

[54] **IGNITION TIMING AND THROTTLE POSITION CONTROL**

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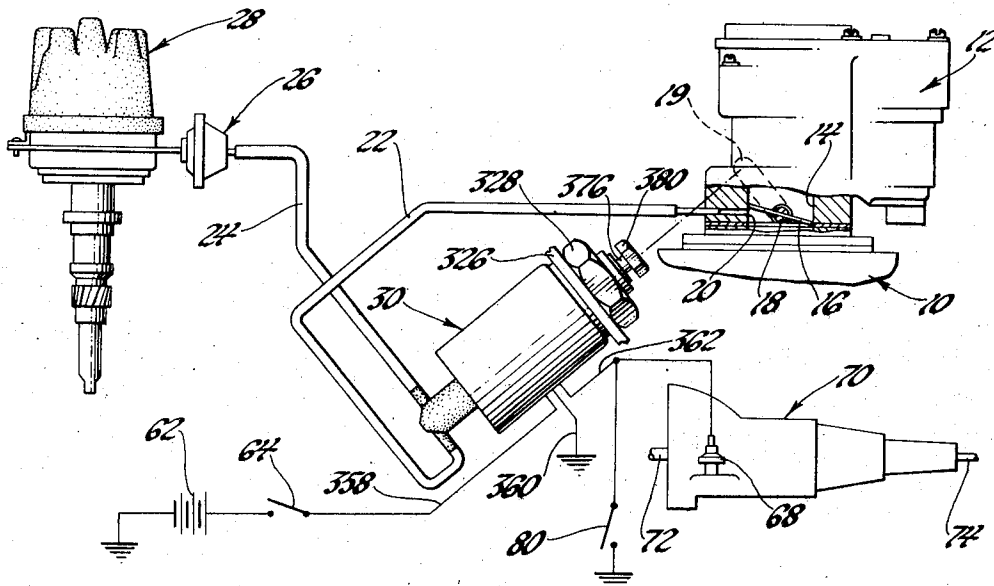
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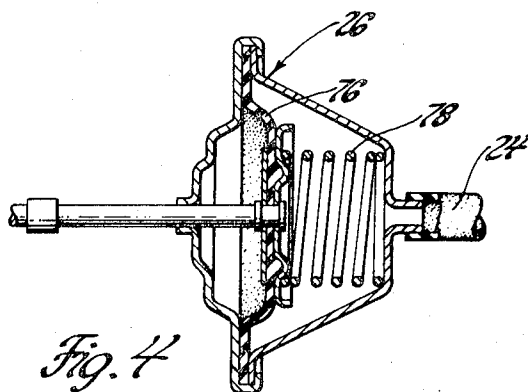
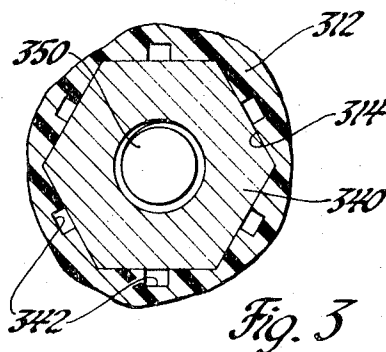
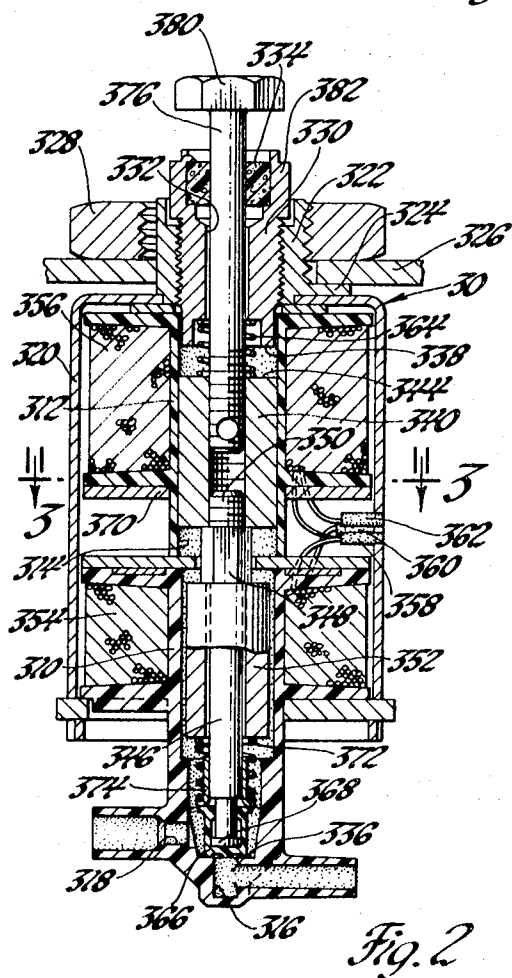
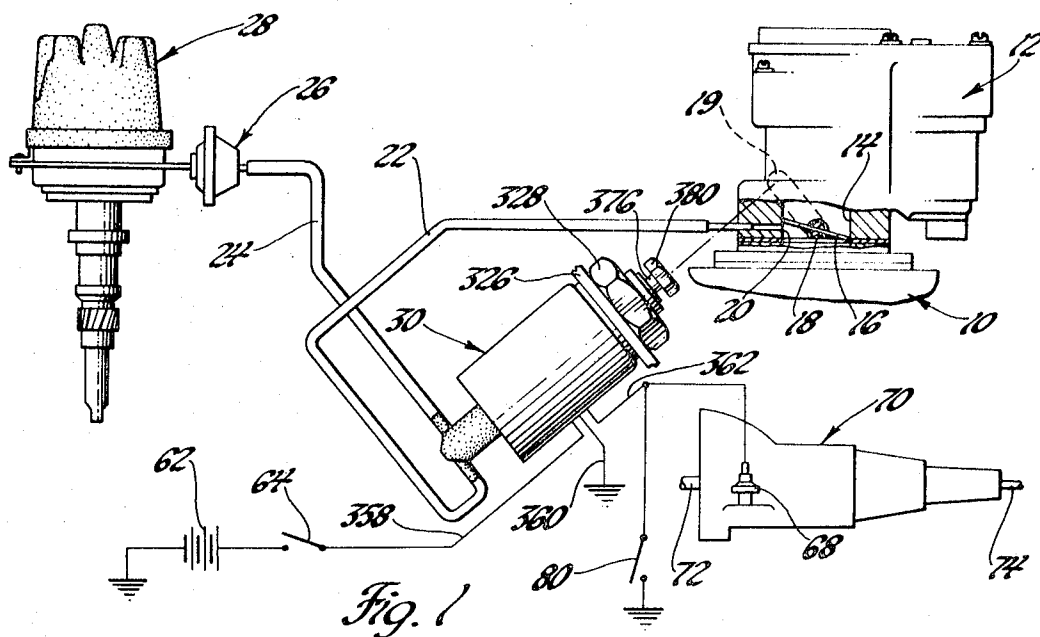
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[57] **ABSTRACT**

