-shaped piece attached to the center of the diaphragm and having an turned edge surrounding the impeller. Any deflection of the diaphragm moves this regulator axially over the impeller and cuts off more or less of the volume of oil thrown off by the impeller, so that the quantity acting on the diaphragm is varied, that portion not caught by the regulator being thrown back into the rear of the oil chamber. The movement of the diaphragm is thus somewhat reduced, which is an advantage, because the characteristics of the diaphragm's resistance are such as would not permit any too great movement of it to give efficient governing. By changing the tension of the spring, the governor will operate over a wide range of speeds, and with equal sensitiveness at any speed selected.

In the accompanying drawings, Figure 1 is a side elevation of a small high speed horizontal steam turbo-generator set equipped with my improved speed governor; Fig. 2 is a longitudinal section of the governor on a larger scale; Fig. 3 is a top plan view of the same, on another scale; Fig. 4 is an end elevation on a still larger scale; Fig. 5 is a cross-section on line 5-5, Fig. 2; Fig. 6 is a cross-section on line 6-6, Fig. 7, and Fig. 7 is a detail of the joint between the lever and the plunger connected to the diaphragm.

The generator 1 is direct connected to the turbine 2, which receives steam through a pipe 3 controlled by a throttle valve 4, preferably of the balanced type. The lever 5 for operating said valve is connected by a rod 6 with a lever 7 controlled by the speed governor which forms the subject matter of this specification.

A cylindrical casing 8 is suitably supported with its axis in line with that of the turbine shaft. One head 9 of said casing is deeply recessed to form an oil chamber 10 which can be filled through an opening closed by a screw plug 11. Between the casing and the head is clamped a partition 12 having a central opening and small holes near its periphery. The other head 13 of said casing clamps the edge of a corrugated flexible sheet metal diaphragm 14.

A shaft 15 extends axially into the casing through the head 9 where it is carried in a long bearing 16 integral with said head, and provided with a stuffing box 17 at its outer end to prevent oil from leaking out of the chamber 10. The shaft may also have an

outboard bearing 18 supported by arms 19 integral with the head 9. The outer end of this shaft is coupled to the end of the turbine shaft, preferably by a universal joint 20. The inner end of the shaft 15 is slightly reduced to form a shoulder, against which is clamped, by a nut 21, a centrifugal pump impeller 22, located in front of the partition 12 and inside the body of the casing or in what may be termed the working chamber. The oil, which fills both chambers, has free access to the center of the impeller through the opening in the center of the partition 12.

On the outer face of the diaphragm is a strengthening piece or follower 23, against which abuts one end of a plunger 24 in alinement with the shaft 15. The plunger is fastened in place by a screw 25 passing centrally through the diaphragm and the piece 23, and serving also to secure to the diaphragm the regulator 26. This consists of a bowl-shaped member having an inwardly-turned sharp edge 27 encircling the periphery of the impeller. The tips of the blades of the impeller lie in the surface of a cylinder concentric with the shaft 15 and adjacent to the edge 27 of the regulator. Openings 28 are made in the regulator to permit the oil to have access to the diaphragm.

The plunger has a screwthreaded end 29 meshing with a screwthreaded sleeve 30 which can be adjusted along said plunger and then locked by a lock nut 31. The sleeve is rotatable in a bearing in a yoke 32 which is adjustable on guide-rods 33 projecting from the head 13 of the casing. Set screws 34 secure the yoke to the rods when it has been adjusted. The sleeve 30 is not only rotatable in its bearing, but is also capable of a certain amount of axial play, due to the flexing of the diaphragm, and to permit it to move with a minimum amount of friction, the bearing is preferably a ball bearing as shown. A collar 35 is mounted on the sleeve 30 to support one end of a helical spring 36, whose other end is attached to a nut 37 on the end of a tubular projection 38 integral with the head 13 and concentric with the plunger 24. In opposite sides of the projection 38 are slots 39 registering with recesses 40 in the plunger. The lever 7 is forked to straddle the projection and its arms carry pins 41 which project through the slots 39 into the recesses 40. The lever is conveniently fulcrumed on trunnions formed by the projecting ends of a pin 42 secured by a set screw 43 in a standard 44 rising from the casing 8.

