

March 22, 1949.

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2,464,853

GOVERNOR

Filed March 12, 1947

3 Sheets-Sheet 1

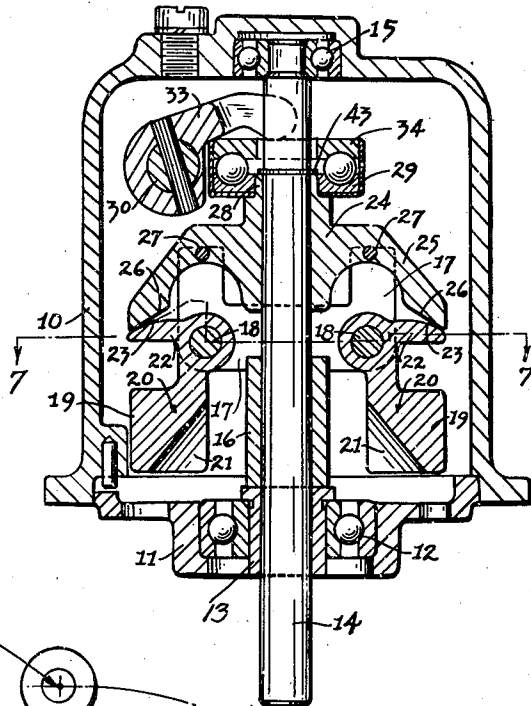


FIG. 1

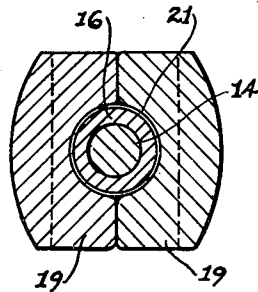


FIG. 4

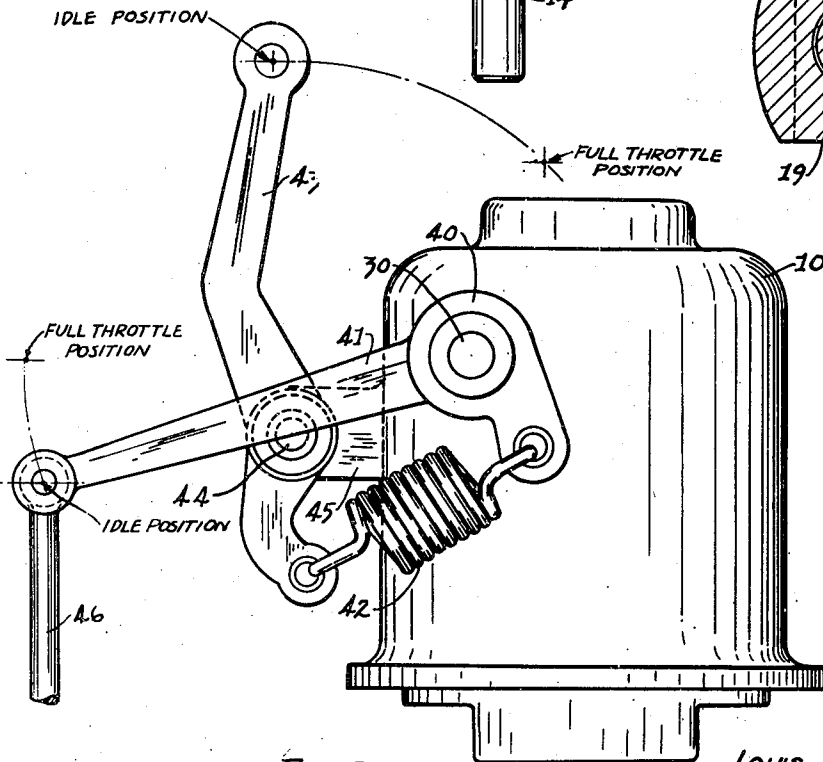


