

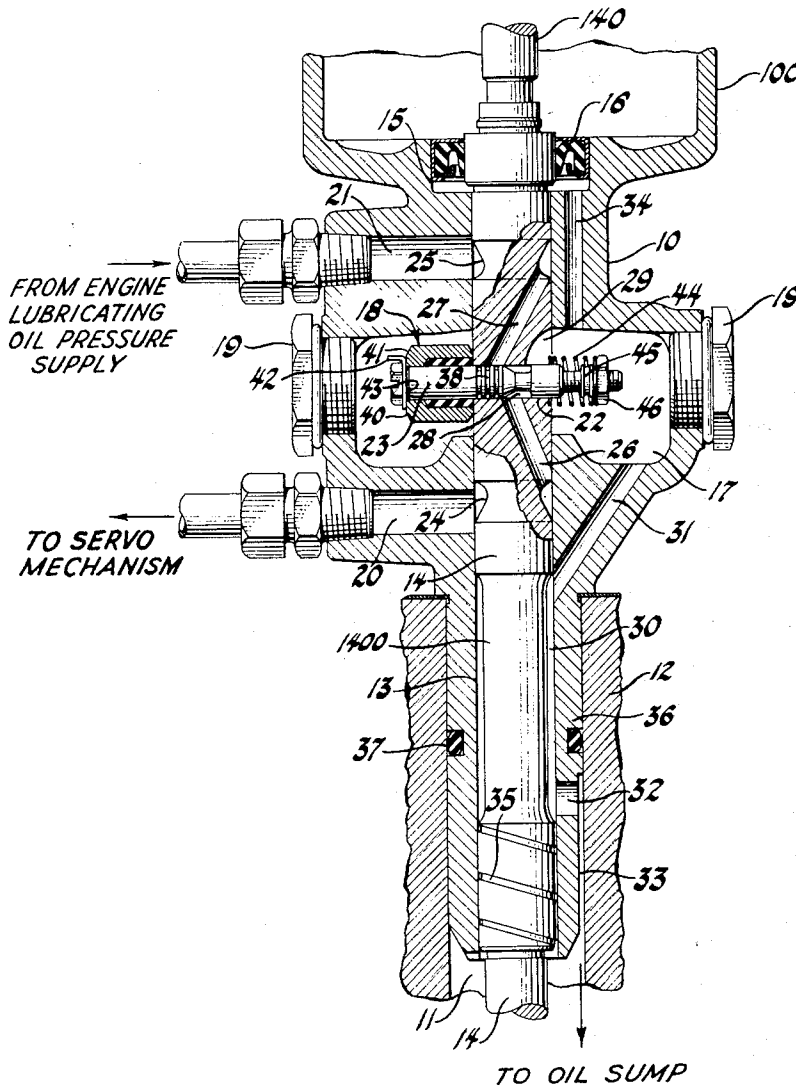
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A. G. LAUTZENHISER

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ENGINE GOVERNOR

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Inventor

*Argyle G. Lautzenhiser*

By

*Willits, Helwig & Baillie*

Attorneys

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## ENGINE GOVERNOR

Argyle G. Lautzenhiser, Anderson, Ind., assignor  
to General Motors Corporation, Detroit, Mich.,  
a corporation of Delaware

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This invention relates to improvements in governors of the centrifugal control valve type.

The primary object of the invention is to provide improved and simplified centrifugal control valve type governors having free and positive valve action whereby to assure sensitivity under all operating conditions.

Another object of the invention is to provide improved centrifugal control valve type governors employing a minimum of parts and seals which requires very little power to operate and a minimum of service to maintain in effective accurate operation.

A further object of the invention is to provide in a centrifugal control valve type governor a simplified arrangement of elements and parts which can be economically manufactured, assembled and installed in an engine crankcase for controlling the operation of the engine by suitable servo mechanisms operated through the governor by a source of fluid pressure, preferably the engine lubricating oil system or any other pressure source necessary for efficient operation of the engine.

Other objects of the invention will become apparent by reference to the accompanying drawing in which the single figure is a vertical sectional view through a centrifugal control valve type governor embodying the invention.

Referring now to the drawing wherein like numerals refer to like and corresponding parts throughout, the improved centrifugal control valve type governor mechanism shown for the purpose of illustrating the invention is disclosed in connection with the drive shaft of the distributor of the electrical ignition system of an internal combustion engine; however, it is to be understood that governor mechanism embodying the invention may be employed independent of the distributor shaft by use of a separate governor drive shaft if desired.