One coil of a solenoid unit is energized when the engine ignition system is on, and a second coil of the solenoid unit is energized when the ignition system is on and the transmission is in high drive ratio. The solenoid plunger is formed in two portions respectively responsive to energization of the two coils, and a lost motion connection is provided between the two portions. A valve carried on the solenoid plunger controls the vacuum conduit between the induction passage and the distributor vacuum advance unit to prevent vacuum advance during low drive ratio operation and to permit vacuum advance during high drive ratio operation. A carburetor throttle stop carried on the solenoid plunger prevents closure of the carburetor throttle beyond a fast idle position when the transmission is in high drive ratio, permits closure of the carburetor throttle to an intermediate idle position when the transmission is in low drive ratio, and permits closure of the carburetor throttle to a slow idle nearly closed position preventing dieseling when the ignition system is off.

6 Claims, 5 Drawing Figures





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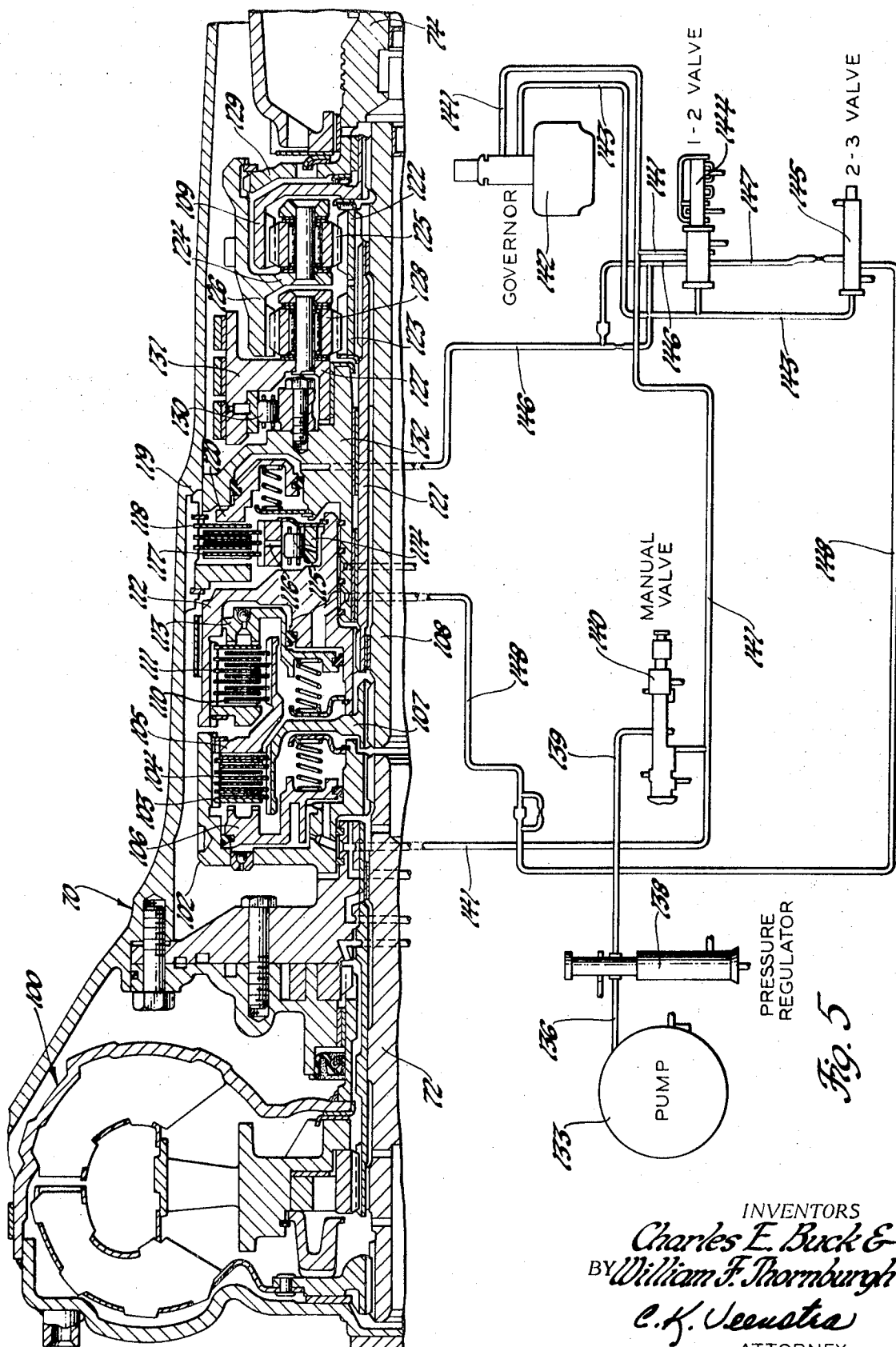


Fig. 5

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IGNITION TIMING AND THROTTLE POSITION CONTROL

SUMMARY OF THE INVENTION

This invention relates to a solenoid unit which can provide advantageous control of internal combustion engine ignition timing and throttle position to reduce emission of undesirable engine exhaust gas constituents.

In the past it has been customary to provide a vacuum unit in association with the ignition distributor of the engine. The vacuum unit senses the vacuum in the engine induction passage below the throttle and, operating on the distributor breaker plate, advances the ignition timing accordingly. By advancing ignition timing in accordance with induction vacuum, fuel economy and engine performance have been maximized.

