

May 25, 1965

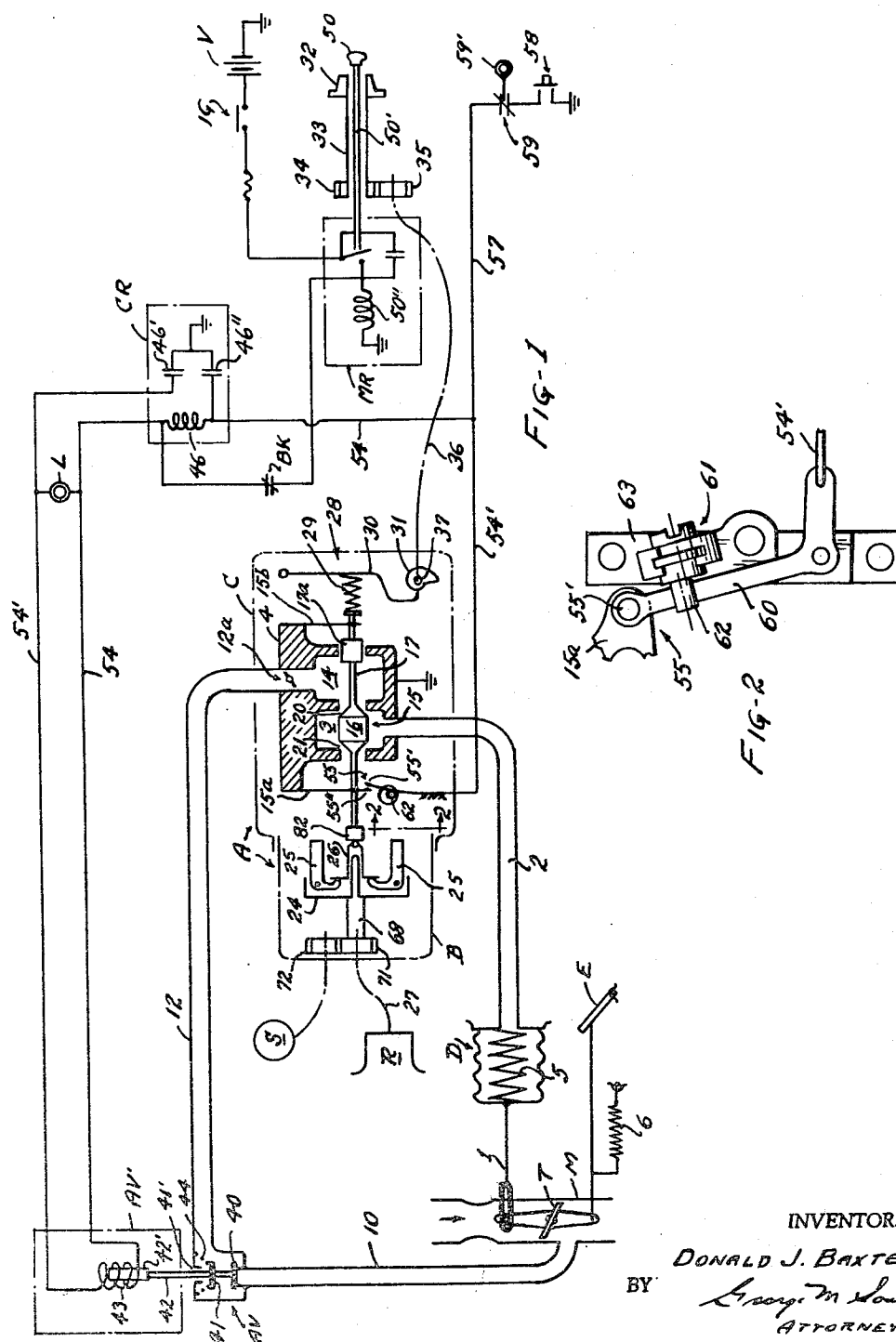
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VEHICLE SPEED GOVERNORS AND CONTROLS

