Aug. 21, 1923. 1,465,674

E. McCRACKEN ET AL

CENTRIFUGAL GOVERNOR

Filed March 31, 1920 3 Sheets-Sheet 1

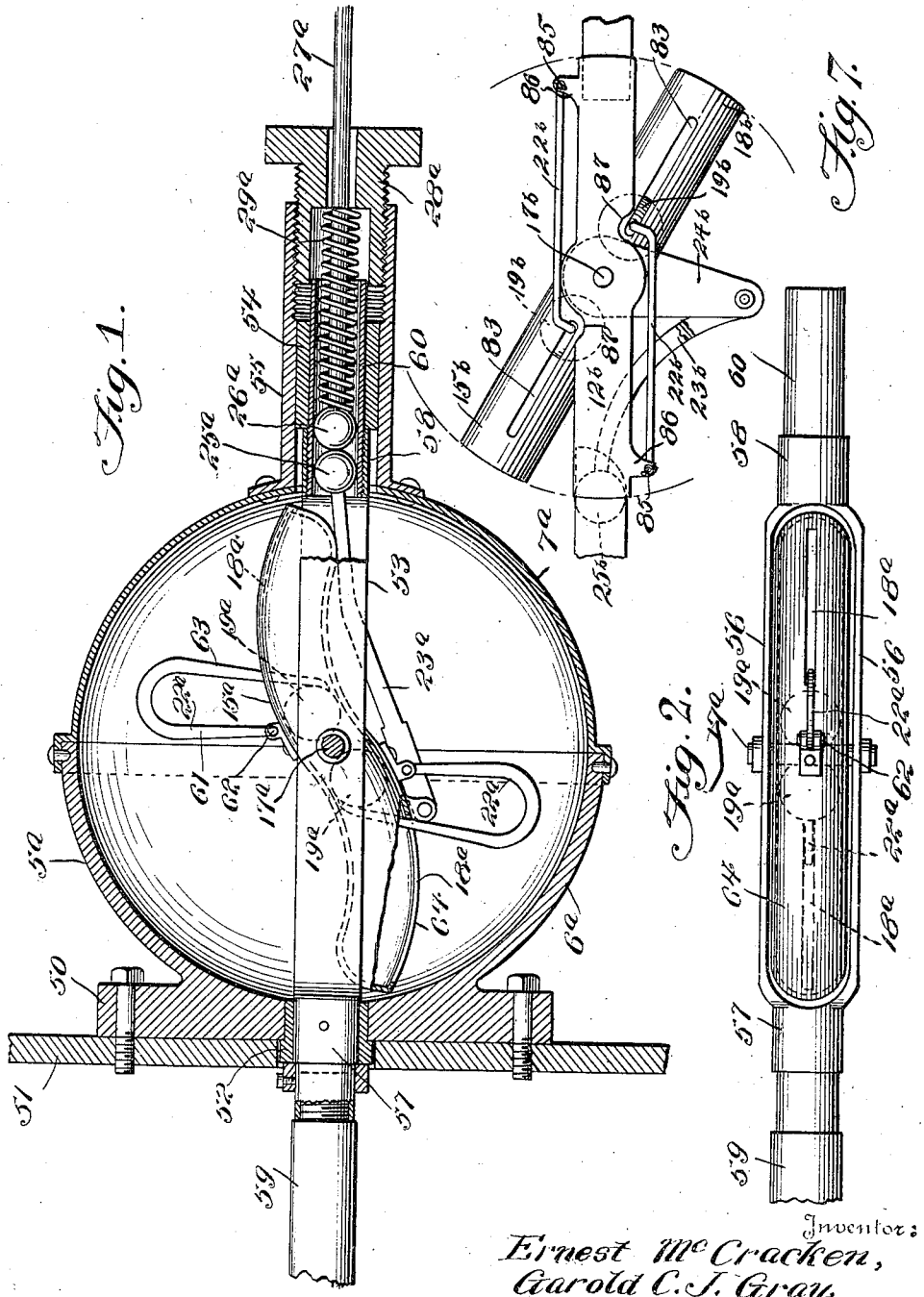


Fig. 1.