More recently, emission of undesirable engine exhaust gas constituents, such as unburned hydrocarbons and oxides of nitrogen, have been substantially reduced by preventing vacuum advance of ignition timing when the engine is driving the vehicle in the lower drive ratios, while maintaining fuel economy and engine performance without significant sacrifice by providing vacuum advance of ignition timing only when the engine is driving in the high drive ratio. That control, known commercially as the Transmission Controlled Spark system, is accomplished by a solenoid valve disposed in the vacuum conduit between the induction passage and the distributor vacuum advance unit. The solenoid is energized through a switch when the transmission is in a low drive ratio mode of operation, and the valve then closes the vacuum conduit to prevent vacuum advance of the ignition timing. When the transmission is in the high drive ratio mode of operation, the solenoid is deenergized and the valve then opens the vacuum conduit to permit vacuum advance of the ignition timing.

Another feature adopted on recent engines has been an increase in idle air flow to improve combustion under high speed closed throttle decelerating conditions. This increase is accomplished by limiting closure of the throttle to what may be termed a "fast idle" position. On some engines, however, the increased closed throttle air flow permits after-run or dieseling of the engine after the engine ignition system is shut off.

To prevent dieseling, a solenoid operated throttle stop has been adopted. The solenoid is energized through the engine ignition switch and positions a throttle stop to limit throttle closure to the fast idle position. When the engine ignition system is off, the solenoid retracts the throttle stop to permit the throttle to close to a slow idle position. With the throttle in the slow idle position, air flow to the engine is insufficient to support dieseling and this undesirable mode of operation is avoided.

The functions of the separate Transmission Controlled Spark and anti-dieseling solenoids also have been combined in a single unit adopted on some engines. That unit additionally functions to vary the closed position of the throttle with transmission drive ratio; thus increased air flow to the engine is provided during a closed throttle deceleration while the transmission is in the high drive ratio, and the throttle is permitted to close to a slow idle position for reduced idle speed after the transmission reaches the lower drive ratios.