Filed July 27, 1962

2 Sheets-Sheet 1



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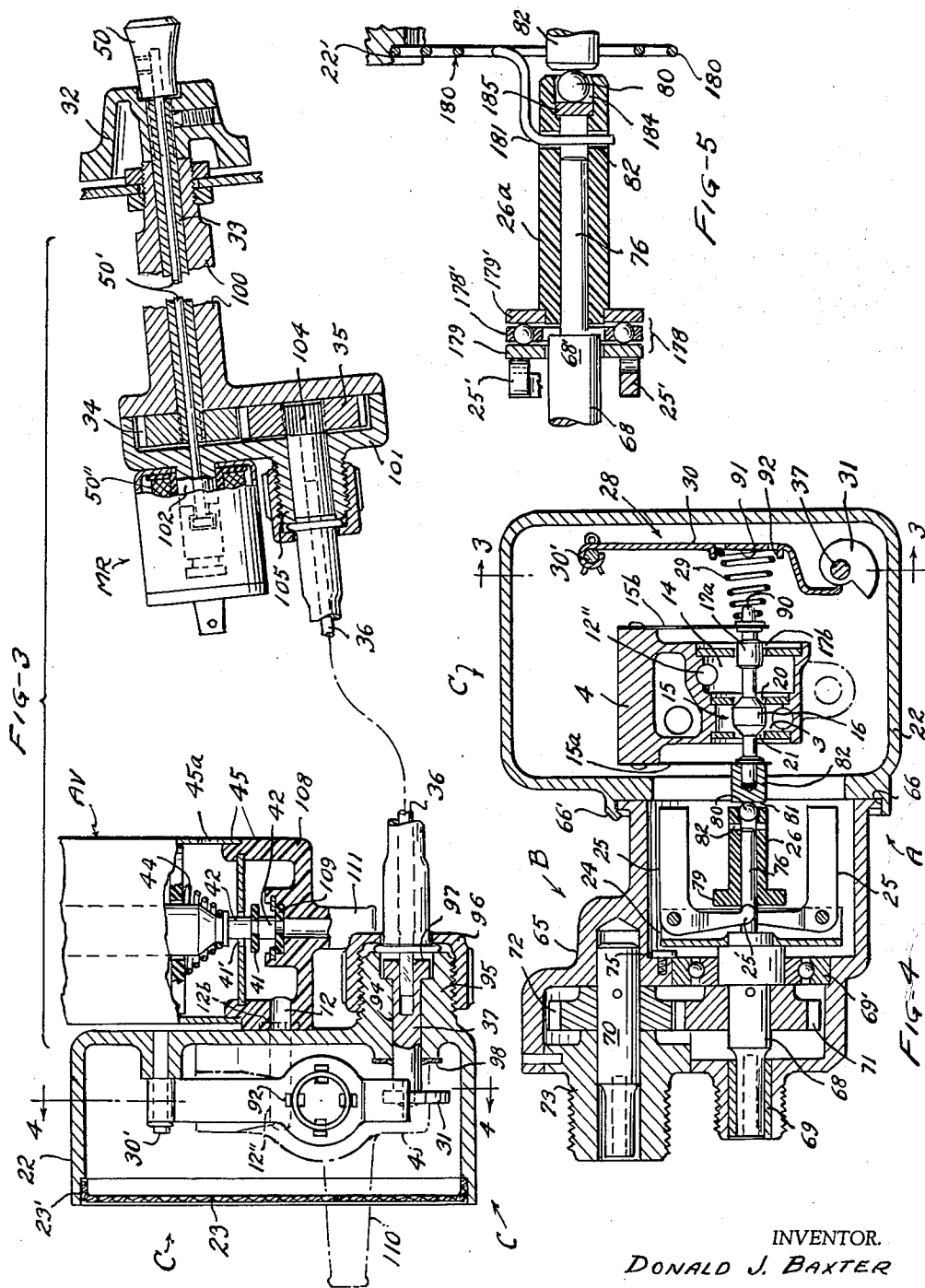
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2 Sheets-Sheet 2



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VEHICLE SPEED GOVERNORS AND CONTROLS

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This invention relates to speed governors for automotive vehicle engines and, as illustrated herewith, the above subject mechanism and controls are especially adapted for controlling an internal combustion engine to maintain selected speeds despite changes in load as reflected by change in gradient of the roadway and without requiring manipulation of an accelerator pedal or the like.

The present governor mechanism and controls are arranged very similarly to those of Patent 3,023,828 wherein a main governor unit is constituted by a fluid operated motor connected to control the engine throttle and forming part of a pneumatic servomechanism including an approximately frictionless pilot valve which continuously and accurately controls the rate of application of elastic fluid media to the motor, and a speed sensing mechanism operative to change the position of a moving element of the pilot valve in accordance with changes in vehicle speed.

The objects of the invention are generally those of J. L. Fuller et al. Patents 2,990,825 issued July 4, 1961, and 3,023,828 issued Mar. 6, 1962, both owned by the assignee hereof, except for special objects which will be explained later herein.

