Feb. 23, 1954 V. C. REDDY ET AL 2,669,983

GOVERNOR MECHANISM

Filed June 17, 1950 2 Sheets-Sheet 1

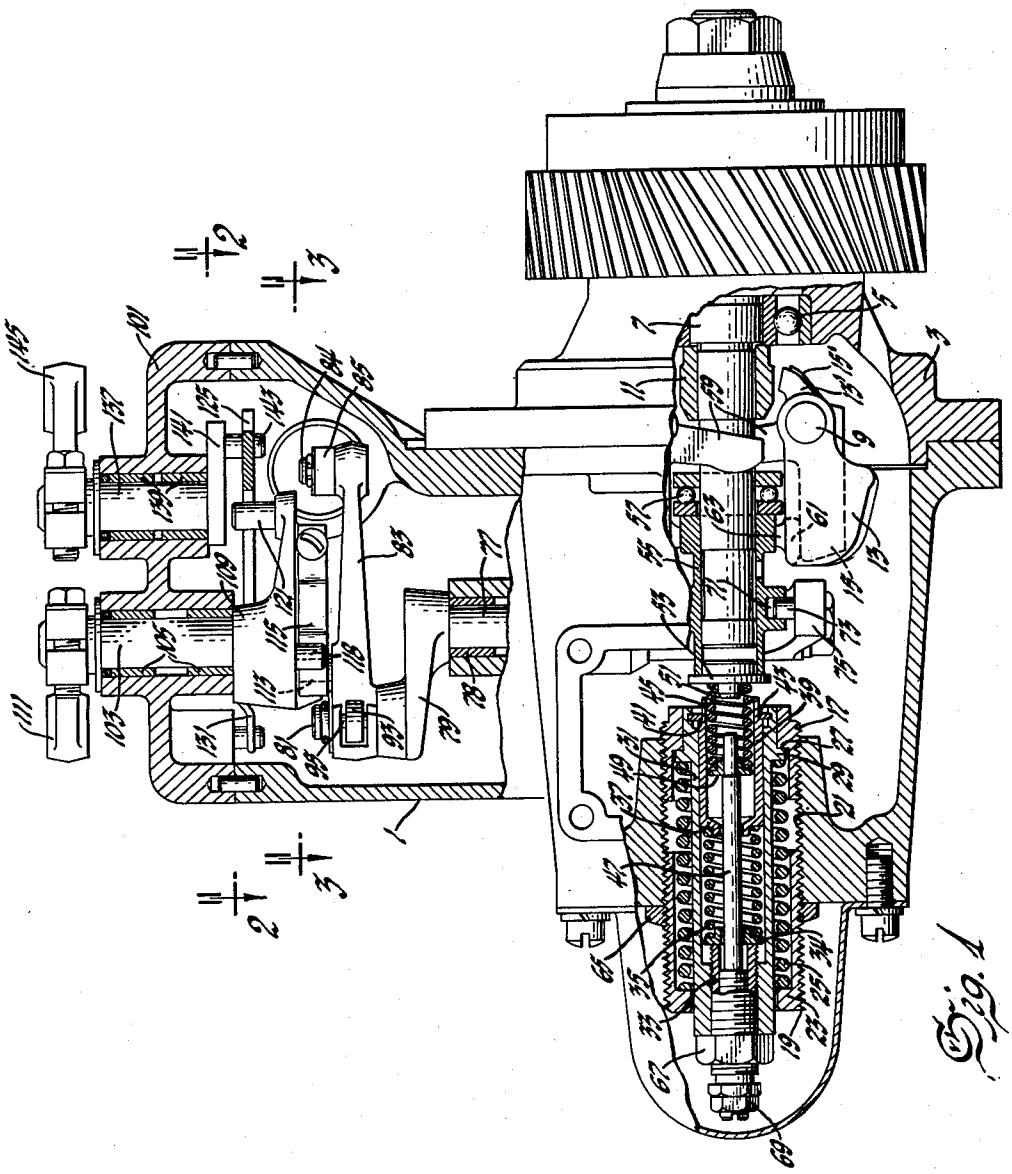

Fig. 1

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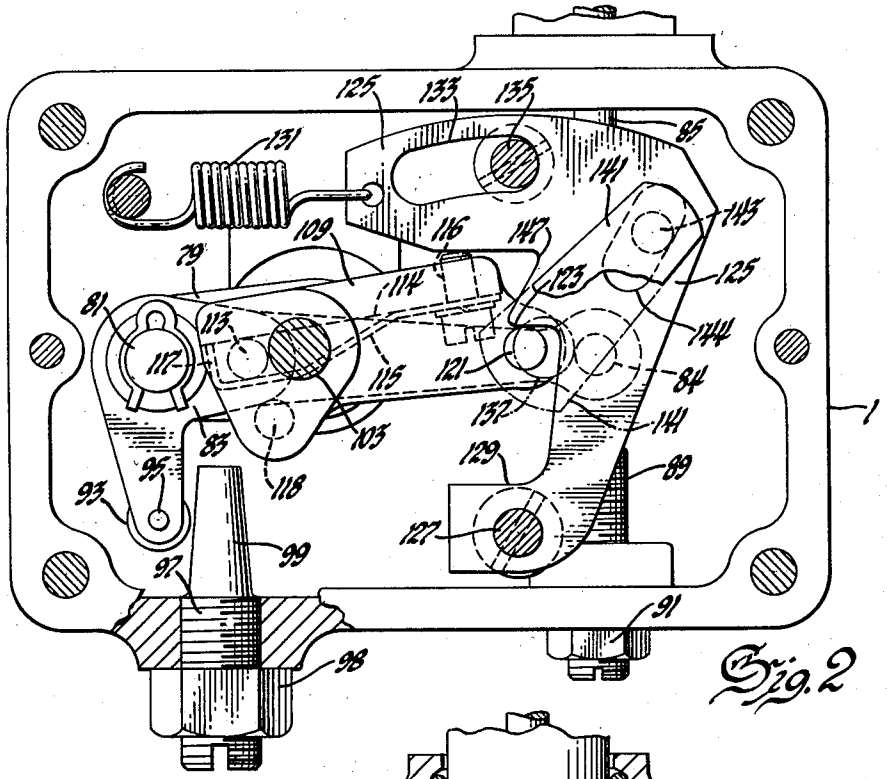

Fig. 2

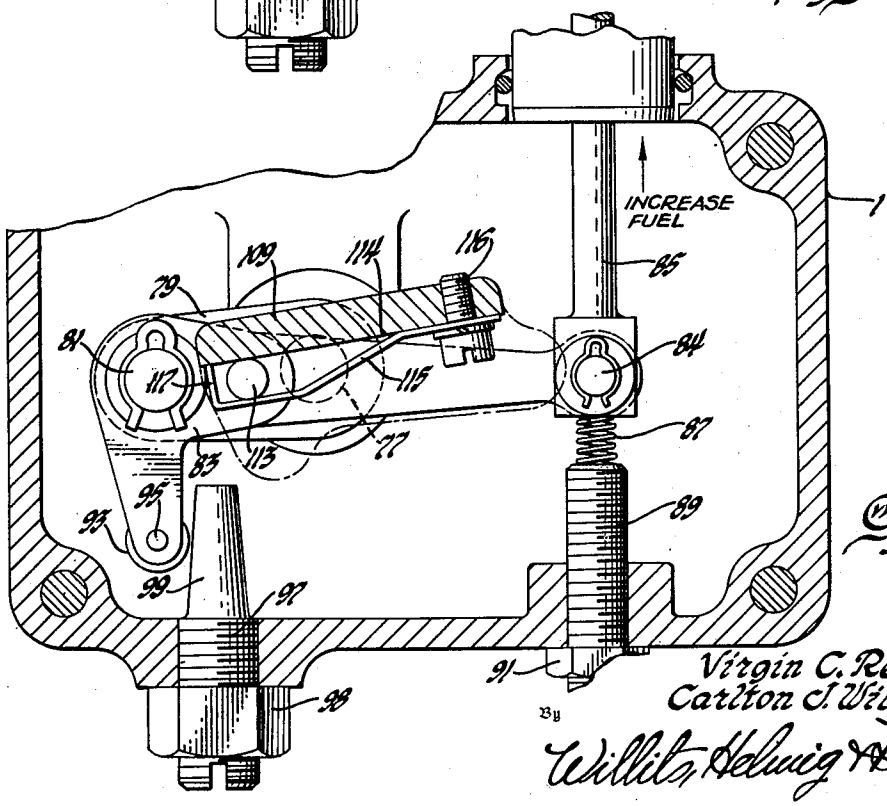

Fig. 3

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GOVERNOR MECHANISM

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11 Claims. (Cl. 123—140)

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This invention generally relates to governor apparatus and more particularly to improvements in governor apparatus for diesel engines.

In diesel engine operation the amount of fuel supplied the engine is proportional to the engine torque. With high speed diesel engines of the two-cycle type in which an air scavenging and charging blower and high pressure fuel injection pumps are driven by the engine, the amount of fuel supplied to the engine is usually set by manual control means and the fuel is limited at low and at high engine speeds corresponding to idling and maximum speed of the engine by an engine driven governor mechanism. These engines are usually supplied with excess scavenging and charging air throughout the operating speed range of the engine and the injection pumps are designed to supply proper amounts of fuel for the air supplied at each engine speed. In that the amount and pressure of the air supplied by the blower and also the pressure and leakage of fuel in the fuel injection pumps vary with engine speed, there is a tendency to supply excess fuel to the engine at certain speeds resulting in incomplete combustion and smoking of the engine.

