

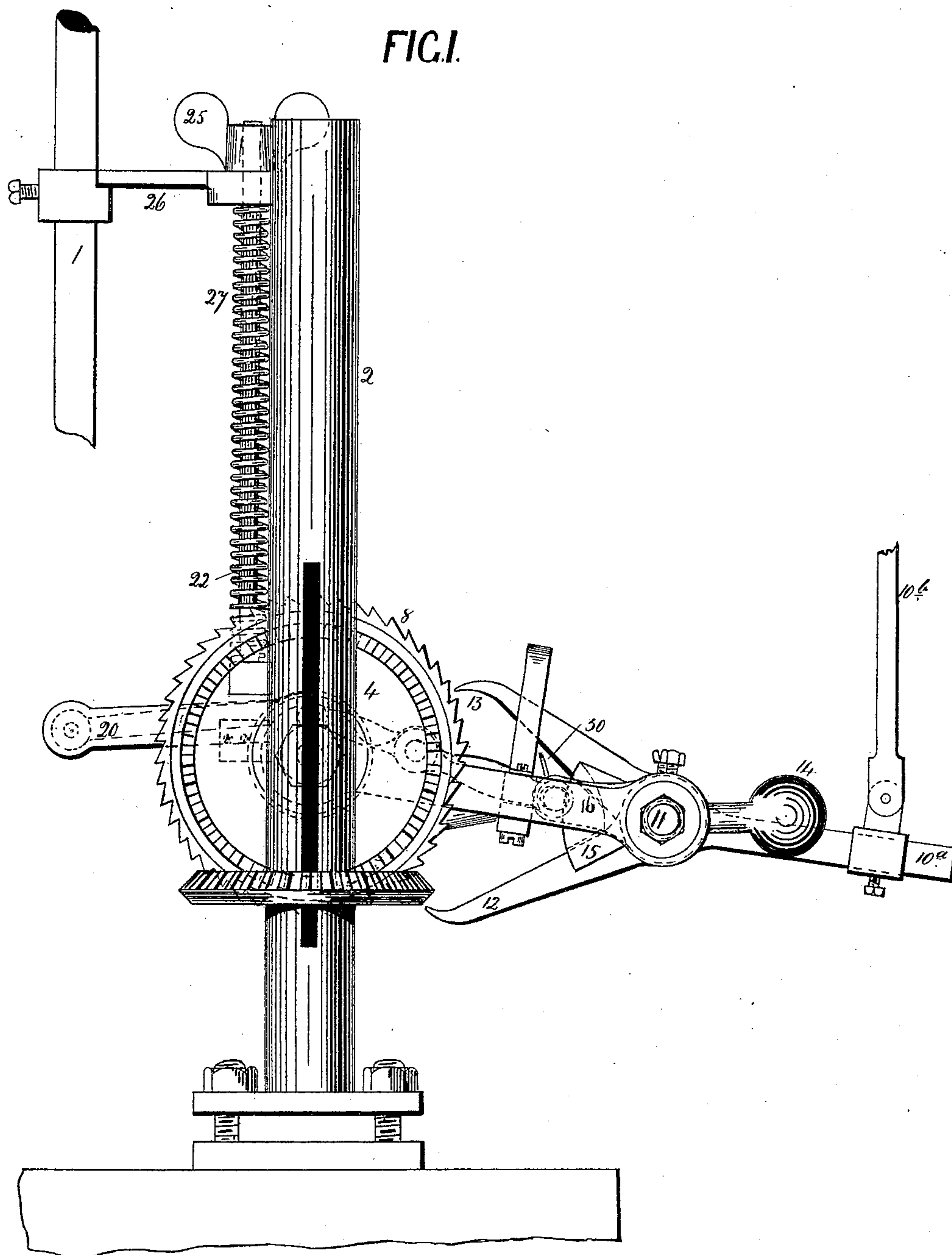
(No Model.)

3 Sheets—Sheet 1.

R. WILBY.
VALVE GEAR.

No. 397,323.

Patented Feb. 5, 1889.



WITNESSES:

H. Daplinger
W. Reilly

INVENTOR:

Richard Wilby
By his Attorney,
Henry Coen

(No Model.)