In the particular form of the invention illustrated, the improved centrifugal control valve type governor mechanism consists of a governor housing 10 which may be a portion of and integral with an engine distributor housing preferably mounted in a conventional manner in an opening 11 in an engine crankcase 12, the said crankcase opening 11 communicating with the engine oil sump, not shown. The governor housing 10 is provided with an axial bore 13 to receive a governor shaft 14 which may serve as a distributor shaft or a shaft to drive some other mechanism. If the centrifugal control valve type governor mechanism is constructed in combination with

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the engine distributor, the distributor housing 100 may be formed integral with the governor housing 10 and the governor shaft 14 extended as indicated at 140 to serve as a distributor shaft.

The governor shaft 14 is driven at its lower end in any suitable manner in timed relationship to the engine by such means as timing gears driven from the engine crankshaft, not shown. The housing 10 is suitably counterbored at 15 to accommodate a suitable oil seal 16 disposed around the governor shaft 14 which prevents leakage of oil from the housing 10 at the top thereof.

The housing 10 is provided with pressure relief chamber 17 intermediate its ends through which the governor shaft 14 passes and into which is located a centrifugally unbalanced valve element generally designated by the numeral 18 carried by and rotatable with the governor shaft 14.

The outer walls of the housing 10 opposite the pressure relief chamber 17 are diametrically bored and threaded to accommodate threaded plugs 19 which, when removed, provide access to the centrifugally unbalanced valve 18. The housing

10 is provided with radially disposed bores above and below the pressure relief chamber 17 forming respectively an inlet passage 21 from the engine oil pressure supply or other source of fluid pressure to the axial bore 13 and an outlet passage 20 from the axial bore 13 to a pressure responsive servo mechanism, not shown, which servo mechanism may be employed to regulate items such as a carburetor butterfly valve whereby to govern or limit the speed of the engine. Obviously, improved centrifugal control valve type governors embodying the invention may be used to regulate or control various other items and functions responsive to pressure operated servo mechanisms.

The governor shaft 14 is diametrically bored at 22 to accommodate the valve spool 23 of the centrifugally unbalanced valve element 18 carried thereby. The governor shaft 14 is annularly grooved at 24 and 25 and diagonally bored to provide diagonal passages 26 and 27 communicating respectively between each annular groove 24 and 25 and the said transverse valve bore 22 through the governor shaft 14. The diagonal passages 26 and 27 preferably meet the transverse valve bore 22 at opposite sides thereof in longitudinally staggered or non-overlapping relationship as indicated in the drawing. The valve spool 23 is annularly grooved to provide an annular passage 28 therearound which communicates with a suitable notch or by-pass passage 29 form-

ed in the governor shaft 14 located to provide communication between the diagonal passage 26 and the pressure relief chamber 17 when the centrifugally unbalanced valve element is in its normal by-pass position to which it is spring loaded, the said valve spool closing the diagonal passage 27 simultaneously. When the valve spool 23 moves to the left as viewed in the drawing, communication is gradually established between the diagonal passages 26 and 27 through the annular valve spool passage 23, and the by-pass passage 29 to the pressure relief chamber 17 is gradually closed.

By suitably arranging the diagonal passages 26 and 27, the annular passage 28 and the by-pass passage 29, for example as indicated in the drawing, communication between the diagonal passages 26 and 27 and flow of oil under pressure from the oil pressure supply inlet passage 21 to and through the outlet passage 20 to servo mechanism is not only established gradually but is cushioned by virtue of the gradual closing of the by-pass passage 29 after the initial opening of the passages 26 and 27 to each other.

The governor shaft 14 is circumferentially formed to a smaller diameter at 1400 whereby to provide a return oil passage 30 therearound. The housing 10 is provided with a diagonal bore 31 between the pressure relief chamber 17 and the bore 13 opposite the upper end of the oil passage 30. The housing 10 is also provided with a radial bore 32 opposite the lower end of the oil passage 30 which communicates with a longitudinal groove 33 formed on the outer periphery of the lower end of the housing 10 extending from the radial bore 32 to within the engine crankcase 12. Thus, a return oil passage is provided from the pressure relief chamber 17 into the crankcase 12 through the diagonal bore 31, the passage 30, the radial bore 32 and the longitudinal groove 33. An oil drainage passage 34 is provided between the counterbore 15 below the oil seal 16 to the pressure relief passage 17. The lower end of the governor shaft 14 is spirally grooved at 35 to lubricate the lower end of the governor shaft 14 below the oil passage 30. The outer periphery of the housing 10 is annularly grooved at 36 at a point above the longitudinal groove therein and within the crankcase 12 to accommodate an O-ring 37 which prevents seepage of oil from within the crankcase 12 around the housing 10.

