June 4, 1946. H. C. EDWARDS 2,401,558

GOVERNOR

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Fig. 1.

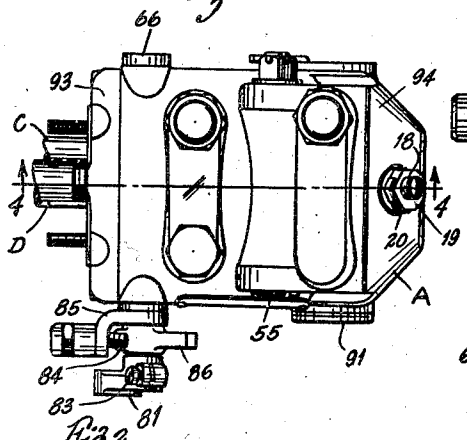


Fig. 13.

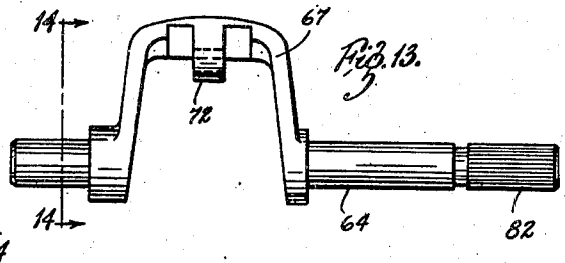


Fig. 14.

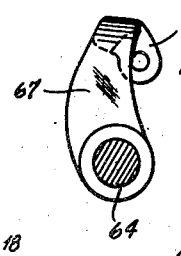


Fig. 2.

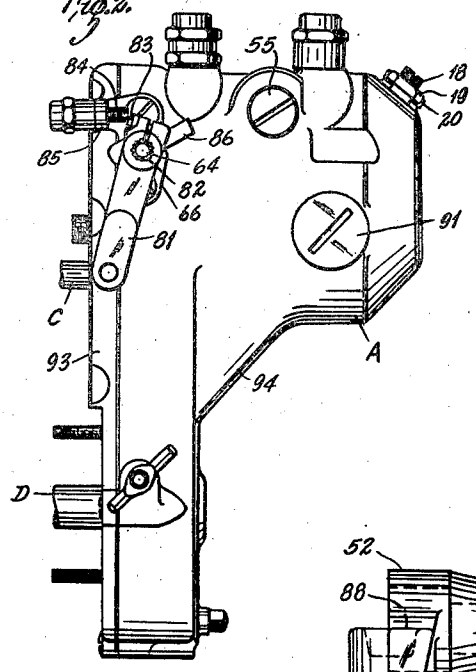


Fig. 3.

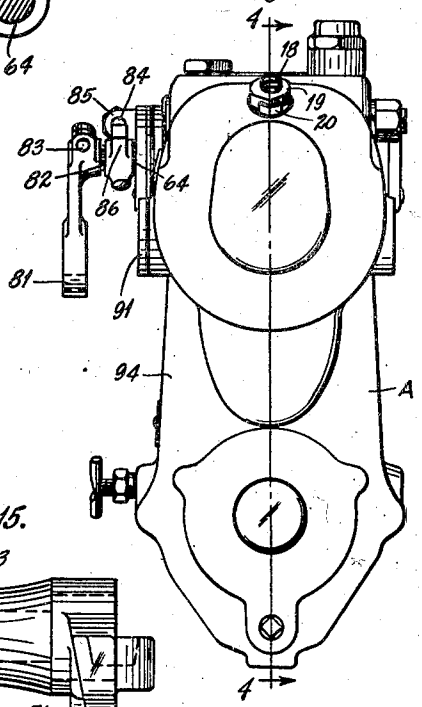


Fig. 15.

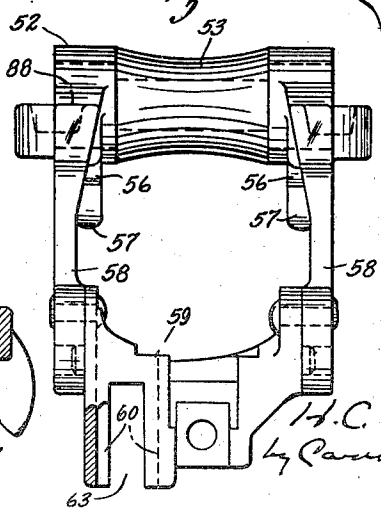
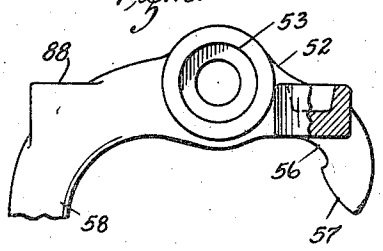


Fig. 16.



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June 4, 1946. H. C. EDWARDS 2,401,558

GOVERNOR

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Fig. 4.

