2 Sheets-Sheet 1.

W. Wright,

Steam-Engine Valve-Gear.

No. 59,886. Patented Nov. 20, 1866.

Fig. 1.

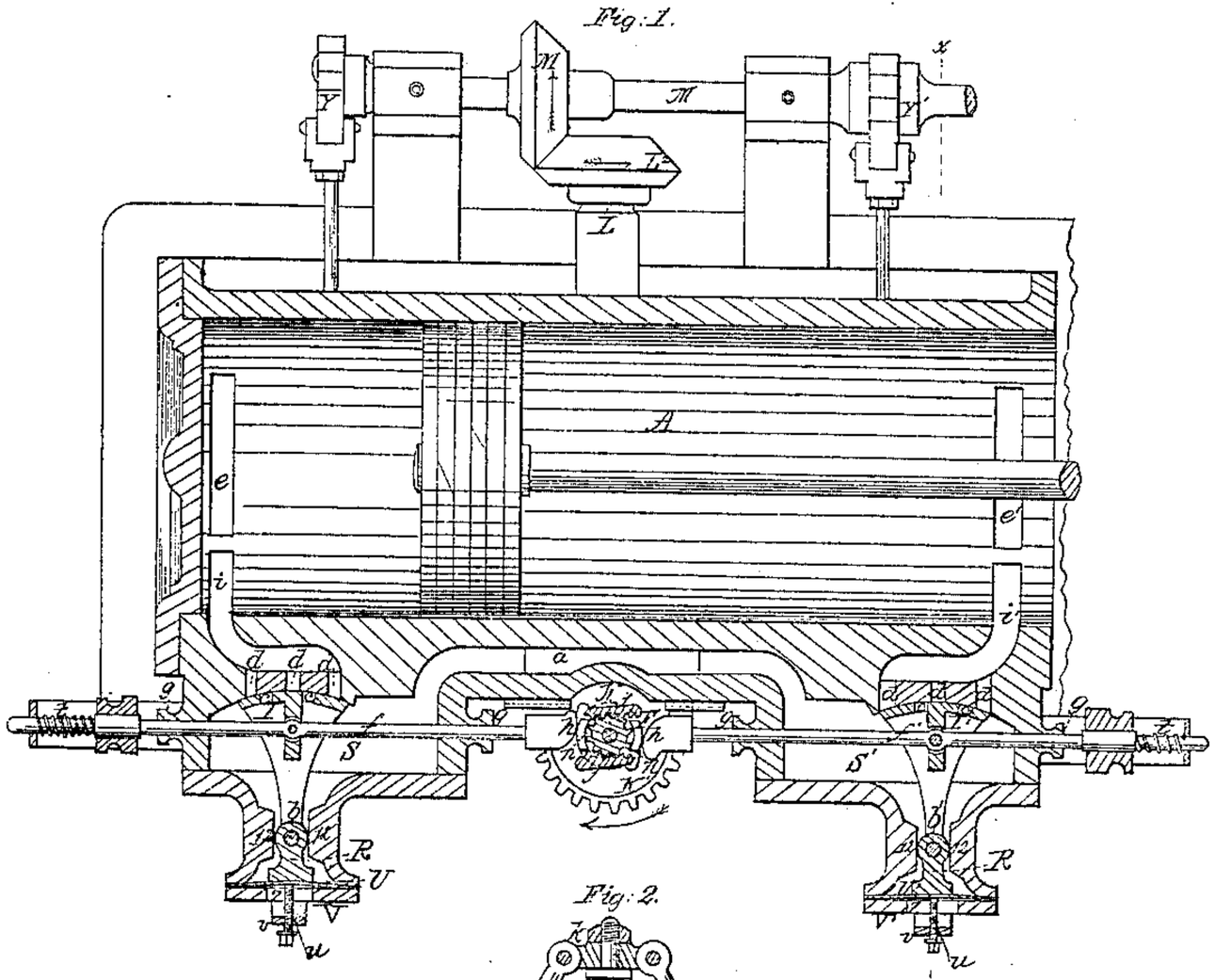


Fig. 2.

