July 21, 1942. W. E. BENJAMIN 2,290,797

UNIVERSAL GOVERNOR

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FIG. 1

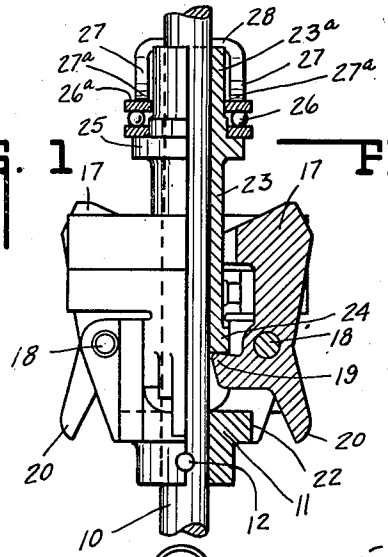


FIG. 2

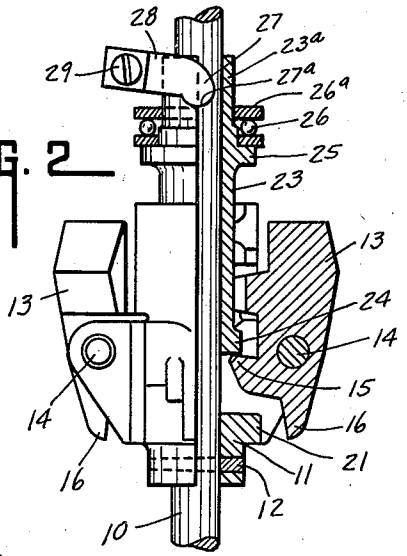


FIG. 3