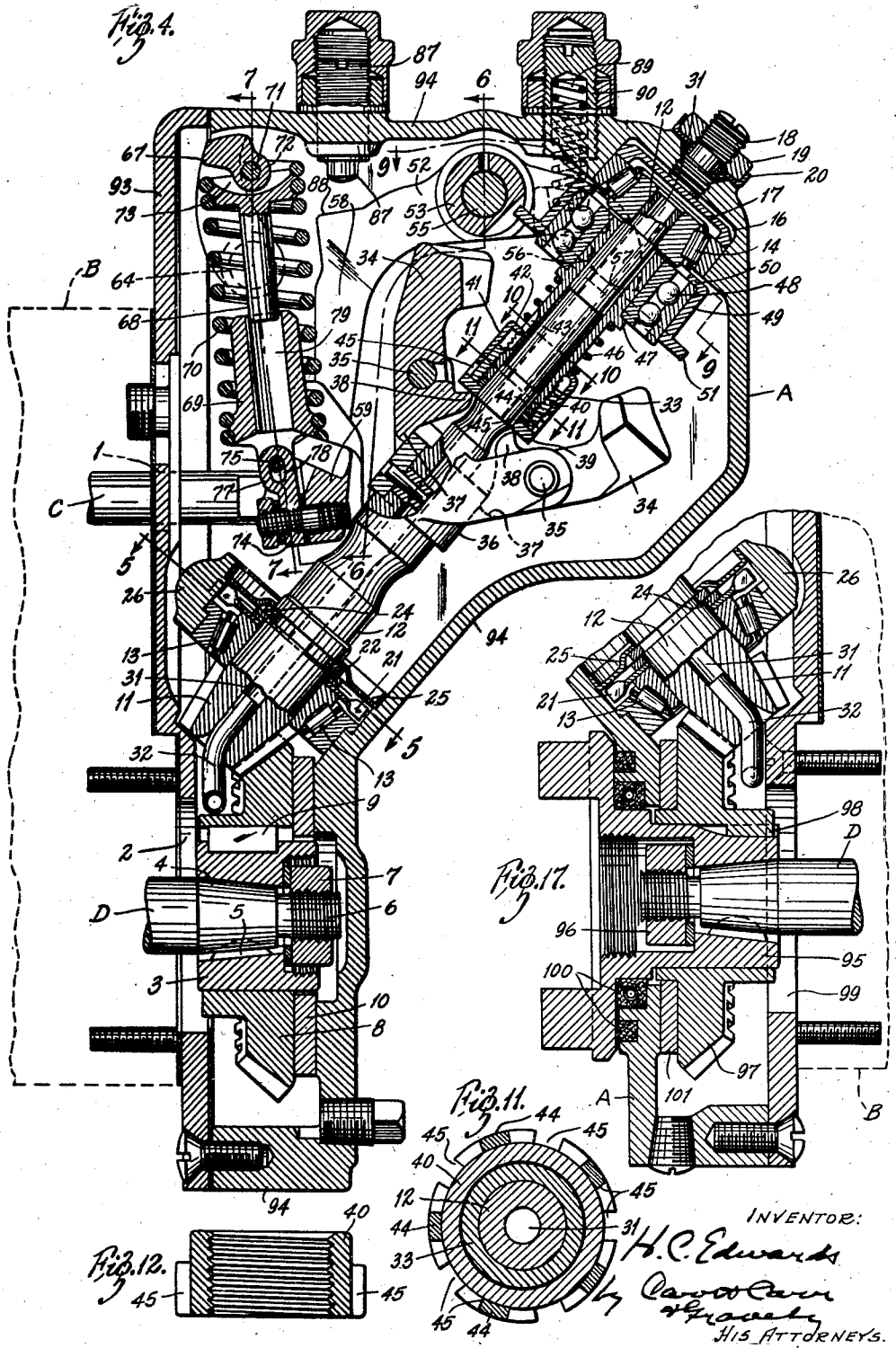

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Fig. 5.

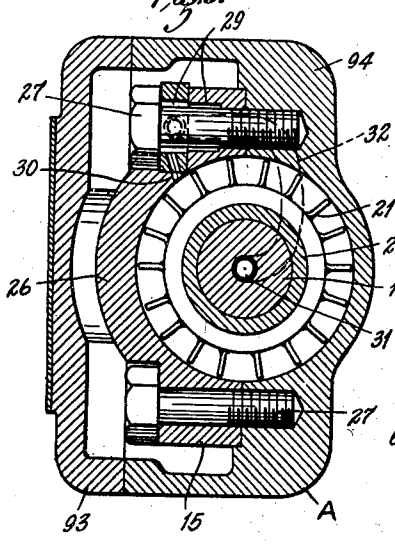


Fig. 6.

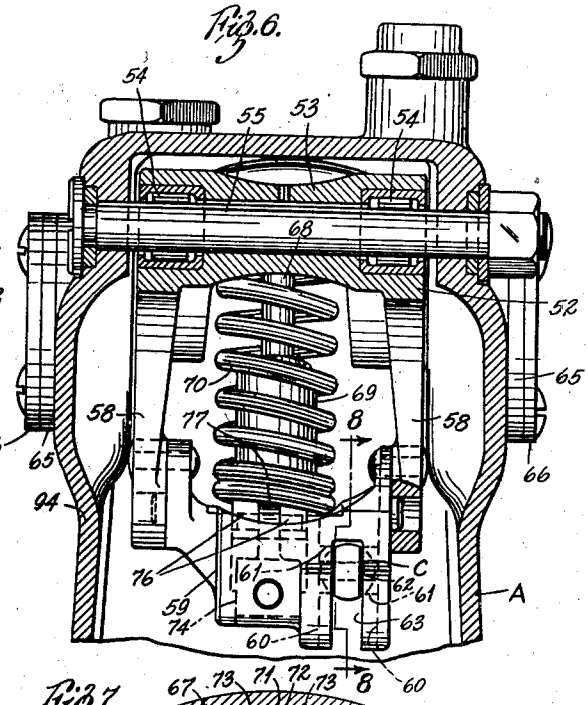


Fig. 8.

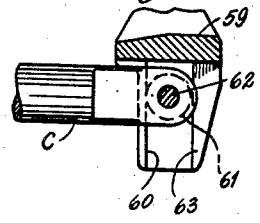


Fig. 7.