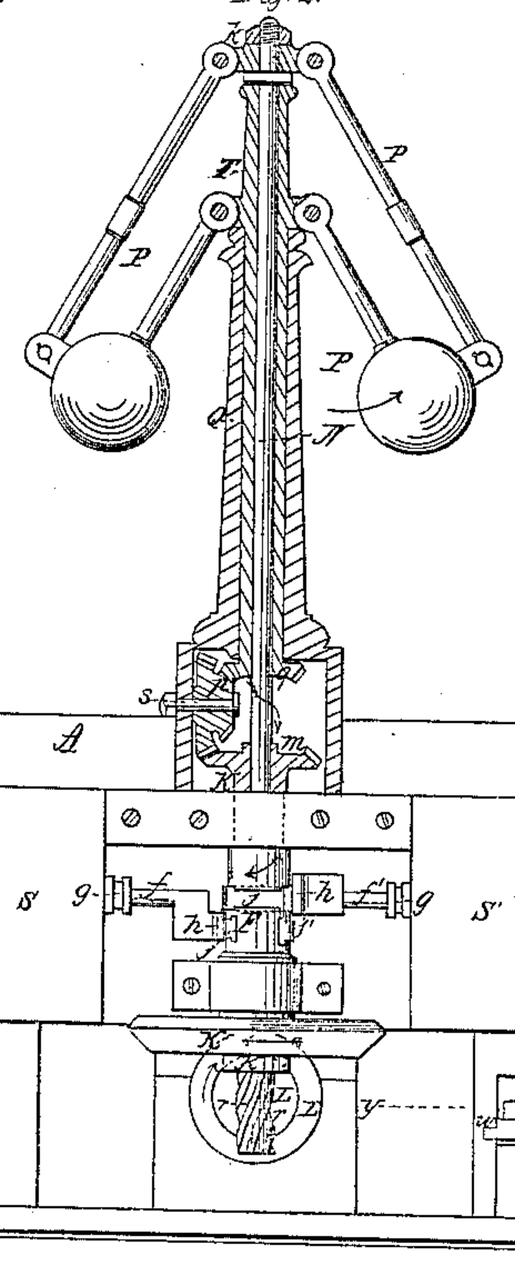
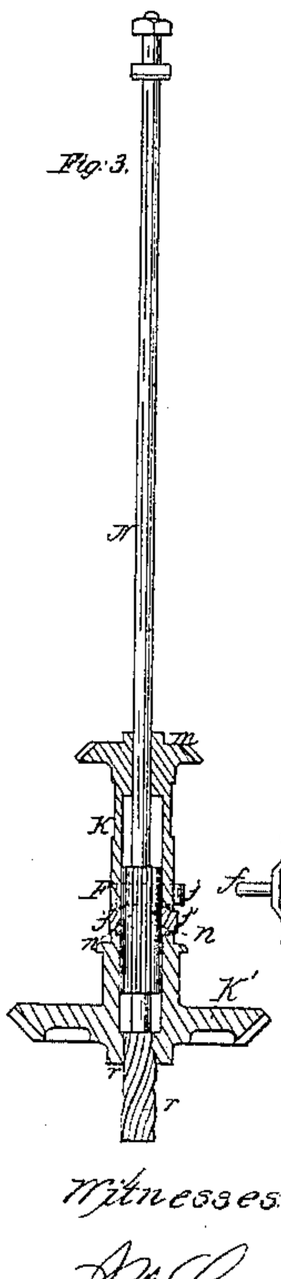


Fig. 3.



Witnesses

J. W. Coombs

L. Holmes Jr

Inventor

Wm. Wright

2 Sheets-Sheet 2.

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Fig: 4.

