R. S. BLAIR.

AUTOMATIC REGULATOR.

APPLICATION FILED MAR. 28, 1905.

1,043,751.

Patented Nov. 5, 1912.

2 SHEETS—SHEET 1.

Fig. 1.

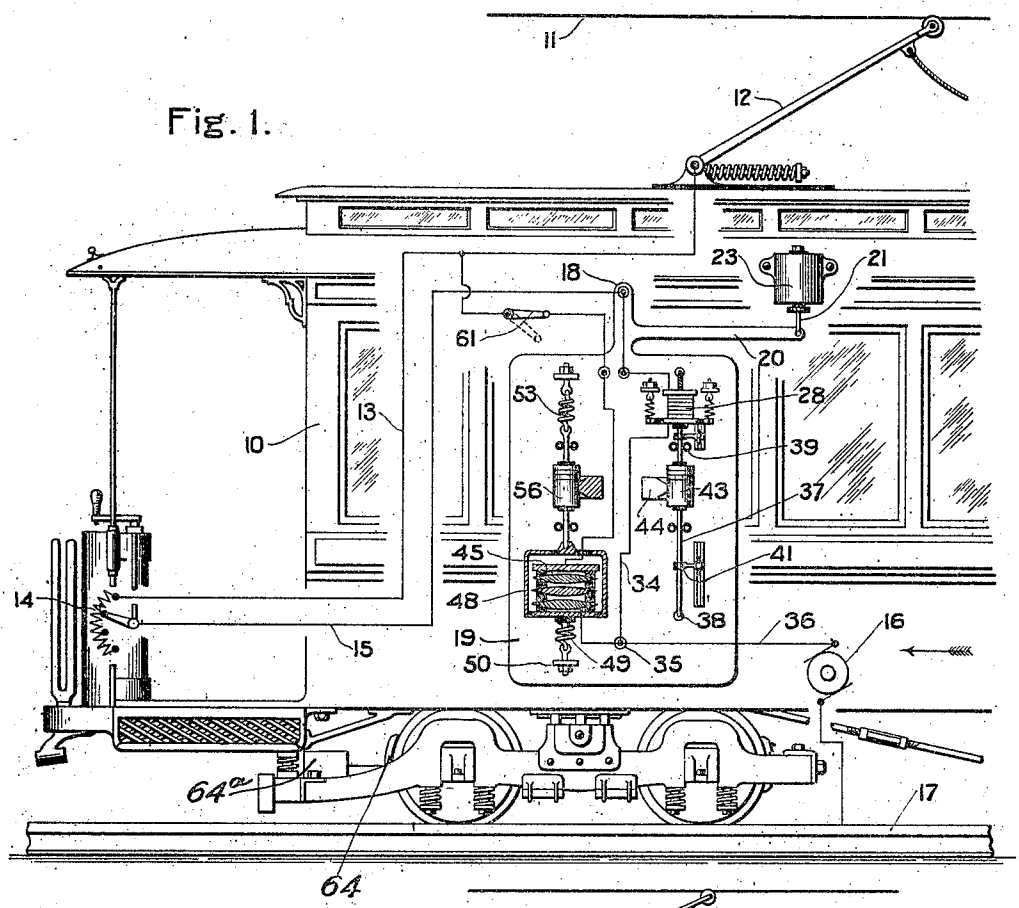
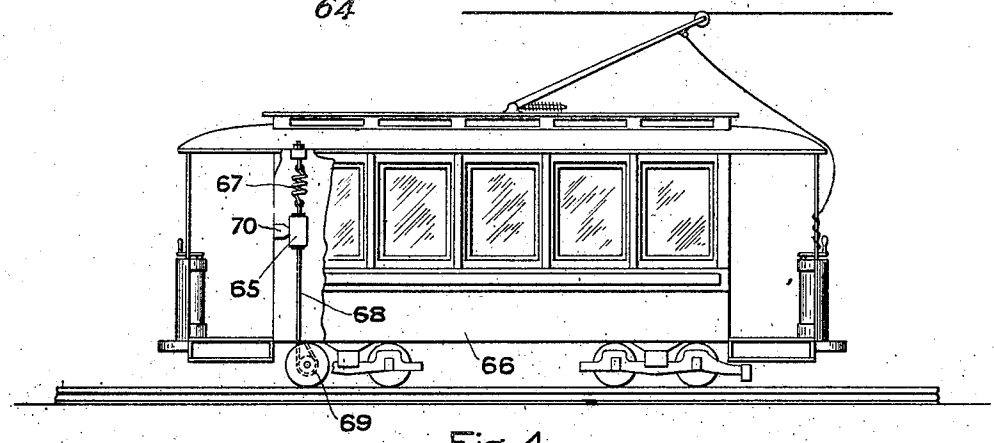


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 2.