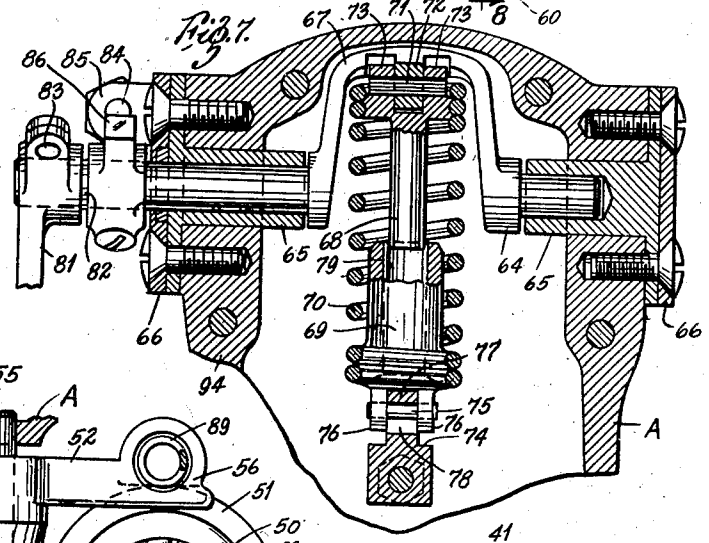


Fig. 9.

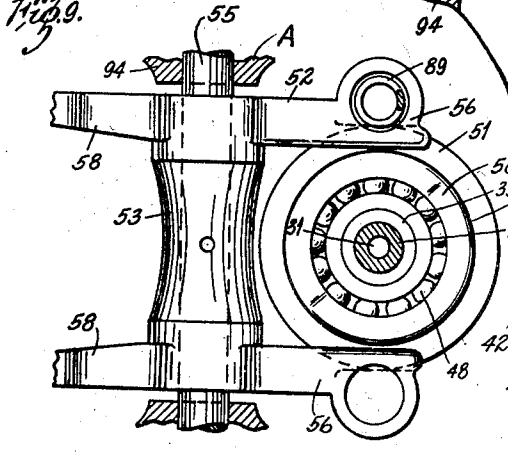
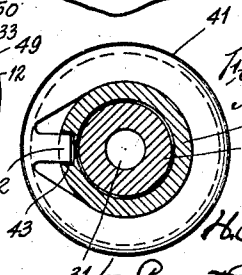


Fig. 10.



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June 4, 1946. H. C. EDWARDS 2,401,558

GOVERNOR

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Fig. 18.

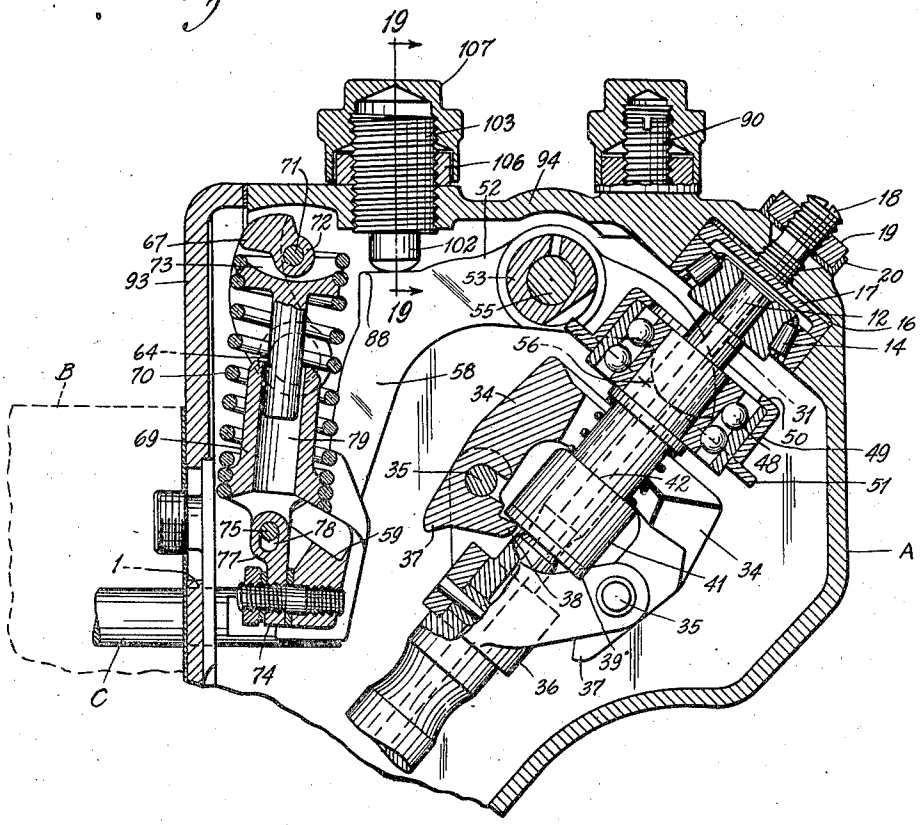
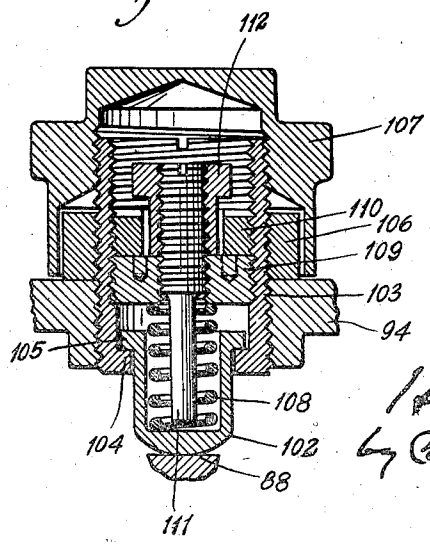


Fig. 19.