FIG. 5

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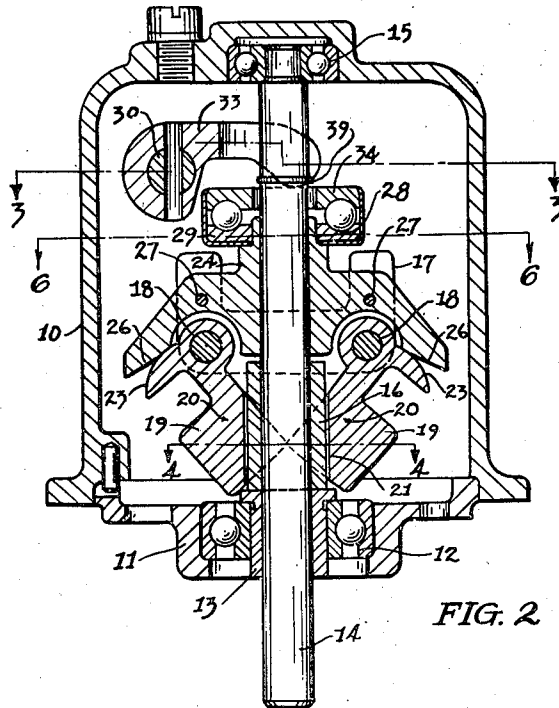


FIG. 2

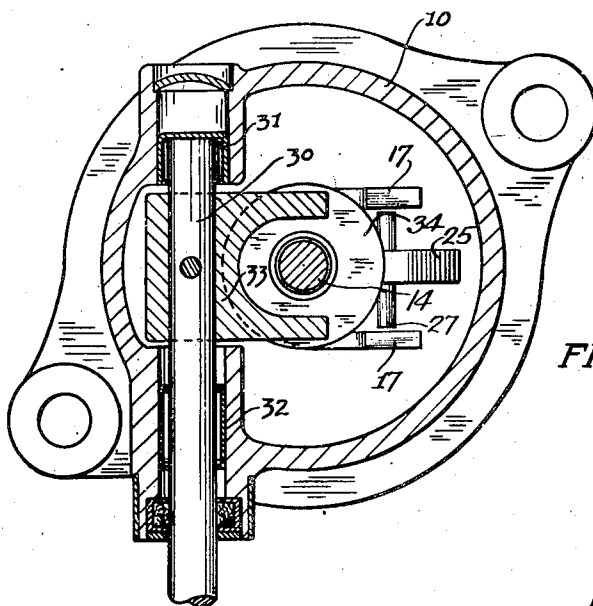


FIG. 3

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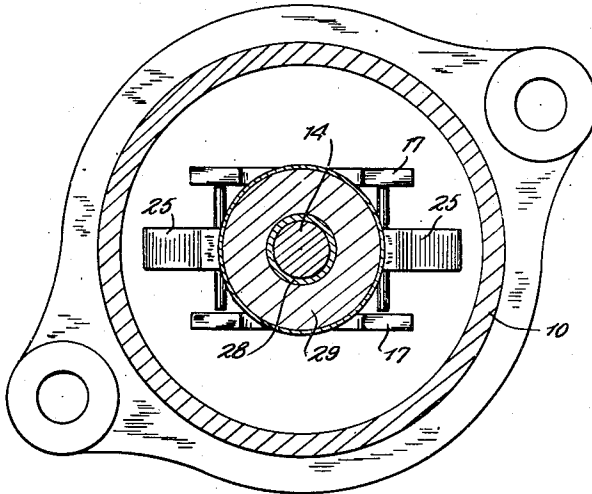