In said patents the speed sensing means is a centrifugal fluid (liquid) pump operating through an output air column thereof to move a flexible diaphragm operatively connected to said movable element of the pilot valve. Because the flexible diaphragm and air column are substantially frictionless neither can impose any restraint on the flexibility and accuracy of operation of the movable pilot valve element. The governor and control mechanism hereof has a novel flyweight-operated speed sensing device in place of and interchangeable with the fluid pressure generator and its speed-signal-sensing means as just outlined above and, among other novel features, an improved speeder spring mechanism and speed setting mechanism operating thereon and certain improvements in the pilot valve mechanism and in the electrical control arrangement all as will be hereinafter explained.

In the accompanying drawings,

FIG. 1 is a schematic view of the preferred governor mechanism and electrical controls therefor.

FIG. 2 is a detail view of an electrical switch assembly (enlarged) as though viewed at 2—2 on FIG. 1.

FIG. 3 is a full scale two part assembly view showing (at the left) principally a portion of the speed setting mechanism and a governor-activating air valve, and (at the right) a cooperating sub-assembly employed to set speed and condition the controls of the governor system for subsequent automatic operation.

FIG. 4 is a more or less central longitudinal view showing the centrifugal speed responsive mechanism, the pilot valve mechanism and part of the improved speed setting mechanism hereof.

FIG. 5 is an enlarged central sectional view of a modified form of the speed responsive mechanism output for operation of the pilot valve.

In FIG. 1, showing the present governor mechanism and controls entirely in schematic form, the mechanism outlined at A comprises a centrifugal speed sensing unit B and a pilot valve mechanism C of a pneumatic amplifier or servomechanism. The servo or motor portion of the servomechanism is separately shown at D (may be in-

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tegral with unit A) in the form of a flexible bellows or diaphragm device.

Servo or motor D is operated by engine vacuum and has a one-way-operating (pull) connection 1 with the throttle valve T in engine intake passage M, to open the throttle as in already known road speed regulators similar to the present one. A passage (e.g. flexible conduit) 2 connected at one end to the motor D and at its opposite end to an air chamber 3 of a valve body 4 of the pilot valve unit C enables delicately metered application of engine vacuum to the motor D against the force of a return spring 5 in or connected to the motor. The throttle valve T, as usual, is arranged for "manual" control as by an accelerator pedal E having a return spring 6 tending to close the throttle.

A vacuum line or passage 10 (e.g. flexible conduit) is connected at one end to the engine intake passage or manifold downstream from the throttle T and its opposite end is connected to the inlet of an air valve unit AV, opening of which initiates activation of the governor mechanism. The outlet of the air valve is connected by a passage or conduit 12 to a vacuum chamber 14 of the pilot valve body 4. The pilot valve mechanism C controls the degree of vacuum in the chamber of motor or servo D according to the position of a leaf-spring-supported, hence approximately frictionless modulating valve plunger 15 in the valve body 4. Two parallel leaf springs 15a and 15b are shown particularly in FIG. 4 mounted on the valve body 4 and with their free ends tightly connected to the valve plunger 15 as described in said Patent 3,023,828.

The valve plunger 15, which for convenience will hereinafter usually be called the pilot valve, has a double conical metering plug portion 16 on a suitable rod or stem 17, one end of the plug portion being arranged variably to restrict or close an orifice or port 20 between the vacuum chamber 14 and the air chamber 3 of valve body 4. The opposite end of the plug portion 16 variably restricts or closes an orifice 21 in the valve body 4 leading to a region around the valve body which is subjected approximately to atmospheric pressure as in a housing 22 (see FIGS. 3 and 4) around the valve body 4. The housing as shown in FIG. 3 has an air filter screen 23 detachably closing or forming one side wall of the housing which is otherwise fully closed. The filter screen is preferably of fairly thin fiberglass construction held in place by friction of its continuous flange 23' with the housing. The pressure drop across the fiberglass filter is negligible.

One end of the stem 17 of the pilot valve 15 is subjected (e.g. as herein shown) to vehicle speed signal force via a generally conventional centrifugal governor flyweight mechanism in unit B comprising, as shown in FIGS. 1 and 4, a rotary ball head 24, fly weights 25 pivotally supported thereon and an operating or output sleeve 26 arranged for operating abutment with the pilot valve stem 17 at a head portion 32 on one end of the stem (further described later). The ball head 24 is connected as by a conventional flexible torque shaft assembly 27 with, for example, the transmission R of the engine. At the opposite end of the pilot valve stem 17 is a speed setting mechanism 28 (cf. FIG. 4) including a coiled speeder spring 29, a lever 30 acting against one end of the speeder spring, and a rotary cam 31 against which the speeder spring holds one end of the lever at all times (all further described later).