Between idle and maximum engine speed where the amount of fuel supplied the engine and therefore the torque and speed of the engine are under control of the manual control means, the engine may be easily overloaded by excess fuel supplied thereto. This likewise results in incomplete combustion and smoking of the engine.

The principal object of the invention accordingly is to provide simple engine fuel and torque control mechanism whereby the fuel supplied the engine and therefore the engine torque is controlled at each setting of the manual control means to prevent overloading of the engine and to provide efficient engine operation at all available speeds and loads of the engine.

The engine fuel and torque control mechanism by which the above object is accomplished will become apparent by reference to the following detailed description and drawings illustrating the details of this mechanism.

Figure 1 is a vertical elevation of the governor with parts shown broken away and in section.

Figure 2 is an enlarged view taken on line 2—2 of Figure 1 with parts shown broken away and in section.

Figure 3 is an enlarged view taken on line 3—3 of Figure 1 with parts shown broken away and in section.

As best illustrated in Figure 1, the governor comprises a housing 1 having an opening in one

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end shown closed by removable bearing cap 3 including an anti-friction bearing 5 rotatably supporting an engine driven governor shaft 7. Governor weights are shown pivoted by means of pivot pins 9 to a weight carrier 11 secured on the shaft 7. Two sets of governor weights are shown, namely, a set of low speed weights 13 and a set of high speed weights 15. Each of these weights is provided with stops indicated at 13' and 15' which engage the weight carrier 11 to limit outward centrifugal movement thereof.

Hollow adjustable abutment members 17 and 19 are shown threaded in the outer and inner ends of an opening 21 in the governor case coaxial with the governor shaft 7. The outer abutment member 19 is provided with an internal flange 23 at the outer end serving as a seat for a high speed governor spring 25. The inner abutment member 17 is provided at the inner end with an internal flange 27 against which the external flange 29 of a sleeve 31 is urged by the high speed spring 25, the inner end of which is shown in contact with the sleeve flange 29. The sleeve 31 is slidable axially outwardly in the aligned bores in the abutment members 17 and 19 against the action of the high speed spring 25.

Another hollow abutment 33 is adjustably threaded into the outer end of the sleeve 31 and is shown engaged by a seat 34 for the outer end of an intermediate spring 35. The inner end of the intermediate spring 35 bears on a flange 37 of a hollow spring seat member 39 having an external flange 41 urged by the spring 35 into engagement with a snap ring 43 in an internal groove in the inner end of sleeve 31 so that the reduced diameter inner end portion 45 of the hollow spring seat 39, forming the flange 41, projects inwardly from the sleeve 31.

An abutment stem 47 is adjustably threaded at the outer end into the hollow abutment 33 and is shown provided with a reduced diameter inner end portion supporting a spring seat 49 for the outer end of an idle speed spring 51 the inner end of which bears on a seat 53 secured in the end of a governor sleeve 55 which is rotatable and axially slidable on the governor shaft 7.

A thrust bearing 57 is placed on the governor shaft 7 adjacent the inner end of the governor sleeve 55. The high speed governor weights 15 are provided with fingers 59 bearing against the inner end of the thrust bearing 57 and with the engine and governor at rest the idle spring 51 urges the sleeve 55 to the right and fingers 59

and the high speed governor weights 15 clockwise about the pivot pins 9. This causes the high speed weights 15 to contact the stops 61 on the low speed weights 13 and urge the stops 63 on the low speed weights into contact with the governor sleeve 55 as shown in Figure 1. It will be noted that lock nuts 65, 67 and 69 are provided to lock the adjustable spring abutments 19, 33 and 47 after they are adjusted.

The governor sleeve 55 is shown provided with an external groove 71 into which project two pins 73 secured in the ends of a fork-shaped lever 75. The fork-shaped lever 75 is secured to the lower end of a vertical shaft 77 rotatable in bearing 78 in the housing 1. On the upper end of the shaft 77 is secured a lever 79 so that this shaft 77 and the levers 79 and 75 are moved angularly in response to variations in speed of the engine. As best shown in Figures 1 and 2, a pin 81 is secured in the outer end of the lever 79 and projects vertically upwardly through an opening in a floating bell crank lever 83. One end of the floating bell crank lever 83 is pivoted by a pin 84 to a link 85 serving in a well-known manner as a fuel control link for the engine fuel injectors, not shown. A buffer spring 87 is placed between the pivoted end of the link 85 and a spring seat 89 adjustably threaded in an opening in governor case 1 and locked thereto by means of a lock nut 91. The outer end of the other arm of the floating bell crank lever 83 has a roller 93 rotatably supported on a pin 95 secured thereto. A fuel stop 97 is adjustably threaded in the governor case 1 and is locked thereto by means of a lock nut 98. The inner end of the fuel stop 97 is provided with a tapered ramp portion 99 and is shown in Figures 2 and 3 extending adjacent the roller 93 on the floating bell crank lever 83 for contact by this roller.