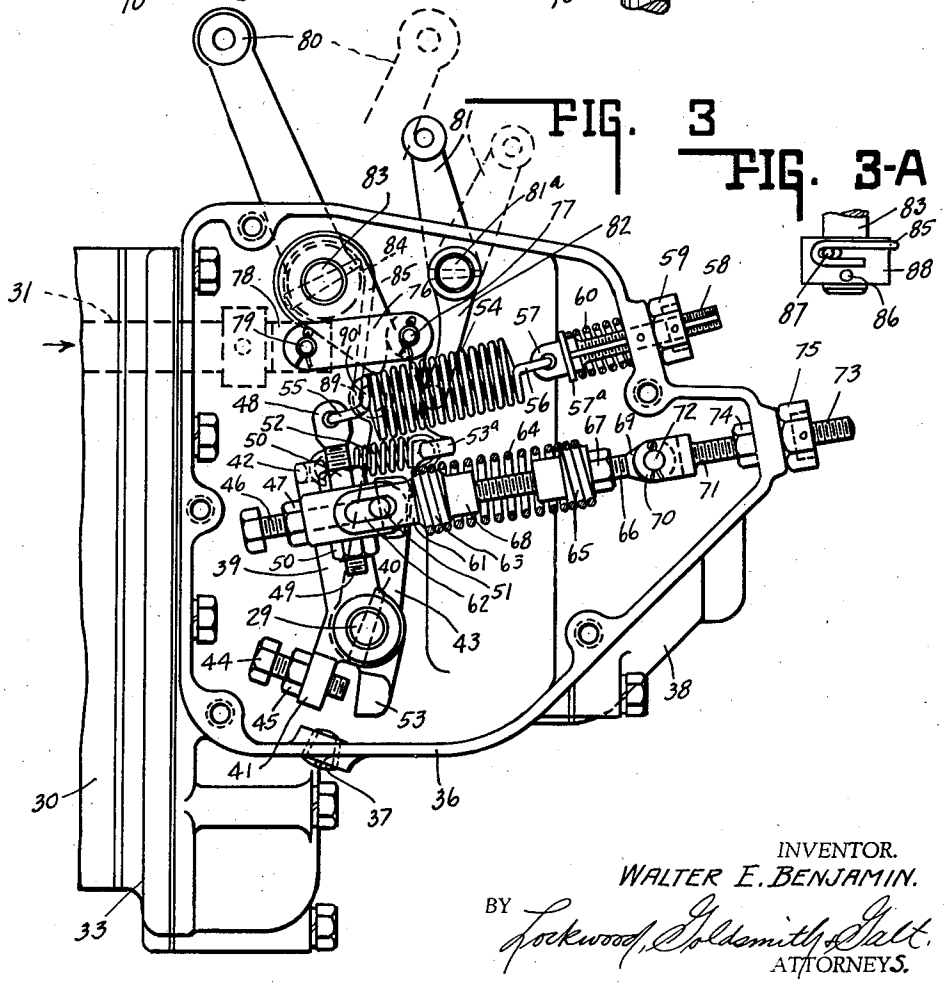


FIG. 3-A

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FIG. 5

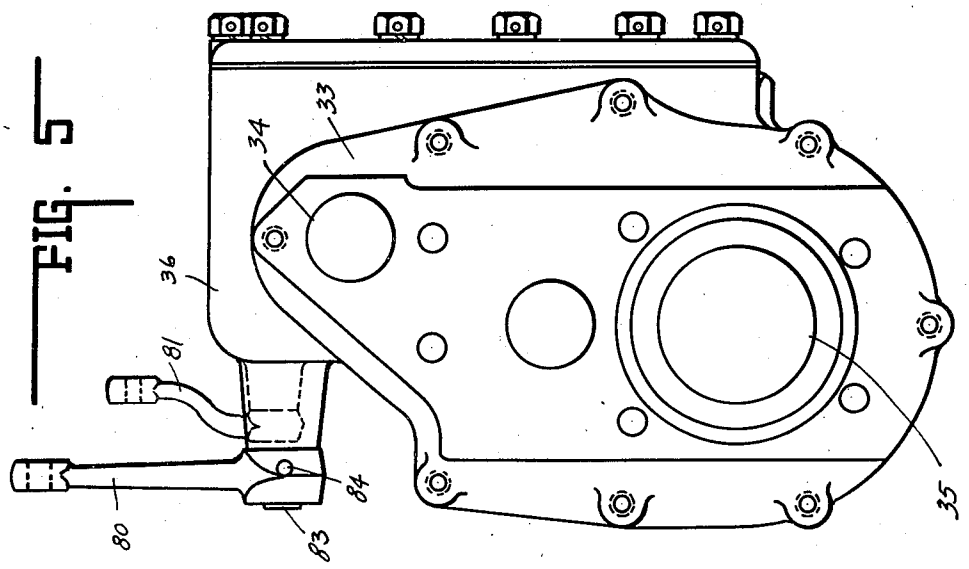


FIG. 4

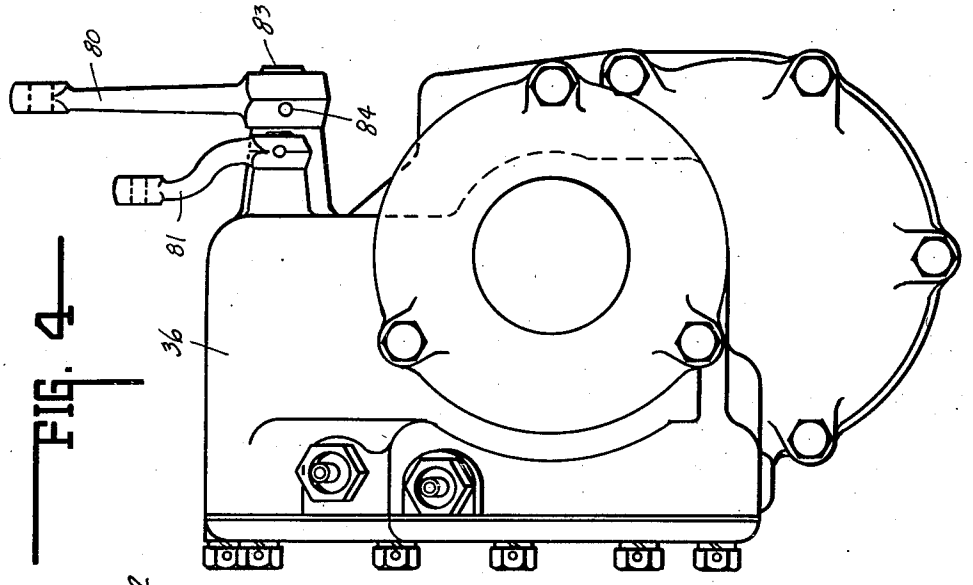
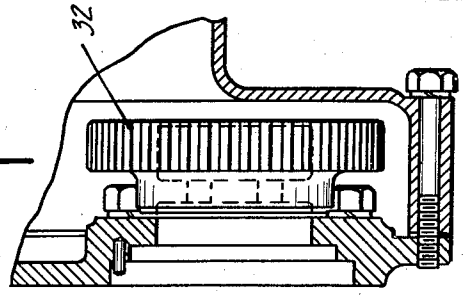


