

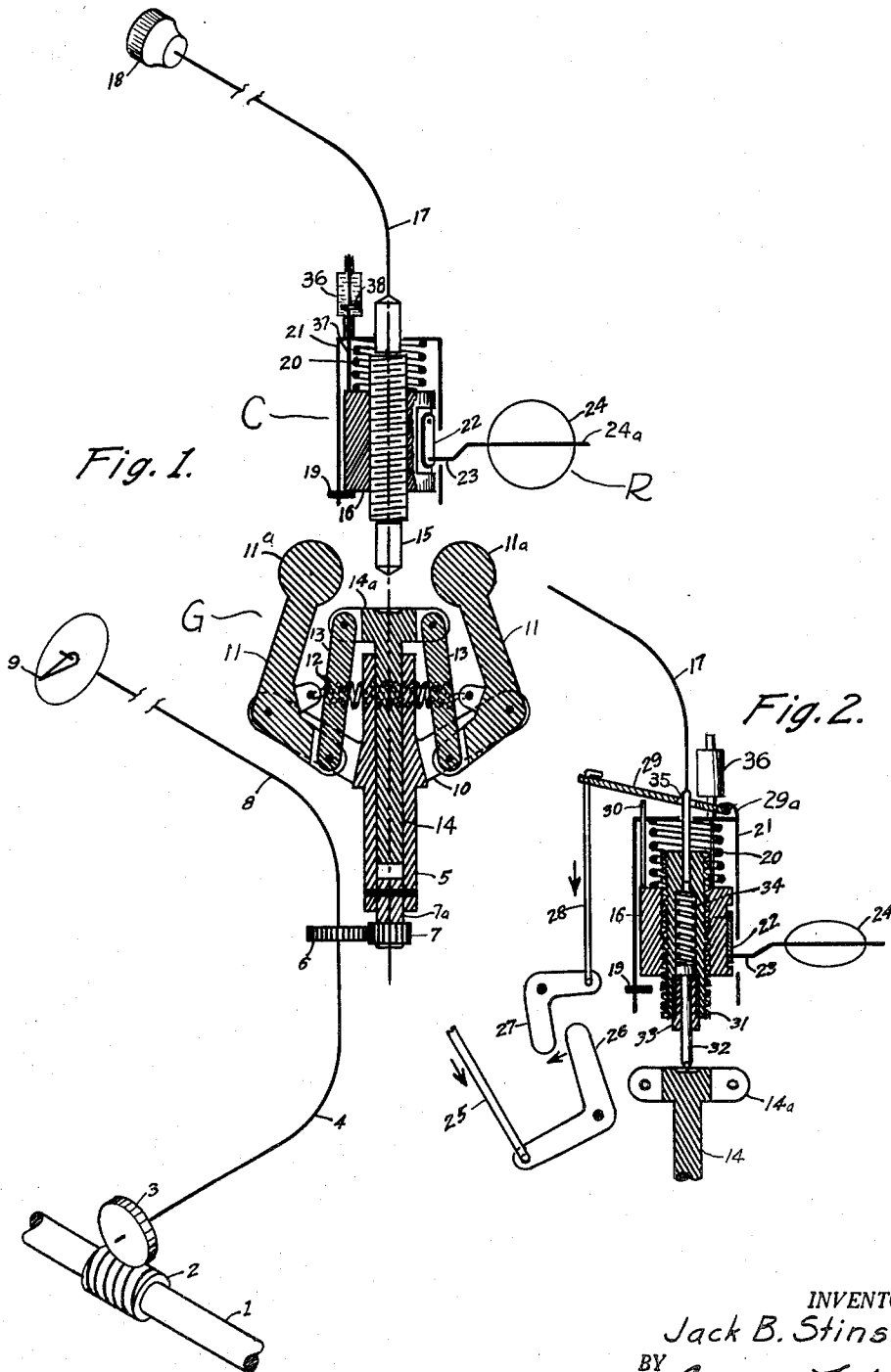
Sept. 22, 1953

J. B. STINSON
SPEED CONTROL SYSTEM

2,653,020

Filed Feb. 16, 1949

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

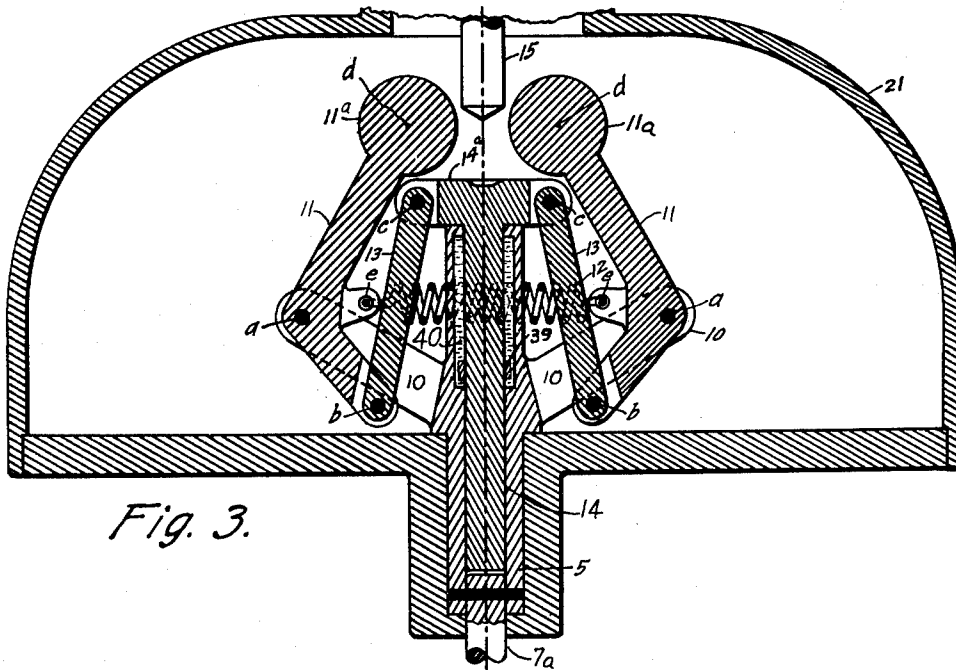


Fig. 3.