3 Sheets—Sheet 2.

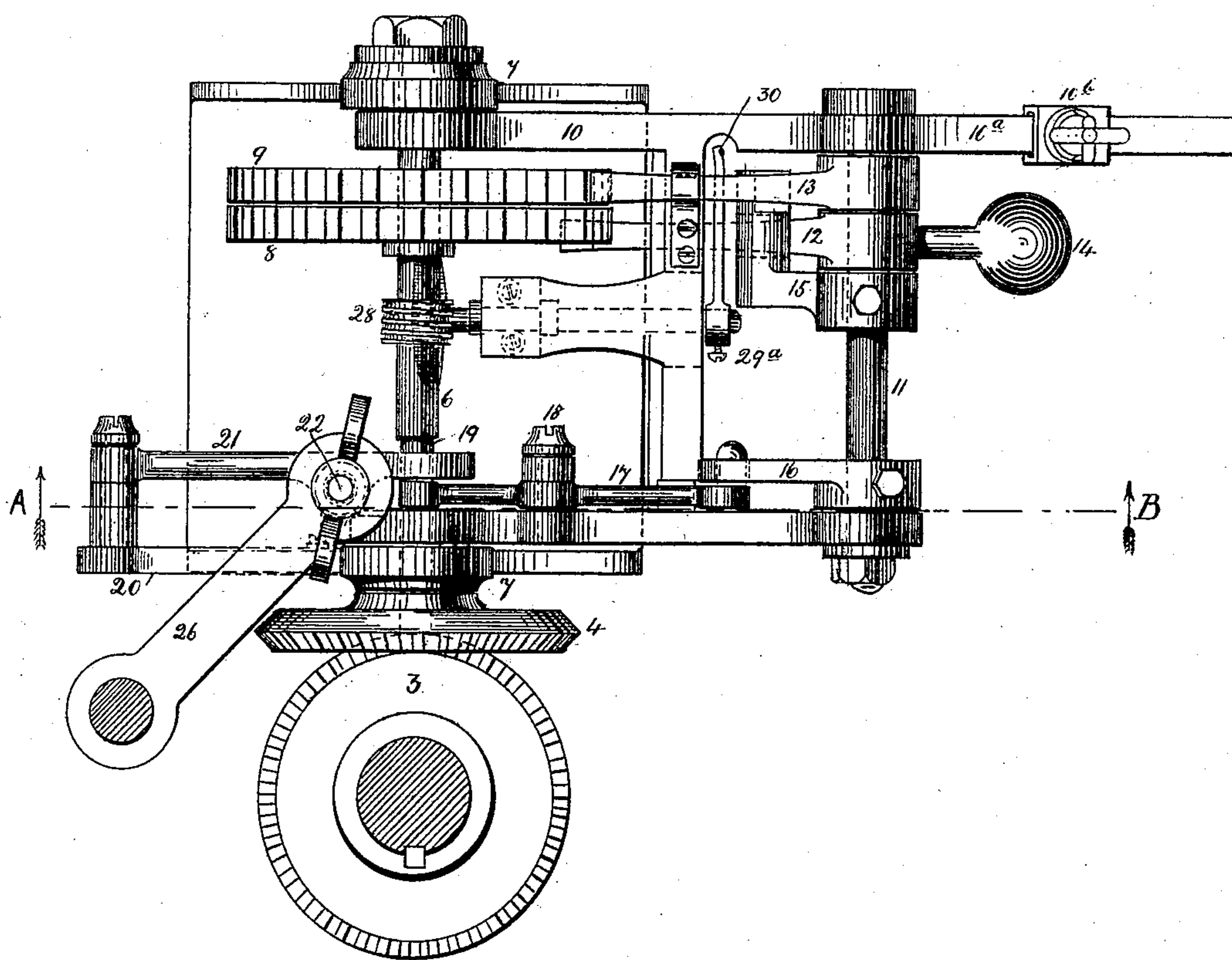
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VALVE GEAR.

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FIG. 2.



WITNESSES:

W. Reilly
W. Reilly

INVENTOR:

Richard Wilby
By his Attorney,
Henry Combs

(No Model.)