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Patented June 4, 1946

2,401,558

UNITED STATES PATENT OFFICE

2,401,558

GgovernOR

Herbert C. Edwards, Massillon, Ohio, assignor to The Timken Roller Bearing Company, Canton, Ohio, a corporation of Ohio

Application October 7, 1942, Serial No. 461,182

4 Claims. (Cl. 264—3)

1

This application is a contiuation in part of my copending application Serial No. 349,034 filed August 1, 1940, Patent No. 2,302,906, Nov. 24, 1942.

This invention relates to speed regulating devices for internal combustion engines and more pa ticularly to governors for automatically controlling the output of fuel injection pumps for compression ignition engines. The objects of the present invention are to provide a stop for limting the maximum quantity of fuel delivered in all high speed adjustments of the throttle lever, to provide for adjusting said stop to regulate maximum quantity of fuel delivery, to provide a maximum fuel feed stop that is yieldable when the engine is overloaded during full load operation to permit an increase in fuel feed above the normal maximum fuel feed and thus provide increased torque sufficient to carry the overload, and to obtain other advantages hereinafter appearing. The invention consists in the governor and in the construction, combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawings, which form part of this specification and wherein like symbols refer to like parts wherever they occur,

Fig. 1 is a plan view of a speed governor embodying my invention,

Fig. 2 is a side elevational view of said speed governor,

Fig. 3 is an outer end view of said governor,

Fig. 4 is an enlarged central vertical longitudinal section on the line 4—4 in Fig. 3,

Fig. 5 is a fragmentary cross-section on the line 5—5 in Fig. 4,

Fig. 6 is a fragmentary vertical section on the line 6—6 in Fig. 4,

Fig. 7 is a fragmentary section on the line 7—7 in Fig. 4,

Fig. 8 is a fragmentary vertical section on the line 8—8 in Fig. 6,

Fig. 9 is a fragmentary section on the line 9—9 in Fig. 4,

Figs. 10 and 11 are enlarged cross-sections on the lines 10—10 and 11—11, respectively, in Fig. 4,

Fig. 12 is an enlarged central longitudinal sectional view of the thrust sleeve nut,

Fig. 13 is a side elevational view of the control lever shaft,

Fig. 14 is a cross-section on the line 14—14 in Fig. 13,

Fig. 15 is an end elevation of the yoke lever, looking at the fuel feed control rod and high speed spring receiving end thereof,

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Fig. 16 is a fragmentary side elevational view of said yoke lever,

Fig. 17 is a central vertical longitudinal section through the lower portion of the governor showing the arrangement of the drive gear therein when the governor is attached to the opposite end of the fuel pump,

Fig. 18 is a view similar to Fig. 4, showing a maximum fuel feed stop of modified form; and

Fig. 19 is an enlarged vertical section through said modified stop construction on the line 19—19 in Fig. 18.

The centrifugal speed regulating device or governor shown in the accompanying drawings comprises a housing A adapted to be removably secured flatwise to one end of a fuel injection pump of which only adjacent portions of the housing B, the reciprocatory fuel control rod C and the rotary cam shaft D are shown. The cam shaft D is adapted to be driven by or in unison with the compression ignition engine (not shown) supplied by said pump; and the fuel control rod C is slid in the direction of the governor to decrease the quantity of fuel supplied to the engine and is slid in the opposite direction to increase such fuel supply. The pump opposing end wall of the governor housing A has vertically spaced openings 1 and 2 extending horizontally therethrough adapted to receive the ends of the control rod C and cam shaft D, respectively.

Mounted on the portion of the cam shaft D located within the governor housing A is a sleeve 3 having a tapered bore adapted to fit a tapered seat 4 provided therefor on said shaft adjacent to the end thereof. This sleeve is nonrotatably secured to the tapered portion 4 of the cam shaft D, by means of a key 5. The cam shaft terminates in a threaded end portion 6 having a nut 7 threaded thereon; and this nut serves to clamp the sleeve 3 on the tapered portion 4 of said shaft, thereby preventing relative endwise movement of said shaft and sleeve. Mounted on the sleeve 3 is a bevel drive gear 8, which is secured to said sleeve by means of a spline 9 that permits relative axial movement of said gear and sleeve while preventing relative rotary movement thereof. Surrounding the sleeve 3, between the front end wall of the governor housing A and the adjacent end face of the drive gear 8, is a washer 10 adapted to receive the end thrust of said gear.

Intermeshing with and driven by the bevel drive gear 8 on the cam shaft C is a bevel gear 11 formed on or secured to the lower end of a governor shaft 12 located in the upper portion of the governor housing A above and at an

oblique angle to the drive gear 8. This governor shaft 12 inclines upwardly and outwardly in the governor housing A at an angle of about forty-five degrees and is journaled near its lower and upper ends in suitable tapered roller bearings 13 and 14, respectively, located in said housing. The bearing 13 for the lower end of the governor shaft 12 is mounted in a split pedestal 15 provided therefor in said housing; and the bearing 14 for the upper end of said shaft is supported in a recess 16 provided therefor in the upper outer end corner portion of said housing. Interposed between the inner end of the recess 16 and the bearing 14 therein is a cup-shaped thrust washer or disk 17 which is held in abutting relation to the adjacent end of the outer raceway member of said bearing by means of a stud 18 that is threaded through the governor housing in axial alinement with said bearing and is locked in adjusted position by a suitable lock nut 19 and lock washer 20. By means of this stud, end play of the governor may be adjusted from outside the governor housing.