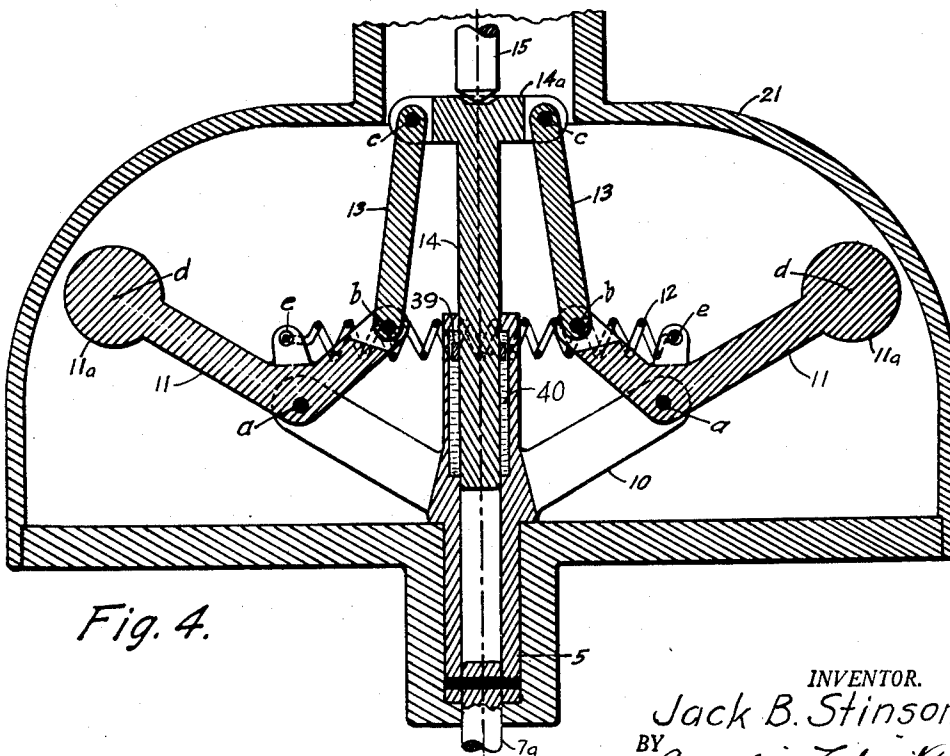


Fig. 4.

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3 Sheets-Sheet 3

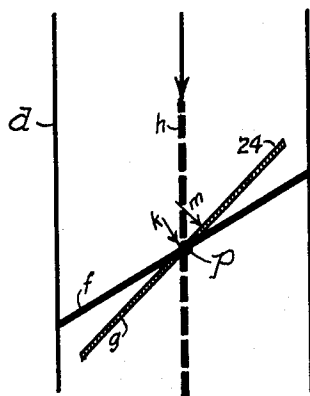


Fig. 5.

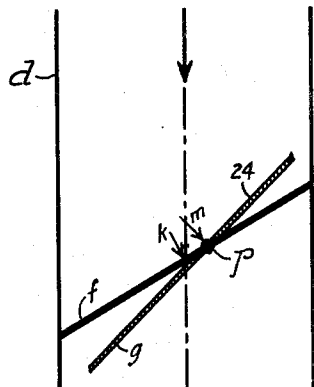


Fig. 6.

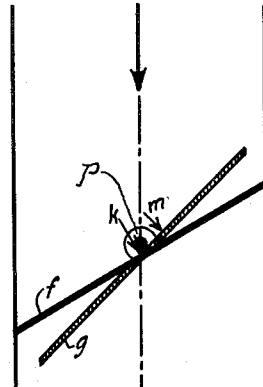


Fig. 7.

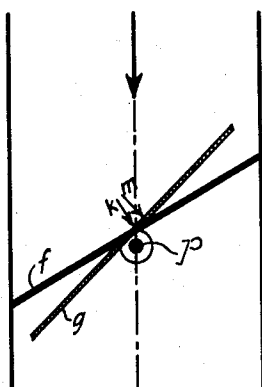


Fig. 8.

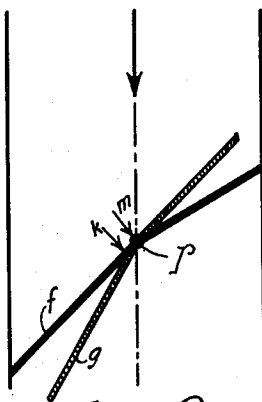


Fig. 9.

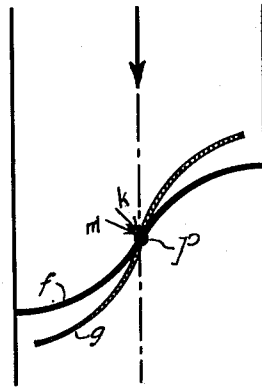


Fig. 10.

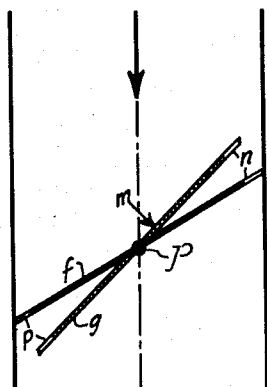


Fig. 11.

