(No Model.) 2 Sheets—Sheet 1.

R. C. CARPENTER.

GOVERNOR.

No. 526,856. Patented Oct. 2, 1894.

Fig. 1.

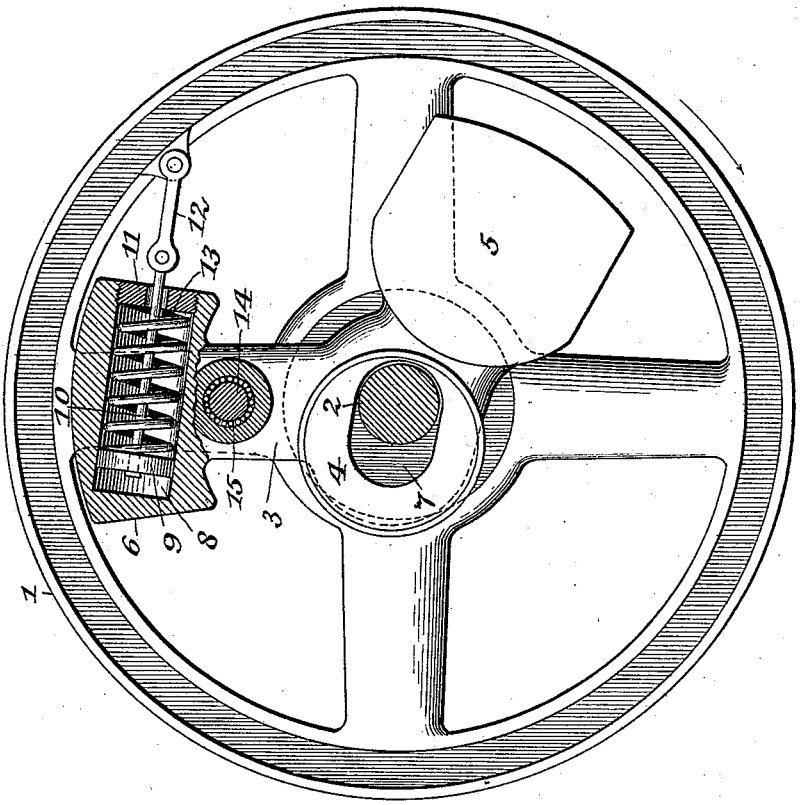
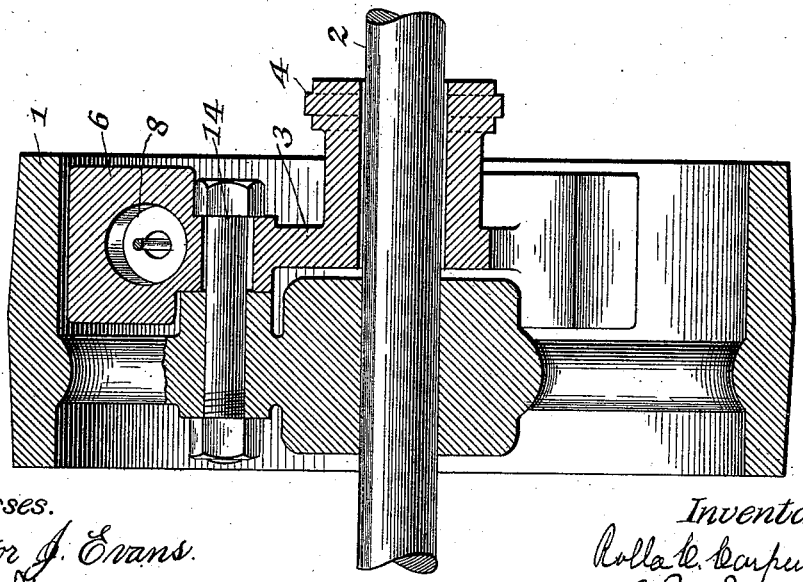


Fig. 2.



Witnesses.
Victor J. Evans.
H. M. Marble.

Inventor.
Rolla C. Carpenter
By E. M. Marble.
Attorney.

(No Model.) 2 Sheets—Sheet 2.

