3 Sheets—Sheet 1.

J. M. NAPIER.

GOVERNOR.

No. 185,691. Patented Dec. 26, 1876.

Fig: 2.

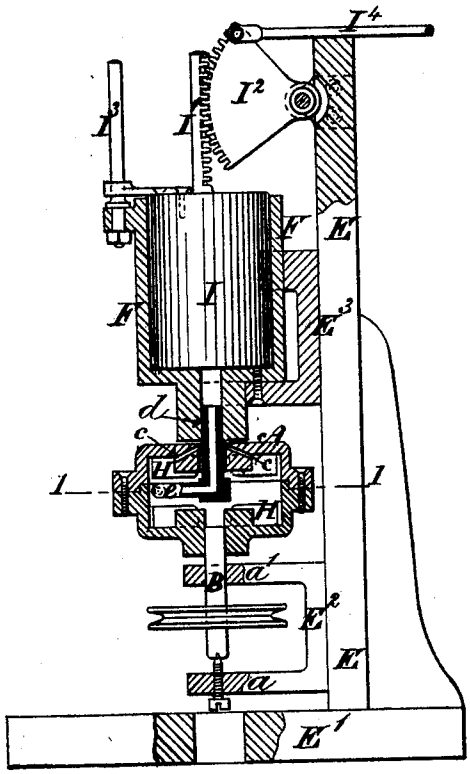


Fig: 1.

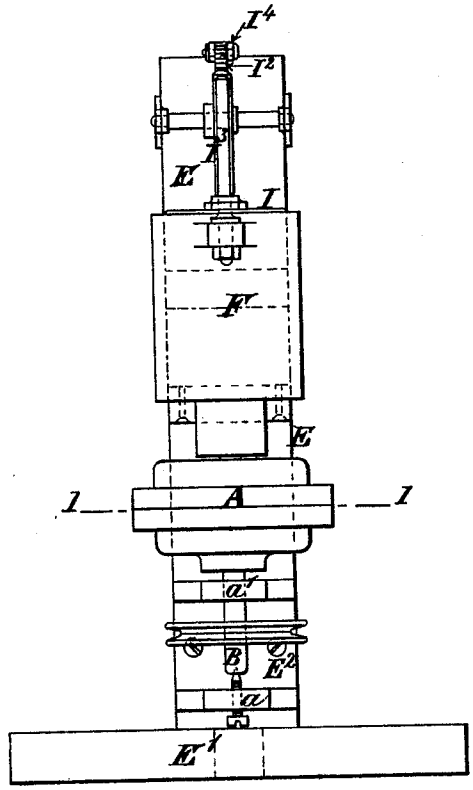
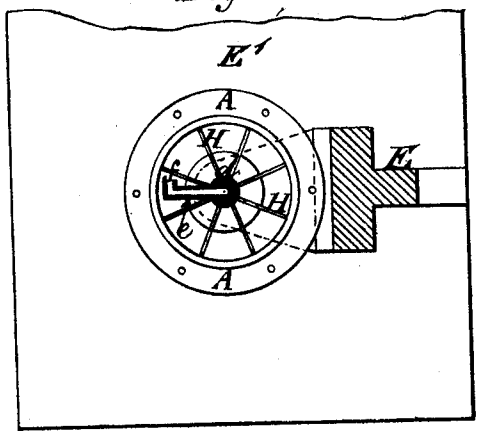


Fig: 3.



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3 Sheets—Sheet 2.