The cam 31 is manually adjusted to set governing speed by a knob 32 within reach of the driver. The knob, via its tubular supporting shaft 33 and mating gears 34 and 35 operated by the shaft 33, enables the cam 31 to be turned to select or set governing speed through the inter-

mediary of a conventional flexible torque shaft assembly 36 connected between the gear 35 and a supporting shaft 37 (cf. FIGS. 3 and 4) of the cam.

In order to equalize axial pressure on the pilot valve plunger assembly 15 during changes in the intensity of vacuum in the valve chamber 14 a cylindrical "compensation" piston 17a on the pilot valve stem 17 extends through and nearly closes an annular orifice constituted in part by a cylindrical hole 17b in the associated wall of the vacuum chamber. The operation of such a pressure equalizing piston is fully explained in United States Patent 3,068,849 issued December 18, 1962, to R. H. Thorner entitled Speed Regulating Mechanism.

As shown herein the compensation piston 17a is sufficiently long so that no portion of it, during valving operation by the plug portion 16 can ever move so far as to affect measurably the operational character of the annular orifice around it. The hole 17b in the present construction is formed substantially identical with the diameters of the holes forming the valve orifices or ports 20 and 21; hence the piston 17a can be made integral with the valve stem 17 at reduced expense as compared with the "two-piece" pilot valves of earlier mentioned Patents 2,990,825 and 3,023,828 wherein a larger hole for the "compensation" piston than those of the valving orifice holes was found experimentally to be necessary for stability of governor operation. The present "one-piece" pilot valve and the present speeder mechanism construction (latter more fully explained later with reference to FIGS. 3 and 4) has been found to operate equally stably with the speed signal generating and transmitting (fluid) system of the patents mentioned in this paragraph and with the present wholly mechanically operated speed signal mechanism as shown in FIG. 4 hereof.

Referring to the principally-electrical controls shown conventionally in FIG. 1, and first to the air valve AV as shown in FIG. 3 particularly, the valve has two plug portions 40 and 41 on a stem 42 which, as shown, is an extension of the armature 42' of a solenoid coil 43. The stem 42 is operated by a spring 44 in a direction to close plug 40 and seal the outlet of vacuum or air passage 10 leading to the engine manifold. When the solenoid coil 43 is energized to activate the governor the other plug portion 41 closes a port 41' within the body 45 and communicating with atmosphere as through a vent hole 45a in the body 45. The venting, via port 41' and hole 45a, enables immediate return of the throttle T towards closed position whenever the governor mechanism is de-activated regardless of the then-occupied position of the pilot valve plug portion 16.

Current from a suitable source V in the conventionally grounded system as shown flows through an ignition switch IG and a suitable fuse to a make-ready relay switch unit MR operated manually to establish a "holding" circuit as by a knob 50 whose operating rod 50' extends through the hollow shaft 33 for connection with the conventionally indicated contacts of the relay which has a spring not shown tending to hold the contacts open. The rod 50' in the actual construction (FIG. 3) is pulled outwardly to energize the make ready holding coil 50". The holding coil 50" of the relay MR conditionally supplies current to a series circuit including a brake (and/or clutch) pedal operated normally closed pair (or pairs) of contacts, as in switch BK, to a coil 46 of a second magnetically locked in or holding relay switch CR (for clicker relay serving in part as a signal) and to the air valve solenoid coil 43 to open the air valve as soon as the two normally open contacts 46' and 46" of the relay switch CR are closed. However the contacts 46' and 46", of which 46' is in series with coil 43 but in parallel with coil 46 and of which 46" is in series with the coil 46, remain open until the circuit through the coil 46 of relay CR is closed; and closing is accomplished for example when a circuit portion 54, 54', which is connected to the coil 46 and to contacts 55' and 55" of a switch 55 in parallel with contact

46" and in the pilot valve unit, is energized by the closing of contacts 55' and 55" incident to movement of the pilot valve 15 pursuant to attainment of governing speed by the vehicle under manual control. A visible signal L (e.g. light bulb) is shown connected across the circuit portion between relay CR and the air valve. The governor-operated contacts 55' and 55" actually close the connected governor activating circuit when the vehicle speed is increased to a point slightly higher than the governing speed as established (e.g.) by setting of the speeder spring 29 via the knob 32 during previous operation of the vehicle when under automatic governor control.