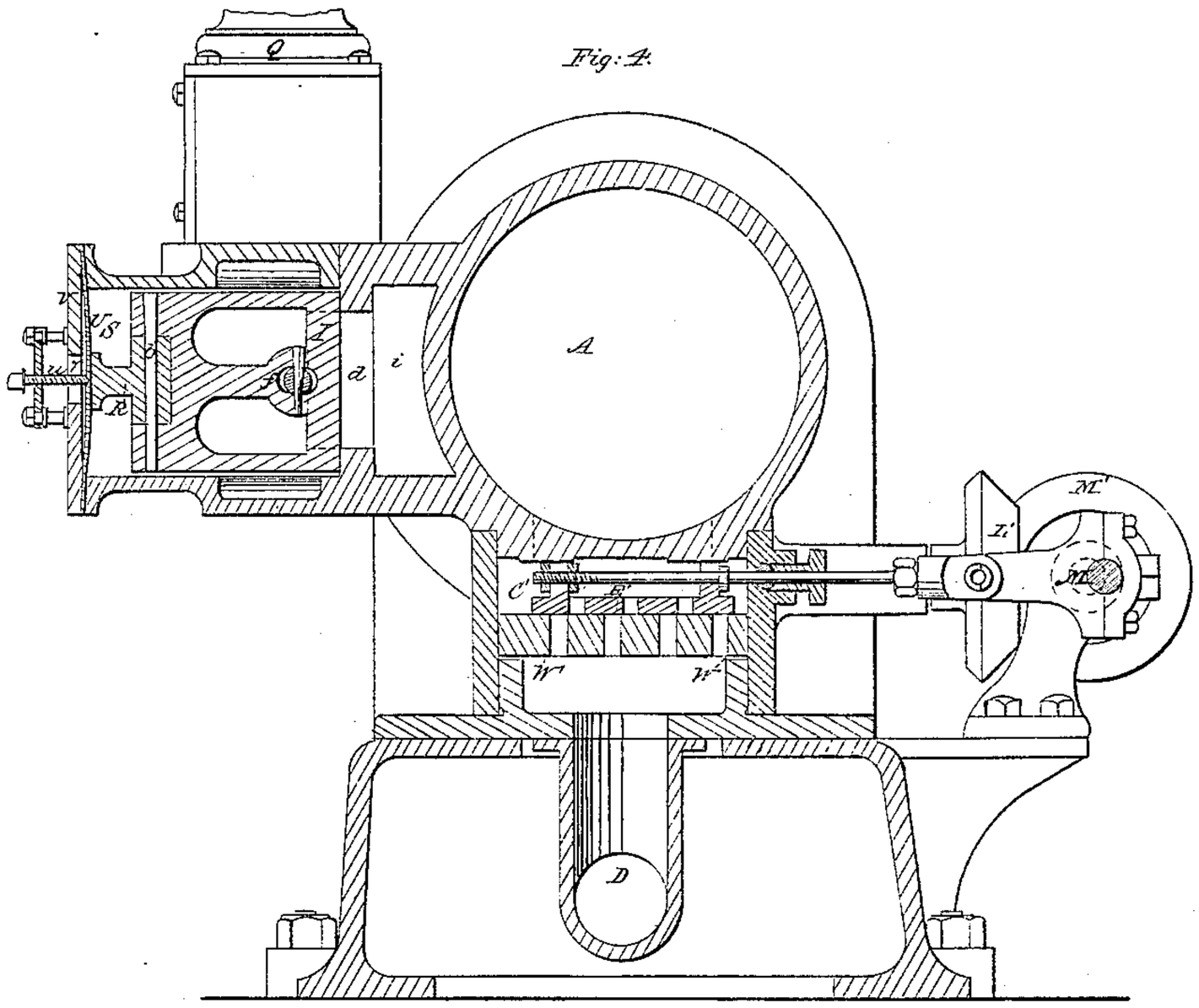
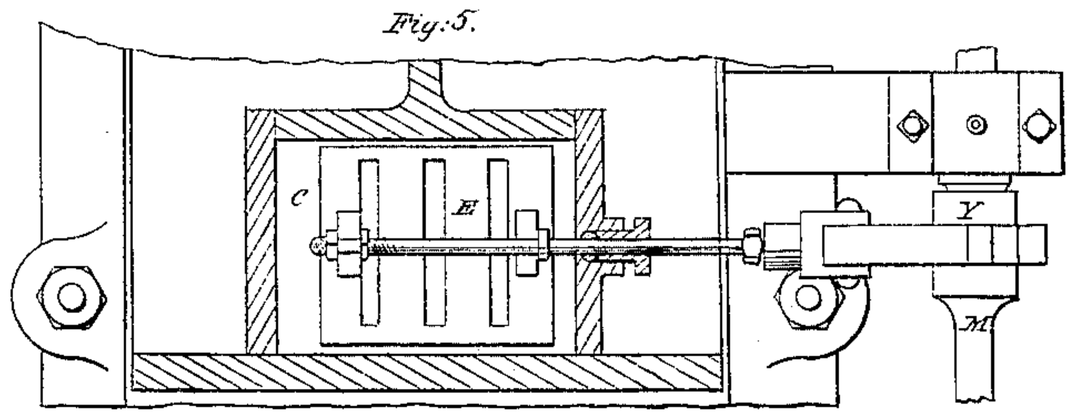