FIG. 6



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FIG. 7

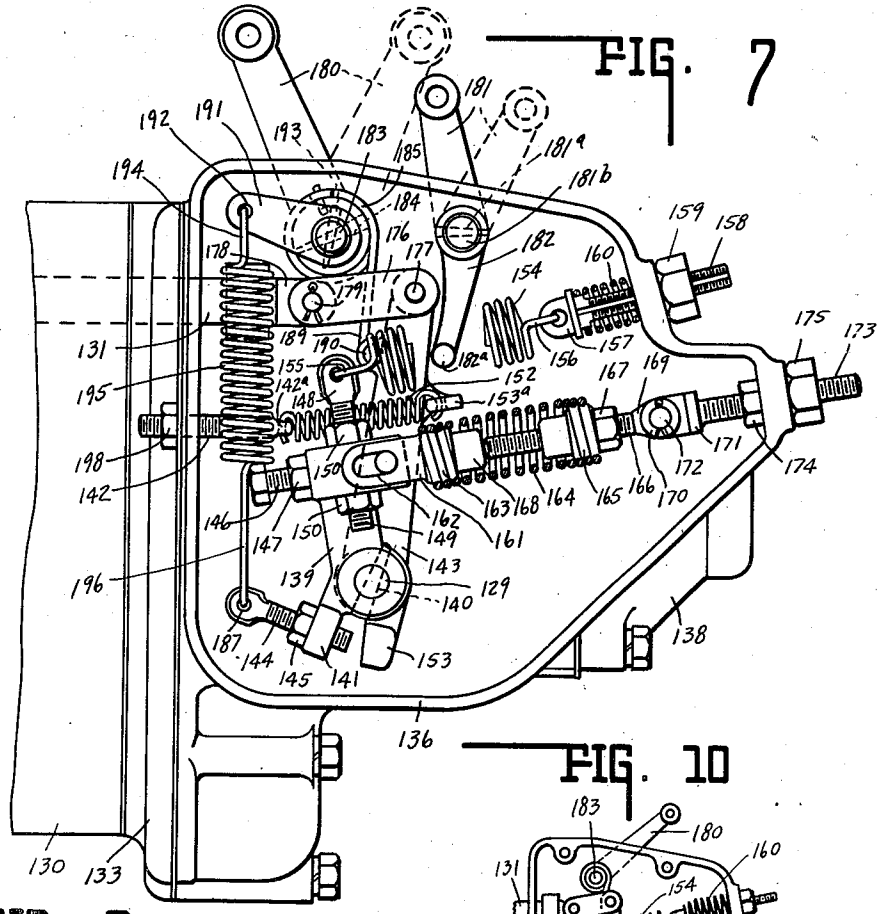


FIG. 10

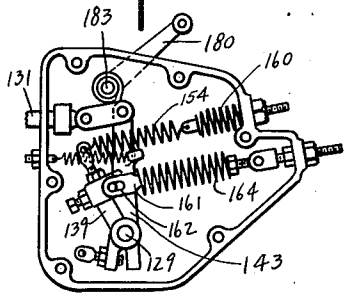


FIG. 8

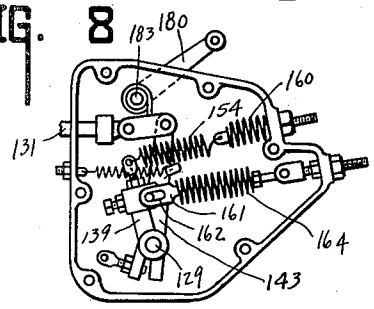


FIG. 11

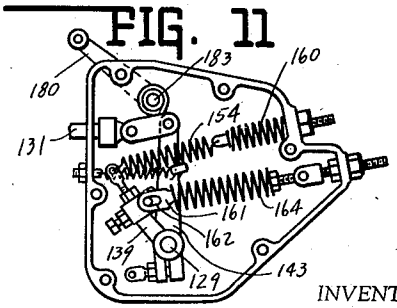
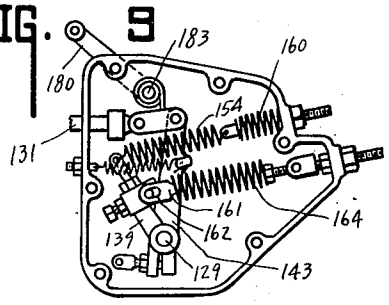


FIG. 9



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UNITED STATES PATENT OFFICE

2,290,797

UNIVERSAL GOVERNOR

Walter E. Benjamin, Anderson, Ind., assignor to Pierce Governor Company, Anderson, Ind., a corporation

Application November 29, 1939, Serial No. 306,653

20 Claims. (Cl. 264—3)

This invention relates to an engine governor and the engine may be of internal combustion character or of Diesel type. Herein the same is represented an disclosed as applied to a Diesel engine construction.

Diesel engines are now employed for not only stationary practice but also for automotive practic.

The chief criticism for automotive practice is that normally manual throttle operation of a Diesel engine as a part of automotive equipment, if governed, entails an enormous exertion on the part of the operator.

The present invention seeks to eliminate this objection so that governed Diesel engine power may be utilized in automotive practice with substantially the same ease of effort as is now the case with internal combustion engine practice.

This invention as hereinafter set forth, is a multi-purpose solution. It may be employed for the automotive type of control, the constant speed type of control or a variable speed type of control.

As herein disclosed, the governor is associated with an engine rotatable, centrifugally operable mechanism substantially of the character now generally employed or the same may be of special character, the former being suitably modified as hereinafter pointed out and the latter being illustrated herein.

It is to be borne in mind, however, that the range of movement of the centrifugally operable mechanism which is the source of power for governor operation for control purposes, should be sufficient for the purposes set forth hereinafter. The governor herein disclosed is capable of governing while idling over quite a range of speeds and under full load is capable of governing over a wide range of speeds and can control engine operation to a predetermined high speed. This governor can be so adjusted that as hereinbefore suggested, it will properly function for this type of control and furthermore by the addition or removal of certain of the parts and the utilization of other parts inherent to the general combination herein disclosed, the governor may be readily adapted to anyone of the several modifications initially mentioned hereinbefore.

When the governor is applied to a Diesel installation of stationary type, there may be provided a stop arrangement for completely cutting off the fuel applied to the Diesel engine. Herein the governor is shown applied to the so-called fuel pump of a Diesel engine and more especially the pump shaft or rack shaft thereof, such fuel pump structures being common to the Diesel industry at this date so that no further description of the same is believed necessary herein, it being understood that movement of the shaft longitudinally in one direction insures increased fuel supply by the pump to the engine cylinders and movement of the shaft in the opposite direction insures a diminishing supply until the shaft reaches the limit of its movement in that direction, which corresponds to the cutoff or full stop position and wherein no fuel is supplied to the cylinders by said pump. It might be parenthetically inserted that one pump of this general character is the well known Bosch type fuel pump for a Diesel engine and the same includes at least one pumping element for each cylinder of the Diesel engine, the supply from these elements to the several cylinders being simultaneously and similarly regulated by the control or pump rack shaft.

When this governor is incorporated in an automotive arrangement, including a Diesel engine, the governor permits full use of the normal throttle lever between low or curb idle speed and road speeds without encountering any weight pressures of the governor at any one of the intermediate speeds, thereby relieving the operator of the vehicle of the excessive strain or effort heretofore required to control an automotive arrangement provided with a governed Diesel engine.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings,

Fig. 1 is an elevational view of the embodiment of a centrifugal assembly of a governor structure, said view being quarter sectioned to show certain parts in detail.

Fig. 2 is a similar view taken at right angles to Fig. 1.

Fig. 3 is an enlarged elevational view of the governor assembly proper applied to a Diesel fuel pump, the cover of the governor housing being removed to expose the operative parts of the governor mechanism proper, the centrifugal assembly being omitted.

Fig. 3A is a top plan view of the torsional sprint-throttle connection.

Fig. 4 is an end view of the governor mechanism shown in Fig. 3 and looking toward the left in said figure.

Fig. 5 is a similar view of the governor structure looking toward the right in Fig. 3, the rack

shaft drive, et cetera, as well as the fuel pump being omitted.

Fig. 6 is a sectional view through the drive connecting portion of the governor assembly showing wherein and how the power for operating the centrifugal mechanism, not shown in Figs. 3 to 5, inclusive, may be obtained from the fuel pump power, the details of the drive or connection between the fuel pump drive and the weight assembly drive being intentionally omitted since the same may be of any conventional character suitable for the purpose.

Fig. 7 is a view similar to Fig. 3 and of a modified form of the invention, this being the preferred form.