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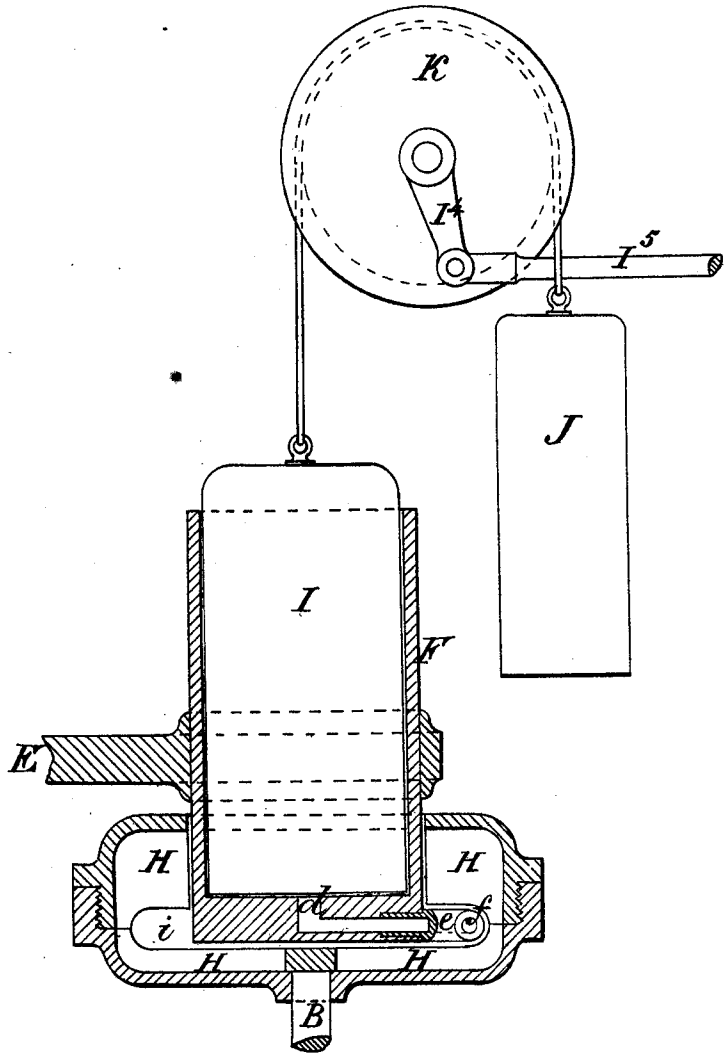
Fig: 4.



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3 Sheets—Sheet 3.

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Fig: 5.

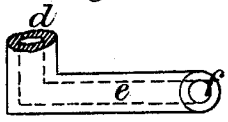


Fig: 7.

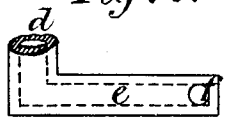


Fig: 6.

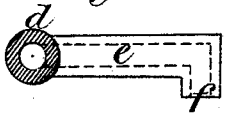


Fig: 8.

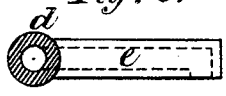


Fig: 9.

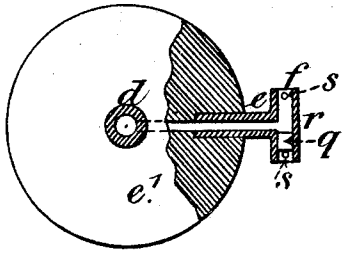


Fig: 10.

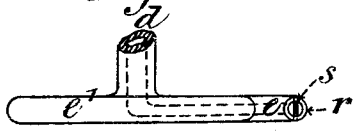
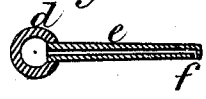


Fig: 11.

Fig: 12.



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UNITED STATES PATENT OFFICE.

JAMES M. NAPIER, OF LAMBETH, ENGLAND.

IMPROVEMENT IN GOVERNORS.

Specification forming part of Letters Patent No. **185,691**, dated December 26, 1876; application filed October 7, 1876.

To all whom it may concern:

Be it known that I, JAMES MURDOCH NAPIER, of York Road, Lambeth, in the county of Surrey, England, have invented new and useful Improvements in Speed Regulators or Governors, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

This invention has for its object the regulating or governing of the speed of motive-power engines, such as steam, water, and other engines which are capable of being governed by the opening and closing of a valve, or by other equivalent means.

I employ a vessel formed to contain a suitable fluid, placed on a spindle or in bearings or supports, so that it can be easily rotated. This vessel is rotated by being placed in connection, by suitable wheels, pulleys, or other convenient mechanical means, with the engine, the speed of which is to be regulated or governed by it, and the fluid, when placed within it, rotates with it.