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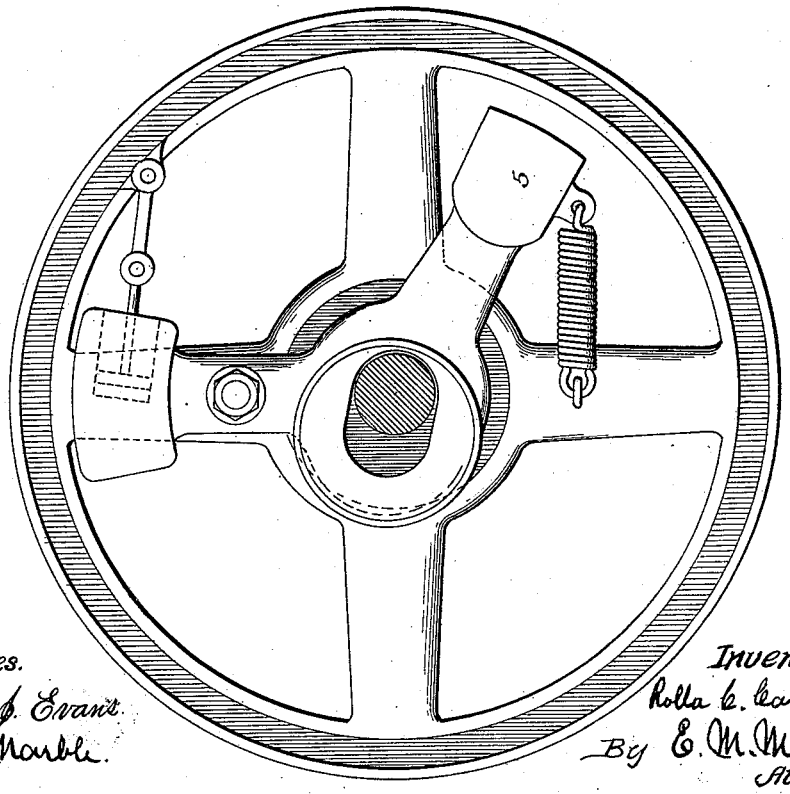

Fig. 3.

Witnesses.
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UNITED STATES PATENT OFFICE.

ROLLA C. CARPENTER, OF ITHACA, NEW YORK, ASSIGNOR OF ONE-HALF TO C. M. GIDDINGS, OF ROCKFORD, ILLINOIS.

GOVERNOR.

SPECIFICATION forming part of Letters Patent No. 526,856, dated October 2, 1894.

Application filed November 13, 1893. Serial No. 490,783. (No model.)

To all whom it may concern:

Be it known that I, ROLLA C. CARPENTER, residing at Ithaca, in the county of Tompkins and State of New York, have invented certain new and useful Improvements in Governors, of which the following is a specification.

My invention relates to governors for steam engines or other motors, and particularly to that class of governors known as automatic cut-off fly wheel governors; and my invention consists in the novel forms and construction of the parts of the governor, in the means employed for reducing the friction of the governor, in the novel location and arrangement of the dash pot, in the novel location and arrangement of the governor spring, and in the novel means employed for adjusting the pressure exerted by the spring. Where governors of this class are used on steam engines, the admission of steam to the engine, and so the speed of the engine, is controlled by varying the length of travel of the side valve of the engine. This valve is usually actuated by means of an eccentric or equivalent device, mounted on the crank shaft or fly wheel of the engine, and the variation in travel of the valve is obtained by varying the throw of the eccentric. To this end, the eccentric is so formed, and so supported, that it may be moved transversely across the shaft; and this movement may take place between two extreme positions, at one of which the eccentricity or throw of the eccentric is so slight that the valve is not given sufficient travel to admit steam at all to the cylinder, while at the other extreme position the travel of the valve is maximum. The cut-off occurs at the latest possible period in the stroke, and the quantity of steam admitted is a maximum. It is the aim of the governing device to so vary the amount of steam admitted, by varying the position of the eccentric, that the speed of the engine shall be constant without regard to variations in the load of the engine which may take place. The adjustment of the position of the eccentric is usually obtained by weights, carried by arms pivoted or otherwise secured to the fly wheel of the engine, the centrifugal force of these weights, due to the rotation of the fly wheel, tending to cause them to fly outward toward the rim of the fly wheel. This tendency is usually resisted by springs; and as the centrifugal force varies with the speed of the engine, and is always constant at one value for any given speed, it follows that an eccentric which is adapted to have its throw varied by the movement of said weights will, neglecting the effects of friction and of the oscillation due to the springs, always occupy one particular position for any given speed of the engine. The effect of friction is to vary this position somewhat, or to render the eccentric slow in assuming its proper position, and the effect of the oscillations of the governor springs is to cause a periodic variation in the position of the eccentric, which at one instant causes too much steam to be admitted to the engine and at the next instant permits too little steam to be admitted to the engine. In governors formerly constructed, much trouble has arisen from the number of joints and bearings required, the friction of which greatly interferes with the delicacy of action of the governor, and causes it to act irregularly. These difficulties are especially marked after the governor has been in use for some time and the joints are worn.