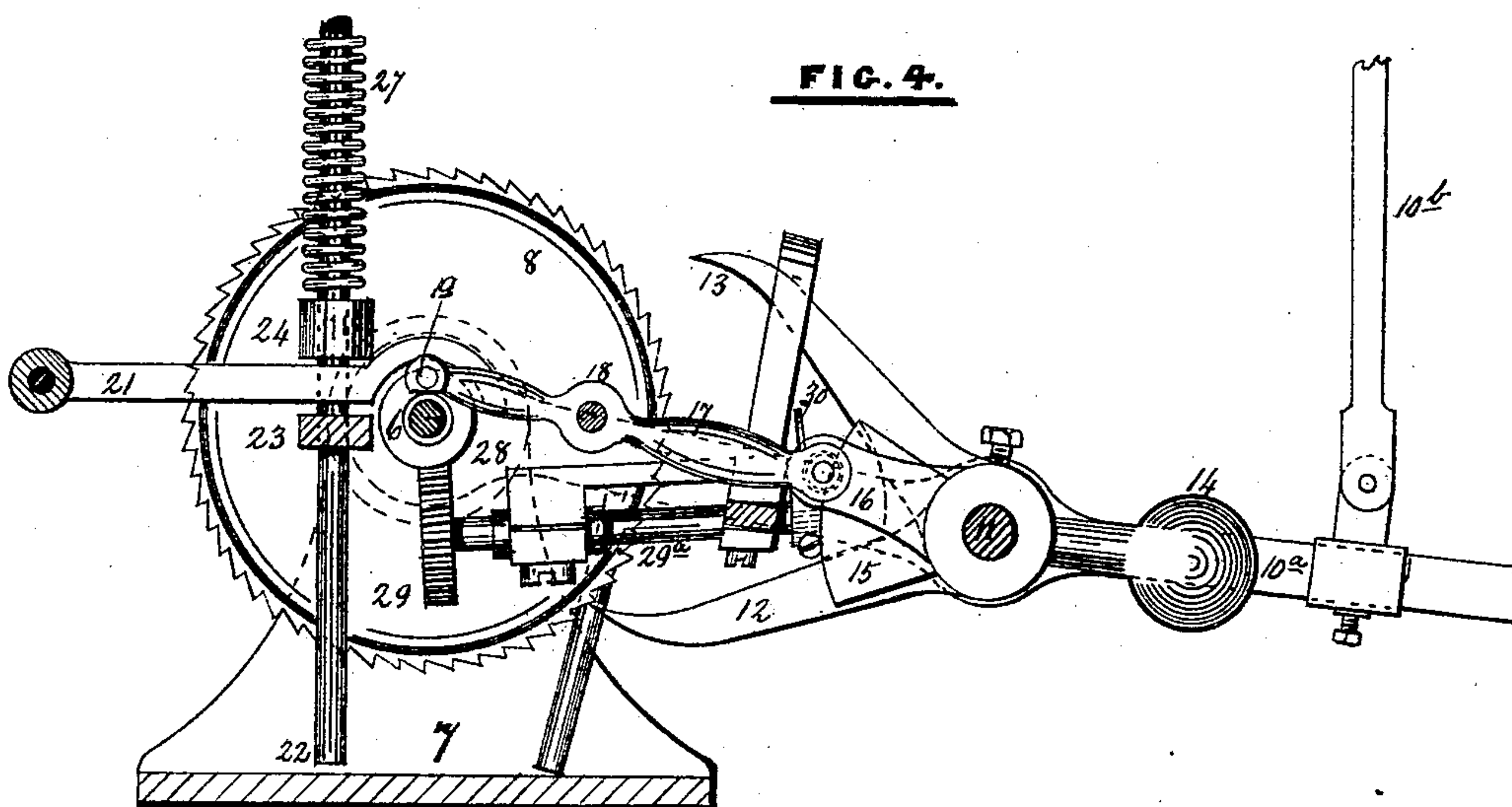
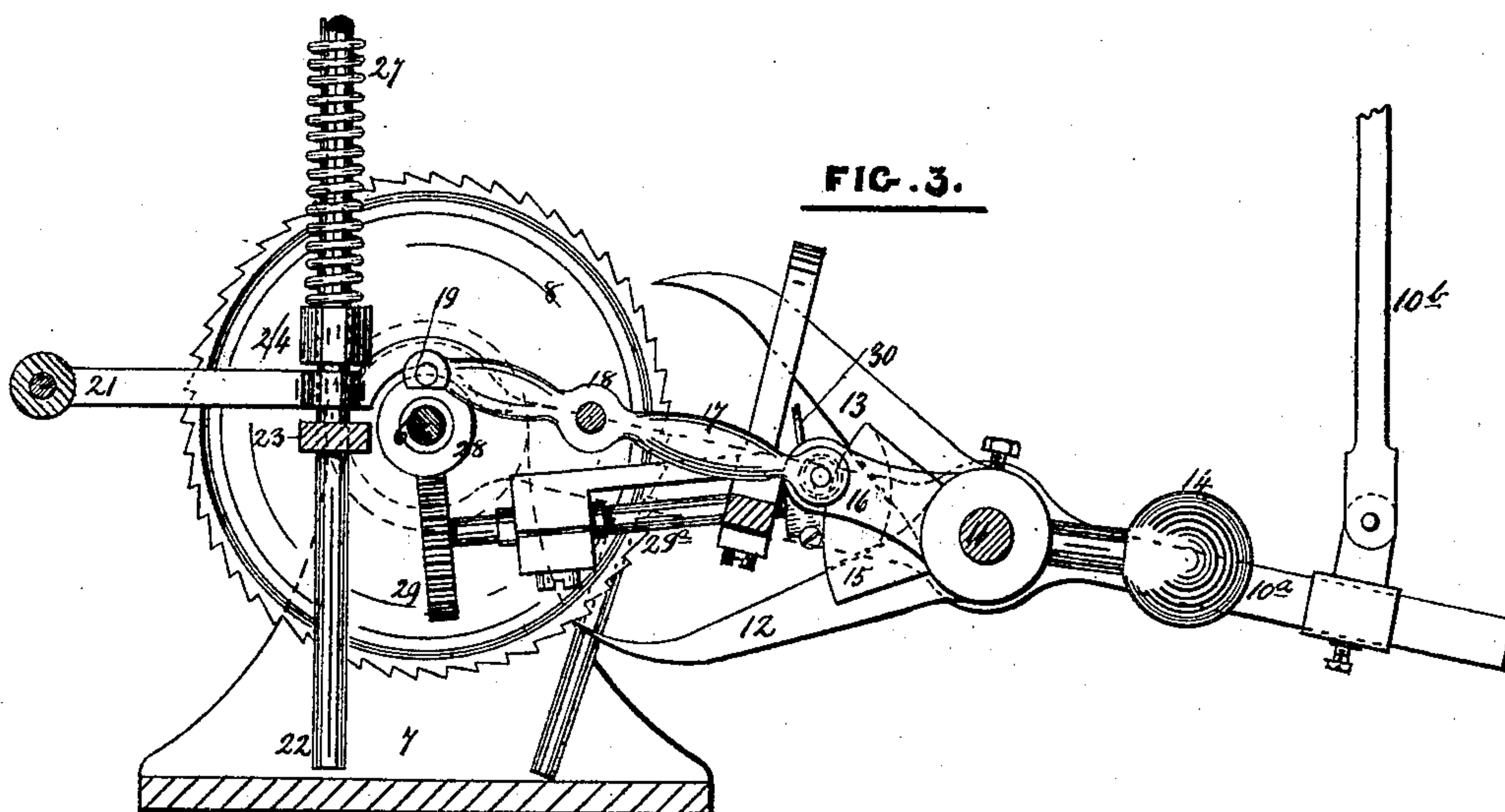
3 Sheets—Sheet 3.