Thus far the electrical control circuit and operation as outlined above is essentially the same as shown and described in above identified Patent 3,023,828. In the present arrangement a branch circuit portion 57 is connected in parallel with the circuit portion 54' normally dominated by the pilot-valve-operated switch 55 and containing a spring-opened pushbutton switch 58, operative to energize the clicker relay coil 46, hence air valve coil 43, at any desired time after closing of the contacts of the make-ready relay switch MR and before the vehicle has attained the set governing speed. Thus the vehicle can be conditioned to accelerate automatically to the preset governing speed or in other words without requiring operation of the accelerator pedal E to attain governing speed.

When the present governing system with the automatic accelerator 57, 58 is applied to high acceleration rate, powerful engines the automatic acceleration can be at an undesirably high rate, in which case the vacuum supply passage leading to the vacuum chamber 14 may be suitably restricted to safeguard vehicle operation as by provision of a fixed or adjustable metering orifice shown conventionally in FIG. 1 as a valve 12a in conduit 12. One convenient position for a fixed orifice of selected size is as diagrammatically indicated at 12b, left FIG. 3, between the air valve AV and the valve housing 4.

Since automobiles are likely to be driven at times by parking attendants and/or minor members of a family who could accidentally or unintentionally use the automatic acceleration feature or purposely misuse it hazardously, a key-operated normally closed lock-out switch, as at 59, is preferably connected in series with the pushbutton switch 58. Thereby the owner of the automobile, by removing the key 59' thus opening the switch 59, can be assured that the automatic acceleration feature will not be accidentally used or misused.

Another improvement (e.g. over the arrangement per Patent 3,023,828) in the present control system is illustrated in FIGURE 2 wherein the contact 55' of the governor pilot valve operated switch 55 is shown as mounted on an elongated leaf spring 60 which is capable of being precisely set in relation to the cooperating contact 55" of leaf spring 15a of the pilot valve unit C as more fully explained in the patent just mentioned. The contacting contact faces are so designed as to come into full face engagement in the usually adjusted position of the leaf spring 60. The leaf spring arm 60 is adjusted by an eccentric pin device 61 having high built-in friction in a mating guide bore in its insulative mounting piece or base 63, the device 61 being arranged for operation only during or prior to installation (e.g., during bench testing) by a suitable screw driver type tool. The axis of the eccentric pin portion 62 bearing against the leaf spring 60 to preload the same and set its contacting position is disposed at right angles to the principal longitudinal axis of the leaf spring 60 and parallel to the principal plane of that leaf spring. Thereby the leaf spring 60 cannot be subjected to torsional stress as could happen with the arrangement according to the just above mentioned patent and, by tilting the contact 55', sometimes produce chatter or arcing as the contacts are being automatically closed by movement of the pilot valve.

Referring further to FIGS. 3 and 4, the speed sensing unit B, as illustrated, is interchangeable in the housing 22

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with the speed-sensing diaphragm assembly (12 etc.) of Patent 2,990,825, and (unless made unitary with the pilot valve unit C hereof, as it may be) the housing 65 of unit B fits snugly into a recess provided, inter alia, by a circular flange 66 of housing 22 approximately concentric with the axis of the pilot valve 15. The two housings can thus be secured together by distortion of the flange as at 66' in several places.

To economize in the length of flexible shafting in installations on present day automobiles, the rotary governor input or ballhead drive shaft 68, FIG. 4, supported in bearings 69 and 69' as will be evident (bearing 69' of sealed construction, not illustrated) is intergeared with a speedometer take-off drive shaft 70 (e.g. via spur gears 71 and 72), the shafts being arranged to receive standard couplings and polygonal shaft ends for the necessary flexible shafting (not shown in FIG. 4; cf. FIG. 3). Shaft 70 thus drives speedometer S, FIG. 1, in the proper direction as though directly coupled to the transmission take-off shaft (not shown).

Gear 72 and its shaft are partially supported by a tubular bearing and housing section 73 in housing 65, FIG. 4, and the shaft 68, with bearing 69' and the ball head or flyweight carrier 24 thereon as an integral unit, is held in place by a series of screws, one shown at 75. A smooth hardened shaft extension or stiff rod 76 accurately centered with the rotational axis slidably supports the output sleeve or tubular body 26 which (because of low mass, high strength, hardness, stability and self lubricating qualities) is preferably made of tough plastic such as nylon or Delrin (reg. T.M. for an acetal resin product of E.I. du Pont de Nemours Co.).

The thrust plate or flange portion 79 of the sleeve 26 against which the arms of the flyweights 25 bear is integral with the rest of the sleeve 26 as illustrated in FIG. 4 only. Thus the sleeve normally turns with the flyweights via friction as there shown.