Fig. 8 is a view more or less diagrammatic of the invention shown in Fig. 7, showing the parts in the position corresponding to that when the motor is not running, the fuel metering shaft or rack shaft of the fuel pump being shown in the full load position and the speed control lever being shown in the idling position.

Fig. 9 is a similar view illustrating the position of the parts when the motor is accelerating in speed, the speed control lever being shown in the sharply advanced position, the fuel metering shaft or rack shaft to the fuel pump having been advanced to full throttle position.

Fig. 10 is a view similar to Figs. 8 and 9 except the parts are illustrated in a position corresponding to when the motor is running at the low idle speed.

Fig. 11 is a similar view of the same parts showing the speed control lever fully advanced, the fuel metering shaft or pump rack shaft under governor control at top motor speed and in this position the pump rack shaft can be moved at will between the low idle position and the top governed idle position by means of the throttle or speed control lever, the governor weight energy of the weight assembly having overcome the preloaded spring energy and the rock shaft having been moved to its maximum counterclockwise position.

Before proceeding to a description of the governor mechanism per se, reference is had to Figs. 1 and 2 hereof, wherein there is disclosed one form of centrifugal operable mechanism. In these figures the numeral **10** indicates a shaft driven by the engine and at a speed corresponding to or proportional to the engine and if desired, the shaft **10** may be connected to the engine rotatable shaft inherent in a Diesel fuel pump of the character described.

In Figs. 1 and 2 a base or central body element **11** is pinned to the shaft **10** as at **12**. A pair of low speed weights **13** are pivotally supported on shafts **14** mounted in ears on the body **11**. The low speed weights **13** have the sleeve engaging portions **15** and the tails **16**.

At right angles to the diametrically positioned low speed weights **13** are the high speed weights **17** also pivotally supported on shafts **18** which are mounted in ears carried by the body portion **11** and these high speed weights have the sleeve engaging portions **19** and the tails **20**. The body portion **11** is provided with diametrically positioned stops **21** engageable by the tails **16** and also is provided in transverse relation with the stop portions **22** engageable by the tails **20**. The sleeve **23** is capable of rotation as well as sliding movement on the shaft **10**.

It includes an enlarged lower portion or collar formation **24** which is engaged at all times by the portions **19** and during a portion of the time by the portions **15** of the respective high and low speed weights **17** and **13**. The opposite end of the sleeve is provided with a collar **25** and the extended portion **23***a* rotatably supports a portion of an anti-friction bearing structure **26**, the face **26***a* of which is normally engaged by the two arm portions **27** of a straddling lever **28** carried by or rigid with a rock shaft **29**. This rock shaft is the main power shaft, as it were, of the governor and it is to be noted that there is a load spring associated therewith as hereinafter pointed out and which normally constrains the lever portion **27***a* into contact with the face **26***a* so that as the sleeve is moved longitudinally on shaft **10**, the shaft **29** is correspondingly rocked and when the sleeve is returned toward its original position by the load spring, the shaft **29** correspondingly returns therewith.

The operation of this form of weight structure may be briefly set forth as follows:

When the engine speed attains a predetermined speed, such as the idling speed or low idle, the high and low speed weights have moved outwardly on their respective pivots and the portions **15** and **19** have moved the thrust sleeve in accordance with the outward movement of said weights until the weights **13** engage by means of tails **16** the stop portions **21**. This amount of sleeve movement is approximately ¼''. This constitutes the low speed control position. If the engine continues to accelerate or race at a speed higher than the low speed rate, the weights **13** have no further outward movement but weights **17** continue their outward movement under such additional centrifugal force incident to such increase of speed rotation. As a result, the portions **19** cause the sleeve **23** to continue its longitudinal movement for another ¼''. In other words, the weights **17** are effective throughout the ½'' range of movement of the sleeve whereas weights **13** are effective only for the initial ¼'' movement of said sleeve. This is one form of weight structure or centrifugal assembly suitable or adapted for power supply to the governor mechanism proper, hereinafter to be described.

Another form of weight structure is a simple 2-weight or flyball assembly utilizing but a pair of like weights, such as weights **17**, it being remember that weights **17** are effective throughout the entire range of sleeve movement. In this respect this last mentioned centrifugal arrangement or flyball assembly is conventional to all flyball assembly arrangements except the range of longitudinal movement is doubled and instead of the conventiontal governor, or more especially the flyball assembly thereof having a range of movement of but ¼'', which is now standard practice, the range of movement is ½'' so that this flyball assembly is effective at what corresponds to low idle engine speeds as well as high speeds.

This pair of weights serves a dual purpose. First, they operate through the low idle range on the first half of the total sleeve movement and secondly, they operate through the high or top governing range on the second or remaining half of sleeve movement. It will be seen by the above in this form the weights must have approximately twice the normal movement as compared with standard governor weights, it, of course, being understood that in both forms of flyball assemblies the governor weights are revolved in the conventional manner and that the weight R. P. M. is in direct relation to the motor R. P. M.

at all times, being driven either directly from the motor at motor speed or through a reduction drive or being driven indirectly from the motor through the fuel pump drive and thus proportional to the motor speed at all times.

Both forms of flyball assemblies previously described, have been suitable for instant governor operation, although the form illustrated and initially described herein in certain instances has certain advantages over the other and second form of the invention described.

It will be recalled that rock shaft 29 is the governor power shaft. In other words, the governor control arrangement is actuated in response to the movement of this shaft. Herein in the several figures it may be assumed that the rock shaft of the governor structure per se is the same as the shaft 29 herein illustrated in Figs. 1 and 2. If desired, however, whenever it is essential or necessary by reason of clearance, accessory adjustments, et cetera, this rock shaft may through a lever and linkage arrangement operate another rock shaft and such movement will be proportional to the movement of rock shaft 29. The other rock shaft in that event will be the governor rock shaft. As stated herein, this rock shaft 29 is extended herein so as to be directly incorporated in the governor structure per se.