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VALVE GEAR.

No. 397,323.

Patented Feb. 5, 1889.



WITNESSES:

W. Reilly

INVENTOR:

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By his Attorney,
Henry Connel

UNITED STATES PATENT OFFICE.

RICHARD WILBY, OF MIRFIELD, COUNTY OF YORK, ENGLAND.

VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 397,323, dated February 5, 1889.

Application filed August 9, 1888. Serial No. 282,392. (No model.)

To all whom it may concern:

Be it known that I, RICHARD WILBY, a subject of the Queen of Great Britain, residing in Mirfield, county of York, England, have invented certain new and useful Improvements in Valve-Gears for Automatically Operating the Cut-Off or Expansion Valves of Steam-Engines, of which the following is a specification.

This invention has reference to a prior United States patent granted to me, bearing date the 8th day of May, A. D. 1888, No. 382,577, in which the mechanism automatically operates the right and left hand adjusting-coupling of the governor-connections so as to keep one uniform speed.

My present invention consists in the application of a similar but modified form of mechanism specially designed to work automatically such variable cut-off or expansion valves as are not capable of being operated by means of "trip-gear."

In the accompanying drawings, Figure 1 is an elevation of my improved apparatus; Fig. 2, a plan thereof, and Figs. 3 and 4 a sectional elevation taken through line A B in Fig. 2.

The apparatus is represented as being in connection with the cut-off-valve spindle 2, which is made with a long feather or sunken key, whereby the bevel-wheel 3 is enabled to impart a rotary motion to the said spindle, so as to alter the point of cut off without interfering with its reciprocating motion.