Fig: 5.



Witnesses.

J. H. Coombs

L. Holmes Jr.

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United States Patent Office.

IMPROVEMENT IN STEAM ENGINE CUT-OFF VALVE-GEAR.

WILLIAM WRIGHT, OF NEW YORK.

Letters Patent No. 59,886, *dated November* 20, 1866.

SPECIFICATION.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, WILLIAM WRIGHT, of the city, county, and State of New York, have invented certain new and useful improvements in the Valves and Valve-Gear of Steam Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings forming part of this specification, in which—

Figure 1 is a horizontal section of the cylinder of a horizontal steam engine and of the induction valves and valve-gear.

Figure 2 is a side view of the cylinder and valve-gear, also exhibiting the governor in section.

Figure 3 is a longitudinal view of the spindle and gearing by which the valve-operating cams or toes are adjusted by the governor or otherwise to make the induction valves operate as a variable cut-off.

Figure 4 is a transverse vertical section of the cylinder and valves in the plane indicated by the line *x*, *x*, fig. 1.

Figure 5 is a horizontal section of one of the eduction-valve chests in the plane indicated by the line *y*, *y*, in fig. 1.

Similar letters of reference indicate corresponding parts in the several figures.

One feature of the invention consists in a novel valve-gear for operating the induction valves of a steam engine, whereby the said valves are made to produce a variable cut-off which may be automatically adjustable under the control of a governor, or adjustable by other means.

In order that the above-mentioned valve-gear may operate with the most perfect success or to the best advantage, it is desirable that the valves should be, as nearly as practicable, free from friction, or that the pressure of steam upon them in such direction as would permit their free action should be counterbalanced; and although the application of the valve-gear is not limited to any particular kind of valve, the valves which I propose generally to use are of what may be termed the rolling-slide kind, having the longitudinal profiles of their faces and seats of the form of arcs of circles; and an important feature of my invention consists in certain devices in combination with such valves, whereby the above-mentioned desirable result is obtained.

To enable others skilled in the art to apply my invention to use, I will proceed to describe it with reference to the drawings.