It has been common to reduce or neutralize the disturbances caused by the vibration or oscillation of the governor springs, by attaching a dash pot to some moving part of the governor. Difficulty has been found, however, in so placing the dash pot that it shall be effective and yet out of the way, and in so securing it that it shall not be in danger of working loose.

The objects of my invention are, first, to reduce the number of parts of the governor to the smallest number possible, and to dispense with all unnecessary joints in the governor; second, to provide means for reducing the friction at such joints as may be necessary to the lowest possible limit; third, to provide for the proper balancing of the parts of the governor, so that it may run smoothly and without strain to the engine; fourth, to so locate the dash pot that it shall be effective in action and yet out of the way; fifth, to provide a more satisfactory location for the governor spring, and to provide means for adjusting the pressure exerted by the spring;

and, sixth, to render the governor cheap, durable, not subject to derangement, delicate in action, and easy of adjustment. These objects are attained in the governor herein described and illustrated in the drawings which accompany and form a part of this application, in which the same reference numerals indicate the same or corresponding parts, and in which—

Figure 1 is a side elevation of the fly wheel of an engine, with my governor attached thereto. Fig. 2 is a central vertical section of the fly wheel and governor; and Fig. 3 is an elevation of a modified form of governor, similar to that shown in Figs. 1 and 2, but with the governor spring in tension instead of in compression.

In the drawings, 1 is the fly wheel, and 2 the main or crank shaft of the engine, the direction of rotation of which is shown by an arrow in Fig. 1.

3 is a bent arm or bell-crank lever, projecting from which is a boss forming the eccentric 4. The lever 3 likewise carries a weight 5, which is a centrifugal weight, and may be removably secured to the lever, though it is preferably cast integral therewith. The lever 3 is pivoted to an arm of the flywheel 1, the pivot being the bolt 14. The lever 3 extends upward from the pivot 14, and carries a weight 6, which, as with the weight 5, may be removably secured to the bell-crank lever, but is preferably cast integrally therewith. This weight serves to balance the governor and prevent strain to the engine when the fly wheel revolves.

The crank shaft 2 of the engine passes through a slot 7 in the bell crank 3. This slot permits the bell crank to have some movement to the one side or the other about the pivot 14 as a center. In this manner the eccentricity or throw of the eccentric, and consequently the point of cut off and the amount of steam admitted to the cylinder is varied, and the desired regulation of speed of the engine is obtained.

The weight 6 has within it a cylinder 8, which forms the dash pot of the governor. Within the dash pot is a piston 9, the piston rod 10 of which passes through an aperture in the head 11 of the dash pot, and has pivoted to its end a link 12, which is pivotally attached to the rim or other convenient portion of the fly wheel. The piston 9 fits somewhat loosely within the dash pot. Its object is to check rapid movement of the lever 3 by interposing a resistance to the rush of air from the one side of the piston to the other, when the movement of the lever 3 causes the piston to move within the dash pot. The amount of the resistance so offered is of course dependent upon the ease with which the air may pass around the piston, and if it is found that sufficient freedom of movement is not obtained when the piston fits somewhat loosely within the piston, the piston itself may be perforated. In this way the action of the dash pot may be readily regulated, and all oscillation of the eccentric prevented.

Interposed between the piston 9 and the cylinder head 11 is a compression spring 13, which constitutes the governor spring. Bearing against the head of the dash pot, as it does, it offers a resistance to the movement of the weight 5 outward toward the rim of the fly wheel, and tends to cause the weight to occupy a position as far from the rim of the fly wheel as possible. The head 11 of the dash pot is secured adjustably therein, by any suitable means, as for instance, by screw threads, and by moving this head in or out the pressure exerted by the spring 13 may be adjusted.