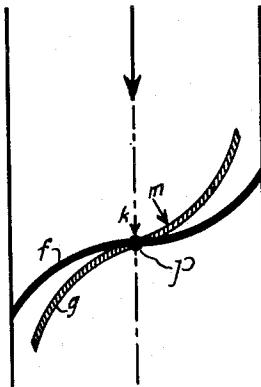


Fig. 12.

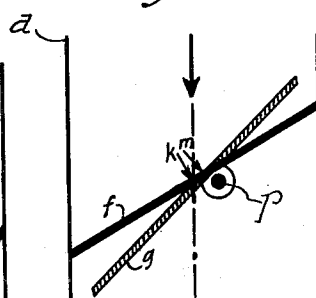


Fig. 13.

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UNITED STATES PATENT OFFICE

2,653,020

SPEED CONTROL SYSTEM

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Application February 16, 1949, Serial No. 76,841

12 Claims. (Cl. 264—3)

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This invention relates to speed control systems and while adapted for general application is primarily intended for use in the control of selected maximum speed of motor vehicles.

In the preferred form of the system of this invention, a regulator, preferably a butterfly valve of novel construction, is positioned in the induction system between the carburetor and the intake manifold of the engine. This valve is connected to a controller so constituted as normally to hold the valve in a fully opened position. The controller has a threaded post which, when axially moved, serves to impart rotation to the valve to move the latter from opened to closed position and vice versa. This post is spring biased normally to hold the valve in its fully opened position. Mounted in normally spaced coaxial relation with said post is a ball governor of novel construction. It embodies a rotor having appropriate mechanical connections to e. g., the drive shaft of the vehicle to be rotated in timed relation therewith. The rotor carries weighted bell cranks having link connections with a spindle axially aligned with the post of the controller. One or more springs, arranged in a novel manner across the bell cranks, normally hold this spindle in retracted spaced relation to the post, but, as the speed of the vehicle increases and approaches the predetermined maximum, the spindle is projected or extended toward and engages with the post and shifts it axially in a direction to close or partially close the regulator valve and thus so regulates the flow of carbureted fuel to the engine as to limit the speed of the vehicle to the predetermined maximum.

A novel feature of this invention resides in the fact that the post is axially adjustable and this adjustment is preferably accomplished from the dash board of the vehicle, so that the maximum speed to which the vehicle is susceptible may be manually controlled and selected at the will of the driver.

Another novel feature of the invention consists in the provision of overriding means whereby, in the event of emergency when higher speeds are desired or essential to safety, the system may be instantly conditioned to permit of such operation of the vehicle.

Another feature of the invention consists in the utilization of dash pots or other damping devices which serve the purpose of steadying the operations of the governor and controller, so as to eliminate fluttering of the regulator valve with consequent bucking or power surging of the associated engine.

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Another feature of the invention resides in the utilization of novel forms of regulator valve, whereby this valve is adapted for more efficient balanced conditions with respect to the controller. Through the use of butterfly valves of the type hereinafter more fully described, I am able to place the center of pressure of a fluid medium passing the valve at an optimum position with respect to the axis of pivotal movement of such valve.

Features of the invention, other than those adverted to, will be apparent from the hereinafter detailed description and appended claims, when read in conjunction with the accompanying drawings.

The accompanying drawings illustrate different practical embodiments of the invention, but the constructions therein shown are to be understood as illustrative, only, and not as defining the limits of the invention.

Fig. 1 is a general and largely schematic view of the system as a whole, with certain of the operating parts shown in section.

Fig. 2 shows an alternative design of the speed adjustment mechanism with means for overriding the normal control.

Fig. 3 is a central sectional view of the centrifugal governor in the position of rest.

Fig. 4 is a like view of said governor in a position of considerable rotational speed.

Figs. 5-11, inclusive, show various forms of the regulating valve in longitudinal section.

Fig. 5 shows conventional valve design.

Fig. 6 shows a valve with an eccentrically positioned shaft.

Fig. 7 shows a valve with the blade plane offset on the shaft in the direction of the fuel mixture flow.

Fig. 8 shows a valve with the blade plane offset in the opposite direction.

Fig. 9 shows a valve with the blade bent angularly at the shaft.

Fig. 10 shows a valve with the blade curved to ogee form.

Fig. 11 shows a valve with openings in the marginal portion of the blade.

Fig. 12 shows another form of ogee blade.

Fig. 13 shows the blade mounted with the axis of its tilting movement exterior of or displaced from the axis of the duct and spaced from the plane of the blade.

In the schematic Fig. 1 of the drawings, the car drive shaft 1 has a worm or other gear 2, driving a worm pinion or other gear 3 having an attached flexible shaft 4. This flexible shaft drives the rotor 5 of a centrifugal governor at a

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rotational speed proportional to the speed of the drive shaft and therefore of the car itself. Fixed on the flexible shaft 4 is the gear 6, to which is attached the flexible shaft 8 driving a speedometer 9 at the same speed and sense as when ordinarily attached to gear 3. Gear 6 meshes with gear 7 fixed on and driving the governor rotor 5. The governor speed may be made greater or less than the speedometer speed as desired, by a mere change in the ratio of gears 6 and 7.

Though other types of centrifugal governors may be used, the type here shown is preferred. Here, its rotor is shown as having radial arms 10 to which bell cranks 11 are pivotally attached. One arm of each bell crank is weighted at 11a and between these arms are stretched tension springs 12 resisting the outward movement of their weighted ends. Rotation of the rotor at increasing speeds, however, causes progressive outward movement of the weights 11a as the centrifugal force increases.

The bell cranks are connected by links 13 to the head 14a of a spindle 14 which is coaxial with rotor 5. This spindle rotates with the rotor and is moved axially upward by the outward movement of the weights 11a.