A represents the cylinder of the engine, having separate ports, *i*, *i'*, for the induction, and *e*, *e'*, for the eduction of the steam, the induction ports communicating with two separate steam chests, S S', on one side of the cylinder which are kept filled with steam from the boiler, when the engine is in operation, through a passage *a*, connecting them with one common steam pipe, and the eduction ports *e*, *e'* communicating with separate eduction chests, C C', under the cylinder connected with one common eduction pipe, D, (fig. 4.) I I' are the induction valves arranged one in each of the steam chests. These valves, in the example of my invention illustrated in the drawings, are of the rolling-slide kind, having the longitudinal profiles of their faces and seats of the form of arcs of circles, as shown in fig. 1, and having an oscillating motion about the centres *b b'*. In order that a proper amount of opening of the steam ports may be obtained with a small amount of motion of the valves, for the better operation of my variable cut-off valve-gear, the valves are made with ports, *c c*, which communicate with two or more branches, *d d*, of the cylinder induction ports *i i*, opening into the valve seats. The stems or working rods, *f f'*, of these valves are arranged parallel with the cylinder and pass through stuffing boxes *g*, *g*, in both ends of their respective steam chests, S S', in order that they may be relieved of pressure of steam on their ends. The inner ends of the said stems are furnished with bevelled or rounded ends, *h h'*, in order that they may be the better acted upon by the toes, *j j'*, of the valve-operating cam, F. The valves I I' only effect the induction and cutting off of the steam, separate valves being used for eduction, as will be hereinafter described.

The induction-valve-operating cam is carried by a hollow upright shaft, K, arranged in suitable fixed bearings in a position between the heads of the valve-stems *f f'*. This cam has a cylindrical body, and has in its exterior surface straight tangential grooves, of dovetail form in their transverse section, for the reception of the sliding-toes *j j* and *j' j'*, which act upon the heads of the valve-stems to produce the opening movements of the valves. The toes *j j*, for operating the valve I, are arranged above and at right angles to those, *j' j'*, for operating the valve I', and the heads, *g g*, of the valve-stems are arranged in a corresponding manner. The hollo

cam-shaft K is geared by an intermediate hollow horizontal shaft, L, and bevel-gearing, K′ L′ L² M′, with a horizontal shaft, M, which is driven by bevel-gearing from the crank-shaft of the engine. As there are two toes for operating each valve, and each valve is required to be operated but once for each stroke of the piston of the engine, the hollow cam-shaft is so geared as to make but one revolution for every two revolutions of the shaft M and crank-shaft. The toes *j j* and *j′ j″* have on their straight inner faces cogs which gear as shown in fig. 1, with long straight cogs, *n n*, or an upright spindle, N, which passes loosely through the hollow main spindle T, of a governor, P, (fig. 2,) which revolves freely, without any longitudinal movement, in a hollow fixed column, Q. The upper end of the said spindle N is so suspended from the governor at *k* (fig. 2) that it will rise as the governor balls fly out from the centre, and descend as the governor balls approach the centre. The said spindle, which passes through the hollow cam-shaft K, has on its lower part a series of long spiral or worm cogs or threads, *r r*, which work like a screw, in a nut formed or fitted and firmly secured within the lower part of the hollow shaft K. The governor is driven by the bevel gears *m p q*, (fig. 2,) from the hollow cam-shaft K, the gear *m* being fast on the cam-shaft, the gear *p* turning loosely on a fixed stud, *s*, and the gear *q* being fast on the main spindle, T, of the governor.

