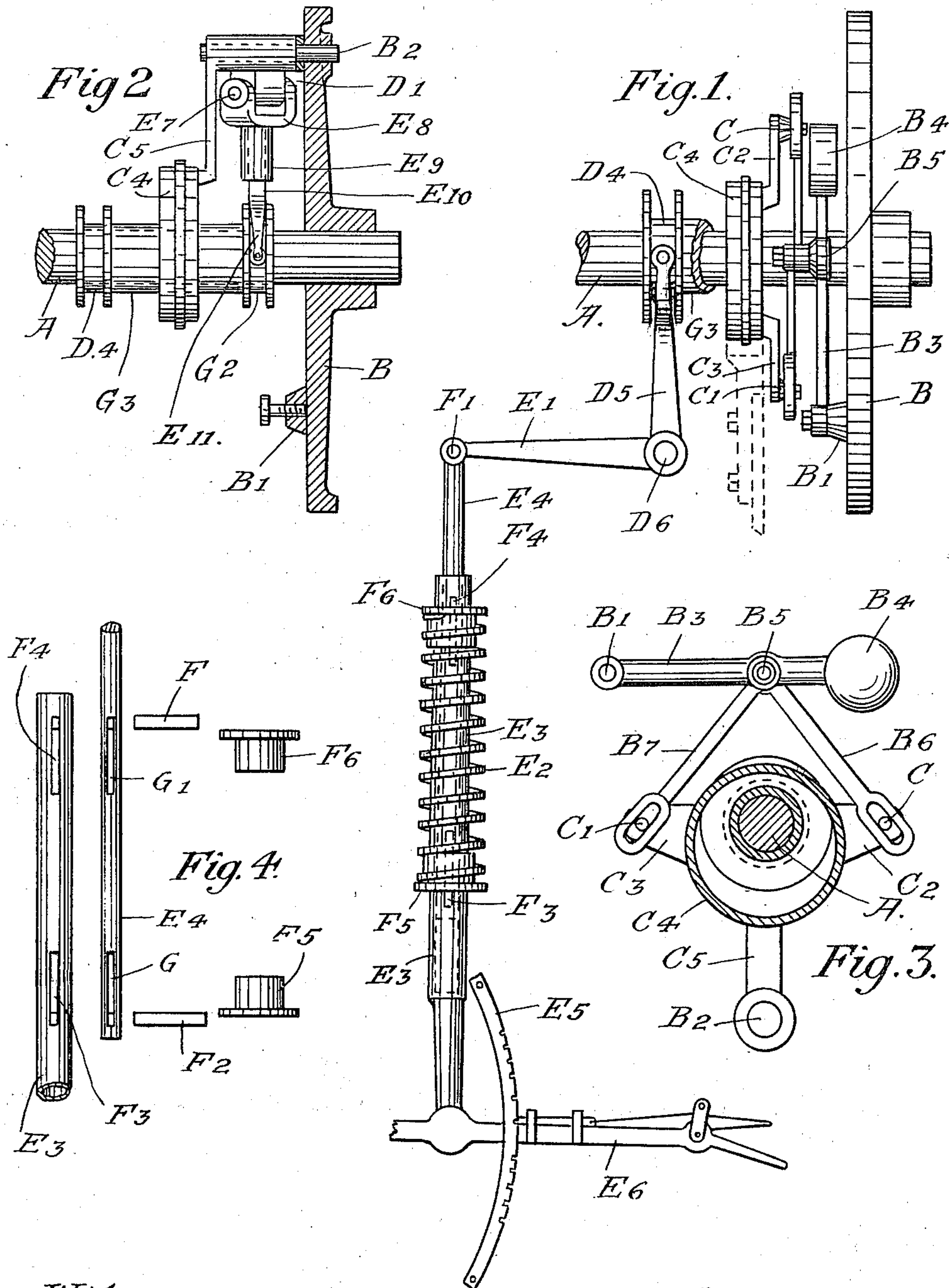


T. T. WAGGONER.
 REVERSING GEAR AND SPEED CHANGER FOR STEAM ENGINES.
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REVERSING-GEAR AND SPEED-CHANGER FOR STEAM-ENGINES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, THOMAS T. WAGGONER, a citizen of the United States, residing at Ward, in the county of Moody and State of South Dakota, have invented a new and Improved Reversing-Gear and Speed-Changer for Automatic Cut-Off Steam-Engines, of which the following is a clear, exact, and full description.