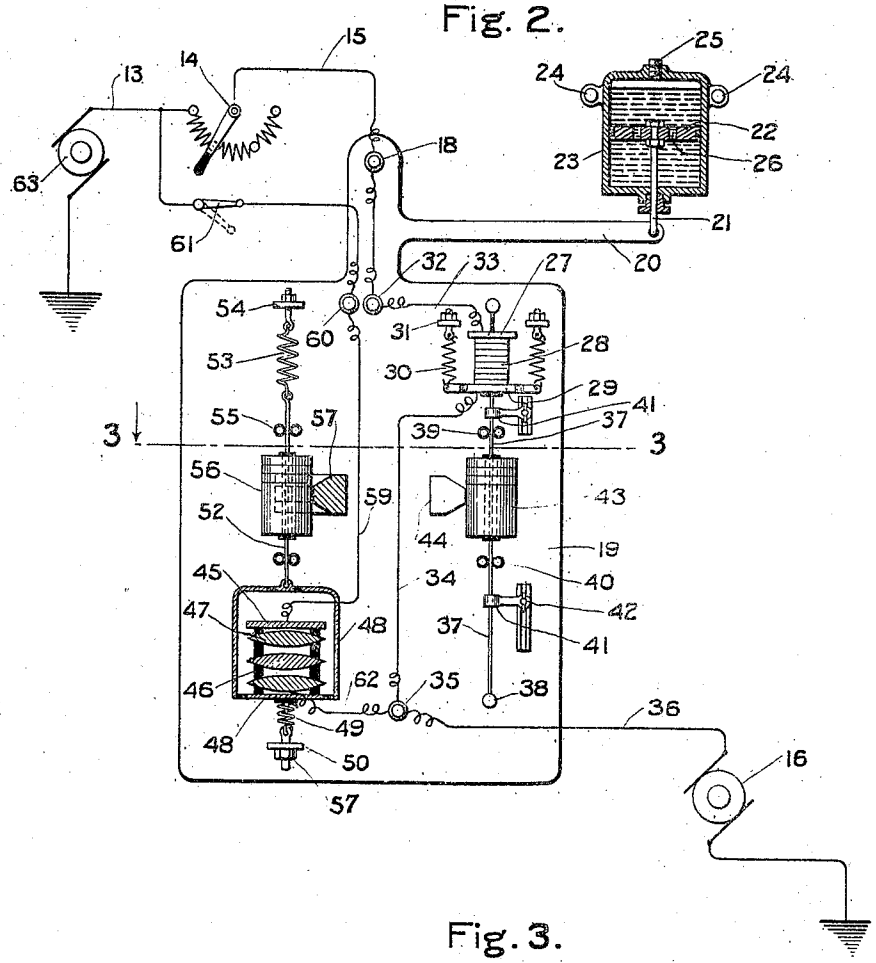
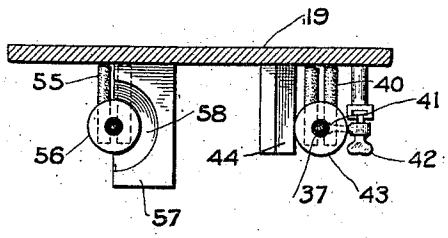


Fig. 3.



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AUTOMATIC REGULATOR.

1,043,751. Specification of Letters Patent. Patented Nov. 5, 1912.

Application filed March 28, 1905. Serial No. 252,476.

To all whom it may concern.

Be it known that I, ROBERT S. BLAIR, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Automatic Regulators, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to vehicles and more specifically to the regulation of the rate of speed and of the rate of change of speed of the same.