The system of the present invention embodies, generally speaking, a governor designated generally by the reference character G, a controller C and a regulator R. This general combination is schematically illustrated in Fig. 1 wherein the drive shaft of a motor vehicle, indicated at 1, is geared to a flexible shaft 4 through any suitable gearing such as worm 2 and worm wheel 3. The flexible shaft carries a gear 6 meshing with a pinion 7 fixed on a stub shaft 7a which is pinned to the rotor 5 of the governor. The flexible shaft 4 is connected beyond the gear 6 to a flexible shaft 8 which leads to and operates a speedometer of any conventional kind. The gearing ratios to which I have referred may be any desired to drive the speedometer 9 and the rotor 5 in proper timed relation and at convenient speeds. As shown in Fig. 1, the rotor has radial arms 10 to which are pivoted bell cranks 11, the power arms of which are provided with weights 11a at their outer ends. The work arms of these bell cranks are connected by links 13 to the head 14a of a spindle 14. This spindle is coaxial with and extends downwardly through the rotor which is made tubular for its reception and said spindle is rotatable with the rotor but axially movable therein. When at rest, the bell cranks are normally held in the position shown in Fig. 1 with their weights spaced the minimum distance apart by one or more springs 12. When in this position, the spindle 14 occupies the fully retracted position shown. As the drive shaft 1 rotates and actuates the rotor 5, the weighted ends of the bell cranks move outwardly under centrifugal force and inwardly under spring tension, according to the speed imparted to the rotor from said shaft, and the spindle 14 is correspondingly raised and lowered with respect to the rotor in accordance with the varying speeds.

The controller C is positioned above and substantially coaxial of and spaced from the governor. It embodies a suitable housing 21 in which a carrier 16 is mounted for vertical axial movement. This carrier is normally held in this depressed position against a stop 19 by a spring 20. A threaded post 15 extends axially through the carrier and has threaded engagement therewith, so that through rotation of the post, it

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may be adjusted axially with respect to the carrier to position the lower end of such post closer to or further away from the head 14a of the spindle. It is through this adjustment that the maximum driving speed of a vehicle is adjusted as hereinafter more fully explained. The adjustment of this post is effected by means of a flexible shaft 17 which extends to the instrument board of the vehicle and is there provided with a knob or other suitable manually operable member 18, whereby the driver of the vehicle may effect this adjustment at will. In some instances in practice, it may be desired to lock this member 18 against operation by the driver. If so, appropriate locking means may be provided for this purpose.

The regulator R shown in Fig. 1 is, in the form of the invention illustrated, a butterfly valve 24. It is mounted within the duct leading from the carburetor to the intake manifold of the engine of the vehicle.

In the embodiment of the invention shown for illustration, the arrangement is appropriate to a down draft carburetor, although the invention is not limited to such use. In any event, however, the regulator is operatively connected to the carrier 16. As illustrated, the butterfly valve 24 is mounted on a pivot pin 24a which has an offset crank 23 connected to the lower end of the link 22, the upper edge of said link being pivotally connected to the carrier. This linkage permits the carrier to move axially and to impart tilting movement to the butterfly valve in accordance with the magnitude of such movement, the side of the housing 21 being cut away to allow of oscillation of the crank 23.

The operation of the system as thus far described will be apparent from the description already advanced, but may be briefly described as follows.

When the vehicle is at rest, the parts will occupy the relative positions shown in Fig. 1. As the vehicle starts to move and the shaft 1 rotates, rotation is imparted to the rotor 5. At this time there will be considerable gap spacing between the lower end of the post 15 and the head 14a of the spindle and the size of the gap will govern the ultimate speed of the vehicle, for in order to close this gap the speed of the vehicle will have to be sufficient to throw the weights 11a outwardly far enough to lift the spindle 14a into contact with the post 15. At all lesser speeds than its maximum speed, a gap will exist between the post and head and the controller will be inactive. However, as the vehicle gains speed, there will come a time and speed at which the head 14a will engage with the post 15 and any further appreciable increase in speed will cause the post to be lifted against the tension of the spring 20. This lifting movement of the post will correspondingly move the carrier 16 and in so doing will effect tilting movement of the butterfly valve 24. This valve is so set that, when the carrier is in its lowermost position against the stop 19, the valve 24 will be substantially fully opened. However, as the carrier is raised in the manner described, it will operate upon the valve through the crank 23 to effect a tilting of the valve toward closed position to an extent proportional to the increase in speed. The parts are preferably so adjusted that by the time the vehicle reaches the predetermined maximum speed, the valve 24 will have closed to a point where the feed of carbureted motive fuel to the engine will be cut off sufficiently to preclude any

greater speed of the engine notwithstanding the accelerator of the motor vehicle is further advanced. It will thus be apparent that the maximum speed to which the engine is susceptible depends upon the adjustment of the threaded post 15 and consequently a pre-setting of this maximum speed may be brought about by proper manual manipulation of the knob 13 to adjust the post appropriately for such speed.

It will of course be understood that the effect of the controller C upon the regulator R will only prevail to withhold the speed of the engine so long as the engine tends to operate at a speed beyond the maximum speed, for as soon as the speed decreases to any appreciable degree below the predetermined maximum, the governor G will retract the spindle 14 leaving a gap between its head 14a and the post, whereupon the spring 29 will return the regulator to its fully opened position.