10 The object of my invention is to provide a new and improved reversing gear and speed-changer for steam engines having automatic cut-off, arranged to permit the operator to conveniently reverse the engine by means of an ordinary reversing lever, and to control and change the speed of the engine while the latter is running.

20 The invention consists principally of a pivoted eccentric carried around on its pivot by the driving shaft of an engine, the said eccentric being connected by the usual strap and rod with the engine valve, and said eccentric being controlled in its swinging motion from a weighted lever pivoted on a support attached to the driving shaft.

25 Reference is to be had to the accompanying drawings, forming a part of this specification.

30 Figure 1 is a side elevation of the improvement. Fig. 2 is a side elevation showing parts left out in Fig. 1. Fig. 3 is a transverse section showing a ring-eccentric and its connected parts. Fig. 4 shows more plainly the parts over which the spring is coiled.

35 On the main driving shaft of the engine is secured a wheel B, on one side of which is secured studs B¹ and B² forming fulcrums for a weighted lever and an eccentric, respectively. Weighted lever B³ is fulcrumed at B¹, having slotted links B⁷ and B⁸, pivotally connected at B⁵. The eccentric C⁴ has arranged on one of its faces lugs C³ and C², said lugs having pivots C¹ and C, respectively, engaging slots in said links, as given in detail in Fig. 3. On the outer end of arm B³ is held a weight B⁴, adapted to swing toward and from the main driving shaft A, which will be readily understood by reference to Fig. 3. A sliding collar G³ on shaft A passes through an opening in said eccentric which is sufficiently large to allow the eccentric to swing back and forth freely across the driving shaft. From one face of the eccentric C⁴ extends an arm C⁵, pivotally connected on the face of wheel B

at stud B². Thus the arm C⁵ and eccentric C⁴ swing from stud B²; and as the shaft revolves, the said eccentric is carried around at its fulcrum with the said shaft A. The eccentric is engaged at its periphery by the usual eccentric strap, and connected by an eccentric rod with the valve of the engine, so as to govern the movement of said valve to regulate the admission and exhaust of steam.

60 From Fig. 2 it will be seen that on one face of the eccentric arm C⁵ is mounted a lug D¹, said lug having a bolt E⁷ passing through the same at an angle of forty-five degrees from the line of the stud B².

70 E⁸, E⁹, E¹⁰ and E¹¹ are parts combined to form a lever, said lever having one of its ends pivoted to the eccentric arm C⁵ adjacent to its fulcrum B², a fork at the other end engaging an annular groove G² of sliding collar G³; the said lever in two parts, one having a round projection E¹⁰, the other a sleeve E⁹ surrounding said round part, and movable thereon longitudinally and rotatively. The said collar G³ is adapted to be shifted longitudinally on the main shaft by a shifting lever D⁵, preferably made in the shape of a bell crank lever and having its arm D⁵ connected with annular groove D⁴ in said collar.

85 In Fig. 2 it will be seen that the pivots B² and E⁷ are rigidly connected with one another, and so angularly related as to cause the eccentric C⁴ to move back and forth across the main shaft A, and the collar G³, as said collar is moved back and forth longitudinally on the said shaft.

90 In Fig. 3 it will be seen that by applying pressure to the body of the eccentric C⁴ on one side, that the stud mounted on lug of the opposite side will engage pivotally the end of its respective slot in one of the links B⁷ or B⁸, and that to change said pressure to the opposite side of eccentric from that described, will engage the opposite stud and slot, thus the engine is reversed; and it will be seen in Fig. 2 that when the slot in one of the links B⁷ or B⁸ is caused to engage its respective stud, that the stud of the opposite side of the eccentric will be free to move-back and forth throughout its slot.