The upper end of the governor case 1 is provided with an opening and a governor cap 101 is secured to the case 1 and covers this opening. A shaft 103 is rotatably supported about a vertical axis in bearings 105 in the cap and has a lever 109 secured to the lower end thereof adjacent the floating bell crank lever 83 within the governor case. An external lever 111 is secured to the upper outer end of the shaft 103 for operation by either a hand throttle lever or the accelerator pedal, not shown, by suitable connections, not shown. An upstanding pin 113 is secured to the floating bell crank lever 83 adjacent the pivot pin 81 on the lever 79. The pin 113, as best shown in Figure 3, is located adjacent a downwardly extending vertical abutment face 114 of the lever 109. A leaf spring 115 is secured at one end by a stud 116 to the outer end of the vertical face 114 of the lever 109 and the opposite end 117 of this spring is hook-shaped and engages the pin 113 on the floating bell crank lever and urges this pin into engagement with the vertical abutment face 114 of the lever 109.

As best seen in Figure 2, a limit pin 118 is secured on the lever 109 adjacent the hook-shaped end 117 of the leaf spring 115 thereon to limit movement of this end of the spring away from the abutment face 114 of the manually operable lever 109.

An upstanding pin 121 is secured to the outer end of the lever 109 as best seen in Figures 1 and 2. The pin 121 is shown in Figure 2 in an engine idle control position in contact with one side 123 of a notch in a detent plate 125 which is pivoted on a pin 127 to the governor cap 101.

The pin 121 on the lever 109, when moved clockwise as viewed in Figure 2 to the full speed and torque control position, contacts the other side 129 of the notch in the detent plate 125.

A spring 131 is secured between the detent plate 125 and the cap 101 of the governor housing and holds one end of a slot 133 in the detent plate in contact with the stop pin 135 secured to the cap 101. Another shaft 137 is pivoted about a vertical axis in bearings 139 in the cap, as best seen in Figures 1 and 2, and has a lever 141 secured to the lower end adjacent the detent plate 125 in the governor housing. A pin 143 is secured to the outer end of the lever 141 and extends into a slot 144 in the detent plate 125. A manually operable lever 145 is secured to the outer end of the shaft 137 for moving it clockwise to cause clockwise movement of the detent plate by the pin 143 acting in the slot 144 therein so that the pin 121 of the other manually operable lever 109 may then be moved counterclockwise into a detent notch 147 in the detent plate 125 which constitutes an engine shutdown control position for the manually operable lever 111.

As best seen in Figure 1 with the engine shut down, the low and high speed governor weights 13 and 15 are in the position shown and the engine is started in the following manner.

The manually operable external lever 111, shaft 103 and lever 109 are moved clockwise from the engine shutdown position through and beyond the engine idle control position as shown in Figures 1 and 2. This causes the pin 121 on the lever 109 to exert force on the lower side of the slot 147 of the detent plate 125 and moves this plate clockwise against the force of the spring 131 and allows the pin to enter the adjacent slot in the detent plate and be positioned between the sides 123 and 129 of this slot which sides, as mentioned, constitute the idle and the full speed and torque-setting positions of this pin and the manually operable levers 111 and 109 connected therewith. This clockwise rotation of the shaft 103 and lever 109 causes the hook-shaped end 117 of the leaf spring 115 on the lever 109 to exert force on the pin 113 on the floating bell crank lever 83 and moves it counterclockwise about the pivot pin 81 of the speed responsive lever 79 which is now stationary with the engine at rest and the weights 13 and 15 in the position shown in Figure 1. Counterclockwise movement of the floating bell crank lever 83 continues until the roller 93 thereon contacts the adjacent tapered fuel stop 97 and the extent of this movement causes the right end of the floating bell crank lever 83 to move the fuel control link 85 in the direction of the arrow shown in Figure 3 to increase the engine fuel for starting. After starting of the engine the lever 109 is returned to the idle position and the pin 121 thereon contacts the side 123 of the notch in the detent plate 125 to position the manually operable levers 109 and 111 in the idle speed and torque-setting position as best shown in Figure 2. Starting of the engine causes outward movement of the low and high speed governor weights 13 and 15 and movement of the governor sleeve 55 to the left against the action of the idle speed spring 51 and with the manual levers 109 and 111 in the idle position and the engine operating at idling speed, the spring seat 53 on the governor sleeve 55 is displaced only a slight distance from the adjacent reduced diameter portion 45 of the hollow intermediate spring seat member 39. Also with the engine

operating at idling speed, the roller 93 on the floating bell crank lever 83 is displaced slightly out of contact with the tapered portion 99 of the fuel stop 97 and the outer end of the buffer spring 87 is in light contact with the adjacent end of the fuel control link 85 as best shown in Figures 2 and 3.