It is possible that, with some engines, dieseling may occur even with the throttle in the position required for engine operation at idle speed. This invention therefore provides a three-position solenoid unit which permits vacuum advance only at high drive ratios, which provides a fast idle throttle position for high drive ratio closed throttle deceleration, which provides an intermediate throttle position for engine operation at idle speed, and which provides a nearly closed slow idle throttle position to prevent sufficient air flow to support dieseling when the ignition system is off.

The details as well as other objects and advantages of this invention are set forth in the drawings and description of a preferred embodiment.

SUMMARY OF THE DRAWINGS

FIG. 1 shows this solenoid unit with the solenoid valve disposed in the vacuum conduit between the induction passage and the distributor vacuum advance unit, with the solenoid throttle stop disposed adjacent the carburetor throttle lever, with both solenoid windings connected through the ignition switch, and with one of the solenoid windings connected through a switch which senses the transmission drive ratio;

FIG. 2 is an enlarged axial sectional view of the solenoid unit, showing the details of its construction;

FIG. 3 is a view along line 3—3 of FIG. 2, further enlarged to show certain atmospheric vent passages;

FIG. 4 is an enlarged axial sectional view of the vacuum advance unit, showing the details of its construction; and

FIG. 5 is a sectional view, in side elevation, of the transmission of FIG. 1, illustrating its construction and schematically showing portions of its hydraulic circuitry.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the engine 10 is illustrated as having a carburetor 12 providing an induction passage 14. Induction passage 14 has a throttle 16 rotatably disposed on a shaft 18 and controlled by a throttle lever 19. A vacuum port 20 opens from induction passage 14 below throttle 16. Port 20 is connected through a conduit 22-24 to a vacuum advance unit 26 mounted on distributor 28. A solenoid control 30 is disposed in conduit 22-24.

Referring to FIG. 2, control 30 includes a pair of spools 310 and 312 which form a housing defining a central passage 314 terminating at one end in an opening 316 connected to conduit 22 and having a lateral opening 318 connected to conduit 24. Spools 310 and 312 are disposed within a case 320. A fitting 322, having a finger 324 welded to case 320, receives a bracket 326 on which it is retained by a nut 328; bracket 326 secures control 30 in a fixed position relative to carburetor 12 for a purpose which will be apparent below. A member 330 is received by fitting 322 and is disposed in the open end of central passage 314. A central opening 332 in member 330 leads through a urethane foam filter 334 to the atmosphere. A pair of valve seats 336 and 338 are defined about openings 316 and 332 respectively.

A magnetically-responsive plunger or actuator 340 is disposed within passage 314 and is reciprocable to and from valve seat 338. As shown in FIG. 3, plunger 340 and passage 314 are essentially hexagonal. A plurality

of grooves 342 defined in passage 314 form channels through which air at atmospheric pressure may be supplied from opening 332 to opening 318. Plunger 340 has a flat end 344 which cooperates with valve seat 338 to close opening 332.

A non-magnetically-responsive brass extension 346 has an enlarged hexagonal portion 348 enabling the end 350 of extension 346 to be threadedly secured to plunger 340. A magnetically-responsive ferrule 352 is slidably disposed on extension 346.

A pair of solenoid coils 354 and 356 are wound about spools 310 and 312 respectively. As shown in FIG. 1, one lead 358 of each coil is connected to a voltage source 62 through the engine ignition switch 64. The other lead 360 for coil 354 is grounded, while the other lead 362 for coil 356 is connected to a switch 68 which closes the circuit to ground when it senses the pressure of the hydraulic fluid used to engage the direct drive clutch in transmission 70 and which opens the circuit in the absence of such pressure. As explained in further detail below, transmission 70 includes a plurality of drive ratios which are selectively engageable between drive shaft 72 and driven shaft 74. When a lower drive ratio is engaged between drive shaft 72 and driven shaft 74, the speed of the driven shaft 74 is reduced below the speed of drive shaft 72 to a greater extent than when the high drive ratio is engaged between drive shaft 72 and driven shaft 74.

Referring to FIG. 4, vacuum advance unit 26 includes a diaphragm 76 biased in a direction to retard ignition timing by a spring 78. When vacuum signals are supplied through vacuum conduit 22-24 to vacuum advance unit 26, the vacuum signals are applied against the right-hand side of diaphragm 76 and pull it in a direction, against the bias of spring 78, to advance ignition timing.

With solenoids 354 and 356 deenergized as shown in FIG. 2, a spring 364 pushes plunger 340 and its extension 346 downwardly and a valve member 366 slidably carried on the tip 368 of extension 346 closes opening 316 to prevent transmission of vacuum signals from induction passage 14 to vacuum advance unit 26. Vacuum advance unit 26 is then vented to atmosphere through vacuum conduit 24, lateral opening 318, and passages 342 about plunger 340, between plunger 340 and valve seat 338, and through opening 332 and filter 334.