There are times in the operation of a motor vehicle when it may be desired, in the interest of safety, to override the maximum speed setting of this system and the present invention provides for such emergency by the employment of a mechanism, such as shown, for example, in Fig. 2. Here the accelerator rod 25 which is conventionally secured to the car carburetor is connected to a lever 26. For normal driving this lever controls the carburetor in the usual manner, but where a sudden burst of speed is desired, the work arm of this lever may be brought into contact with a second lever 27 by pushing the accelerator forwardly considerably beyond that of normal driving. The lever 27, when thus engaged and operated, serves to impart tension to a link 28 connected to a lever 29 pivoted to a fixed lug 29a on the top of the housing 21. When tension is applied to the link 28 and the lever 29 thus depressed, it is adapted to engage with a pin 30 engaging the carrier 16 and bodily forces said carrier 16 downwardly to effect a quick opening of the valve 24. At such times the head 14a of the spindle will of course be in contact with a threaded post, corresponding to post 15 of Fig. 1. The post construction employed in the construction of Fig. 2 is so constituted as to permit the downward movement of the carrier without necessitating retraction of the governor arms. This is accomplished in the following manner.

An adjusting screw 31 is threaded through the carrier 16. This screw is counterbored to hold the spring 34 which presses downward upon a plunger 32 adapted to slide in a tubular holding sleeve 33 screwed into the lower end of the member 31. The spring 34 is given a compression greater than that of the spring 29, so that when the spindle 14 presses the plunger 32 upwardly, the spring 29 will yield and not the spring 34 and thus cause the carrier to move upwardly under normal operation to effect the closing of the valve 24. However, when the accelerator rod 25 is pushed forwardly sufficiently to depress the carrier 16, the spring 34 will permit the carrier to descend without necessarily changing the position of the governor parts and thus the butterfly valve 24 may be opened, while the spindle head 14a is still pressing upwardly against the plunger 32. The interposition of these yieldable elements will not, however, affect the normal adjustment of the controller for the aforesaid adjusting shaft 17 is connected to a rod 35 which is splined, slotted or otherwise shaped to fit into a mating hole in the adjusting member 31 and thus permit

relative sliding movement between them while precluding relative rotation.

For reasons hereinafter more fully explained, I have found it desirable to damp or steady the operations of the carrier 16 in both the structures of Figs. 1 and 2 by associating with the carrier a dash pot in the form of a cylinder 36 carried by the housing 21 and having therein a loose fitting piston 38 connected by a piston rod 37 to the carrier. This dash pot may be either pneumatic or hydraulic in character, but I prefer to fill the cylinder 36 with oil or some other liquid and fit the piston 38 with sufficient clearance to permit the oil to by-pass the piston as the piston moves axially of the cylinder. This operation produces a very nice damping effect which does not seriously interfere with the movement of the carrier, but rather steadies such movement and damps any tendency of the carrier to vibrate or fluctuate.

The preferred form of governor which I find to be particularly efficient in carrying out its functions in the present system is shown in detail in Figs. 3 and 4. The several pivots which enter into the construction of the governor are indicated by the reference characters a, b and c, the center of gravity of each weight by the reference character d and the points of spring attachment by the reference character e. Each bell crank 11 is mounted for oscillation on its pivot a on one of the arms 10 of the rotor and is biased against outward centrifugal tilting by one or more tension springs 12 attached at the points e of the corresponding arms. From the pivot a the power arm of the bell crank extends to the weight 11a, while the work arm carries the pivot b to which a link 13 is attached. These several points of pivoting and attachment are located in such relation, as to result in certain advantageous relative movements of the several parts. It is in general desirable to have the same relative sensitivity of control at high speeds as at low speeds, but the centrifugal force increases as the square of the linear velocity of the center of gravity d and inversely as the radial distance of d from the axis of governor rotation. Linear velocity increases directly both with that radial distance and the car speed. In consequence, the centrifugal force varies directly as that radial distance and as the square of the car speed. The mechanism is, however, so designed as largely to offset the resulting sensitivity decrease by several means.

First, the spring attachment points are set well inward of and substantially in line with the weight pivots a when the governor is at rest or slowly rotating as in Fig. 3. In other words, the spring is anchored at its opposite ends to the bell cranks at points in spaced relation to the pivots of said bell cranks, which points are in substantially the cross-axial plane of said pivots when the bell cranks are in position of rest. Unit increments of angular tilting will then result in very slight horizontal increments of spring extension. When, however, the governor is rotating rapidly and the weights are tilted outward considerably, as in Fig. 4, the points e are so placed relative to the pivots a that a unit increment of angular tilt causes a large horizontal increment of spring extension. As a result, the much greater centrifugal force at the higher governor speeds is in part counteracted by increasing increments of spring extension.

Second, the weight pivot a is placed well outward from the axis of governor rotation, so that

increase of distance of the center of gravity d from that axis is relatively small with increase of tilt of the weight. This factor of increase in centrifugal force is therefore kept smaller at higher car speeds, again somewhat counteracting the relatively high centrifugal force at those speeds.

Third, that same placing of the weight pivot a well outward of the axis of rotation also permits tilting of the weight through a very wide angle, from an inward tilt position as in Fig. 3 to the substantially horizontal position being approached in Fig. 4. As this latter position is being approached, the horizontal component of the angular motion is progressively reduced. As the centrifugal force applies horizontally, this means that there is a progressive reduction in mechanical effectiveness in producing angular motion as car speed increases, another factor tending to counteract excessive centrifugal force at higher speeds.

These several compensating devices of course combine their effects in the operation of the governor, and can be so adjusted relatively as to secure a roughly uniform sensitivity of control throughout the entire range of car and governor speeds.

The construction shown combines swing of the weights through a wide vertical angle with a linkage permitting a long thrust stroke of the spindle 14. This means possible control over a very wide range of car speeds. In contrast, use of an ordinary governor, lacking such long thrust stroke, would limit control to a narrow speed range and would require change of the resisting spring to shift from one narrow range to another. This obviously would have to be done by opening the control unit and would prevent instant and handy change of maximum speed settings from the instrument board over the wide range of speeds demanded in practice.

