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ENGINE CONTROL MECHANISM

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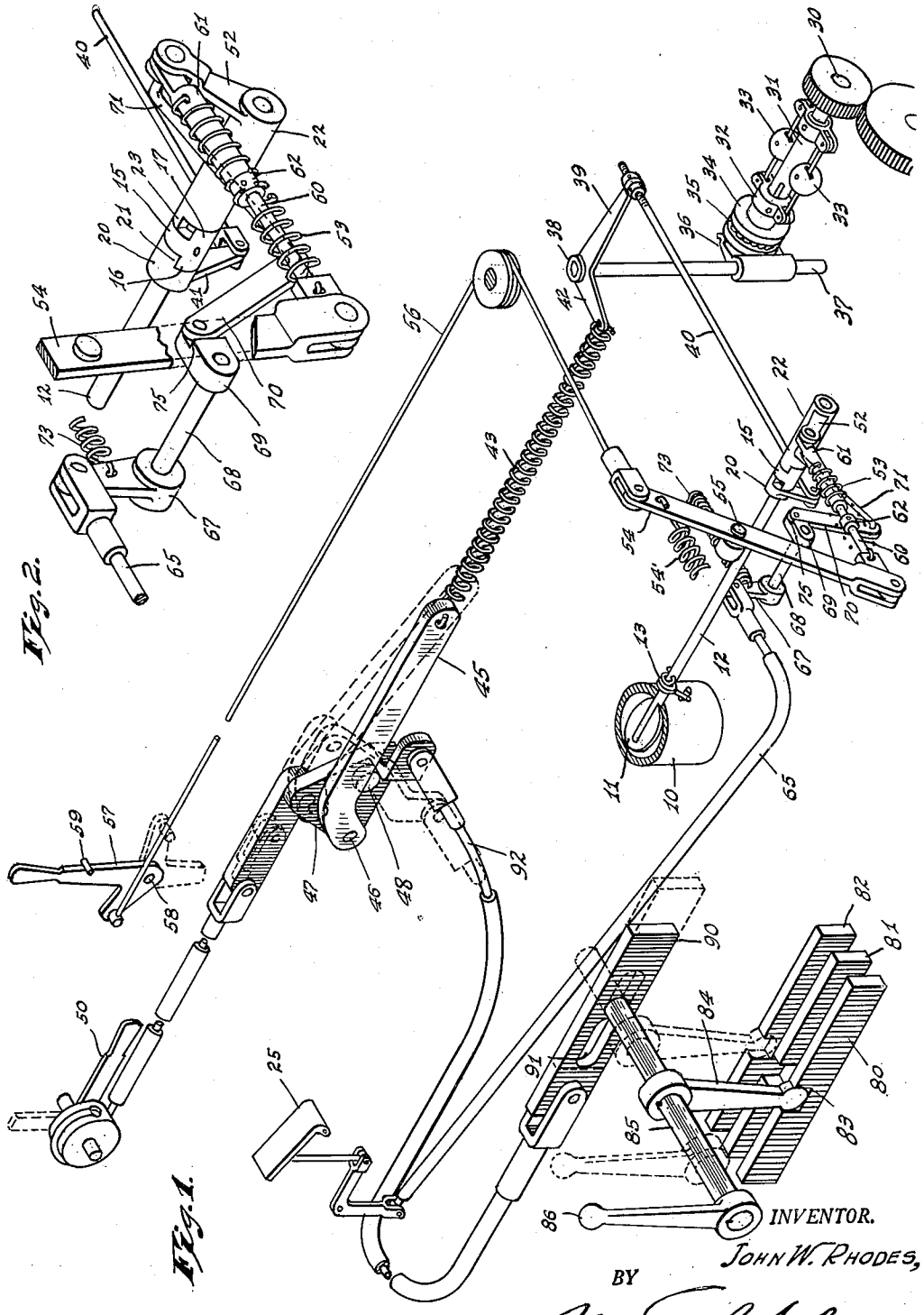


Fig. 2.

Fig. 1.

