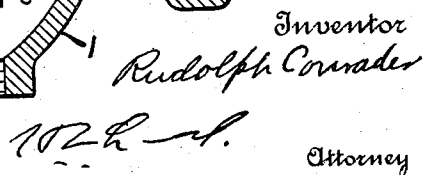


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UNITED STATES PATENT OFFICE.

RUDOLPH CONRADER, OF ERIE, PENNSYLVANIA.

GOVERNOR.

1,272,384.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RUDOLPH CONRADER, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented new and useful Improvements in Governors, of which the following is a specification.

This invention relates to governors and consists in certain improvements in the construction thereof as will be hereinafter fully described and pointed out in the claims.

In its more specific phases the invention relates to pump governors and preferably such as have their controlling means sensitive to pressure. While I have referred to the pump as an air compressor, fluids other than air may be pumped.

The invention is illustrated in the accompanying drawings as follows:—

Figure 1 shows a vertical section through the center of the governor.

Fig. 2 shows a side elevation, partly in section, of the pressure element giving axial movement to the valve.

Fig. 3 shows a section on the line 3—3 in Fig. 1.

Fig. 4 shows a section on the line 4—4 in Fig. 1.

Fig. 5 shows a section on the line 5—5 in Fig. 1.

Fig. 6 shows a front elevation of the valve actuating cam.

Fig. 7 shows a modification of this cam.

Fig. 8 shows a section on the line 8—8 in Fig. 1.

1 marks the valve body and 2 the valve diaphragm which as shown is double-walled with an annular steam chamber. This is a common construction for such valve diaphragms. The valve 3 is cylindrical and is mounted in a valve casing 4. The valve casing 4 has an extension 5 extending below the diaphragm 2 and is provided with the openings 6. These openings may be varied to suit the opening desired. The valve 3 has the cylindrical walls 7 which fit into the casing 4. The valve has the upward extension 8 and the slots 9 which are adapted to register with the slots 6. The valve also has the horizontal closures 10, one adapted to operate with each wall of the diaphragm. The cylindrical casing 4 has the closures 6^a for the slots 6 opposite the closures 10 so that with the closures 10 in register with the

diaphragms there is a complete closure of the valve. This valve is adapted to operate both by rotative movement and by axial movement. By moving the valve axially the closures 10 are moved out of register with the closures 6^a so that steam is permitted to pass through the slots. The valve, however, does not go below the extension 5, nor is the upper end of the casing exposed by reason of the downward movement because of the extension 8. A rotative movement of the valve tends to close the valve by bringing the slots 9 out of register with the slots 6 so that with either an axial movement or a rotative movement of the valve opening may be varied. This is important in that with the varying loads and varying speeds to which it is desired to control a motor this double adjustment of the valve makes possible a greater variety of control.

A stem 11 extends upwardly from the valve through a gland 12 in the cap 13 and the governor frame 14 is mounted on the cap 13.

A cylinder 15 is secured to the upper end of the governor frame. It is provided with the screw-threaded end 16 which is screwed into the upper end of the frame. The cylinder is provided with an extension 17 which is screw-threaded and extends through the upper end of the frame and a nut 18 is arranged at the lower end of the extension 17 so as to lock the cylinder 15 in place. The piston 19 is arranged in the cylinder 15. It operates against a stem 20, the stem extending through a gland 21 to the end of the cylinder and into position to operate in conjunction with the stem 11. Air from the system to which air is pumped by the compressor controlled by the governor is admitted through the pipe 23 to the upper end of the cylinder 15.

Counterpressure springs 24 are secured to the cross head 25. The cross head 25 has a socket 26 and the stem 11 extends through the cross head into a socket 26. A head 27 is arranged on the upper end of the stem 11 and a plug 28 is screwed into the socket thus locking the head 27 in the socket. It will be noted, however, that the stem 11 and its head 27 are free to rotate but are moved axially by the cross head 25. The upper ends of the springs 24 are secured to a nut 29 which is screwed into the spring, the wires of the

spring engaging the threads on the nut 29 and the nut 29 is screwed onto a bolt 30 which extends through a projection 31 at the upper end of the cylinder 15. There are two of the springs 24, one at each side of the cross head and the adjusting mechanism for said springs as just hereinbefore described. By varying the position of the nut 29 in the spring the effective length of the spring may be varied and by adjusting the position of the nut 29 on the bolt 30 the initial tension of the springs may be maintained or varied as desired.