Note that the opposite weights 11a pull against each other through the springs 12. In case of any dynamic imbalance between them, the stronger powered weight would pull the other inwards, while itself moving outwards, thereby aggravating the imbalance by increasing its own and decreasing the opposing centrifugal force. However, this is entirely prevented by the construction shown, for all the weights 11a are interconnected through the common spindle 14 at the pivots c and must needs act together, the imbalances checking each other through that mechanical interconnection. They are therefore prevented from taking initial effect to produce aggravated imbalances and therefore result in only minor strains within the mechanism as a whole.

In the series of diagrammatic Figs. 5 to 13, inclusive, are shown regulator valves of the butterfly type placed in a duct leading from the carburetor to the intake manifold. Each figure shows the valve blade 24 and its shaft or pin p in cross section and the throat or duct d in longitudinal section. Vertical arrows show the direction of flow of the fuel mixture. The valve blade is shown in closed position by f , in partially opened position by g , and in fully opened position (in Fig. 5 only) by h .

In the fully opened position h , the conventional design of valve (Fig. 5) operates satisfactorily, there being a minimum of resistance to fuel flow and that resistance balanced. But the ordinary valve is not conducive to best results in the critical positions f and g for use in my car speed control device. With valve position f , fully closed, 75

there is no fuel flow and the pressure on the blade is static and therefore balanced at the neutral point k on the shaft axis. However, with valve position g , partially opened, there is fuel flow over and past the blade, producing dynamic pressures with the center of pressure not at the point k , but shifting with the angle of the blade to the fuel flow direction and tending towards the leading edge of the blade 24, as at point m . The net effect is to produce a closing moment in the partially open position and sudden release of that closing moment at the instant of complete closing. This sudden change of moments thereupon modifies the balance of pressures between spring 20 and the governor piston 14 which actuate the valve closing and opening, causing alternate closing and opening of the valve and a consequent surging of power and car speed.

Fortunately, such complete closing of the valve and consequent center of pressure and moment shifting and tendency to power surging, seldom occurs unless the car is running downhill, with the engine being used as brake. Then high governor speed may occur with the power shut off and the balancing of control pressure may occur at the closed position instead of a partially open position of the valve.

A further, more general and more usual cause of power surging is the fluctuation of the valve due to unavoidable backlash in the mechanism between the governor spindle 14 and the valve 24. Such backlash can be prevented only by maintaining all pressures within the mechanism in one direction against the pressure of the piston 14. The spring 20 is one source of such pressure, in the required direction. The moments on the valve 24 (shown at k and m in Fig. 5) are another source of pressures. The dynamic moment m is, however, in the wrong direction, tending to close rather than open the valve. The static moment k is in this case neutral. To avoid backlash, these moments must always tend to open the valve 24 against the pressure of the spindle 14 tending to close it.

At first thought it would appear that the spring 20 which acts upon the carrier might be made sufficiently strong to bias the valve for opening movement under all conditions, but experience has shown that, when a sufficiently heavy spring is employed to accomplish this result, the compression thereof is so great as to overcome power transmitted from the governor at relatively low car speeds and thus interfere with the effective control desired. The present invention provides simple and efficient means whereby a more delicate and adequate control may be accomplished. I have been able to obtain this result by novel butterfly valve constructions next to be described.

Figs. 6 to 13, inclusive, show various valve blades designed to shift the centers of pressure m and k to produce opening moments, and so prevent the power and speed surging. In Fig. 6, the valve shaft is shifted eccentrically of the centerline of the valve throat, with less of the valve blade towards its leading edge and more towards its trailing edge. In position f , the static center k gives an opening moment. In position g , the dynamic center of pressure m is shown at the neutral position opposite the shaft axis, but by increasing the eccentricity of the valve shaft, this center of pressure may be positioned to give an opening moment as required.

In Fig. 7, the plane of the blade is offset in the direction of fuel flow from the axis of shaft rota-

tion. The static center k gives an opening moment, but the dynamic center of pressure m produces a strong closing moment, contrary to need.

In Fig. 8, the plane of the blade is offset from the axis of the shaft, but in the opposite direction. The static center k now produces a slight closing moment, which is not desired. The dynamic center of pressure m also produces an undesired closing moment, but weaker than in the case shown in Fig. 5.

In Fig. 9, the valve blade is angularly bent at the shaft axis of rotation, with less of the blade towards the leading edge and more towards the trailing edge. The static center k gives an opening moment as desired. The dynamic center of pressure m is shown at the neutral position opposite the axis of rotation, but by increasing the angle of bending, can be shifted to give an opening moment as required.

In Fig. 10, the blade is curved to ogee form, with the convexities towards the centerline of the valve throat. The static center k is at the neutral position, giving no moment. The dynamic center of pressure m , according to the theory of airfoils, tends to shift towards the trailing edge of the blade as the angle to the flow increases. By suitable combination of blade curvature and angle of closing, the center of pressure m may accordingly give an opening moment as desired.

In Fig. 12, the blade is again curved to ogee form, but with the concavities towards the centerline of the valve throat. The static center k is again at the neutral point, producing no moment. The dynamic center of pressure m now tends towards the leading edge of the blade, producing a strong closing moment, contrary to the need.

In Fig. 11, the blade, placed as in Fig. 5, is given an opening or openings, as at n and p . In effect, this prevents complete closing in position f , so no static pressure or moment results. The dynamic center of pressure m produces a closing moment, just as in Fig. 5. Such incomplete closing may also be effected by means of stops or like means, instead of by openings in the blade.

In Fig. 13, a combination of the means shown in Figs. 6 and 8 is shown. The static center k has a strong opening moment. The dynamic center of pressure m produces a weak opening moment. Both moments are in the required direction. By other suitable combinations of the several devices shown in these Figs. 6 to 12, inclusive, an optimum effect can be attained in relation to shifts of centers of pressure, prevention of backlash and thereby to avoidance of power and speed surging. Such further combinations promoting effective car speed control are here intended, without being described in further detail.