With the engine idling, if the engine speeds up slightly the low and high speed governor weights 13 and 15 will move outwardly against the force of the idle spring 51 and move the sleeve 55 to the left to cause clockwise movement of the levers 75 and 79 and the vertical shaft 77. Clockwise movement of the lever 79 and pin 81 thereon causes a corresponding movement of the left end of the floating bell crank lever 83 and as the pin 113 thereon is fulcrumed on the vertical abutment face 114 of the manual setting lever 109, the right end of the bell crank lever 83 and fuel control link is moved in the opposite direction to the arrow in Figure 3 to reduce the engine fuel and therefore reduce the speed of the engine to the proper idling speed value. This causes the roller 93 to be moved further away from the fuel stop 97 and causes the fuel control link 85 to compress the buffer spring 87. If the engine speed falls below the idle value, the governor weights 13 and 15 will be moved inwardly by the idle spring 51 and the governor sleeve 55 will cause counterclockwise movement of the lever 79 and the pin 81 thereon. This causes counterclockwise movement of the left-hand end of the floating lever 83 about the pin 113 thereon now fulcrumed on the leaf spring 115 to cause the right-hand end of the floating lever to move the fuel control link 85 in the direction of the arrow and increase the engine fuel and speed to the correct idle value. It will be evident that the buffer spring 87 opposes fuel decreasing movement of the fuel control link and aids in increasing fuel movement thereof to maintain engine idling speed at the proper value and to prevent hunting of the engine speed in conventional manner.

Control of the engine in the range between idle and full speed and torque values is accomplished as follows.

With the engine idling a sudden clockwise movement of the manual lever 109 from the idle to the full speed and torque position causes the pin 121 on this lever to be moved into contact with the side 129 of the notch in the detent plate 125 and be positioned in the full speed and torque position. This sudden clockwise movement of the lever 109 causes the leaf spring 115 to exert force on the pin 113 of the floating lever 83 to move it counterclockwise a limited amount about the pin 81 causing only a slight increase in the fuel supply of the engine as the roller 93 immediately moves a slight distance and contacts the tapered portion 99 of the fuel stop 97 and prevents further increase in the engine fuel. Upon contact of the roller 93 with the fuel stop 97, further clockwise movement of the manual lever 109 relative to the pin 113 of the floating bell crank lever 83 causes a slight bending of the leaf spring 115 and this spring then exerts an upward force on the pin 113. If there is little load on the engine this slight increase in fuel supplied the engine will cause an immediate increase in the engine speed and the low and high speed governor weights 13 and 15 move outwardly initially against the action of the idle spring 51 only. Further outward movement of the weights upon further increase in engine speed brings the stops

13' on the low speed weights 13 into contact with the weight carrier 11 to stop further outward movement of the low speed weights. At this time the spring seat 53 on the governor sleeve 55 contacts the reduced diameter projecting end portion 45 of the intermediate spring seat 39 and further increase in the engine speed, up to the full speed value, causes further outward movement of the high speed governor weights 15 opposed by the combined forces of the idle and intermediate springs 51 and 35. This initial outward movement of the low and high speed weights and subsequent outward movement of the high speed weights only, causes the governor sleeve to be moved to the left, as viewed in Figure 1. This causes clockwise movement of the governor operated levers 75 and 79 and connecting shaft 77 as viewed in Figures 1, 2 and 3. The pin 81 on the lever 79 to which the left end of the floating bell crank lever is pivoted applies an upward force on the left end of the floating bell crank lever and as the bent spring 115 on the manual lever 109 is also applying an upward force on the pin 113 of the floating lever 83 adjacent the pin 81, the floating lever 83 will be moved upwardly with the roller thereon retained in contact with the tapered portion 99 of the fuel stop 97. This causes the fuel control link 85 pivoted to the right end of the floating lever to be moved upwardly as shown by the arrow in Figure 3 to increase the engine fuel. This upward movement of the floating lever 83 causes the roller 93 thereon to roll toward the smaller diameter tapered portion 99 of the fuel stop 97 which causes a slight counterclockwise movement of the floating lever about the pivot pin 81 to cause a slight additional upward movement of the fuel control link 85 and a corresponding increase in the fuel supplied the engine. Should the engine be loaded to a greater degree when the manual control lever 109 is moved suddenly clockwise toward the full speed and torque position, the engine speed will increase more slowly in response to this slight increase in fuel supplied the engine, which as described above, is limited by counterclockwise movement of the floating lever 83 about the pin 81 only until the roller 93 on the floating lever contacts the fuel stop 97. The spring 115 on the manual control lever 109 is consequently bent more when there is more load on the engine as the floating lever cannot be moved upwardly to increase the engine fuel by this spring until the engine speed increases or the load thereon decreases which again causes clockwise rotation of the governor operated lever 79 and pin 81 thereon to which the floating lever 83 is pivoted to then increase the engine fuel and torque. It will be noted that any speed and torque value may be selected by movement of the manually operable levers 109 and 111 and the governor mechanism and fuel stop mechanism then act to limit the amount of fuel supplied the engine to the available engine speed and torque value without overloading and smoking of the engine.