4 is a bevel-wheel gearing with wheel 3, which is fastened onto the end of a horizontal axis or shaft, 6, supported at each end by brackets 7. In some kinds of cut-off valves the wheels 3 and 4 may be bevel, spur, or a crown wheel and pinion, as will best suit the conditions of the case. On the shaft 6 are fixed two ratchet-wheels, 8 and 9, whose teeth are set in opposite directions. This shaft 6 also carries loosely an oscillating frame, 10, the free end thereof 10^a being connected by a rod, 10^b, or other means to some reciprocating part of the engine, so that the said frame 10 may receive a continuous rocking motion when the engine is running, for purposes hereinafter explained.

I have not thought it necessary to illustrate the steam-engine, as the connection of rod 10^a with a reciprocatory part of an en-

gine is within the ordinary skill of an engineer or skilled mechanic. The oscillating frame 10 also carries a rod or shaft, 11, upon which are placed two pawls, 12 and 13, both of which pawls ride loosely on said rod 11, and, when required, are capable of engaging with the two ratchet-wheels 8 and 9, the upper pawl, 13, being a gravity-pawl; but the bottom pawl, 12, is lifted into gear with its ratchet-wheel 8 by a counterbalance-weight, 14, or by means of a spring. Onto the horizontal rod 11, I fix by screw or other means what I choose to term the "pawl-reliever" 15, placed in such position as to lie between the upper and lower pawls, 12 and 13, such pawl-reliever being used for the purpose of removing both the pawls 12 and 13 clear or out of gear with their respective ratchet-wheels until one of the pawls is required to be in action. Onto the horizontal rod 11, I also fix a crank, 16, the free end of which loosely carries one end of a lever, 17, working on a fulcrum or stud, 18, projecting from the oscillating frame 10, while the opposite end of said lever 17 carries a short horizontal pin, 19, so placed and arranged that when the oscillating frame 10 gets into a horizontal position the center of the short pin 19 is vertically over the center of ratchet-wheel shaft 6, and this is essential to the proper working of the apparatus.

The arm 20, projecting from the bracket 7, carries a lever-arm, 21, the free end of which is curved to a suitable radius and rests upon the short pin 19, projecting from lever 17, which curvature in lever 21 is employed for the purpose of preventing any aberration or irregularity in the motion of the pawls, which must necessarily be produced when the short horizontal pin 19 is not practically in the line of center of ratchet-wheel shaft. The radius of the curve made on the under side of lever-arm 21 must be made from the center of ratchet-wheel shaft 6 to the top of short pin 19, when said pin is pressed down half-way. Near to the free end of lever-arm 21 is a hole through which the vertical needle 22 passes, and immediately underneath such hole is a short bracket, 23, also made with a hole, through which the said needle also passes, which said bracket 23 is employed for the purpose of guiding or steadying the needle.

This needle 22 carries a fixed collar, 24, placed at a suitable position thereon, while the upper portion of said needle is screw-threaded to receive lock-nuts 25, which are used to raise or lower the needle for adjusting the speed of the engine to any given number of revolutions per minute.

The rod 1 is arranged (by a lever or other means best suited to the particular case in hand) to be in working connection with the sleeve of the governor, and on this rod 1, I fix an adjustable bracket, 26, through the projecting arm of which bracket the upper end of the needle 22 passes. Onto this needle 22 I place a spiral spring, 27, between the collar 24 and bracket 26, which spring is employed to give a certain amount of pressure between the collar and bracket, for purposes hereinafter explained.

The *modus operandi* is as follows: When the machine is first connected with the engine, the bracket 26 is fixed at a suitable height on the rod 1, which is in working connection with the governor-sleeve of the engine, so that the collar 24 on the lower part of the needle 22 presses the lever-arm 21 downward, acting upon levers 17 and crank 16, and slightly oscillating rod 11, so as to keep both pawls 12 and 13 clear of their respective ratchet-wheels, and the parts thus arranged will remain in this position so long as the engine runs at its normal speed; but if the speed of the engine slackens through extra weight of machinery or diminished pressure of steam, the governors of the engine would lower, thereby causing the rod 1 to rise, carrying with it the bracket 26 and needle 22, the effect of which would be to relieve the pressure of the collar 24 from the free end of lever-arm 21, also releasing crank 16 and lever 17, allowing the two pawls to lower, whereby the upper pawl, 13, is allowed to engage with its ratchet-wheel 9. The oscillating frame 10, which is attached by a rod, 10^b, to some reciprocatory part of the engine, will now cause the engaged pawl 13 to turn the ratchet-wheel 9 a few teeth at each upward movement of the oscillating frame 10, which motion of the ratchet-wheel is communicated by the toothed wheel 4 to the wheel 3 on cut-off spindle 2 or its equivalent, thereby retarding the cut-off, in which case the engine would gain in speed and the governors resume their normal position, the effect of which would be that the rod 1, with its bracket 26 and needle 22, will also be brought back to their normal positions, removing the pawls clear of their respective ratchet-wheels, and so long as the engine continues to run at the proper speed the pawl-clicks will remain inoperative.