A hard smooth (e.g., steel) ball 80, as shown, forms the terminus of the sleeve 26, the ball being carefully centered on the axis of the bore of the sleeve and being shown as though pressed into a counterbore of the sleeve to fix the effective length of the sleeve and ball assembly. Whenever the drive shaft 68 is being turned during operation of the vehicle the ball 80 is held by the flyweights 25 in approximately single point contact with a hardened and extremely smooth surface 81 of the head 82 which is suitably fixed tightly on the stem 17 of the pilot valve 15. Since the pilot valve 15 does not rotate it is immaterial whether its axis and that of the shaft 68 are accurately aligned, but it is presently believed important that the ball 80 be as nearly accurately centered with the shaft axis as practicable (via the sleeve bore) so that the ball will not gyrate in contact with the hard surface 81 and cause friction and wear and, eventually, inaccurate governing operation. A cross hole 82 in the sleeve serves as an air vent to forestall the existence of an elastic cushion between shaft extension 76 and the sleeve 26 since the clearance between those parts is maintained at a minimum such as will allow the sleeve to slide freely.

The clearance tolerance between shaft extension 76 and the output sleeve (as 26, FIG. 4) can to advantage be increased in the construction according to FIG. 5 and, inter alia, static friction tending to produce lag in free floating movement of the pilot valve 15 in a direction toward the flyweights can be converted into continuous running friction in that arrangement or its equivalent at no greatly increased cost.

In FIG. 5 the flyweight arms 25' are shown as resting against an adjacent hard and smooth floating thrust ring 179 of a known type of anti-friction axial thrust bearing assembly 178 wherein the ball retainer 178', having through bores loosely embracing the balls, is preferably nylon or the like. The retainer 178' is held loosely in place by an associated cylindrical portion 68' of the drive shaft. Since the total possible movement of the pilot

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valve is on the order of .030" the drive shaft portion 68' can move back and forth during the valving operation in the retainer 178' and without abutting the body 26a. The hard and smooth-surfaced thrust ring 179' of the bearing assembly 178 is suitably secured as by press fitting to the tough plastic tubular body or sleeve 26a. As a suitable non-friction-producing means for holding the sleeve 26a against rotation a generally planar spiral spring 180 whose outer convolution can be staked in a recess (as at 22' in the pilot valve housing 22 or other fixed part) and having a portion 181 loosely and detachably entering the vent hole 82 in the sleeve. A cantilever leaf spring, not shown, could be used in place of the spring 180 if loosely coupled at its free end to the tubular body or sleeve 26a. Spring 180 has approximately negative rate incident to movement of the pilot valve through its operating range as have the pilot-valve-suspending leaf springs 15a and 15b; and the spring 180 allows the thereby arrested end of the sleeve 26a to move freely slight amounts laterally as may sometimes be desirable as explained below.

Despite the friction inherent in a properly designed flyweight mechanism of the mechanical governor type shown in FIG. 4 (i.e. without the above described refinements according to FIG. 5 or equivalents) the present governor has been proven entirely adequate in response to small changes in road grade during many miles of test operation under average driving conditions and without observance of evidence of hysteresis or lag in the governor operation. Thus the principal advantage of the refinements of FIG. 5, other than maintenance of running friction as explained, appears, at present, to be avoidance of having to maintain as close manufacturing tolerances—e.g., accuracy in centering ball 80 on the axis of rotation of the flyweights as in FIG. 4.

It will be apparent from FIGS. 4 and 5 that the output members 26 or 26a and their supports could, by reversal of parts, be so modified that their supporting shaft (cf. 68) would be axially bored centrally thereof (not shown) to receive a male projection of the output members, but such modified construction would increase centering problems and cost.

At the right in FIG. 4 and left in FIG. 3 the coiled and expanding-diameter-type speeder spring 29 is supported, as already indicated, between an associated piloting guide and generally flat seat device or perch 90 and a flat associated surface 91 of the speeder arm or cam follower lever 30 which as shown is a metal stamping pivoted on a pin 30' in housing 22. The spring 29 is accurately flat ground at its two ends and is held laterally in position on the supporting arm 30 by a series of radially outstruck or lance-formed nibs 92, the nibs collectively holding the larger diameter end of the spring in position. By turning the nibs outwardly as illustrated rather than inwardly toward the axis of the spring the latter is supported without possibility of touching any rounded fillets such as would have resulted from lancing and striking the tabs inwardly toward the axis of the spring 29 which could then sometimes form an uneven seat and "cock" the spring or cause its set length to vary during operation.