Reference now will be had to Figs. 3 to 6, inclusive, wherein one embodiment of the invention is illustrated. This embodiment of the invention permits the full use of the throttle lever between low or curb idle speed and road speeds without encountering any weight pressures at any speed when the invention is used in conjunction with the manually operable throttle more particularly in automotive applications wherein a Diesel engine is the source of power.

It may be here stated that the embodiment illustrated in the aforesaid figures is the first form of the invention developed and while satisfactory for many purposes and applications, it is not universally satisfactory as is the subsequent form of the invention shown in Fig. 7 and the other figures sequentially thereof.

It is to be understood that Figs. 4, 5 and 6 do constitute a representation of the basic form of the invention shown in Fig. 7 except as otherwise noted.

In Figs. 3 to 6 inclusive, the numeral 30 indicates the fuel pump for a Diesel engine and the numeral 31 indicates the so-called pump or rack shaft thereof, which when moved in the direction of the arrow, moves to the full load position—in other words, supplies the maximum amount of fuel to the engine cylinders and when moved to the left—see Fig. 3—reduces the amount of fuel supplied to the engine or entirely cuts off the amount of fuel thereby stopping the engine, when maximum movement to the left has been effected.

Fig. 6 illustrates a drive structure interposed between the governor and the fuel pump operating mechanism and the gear 32 is the power member for the weight assembly previously described.

In Fig. 5 it will be noted that the casting 33 includes the opening 34 for pump shaft accommodation, the opening 35 being for the power application accommodation. Secured to this casting is the housing 36 provided with a suitable drain as at 37 in the event it is desired to enclose the mechanism completely or partially and submerge the same in lubricant. The flyball assembly or weight mechanism is housed in the portion which is generally indicated by the numeral 38 and the power, as stated, is derived from the gear 32. Herein the numeral 29 indicates the main rocker shaft.

When the flyball weights start to expand, the shaft 29 rotates counterclockwise—see Fig. 3—and if dual pairs of weights are employed, the second set of weights becomes effective to continue the counterclockwise rotation of shaft 29 the additional amount or distance incident to the expansion movement of the second set of weights or in the single pair of weight application incident to the continued separation or expansion movement of the single pair of weights. As before state, this rock shaft is the source of power for the governor.

The lever 39 is the master lever and is rigid with said shaft 29 as indicated at 40. Lever 39 includes the extension 41 and includes the lateral offset portion 42 in this form of the invention, this offset portion being omitted in the form of the invention shown in Fig. 7. Loosely mounted on the shaft 29 to the extent that it may independently rotate with reference to the shaft, is a lever 43. This is of full floating character so far as shaft 29 is concerned. The lever 39 includes an adjustable pickup in the form of bolt 44 and lock nut 45. An adjusting bolt 46, locked by nut 47 and carried by the lever 39, controls the position of the floating lever 43. The lever 39 also mounts an eye member 48 with an elongated threaded body portion 49 which is adjusted relative to the body portion of the lever as by the lock nuts 50. This forms a spring eye adjustment to assist in adjusting the idle position of the governor for idle running of the engine. The lever 39 supports the oppositely projecting stud 51.

The floating lever 43, before mentioned, is held in position by the spring 52 which is connected to said floating lever at the ear 53*a*, the other end of the spring in this form of the invention being connected to the lateral offset portion 42 of lever 39. This spring tends to hold the floating lever 43 against the adjustable stop 46 of the lever 39. When the position of the floating lever 43 is changed, the spring 52 is extended and such position change can be affected up to the point where the downwardly extending contact portion 53 of lever 43 is in direct contact with the adjustable member 44 carried by lever 39.

The so-called idling speed adjusting spring is indicated by the numeral 54 and one end 55 is secured to the eye 48 carried by the lever 39. The other end of the spring 56 is carried by the eye 57 which has an elongated threaded extension 58 and the same mounts a nut 59 for adjustment purposes. Interposed between the casting or housing 36 and the shoulder 57*a* is a spring 60.

The main or high speed spring assembly adjustment includes a yoke 61 including parallel slots 62 therein in which ride the oppositely projecting ends of the stud 51. The opposite end of the yoke 61 has anchored, as at 63, to its one end of a main spring 64, the other end being similarly anchored to a member 65. This member 65 is axially threaded to receive an elongated threaded member 66, the position of which is adjusted or locked by the nut 67. The member 66 extends into the spring and engages portion 68 of the member 61 when the main spring is compressed. The other end 69 of the member 66 lies between the ears 70 of the member 71 and

the two members are pivotally connected together as at 72. This member 71 is elongated and exteriorly threaded as at 73 and nuts 74 and 75 are secured thereto on opposite sides of the housing 36, as shown.

When the spring holders 65 and 63 are screwed into the coils of the spring 64, the aforesaid changes the rate of the spring by decreasing the number of operating coils of said spring. Similarly unscrewing these members increases the number of operating coils or turns of said spring 64. Screwing the member 66 into the member 65 and against the stop 68 will determine the amount of preloading that is desired on the main spring 64. The adjustment 73 places the entire spring assembly in proper adjustment in relation to the stud 51 in the elongated slots 62 in the spring holder 63.

The floating lever 43 is herein shown attached to the pump control through suitable linkage. Herein a pair of links 78 is secured by pin 77 to the upper end of the lever 43 and are positioned at opposite sides thereof. In like manner, these links at the opposite ends are connected to the end 78 of the pump rack shaft 31 and secured thereto as at 79.

There also is shown in Fig. 3 a speed control or throttle lever 80 to which the accelerator structure may be connected. Also, there is illustrated a shut-off lever 81. These are shown mounted on the shafts 83 and 81*a*, respectively. Lever 80 is pinned to shaft 83 at 84. Interiorly shaft 83 mounts collar 88 pinned thereto as at 86. The shut-off lever 81 operates an arm 82, carried by shaft 81*a*, which moves lever 43, links 76 and rack rod 31 to cut-off position.