I provide a fixed tube or vessel, supported by a suitable frame or bracket. The lower end or portion of this tube or vessel passes into the rotating vessel at its upper end and at or near its axis. From this fixed tube or vessel a hollow arm projects toward and terminates near the inner circumference of the rotating vessel, but not touching it. In this hollow arm, at or near its extremity, is an orifice though which the fluid, when put into the rotating vessel, finds its level in the stationary tube or vessel. The orifice referred to is so placed that, when motion is given to the rotating vessel, a portion of the fluid in it is forced in at the orifice of the stationary tube or vessel, and as the pressure of the fluid at the orifice increases, by an increase in the speed of rotation, the fluid rises higher in the stationary tube or vessel, and so the height of the fluid varies more or less according to the speed of rotation given to the rotating vessel and to the fluid contained in it.

I inforce and sustain the rotation of the fluid as completely as possible in conformity with that of the vessel by internal projections connected with or being part of the rotating vessel. In forming these projections I leave a space sufficient so that they may not interfere with the part which projects from the fixed tube or vessel.

It will be understood that the projections used for insuring the rotation of the liquid with the vessel insure at the same time the due pressure of the liquid at the orifice, and the equivalent rise of the fluid in the fixed tube or vessel.

In order to operate upon the governing or throttle valve of the engine by means of the rising or falling of the liquid in the stationary tube or vessel, I employ a float, which I connect with the throttle-valve of the engine by means of toothed wheels, pulleys and cords, levers, or other ordinary and convenient mechanical arrangements, so that when, in consequence of an excess of speed in the engine, the fluid is raised above a certain height in the stationary tube or vessel, the consequent rising of the float partly or entirely closes the valve and shuts off the steam or other power. When, on the other hand, the engine does not run fast enough, the fluid in the stationary tube or vessel falls so that the float is lowered, and thus the valve is opened to permit more steam or other power to operate, and thus the engine is kept at the desired rate of speed. The float may be partly balanced by a weight, so that the balance-weight will operate on the valve when the float is raised by the rise of the fluid, while, when it falls, the excess in the float over that in the balance-weight will operate on the valve, or the valve may be actuated, in one sense, by the float being forced up by the fluid, and, in the opposite sense, by the weight of the float on the falling of the fluid. Mercury, water, or other suitable fluid, may be used for my regulator or governor.

The rotating vessels for my improved speed-governor may be made cylindrical or of other suitable form, and may be furnished with a cover, or otherwise be constructed in two convenient parts, securely fixed together to prevent the escape of the liquid at their junction, and when a fixed central tube or vessel passes through a hole in the cover or upper part of the rotating vessel, and, further, when this tube or vessel is firmly supported by a bracket or frame, it may be fitted to the hole in the cover or upper part of the rotating ves-

sel, and form a bearing or support to steady the vessel in its revolutions. When a large float is used, such as will generally be necessary for my speed governor, I prefer only to enlarge, to receive it, that part of the stationary tube or vessel which rises above the rotating vessel, leaving that part which enters the rotating vessel small. If desired, however, the full size of the fixed tube or vessel required for the float may pass into the rotating vessel.

In order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

Figure 1 is an elevation, and Fig. 2 is a vertical section, of a governor constructed according to my invention. Fig. 3 is a horizontal section taken on the line 1 1, Figs. 1 and 2.