Mounted on the governor shaft 12 adjacent to the upper end of the bearing 13 therefor is a paddle wheel 21 which is clamped between the end of the inner raceway member of said bearing and a washer 22, which is held in place on the governor shaft by means of a snap ring 24 seated in an annular groove provided therefor in said shaft. The paddle wheel 21 works in the bearing receiving bore of the bearing supporting pedestal beyond the upper end of the bearing 13 therein; and the upper end of said bore is closed by means of an annular closure member 25 that seats in said bore and has a central opening for the governor shaft 12. By this arrangement, the intermeshing gears 8 and 11 pick up oil contained in the lower portion of the governor housing A and throw it against the lower roller bearing 13; and this bearing functions as a pump to force such oil through the bearing into the portion of the bore in the pedestal 12 in which the paddle wheel operates as a centrifugal pump to force the oil out through a small passage in the bearing cap around one of the securing studs therefor. The split pedestal 15 is provided with a cap 26 that is removably secured to the portion of the pedestal formed integral with the governor housing A by means of cap screws 27. As shown in the drawings, one of the cap screw receiving holes in the pedestal cap 27 is counterbored to provide an annular clearance space 29 around the cap screw in said hole; and a passageway 30 in said cap establishes communication between said annular space and the space in which the paddle wheel 21 works. An annular fitting is sleeved on said cap screw between the head thereof and the pedestal cap 26 and has its bore enlarged to form a continuation of the annular oil space 29; and communication is established between the annular space and the lower end of an axial bore 31 in the governor shaft 12 through a tube or conduit 32. Thus, the oil is conveyed through the tube 32 from the annular space 29 to the axial bore 31 in the governor shaft and then forced upwardly through said bore into the supporting recess 16 for the upper bearing 14 from which it is thrown by the pumping action of this bearing into the upper portion of the governor housing to lubricate the parts hereinafter referred to located therein.

A thrust sleeve 33 is slidably mounted on the governor shaft 12 and is adapted to be slid upwardly along said shaft by means of a pair of

weighted centrifugal levers 34 that are pivotally supported one on each side of said shaft on horizontal pivots 35 carried by pairs of ears or lugs on the upper end of a spider 36 that is pinned or otherwise fixed to said shaft. Each of these centrifugal levers 34 is provided at the end remote from its weighted end with a finger 37, which is adapted to abut against the spider 36 and limit the outward swinging movement of said lever, and a finger 38 that is adapted to exert an end thrust on the lower end of the thrust sleeve 33 through a thrust washer 39 sleeved on the governor shaft 12 in abutting relation to the lower end of the sleeve nut 40 which is threaded on the lower end of said thrust sleeve. The sleeve nut 40 is locked in the desired position of adjustment on the thrust sleeve 33 by means of a locking sleeve 41 that has axially sliding but non-rotary connections with said lock sleeve and with said thrust sleeve. The connection between the lock sleeve 41 and the thrust sleeve 33 comprises a lug 42 on the upper end of the lock sleeve that seats in a longitudinal groove 43 in said thrust sleeve, and the connection between said lock sleeve and the sleeve nut 40 comprises a series of circumferentially spaced lugs 44 on the lower end of said lock sleeve that seat in but are disengageable endwise from a corresponding series of longitudinal peripheral grooves 45 in said sleeve nut. The lock sleeve 41 is yieldably held in engagement with the sleeve nut 40 by means of a coil compression spring 46 that is sleeved on the thrust sleeve 33 between said lock sleeve and an annular flange 47 on said thrust sleeve.

Mounted on the upper end of the thrust sleeve 33 between the collar 47 thereon and the upper end thereof is a suitable ball thrust bearing 48; and mounted on the outer raceway member of this bearing is a sleeve 49 having an inwardly extending annular supporting flange 50 at the upper end thereof that seats on the upper end of said raceway member. The thrust bearing sleeve 48 also has an outstanding peripheral thrust flange 51 at the lower end, the purpose of which will hereinafter appear.

A yoke lever 52 has a hub 53 journaled on roller bearings 54 mounted on a horizontal shaft 55 that extends from side wall to side wall of the governor housing A above and clear of the centrifugal levers 34. This yoke lever is provided on one side of its hub 53 with a pair of relatively short downwardly curved arms 56 that extend on opposite sides of the thrust bearing 48 and terminate in convex ends 57 that bear against the upper surface of the outstanding thrust flange 51 of the sleeve 49 supported on said bearing. The yoke lever 52 is provided on the opposite side of its hub 53 with a pair of spaced, relatively long, downwardly curved arms 58 that are cross connected at their lower ends by a cross bar or head 59 that is riveted or otherwise rigidly secured to said arms. This cross bar 59 is located adjacent to the end of the endwise slidable fuel control rod C of the fuel injection pump and has a rectangular downwardly opening trackway 60 formed therein for a pair of rollers 61 supported on opposite sides of the fuel control rod by means of a pin 62 that extends horizontally therethrough, said trackway having an opening 63 through the sides thereof through which the control rod extends.

The cross bar 59 of the long arms 58 of the yoke lever 52 has an extensible link and spring connection with a horizontal control shaft 64 located thereabove. The control shaft 64 is jour-

naled at its ends in bushings 65 mounted in horizontal openings provided therefor in the side walls of the governor housing A, said bushings being held in said openings by annular plates 66 that are secured to said housing in abutting relation to the outer ends of the respective bushings; and said shaft has an upwardly offset portion or crank 67 located above the cross bar 59 of the yoke lever 52. The connection between the cross bar 59 and the control lever 52 comprises a pair of axially alined upper and lower links 68 and 69, respectively, and a coiled tension spring 70, hereinafter referred to as the high speed spring, which surrounds said links and has its end portions seated in helical grooves provided therefor in the respective links. The upper link is pivotally suspended from the top of the control shaft crank 67 centrally thereof, for swinging movement crosswise of the control shaft, by means of a horizontal pivot pin 71 that extends through registering holes provided therefor in a depending central lug 72 at the top of said crank and a pair of upstanding lugs 73 disposed one on each side of said lug on the upper end of said link. The lower end of the lower link 69 has a slot-and-pin connection with a plate 74 secured to the cross bar 59 of the yoke lever 53 centrally of said bar. The connection comprises a horizontal pin 75 that extends through alined openings in a pair of depending lugs 76 on the lower link 69 and a single upstanding lug 77 on the plate 74, the lug 77 being disposed in line with the axis of said link and parallel with the supporting pin 71 for the upper link 68 and the opening through the lug 77 being elongated in the direction of said axis to form a slot 78 which permits relative movement of said yoke lever and said lower link when the high speed spring 70 is not under tension. The lower spring supporting link 69 has a cylindrical main body portion with an axial bore 79 extending therethrough and the upper link 68 has a depending axial stem adapted to enter said bore when the high speed spring 70 contracts.