105 In Fig. 1 it will be seen that the hollow rod E³ surrounds the solid rod E⁴, and is arranged to pass freely back and forth over the same; that the slots F³ and F⁴ of the said hollow rod are arranged to correspond

with the slots G and G¹ of said round rod, respectively, with pins F² and F³ movably mounted to engage and pass freely back and forth longitudinally through the same. A
 5 spring E² is coiled around the hollow rod, and the cups F⁵ and F⁶ mounted on said rod and at the ends of said spring, said cups pressing the ends of said spring at all times, more or less, as desired by the operator.

10 It will be seen in Fig. 4 that the pins movably mounted in the slots of the hollow and solid rods are free to pass back and forth throughout the length of their respective slots, and as the spring presses the pins
 15 against the ends of slots in the said rods, the said rods are caused to move alike as the operator moves the reversing lever over the segment; and as the speed increases, and as the weighted lever is caused to move out-
 20 ward by centrifugal force, the spring is pressed, as the distance between the pivotal ends of the two said rods lengthens, or shortens, as the case may be, owing to the direction which the engine is running.

25 The bell crank lever D⁵ is fulcrumed at D⁶, and the arm E¹ of said bell crank lever pivotally connected by rods E³ and E⁴ to a reversing lever E⁶ adapted to engage a notched segment E⁵ to lock the said revers-
 30 ing lever in any desired position.

The operation is as follows: When the several parts are in position as illustrated, the engine is set in motion, and the speed increases, then the weight B⁴ of the weight-
 35 ed lever B³ will swing outwardly, owing to the centrifugal force on revolving of the wheel B, on which the said lever is fulcrumed. The outward swinging motion is limited by the studs C¹ and C² engaging the
 40 slotted links B⁷ and B⁸, respectively, so that the eccentric is shifted relative to the shaft A, according to the speed of the engine. A similar movement in the inverse direction takes place in case the speed of
 45 the engine decreases below the normal rate of speed, so that the eccentric is again shifted to open the valve of the engine to the fullest extent to admit as much steam as possible, so as to cause the engine to again
 50 assume its normal rate of speed. Now, it will be seen that when it is desired to reverse the engine, the operator manipulates the reversing lever E⁶ by throwing it either up or down so as to move the hollow rod E³
 55 in like direction, and thereby cause the spring E² to act on the rod E⁴, and said rod to act on the arm E¹, of the bell crank lever D⁵, to impart a swinging motion to the same. The swinging motion of the said
 60 bell crank lever is transmitted by its arm D⁵ to the collar G³, so that the latter is longitudinally shifted on the main driving shaft A, and as the said collar connects with fork E¹⁰ and E¹¹, the latter receives a
 65 swinging motion relative to the main driv-

ing shaft while revolving with the same, causing the sleeve E⁹ and the fork to impart a swinging motion longitudinally, while the eccentric arm and the eccentric are caused to swing transversely. It will further be
 70 seen that by the operator swinging the reversing lever only a short distance from its center on the segment he is enabled to apply spring pressure in either direction with only such force as would be desired for the re-
 75 quired speed, by using different resistance against the centrifugal force of the weight B⁴, in such a manner as to cause the valve of the engine to cut off sooner or later, as the case may require. 80

It will thus be seen that the device shown and described not only forms a sensitive and accurate governor for regulating the speed of the engine, but it also affords a means of conveniently reversing the engine
 85 while the same is running, and a means for changing the speed by using different notches which changes the pressure of the spring relative to the governor.

Having thus fully described my inven- 90
 tion, I claim as new and desire to secure by Letters Patent—

1. A device of the class described, comprising a wheel secured on the main shaft of an engine, a ring-shaped eccentric having
 95 an arm pivoted to said wheel, said shaft passing through the center opening of the said eccentric and eccentric thereto, a weighted lever pivoted on the said wheel, and pivotally connected with the eccentric, 100
 a forked lever angularly pivoted to the arm of said eccentric and its fork engaging a collar mounted to slide on the said driving shaft, and controlling the movement of said
 105 forked arm, substantially as described.

2. A device of the class described, comprising a wheel secured on the main driving shaft, a ring-shaped eccentric having an arm pivoted on said wheel, said shaft passing
 110 through the center opening in the said eccentric, a weighted lever pivoted on said wheel and pivotally connected with said eccentric, an arm with fork engaging sliding collar on the main driving shaft and its other end
 115 pivoted to arm of eccentric at a point near its fulcrum, said pivot being angularly arranged to move the eccentric transversely as the sliding collar moves longitudinally, substantially as shown and described.