In practice, when the governor weights $11a$ swing outwardly, due to the centrifugal force as the car speed increases, to a point where the extension of the springs 12 prevents further outward swinging, the weights have a tendency to dangle, as when any weight is suspended on a tension spring. This results in momentary lateral oscillation of the weights $11a$ when the balance point between centrifugal force and spring tension is reached. This lateral oscillation of the weights $11a$, through the mechanical interconnection by means of the linkage rods 13 , results in a longitudinal oscillation of the spindle 14 which, in turn, permits a slight alternate fluctuation of the opening of the valve

24 , resulting in corresponding surges and fluctuations of power and thus of the speed of the vehicle.

Under some driving conditions, particularly when the car is under load such as when climbing a hill, these surges of power quickly die out. Under other conditions, when the car is under light load or when the car is descending an incline, the momentary oscillation of the weights $11a$ resulting in power surges as above, is aggravated by the quick response of the car speed to these power surges. This results in a continuation of the surging which is undesirable.

This power surging may be eliminated by maintaining all pressures in the same direction as explained above and as shown in Fig. 6, Fig. 7, or Fig. 10. Unfortunately, however, this results in decreased sensitivity of car speed control, particularly when going up or down inclines in the roadway.

In general, it is desirable to keep the loss of speed when climbing a hill and the gain of speed when descending a hill to a minimum, when the car is operated at governed speeds. This may be done by bringing about a condition of instability, as shown in Fig. 13, resulting in a slight tendency of the valve 24 to close, which tendency is offset by the pressure of the spring 20 , and further, by restraining the oscillation of the weights $11a$, the spindle 14 , and consequently of the valve 24 which such instability permits. The dash pots 36 to which I have hereinbefore referred serve this damping action with respect to the operations of the controller C . The damping of the operations of the governor may be accomplished by incorporating a dash pot within the governor construction. Thus, as shown in Figs. 3 and 4, the rotor is provided, intermediate the ends of the spindle 14 , with a chamber liquid sealed at both ends and constituting a cylinder 40 adapted to be filled with a liquid. A fixed collar 39 is carried by the spindle 14 within the cylinder 40 and serves the purpose of a piston. This piston has sufficient clearance between its periphery and the wall of the cylinder to permit the liquid in the cylinder to bypass the piston as the spindle moves axially of the rotor and thus the conjoint action of the piston 39 and cylinder 40 function as a dash pot to dampen the operations of the governor and thus minimize the dangling above referred to of its weights.

The foregoing detailed description sets forth the preferred form of the invention, but the invention is to be understood as fully commensurate with the appended claims.

Having thus fully described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A system of the character described comprising: a controller embodying a housing mounted in fixed position and having therein a carrier mounted for axial movement, a post threaded through the carrier and adapted through rotation for axial adjustment in the carrier, a regulator operatively connected to the carrier, a spring normally impelling the carrier into a position to place the regulator in predetermined adjustment, in combination with a driven speed governor mounted in fixed position and including weighted arms having a link connection with a governor spindle arranged coaxially of both the governor and the post and spaced from said post during a predetermined speed range of the governor below a predeter-

mined maximum, said spindle being operable to engage the post and move the carrier to change the adjustment of the regulator when the governor is operated at a speed in excess of the predetermined maximum governor speed, said post having telescoping sections with an interposed spring to maintain them normally in extended position, a manually operable device, and operating connections between said manually operable device and the carrier to move the carrier at the will of the operator into a position to return the regulator to initial adjustment causing a corresponding shortening of the post which is permitted by compression of the spring between said telescoping sections of the post.

2. A system of the character described comprising: a movable regulator, a controller for said regulator which controller embodies a movable part connected to the regulator, a driven centrifugal governor having a spindle operable upon said movable part to move the said part and thus shift the regulator, the spindle of the governor being normally spaced from the movable part of the controller to permit operation of the governor within a limited range of speed without moving the regulator, and a shaft connected at one end to the movable part of the controller for relative movement longitudinally thereof and locked thereto against relative rotation, said shaft being provided at its remote end with a manually operable member for manipulating said shaft to vary the gap between the movable member of the controller and the spindle of the governor to correspondingly increase or decrease such limited speed range of operation of the governor.

3. In a system of the character described, a movable regulator, and a controller having a carrier mounted for axial movement and operatively connected to the regulator to translate the axial movement of the carrier into movement of the regulator, a spring for normally urging the carrier into a position to hold the regulator in a predetermined position, a post threaded axially through the carrier and axially adjustable therein, and a manually operable member for rotating said post to adjust it axially with respect to the carrier, in combination with a driven centrifugal governor arranged coaxially of the post and having an operating spindle spaced from the post during a predetermined limited speed range of operation of the governor and engageable with the post when the speed exceeds such predetermined limited speed range, the adjustment of the post determining the extent of such speed range.

4. In a system of the character described, a movable regulator, and a controller having a carrier mounted for axial movement and operatively connected to the regulator to translate the axial movement of the carrier into movement of the regulator, a spring for normally urging the carrier into a position to hold the regulator in a predetermined position, a post threaded axially through the carrier and axially adjustable therein, and a manually operable member for rotating said post to adjust it axially with respect to the carrier, in combination with a driven centrifugal governor arranged coaxially of the post and having an operating spindle spaced from the post during a predetermined limited speed range of operation of the governor and engageable with the post when the speed exceeds such predetermined limited speed range, the adjustment of the post determining the extent of such speed range, and a

dash pot connected to the carrier for damping the operations of the latter.