When ignition switch 64 is closed, coil 354 is energized to lift magnetically-responsive ferrule 352. Ferrule 352 engages the enlarged portion 348 of extension 346, lifting extension 346 and plunger 340 until ferrule 352 strikes a steel stop plate 370 disposed between spools 310 and 312. Stop plate 370 limits travel of ferrule 352 and extension 346 to a distance insufficient to take up the lost motion between tip 368 of extension 346 and valve 366. Thus a spring 372, disposed between ferrule 352 and a collar 374, holds valve 366 against its seat 336.

When transmission 70 is in high drive ratio, switch 68 causes the solenoid coil 356 to be energized; magnetically-responsive plunger 340 then is lifted against the bias of spring 364 so that end 344 of plunger 340 engages valve seat 338 and tip 368 of valve-actuating extension 346 lifts valve 366 away from valve seat 336. Engagement of end 344 with valve seat 338 closes off the atmospheric vent to vacuum advance unit 26, and a vacuum signal is transmitted from induction passage

14 through vacuum conduit 22, opening 316, valve seat 336, lateral opening 318, and vacuum conduit 24 to vacuum advance unit 26 to cause the ignition timing to be advanced.

5 If desired, port 20 may be located just above, rather than below, throttle 16 so that, when throttle 16 is moved to an open position, its edge traverses the port. Port 20 then would sense vacuum in induction passage 14 only when throttle 16 is open, and vacuum advance unit 26 then would advance the ignition timing only during open throttle operation in a high drive ratio; the ignition timing would not be advanced, for example, whenever throttle 16 were closed for deceleration even though transmission 70 momentarily remained in the high drive ratio mode of operation.

As shown in FIG. 1, solenoid 356 may be energized by a switch 80 independently of transmission controlled switch 68. With some engines, vacuum advance of ignition timing is desired at engine temperatures below a certain level, 82°F. for example, irrespective of the transmission drive ratio. This is achieved by closing switch 80 through a thermostat responsive to engine coolant temperature, thus energizing solenoid 58.

Similarly, with some engines vacuum advance of ignition timing is desired as engine coolant temperatures approach an upper limit, 220°F. for example. Switch 80 also may be closed under such conditions to energize solenoid 58 and permit vacuum advance of ignition timing.

Moreover, with some engines vacuum advance of ignition timing is desired for a certain time, 20 seconds for example, after the engine is started. For this purpose, switch 80 may be closed through a relay which times out after energization by a circuit, such as that responsive to engine oil pressure for example, which indicates when the engine has started to operate.

FIG. 5 illustrates certain details of transmission 70. Since transmission 70 is of well-known construction, as shown, for example, by the 1969 Oldmobile Chassis Service Manual, and since it has been explained at length in U.S. Pat. No. 3,321,056, only certain portions are set forth and discussed here.

Transmission 70 has an input shaft 72 driven by the engine through a torque converter 100. A clutch housing 102 is splined to shaft 72 for rotation therewith. A series of clutch discs 103 and 104 are adapted to be engaged when forced against a backing member 105 by a piston 106. Clutch discs 103 are splined for axial movement on clutch housing 102, and clutch discs 104 are splined for axial movement on a clutch hub 107. Clutch hub 107 is splined to an intermediate shaft 108 for driving shaft 108 when discs 103 and 104 are engaged. A ring gear 109 is splined to shaft 108 for rotation therewith. A series of clutch discs 110 are splined for axial movement on an extension of clutch backing member 105. Clutch discs 110 are adapted to engage with a series of clutch discs 111, splined for axial movement on a clutch drum 112, when forced by a piston 113. Clutch drum 112 carries a race 114 adapted to be gripped by a one-way brake 115. A second race 116 is held against rotation upon engagement of a series of brake discs 117 with a series of brake discs 118. Brake discs 117 are splined for axial movement on race 116, and brake discs 118 are splined for axial movement on the transmission housing 119. Brake discs 117 and 118 may be engaged by a piston 120. Clutch drum 112 is splined to a sleeve shaft 121 which in turn is splined to

a pair of sun gears 122 and 123. A planet carrier 124 supports a planet gear 125 in mesh with sun gear 122 and ring gear 109 and also supports a ring gear 126. A second planet carrier 127 supports a planet gear 128 in mesh with sun gear 123 and ring gear 126. Planet gear 124 and ring gear 126 rotate as a unit, with output shaft 74 connected to planet carrier 124 by a flange 129. A one-way brake 130 is disposed between a brake drum 131 and a fixed support 132.

In operation, low gear is obtained by engaging clutch discs 103 and 104. Power from input shaft 72 is delivered to ring gear 109 through clutch discs 103 and 104 and shaft 108 to drive ring gear 109 forwardly. Due to the load of output shaft 74 on planet carrier 124, planet carrier 124 tends to remain stationary so that sun gears 122 and 123 are driven reversely. Power input to planet gear 128 from sun gear 123 tends to cause planet carrier 127 to spin but such rotation of planet carrier 127 is prevented by one-way brake 130. Planet gear 128 therefore drives ring gear 126 forwardly. In low gear, drive is at the compound reduction of both planetary gearing units.