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ENGINE CONTROL MECHANISM

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2 Claims. (Cl. 123—98)

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This invention relates to an automatic means for controlling the speed of an internal combustion engine. Devices for automatically controlling the speed of an internal combustion engine commonly take either of two forms. One form, known as a speed governor, operates to limit engine speed to a predetermined maximum, permitting unrestricted variation of engine speed below that maximum. The other form of governing mechanism, commonly called a load governor, operates to maintain the associated engine in operation at a substantially constant speed irrespective of variations in the load to which the engine is subjected.

It is the object of this invention to provide for an internal combustion engine an automatic control capable of functioning alternatively as a speed governor or as a load governor. Another object of my invention is to adapt a single speed-responsive mechanism for operation as a speed governor, to impose a maximum-speed limitation on speed variations effected under manual control, or as a load governor, to control the supply of fuel to the engine co-ordinately with the load on the engine, whereby the engine may be caused to operate at a substantially constant speed even though the load to which it is subjected may vary.

In carrying out my invention, I employ manually operable means, such as an accelerator pedal, and speed-responsive means each adapted to control the throttling of the engine and thereby to control engine speed. I also provide mechanism for rendering the manually operable means inoperative to control engine throttling. The speed-responsive means is adjustable to vary the engine speed it maintains when the manually operable means is rendered inoperative and also to vary the extent of throttle-opening attainable by the manually operable means when the latter is operative. Preferably, the engine-throttle is biased toward open position and two independently operable means are provided for limiting the extent to which the throttle opens. One of the throttle-limiting means is operatively connected to mechanism responsive to engine-speed, while the other is connected to an accelerator pedal or other manually operable speed controlling member. The control mechanism further includes a device by which the second throttle-limiting means just referred to may be rendered inoperative to limit throttle-opening.

The accompanying drawing illustrates my invention:

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Fig. 1 is an isometric, somewhat diagrammatic, view of the complete mechanism showing the condition existing when the accelerator pedal is operative to move the throttle; and Fig. 2 is a fragmental view similar to Fig. 1, but on a larger scale, showing the condition existing when the accelerator pedal has been rendered inoperative to control the throttle.

In the mechanism illustrated in the drawing, it is contemplated that an explosive mixture will be supplied to the engine of the vehicle through a conduit 10 under the control of a throttle 11. The throttle 11 is mounted on a rock shaft 12 and is biased toward open position, or in a clockwise direction in the drawing, by a spring 13. Fixed upon the rock shaft 12 is a collar 15 having on its opposite ends abutments 16 and 17 presented in a clockwise direction. Rotatably mounted at one side of the collar 15 and co-axial with the shaft 12 is a swinging element 20 provided with an abutment 21 engageable with the abutment 16. On the opposite side of the collar 15 is a second swinging element 22 also co-axial with and rotatable relatively to the shaft 12 and provided with an abutment 23 engageable with the abutment 17 on the collar 15. In such an arrangement, the spring 13 will open the throttle 11 to the extent determined by that one of the swinging elements 20 and 22 whose abutment is first engaged by the co-operating abutment (16 or 17) on the collar 15. Either swinging element can close the throttle, but neither can open it beyond the throttle-position which the other swinging element would provide. Each swinging element may be swingable in a clockwise direction to a position in which its abutment will not interfere with complete opening movement of the throttle under control of the other element.

As will be brought out in greater detail hereinafter, one of the swinging elements, here shown as the element 20, is connected to adjustable governor mechanism responsive to engine speed, while the other is connected to a manually operable member such as the accelerator pedal 25. When the throttle is to be automatically controlled by the governor alone, the element 22 is taken out of control by the accelerator pedal and moved, or permitted to move, to its clockwise limit of movement by mechanism hereinafter described, so that the position of the throttle will thereafter be determined solely by the governor, and the speed of the engine will therefore be determined by the setting of the governor. When it is desired to regulate the

engine-speed manually, the element 22 is restored to control by the accelerator pedal. Thereafter, the element 22 can be swung throughout its entire range of movement by operation of the accelerator pedal. In this condition, the governor will operate to limit the maximum engine-speed attainable by operation of the accelerator pedal; for the element 20 remains connected to the governor, and its abutment 21 will limit throttle-opening movement of the collar 15 and shaft 12.