The centrifugally unbalanced valve element 18 carried by the governor shaft 14 in the diametric valve bore 22 therein comprises a valve spool 23 slidably fit in the said valve bore 22 and formed with an annular passage 28 therein as hereinbefore described. The portion of the valve spool 23 normally closing the diagonal passage 27 is preferably provided with a plurality of spaced circumferential grooves 38 to reduce friction on the valve spool and cause a relative free valve action by giving somewhat of a floating action to the valve spool 23 within the valve bore 22. The left end of the valve spool 23 as viewed in the drawing is provided with a suitable centrifugal flyweight 40 bored and counterbored as shown to accommodate a bushing 41 of synthetic rubber or the like. The said flyweight 40 is telescoped onto the valve spool 23 and secured thereon by such means as a spring clip 42 engaging the valve spool 23 near the left end thereof at a circumferential groove 43 therein, or, as an alternate, an enlarged head may be employed on the said left end of the

valve spool 23. The right end of the valve spool 23 as viewed in the drawing is reduced in diameter and threaded to accommodate a compression spring 44, a round spring adjustment nut 45 over which the spring 44 is telescoped, and a lock nut 46. The compression spring 44 bears at one end on the underside of the lock nut 46 and at its other end on the side of governor shaft 14 adjacent the valve bore 22 therethrough which is counterbored to provide a suitable spring seat.

Upon rotation of the governor shaft 14, the centrifugal action of the centrifugally unbalanced valve element 18 causes the valve spool 23 thereof to move circumferentially outward with its flyweighted end under restraint of its compression spring 44. The weight of the flyweight 40, the adjusted compressive strength of the compression spring 44, and the speed of revolution of the governor shaft 14 determines when and the extent to which the valve spool 23 moves to govern the flow of fluid under pressure from the oil pressure supply to the servo mechanism.

The improved centrifugal control valve type governor construction herein disclosed is extremely sensitive and accurate in operation, is inexpensive to manufacture and assemble, has relatively few parts, and is readily adjusted as to various control requirements by substituting lighter or heavier valve springs for the spring 44 or by simple adjustment of the spring 44 by removing the threaded plugs 19 from the housing 10, releasing the lock nut 46 on the valve spool 23 and threading the spring adjustment nut 45 inwardly for heavier spring pressure or outwardly for lighter spring pressure.

Although but a single embodiment of the invention has been disclosed and described in detail, it is obvious that many modifications may be made in the size, shape, detail and arrangement of the various elements of the invention without departing from the spirit and scope thereof as defined by the appended claims.

I claim:

1. In a centrifugal control valve type governor, a housing having a pressure relief chamber therein, a shaft rotatable in said housing extending through said pressure relief chamber annularly grooved each side of said pressure relief chamber, the said housing having a fluid pressure inlet and a fluid pressure outlet therein each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a notch therein communicating with said valve bore and said pressure relief chamber, an unbalanced valve element including a spool slidably mounted in said valve bore having an annular passage therein and means spring loading said valve element to a position normally closing communication between said fluid pressure inlet and said pressure relief chamber, the said valve spool being movable against the spring loading thereof responsive to the rotation of said shaft whereby to close communication gradually between said fluid pressure outlet and said relief chamber and establish communication gradually between said fluid pressure inlet and the fluid pressure outlet as the speed of rotation of said shaft increases, the said annular passage in said valve spool overlapping the point of communication of said notch

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with said valve bore and the end of one of said diagonal shaft passages entering the valve bore in the said normally closed position of the valve element.

2. In a centrifugal control valve type governor, a housing having a pressure relief chamber therein, a shaft rotatable in said housing extending through said pressure relief chamber annularly grooved each side of said pressure relief chamber, the said housing having a fluid pressure inlet and a fluid pressure outlet therein each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a notch therein communicating with said valve bore and said pressure relief chamber, a valve spool slidably mounted in said valve bore having an annular passage therein including a flyweight at one end thereof and a spring at the other end thereof urging said valve spool to a normal position with the flyweight disposed against said shaft and closing communication between said fluid pressure inlet and said pressure relief chamber, the said valve spool being movable against said spring urge thereof responsive to the rotation of said shaft whereby to close communication between said fluid pressure outlet and said relief chamber gradually while simultaneously establishing communication between said inlet and said outlet as the speed of rotation of said shaft increases, the said annular passage in said valve spool overlapping the point of communication of said notch with said valve bore and the end of one of said diagonal shaft passages entering the valve bore in the said normally closed position of the valve spool.