If the engine runs faster than the normal speed, either through increased pressure of steam or through diminished load, the governors would immediately rise to a higher altitude, causing the rod 1, with its bracket 26, needle 22, and collar 24 thereon, to lower, thereby pressing down the forward end of

lever 21, so as to oscillate the lever 17 and crank 16, also causing a slight rocking motion of the shaft 11 in such manner as to lift the pawl-reliever 15, allowing the lower pawl, 12, through the medium of the counterbalance-weight 14, to rise and engage with the teeth of the ratchet-wheel 8, (see Fig. 4,) and as the rocking frame continues to be oscillated by the moving part of the engine such pawl 12 will turn or push forward the ratchet-wheel 8 a few teeth at each downward movement of the frame 10 in the opposite direction to that mentioned in the previous illustration, in which case the toothed wheel 4 would operate the expansion or cut-off valves, so as to accelerate the cut-off and bring the speed of the engine back again to its normal rate, and also the governors to their proper altitude or plane, insuring the release of the pawls from their ratchet-wheels, all of which parts will remain inoperative until the speed of the engine is again varied.

If the steam-pressure necessary to run the engine at the normal speed had got too low, it is obvious that it would be necessary for my improved apparatus to suspend its action; and to accomplish this I place a worm, 28, on shaft 6, gearing with a wheel, 29, on a short shaft, 29^a, which shaft carries a finger, 30, the front end thereof being between the pawls 12 and 13. If, therefore, the pressure of steam has fallen below what is necessary to turn the engine at its normal speed, after my improved apparatus has operated the cut-off spindle or its equivalent sufficiently the finger 30 lifts the top pawl out of gear with its ratchet-wheel, thereby preventing the machine from being damaged, as would be the case if the machine was allowed to go on when there was not sufficient steam to work the engine at the normal speed. The finger 30 is fastened on the short shaft 29^a by a set-screw or other means, and can be adjusted so as to lift the top pawl out of gear by the time the cut-off valves have been altered a predetermined amount.

The function of the spiral spring 27 on needle 22 is to prevent obstruction to the free action of the governors when the acceleration of speed of the engine causes said governor to move rod 1 downward farther than needle 22 can move. Under these conditions the spring 27 yields by compression and permits the bracket 26 to descend after the needle 22 can descend no farther, thereby allowing the governors free action.

By working the expansion or cut-off valves by the mechanism herein described and illustrated the engine is automatically kept at one uniform speed without withdrawing or diminishing the pressure of steam when the engine is lightly loaded, thus effecting a great economy in the steam used, and, as the lever 17 multiplies or increases the motion of the rod 1, the apparatus is very sensitive to the least variations in the load on the engine.

I would have it understood that I do not

restrict myself to all the exact forms of mechanism herein illustrated.

By reference to my former patent, No. 382,577, it will be seen that the ratchet device
5 herein illustrated, which converts vibrating into intermittent rotary motion, and the controlling mechanism whereby the governor is enabled to cause the ratchet-wheel shaft to rotate in either direction or to cease its rota-
10 tion, are the same as those described in said patent, and I do not, of course, claim them herein. In the present construction, however, the arrangement and adaptation are entirely different, the governor-rod that controls
15 the ratchet device being entirely independent of the rotary portion of the mechanism, the latter acting directly on the stem of the cut-off valve.

I claim as my invention—

20 The combination, with the ratchet device

for converting vibratory into intermittent rotary motion, the governor-rod 1, and the controlling mechanism intermediate between the pawls of said ratchet device and rod, whereby the engine-governor is made to control the
25 rotation of the ratchet-wheel shaft, of the stem 2 of the cut-off valve, the wheel 3 thereon, and the wheel 4 on the ratchet-wheel shaft meshing with the wheel 3, substantially as set forth.

30 In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

RICHARD WILBY.

Witnesses:

ARTHUR B. CROSSLEY,
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ERNEST P. NEWTON,
Moorfield Villa, Halifax.