A screw 32 extends through the upper end of the cylinder 15 into engagement with the piston 19 and by its adjustment the initial position of the piston and with it the valve may be adjusted.

The post 33 is rotatively mounted in the cross piece 34 of the frame. A cam 35 is adjustably mounted on the post 33 by means of the bolt 36. The cam may be swung on the bolt 36 and locked in position by the nut 36^a. Preferably adjusting screws 33^b are provided. These extend through ears 33^c on the post 33. The cam is formed with a cam groove 37 which forms a track for a ball 38, the ball being rotatively mounted on an arm 39 extending from a block 40. The block 40 is secured on the stem 11 by means of the set screws 41. The block may be adjusted vertically or rotatively by loosening the set screws and moving it to position on the stem.

As the air builds up above the piston 19 it finally reaches a position which will overcome the springs 24, the springs 24 being adjusted to yield at the desired pressure of the air. As the stem 11 is moved axially carrying with it the valve 3, the ball 38 is moved axially in the cam groove 37. By shaping the adjusting cam groove, the valve may also be given a rotative movement depending on the slant or spiral of the cam. Thus, for instance, with a compressor it is desirable to gradually open the valve as the air pressure increases. In this instance the springs 24 would be so adjusted that they would begin to yield immediately the pressure began to build up. It may be desirable in order to maintain a uniform speed of the compressor to increase the valve opening from that which may be given to it by this axial movement and if the valve is set partially closed so far as the slots 6 and 9 are concerned it may be partially opened by the cam action of the cam 35, this cam action rotating the valve, and by shaping the cam any curve or increase may be attained so as to give to the compressor a comparatively constant speed up to the desired normal speed in the receiver. This is very important in a control of this kind in that it gives a variety of adjustment in a simple and efficient manner. In the operation of a com-

pressor it is desirable when the pressure has reached the desired normal pressure to begin to slow down the compressor so as to avoid completely stopping it and to avoid the excessive building up of pressure in the receiver. By reversing the direction of the cam, the valve may be gradually rotated so as to effect a closing action even though the axial movement due to the action of the piston would tend to open it. A cam for accomplishing this is clearly shown in Fig. 6 wherein the upper part of the cam 42 shows a direction to give a rotative movement in one direction and the lower part of the cam 43 shows a direction to reverse the rotation and to close the valve. Any combination of this kind may be had, or the upper part of the cam may be straight, the lower part of the cam being abrupt so that the closing movement follows exactly the axial travel of the valve but the rotative movement takes place at the critical pressure. In Fig. 7 a cam plate with perfectly straight sides is shown. For some purposes this shape might be desirable.

In order to give a still further control of the valve, I prefer to provide a device sensitive to pressure which will automatically vary the cam and give a rotative action responsive to differences in pressure. A cylinder 44 is mounted on the frame 14 and is connected with the air system 23 by means of a pipe 45. The piston 46 is arranged in the cylinder 44 and a stem 46^a extends outwardly from the piston. The air pressure on the piston is opposed by a spring 47, the spring exerting pressure against a shoulder 47^a on the stem 46^a and the opposite end of the spring being seated in an adjusting nut 47^b by means of which the spring 47 may be adjusted. A rack 48 is mounted on the stem 46^a and engages a gear 49. The gear 49 is mounted on a projection 33^a extending downwardly from the post 33, the projection 33^a extending through the cross piece 34 and being journaled therein. The gear 49 is keyed by means of a key 50 on the projection 33 so that a turning movement of the gear results in a turning movement of the projection 33^a and with it the post 33 carrying the cam 35. If it is desired to confine the entire rotative effect to that of the pressure device acting on the gear 49, the cam 35 may be a straight-sided cam such as shown in Fig. 7 and arranged in a vertical position.