Fig. 7.

Fig. 2.

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3 Sheets-Sheet 2

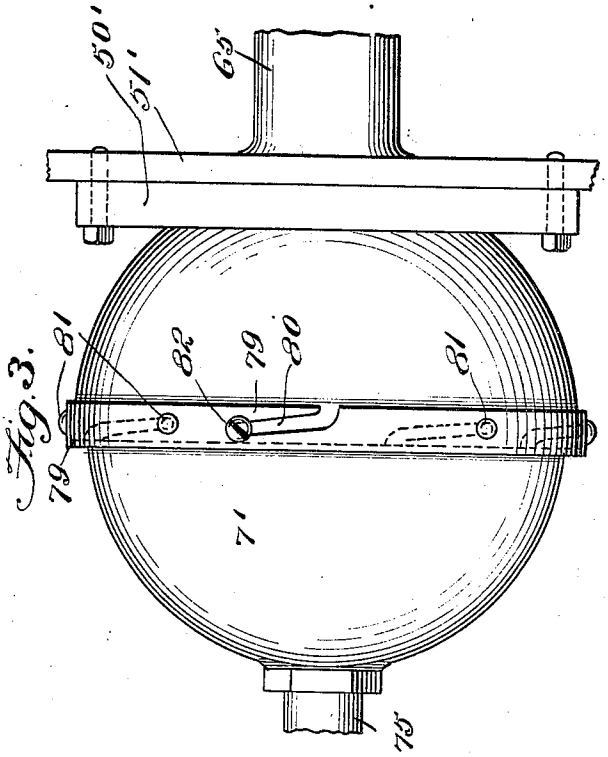


Fig. 3.

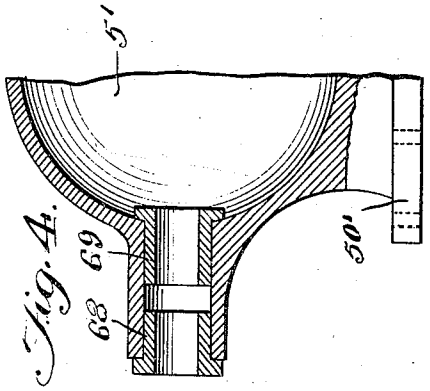


Fig. 4.