The speed-responsive governor mechanism employed to control the position of the element 20 may take any desired form. That shown in the drawing comprises a shaft 30 operatively connected to the engine so as to rotate at a speed proportionate to engine speed. Slidable upon the shaft 30, but rotatable therewith, is a sleeve 31 which projects through a collar 32 fixed both axially and rotatively relative to the shaft 30. Link mechanism including governor weights 33 interconnect the collar 32 with the sleeve 31 in such a way that as the weights 33 fly outwardly under the influence of centrifugal force the sleeve 31 will be moved rearwardly along the shaft 30. Beyond the collar 32, the sleeve 31 is provided with a flange or head 34 engaging one member of an anti-friction thrust bearing 35 the other member of which is engaged by an arm 36 fixed to and projecting laterally from a vertical shaft 37. Also fixed on the shaft 37 is a bell crank 38 one arm 39 of which is operably connected through a link 40 with an arm 41 projecting from the element 20 previously decribed. The other arm 42 of the bell crank 38 is connected to a tension spring 43 so arranged as to force the arm 36 on the shaft 37 against the thrust member 35 and thus oppose movement of the sleeve 31 under the influence of centrifugal force acting on the weights 33.

The arrangement of the parts just described is such that any increase in engine speed tends to swing the element 20 in a counter-clockwise direction in opposition to the force exerted by the spring 43. The position of the element 20 for any given engine speed may be controlled by regulating the tension of the spring 43. For this purpose, the spring 43 is connected to a link 45, and the link 45 is in turn pivotally connected, as by a bolt or pin 46, with a plate 47 mounted for swinging movement on a fixed pivot pin 48. To control the position of the plate 47, and thus to vary the tension in the spring 43, the plate is connected through any suitable mechanism with a swinging control lever 50, conveniently positioned so as to be readily accessible for operation by the driver of the vehicle. Associated with the control lever 50 is a friction brake (not shown) or other mechanism for retaining the lever fixed in any position of adjustment against the force exerted by the spring 43.

The governor mechanism operates alternatively either as an ordinary speed governor to provide a maximum engine speed or as a load governor to maintain the engine at a substantially constant speed, depending upon whether or not the element 22 is under control by the accelerator pedal 25. Thus, if the element 22 is being controlled by the accelerator pedal, it can be moved in a counter-clockwise direction to close the throttle 11 completely, or it can be moved in a clockwise direction to permit the throttle to open to any extent up to the maximum permitted by the position of the governor-

controlled element 20. If the element 22 is taken out of control by the accelerator pedal, the abutments 16 and 21, on the collar 15 and element 20 respectively, remain always in engagement with each other, and the throttle is under the sole control of the governor, which therefore operates to maintain the engine at a substantially constant speed determined by the setting of the control lever 50.

The means preferably employed for controlling the swinging element 22 includes a spring capable of biasing the element 22 in a counter-clockwise (throttle-closing) direction and mechanism including a lost-motion connection for interconnecting the element 22 with the accelerator pedal whereby the latter may be employed to swing the element 22 in a clockwise direction against the force of the spring. A manually operated device is provided for relieving spring-pressure on the element 22 and/or for swinging such element to the limit of its movement in a clockwise direction where it will not interfere with complete control of the element 20 (and the throttle) by the governor.

To accomplish the purposes just noted, the element 22 is provided with a rigid arm 52 operatively connected to a tension spring 53 which biases the element 22 in a counter-clockwise direction. The opposite end of the spring 53 is operatively connected to the lower end of a lever 54 pivotally supported at 55 from any convenient stationary support and swingable about its pivot to increase or relieve the force which the spring 53 exerts on the element 22. The lever 54 is conveniently biased in one direction, here shown as counter-clockwise, by a spring 54' and is arranged to be moved in the opposite direction by a cable 56 connected to a manually operated control lever 57. To retain the lever 54 in the position shown in Fig. 1 against the force exerted upon it by the spring 54' the control lever 57 may be mounted on a pivot 58 so positioned that as the lever 54 approaches the position of Fig. 1 the cable 56 will cross the axis of the pivot 58, whereby tension in the cable will thereafter hold the lever 57 against a suitably positioned stop pin 59.