As best seen in Figures 2 and 3, if the engine is operating at any constant available speed and torque value between idle and full value as set by the manually operable lever 109 and controlled by the roller 93 on the floating lever 83 and governor mechanism, the roller 93 will be in engagement with the fuel stop 97. Should the load increase on the engine, the speed will decrease and the governor operated lever 79 and pin 81 thereon, to which the floating lever 83 is pivoted,

will then be moved counterclockwise as viewed in Figures 2 and 3 with reference to the manually operable lever 109. A downward force is accordingly applied to the left end of the floating lever 83 and this end of the floating lever will move downwardly and the roller 93 thereon will accordingly roll toward the larger diameter tapered portion 99 of the fuel stop 97 against the action of the leaf spring 115 on the manually operable lever 109 on which the pin 113 of the floating lever now bears. This combined downward movement of the left end of the floating lever and movement of the roller 93 thereon relative to the fuel stop causes downward and slightly clockwise movement of the floating lever relative to the pin 81 which causes bending of the spring 115 and downward movement of the fuel control link 85 to reduce the fuel supplied the engine and prevent overloading and smoking thereof.

With the engine operating at any constant available speed and torque between idle and full values, should the load on the engine decrease, the speed will increase and the governor operated lever 79 will be moved clockwise and the pin 81 thereon will cause upward movement of the left end of the floating bell crank lever 83. The pin 113 on the floating lever will accordingly now be fulcrumed on the abutment face 114 of the manual lever 109 and the floating bell crank will rotate clockwise causing downward movement of the fuel control link 85 to reduce the engine fuel and also causing the roller 93 to move away from the fuel stop 97. The engine fuel is accordingly reduced to prevent overspeeding of the engine.

It will be apparent that with the engine operating at any available value of speed and torque between idle and full values, the governor mechanism acts either on an increase in engine load or an increase in engine speed to reduce the fuel supplied the engine to prevent overloading and smoking thereof or to prevent overspeeding of the engine.

With the manually operable control lever 109 in the full speed and torque-setting position and the engine operating at full available speed and torque under control of the governor, the roller 93 on the floating lever 83 is engaged with the smaller diameter tapered end portion 99 of the fuel stop 97 and the spring seat 53 on the governor sleeve 55 is displaced only a slight distance from the inner end of the sleeve 31 having the external flange 29 on which one end of the high speed governor spring 25 bears. Upon a slight rise in engine speed above full value the high speed weights 13 move the governor sleeve and seat 53 thereon to the left into contact with the sleeve 31 and move it to the left against the force of the high speed governor spring 25. Movement of the governor sleeve 55 to the left again causes clockwise movement of the lever 79 and pin 81 thereon on which the left end of the floating lever 83 is pivoted. This causes upward movement of the left end of the floating lever 83 and the pin 113 thereon is fulcrumed on the abutment face 114 of the manual lever 109 causing the right end of the floating lever to move the fuel control link 85 downwardly to decrease the engine fuel and speed thereof. The roller 93 on the lever 83 at this time is also moved away from the fuel stop 97. The above operation prevents overspeeding of the engine.

The linkage arrangement provided permits a reduction in the engine fuel and its speed at will, upon counterclockwise operation of the manually operable levers toward idle and shutdown positions. Counterclockwise movement of the manual lever 109 as viewed in Figures 2 and 3 causes the abutment face 114 thereof to contact and move the pin 113 on the floating lever 83 downwardly about the pivot pin 81 on the governor operated lever 79. The roller 93 on the floating lever 83 is accordingly moved away from the fuel stop and the fuel control link is moved downwardly to reduce the fuel supplied the engine and slow it down to idling value or to shut the engine down.

To shut down the engine the levers 141 and 145 and shaft 137 in the cap 101 are rotated clockwise. The pin 143 on the lever 141 then engages one side of the slot 144 in the detent plate 125 and moves it clockwise about the pin 127 and against the action of the spring 131. This allows the pin 121 on the manual lever 109 to be moved counterclockwise and enter the shutdown slot 147 in the detent plate and thereby shut off the fuel to the engine.