The operation of the device is as follows:—The rapid rotation of the shaft 15 causes the impeller 22 to throw the oil outwardly. The regulator 26 catches a portion of the oil and directs it through the openings 28 against the flexible diaphragm 14.

The oil not caught by the regulator returns to the oil chamber 10 through the holes in the partition 12. When the machine is running at normal speed, the pressure of the oil against the diaphragm is balanced by the spring 36. An increase of speed of the shaft 15 produces a greater pressure against the diaphragm which causes it to be deflected, compressing the spring, and moving the lever 7. This movement is transmitted by the rod 6 and lever 5 to the throttle valve 4 which at once reduces the amount of steam flowing to the turbine 2 and thus brings the speed down to normal again. A decrease of speed below normal permits the spring to force the diaphragm inwardly, and move the lever 7 in the opposite direction to that in which it was formerly moved. This results in opening the throttle 4 a little, to admit more steam and speed up the machine.

The regulator 26 is attached to and moves with the diaphragm, so that when the diaphragm is forced outwardly, the regulator at once decreases the quantity of oil delivered against the diaphragm, which relieves the pressure and prevents the diaphragm from compressing the spring to excess. This overcomes any tendency of the governor to "hunt," and renders it more sensitive and accurate in operation; the governing being limited to only a short range of deflection of the diaphragm. By adjusting the tension of the spring by means of the sleeve 30, the speed at which the governor will operate can be varied to a considerable extent.

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. A speed governor comprising a rotatable impeller, a casing for said impeller, a body of liquid in said casing, a flexible diaphragm exposed to the pressure produced by said impeller, a regulator for said pressure actuated by said diaphragm, and operative connections between said diaphragm and mechanism to be governed.

2. A speed governor comprising a casing filled with liquid, a rotatable impeller therein, a flexible diaphragm in one side of said casing, a spring pressing against the outside of said diaphragm, means actuated by said diaphragm for regulating the quantity of liquid thrown by said impeller against said diaphragm, and means for transmitting the movement of said diaphragm to the mechanism to be governed.

3. A speed governor comprising a casing filled with liquid, a rotatable impeller in said casing, a flexible diaphragm in one side of said casing, a spring opposing outward deflection of said diaphragm, a bowl-shaped device attached to said diaphragm and encircling said impeller, and means for transmitting the movement of said diaphragm to the mechanism to be governed.

10 4. A speed governor comprising a casing filled with liquid, a rotatable cylindrical impeller in said casing, a flexible diaphragm in one side of said casing, a spring opposing outward deflection of said diaphragm, a bowl-shaped device attached to said diaphragm provided with openings and having a sharp inturned edge adjacent to the periphery of said impeller, and means for transmitting the movements of said diaphragm.

20 5. A speed governor comprising a casing filled with liquid, a partition in said casing provided with openings, a shaft extending into said casing and through said partition, an impeller on said shaft in advance of said partition, a flexible diaphragm in one side of said casing, a head clamping the edge of said diaphragm, a regulator attached to said diaphragm and varying the quantities of liquid thrown off by said impeller against said diaphragm, a plunger attached to the outside of said diaphragm, a sleeve threaded on said plunger, and a spring between said sleeve and the head of the casing.

25 6. In combination, a motor, a controller

therefor, a governor for actuating the controller comprising a rotary impeller for creating a pressure that varies with the speed of the motor, an abutment that is movable in response to changes in fluid pressure delivered by the impeller, a means actuated by said abutment for varying the effective discharge of the impeller, and a means for transmitting movements of the abutment to the controller.

45 7. In combination, a motor, a controller therefor, a governor for controlling the controller comprising a rotary impeller for creating a pressure that varies with the speed of the motor, a means acted upon by the fluid pressure from the impeller, and a means actuated by the aforesaid means for varying the effective discharge pressure of the impeller independently of changes in speed.

55 8. In combination, a motor, a controller therefor, a pump driven by the motor whose discharge pressure is responsive to speed changes of said motor, a means for communicating the effects of the fluid discharged under pressure by the pump to the controller, and a device which moves with the controller for varying the effective discharge of the pump.

In witness whereof, I have hereunto set my hand this 2nd day of November, 1911.

LOUIS C. LOEWENSTEIN.

Witnesses:

JOHN A. McMANUS, Jr.,

FRANK G. HATTIE.