Second gear is obtained by retaining clutch discs 103 and 104 in engagement and engaging brake discs 117 and 118. Through action of brake discs 117 and 118, one-way brake 115 is rendered effective to prevent reverse rotation of clutch drum 112 and sun gears 122 and 123. Power is applied to ring gear 109, sun gears 122 and 123 are held against rotation, and planet carrier 124 is driven forwardly at the reduction ratio of the gear unit 109, 125, 122. One-way brake 130 on planet carrier 127 releases to permit planet carrier 127 to spin freely.

Direct drive or high gear is obtained by retaining clutch discs 103 and 104 in engagement, retaining brake discs 117 and 118 in engagement, and engaging clutch discs 110 and 111. One-way brake 115 permits forward rotation of clutch drum 112 and drive of sun gears 122 and 123. Since both ring gear 109 and sun gear 122 are driven at the same speed, the gear unit 109, 125, 122 is locked up and drives planet carrier 124 in direct drive. Since planet carrier 124 and sun gear 123 are driven at the same speed, the gear unit 123, 128, 126 is locked up and drive of output shaft 74 is direct drive without gear reduction.

Fluid pressure for the control system is supplied by an engine driven pump 133. Oil is discharged under pressure from pump 133 through a passage 136 to a pressure regulator 138. A main line supply passage 139 extends from pressure regulator 138 to a manually operable drive range selector valve 140. With manual valve 140 in "drive" position, pressure is conducted from main line supply passage 139 to a drive passage 141. Drive passage 141 conducts pressure to clutch piston 106 which engages clutch discs 103 and 104; this places transmission 70 in low gear operation.

A governor 142, driven by transmission output shaft 74 receives pressure from drive passage 141 and delivers variable pressure to a governor pressure delivery passage 143. The pressure in governor passage 143, which increases as vehicle speed increases, is conducted to a low gear to second gear (1-2) shift valve 144 and to a second gear to high gear (2-3) shift valve 145. At a predetermined vehicle speed, governor pressure causes 1-2 shift valve 144 to move to its upshift position and transmit pressure from drive passage 141 through a passage 146 to brake piston 120 which en-

gages brake discs 117 and 118; this places transmission 70 in second gear operation. Upon a further increase in vehicle speed, governor pressure causes 2-3 shift valve 145 to move to its upshift position and transmit pressure, received through a passage 147 from 1-2 shift valve 144, through a passage 148 to clutch piston 113 which engages clutch discs 110 and 111; this places transmission 70 in direct drive or high gear operation.

As indicated above, switch 68 is responsive to pressure in passage 148. It will be appreciated, however, that switch 68 also could be responsive to a predetermined pressure in governor pressure delivery passage 143, or as another alternative, switch 68 could be mechanically operated by 2-3 shift valve 145.

It also will be appreciated that in a transmission where the drive ratio is changed manually rather than through the use of hydraulic pressure, switch 68 may be arranged to be operated by the transmission shift linkage rather than by hydraulic pressure.

As indicated, with the illustrated three speed automatic transmission it has been found most advantageous to advance the ignition timing when the transmission is in the high gear — direct drive mode of operation and to prevent advanced ignition timing when the transmission is in first and second gear — low and intermediate drive ratio modes of operation. With a two speed automatic transmission, it has been found advantageous to permit advanced ignition timing in the high drive ratio and to prevent advanced ignition timing in the low drive ratio. With a three speed manual transmission, it has been found advantageous to permit advanced ignition timing in high gear and to prevent advanced ignition timing in first and second gear and when the clutch is disengaged. With a four speed manual transmission, it has been found advantageous with some engines to limit advanced ignition timing to third and fourth gear operation and with other engines to limit advanced ignition timing to fourth gear operation. In some instances, vacuum advance during reverse operation is also desirable.

It also is contemplated that, in some applications, it may be desirable to energize coil 356 above a selected vehicle speed rather than in selected vehicle drive ratios. This may be accomplished if switch 68 is responsive to pressure in governor pressure delivery passage 143 or to another vehicle speed responsive means.

Referring again to FIGS. 1 and 2, a carburetor throttle stop member 376 is threadably received in plunger 340 and extends through central opening 332 adjacent throttle lever 19. When solenoid 356 is energized during the high drive ratio mode of operation, stop member 376 is extended to engage throttle lever 19 and prevent throttle 16 from closing beyond a fast idle position. This permits the flow of air to the engine necessary for proper combustion when throttle 16 is initially closed to decelerate the engine.

After transmission 70 downshifts to a lower drive ratio, coil 356 is deenergized, but coil 354 remains energized. Spring 364 then retracts plunger 340 until the enlarged portion 348 of extension 346 engages ferrule 352, and stop member 376 assumes an intermediate idle position. This permits throttle 16 to allow the flow of air to the engine necessary for idle operation.