5. In a system of the character described, a movable regulator, and a controller having a carrier mounted for axial movement and operatively connected to the regulator to translate the axial movement of the carrier into movement of the regulator, a spring for normally urging the carrier into a position to hold the regulator in a predetermined position, a post threaded axially through the carrier and axially adjustable therein, and a manually operable member for rotating said post to adjust it axially with respect to the carrier, in combination with a driven centrifugal governor arranged coaxially of the post and having an operating spindle spaced from the post during a predetermined limited speed range of operation of the governor and engageable with the post when the speed exceeds such predetermined limited speed range, the adjustment of the post determining the extent of such speed range, said governor including a dash pot coaxing with the spindle for damping the operations thereof.

6. In a system of the character described, a movable regulator, and a controller having a carrier mounted for axial movement and operatively connected to the regulator to translate the axial movement of the carrier into movement of the regulator, a spring for normally urging the carrier into a position to hold the regulator in a predetermined position, a post threaded axially through the carrier and axially adjustable therein, and a manually operable member for rotating said post to adjust it axially with respect to the carrier, in combination with a driven centrifugal governor arranged coaxially of the post and having an operating spindle spaced from the post during a predetermined limited speed range of operation of the governor and engageable with the post when the speed exceeds such predetermined limited speed range, the adjustment of the post determining the extent of such speed range, there being dashpots associated with both the carrier and the spindle for respectively damping the operations of each of them.

7. In a system of the character described, a movable regulator, and a controller having a carrier mounted for axial movement and operatively connected to the regulator to translate the axial movement of the carrier into movement of the regulator, a spring for normally urging the carrier into a position to hold the regulator in a predetermined position, a post threaded axially through the carrier and axially adjustable therein, and a manually operable member for rotating said post to adjust it axially with respect to the carrier, in combination with a driven centrifugal governor arranged coaxially of the post and having an operating spindle spaced from the post during a predetermined limited speed range of operation of the governor and engageable with the post when the speed exceeds such predetermined limited speed range, the adjustment of the post determining the extent of such speed range, and a manually operable emergency device for bodily shifting the carrier of the controller to shift the regulator against the force of the governor.

8. A system of the character described comprising: a controller embodying a housing mounted in fixed position and having therein a carrier mounted for axial movement, a post threaded through the carrier and adapted

through rotation for axial adjustment in the carrier, a regulator operatively connected to the carrier, a spring normally impelling the carrier into a position to place the regulator in predetermined adjustment, and a manually operable flexible shaft connected to the post to rotate the same, in combination with a driven speed governor mounted in fixed position and including weighted arms having a link connection with a governor spindle arranged coaxially of both the governor and the post and spaced from said post during a predetermined speed range of the governor below a predetermined maximum, said spindle being operable to engage the post and move the carrier to change the adjustment of the regulator when the governor is operated at a speed in excess of the predetermined maximum governor speed.

9. A system of the character described comprising: a controller embodying a housing mounted in fixed position and having therein a carrier mounted for axial movement, a post threaded through the carrier and adapted through rotation for axial adjustment in the carrier, a regulator operatively connected to the carrier, a spring normally impelling the carrier into a position to place the regulator in predetermined adjustment, and a manually operable flexible shaft connected to the post to rotate the same, in combination with a driven speed governor mounted in fixed position and including weighted arms having a link connection with a governor spindle arranged coaxially of both the governor and the post and spaced from said post during a predetermined speed range of the governor below a predetermined maximum, said spindle being operable to engage the post and move the carrier to change the adjustment of the regulator when the governor is operated at a speed in excess of the predetermined maximum governor speed, said post having telescoping sections with an interposed spring to maintain them normally in extended position, a manually operable device, and operating connections between said manually operable device and the carrier to move the carrier at the will of the operator into a position to return the regulator to initial adjustment causing a corresponding shortening of the post which is permitted by compression of the spring between said telescoping sections of the post.

10. A governor comprising: a rotor mounted for rotation about a fixed axis, a spindle mounted coaxially of the rotor and adapted for axial movement with respect thereto, a plurality of bell cranks pivoted at their elbows to the rotor in spaced relation to the axis of the latter, one arm of each of which is weighted while their other arms have link connections with the spin-

dle, and a tension spring connecting the bell cranks and normally biasing the latter into a position of rest wherein the weights of the bell cranks are at minimum spacing from the axis of the rotor, said spring being anchored at its opposite ends to the bell cranks at points of attachment within the angles formed by the arms of the bell cranks and substantially in the cross-axial plane of the elbow pivots of the bell cranks when said bell cranks are in said position of rest.

11. A governor comprising: a rotor mounted for rotation about a fixed axis, a spindle mounted coaxially of the rotor and adapted for axial movement with respect thereto, a plurality of bell cranks pivoted at their elbows to the rotor in spaced relation to the axis of the latter and having arms of unequal length the longer of which arms are weighted and the shorter of which arms have link connections with the spindle, and a tension spring connecting the bell cranks and normally biasing the latter into a position of rest wherein the weights of the bell cranks are at the minimum spacing from the axis of the rotor, said spring being anchored at its opposite ends to the bell cranks at points of attachment within the angles formed by the arms of the bell cranks and substantially in the cross-axial plane of the elbow pivots of the bell cranks when said bell cranks are in said position of rest.

12. A governor comprising: a rotor mounted for rotation about a fixed axis, weighted arms pivoted to the rotor in spaced relation to said axis, and a tension spring connecting said arms and normally biasing the latter into a position wherein the weights are at their minimum spacing from said axis, said spring being anchored at its opposite ends to said arms at points spaced apart a lesser distance than the spacing of the pivots and in a plane cross axially of and perpendicular to the axis of rotation of the rotor and which plane substantially includes the pivots of said arms when the weights are at such minimum spacing.

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