One of the objects thereof is to provide means in connection with vehicles adapted to improve the riding qualities of the same.

A further object is to provide means for reducing the lurching effect to which passengers or freight are often subjected upon the increase or decrease in speed of the vehicle.

Another object is to provide efficient and automatic means for regulating the speed of vehicles, under certain conditions, and rendering travel thereon more safe.

Other objects are to provide means of the above types which shall be substantially unaffected by change in inclination of the vehicle upon which they are mounted.

Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, arrangement of parts and utilization of principles which will be exemplified in the apparatus and devices hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, wherein are set forth one or more of various possible embodiments of several features of my invention, Figure 1 is an elevation of a portion of a vehicle having regulating apparatus mounted thereon. Fig. 2 is a diagrammatic view of circuits and devices associated therewith. Fig. 3 is a sectional view taken substantially on the line 3—3 of Fig. 2. Fig. 4 is an elevation of a vehicle provided with a different form of regulating apparatus.

Similar reference characters refer to similar parts throughout the several views.

As tending to render clearer certain features of my invention, it may here be noted that upon the starting or increase in speed of many vehicles now in common use, the passengers or freight thereon are subjected, on account of their inertia, to a more or less violent shock, rendering riding often disagreeable and sometimes unsafe. A similar effect is caused by the stopping or sudden decrease in speed of the vehicle. I have found that the above defects are due in a considerable measure to the lack of uniformity of change in speed or suddenness of change from or to a state of rest, and I propose to provide means for rendering this change more uniform and gradual. It may also here be noted that passengers are exposed to a somewhat similar effect upon the vehicle rounding curves, due to centrifugal force. This last-mentioned effect takes place to some extent even upon slight curves and results not only in the above discomfort to passengers but in a considerable wear upon the roadbed at the point at which the same takes place. As these last-mentioned effects obtain to some extent upon slight curves, it is sometimes impracticable, even with a careful engineer or other operator, entirely to prevent the same. The above and other defects are remedied in constructions of the nature of those hereinafter described.

Referring now to the illustrative embodiment shown in the drawings, there is shown in Fig. 1 a vehicle 10 which, in this illustrative embodiment, is in the form of an electrically-propelled car deriving current from a trolley wire 11 through a trolley pole 12, conductor 13 and a controller 14. Leading from this controller is a conductor 15 electrically connected, as hereinafter described, with a motor 16 from which the circuit is carried to the rail 17 and completed in any desired manner. The motor 16, which is herein shown in a diagrammatic form may be of any desired type and is suitably connected so as to be adapted to propel the vehicle 10. Mounted upon the vehicle as by the pivotal support 18, or in any other broadly equivalent manner, is what may be termed a "frame" 19 having thereon a rigid arm 20 jointed to a piston-rod 21, as is best shown in Fig. 2 of the drawings. The latter member is connected with a piston 22 positioned in a cylinder 23, mounted in fixed relation to the vehicle, as by the lugs 24, and preferably filled with a heavy fluid, as oil, through a port 25.

Piston 22 is perforated as shown at 26 and is thus adapted to move slowly through the fluid and act as a retarding device controlling the position of the swinging frame 19. In this manner, frame 19 is permitted to occupy a substantially vertical position irrespective of the inclination of the vehicle and yet any sudden swinging movement thereof is prevented. It may here be noted that by the term "inclination", as used throughout this specification and the following claims with reference to a vehicle, is meant the position of its longitudinal axis with respect to the vertical, changes in this inclination being occasioned principally by the varying grades of the road upon which the vehicle is traveling.

Mounted upon frame 19 is an abutment 27 having positioned adjacent thereto a pile of carbon blocks, or other variable resistance medium 28, electrically connected with what may be termed a "yoke" 29, also insulated from the frame. This yoke is normally held against the variable resistance medium 28 as by means of springs 30, the effective tension of which is adjustable by nuts 31 or equivalent devices. Conductor 15 passes preferably adjacent pivotal point 18 and thence to a binding post 32 electrically connected, as by means of conductor 33, with the abutment 27. The circuit leads thence through variable resistance medium 28, yoke 29 and a conductor 34 to a binding post 35 connected, as by means of conductor 36, with the motor 16.