When ignition switch 64 is opened, both coils 354 and 356 are deenergized. Spring 364 then retracts plunger 340 and extension 346 until the tip 368 of extension 346 forces valve 366 into engagement with seat

336, and stop member 376 is fully retracted. Throttle 16 is then permitted to close to a slow idle, substantially closed, position determined by the usual curb idle adjustment screw. This limits air flow to the engine to less than that which will support dieseling.

The head 380 of stop member 376 is formed to receive a wrench so that stop member 376 may be threadedly adjusted within plunger 340, the complementary hexagonal configurations of plunger 340 and passage 314 preventing plunger 340 from turning as stop member 376 is adjusted. Movement of stop member 376 relative to plunger 340 permits adjustment of the intermediate idle position of throttle 16 which is established by stop member 376.

The head 382 of member 330 also is formed to receive a wrench so that member 330 may be threadedly adjusted within fitting 322. Movement of member 330 permits adjustment of the fast idle position of throttle 16 which is established by stop member 376 when the flat end 344 of plunger 340 engages the end 338 of fitting 330.

Thus this invention provides a fast idle carburetor throttle setting for high gear closed throttle deceleration, an intermediate idle carburetor throttle setting for engine operation at idle speed, and a slow idle, substantially closed carburetor throttle setting to prevent dieseling. Proper combustion is thereby enhanced during high gear closed throttle deceleration while avoiding the increased fuel consumption and tendency toward dieseling attendant upon a fast idle throttle position for operation at idle speed. This novel control over throttle position is combined with control over ignition timing in a single solenoid unit, thus reducing the complexity of assembly on an engine and assuring a reduction in emission of undesirable exhaust gas constituents.

We claim:

1. In combination with an internal combustion engine having an induction passage for air flow to the engine, a throttle in said induction passage for controlling air flow therethrough, said throttle having fast, intermediate and slow idle positions, a throttle lever connected to said throttle for controlling the position thereof, a vacuum unit for advancing the timing of ignition in said engine when vacuum signals are applied thereto, a vacuum conduit connected between said vacuum unit and said induction passage for transmitting vacuum signals from said induction passage to said vacuum unit, and an associated transmission with an input connected to said engine and an output connected to a load and with variable ratio drive means driving said output from said input, said variable ratio drive means providing high and low drive ratios wherein said low drive ratio reduces the speed of the output from the speed of the input to a greater extent than said high drive ratio:

a solenoid operated ignition timing and throttle position control unit comprising

hollow elongated housing means having first and second openings respectively located in opposite ends thereof and having a lateral opening located intermediate the ends thereof, said first opening forming a portion of said vacuum conduit for receiving vacuum signals from said induction passage, said lateral opening forming a portion of said vacuum conduit for supplying vacuum signals to said vacuum unit, said second opening being connected to atmosphere for venting said vacuum unit thereto,

said first and second openings respectively defining first and second valve seats,

a magnetically-responsive actuator disposed within said housing and reciprocable to and from engagement with said second valve seat for controlling air flow through said second opening,

a stop member carried by said actuator and extending through said second opening and engageable with said throttle lever for controlling the idle position of said throttle,

a valve member disposed within said housing and engageable with said first valve seat for controlling fluid flow through said first opening,

a non-magnetically-responsive valve actuating member disposed within said housing and carried by said actuator, said valve actuating member including means engageable with said valve member upon movement of said valve actuating member a selected distance away from said first valve seat to thereby cause disengagement of said valve member from said valve seat and permit advance of ignition timing by said vacuum unit, said valve actuating member having a radially enlarged portion on the end opposite said valve member engaging means,

a magnetically-responsive ferrule slidably disposed on said valve actuating member between said radially enlarged portion and said valve member engaging means,

a coil spring surrounding said valve actuating member and extending between said ferrule and said valve member to bias said ferrule toward engagement with said radially enlarged portion of said valve actuating member and to bias said valve member toward engagement with said first valve seat,

a first coil surrounding said ferrule, first switch means energizing said coil when said engine is operating to cause movement of said ferrule, said actuating member, said actuator, and said stop member toward said throttle lever to thereby prevent closure of said throttle beyond said intermediate idle position,

stop means for limiting movement of said ferrule to less than said selected distance whereby energization of said coil does not permit advance of ignition timing by said vacuum unit,

a second coil surrounding said actuator, second switch means energizing said second coil when said engine is operating and said high drive ratio is operative to cause movement of said actuator and said valve actuating member said selected distance away from said first valve seat and toward said second valve seat whereby said valve member engaging means on said valve actuating member engages said valve means and causes disengagement of said valve member from first said valve seat and whereby said actuator engages said second valve seat to thereby permit advance of ignition timing by said vacuum unit, and to cause movement of said actuator and said stop member toward said throttle lever to thereby prevent closure of said throttle beyond said fast idle position,

and a spring which is effective upon deenergization of said second coil to move said actuator and said valve actuating member away from said second valve seat toward said first valve seat into engagement with said ferrule whereby said actuator disen-

gages from said second valve seat and said valve member engages said first valve seat and to move said actuator and said stop member away from said throttle lever to thereby permit closure of said throttle to said intermediate idle position, and which is effective upon deenergization of said first coil to move said actuator, said valve actuating member, said ferrule, and said stop member away from said throttle lever to thereby permit closure of said throttle to said slow idle position.