3. In a centrifugal control valve type governor, a housing having a pressure relief chamber therein, a shaft rotatable in said housing extending through said pressure relief chamber annularly grooved above and below said pressure relief chamber and formed along a portion thereof below said lower annular groove to provide a fluid return passage between said shaft and said housing, the said housing having passages formed therein communicating between said pressure relief chamber, the said fluid return passage between said shaft and said housing, and a sump, the said housing having a fluid pressure inlet and a fluid pressure outlet therein each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a notch therein communicating with said valve bore and said pressure relief chamber, an unbalanced valve element including a spool slidably mounted in said valve bore having an annular passage therein and means spring loading said valve element to a position normally closing communication between said fluid pressure inlet and said pressure relief chamber, the said valve spool being movable against the spring loading thereof responsive to the rotation of said shaft whereby to close communication between said fluid pressure outlet and said relief chamber and simultaneously establish communication between said fluid pressure inlet and the fluid pressure outlet as the speed of rotation of said shaft increases, the said

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annular passage in said valve spool overlapping the point of communication of said notch with said valve bore and the end of one of said diagonal shaft passages entering the valve bore in the said normally closed position of the valve element.

4. In a centrifugal control valve type governor, a housing having a pressure relief chamber therein, a shaft rotatable in said housing extending through said pressure relief chamber annularly grooved above and below said pressure relief chamber and formed along a portion thereof below said lower annular groove to provide a fluid return passage around said shaft, the said housing having passages formed therein communicating between said pressure relief chamber, the said fluid return passage around said shaft and a sump, the said housing having a fluid pressure inlet and a fluid pressure outlet therein each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a notch therein communicating with said valve bore and said pressure relief chamber, a valve spool slidably mounted in said valve bore having an annular passage therein including a flyweight at one end thereof and a spring at the other end thereof urging said valve spool to a normal position with the flyweight disposed against said shaft and closing communication between said fluid pressure inlet and said pressure relief chamber, the said valve spool being movable against the spring urge thereof responsive to the rotation of said shaft whereby to close communication between said fluid pressure outlet and said relief chamber gradually while simultaneously establishing communication between said inlet and said outlet as the speed of rotation of said shaft increases, the said annular passage in said valve spool overlapping the point of communication of said notch with said valve bore and the end of one of said diagonal passages entering the valve bore in the said normal position of the valve spool.

5. In a centrifugal control valve type governor, a housing having a pressure relief chamber therein, a shaft rotatable in said housing extending through said pressure relief chamber annularly grooved each side of said pressure relief chamber, the said housing having a fluid pressure inlet and a fluid pressure outlet therein each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a notch therein communicating with said valve bore and said pressure relief chamber, a valve spool slidably mounted in said valve bore having an annular passage therein including a flyweight at one end thereof and a spring at the other end thereof urging said valve spool to a normal position with the flyweight disposed against said shaft closing communication between said fluid pressure inlet and said pressure relief chamber, the said valve spool having annular grooves therein along the portion nearest the weighted end thereof opposite the said pressure outlet passage, the said valve spool being movable against said spring urge responsive to the rotation of said shaft whereby

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to close communication between said fluid pressure outlet and said relief chamber gradually while simultaneously establishing communication between said inlet and said outlet as the speed of rotation of said shaft increases, the said annular passage in said valve spool overlapping the point of communication of said notch with said valve bore and the end of one of said diagonal passages entering the valve bore in the said normal position of the valve spool.

6. In a centrifugal control valve type governor, a housing having a pressure relief chamber therein, a shaft rotatable in said housing extending through said pressure relief chamber annularly grooved above and below said pressure relief chamber and formed along a portion thereof below said lower annular groove to provide a fluid return passage around said shaft, the said housing having passages formed therein communicating between said pressure relief chamber, the said fluid return passage around said shaft, and a sump, the said housing having a fluid pressure inlet and a fluid pressure outlet each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a passage therein communicating with said valve bore and said pressure relief chamber, a valve spool slidably mounted in said valve bore having an annular passage therein including a flyweight at one end thereof and a spring at the other end thereof urging said valve spool to a normal position with the flyweight disposed against said shaft closing communication between said fluid pressure inlet and said pressure relief chamber, the said valve spool having annular grooves therein along the portion nearest the weighted end thereof opposite the said pressure inlet passage, the said valve spool being movable against the spring urge thereof responsive to the rotation of said shaft to close communication between said fluid pressure outlet and said relief chamber gradually while simultaneously establishing communication between said inlet and said outlet as the speed of rotation of said shaft increases, the said annular passage in said valve spool overlapping the point of communication of said shaft passage with said valve bore and the end of one of said staggered diagonal passages entering the valve bore in the said normal position of the valve spool.