FIG. 6

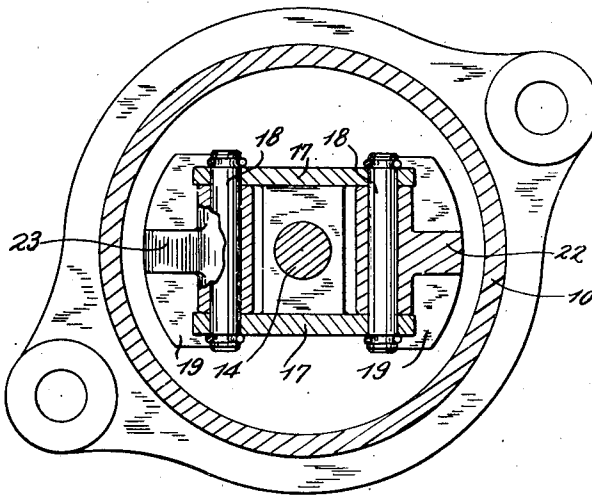


FIG. 7

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GOVERNOR

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Application March 12, 1947, Serial No. 734,279

4 Claims. (Cl. 264—15)

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This invention relates to governors, particularly governors for engines which are subject to wide and sudden fluctuations of load, as for example farm tractor engines. In the interest of efficient operation of the tractor and also in the interest of long life of the engine and other moving parts of a tractor, engine speed should be maintained nearly constant even though the load must be thrown on or off very rapidly as when plows or other earth working tools are lowered into the ground while the tractor is in motion or are lifted out of the ground under similar circumstances.

In order to satisfy the requirements of a governor for the purpose mentioned the increasing centrifugal force of revolving weights as the speed increases must be nicely balanced against the increasing force of a spring as it is placed under increasingly heavier stress, and in order that there may be an immediate response to speed variations in either direction friction must be held to a minimum.

In accordance with the foregoing it is an object of the present invention to provide governor mechanism wherein the weights may be of minimum mass and wherein the effect of centrifugal force as speed increases shall be caused to act through an increasing leverage.

Another object is to provide for such increasing leverage by forming the lever with a curved surface which is caused to roll upon a cooperating surface as the power arm of the lever lengthens, thus avoiding slippage and consequent friction.

A further object is the provision of a mechanism of the character stated in which the center of mass of each weight swings in an arc that approximates a radial line, while the arc of movement of the lever which constitutes a part of the weight approximates a straight line parallel to the axis of the governor, whereby the arcs having the greatest useful movement for a given angle are utilized.

Other objects and features of novelty will appear as I proceed with the description of that embodiment of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which

Fig. 1 is a vertical central sectional view of a governor embodying the invention, showing the mechanism in idling position.

Fig. 2 is a view similar to Fig. 1 with the parts in a position such as they would assume were the manual control set for high speed and the load became excessively heavy.

Fig. 3 is a horizontal sectional view taken substantially on the line 3—3 of Fig. 2.

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Fig. 4 is a detail sectional view taken substantially on the line 4—4 of Fig. 2.

Fig. 5 is an elevational view showing a manual control.

Fig. 6 is a cross-sectional view taken substantially on the line 6—6 of Fig. 2, and

Fig. 7 is a cross-sectional view taken substantially on the line 7—7 of Fig. 1.

In the drawings a governor casing of inverted cup shape is shown at 10. A base 11 closes the open end of the cup and carries an antifriction bearing 12 in which is supported a collar 13 fixed upon the governor shaft 14. The upper end of the shaft is mounted in an antifriction bearing 15 pressed into a socket in the top of the casing. While I prefer to mount the governor in such manner as to position the shaft 14 vertically, the mechanism will function in other positions.

Just above the collar 13 there is fixed upon shaft 14 a bracket comprising a sleeve 16 and a pair of parallel spaced walls 17, the sleeve and spaced walls being formed preferably as an integral casting which of course turns with the shaft. The walls 17 of the bracket have bearings therein for a pair of pivots 18 that are parallel to each other and disposed in a plane normal to the shaft 14. These pivots are relatively close to the shaft. They support two weights 19, the centers of gravity of which are approximately at the points marked 20 in the drawing. Each of these weights is hollowed out on its inner lower side as indicated at 21 so as to straddle the sleeve 16, the latter constituting a stop to limit the inward movement of the weights and permitting the centers of gravity 20 to assume positions in which they are spaced from shaft 14 a distance less than the distance of pivots 18 from the shaft. The centers of gravity 20 therefore swing between inner and outer positions through an arc which approaches a straight line from the position of 20 in Fig. 2 to that of 20 in Fig. 1. In other words the centers of gravity move in paths which closely approximate radial lines. The weights also comprise arms 22 which have upper cam or curved surfaces 23. As the center of gravity 20 of a weight moves outward the curved surface 23 moves upward.