In order to reduce to the lowest possible limit the friction of the pivot joint, I have thought it best to provide this joint with roller or ball bearings, the former being preferable. To this end, therefore, the aperture in the lever 3 through which the axis bolt 14 passes is somewhat larger than said bolt, and between the bolt and the walls of this aperture are placed small cylindrical rods or rollers 15. Shown in Fig. 1. These rollers act upon the same principle as the ball bearings commonly used for light machinery, and greatly reduce the friction of the bearing.

The operation of the governor is as follows: When the lever 3 is in the position shown in Fig. 1, which is the position assumed when the engine is at rest, the throw of the eccentric 4 is greatest. Consequently, when the engine begins to rotate, the governor permits the valve to have full travel, and steam is admitted to the maximum point of cut-off. As the speed of the engine increases the centrifugal force exerted by the weight 5 tends to cause it to fly outward toward the rim of the fly wheel, turning the lever 3 about its pivot. This tendency is resisted by the spring 13, which is compressed by this movement of the lever 3, the governor weight being thus in equilibrium for each speed of the engine. Any sudden movement of the lever 3 is likewise prevented by the action of the dash pot. As the speed of the engine increases, the centrifugal force of the weight 5 grows stronger, the lever 3 swings somewhat about its pivot, thus compressing the spring 13 and thus neutralizing the increased strength of the centrifugal force. This movement of the lever 3, however, decreases the throw of the eccentric 4, and causes the cut-off to occur earlier in the stroke, thus decreasing the quantity of steam admitted to the engine-cylinder. In this manner, the point of cut-off will finally be so early in the stroke that the speed of the engine will increase no farther, and the engine will run constantly at this speed so long as the load on the engine and the steam pressure remain constant.

If at any time the load on the engine is decreased, the tendency is for the speed to rise. This increase in speed, however, increases the strength of the centrifugal force acting on the

weight 5, and this weight moves outward somewhat, thus reducing the throw of the eccentric 4, making the point of cut-off earlier in the stroke, and so reducing the speed of the engine to the former rate. If the load on the engine is decreased the speed of the engine falls. With this decrease of speed the strength of the centrifugal force acting on the weight 5 is decreased, and the spring 13 causes the weight to swing inward toward the center of the shaft, making the point of cut-off later in the stroke, and so causing the speed of the engine to increase until the former rate of speed is reached.

Where the speed of the engine is varied suddenly, as when load is thrown on or off very quickly, the inertia of the parts of the governor likewise operates to aid in so moving the eccentric as to restore the speed of the engine to its normal rate. Thus, if the speed of the engine is suddenly increased, the weights 5 and 6 tend to lag behind the wheel 1 somewhat, and this lagging causes the lever 3 to swing about its pivot in such a manner as to carry the eccentric 4 toward the center of the shaft and so, by reducing its throw, to decrease the speed of the engine. In the same way, if the speed of the engine is suddenly decreased, the weights 5 and 6 move ahead of the wheel 1 somewhat, thus carrying the eccentric outward from the center of the shaft, and so causing the speed of the engine to increase. It will be seen therefore that the centrifugal and inertia effects of the parts of the governor act in harmony to preserve the speed of the engine practically constant. It will be understood that the variations in speed above mentioned are slight, since with well designed governors the governor acts to properly adjust the point of cut-off before the speed of the engine has risen more than two or three revolutions per minute above the normal rate.

By placing the dash pot within one of the weights of the governor, I am able to place it in a most advantageous position for action, while it is entirely out of the way, and there is no possibility that it may work loose. The dash pot so placed likewise forms a convenient receptacle for the governor spring.

It may not at all times be advisable to use a compression spring for the governor, or to locate the spring within the dash pot. I have therefore, in Fig. 3, shown how a tension spring may be substituted for the compression spring, the spring connecting the weight 5 with one of the arms of the fly wheel. If desired any suitable means may be provided for adjusting the strength of the force exerted by this spring.

It will be observed that in my engine all of the important parts are contained in one piece, and that only one pivotal joint is required. I have in this way been able to increase greatly the durability of the governor, and to make it very sensitive and quick in action, as the friction is slight and there are no joints which, by working loose, can interfere with the correct action of the governor.