2. The control of claim 1 wherein said stop member is adjustable with respect to said actuator whereby said intermediate idle position of said throttle may be varied.

3. The control of claim 1 which further includes a member adjustable with respect to said housing means to limit movement of said actuator and said stop member whereby said fast idle position of said throttle may be varied.

4. In combination with an internal combustion engine having an induction passage for air flow to the engine, a throttle in said induction passage for controlling air flow therethrough, said throttle having fast, intermediate and slow idle positions, a throttle lever connected to said throttle for controlling the position thereof, and an associated transmission with an input connected to said engine and an output connected to a load and with variable ratio drive means driving said output from said input, said variable ratio drive means providing high and low drive ratios wherein said low drive ratio reduces the speed of the output from the speed of the input to a greater extent than said high drive ratio:

a solenoid operated throttle position control unit comprising

hollow elongated housing means,

a magnetically-responsive actuator reciprocally disposed within said housing,

a stop member carried by said actuator and engageable with said throttle lever for controlling the idle position of said throttle,

a non-magnetically-responsive member disposed within said housing and carried by said actuator and having a radially enlarged portion adjacent said actuator,

a magnetically-responsive ferrule slidably disposed on said member and engageable with said radially enlarged portion,

a first coil surrounding said ferrule,

first switch means energizing said coil when said engine is operating to cause movement of said ferrule, said actuator, and said stop member toward said throttle lever to thereby prevent closure of said throttle beyond said intermediate idle position,

stop means for limiting movement of said ferrule,

a second coil surrounding said actuator,

second switch means energizing said second coil when said engine is operating and said high drive ratio is operative to cause movement of said actuator and said stop member toward said throttle lever to thereby prevent closure of said throttle beyond said fast idle position,

and a spring which is effective upon deenergization of said second coil to move said actuator and said stop member away from said throttle lever to thereby permit closure of said throttle to said intermediate idle position and which is effective upon deenergization of said first coil to move said actua-

tor, said member, said ferrule, and said stop member away from said throttle lever to thereby permit closure of said throttle to said slow idle position.

5. In combination with an internal combustion engine having an induction passage for air flow to the engine, a throttle in said induction passage for controlling air flow therethrough, said throttle having fast, intermediate and slow idle positions, a throttle lever connected to said throttle for controlling the position thereof, and an associated transmission with an input connected to said engine and an output connected to a load and with variable ratio drive means driving said output from said input, said variable ratio drive means providing high and low drive ratios wherein said low drive ratio reduces the speed of the output from the speed of the input to a greater extent than said high drive ratio:

a solenoid operated throttle position control unit comprising

hollow elongated housing means,

a magnetically-responsive actuator reciprocally disposed within said housing and including stop means engageable with said throttle lever for controlling the idle position of said throttle,

a magnetically-responsive member engageable with said actuator,

a first coil surrounding said member,

first switch means energizing said coil when said engine is operating to cause movement of said member, said actuator, and said stop means toward said throttle lever to thereby prevent closure of said throttle beyond said intermediate idle position,

means for limiting movement of said member,

a second coil surrounding said actuator,

second switch means energizing said second coil when said engine is operating and said high drive ratio is operative to cause movement of said actuator and said stop means toward said throttle lever to thereby prevent closure of said throttle beyond said fast idle position,

and a spring which is effective upon deenergization of said second coil to move said actuator and said stop means away from said throttle lever to thereby permit closure of said throttle to said intermediate idle position and which is effective upon deenergization of said first coil to move said actuator, said member, and said stop means away from said throttle lever to thereby permit closure of said throttle to said slow idle position.

6. In an internal combustion engine having an induction passage for air flow to the engine, a throttle in said induction passage for controlling air flow therethrough, said throttle having fast, intermediate, and slow idle positions, an ignition system, and an associated transmission with an input connected to said engine and an output connected to a load and with variable ratio drive means driving said output from said input, said variable ratio drive means providing high and low drive ratios wherein said low drive ratio reduces the speed of the output from the speed of the input to a greater extent than said high drive ratio: the method of controlling said throttle which comprises the steps of

preventing closure of said throttle beyond said fast idle position when said ignition system and said high drive ratio are operating,

permitting closure of said throttle to said intermediate idle position when said ignition system and said low drive ratio are operating,

and permitting closure of said throttle to said slow idle position when said ignition system is not operating.

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