The control shaft 64 extends exteriorly of the governor housing A on one side thereof and has a manually operable control lever 81 fixed thereto. The cooperating portions of the shaft and lever are provided with interfitting ribs and grooves 82 whereby said lever may be angularly adjusted on said shaft. The hub portion of the control lever 81 is split and provided with a clamping screw 83 for locking said lever in the desired position of its angular adjustment. The swinging movement of the control lever 81 is limited in the direction of its high speed setting by an adjustable stop screw 84 which is threaded through a plate 85 fixed to the side of the governor housing A and is disposed in the path of a lug 86 that projects radially from the control shaft 64 between said lever and said side of said housing. A maximum fuel quantity stop comprises an adjustable stop pin 87 that extends downwardly through the top of the governor housing A in position to be engaged by a flat abutment surface 88 formed on the upper edge of one of the long arms 58 of the yoke lever 52. These two stops limit the operator's control over the output of the fuel pump.

A coiled compression spring 89, hereinafter referred to as the idling speed spring, is located in the governor housing A, with its upper end seated in a fitting 90 threaded through the top wall of said housing above one of the short arms 56 of the yoke lever 52 and with its lower end seated in an upwardly opening recess provided therefor in the top of said arm. This idling speed spring is placed under compression by the upward pressure of the yoke lever arm 56 thereon only when the high speed spring 70 is fully contracted.

The operation of the hereinbefore described centrifugal speed governor is as follows: When the centrifugal weights 34 on the governor shaft 12, which is driven by or in unison with the engine, are closed, the fuel control rod C is in its position of maximum fuel feed; and when said weights are fully open, said fuel rod is in its position of minimum fuel feed. As said weights swing outwardly due to increased speed of said shaft, the fingers 38 of these weights force the thrust sleeve 33 and the thrust bearing 48 carried thereby upwardly along the governor shaft. During this upward movement of the thrust bearing 48, the thrust flange 51 carried thereby pushes upwardly against the curved lower ends 57 of the short arms 56 of the yoke lever 52, thus rotating said lever on its supporting shaft 55 and causing the long arms 58 of said lever to swing downwardly toward the front end of the governor and move the fuel control rod C, which is operatively connected to said arms through its track and roller connection 60, 61 with the cross bar 59 thereof, in the direction of decreased fuel feed and thus decrease the speed of the engine. When the control lever 81 is set for idling speed, the crank 67 of the control shaft 64 is moved in the direction of the yoke lever supporting shaft 55 and the high speed spring 70 is under minimum tension and the slot-and-pin connection 75, 78 between the lower spring supporting link 69 and the yoke lever 52 permits the idling speed spring 89 to come into play to stabilize the governor and adapt the spring load to the weight load at the speeds demanded under idling conditions. When the control lever 81 is moved further from its idle speed setting, the links 68 and 69 and the high speed spring 70 act as solid links and move the fuel control rod C to a fuel cut-off position. When the control lever 81 is set for maximum high speed, the crank 67 is swung away from the yoke lever supporting shaft and the high speed spring is stretched to its maximum tension when said crank bumps against the pump opposing end wall of the governor housing. When the control lever 81 is set for any speed above idling speed, the high speed spring 70 is placed under tension by the upward swinging movement of the crank 67 of the control shaft 64, the tension on said spring being at a minimum at the low speed setting and at a maximum at the highest speed setting. In all high speed settings of the control lever 81, the fuel control rod C is set to deliver the proper quantity of fuel and the centrifugal governor weights 34 and the high speed spring 70 cooperate to shift the fuel control rod C in either direction and thus maintain within the regulated limits of the particular setting the engine speed selected by the operator regardless of the load applied, provided the load is within the capacity of the engine. The high speed spring 70 is pivotally suspended from the crank 67 centrally thereof and extends in a straight line from this pivotal support to its pivotal connection with the yoke lever 52 midway of the length of the cross bar connection 59 between the long arms 58 of said lever. Thus, as the crank 67 swings about the axis of the throttle or control shaft 64, the spring 70 has a varying moment arm relative to the line of action of the weight force on the

thrust sleeve 33 that is greater at high speed and lesser at idle speeds. On the other hand, the weight forces at the various speed settings of the control lever 81 also increase as the speed of the engine increases. At any fixed setting of crank 67 the high speed spring 70 has the same moment arm relative to line of weight action and, therefore, the same slope or increment of force over the weight force over the full range of travel of control rod. This spring arrangement provides a closer regulation in the various high speed settings of the control lever and it enables the same spring to be used for all high speed settings and limits the top speed of the governor to any one of these settings with satisfactory regulation. It is noted that the crank or control shaft 64 which constitutes the throttle shaft, is arranged so that, as the high speed spring tension increases, its affect on the yoke lever 52 is decreased due to the angle of action of said spring having a decreased moment arm about the center of the crankshaft. This arrangement greatly reduces the effort required to hold the control or throttle lever in the desired position.