Surrounding the shaft 14 above the sleeve 16 there is a slide 24 which has a pair of diametrically opposed arms 25 with inner surfaces 26 which are inwardly and upwardly inclined and which contact the curved surfaces 23 of the weights. This inward and upward inclination, as viewed in the drawings, I have referred to hereinafter as undercutting. As shown in the draw-

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ings the surfaces 26 are well under a 45° angle with a transverse plane normal to the shaft 14. In fact the angle may be of the order of 30°. This angle together with the cam surfaces 23 which are formed on a long radius of curvature and which begin close to the pivots 18, results in a relatively long axial travel of the slide 24 for a given angle of movement of the weights 19.

The disposition of the pivots inwardly of the cam surfaces contributes to compactness. The lines of contact between the surfaces 23 and 26 on the two sides of the governor tend to remain in a transverse plane through the axes of the pivots. A line drawn between the center of gravity 20 of each weight and the point of contact between surfaces 23 and 26 at any given time approaches a right angle with surface 26. Also the centrifugal effect of the rocker 22 and that of weight 19 are additive, that is the complete mass of the weight units aside from their hubs throughout the major portion of weight movement is on the same side of the pivots. These features of construction contribute to the efficiency of the governor. The slide 24 is guided in its movements and caused to revolve with the bracket or sleeve 16 and walls 17 by a pair of pins 27 which are fixed in the slide 24 and bear loosely at their ends against the walls 17 of the bracket composed of the integral sleeve 16 and walls 17.

At the upper end of the slide 24 there is a constriction 28 upon which is fitted the lower race 29 of a ball bearing. 30 is a control shaft which is mounted in bearings 31 and 32 carried by the casing 10. This shaft has a yoke 33 pinned thereto, the bifurcations of which bear upon the upper race 34 of the ball bearing at the top of the slide. Upward movement of slide 24 may be limited by means of a snap ring 39 mounted in an annular groove formed in the shaft 14 and adapted to engage constriction 28 on the slide.

Exteriorly of the governor shaft 30 may have keyed thereto a bell crank lever having two arms 40 and 41. To the free end of arm 40 a tension spring 42 is connected, the opposite end of the spring being connected with the short arm of a lever 43 that is pivoted at 44 upon a post 45 integral with the governor casing 10 or other fixed support. The arm 41 of the bell crank is connected with a link 46 which extends to the throttle of the butterfly valve or the fuel valve of an internal combustion engine. Lever 43 is the manual control lever. Suitable means are provided enabling an operator, after he has moved the free end of the lever to a desired speed position, to secure it in that position.

When the engine is not running the parts of the device are in the position illustrated in Figs. 1 and 5. In order to start the engine the operator moves the free end of lever 43 clockwise somewhat, as viewed in Fig. 5, thereby causing spring 42 to rock bell crank 40, 41 and open the engine throttle more or less. At the same time yoke 33 moves to press against bearing race 34, moving slide 24 downwardly and swinging weights 19 inwardly. Now, when the engine starts, shaft 14 turns and weights 19 swing out substantially to the position indicated in Fig. 1, thereby putting the spring 42 under tension. The operator then moves lever 43 to the desired speed position, putting the spring 42 under heavier tension and opening the engine throttle valve to the extent necessary to enable it to attain a certain speed, a balance being struck between the tension of the spring 42 and the centrifugal force exerted by the