To maintain the speeder spring under at least some axial stress in all speed adjustments of the cam 31, which as shown is a flat metal stamping with the necessary gradually expanding spiral contour, one of the pilot-valve-supporting leaf springs (15a preferably) as mounted on the valve body 4 is permanently deflected toward the valve body sufficiently so as initially to hold the conical plug 16 in contact with the orifice 20; and during assembly each speeder spring as installed must be found snug in the lowest possible speed selecting position of cam 31 in order to pass inspection. In that way the spring is never likely to rotate about its axis (as it could if it became loose). Looseness, in event the ends of the spring during manufacture were not ground strictly parallel to each other, could cause inconsistent or non-uniform low speed settings to occur in operation pursuant to predetermined

uniform turning movements of the speed selector knob 32.

The cam-supporting shaft 37 (left FIG. 4) is mounted in a bore 94 of a boss portion 95 which is threaded to receive one of the coupling nuts 96 of the conventional flexible drive shaft assembly 36 as will be evident and the shaft has a socketed enlarged portion or head 97 at its outward end to receive the flexible shaft end. The opposite end of the shaft is locked as by a push-on spring lock ring 98 cooperating, inter alia, with the head 97 to hold the cam 31 in position. The cam follower end of the lever is rounded for contact with the cam; and associated portions of the lever are otherwise formed as shown in FIG. 4 largely to conserve space in the housing 22.

Because the speeder spring exerts its reactance force against the gradual-rise spiral cam 31 the speeder spring can have no effect tending to turn the rotary members provided to set speed, as from a high speed setting toward a lower speed setting, wherefore no special retaining means has to be used in the housing 100 for the tubular shaft 33, right FIG. 3, such as required in the corresponding mechanism of Patent 3,023,828 (device 75, FIG. 2A thereof). Also the knob 32 can have a desirably large turning movement over the governing speed range so that fairly large angular increments of movement of the knob can be designed to produce very little speed setting changes.

The housing 100 hereof is shown with an end piece or cap member 101 enclosing the gears 34 and 35 as will be evident and supporting the make-ready relay switch assembly MR on an integral projection 102 of the cap member. The gearing 34, 35 and the rest allows the operating rod 50' of the relay switch assembly to be conveniently located coaxial with the speed setting knob 32 which incidentally is turned clockwise from the driver's viewpoint for increased speed setting as is desirable. The shaft 104 to which the gear 35 is suitably secured (e.g. serration-connected) is carried wholly by the boss portion 105 of the cap member 101 which is externally threaded for the associated flexible shaft coupling nut as clearly apparent.

The air valve assembly AV, as shown at the left in FIG. 3, is suitably attached to the pilot valve housing 22 by screw means not shown and the air passage 12 can be formed partly in the moulded base 108 which contains a rubber sealing disc or ring cooperating with the flat lower end of the stem 42 which constitutes the vacuum inlet plug (shown closed). The portion of passage 12 shown in FIG. 3 communicates with aligned passage portions 12'' in the housing 22 and valve body 4 intersecting the wall of the vacuum chamber 14. The plug 41 is shown as a flat rubber ring or disc which, during assembly of the air valve, is expanded into a peripheral groove in the stem 42 to hold the plug 41 in place. The valve body 4 and base 108 of the air valve have tubular projections located as indicated at 110 and 111 respectively for attachment of flexible air tubing not shown leading respectively to the servo D and the engine manifold D. Extension 110 in the illustrated construction projects through an opening, not shown, in the filter wall 23 toward the engine in most installations.

I claim:

1. In a speed governor, a fluid operated servomechanism including a fluid motor and a pilot valve mechanism fluid-connected to the motor to control its operation, the pilot valve mechanism including a freely suspended pilot valve plunger having a metering portion movable between inlet and outlet ports of the pilot valve mechanism out of contact therewith to meter fluid to operate the motor, speed responsive flyweight mechanism including flyweight means, a drive shaft therefor having a generally cylindrical stiff metal rod portion extending toward the valve plunger and a tubular output member of the flyweight mechanism having a bore surface slidably telescoping the rod portion in approximate alignment with the longitudinal axis of the valve plunger, speeder spring means connected to one end of the valve plunger and tending to move it toward the flyweight mechanism, the other end

of the valve plunger having a high-wear-resisting smooth generally planar surface at right angles to said axis, the tubular output member having a counterbore and a high-wear-resisting tip member therein having a smooth spherical surface held by operation of the flyweight mechanism and speeder spring in contact with said generally planar surface.

2. A speed governor according to claim 1 wherein said tip member is wholly spherical and tight in the counterbore.

3. The speed governor according to claim 1 wherein said tip member is wholly spherical and is contained in the counterbore for movement laterally of the longitudinal axis thereof, and means providing a smooth hard surface fixed in the tubular member and against which the spherical tip member can roll.