The governor may be adjusted to adapt it to the particular injection pump controlled thereby by adjusting the sleeve nut 40 relative to the thrust sleeve 33 which has the effect of lengthening or shortening said thrust sleeve; and this adjustment is made through an opening which is located in the governor housing opposite said sleeve nut and is closed by a screw plug 91. The governor shaft end thrust adjustments are made from the outside of the governor housing by means of the adjusting screw 18. The bevel drive gear 8 is adapted to rotate with and also slide axially of the pump shaft D, this endwise floating movement of the drive gear being limited in one direction by the gear 11 of the governor shaft 12 and in the other direction by the thrust washer 10 back of the drive gear. This floating gear arrangement provides proper meshing of the gears 8 and 11. Proper lubrication of all of the parts in the upper portion of the governor housing is provided by the pumping action of the lower bearing 13 and the paddle wheel 21 which force the lubricant upwardly through the bore of the governor shaft 12 into the upper bearing 14 and thence into the upper portion of the governor housing.

The governor housing A is preferably made in two sections, one of these sections being a mere plate 93 that is bolted to one end of the injection pump housing B and the other section 94 containing all of the working parts which are assembled and adjusted therein at the factory.

The beveled drive gear 8 of the hereinbefore described governor is shown attached to the end of the pump cam shaft D remote from the drive receiving end thereof. In some instances, however, it is desirable to connect said gear to the drive receiving end of said shaft. In such case, as shown in Fig. 17, one of the members 95 of the coupling which connects the cam shaft D to the driving shaft (not shown) therefor, is rigidly secured by means of a nut 96 to the drive receiving end of said cam shaft and the drive gear 97 is mounted on said coupling member and has a longitudinal spline connection 98 therewith which permits relative axial sliding movement of said gear and coupling member while preventing relative rotary movement thereof. In this construction, the outer end wall of the governor housing has a horizontal opening 99 therethrough through which the hub of the coupling member 95 extends, suitable oil seals 100 are provided between said coupling member and said housing and an end thrust washer 101 is disposed between the drive gear 97 and said end wall of said housing.

Figs. 18 and 19 illustrate a modified form of maximum fuel quantity stop, which stop, like the stop 87 shown in Fig. 4, is mounted in the top wall of the governor housing A and is adapted to be engaged by the flat abutment surface 88 formed on the upper edge of one of the long arms 58 of the yoke lever 52. This modified stop construction is adapted to establish a normal maximum fuel feed position for the yoke lever 52 during the normal full load operation of the engine in all speed throttle positions or adjustments of the manually operable control or throttle lever 81. When, however, the engine is overloaded when operating at the desired maximum speed, this modified stop construction is adapted to yield under the pressure of the yoke lever 52 thereagainst and thus permit further fuel feed movement of said lever beyond the normal maximum fuel feed position thereof and thus prevent stalling of the engine.

The yieldable stop device shown in Figs. 18 and 19 preferably comprises a cup-shaped plunger member or thimble 102 that is disposed above the abutment surface 88 of the yoke lever 52 with its closed bottom in position to be engaged by said abutment surfaces. The thimble 102 is axially slidable in and projects below the lower end of a cylindrical sleeve 103 that is threaded through a vertical opening provided therefor in the top wall of the governor housing A. The sleeve 103 has an internal annular shoulder 104 at the lower end thereof adapted to form a supporting seat for an exterior annular shoulder 105 formed on the upper end of the thimble 102. The sleeve 103 is locked in the desired position of axial adjustment by a check or lock nut 106 which is threaded thereon in abutting relation to the upper surface of the top wall of the governor housing A. A cap nut 107 is threaded on the upper end of the sleeve 103 and serves as a cover for the yieldable stop mechanism.

The shouldered upper end 105 of the thimble 102 is normally held down on the seat 104 provided therefor in the lower end of the sleeve 103 preferably by means of a coil compression spring 108 whose lower end seats against the bottom of said thimble and whose upper end seats against the underside of a round nut 109 that is threaded into said sleeve. The nut 109 is locked in position by means of a round check or jamb nut 110 that is threaded into the sleeve 103 in abutting relation to the upper surface of the nut 109. Screwed into the round nut 109 is a pin 111 which is locked in place by means of the nut 112 that seats against the upper surface of said round nut. The pin 111 extends downwardly into the thimble 102, which is normally held clear of the lower end of said pin by the downward pressure extended on said thimble by the spring 108.

By this arrangement, the sleeve or shell 103 may be screwed up and down in the top wall of the governor housing A to adjust the thimble 102 relative to the knee or abutment surface 88 of the yoke lever 52, while the stop pin 111 for said thimble may be adjusted vertically in said sleeve to vary the clearance between the lower end of said pin and the bottom of said thimble.

Fig. 18 shows the position of the parts when the manually operable throttle or control lever 81 of the governor is in its highest speed setting

or full speed position and the engine is operating at the maximum speed desired for such adjustment of the control or throttle lever. In this position of the parts, the portion 88 of the yoke lever 52 is in engagement with the bottom of the fully projected stop thimble 102 therefor, in which position of the parts said thimble serves to establish a normal maximum fuel feed or full throttle position for said lever and the fuel feed control rod C actuated thereby. In this normal maximum fuel feed position of the yoke lever 52, the flyweights or centrifugal levers 34 of the governor are almost closed and the contracted high speed spring 70 serves to hold said yoke lever against the fully projected spring-pressed stop thimble therefor. When, however, the engine is overloaded during such full load operation, the engine slows down and the governor weights 34 close, thereby permitting further contraction of the high speed spring 70, which exerts a pull on the yoke lever 52 sufficient to force the spring-pressed stop thimble 102 upwardly in its supporting sleeve 103 until the bottom of said thimble seats against the lower end of the stop pin 111. This fuel feed movement of the yoke lever 52 beyond the normal maximum fuel feed stop position thereof established by the thimble 102 in the projected position thereof increases the quantity of fuel feed and thus provides increased torque sufficient to carry the overload and prevent stalling of the engine. When the speed of the engine increases due to the movement of the yoke lever beyond its normal maximum fuel feed position, the governor weights 34 swing outwardly and move said lever against the tension of the high speed spring 70 in the direction of decreased fuel feed, whereupon the thimble 102 is forced downwardly by the spring 108 and again is in position to establish the normal maximum fuel feed position for said lever.