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3 Sheets-Sheet 3

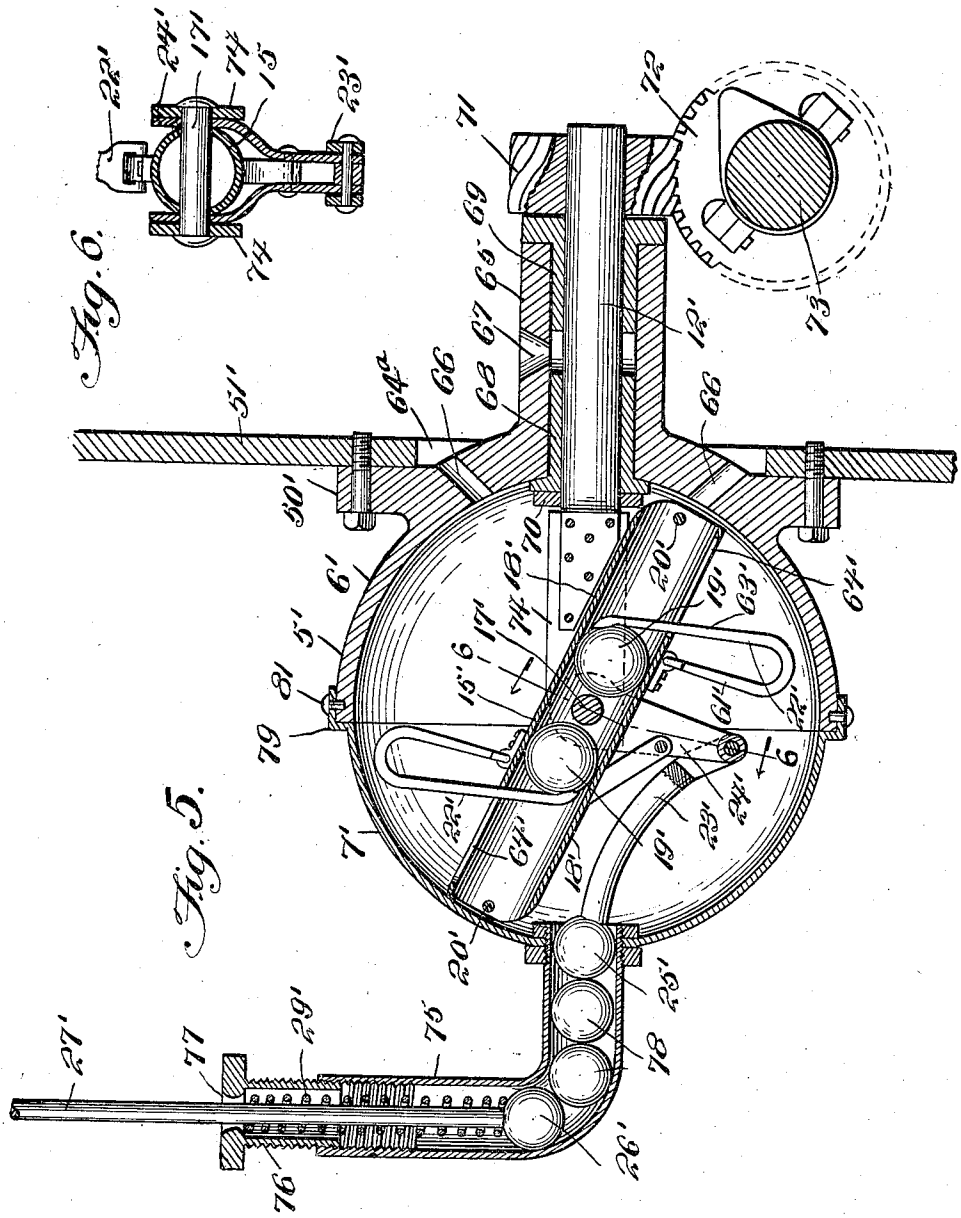


Fig. 6.

Fig. 5.

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL GOVERNOR.

Application filed March 31, 1920. Serial No. 370,316.

To all whom it may concern:

Be it known that we, ERNEST McCRACKEN and GAROLD C. J. GRAY, citizens of the United States, residing at Hastings, in the county of Adams and State of Nebraska, have invented new and useful Improvements in Centrifugal Governors, of which the following is a specification.

This invention relates to improvements in centrifugal governors for internal combustion or steam engines or machinery of any kind requiring accurate and sensitive speed control.

One object of our invention is to provide a governor which may be placed at any working angle desired or as circumstances may require, and which will be automatically balanced in action at all times so that it will not be affected in its control of the part to be governed by sudden jars, vibrations or similar temporary irregular motions of the mechanism as a whole or the drive shaft of the engine or prime mover.

Another object of the invention is to provide a governor embodying a plurality of cooperating centrifugally controlled elements conjointly acting to oppose sudden and irregular actions of the governor and operating to sensitively balance the same for smooth and regular control motions.

Still another object of the invention is to provide a governor which obviates the use of jointed parts and in which all lost motion or wear of rotating and sliding parts will be automatically compensated for and taken up, with a consequent reduction of wear and tear and assurance of greater durability and working efficiency of the governor mechanism.