Secured to yoke 29 is a flexible member 37, preferably a cord, wire or linkage, terminating at a fixed point 38 and guided by insulating pins as shown at 39 and 40. Additional guides 41 adjustable toward and away from one another as by wing nuts 42 are preferably provided so as to insure that the effect of any such displacement upon the yoke 29 will be in a direction substantially directly away from the variable resistance 28. Mounted upon this member between these pins is a weight 43 of any desired form and preferably comprising a plurality of parts so as to be adjustable in effect. This weight normally rests in contact with a suitable abutment 44, best shown in Fig. 3 of the drawings, which prevents a forward movement thereof, assuming the car to be traveling in the direction indicated by the arrow in Fig. 1, and yet permits a substantially free, lateral or lagging displacement. There is also preferably mounted upon the frame an abutment 45 having thereon a resilient insulating washer or gasket 46 against which is positioned a carbon disk or other electrically conducting member 47 preferably substantially of the shape indicated. A succession of gaskets 46 is provided alternating with a series of disks 47, the adjacent surfaces of the disks being slightly separated one from another and the lowermost gasket being supported by a yoke 48. This yoke is connected as by means of a spring 49 with a lug 50, the tension of the spring being adjustable as by means of nut 51. The upper portion of yoke 48 is provided with an insulated lug to which is connected a member 52 flexible in effect and supported by means of the adjustable spring 53 upon a lug or projection 54. Suitable guide pins 55 are positioned adjacent member 52 for a purpose similar to that of the guide pins 39 and 40, above described. Mounted upon member 52 is an adjustable weight 56 resting in contact with an abutment 57 and preferably positioned within a curved recess 58 therein, as is shown in Fig. 3 of the drawings, so as to prevent lateral movement of this weight, or lagging thereof with respect to the direction of travel of the vehicle. It may here be noted that by the term "lagging," as used throughout this specification and the following claims, is meant a relative movement in a direction away from the direction of movement of the vehicle.

The abutment 45 is in electrical connection, by means of a conductor 59, with a binding post 60, which in turn is connected with conductor 13, through a suitable switch 61, and a connection 62 is provided from the yoke 48 to the binding post 35 and thence through the motor 16, as above described.

The electrical connections of this illustrative embodiment of certain features of my invention may be briefly reviewed by reference to Fig. 2, in which is shown a grounded generator 63, from which one circuit leads through controller 14, variable resistance 28 and the propelling motor 16 to ground, and a branch circuit leads through switch 61, and disks 47, assuming the same to be in contact, and thence joins the first-mentioned circuit through the motor to ground.

In order to avoid ambiguity in the interpretation of certain terms used throughout this description or the following claims, it may here be noted that the term "vehicle" is used in its broad sense and the expression "inertia controlled" is used to denote that characteristic of a body by virtue of which it is adapted to change its position or condition relative to another body by reason of its inertia. It may also here be noted that by "inertia" is meant tendency of a body to resist change to or from a state of rest or change in the rate of speed at which it travels.

The operation of the above illustrative embodiment of my invention is substantially as follows: Assuming that the vehicle is started suddenly, as by completing a circuit through the controller 14, the same will tend to lurch forward and the weight 43

by virtue of its inertia will tend to lag to a greater or less extent with reference to the vehicle, thus causing the flexible member 37 to be displaced and to draw upon the yoke 29. In this manner the pressure upon the variable resistance 28 is released to a greater or less extent and the electrical resistance thereof proportionately increased, thus tending to cut down the current flowing through the motor and to affect its speed or the rate of increase of its speed. In this manner, by a suitable adjustment of the variable resistance, the pressure thereon, the weight and other factors, the tendency of the car to lurch forward is checked to any desired extent and the weight 43 then returning toward the abutment 44 the variable resistance is again reduced and the current supplied to the motor proportionately increased. The forward lurch of the car is thus transformed into a series of quickly succeeding and minute lurches of any desired magnitude and the speed thereof thus built up substantially uniformly to the desired point. By proper adjustment, this rate of increase of speed may be regulated until the car is started as suddenly as is desired and yet with a material gain in the uniformity of acceleration. It will be seen that the quickly succeeding impulses by which the speed is built or cut down may be of such an exceedingly minute character as to render the rate of change of speed substantially uniform. The above would hold true to a greater or less extent irrespective of the value to which the resistance is increased, and many of the advantages of this invention would be obtained if the resistance were brought to an infinite value as by a suitable proportionment of weights, springs and other factors. The above effect takes place in a substantially identical manner upon the sudden increase of speed of the car while the same is running.