Some engines are so constructed that it is not necessary to place the eccentric on the inner side of the fly wheel, and in such engines it is customary not to have the crank shaft projecting beyond the hub of the fly wheel, as is the case with the shaft shown in the drawings. In such engines it is not necessary to use an eccentric to actuate the slide valve, as a crank pin carried by some portion of the fly wheel or by an object secured thereto may be used, and the construction of this portion of the engine is thus simplified. It is customary, therefore, in engines where the governor may be permitted to overhang, to substitute for the eccentric a crank pin, carried by the same portion of the governor mechanism which ordinarily carries the eccentric; and it will be evident that such a change may be made in my governor without departing from my invention, as the crank is a well known equivalent for the eccentric.

Having thus completely described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a governor, the combination, with a fly wheel revolubly mounted, of a lever pivotally secured thereto, and carrying an eccentric or equivalent device, a centrifugal weight carried by said lever, a counterbalance weight secured to said lever, and a spring opposing the centrifugal force of said centrifugal weight, substantially as described.

2. In a governor, the combination, with a fly wheel revolubly mounted, a lever pivotally secured thereto, and carrying an eccentric or equivalent device, a centrifugal weight carried by said lever, and a spring opposing the centrifugal force of said weight, of a counterbalance weight secured to said lever and provided with a dash pot adapted to retard the motion of said lever, substantially as described.

3. In a governor, the combination, with a fly wheel revolubly mounted, and a lever pivotally secured thereto, of a governor weight carried by said lever, a dash pot or cylinder formed in said lever, and a piston working in said dash pot and connected to the fly wheel, substantially as described.

4. In a governor, the combination, with a fly wheel revolubly mounted, a lever pivotally secured thereto and carrying an eccentric or equivalent device, a centrifugal weight secured to said lever, and a spring opposing the centrifugal force of said weight, of a counterbalance weight likewise secured to said lever, a dash pot or cylinder formed therein, and a piston working in said dash pot and connected to the fly wheel, substantially as described.

5. In a governor, the combination, with a fly wheel revolubly mounted, a lever pivotally secured thereto and carrying an eccentric or equivalent device, and a centrifugal weight secured to said lever, of a dash pot

likewise secured to said lever and having a piston connected with said fly wheel, and a governor spring, located within said dash pot cylinder, and bearing against the piston and against the end of the dash pot, substantially as described.

6. In a governor, the combination, with a fly wheel revolubly mounted, a lever pivotally secured thereto and carrying an eccentric or equivalent device, and a centrifugal weight secured to said lever, of a counterbalance weight likewise secured to said lever, a dash pot cylinder formed therein and having an adjustable cylinder head, a piston for said dash pot connected with said fly wheel, and a governor spring located within said dash pot and bearing against the piston and against the head of said dash pot, and adjustable through the adjustment of the position of said dash pot cylinder head, substantially as described.

7. In a governor, the combination, with a fly wheel revolubly mounted, a lever pivoted thereto at a point eccentric to the center of the fly wheel, a centrifugal weight secured to one end of said lever, a counterbalance weight secured to the other end of said lever, and a spring opposing the centrifugal force of said centrifugal weight, of an eccentric or equivalent device located upon said lever at a point between said pivot and said centrifugal weight, the center of the eccentric being out of line with said pivot and centrifugal weight, substantially as described.

8. In a governor, the combination, with a fly wheel 1 revolubly mounted, a lever 3 pivotally secured to said fly wheel, a centrifugal weight 5 secured to said lever, and a spring 13 for opposing the centrifugal force of said weight, of a counterbalance weight 6 likewise secured to said lever and having formed within it a dash pot 8, and a piston 9, working in said dash pot, and connected with the fly wheel, substantially as described.

9. In a governor, the combination, with a fly wheel, of an eccentric, centrifugal weight, and counterbalance weight, formed in one piece and pivotally attached to said fly wheel, and a spring for opposing the centrifugal force of said weight, substantially as described.

10. In a governor, the combination, with a fly wheel, of an eccentric, centrifugal weight, and counterbalance weight formed in one piece and pivotally attached to said fly wheel, a spring for resisting the centrifugal action of said centrifugal weight, and a dash pot adapted to impede the motion of said eccentric, substantially as described.

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

ROLLA C. CARPENTER.

Witnesses:
WM. HAZLITT SMITH,
FRED H. SMITH.