It has been hereinbefore stated that the toes *j j* and *j′ j″*, of the cam F, produce the opening movement of the induction valves I I′. The return movement for cutting off the steam may be produced by weights or any other devices acting upon the outer ends of the stems. The drawing (see figs. 1 and 2) represents spiral springs, *t t*, applied to the stems for this purpose. In the closing movement the valves may be stopped by fixed stops suitably arranged, but they are represented as being stopped by the inner ends of the stems coming into contact with the cylindrical portions of the cam F between the toes. The opening movement of the induction valves is greater or less, and the said valves are caused to remain open a longer or shorter time, according to the degree of the protrusion of the toes, *j j* and *j′ j″*, beyond the cylindrical portion of the cam K. The amount of this protrusion is regulated by the higher or lower position of the spindle N. The raising of this spindle causes it to turn on its axis within and independently of the hollow cam-shaft K, by the spiral cogs or threads, *r r*, working in the nut in the lower part of the cam-shaft, and by this independent turning movement the straight cogs, *n n*, are caused so to act upon the cogs of the toes and to draw the points of the latter inward; and the descent of the spindle is by the same means caused to produce an opposite result. It will thus be understood, the governor, as it begins to rise by any increase of speed, raises the spindle N, and so drawins the toes and reduces the length of the opening movement of the valves and the time which they are all allowed to remain open; and as it falls, with any diminution of speed depresses the said spindle and so produces an opposite result, thereby regulating the speed of the engine. To permit the above action of the governor the connection of the spindle at *k* may be such that the spindle N may be capable of turning independently of the governor. This must be the case whether the governor rotates in the same direction with the cam-shaft K or in the reverse direction, as it does with the system of gearing, *m p q*, hereinbefore described. The proper direction of the pitch of the spiral cogs or threads, *r r*, will depend upon whether the governor rotates in the same direction as, or the opposite direction to, the cam-shaft K, owing to the spindle N rotating with the cam-shaft. By the use of two toes for operating each valve, and thereby enabling the cam-shaft to be run at half the velocity of the crank-shaft of the engine, the engine may be run very fast and yet the valve-operating cam may rotate slowly, and a very steep pitch of the spiral cogs or threads is enabled to be used; although if the cam-shaft rotated at the same velocity as the crank-shaft a single toe might be used with the same variable adjustment to operate both valves. This method of operating the valve to obtain a variable cut-off is applicable to engines without a governor, the spindle N, in such case, being adjustable lengthwise to produce the variable action of the cut-off, either by a screw, lever, or other contrivance operated by hand. The mode of counterbalancing the pressure of steam on the induction valves I I′, to obtain the proper freedom of operation, is illustrated in figs. 1 and 4. The centres upon which the valves oscillate, consisting of pins *b b′*, concentric with their faces and seats, are secured in or inserted through blocks of metal, R R′, riveted or otherwise secured to bonnet-plates, U U′, of steel or other metal thin enough to be moderately flexible, applied to the backs of the steam-chests S, S′. These plates have their inner faces exposed to the pressure of steam in the chests and their outer faces exposed only to the pressure of the atmosphere. The said bonnet-plates are secured to the valve-chests by means of rigid flange-plates, V V′, and screw-bolts, in which there are suitable openings, 7 7, for the exposure of the said bonnet-plates to the atmosphere. The said bonnet-plates being of suitable size, the pressure of the steam upon them so nearly balances the pressure on the backs of the valves as to allow their faces to be pressed only just as close upon their seats as is necessary to keep them tight. At the back of the valves there are applied set-screws, *u*, which screw through fixed bridges, *v*, arranged across the opening, 7, outside of the flange-plate V. These set-screws serve to prevent the valves from being pressed back too far from their seats by an excess of outward pressure of the steam within the cylinder. The connections of the valves with the blocks R R′, are fitted to slide between cheek-pieces, 12 12, in the chests, which prevent any lateral motion, but permit the movement of the flexible plates and valves outward and from the valve seats. The eduction valves E E′, working in the chests C C′, below the cylinder, are connected with and operated by separate cranks, Y Y′, on the shaft M, which is parallel with the cylinder. The seats, W W′, of these valves consist of plates which are fitted into grooves, *w w′*, in the sides of the chests C C′, as shown in fig. 2, and are faced and have the valves fitted to them before being inserted into their places. This construction of the valve seats affords greater facility for the accurate fitting of the valves than if they were formed directly in the chests or on the cylinder.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The cogged sliding toe or toes and the spirally grooved or threaded longitudinally moving spindle N, in combination with each other and with the cam F, and valves, substantially as and for the purpose herein specified.

2. The spirally cogged or threaded spindle N, so combined with the governor and the sliding toe or toes of the valve-operating cam as to have a longitudinal movement as the governor rises and falls, and also to be capable of turning independently of the governor as the latter rises and falls, substantially as and for the purpose herein specified.

3. The combination of the rolling slide valves I I′, with the flexible plates U U′, substantially as herein described for the purpose herein set forth.

4. The set-screws *u u′*, in combination with the flexible plates U U′, and valves I I′, substantially as and for the purpose herein specified.

W. WRIGHT.

Witnesses:

HENRY T. BROWN,

A. LE CLERC.