Upon the vehicle rounding a curve the weight 43 is laterally displaced with respect to the direction of travel, due to its centrifugal force, and a corresponding decrease in current supplied to the motor results on account of the increase in the variable resistance which is caused substantially as above described by a downward pull upon the yoke 29. The guides 41 are adjustable, as shown, so as to give the effect of centrifugal force upon rounding a curve the desired magnitude without altering the weight or changing the effect of the lagging of the same.

The operations of the remaining devices shown mounted upon the frame 19 is, to a certain extent, the contrary of the first mode of operation described inasmuch as the weight 56 is adapted upon a decrease in speed of the car, or the stopping thereof, to move forwardly, in the direction of movement of the car, and, by means of the flexible member 52, draw upwardly on the yoke 48 and compress the several resilient gaskets 46 so as to bring the disks 47 into more or less intimate contact. In this manner a greater or less current is supplied to the motor 16, independent of the condition of controller 14, and the same is driven in a forward direction so as to neutralize the too sudden retarding effect of the brakes 64 or equivalent means actuated by air cylinder 64^a or any other desired mechanism. Switch 61 is provided so as to cut out the last-described mechanism, if desired.

The retarding device or dash-pot piston 22 operates in a well known manner to prevent a quick swinging of the frame 19 with a consequent decrease in effectiveness of the weights 43 and 56 and yet to permit a slow movement thereof so as to render the several parts mounted thereon substantially unaffected by changes in the inclination of the car.

It will thus be seen that I have provided simple and efficient means for accomplishing the objects of this invention and that the several component features of this means, although co-acting to accomplish the desired result, may nevertheless perform their functions independently and many of the advantages of the conjoint use be realized. It will also be seen that the apparatus above described although distorted for purposes of illustration, may be formed cheaply and compactly and be readily and inexpensively mounted upon vehicles now in use. Moreover, by virtue of a direct control by means of inertia, to which are due many of the defects which it is desired to eliminate in apparatus of the general type above described, it is well adapted exactly to overcome these defects.

Although I have set forth what I believe to be the exact mode of operation, nevertheless I do not intend that this invention be limited by statements of theory of action herein made.

In Fig. 4 of the drawings is shown a different embodiment of certain features of my invention, indicative of its broad character, in which a weight 65, upon a vehicle 66 is supported by means of an adjustable spring 67 and is connected as by a flexible member 68 with a band brake 69 operatively mounted with relation to one of the wheels of the vehicle. A suitable abutment 70 is provided to prevent forward movement of the same and it will readily be seen that by virtue of the lagging or lateral swinging of this weight, many of the advantageous features of the above described embodiment are realized.

As many changes could be made in the above construction and many apparently widely different embodiments of my inven-

tion could be made without departing from the scope thereof, I intend that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I desire it also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In combination, a vehicle, means adapted to move said vehicle, and inertia-controlled means unaffected by a constant speed of the vehicle mounted on said vehicle adapted to vary the power of said moving means.

2. In combination, a vehicle, means mounted upon said vehicle adapted to move the same, and inertia-controlled means unaffected by constant speed of the vehicle mounted on said vehicle adapted to vary the power of said moving means.

3. In combination, a vehicle, means adapted to move said vehicle, and inertia-controlled means unaffected by a constant speed of the vehicle flexibly mounted on said vehicle adapted to vary the power of said moving means.

4. In combination, a vehicle, means adapted to move said vehicle, means mounted on said vehicle adapted upon acceleration of said moving means to change position with reference to said vehicle due to said acceleration, said second means being adapted to maintain a substantially constant position relative to said vehicle independent of the speed at which said vehicle is running, and means controlled by said second means adapted to vary the power of said moving means.

5. In combination, a vehicle, means adapted to move said vehicle, means mounted upon said vehicle adapted upon the acceleration thereof to move relative thereto in a direction away from the direction of movement thereof, and means controlled by said last-mentioned means adapted to decrease the power of said moving means.