With these and other objects in view, the invention consists of the features of construction, combination and arrangement of parts, hereinafter fully described and claimed, reference being had to the accompanying drawings, in which:—

Figure 1 is a central, vertical longitudinal section through a governor constructed in accordance with our invention.

Figure 2 is a top plan view of parts thereof.

Figure 3 is a side elevation of the governor.

Figure 4 is a detail vertical longitudinal section through one end of the governor casing.

Figure 5 is a view similar to Figure 1 showing a modified form of the invention.

Figure 6 is a sectional view on the line 6—6 of Figure 5.

Figure 7 is a view in side elevation showing another modified form of the invention.

In the form of our invention shown in Figures 1 to 4, inclusive, the governor casing 5^a is constructed of two semi-spherical sections, and one of these sections is provided with a flange or head 50 for attaching said casing to a support 51, which may be a part of the frame or chassis of a vehicle or a part of the frame of an engine. These members 50 and 51 are provided with bearing openings for the reception of a bearing bushing 52 on one end of the governor shaft 53, the other end of said shaft being journaled in a bushing 54 fitted in a tubular bearing projection 55 extending from the governor casing. The governor shaft in this construction has a body portion composed of a pair of spaced plates 56 united by tubular end portions 57 and 58, the end portion 57 being fixed to the bushing 52 and suitably coupled to a driving shaft 59, while the end portion 58 has a cylindrical extension 60 enclosed in the tubular projection 55 and turning in the bearing 54. The plates 56 form a support for the centrifugal governor bar or lever 15^a, which is hollow or tubular and pivotally mounted upon a cross pin or bolt 17^a, the arms 18^a of said lever forming enclosing guideways for balls or spherical weights 19^a which are slidably mounted therein for outward movement under the action of centrifugal force. The outward movements of these weights 19^a is resisted and controlled by substantially U-shaped spring controlled levers 22^a, each of said levers having an arm 61 pivotally connected with the lever 15, as at 62, and an arm 63 movable in a guide slot 64 in the cooperating lever arm 18^a and attached to or bearing at its extremity upon the cooperating weight 19^a, the spring arm 63 resisting outward movement of the weight 19^a by its resistance to flexion and exerting its spring action to return the weight to normal position, the control lever 22^a being also free to swing on its pivot to adapt the weight to have the required range of movement and to ensure an easy movement thereof. The lever 15^a has pivotally connected therewith a thrust rod 23^a which is provided

with a spherical contact head 25^a for engagement with the contact head 26^a of the sliding governor rod 27^a to move the same in one direction against the resistance of the spring 29^a. As shown, the tubular extension 55 is threaded to receive a screw plug or nut 28^a forming an abutment for one end of the spring 29^a and through the adjustments of which the tension of said spring may be regulated.

In the form of our invention shown in Figures 5 and 6, the governor casing 5′ is of the sectional construction previously described and has one of its sections provided with a bolting flange 50′ for attachment to a frame support 51′. The governor here shown is particularly adapted for use upon Ford tractors, and the support 51′ may form one of the walls of the crank casing of the engine. As shown this wall has an opening 64^a to receive the adjacent side of the governor casing section 6′, which is provided with a tubular bearing extension 65 which projects into the crank casing, the said casing section 6′ and bearing extension 65 being provided with ports or passages 66 and 67, whereby lubricant may be applied to the working parts of the governor from the crank casing. The governor shaft 12′ is here shown as journaled in opposed end bearings 68 and 69 fitted in the extension 65, the bearing 68 being retained in position by a thrust collar 70 fitted on one end of the shaft, while the other end of the shaft carries a worm pinion 71 meshing with a worm gear 72 on the cam shaft 73 whereby the governor shaft 12′ is driven.