7. In a centrifugal control valve type governor for actuating servo mechanisms responsive to engine speeds comprising a housing having a bore therethrough and a pressure relief chamber therein communicating with said bore, the said housing also having an inlet passage from an engine developed source of fluid under pressure and a pressure outlet passage to a servo mechanism each communicating with said bore adjacent said pressure relief chamber, and a fluid return passage from said pressure relief chamber, an engine driven shaft extending through said bore annularly grooved opposite said inlet and outlet passages, the said shaft having a valve bore diametrically therethrough and diagonal passages communicating between each of said annular grooves and said valve bore entering said valve bore in longitudinal staggered relationship, the said shaft having a notch therein communicating with said valve bore and said pressure relief chamber, a valve spool slidably mount-

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ed through said shaft in said valve bore including a flyweight on one end thereof and spring means at the other end thereof resiliently maintaining the said valve spool in its normal position with said flyweight against said shaft, the said valve spool having an annular passage therein connecting the diagonal passage communicating with the pressure outlet passage and the shaft notch communicating with the pressure relief chamber when said valve spool is in its normal position, the said valve spool being slidable responsive to the speed of rotation of the shaft under restraint of said spring means whereby to gradually close communication between said pressure outlet passage and said pressure relief chamber and establish communication between said pressure inlet passage and said pressure outlet passage.

8. A centrifugal control valve comprising a housing having a shaft bore therethrough and a pressure relief chamber therein communicating with said shaft bore intermediate its ends, a shaft rotatable in said shaft bore extending through said pressure relief chamber annularly grooved each side of said pressure relief chamber, the said housing having an oil pressure inlet and an oil pressure outlet therein each communicating with one of said shaft grooves, the said shaft having a diametrically disposed valve bore therethrough opposite said relief chamber and diagonal passages therein communicating between each annular groove and said valve bore, the said shaft having a passage therein communicating with said valve bore and said pressure relief chamber, an unbalanced valve element including a valve spool slidably mounted in said valve bore having an annular passage therein providing communication between said pressure outlet and said pressure relief chamber when said spool is in its normal position, means biasing said spool to its normal position, the said valve spool being movable from its normal position responsive to the rotation of said shaft to close communication between said pressure outlet and said pressure relief chamber and establish communication between said pressure inlet and said pressure outlet gradually according to the speed at which said shaft is rotated, the said annular passage in said valve spool overlapping the point of communication of said shaft passage with said valve bore and the end of one of said diagonal passages communicating with the valve bore in the said normal position of the valve spool.

9. A centrifugal control valve according to claim 8 wherein the rotating shaft is vertically disposed and of less diameter than the shaft bore along a portion thereof below the lowermost annular groove therein forming an oil passage therealong between said shaft bore and said shaft, the said housing having passages formed therein communicating between said pressure relief chamber and said oil passage along said shaft and between said oil passage along said shaft and a sump, the said shaft having a spiral groove therearound extending from said oil passage along said shaft to said sump lubricating said shaft within the lower end of said housing and aiding in the return of oil from said pressure relief chamber to said sump.

10. A centrifugal governor valve comprising, in combination, a valve body constituted by a shaft adapted to be driven by a rotating agency in accordance with the rotational speed thereof, said shaft having a pair of spaced annular grooves thereon, a diametrically extending crossbore between the said annular grooves, a pair of diagonal

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passages communicating between each annular groove and the said valve bore and entering said valve bore in longitudinally staggered relationship and a notch in the periphery of the shaft communicating with said valve bore, and an unbalanced valve element including a valve spool slidably mounted in said valve bore and having an annular passage therein, means urging said valve element to a position normally closing communication between one of said diagonal passages and said notch, the said annular passage in said valve

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spool overlapping the point of communication of said notch with said valve bore and the end of one of said diagonal passages entering the valve bore in the said normally closed position of the valve element.

ARGYLE G. LAUTZENHISER.

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