A torsional spring or spring 85, see Figs. 3 and 3A, is interposed between the throttle lever 80 and the floating lever 43. This spring includes a spring strap that is connected with slip-fit arrangement to pin 87 on a collar 88. The opposite end of said torsional spring is anchored as at 89 by surrounding pin 90 carried by the lever 43. Levers 80 and 81, as shown in Figs. 4 and 5, are exteriorly mounted with respect to casting 36.

The operation of this form of the invention is substantially as follows:

Starting with a dead motor, the idling spring 54 holds the weights closed when the motor is not running. This constitutes a wide open throttle on the pump. Therefore, this device starts a motor with a wide open pump, or full throttle. This is desirable. When the motor starts to run and comes up to idling or low idle speed, the weights 13 and 17 expand against the idling spring 54 through the lever 39 and the lever 43. During the idling period, the spring 52 causes the levers 39 and 43 to act as a single unit. It must be understood that during this idling period the speed change lever 80 is in a position somewhat near the shut-off position shown in dotted lines.

As the lever 80 is moved toward a full load position, the torsional spring 85 picks up the lever 43 and moves it towards a wide open pump position. In doing so, it extends the small spring 52. As the motor speed increases, the idling weights 13 go out against the stops 21 and the weights 17 follow them out to the same distance. The weights are automatically stopped at this point because of the fact the stud 51 has moved with the lever 39 until it just contacts the other end of the elongated slots 62 in yoke 61. The weights 17 being much lighter in mass than weights 13, there must be a considerable increase of R. P. M. before these weights can overcome the load imposed on the spring 64 by means of adjustment of bolt 66 through spring holder 65. When the R. P. M. is built up to this point and weight energy overcomes the spring energy, the lever 39 moves still further under the influence of weights 17 and the adjustment 44 picks up the lever 43 and starts to shut off or govern the pump. Now, it will be seen that at any point between the low idle and the high governed idle, the rack shaft 31 of the pump 30 can be moved at will and manually from one position to another position without working against any weight pressures at all. It will be also seen that when the governor is under the influence of the high speed weights 17, the only spring pressures encountered will be the spring 85 which need only be enough to overcome the spring 52.

Reference now will be had to Fig. 7 particularly with reference to structural details and Figs. 8 to 11, inclusive, for operation details, the latter being shown more or less diagrammatically illustrated in view of the detailed illustration of the parts and their construction in Fig. 7. Whenever and wherever possible in Fig. 7, numerals of the 100 series similar to numerals of the primary series will indicate parts in Fig. 7 similar or identical to those in Fig. 3 and which the primary series of numerals correspondingly indicate in Fig. 3. Proper explanation accompanying any change in form or location of said parts in Fig. 7, as compared to the corresponding parts illustrated in Fig. 3 will be recited also in detail. The form of the invention illustrated in Fig. 7 is very similar to that illustrated in Fig. 3. It is noted the preferred form, Fig. 7, is capable of operating at much higher engine speeds with perfect satisfaction, whereas the form of the invention shown in Fig. 3 was capable of operating with perfect satisfaction at low engine speeds but did not produce the desired perfect results at high engine speeds; hence, the preferance stated.

The chief distinction in Fig. 7 is that the small coil spring, previously interconnected between the lever 39 and the floating lever 43, in this form of the invention, is not connected to the lever secured to the rock shaft but is secured to the governor case at one end, and, of course, is secured at its opposite end to the floating lever. Furthermore, this form of the invention is capable of modification to easily transform the same into a variable speed governor by the addition of another spring to which reference will be had hereinafter.

More particularly, it is to be observed that the spring 152 herein which is connected at 153*a* to the floating lever 143, has its opposite end connected to the eye 142*a* of the adjustable anchorage 142, the same being locked in adjusted position by the nut 193, the throttle member extending through the casting for that purpose.

Thus shut-off lever 181 in this form of the invention is shown carried externally on the shaft 181*b* that extends through the governor casing. Interiorly of the casing, there is rigidly secured, as at 181*a*, on said shaft 181*b*, a depending portion 182 that terminates in a lateral portion 182*a*. This lateral portion is adapted to engage the right hand edge of the floating lever 143 in order to force the floating lever counterclockwise, thus forcing the links 176 to the left and the rack shaft 131 to the left therewith. This is in cutoff direction. The dotted line position shows the cutoff position of the shut-off

lever 181. The full line position shows the shut-off lever 181 ineffective for control of the pump rack shaft 131.

The full line representation of the lever or throttle 180 shows said lever in the wide open throttle position as an automotive governor. The dotted line representation thereof shows the same in the wide open position as a variable speed or tractor type governor and the low idle position when used as an automotive governor. The full line representation of the lever 180 also indicates the same in the low idle position as a variable speed governor or a tractor type governor.

In this form of the invention there is illustrated the following additions and modifications: Shaft 183 has pinned thereto as at 193 a lever arm 191 having an eye portion 192 therein at its outer end. One elongated angular end 194 of a spring 195 is secured therein. The other angular end of this spring, and indicated by the numeral 196, is seated in the aperture or eye formation 187 as an integral part of the stop 144. These constitute the only changes required to make the governor an all-purpose governor.

It will be noted the idling spring 154 is adjustable for regulation at 148 and for speed at 158. The main spring 164 is associated with one spring load adjusting member 166 and a spring assembly positioned adjusting member 173. By referring to the previous description for the form of the invention shown in Fig. 3, the arrangement of the other parts shown in Fig. 7 will be obvious.

Operation as an automotive governor

When the governor shown in Fig. 7 is to be used in an automotive set-up, the spring 195 is not utilized. Of course, the arm 191 may be included or omitted and it is not necessary that member 187—144 be an adjustable eye construction. It may be an ordinary bolt as shown in Fig. 3. Fig. 7 represents the position of the parts when the motor is not running. This same position is illustrated in Fig. 8. The idling spring 154 then is holding the metering shaft 131 in full throttle position by means of the lever 139, spring eye 149, adjusting bolt 146, minor spring 152 and floating lever 143 through the linkage 176.