The end of the shaft 12′ which enters the casing 5′ has secured thereto a pair of spaced plates 74 forming a support for the centrifugal governor lever 15′, which is pivotally mounted upon a cross pin or pivot member 17′. This lever 15′ is hollow or tubular and, as in the construction shown in Figures 1 and 2, its arms 18′ form guideways for sliding weights 19′ movable outwardly along the length of said arms by centrifugal force and limited in their outward movement by stop pins 20′. These weights 19′ are controlled by substantially U-shaped spring controlled levers 22′, each having an arm 61′ hinged or pivoted to the cooperating governor lever arm 18′, as at 62′, and an arm 63′ movable in a guide slot 64′ in the said governor lever arm and bearing upon or attached at its extremity to the cooperating weight 19′. The spring controlled levers 22′ in this construction, have a dual control movement, its spring arm operating by its own flexibility to permit the ball 19′ to have a certain range of movement, while the said spring controlled lever as a whole is also adapted to swing on its pivotal connection to ensure easy and free movement of the weight along the guideway. In this construction the governor lever 15′ is fixed to the pin 17′ and also fixed to said pin are crank arms 24′ coupled to one end of a thrust rod 23′ carrying at its opposite end a spherical head 25′, said thrust rod 23′ being similar in construction and function to the thrust rod 23^a previously described. In this form of the invention, however, the spherical contact member 25′ is movable in the lower horizontal arm of an L-shaped guide tube 75 for cooperation with the spherical contact member 26′ upon the lower end of the governor control rod 27′, which is held mounted for vertical instead of horizontal movement and may be directly coupled at its upper end to the arm 35 of the friction disk 36 or coupled thereto in any suitable manner. As shown, the lower end of the rod 27′ is movable in the upright or vertical portion of the tube 75 and is slidable upwardly for control action under the movement of the thrust rod 23′ against the resistance of a spring 29′. This spring 29′ bears at one end against an adjusting nut or cap 76 having an opening 77 therein of greater diameter than the rod 27′ and provided with rounded walls adapted to permit the rod to oscillate as well as reciprocate in its control movements for an obvious purpose, the tension of said spring being regulable by adjustment of the nut 76. In this construction also motion is transmitted from the contact member 25′ to the contact member 26′ through one or more interposed freely movable balls 78, which are adapted to travel easily in the bent portion of the tube 75, thus enabling the motion of the rod 23′ to be sensitively transmitted to the rod 27′ without the use of connecting joints, such construction also allowing the rounded head 25′ to rotate freely and easily in the tube 75 as it revolves with the governor control lever. It will be observed that this feature of construction is also present in the forms of the invention shown in Figures 1 to 4 inclusive, and is of importance and advantage in transmitting motion from the centrifugal governor lever to the control rod without the use of joints liable, through wear and tear, to become faulty and irregular in action, it being evident from the constructions described that all wear and tear upon the motion transmitting surfaces between the thrust rod and governor rod being compensated for and taken up by the action of the governor rod control spring. In the forms of the invention illustrated, we have shown a mode of connecting the governor casing sections which may be employed and wherein one of the casing sections is provided with a flange 79 to overlap the adjacent edge of the other casing section, said flange 79 of one section being provided with inclined

slots 80 to receive headed pins or studs 81 upon the other casing section. This construction provides a bayonet joint connection between the casing sections whereby said sections may be connected by a relatively rotary movement. The casing sections are also formed with threaded openings to receive a fastening screw 82 for securing the same against rotary movement and liability of casual displacement of one section upon the other section.