The above-described engine control means permits the engine fuel to be set by manual means to shut down the engine or to cause operation thereof between idle and maximum values of speed, torque and output and the fuel stop and engine speed responsive control means associated with the manual means prevents overspeeding and overloading of the engine at any operating speed and torque value set by the manual means. The form of the adjustable stop 97 shown tends to reduce the fuel supplied the engine more at the lower operating speeds than at higher speeds to prevent smoking of the engine at lower speeds. The form of the adjustable fuel stop may of course be of any desired form to limit the fuel supplied the engine in order to prevent overloading and smoking of an engine of either the two or four-stroke cycle compression ignition type at any particular speed value or over a given operating range in which overloading and smoking occurs.

We claim:

1. In an engine control mechanism, the combination of a floating actuating lever for an engine fuel regulator, a lever movable in response to the engine speed and operably connected to the floating lever, a formed stationary stop engageable by the floating lever to modify the movement thereof, said floating lever being pivotable on an axis translatable relative to said stop, and a manually operable lever movable freely from idle to full speed and torque position having spring means thereon engageable by the floating actuating lever and deflectable by the lever movable in response to the engine speed upon a speed reduction to cause movement of the said actuating lever along the formed stop and a reduction in fuel supplied the engine to prevent overloading and smoking of the engine.

2. In an engine control system, the combination of a floating actuating lever for an engine fuel regulator, a lever movable in response to variations in the engine speed, a formed stationary stop located adjacent the floating lever movable freely from idle to full speed and torque position, said floating actuating lever being pivotable on an axis translatable relative to said stop, a manual speed and fuel-setting lever having means thereon urging the floating actuating lever into engagement with the formed stop to modify movement of the actuating lever and fuel supplied the engine by movement of the lever

movable in response to variations in the engine speed.

3. In an engine control mechanism, the combination of an actuating lever for an engine fuel regulator having abutment and follower portions, a governor acting in response to the engine speed and having a lever movable thereby and operably connected to the actuating lever, a manually operable control lever having an abutment portion and spring means thereon urging the abutment portions of the actuating and manually operable levers into engagement, and fuel stop means adjacent the follower portion of the actuating lever and contactable by the follower portion by action of the spring for certain positions of the manually operable lever to modify movement of the actuating lever by the governor operated lever to control the engine fuel throughout a preselected speed range as determined by the position of the manually operable lever in order to prevent overloading and smoking of the engine and to prevent overspeeding of the engine.

4. In a compression ignition engine control mechanism, the combination of an actuating lever for an engine fuel regulator, said actuating lever having pivot and follower portions, an engine governor having a lever operable angularly thereby in response to engine speed variations, a manually operable fuel-setting lever having an abutment surface and a spring thereon urging the actuating lever pivot portion into contact with the abutment surface of the manually operated lever, a formed stationary stop located adjacent to and contactable by the follower portion of the actuating lever when the fuel supplied the engine under control of the governor causes operation of the engine at its available speed and torque without smoking as set by the manually operable fuel-setting lever, said governor operated lever acting in response to overloading and underspeeding of the engine to move the actuating lever to reduce the fuel supplied the engine by deflecting the spring on the manual lever thereby causing the follower portion of the actuating lever to be retained in contact and moved along the stop, said governor acting upon an overspeeding and underloading from the available speed and torque to move the actuating lever with the pivot portion thereon in engagement with the abutting surface of the manual lever to move the follower out of contact with the stop and to reduce the engine fuel.

5. In an engine control system, the combination of an engine driven shaft, governor weights pivoted thereon, springs opposing outward movement of the weights upon an increase in engine speed, a lever operated by the weights, an engine fuel regulator actuating lever operably connected to the weight operated lever, a formed stop adjustably mounted adjacent the actuating lever, a manually operable engine speed and fuel-setting lever contactable with the actuating lever for moving it relative to the weight operated lever to cause a reduction in fuel and speed of the engine, said weight operated lever upon an increase in engine speed causing contact of the speed and fuel-setting lever by the actuating lever and relative movement of the latter to reduce the engine fuel, said speed and fuel-setting lever having spring means carried thereby, said spring means engaging the actuating lever for moving it into engagement with the adjustable stop means to limit increase in the engine fuel, said weight operated lever, upon a decrease in engine speed, moving the actuating member along the stop means and against the force of the spring means to reduce the fuel supplied the engine.