3. A device of the class described comprising a wheel secured on the main driving shaft, a ring-shaped eccentric having an arm pivoted on the said wheel, said shaft passing
 120 through the center opening of said eccentric, a weighted lever pivoted on the wheel and pivotally connected with said eccentric, the said eccentric having a forked arm pivotally
 125 connected adjacent to its fulcrum, and said forked arm engaging a sliding collar, said collar mounted to slide on the main driving 130

shaft and through the hollow opening in the eccentric for the purpose of controlling its movement, a bell crank lever connected with the said collar, and a rod engaging said bell crank, substantially as described.

4. A device of the class described comprising a wheel secured to the main driving shaft, and movable therewith, a ring-eccentric with arm projecting from one of its faces, said arm pivoted on, and carried around with said wheel, and movable transversely with said eccentric, back and forth across the main driving shaft, a weight mounted on a lever pivoted on said wheel, said weight being movable toward and from the main driving shaft, said weight and lever having two slotted links pivoted thereto, with the slot ends engaging studs arranged at opposite sides of the body of said ring-eccentric, thus causing said eccentric to move toward said main driving shaft as the centrifugal force causes the said weight to move away, a lever pivotally connected with arm of eccentric adjacent to its fulcrum, to swing at an angle of forty-five degrees from that of the eccentric and cause the same to move transversely as the lever moves longitudinally on the shaft, the said lever having at its other end a fork with projections engaging an annular slot in a sliding collar mounted on the main shaft, to move on the same and through hollow opening in eccentric, a bell crank lever with one of its arms engaging said sliding collar, and having its other arm pivotally connected with a rod, a hollow rod surrounding and movable over a portion of the other end of the first named rod, a spring coiled around both of said rods, with slots and pins, said pins pressing the ends of the spring, in a manner to oppose the centrifugal force of the weight, to regulate the speed of the engine, and a reversing lever pivotally connected with said hollow rod for the purpose of reversing the engine and to control the speed of same by applying spring pressure to the eccentric and thence to the weighted lever, substantially as shown and described.

5. A device of the class described comprising a main driving shaft with a wheel secured thereon, and caused to revolve with the same, said wheel having pivoted thereto a weighted lever, and a movable eccentric, said eccentric pivotally connected with the

weighted lever by two slotted links, the slots in said links engaging the body of eccentric, and limiting the movement of same, a forked lever pivotally connected with, and near the fulcrum of an arm extending from one of the faces of the eccentric, with fork of said arm engaging annular groove in sliding collar mounted to move longitudinally on main shaft and through hollow opening in the eccentric for the purpose of moving said eccentric back and forth transversely across the main shaft while running.

6. A means for actuating a swinging eccentric across the main driving shaft of an engine, for the purpose of reversing the same, and regulating the speed while running, comprising a reversing lever, an actuating spring coiled around the body of two rods of which one is longitudinally movable within the other, a bell crank lever, a sliding collar having in engagement forked end of a lever, said lever having its other end pivotally engaged with the arm of the eccentric, said pivotal engagement being arranged at forty-five degrees angle from the direction which it swings, substantially as shown and described.

7. A mechanism for reversing an automatic cut-off steam engine while running, comprising a wheel secured to the driving shaft, having two studs mounted thereon, a ring-eccentric with an arm, a weighted lever, slotted links connecting said weighted lever with body of eccentric, a sliding collar movably mounted on the main driving shaft and connected by an angularly pivoted lever with eccentric arm, adjacent to its fulcrum, a bell crank lever engaging a sliding collar mounted on the main driving shaft, a hollow rod supporting a solid rod therein, said rods pivotally connecting said bell crank with a reversing lever, a spring coiled around the body of both of said rods, having cups and movably mounted pins pressing the said spring, thus the mechanism is capable of applying spring pressure to either side of the body of said eccentric, and to resist the centrifugal force of the weighted lever, substantially as shown and described.

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Witnesses:

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