In the position of the lever 54 shown in Fig. 1, which is the position occupied when the throttle 11 is to be controlled by the pedal 25, the spring 53 exerts on the element 22 a torque great enough to overcome the torque of the spring 13, thereby tending to close the throttle 11. When it is desired to operate the engine under sole control by the governor, the lever 57 is released and the spring 54' swings the lever 54 in a counter-clockwise direction to the limit of movement permitted by the lever 57, or to the position shown in Fig. 2, and thus relieves tension in the spring 53. The extent to which counter-clockwise movement of the lever 54 relieves tension in the spring 53 may or may not be great enough to prevent the spring 53 from effectively opposing the spring 13.

If in the position of Fig. 2 the spring 53 is capable of overcoming the spring 13, and desirably in any event, I provide means for positively moving the element 22 to the clockwise limit of its movement whenever the engine speed is to be controlled by the governor. To this end, the arm 52 and the lower end of the lever 54 may be interconnected by an extensible link comprising inner and outer telescoping parts 60 and 61 and an abutment collar 62 which is fixed on the inner part 60 and engages the end of the outer part 61 to limit the minimum effective length of the link.

In counter-clockwise movement of the lever 54 to the position of Fig. 2, the collar 62 engages the outer telescoping link-part 61 and positively forces the element 22 in a clockwise direction into a position such that its abutment 23 will not interfere with throttle-opening movement of the collar 15 under control by the governor-actuated element 20.

In the condition illustrated in Fig. 1, the element 22, if moved in a clockwise direction against the force exerted on it by the spring 53, would permit throttle-opening movement of the collar 15 and throttle-shaft 12 under the influence of the spring 13. Such clockwise movement of the element 22 may be effected under the control of the accelerator pedal 25 by the mechanism now to be described.

The accelerator pedal 25 is operatively connected by any convenient means 65 with an arm 67 rigid with a rock shaft 68. The latter is provided with a second rigid arm 69 connected through a lost-motion connection with the arm 52 on the element 22. Conveniently, this connection is effected by a pair of pivotally interconnected links 70 and 71, the former of which is pivoted to an eccentric point on the arm 69 and the latter of which is pivoted to the arm 52. The lost-motion in this connection is provided by relative movement of the link 70 and arm 69, such lost-motion being limited by an abutment 75 provided on the arm 69 in position to engage the link 70 and limit its clockwise movement under the influence of the spring 53.

When the lever 54 is in the position shown in Fig. 1, the spring 53 acts to hold the link 70 at all times against the abutment 75 so that such link acts as an extension of the arm 69 connected to the arm 52 of the element 22 by the link 71. In consequence, the position of the element 22, and hence the position of the throttle, will be controlled by the shaft 68. However, because of the lost-motion between the arm 69 and link 70, the element 22 can at any time be moved to the clockwise limit of its movement by the arm 54 and link 60—61 without affecting the shaft 68.

If desired, a spring 73 may be employed to urge the shaft 68 in a clockwise direction and the accelerator pedal 25 upwardly.

The particular speed-controlling mechanism illustrated in the drawing has associated with it a device for co-ordinating the possible adjustments of the speed-responsive mechanism with the setting of a change-speed transmission mechanism embodied in an automotive vehicle. Such a change-speed transmission mechanism may embody a set of shift rods 80, 81, and 82 operatively connected in known manner with sliding gears of the transmission. Each of such shift rods is provided with a notch 83 for the reception of the outer end of an arm 84 fixed to an axially slidable rock-shaft 85. For the purpose of moving the shaft 85, there is also fixed to it an arm 86 adapted for connection to the conventional gear-shift lever (not shown) by which the shaft 85 can be moved axially of itself to bring the arm 84 into operative association with any of the shift rods and then rocked to move such shift rod in either direction.

The means shown for co-ordinating the speed-responsive mechanism with the setting of the transmission comprises a sliding plate 90 having a slot 91 which can, by movement of the plate 90, be positioned either in alignment with or out of alignment with the shaft 85, the plate 90 being so positioned with respect to the rock shaft 85

that when the slot 91 is out of alignment with the shaft the latter cannot be moved into the dotted-line position shown to bring the arm 84 into association with the shift rod 82 which operates the transmission to provide relatively low-speed gear ratios. The plate 90 is connected, as through the Bowden wire 92, with the pivoted plate 47 of the governor-control mechanism, the arrangement being such that the slot 91 will be brought into alignment with the shaft 85 only when the governor-controlling mechanism is set to insure relatively low engine-speeds.