When the engine is operating at full throttle and high speed the parts are in the positions shown in Fig. 18; that is with the stop thimble 102 fully projected and in position to prevent movement of the yoke lever 52 beyond the normal maximum fuel feed position therefor established by the projected stop thimble. In this normal maximum fuel feed position of the parts, the force of the spring 108 at high speed just balances the force of the centrifugal weights 34. When, however, an increase load is placed on the engine the speed thereof decreases and the load of the high speed spring 70 becomes predominant over the weight force and exerts sufficient pressure on the yoke lever 52 to force the stop thimble 102 upwardly against the force of the spring 108 into engagement with the lower end of the stop pin 111.

If the position of the throttle or control lever 81 is changed, that is, if the pin 71 is moved toward the right and the tension of the high speed spring 70 is decreased, then the balance between the thimble spring 108, said high speed spring and the force of the centrifugal weights 34 occurs at a lower engine speed. Since the position of the pin 71 determines the maximum engine speed, this point of balance for different positions of the throttle or control lever 81 varies according to the position of said pin. It will be seen, therefore, that the resilient fuel stop is operable to establish a normal maximum fuel feed position for the yoke lever 52 and to permit an additional fuel feed movement of said lever beyond its normal maximum fuel feed position in each high speed setting of said control or throttle lever.

Obviously, numerous changes may be made without departing from the spirit of my invention. Therefore, I do not wish to be limited to the precise arrangement shown and described, except as required by the claims.

What I claim is:

1. A speed governor for an internal combustion engine, said governor comprising a shaft operating in unison with said engine, a lever having one arm adapted to control the quantity of fuel supplied to said engine, a spring separate from said shaft and operatively engaging said arm of said lever for urging the same in the direction of increased fuel feed, centrifugally actuated means mounted on said shaft and operatively engaging the other arm of said lever for moving the same against the resistance of said spring in the direction of decreased fuel feed when the speed of said shaft increases, and a stop entirely separate from said lever and directly engageable by the first mentioned arm of said lever for establishing a normal maximum fuel feed position therefor, said stop being yieldable under the influence of said spring when said lever is relieved of the influence of said centrifugal means and is thereby free to exert pressure sufficient to overcome the resistance of said yieldable stop and permit further fuel feed movement of said lever beyond the normal maximum fuel feed position thereof.

2. A speed governor for an internal combustion engine, said governor comprising a shaft operating in unison with the engine, a lever having one arm adapted to control the quantity of fuel supplied to said engine, a spring separate from said shaft and operatively engaging said arm for urging said lever in the direction of increased fuel feed, speed responsive means mounted on said shaft and operatively engaging the other arm of said lever for moving said lever against the resistance of said spring in the direction of decreased fuel feed when the speed of said shaft increases, and a stop device comprising a spring-loaded plunger entirely separate from said lever and directly engageable by said first mentioned arm of said lever and adapted when projected to establish a normal maximum fuel feed position therefor, said spring-loaded plunger being yieldable under a predetermined pressure of said lever thereon to permit fuel feed movement of said lever beyond the normal maximum fuel feed position thereof established by said spring-loaded plunger in the projected position thereof.

3. A speed governor for an internal combustion engine, said governor comprising a shaft operating in unison with the engine, a lever adapted to control the quantity of fuel supplied to said engine, a spring for urging said lever in the direction of increased fuel feed, speed responsive means mounted on said shaft for moving said lever against the force of said spring in the direction of decreased fuel feed when the speed of said shaft increases, and a stop device entirely separate from said lever and comprising a spring-pressed plunger directly engageable by said lever and adapted when projected to establish a normal maximum fuel feed position therefor, said spring-pressed plunger being yieldable under the influence of said lever actuating spring when the latter is relieved of the influence of said speed responsive means and is thereby free to exert sufficient pressure to overcome the resistance of said spring pressed plunger and permit further fuel feed movement of said lever beyond the nor-

mal maximum fuel feed position thereof, said stop device including means for bodily adjustng the same relative to said lever, means for varying the resistance offered by said spring-pressed plunger to the fuel feed movement of said lever, and adjustable means for limiting the yielding movement imparted to said plunger by said lever.

4. A speed governor for an internal combustion engine, said governor comprising a shaft operating in unison with said engine, a lever adapted to control the quantity of fuel supplied to said engine, a spring operatively engaging one arm of said lever for urging the same in the direction of increased fuel feed, speed responsive means mounted on said shaft and operatively engaging the other arm of said lever for moving the same against the resistance of said spring in the direction of decreased fuel feed when the speed of said shaft increases, and a stop device for limiting the

fuel feed movement of said lever, said stop device comprising a holder, a plunger mounted in said holder, a spring mounted in said holder for urging said plunger in one direction, means for regulating the tension of said spring, and an adjustable stop for limiting the movement of said plunger in the opposite direction, said stop device being mounted in said governor entirely separate from said lever and with said plunger in position to be engaged by said lever during the fuel feed movement thereof, whereby said plunger when fully projected is adapted to establish a normal maximum fuel feed position for said lever and is yieldable under a predetermined pressure of said lever thereon to permit fuel feed movement of said lever beyond the normal maximum fuel feed position thereof established by said plunger in the fully projected position thereof.

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