A is the vessel which contains the fluid; B, the spindle to which it is fixed. The spindle B is pivoted at *a*, and has an upper bearing at *a'*. The means shown for communicating rotation to the vessel A are a pulley on the spindle B, which receives a driving-band from a pulley driven in any convenient manner from the motive-power engine. The supporting-frame E is fastened to base-plate E^1, and carries the upper bearing-bracket E^2, the bracket E^3 for supporting the central fixed tube or vessel *d*, and the cylinder or tube F, in which is the float I. The rack I^1, which is fixed to float I, gears with the toothed sector I^2. The float is guided by the upright I^3. Connecting-rod I^4 is jointed to the sector I^2, and is part of the means shown for transmitting the movement of the float to the valve of the steam or other motive engine. On the vessel A being rotated, the fluid in the vessel passes in at the orifice *f* at the end of the hollow arm *e*, which projects from the center fixed tube or vessel *d*. H are internal projections, which serve to enforce and sustain the rotation of the fluid as completely as possible in conformity with that of the vessel, and to insure the due pressure of the fluid at the orifice *f*, according to the speed of rotation. When sufficient speed of rotation is given to the vessel A the fluid will rise in tube *d* until it reaches the float I. When a further increase of speed is given the float I will be acted upon, and as the speed increases it will be raised. The instrument may be so connected with the engine it has to govern that when the engine is running at nearly its full speed the float I will be on the point of being raised, so that, on any increase in the speed, the valve of the engine will be operated to close through the connections already explained. As the speed of the engine, and consequently of the vessel A, diminishes, the float I will fall, and the valve of the engine will be reopened. Small air-holes *c c* are provided. Fig. 4 shows the fixed tube or vessel F required for the float I, placed so that it passes into the rotating vessel A. In this figure the float I is shown assisted by the balance-weight J. The two are connected by a cord passing over a pulley, K, to which it is attached to prevent slip. The lever I^4 and connecting-rod I^5 are part of the means shown for transmitting the movement of the float to the valve of the steam or other motive-power engine. E represents a bracket or part of a supporting-frame. It is shown supporting the central cylinder or vessel F rising from the central tube *d*.

Figs. 5, 6, 7, 8, 9, and 10 represent various forms of projecting arms and orifices suited to my invention. In each figure, *d* is the central fixed tube or vessel, *e* the hollow arm, and *f* the orifice. In Figs. 9 and 10 the hollow arm *e* is shown projecting from the circular disk *e'*, which operates to prevent the action of the full length of the arm against the fluid. In Figs. 9 and 10 a means is shown of reversing the orifice *f* from one side of the hollow arm to the other, in order that, when desired, the vessel containing the fluid may be rotated in either direction. The reversing of the orifice *f* is obtained by the cylindrical valve *q*, which fits freely in the tube *r*. This valve takes its position on one side or the other of the hollow in the arm *e*, according to the direction in which the fluid is moved. The pins *s* form stops for the valves *q*.

In Figs. 11 and 12, *d* is the central tube, *e* the projecting arm, and *f* the orifice. These last figures represent a small-size arm and orifice. The sizes of the fixed center tubes, the projecting arms, and orifices will depend upon the size of the instrument and the use for which it is destined.

The disk *e'*, Figs. 9 and 10, may be used or not, as preferred, in conjunction with any of the forms of projecting arms *e* shown.

In indicating the similar parts on the various figures I have endeavored to use similar letters of reference, in order to render it unnecessary to repeat the explanation of such parts.

My rotating vessels may be filled with the fluid, or may sometimes be only partially filled.

In arranging the drawings which illustrate my invention I have supposed mercury to be the fluid used.

More than one orifice, *f*, may be used, when desired, connected with the center fixed tube or vessel *d*.

Having thus described the nature of my said invention, and the manner of performing the same, I would have it understood that I do not claim the mechanical parts separately; but

I claim—

1. A speed regulator or governor, consisting of the combination, with valve-connections or actuating mechanism, of a rotating vessel adapted to contain and carry around with it mercury or other liquid; a stationary arm supported within the rotating vessel and provided with an orifice; and a tube or vessel communicating by a channel with the orifice in the arm, into which orifice, and by way of the channel, the liquid is forced to the tube or vessel in which, by virtue of the pressure of the liquid at the orifice increasing with the speed of ro-

tation of the vessel, it operates through said connections upon the throttle-valve or equivalent part of the engine to be controlled, substantially as described.

2. The combination, substantially as hereinbefore set forth, of the rotating vessel driven from the engine, the speed of which is to be controlled, and adapted to contain and carry around with it the mercury or other liquid, the cylinder or tube located above said vessel, the float in the cylinder, the hollow arms connected with the cylinder, projecting into the rotating vessel and having an orifice in its outer end, and mechanism, substantially such as described, for connecting said float with the valve of the engine.

3. The combination of the cylinder or tube connected at its lower end with a rotating vessel provided with internal projections and supplied with liquid, the float in said tube, and mechanism for connecting said float with the valve of the engine, the speed of which is to be governed, these members being constructed and operating, substantially as hereinbefore set forth, whereby the movements of the float and its connections are controlled by the upward pressure of the liquid, caused to ascend from the vessel by its rapid revolution.

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