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weights 19. Now should a load be imposed upon the engine suddenly or otherwise the speed of shaft 14 will be decreased and the spring will contract to compensate for the decreased centrifugal force, and will turn the bell crank 40, 41 thereby opening the throttle sufficiently to enable the engine to maintain its speed. Conversely, when the load or some part of it is removed the speed of shaft 14 will increase, the weights 19 will swing out, causing the curved surfaces 23 to roll upon the inclined surfaces 26 and thus to move slide 24 upwardly and thus act through bearing race 34 to turn shaft 30 counterclockwise as viewed in Fig. 5, thus closing the throttle valve sufficiently to reduce the speed of the engine to that for which the control lever 43 has been set. In the operation of the device when the weights 19 swing outwardly their centers of gravity move outwardly in paths which approximate straight radial lines. At the same time the curved surfaces 23 swing upwardly through arcs that approximate straight lines parallel to the direction of movement of the slide 24. The latter is guided in its movement by the pins 27 running on the walls 17 of the revolving bracket.

Having thus described my invention, I claim:

1. In a governor, a driven shaft, a bracket mounted thereon to rotate therewith, pivots carried by said bracket disposed near said shaft in a plane normal to the shaft, weights mounted on said pivots, a slide surrounding said shaft rotatable therewith and movable lengthwise thereupon, said slide having undercut internal plane surfaces inclined relative to a plane normal to the shaft and disposed radially outward of said pivots, said weights having integral curved rocker surfaces of long radius of curvature adapted to roll upon said inclined surfaces outwardly of the pivots and adjacent thereto as said weights begin their outward travel, and a line drawn from the center of gravity of a weight to the point of contact between the slide and rocker at any given time approaching a perpendicular to said inclined surface.

2. In a governor, a driven shaft, a bracket mounted thereon to rotate therewith, pivots carried by said bracket disposed near said shaft in a plane normal to the shaft, weights mounted on said pivots, a slide surrounding said shaft rotatable therewith and movable lengthwise thereupon, said slide having undercut internal surfaces inclined relative to a plane normal to the shaft and disposed radially outward of said pivots, said weights having integral rocker arms with cam surfaces of long radius of curvature adapted to roll upon said inclined surfaces as said weights swing inwardly or outwardly, the centers of gravity of said weights being movable through a relatively small angle between positions closer together than said pivots and further apart than said pivots, the effective weight of the rocker arms being below said pivots so as to aid the weights in their initial outward movement.

3. In a governor, a driven shaft, a bracket mounted thereon to rotate therewith having a pair of parallel walls on opposite sides of said shaft, pivots carried by said walls near said shaft on opposite sides thereof, said pivots being disposed in a plane normal to said shaft, weights mounted on said pivots, a slide surrounding said shaft having oppositely disposed arms between said walls, means spaced radially from said shaft interposed between said walls and said slide presenting small contact surfaces in a transverse plane for rotating said slide while permitting it

to move axially, the arms of said slide having undercut internal plane surfaces inclined relative to said normal plane and disposed radially outward of said pivots, said weights having integral curved rocker surfaces adapted to roll upon said inclined plane surfaces as said weights swing inwardly or outwardly.

4. In a governor, a driven shaft, a bracket mounted thereon to rotate therewith, pivots carried by said bracket disposed near said shaft in a plane normal to the shaft, weights mounted on said pivots, a slide surrounding said shaft rotatable therewith and movable lengthwise thereupon, said slide having undercut internal plane surfaces inclined to a plane normal to the shaft by an angle less than 45°, said inclined surfaces being disposed radially outward of said pivots, said weights having integral curved rocker surfaces of long radius of curvature adapted to roll upon said inclined surfaces outwardly of the pivots and adjacent thereto as said weights begin their outward travel, and a line drawn from the center of gravity of a weight to the point of contact between the slide and rocker at any given time approaching a perpendicular to said inclined surface.

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