6. In a compression ignition fuel control system, the combination of an engine driven shaft, low and high speed governor weights pivoted on the shaft, an idle speed spring opposing outward movement of the low and high speed weights to control idle speed operation of the engine, stops on the low speed weights to stop outward movement thereof slightly above the idle speed value, an intermediate speed spring acting in combination with the idle spring to oppose further outward movement of the high speed weights to control the engine in the available speed and torque range, a high speed governor spring opposing further outward movement of the high speed weights to limit maximum speed of the engine, a governor lever operable by the weights, an engine fuel regulating lever operatively connected to the weight operated lever, a formed adjustable stop located adjacent the actuating lever and engageable thereby to modify movement thereof in order to prevent excess fuel being supplied the engine and smoking thereof, and a manually operable lever having spring means thereon and movable from an engine shutdown position to an idle position to move the fuel regulating lever by the spring means thereon to increase the engine fuel to the idle value and to position the fuel regulating lever adjacent the stop means for operation by the low and high speed weights to control engine fuel and maintain idle speed of the engine, said manually operable lever being movable from idle toward a maximum speed position to cause movement of the fuel regulating lever by the spring means thereon into contact with the stop means thereby limiting the increase in fuel supplied the engine and to bend said spring means to retain the fuel regulating lever in contact with the stop means, the resulting outward movement of the high speed governor weights opposed by the idle and intermediate springs and the bent spring means causing movement of the fuel regulating lever along the stop means to increase the fuel to the engine without overloading and smoking of the engine, said high speed weights acting upon an increase in the engine speed above that set by the manual lever between idle and maximum moving the weight operated lever to contact and move the fuel regulating lever to reduce the engine fuel, said manually operable lever upon movement toward the shutdown position contacting and moving the fuel regulating lever to reduce the engine fuel.

7. In an engine control system, the combination of a floating bell crank lever having one arm operatively connected to an engine fuel regulator at the outer end and a fulcrum pin adjacent the outer end and the other arm having a follower roller thereon, a lever movable in response to the engine speed pivotally connected to the floating lever at the junction of the arms thereof, a tapered stop adjacent the follower roller contactable thereby, and a manually operable speed-setting lever angularly movable adjacent the floating bell crank lever and having an abutment and a spring thereon, said spring contacting the fulcrum pin and urging the pin into contact with the abutment, said speed-setting lever when moved to decrease the engine speed setting moving the fulcrum of the floating bell crank lever by the abutment thereon to decrease the fuel supplied the engine and when moved to increase the engine speed setting moving the fulcrum pin

by the spring to retain the follower roller in engagement with the tapered stop for further movement thereon by the speed responsive lever upon an increase in engine speed.

8. In an engine control system, the combination of a bell crank lever having a follower roller on one arm and the other arm operatively connected to an engine fuel control link and having a fulcrum pin thereon, a tapered stop adjustably mounted adjacent the follower roller, a lever movable in response to changes in engine speed pivotally connected to the bell crank and a manually operable speed-setting lever having an abutment portion and a spring thereon urging the bell crank fulcrum pin into contact with the abutment portion of the speed-setting lever, said spring being deflectable upon movement of the speed-setting lever toward an increased speed-setting position to move the bell crank to increase the engine fuel and to move the follower roller on the bell crank into contact with the stop and limit this increase in fuel, the speed responsive lever acting upon variations in speed of the engine to move the bell crank with the roller thereon along the stop and limit the change in fuel supplied the engine and prevent overloading and smoking thereof.

9. In an engine control system, the combination of a bell crank lever having a follower roller on one arm and the other arm operatively connected to an engine fuel regulator and provided with a fulcrum portion, a speed responsive lever pivotally connected to the bell crank and movable by changes in the engine speed and a speed-setting lever having an abutment and a spring thereon located on opposite sides of the fulcrum pin of the bell crank, said speed-setting lever moving the bell crank follower roller into contact with the tapered stop through engagement of the spring and fulcrum portion relative to the speed responsive lever for subsequent movement of the bell crank by the speed responsive lever to increase the fuel supplied by the engine with the follower roller retained in engagement with the stop by the spring to control the increase in fuel supplied the engine.

10. In an engine control mechanism, the combination of a floating actuating lever for an engine fuel regulator, governor means operably engaging and moving the same to control fuel supply to the engine responsive to engine speeds, a formed permanent stop engageable by said floating lever limiting the movement thereof responsive to its movement by said governor means, said floating actuating lever being pivotable on an axis translatable relative to said stop, and a manually operable lever movable freely from idle to full speed and torque position engaging the floating actuating lever manually controlling fuel supplied to the engine including resilient means urging said floating actuating lever into engagement with said formed stop whereby to permit said governor means to modify the movement of the floating actuating lever and fuel supplied to the engine responsive to variations in engine speed at any position of said manually operable lever.

11. A control mechanism for an engine having an engine fuel regulator comprising, in combination, an engine driven governor shaft, governor weights revolved by said shaft, a governor sleeve slidable axially of said shaft by said weights, a balance spring resisting movement of said sleeve by said weights, a lever rotatable by the movement of said sleeve, a bell crank having a pair of arms carried by said lever, one of said arms being connected to said fuel regulator, a stationary stop adjacent to the said other arm of said bell crank and contactable thereby, and a manually operable lever having spring means thereon engageable by said bell crank and deflectable by said first-named lever urging the said bell crank to engagement with said stop to modify movement of the bell crank in response to variations in engine speed.

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