In order to limit the effect of the rotatively actuating pressure device, a lever 51 is mounted on the projection 33^a below the gear 49. This lever has a tooth 52 which is adapted to be placed between any of the teeth on the gear so as to lock the lever against turning on the projection. A nut 52^a is screwed onto the lower end of the projection 33^a and locks the lever in place. Ad-

justing screws 53 and 56 extend through the projections 54 and 57 on the frame. These screws may be locked in adjustment by the jam nuts 55 and 58. These screws engage the lever 51 and thus limit the throw or turning movement of the gear 49. In this way the minimum and maximum effect of the pressure device giving rotative action may be limited.

Where it is desired to use the governor as with a vacuum pump the pipe 23 is connected to the opening 23^a and the pipe 45 with the opening 45^a. Under these conditions the atmosphere operates at one side of the piston and the pressure is reduced at the opposite side of the piston through the openings 23^a and 45^a. In this way the governor can be made to operate with a vacuum pump. The cam action with its adjustments and the relative adjustments through the two cylinders make it possible to adjust the action of the device to the peculiar conditions encountered in connection with vacuum pumps.

What I claim as new is:—

1. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; devices sensitive to changes of pressure; and mechanism acting with said devices to move said valve rotatively and axially.

2. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; controlling means actuating the valve axially; and devices sensitive to changes of pressure for actuating said valve rotatively.

3. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; pressure actuated controlling means actuating the valve axially; and devices sensitive to changes of pressure for actuating said valve rotatively.

4. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; devices sensitive to pressure for actuating said valve axially; and means for actuating the valve rotatively to modify the valve opening incident to the axial movement.

5. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; pressure actuated devices for actuating said valve axially; and means for actuating the valve rotatively to modify the valve opening incident to the axial movement.

6. In a governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; and devices actuating the valve rotatively to modify the valve opening incident to the action of the controlling means.

7. In a governor, the combination of a

governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; and a cam actuating the valve rotatively as it is moved axially by said means.

8. In a governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; and a cam actuating the valve rotatively as it is moved axially by said means, said cam varying the rotative effect with a given axial movement in different parts of the axial movement of the valve.

9. In a governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; and a cam actuating the valve rotatively as it is moved axially by said means, said cam reversing the direction of rotation in the range of axial movement of the valve.

10. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means sensitive to pressure actuating the valve axially; and a cam actuating the valve rotatively as it is moved axially by said means.

11. In a governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; a cam actuating the valve rotatively as it is moved axially by said means; and means for adjusting the cam to vary the rotative effect.

12. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means sensitive to pressure actuating the valve axially; and a cam actuating the valve rotatively as it is moved axially by said means, said cam varying the rotative movement in different points in the axial movement of the valve.

13. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; a cam actuating the valve rotatively as it is moved axially by said means; and devices sensitive to pressure for adjusting said cam.

14. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; a cam actuating the valve rotatively as it is moved axially by said means, said cam varying the rotative movement at different points in the axial movement; and devices sensitive to pressure for adjusting said cam.

15. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; a stem on the valve; an arm on the stem; a controlling means acting axially on said stem to move the valve

axially; and a cam mounted concentrically with the stem and adapted to act on said arm.

16. In a pump governor, the combination
5 of a governor valve controlling by rotative and axial movement; a stem on the valve; an arm on the stem; a cam acting on the arm to rotate the stem and with it the valve with an axial movement of the stem; and
10 means for adjusting the arm on the stem.

17. In a pump governor, the combination of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; a gear locked
15 to rotate with the stem; a rack meshing the gear; and a pressure device actuating the gear.

18. In a pump governor, the combination of a governor valve controlling by rotative
20 and axial movement; a controlling means actuating the valve axially; a gear locked to rotate with the stem; a rack meshing the gear; a pressure device actuating the gear;

a lever rocked with the gear; and stops for the lever.

19. In a pump governor, the combination
25 of a governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; a gear locked to rotate with the stem; a rack meshing the
30 gear; a pressure device actuating the gear; a lever having a tooth thereon adapted to engage the teeth of the gear; and stops acting on the lever.

20. In a governor, the combination of a
35 governor valve controlling by rotative and axial movement; a controlling means actuating the valve axially; a cam swingingly mounted and actuating the valve rotatively as it is moved axially by said means; and
40 devices for adjusting the angle of the cam to vary its rotative effect.

In testimony whereof I have hereunto set my hand.

RUDOLPH CONRADER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."