The means just described for co-ordinating the adjustment of the speed-responsive mechanism with the change-speed mechanism operates to prevent the transmission from being adjusted to provide a low-speed gear ratio when the speed-responsive mechanism is adjusted to permit high engine-speeds, and also to prevent the speed-responsive mechanism from being adjusted to provide high engine-speeds when the transmission is set to provide low-speed gear ratios. The interlock or co-ordinating mechanism is described herein merely for the sake of completeness, as it forms no part of the present invention and is more fully set forth and described in my co-pending application Serial No. 514,743, filed December 18, 1943, (now U. S. Patent No. 2,443,084, granted June 8, 1948) of which prior application the present one is a division.

In the operation of a vehicle embodying my invention the engine speed can be controlled as desired either by the accelerator pedal 25 or by the governor-control lever 50. If control by the accelerator pedal is desired, the lever 57 is put in the full-line position of Fig. 1, thus placing the lever 54 and the parts associated with it in the condition shown in Fig. 1 and rendering the throttle subject to control by the accelerator pedal as above set forth. If control of engine speed through the governor mechanism is desired, the control lever 57 is put in the dotted-line position of Fig. 1, thus placing the lever 54 in the position shown in Fig. 2. Thereafter, the throttle will be under control by the governor mechanism alone, and engine speed can be varied as desired by moving the governor-control lever 50 in a clockwise direction to increase engine speed and in the opposite direction to reduce it.

Ordinarily, control of engine speed through the governor mechanism will be employed only when the vehicle is to operate for an appreciable interval at substantially constant speed. Because of the nature of the governor mechanism, the response of the engine to changes in adjustment of the governor-control lever 50 are necessarily somewhat sluggish. For that reason, as well as because frequent speed changes are more easily effected by the foot-operated pedal 25 than by the hand-operated lever 50, the operator will usually prefer pedal control when driving along a highway or in other situations where speed-changes are more or less frequent. On the other hand, where a substantially constant vehicle speed is desired, the throttle can be placed under control by the governor and the lever 50 set to maintain that speed, thus leaving the operator free to devote his attention to other matters.

While I have illustrated and described my invention as embodied in association with an engine the speed of which is controlled by regulating the rate of mixture-supply, my invention is not limited to engines and speed-controlling devices of that particular type. It is therefore to be noted that with obvious modifications the in-

vention can be adapted to internal combustion engines of types other than that in which engine speed is controlled by a throttle in a mixture-supply conduit.

I claim as my invention:

1. In combination with an internal combustion engine having a throttle, means biasing said throttle toward open position, a pair of elements associated with said throttle and independently movable to limit the extent to which said means opens the throttle, speed-governing mechanism responsive to engine-speed and operatively connected to the first of said elements, said governing means including a control member adjustable to vary the position of said first element for any given engine speed, means biasing the second of said elements in a direction to close said throttle and effective to overcome the throttle-opening effort of said first-named biasing means, a manually operable member operatively connected to the second of said elements through a lost-motion connection and operable to move said second element in a throttle-opening direction against the effort exerted by said last named biasing means, and mechanism for relieving the throttle-closing effort exerted on said second element by said last named biasing means.

2. In combination with an internal combustion engine having a throttle, means biasing said throttle toward open position, a pair of elements associated with said throttle and independently

movable to limit the extent to which said means opens the throttle, speed-governing mechanism responsive to engine-speed and operatively connected to the first of said elements, said governing means including a control member adjustable to vary the position of said first element for any given engine speed, means biasing the second of said elements in a direction to close said throttle and effective to overcome the throttle-opening effort of said first named biasing means, a manually operable member operatively connected to the second of said elements through a lost-motion connection and operable to move said second element in a throttle-opening direction against the effort exerted by said last named biasing means, and mechanism operable independently of said control member for relieving the throttle-closing effort exerted on said second element by said last named biasing means.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,932,802	Pierce et al.	Oct. 31, 1933
2,108,970	McKinney	Feb. 22, 1938
2,224,600	Howard	Dec. 10, 1940