4. A speed governor according to claim 1 wherein the tubular member is composed principally of tough plastic material capable of being self-lubricating in contact with metal.

5. A speed governor according to claim 1 wherein said tip member constitutes a seal, closing the bore of the tubular member, and the latter has an air vent intersecting its bore between the free end of the rod portion and the seal.

6. The governor according to claim 1 including spring means connected to hold said output member against rotation and in a manner to impose substantially negligible axial and lateral restraining force on the output member.

7. The governor according to claim 6 including bell-crank type flyweights and an axial thrust anti-friction bearing assembly between arm portions of the flyweights and the tubular output member, portions of which assembly are loosely held in position by the rod portion of the drive shaft.

8. The governor according to claim 6 including a cantilever leaf spring support for the pilot valve plunger constraining the valve plunger to move laterally of its axis within fixed limits as the plunger moves axially for valving, and means enabling said spherical tip member to move laterally with said generally flat surface of the valve plunger without rubbing thereon.

9. The governor according to claim 1 including means to prevent rotation of the tubular member, and swingable means supporting the valve plunger so that the plunger is constrained to move laterally within fixed limits as it performs its valving movements, the radial clearance between the bore of said tubular member and the rod being greater than the maximum lateral movements of the valve plunger.

10. A speed governor having a fluid servomotor and a swingably supported pilot valve plunger member movable relative to a fluid port connected with the servomotor to control its movements and while out of contact with the port, speed responsive means operatively connected to one end of the valve plunger to control its movements, a coiled speeder spring generally coaxial with the valve plunger and acting thereon axially toward the speed responsive means, a lever pivoted remotely of the speeder spring and extending transversely of the axis of the spring and bearing thereon, a rotary cam in contact with the lever, and angularly movable speed setting means connected to turn the cam to set speed, said lever comprising a sheet metal member having a flat surface portion in supporting contact with an associated end portion of the speeder spring, said member having a plurality of tabs struck outwardly therefrom transversely of said flat surface portion and holding said end coil of the spring in position on the flat surface.

11. The speed governor according to claim 10 wherein the tabs are lanced-out portions of the sheet metal lying inwardly toward the axis of the speeder spring for locating engagement with radially external portions of said end coil portion of the spring.

12. In an automotive vehicle having an engine including a speed control member and an accelerator device po-

sitionable by the vehicle driver and operatively connected to the control member, an automotive governor having output means also operatively connected to the control member and having a speed sensing means controlling the output means and a speeder spring biasing the speed sensing means in a direction to increase engine speed, speed setting mechanism including a rotary cam and lever mechanism connected to stress the speeder spring, a speed setting hollow shaft remotely of the governor in a position available to the driver and connected to vary the biasing force of the speeder spring, an electrical circuit including electrically operable means connected to activate the governor, a governor speed-sensing-means-operated switch in series therewith in the circuit, and a make-ready, electrically locked in switch mechanism including a coil connected in the circuit coaxial with the hollow shaft and including contacts in the circuit connected for operation when the coil is energized conditionally to establish a portion of the circuit necessary for activation of the governor, an operating stem slidable within the hollow shaft and adapted for manipulation by the driver to energize said coil, constantly meshed gearing connected with the hollow shaft and including an output gear member in offset relation to the axis of the hollow shaft, and flexible torque transmitting shaft means connecting the output gear member with the rotary cam and lever mechanism.

13. In a motor vehicle governing system, the combination comprising a speed setting device; speed responsive mechanism conditioned thereby for automatically controlling the engine throttle to maintain a speed predetermined by the setting of said device; means operably connected with said speed responsive mechanism to initiate and discontinue automatic speed control; and a control circuit for the operably connected means including an element which when energized causes the said means to initiate automatic control, a brake operated switch to deenergize said element upon operation of the brake, a speed responsive switch which closes upon attainment of a predetermined speed, and a manually controllable switch, said speed responsive switch and manually controllable

switch being connected in parallel with each other but in series with the said element and brake operated switch.

14. The combination defined in claim 13 including a control coil for the operable means and a contact operable by the said element for energizing the control coil whenever said element is energized.

15. The combination defined in claim 13 including a control coil for the operable means and a contact in series with the control coil and operable by the said element for energizing the control coil whenever said element is energized, the control coil and contact being connected in series with the brake operated switch but in parallel with the said element as well as the speed responsive switch and manually operable switch.

16. The combination defined in claim 15 including another contact operable by said element and connected in parallel with the speed responsive switch and the manually operable switch.

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