When the motor is started and is running at an idling speed, of say 400 R. P. M., the levers 139 and 143 act as an integral unit, shutting off the fuel and only allowing sufficient fuel to operate the motor at the idling speed. This position of the parts is illustrated in Fig. 10. When the levers 139 and 143 have moved counterclockwise to the low idling position, it will be noted the stud or pin 151 has taken a position in the opposite end of the slots 162 in yoke member 161, see more particularly Fig. 7 and compare with Fig. 10. The movement of this pin in these slots in the spring holder 163 is equivalent to the first half of the weight lift or travel of the second form of weight assembly described, or that portion of the weight lift or sleeve travel accomplished by the weights 13 and 17 in the centrifugal assembly shown in Figs. 1 and 2. This is necessary to accomplish a satisfactory low idle control.

At low speeds, the levers 139 and 143 cannot advance beyond the position which is allowed or provided for by the slots 162 in the member 161, because of the preloading of the main spring 164 in the main spring assembly, this preloading being obtained by means of the member 166 and its positioning being adjusted by means of the member 173. It will be seen this main spring assembly, including the parts last mentioned, is also an adjustable weight stop inasmuch as it prevents the weights of the centrifugal assembly from further functioning until top motor speed is attained. This statement refers to the second form of weight assembly described but not illustrated.

While the motor is idling, the speed-change lever 180 is positioned, as indicated by the dotted lines in Fig. 7 and this also is shown in Fig. 10. When this control lever is in such position, the torsional spring or spring 185 is not functioning—that is, it is not effective for fuel control.

When the throttle lever 180 is moved counterclockwise or to the position shown by the solid lines in Fig. 7, the torsional spring 185 forces the floating lever 143 to full throttle position, working against the energy exerted by the spring 152. At this point the lower end 153 of the lever 143 contacts the adjusting screw 144 and is restricted from further relative movement.

The motor now will start to speed up due to full throttle being applied and will continue to accelerate until the governor weights of the centrifugal assembly develop enough energy to overcome the preloading, especially in the spring assembly including the main spring 164. The stud or pin 151 then extends the spring 164 and governing again is accomplished at the top engine speed for which the several springs, et cetera, are adjusted.

It will thus be seen that by this arrangement the operator has full control of the fuel metering shaft position while the motor is running and at all positions from low idle speed to top governor speed, at which latter point the governor automatically takes over the engine control from the operator.

It also will be noted the only pressure required on the throttle lever 180 to maintain top speed of the engine is that required to overcome the energy included in the small spring 152.

Full range governing vehicle governor

In this type of operation, the spring 195 interposed between the throttle lever and lever 139 is employed. However, the torsional spring or spring 185 is removed. Also, the main load spring structure is removed. The levers 139 and 143 are solidly connected together by running up the adjustments 146 and 144. The idling spring 152 may or may not be employed, depending upon the requirement for operation. The small spring 152 is also removed.

With these changes, it will be observed that any movement of the throttle lever in a clockwise direction will extend the spring 195, forcing the lever 139 together with lever 143 to full throttle position. The motor thereupon will speed up until the governor weights of the centrifugal assembly develop enough energy to overcome the spring energy in the spring 195 increasing or decreasing spring tension of the spring 195 by shifting the poistion of lever arm 184, and through a shifting of the position of the throttle lever 180 will thereupon determine the motor speed and give governing action at all speeds within the limits of the spring 195.

Operation as constant speed governor

Referring to Fig. 7, the torsional spring or spring connection 185 is removed. Likewise, the spring 195 is removed. Furthermore, the spring

assembly including spring 164, is removed as well as the minor spring 152. The levers 139 and 143 are locked together in unitary relation as previously described under the heading of "Full range governing vehicle governor." A suitable heavier spring then is substituted for the spring 154, for the motor speed now is adjusted by adjusting at 158 and 159 and the degree of regulation—that is, the change in speed from full load to no load, is accomplished by the adjustment at the opposite end of this substituted spring to eye 148 at 149—150.

It is to be observed that in all three cases or applications of this type of governing structure, the shut-off lever 131 operates in exactly the same manner and shut-off or engine stopping may be accomplished.

While the invention has been illustrated and described in great detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement.

2. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, the last mentioned means being arranged to permit relative independent movement between the second and third mentioned levers within the operation range of said last mentioned means.

3. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, the last mentioned means being arranged to operatively unite the second and third mentioned levers together for simultaneous movement.

4. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, the first mentioned connecting means being arranged for selective connection, movement of the throttle lever in one direction for fuel reduction purposes rendering the first mentioned connecting means inoperative, throttle lever movement in the opposite and fuel increasing direction rendering said first mentioned connecting means operative for imposing governor control at open throttle positions under predetermined engine speed conditions.

5. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control,

the combination of a lever adapted for fuel pump control rod connection, a second lever, an operating shaft coaxial with both levers, means operatively connecting together under predetermined engine speed conditions said levers for conjoint operation, a throttle lever, spring means connecting the throttle lever to one of the other levers, and a centrifugally operable mechanism operatively associated with the shaft and effective at predetermined engine speed for shaft and lever movement responsive and proportional to engine speed.

6. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control, the combination of a lever adapted for fuel pump control rod connection, a second lever, an operating shaft coaxial with both levers, means operatively connecting together under predetermined engine speed conditions said levers for conjoint operation, a throttle lever, spring means connecting the throttle lever to one of the other levers, a centrifugally operable mechanism operatively associated with the shaft and effective at predetermined engine speed for shaft and lever movement responsive and proportional to engine speed, and a shut-off lever arranged for fuel pump control rod movement to shut-off position and through the first mentioned lever.

7. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control, the combination of a throttle lever, a dual lever construction, a portion of which is operatively connected to the fuel pump control rod for governor control thereof, an operating shaft for the dual lever construction, means connecting the throttle lever to the dual lever construction, spring means for load purposes operatively connected to the dual lever construction, and a centrifugally operable mechanism operatively associated with the shaft and effective at predetermined engine speed for shaft and dual lever movement responsive and proportional to engine speed.

8. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control, the combination of a throttle lever, a dual lever construction, a portion of which is operatively connected to the fuel pump control rod for governor control thereof, an operating shaft for the dual lever construction, means connecting the throttle lever to the dual lever construction, spring means for load purposes operatively connected to the dual lever construction, said throttle and dual lever connecting means being of resilient character, and a centrifugally operable mechanism operatively associated with the shaft and effective at predetermined engine speed for shaft and dual lever movement responsive and proportional to engine speed.

9. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control, the combination of a throttle lever, a dual lever construction, a portion of which is operatively connected to the fuel pump control rod for governor control thereof, an operating shaft for the dual lever construction means connecting the throttle lever to the dual lever construction, spring means for purposes operatively connected to the dual lever construction, said throttle and dual lever connecting means being of resilient character and having operative connection with the throttle lever permitting throttle lever movement in the cutoff direction without affecting dual lever construction movement and movement in the opposite direction beyond a predetermined throttle position affecting dual lever operation, and a centrifugally operable mechanism operatively associated with the shaft and effective at predetermined engine speed for shaft and dual lever movement responsive and proportional to engine speed.

10. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, and a lost motion connection between one of the spring structures and its associated lever.

11. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, the first mentioned means connecting the throttle and pump control rod connected levers including a yielding member normally resisting separation movement between said last mentioned yielding member connected levers.

12. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel

pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, and another spring means normally constraining one of the first two mentioned levers toward the other of the first two mentioned levers.

13. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in opposition to the centrifugal mechanism, other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, another spring means normally constraining one of the first two mentioned levers toward the other of the first two mentioned levers, and a lost motion connection between one of the first two mentioned levers and its associated spring structure.

14. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in operation to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, means for adjusting the initial position of one of the spring structures, and other means for adjusting the strength of said adjustably positioned spring structure.

15. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in operation to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, means for adjusting the initial position of one of the spring structures, other means for adjusting the strength of said adjustably positioned spring structure, and a lost motion connection between said dual adjustable spring structure and its associated lever.

16. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control through a control rod, a throttle lever, and centrifugally operable mechanism effective at predetermined engine speed for control purposes, the combination of a lever adapted for fuel pump control rod connection, a third lever, a shaft coaxial with the last mentioned lever, the third mentioned lever being rigid with the shaft, means operatively connecting the throttle lever and fuel pump rod connected lever together, the centrifugally operable mechanism actuating said shaft and the lever rigid therewith for movement of said lever responsive and proportional to engine speed above the predetermined speed, a spring connected to the fuel pump rod connected lever and normally constraining said fuel pump rod connected lever toward non-fuel supplying position, a second spring structure operatively connected to the shaft rigid lever and normally constraining that lever toward fuel supplying position in operation to the centrifugal mechanism, and other means operatively connecting under predetermined engine speed conditions, the second and third mentioned levers together for conjoint movement, means for adjusting the initial position of one of the spring structures, other means for adjusting the strength of said adjustably positioned spring structure, a lost motion connection between said dual adjustable spring structure and its associated lever, and an adjustable stop arrangement included in said dual adjustable spring structure.

17. A multi-load full range governor, including centrifugal mechanism including centrifugal operable means progressively effective for successive progressive control, a shaft rockable by said mechanism, a multiple lever construction mounted upon said shaft and responsive to and operable by said centrifugal mechanism only

through said shaft and having operative connection with an engine fuel controlling member, spring means independent of the centrifugal mechanism for controlling the idling range of the engine and operatively associated with the multiple lever construction, other spring means also independent of the centrifugal mechanism and operatively associated with the multiple lever construction for controlling the remainder of the range of engine operation, and a lost motion connection between the last mentioned spring means and the lever construction permitting first mentioned spring means control independent of second mentioned spring means control for low speed range control.

18. A multi-load full range governor, including centrifugal mechanism including centrifugal operable means progressively effective for successive progressive control, a shaft rockable by said mechanism, a multiple lever construction mounted upon said shaft and responsive to and operable by said centrifugal mechanism only through said shaft and having operative connection with an engine fuel controlling member, spring means independent of the centrifugal mechanism for controlling the idling range of the engine and operatively associated with the multiple lever construction, other spring means also independent of the centrifugal mechanism and operatively associated with the multiple lever construction for controlling the remainder of the range of engine operation, and a lost motion connection between the last mentioned spring means and the lever construction permitting first mentioned spring means control independent of second mentioned spring means control for low speed range control, said lost motion connection when the lost motion is exhausted becoming effective for weight mass control of a portion of the centrifugal operable means until increased engine speed becomes effective through increased centrifugal force upon the remainder of the weight mass for the operation of the lost motion connected spring means.

19. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control, the combination of lever means adapted for fuel pump control rod connection, a throttle lever connected thereto for engine control, an operating shaft for said lever means, a centrifugally operable mechanism operatively associated with the shaft and effective at predetermined engine speed for shaft lever means movement responsive and proportional to engine speed, a spring construction, and a lost motion means between the spring construction and lever means, said spring construction including a spring operatively connected at one end to the last motion means, an adjustable anchorage at the opposite end, of the spring, turn varying anchoring means therefor for spring length and rate of spring variation, and an adjustable connection between the spring and the adjustable anchorage for spring load variation.

20. In a multi-purpose governor structure particularly adaptable for Diesel fuel pump control, the combination with a speed responsive control for the fuel pump control rod and a manually operable control for the rod, each control including a lever, of another lever coaxial with one of the other levers but movable relative thereto, means normally constraining each coaxial lever to predetermined position, a lost motion connection between the coaxial levers, and means connecting the manually operable control lever to one of the coaxial levers, the latter having direct connection to the pump rod.

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