In the form of our invention shown in Figure 7, 12^b designates the body portion of the governor shaft, which is composed of side plates 56^a which may be cast or stamped from a single piece or otherwise suitably constructed. The governor lever 15^b is pivotally mounted for movement between these plates on a cross pin 17^b and is of hollow or tubular form so that its arms 18^b form guideways for the sliding spherical governor weights 19^b. Fixed to the pin 17^b is the crank arm or yoke 24^b to which is pivotally coupled the thrust rod 23^b carrying the contact head 25^b. The lever arms 18^b are provided in their sides with guide slots 83 to receive the offset cross portions 84 of substantially U-shaped weight control rods 23^b. The weights 19^b are provided with transverse openings for the reception and passage of said cross portions 84, on which the weights are pivotally mounted or journaled so that they may turn freely in their back and forth travels to reduce friction. The cross portions 84 connect the arms of each rod at one end, and at their opposite ends the arms are bent outwardly forming pintles 85 pivotally engaging ears 86 on the body 12^b. By this construction it will be seen that the use of springs may be dispensed with and that the rods 23^b form positive connections between the lever and weights whereby the throw of the latter will at all times be controlled, the rods 22^b also allowing a wide range of movement of the weights for an exact and equal counterbalancing or leverage action.

In all the forms of our invention an important advantage is gained, i. e., as the governor slows down and the lever swings back toward normal position, the weights move toward the center, thus decreasing the leverage and allowing the lever to swing back at faster (any required) speed. Similarly, when the governor starts to speed up the weights move outward from center and increase the leverage, thus preventing jerking or spasmodic action while allowing the lever to quickly swing outward for a smooth control action. This compound control movement, therefore, provides not only for a very smooth and even but also for a very quick control.

From the foregoing description, taken in connection with the accompanying drawings, the construction and mode of operation of our improved centrifugal governor will be readily understood and the advantages thereof appreciated without further and extended description. The invention is primarily adapted for controlling the speed of automobile or other internal combustion engines or steam engines, but is not limited to this use in this connection, as it may also be employed for controlling the speed of operation of various parts of machinery. By slight modifications in the construction or arrangement of the working parts, such as disclosed, the invention may also be adapted for use in connection with stationary or marine engines, automobile or tractor engines, or other internal combustion or steam engines arranged in either a vertical or horizontal position, and in which the throttle valves are also arranged in different positions with relation to the engine.

Having thus fully described our invention, we claim:

1. In a centrifugal governor, a rotary shaft, a lever centrally pivoted to the shaft for movement to different angular positions under centrifugal force with relation to the shaft, said lever having hollow arms provided with slots therein, weights movable within and longitudinally of said arms, means mounted externally of the lever arms and extending through the slots therein and acting on said weights to yieldingly oppose outward movement thereof, and controlling means governed by the movements of the lever.

2. In a centrifugal governor, a rotary shaft, a lever centrally pivoted to the shaft and having hollow arms projecting equally beyond opposite sides of the shaft, weights mounted in and movable longitudinally of said arms, means for yieldingly opposing outward movement of said weights, and controlling means governed by the movements of the lever.

3. In a centrifugal governor, a rotary shaft, a lever centrally pivoted to the shaft and having hollow arms projecting equally upon opposite sides of the shaft, said arms being provided with slots, weights mounted within and movable longitudinally of said arms, springs hinged at their outer ends to the outer surfaces of the arms and extending through said slots and having their inner ends arranged to bear upon the weights for opposing a yielding resistance to the outward movement thereof, and controlling means governed by the movements of the latter.

4. In a centrifugal governor, a rotatable shaft, a lever pivoted intermediate its ends to said shaft, the outer portions of said lever being hollow, the said hollow portions being provided with longitudinally disposed

slots, weights freely movable in said hollow portions, yieldable members carried by said lever and extending through said slots to the interior of said hollow portions and disposed in the path of said weights when moving toward the outer ends of said lever, and controlling means governed by the movements of said lever.

5. In a centrifugal governor, a rotatable shaft, a hollow lever pivoted intermediate its ends to said shaft, the said lever having longitudinally disposed slots therein, balls loosely mounted in said lever upon each side of the centrally pivoted support thereof, yieldable members carried by said lever and extending through said slots and lying in the path of outward movement of said balls, and controlling means governed by the movements of said lever.

In testimony whereof we affix our signatures.

ERNEST McCRACKEN.
GAROLD C. J. GRAY.