6. In combination, a vehicle, means movably mounted upon said vehicle and adapted upon the increase in speed of said vehicle to lag with respect thereto, means adapted to move said vehicle, and means controlled by said movably mounted means adapted to decrease the power of said moving means.

7. In apparatus of the class described, a vehicle, having mounted thereon inertia-controlled means adapted to render uniform the rate of change of speed thereof.

8. In apparatus of the class described, in combination, a vehicle having mounted thereon inertia-controlled means, means adapted to move said vehicle, and means controlled by said inertia-controlled means adapted to render uniform the rate of change of speed of said moving means.

9. In combination, a vehicle, propelling means mounted thereon and inertia-controlled means movably mounted upon said vehicle and unaffected by any constant speed at which said vehicle is running, adapted upon the speed thereof being changed to render uniform the rate of change of speed of said propelling means.

10. In combination, a vehicle, means adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon the rate of movement thereof being increased, and means controlled by said second-mentioned means adapted to reduce the effective power of said first-mentioned means.

11. In combination, a vehicle, propelling means mounted upon said vehicle, means mounted upon said vehicle adapted to lag with respect thereto upon the speed thereof being accelerated, and means controlled by said second-mentioned means adapted to reduce the effective power of said first-mentioned means.

12. In combination, a vehicle, an electric motor adapted to move the same, inertia-controlled means mounted upon said vehicle adapted to move with respect thereto and resume a constant position upon the speed of said vehicle becoming uniform irrespective of its rate of travel, and means controlled by said inertia-controlled means adapted to affect said vehicle-moving means substantially in proportion to the movement of said inertia-controlled means.

13. In combination, a vehicle, an electric motor adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon said vehicle being put in motion or the speed thereof increased, and means controlled by said first-mentioned means and affecting said vehicle-moving means substantially in proportion to the lag thereof.

14. In combination, a vehicle, an electric motor adapted to move said vehicle, means mounted upon said vehicle adapted to lag with respect thereto upon said vehicle being put in motion or the speed thereof increased, and means controlled by said last-mentioned means adapted to tend to cut down the current supplied to said motor.

15. In combination, a vehicle, an electric motor adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon the same being put in motion or the speed thereof increased, and means controlled by said last-mentioned

means adapted to tend to cut down the voltage across the terminals of said motor.

16. In combination, a vehicle, an electric motor adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon said vehicle being put in motion or the speed thereof increased, and means controlled by said last-mentioned means adapted to interpose resistance in circuit with said motor.

17. In combination, a vehicle, an electric motor adapted to move the same, means movably mounted upon said vehicle and adapted to lag with respect thereto upon said vehicle being put in motion or the speed thereof increased, and means controlled by said last-mentioned means adapted to cut down the voltage across the terminals of said motor substantially in proportion to the rate of increase of speed thereof.

18. In combination, a vehicle, an electric motor mounted upon said vehicle adapted to propel the same, means movably mounted upon said vehicle adapted to lag with respect thereto upon said vehicle being put in motion or the speed thereof increased, and means controlled by said last-mentioned means adapted to cut down the voltage across the terminals of said motor.

19. In combination, a vehicle, electrically-driven means mounted upon said vehicle adapted to propel the same, a member mounted upon said vehicle and movable with relation thereto and adapted to lag with respect thereto upon said vehicle being set in motion or the speed thereof increased, and means controlled by the lagging of said means adapted upon said lagging taking place to interpose resistance in the circuit of said electrically-driven propelling means.

20. In combination, a vehicle, electrically-driven means mounted upon said vehicle adapted to propel the same, means mounted on said vehicle and movable with relation thereto and adapted to lag with respect thereto upon said vehicle being set in motion or the speed thereof increased, means controlled by the lagging of said means adapted upon said lagging taking place to interpose resistance in the circuit of said electrically-driven propelling means, and means adapted to render said lagging means substantially independent of the inclination of said vehicle.

21. In combination, a vehicle, electrically-driven means mounted upon said vehicle adapted to propel the same, a member mounted on said vehicle and movable with relation thereto and adapted to lag with respect thereto upon said vehicle being set in motion or the speed thereof being increased, and means controlled by the lagging of said member adapted upon said lagging taking place to tend to cut down the voltage at the terminals of said motor.

22. In combination, a vehicle, electrically-driven means mounted upon said vehicle adapted to propel the same, a member mounted on said vehicle and movable with relation thereto and adapted to lag with respect thereto upon said vehicle being set in motion or the speed thereof increased, means controlled by the lagging of said member adapted upon said lagging taking place to tend to cut down the voltage at the terminals of said motor, and means adapted to render said lagging member substantially unaffected by changes in the inclination of said vehicle.

23. In combination, a vehicle, means adapted to move said vehicle, inertia-controlled means unaffected by a constant speed of the vehicle mounted upon said vehicle adapted to vary the power of said moving means, and means adapted to render said inertia-controlled means substantially unaffected by changes in the inclination of said vehicle.

24. In combination, a vehicle, means adapted to move the same, inertia-controlled means adapted to decrease the power of said first means mounted upon said vehicle and adapted upon an acceleration thereof to change position with respect thereto due to said acceleration and adapted to maintain a substantially constant position relative thereto independent of the speed at which said vehicle is running, and means adapted to render said inertia-controlled means substantially unaffected by changes in the inclination of said vehicle.

25. In combination, a vehicle, means adapted to move said vehicle, inertia-controlled means mounted upon said vehicle and unaffected by a constant rate of travel of said vehicle, means controlled by said inertia-controlled means adapted to render uniform the rate of change of speed of said vehicle, and means adapted to render said inertia-controlled means substantially independent of changes in the inclination of said vehicle.

26. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, means movably mounted upon said vehicle and adapted to swing with rererence thereto, inertia-controlled means movably mounted upon said third-mentioned means, and means controlled by said inertia-controlled means adapted to reduce said current.

27. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, means movably mounted upon said vehicle and adapted to swing with reference thereto, inertia-controlled means movably mounted upon said swinging means adapted upon the speed of said vehicle being increased to lag with

respect thereto, and means controlled by said inertia-controlled means adapted to tend to cut down the voltage at the terminals of said electrically-operated means.

28. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, means movably mounted upon said vehicle and adapted to swing with reference thereto, inertia-controlled means movably mounted upon said swinging means adapted upon the speed of said vehicle being increased to lag with respect thereto, and means controlled by said inertia-controlled means adapted to insert resistance in said current-leading means.

29. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, a variable resistance serially connected within said current-leading means, means mounted upon said vehicle adapted to swing with respect thereto, inertia-controlled means movably mounted upon said swinging means and adapted upon the speed of said vehicle being increased to lag with respect thereto, and means controlled by said inertia-controlled means adapted to control said variable resistance.

30. In combination, a vehicle, an electric motor adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon the speed of said vehicle being increased, a variable resistance within the circuit of said electric motor, and means controlled by said lagging means adapted to increase said variable resistance.

31. In combination, a vehicle, an electric motor adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon the speed of said vehicle being increased, a variable resistance within the circuit of said electric motor, means controlled by said lagging means adapted to control said variable resistance, and means adapted to adjust said variable resistance.

32. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, means movably mounted upon said vehicle and adapted to swing with reference thereto, retarding means connecting with said swinging means, inertia-controlled means movably mounted upon said swinging means adapted upon the speed of said vehicle being increased to lag with respect thereto, and means controlled by said inertia-controlled means adapted to reduce said current.

33. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, means movably mounted upon said vehicle and adapted to swing with reference thereto, retarding means connected with said swinging means, and inertia-controlled means movably mounted upon said swinging means adapted upon the speed of said vehicle being increased to lag with respect thereto and adapted to tend to cut down the voltage at the terminals of said electrically-operated means.

34. In combination, a vehicle, a controlling switch, an electric motor mounted upon said vehicle and adapted to propel the same, a variable resistance serially connected with said controlling switch and said motor, inertia-controlled means mounted upon said vehicle adapted upon the speed thereof being increased to lag with respect thereto, and means adapted to vary said variable resistance and controlled by said inertia-controlled means.

35. In combination, a vehicle, an electric motor adapted to propel the same, means adapted manually to control the current supplied to said motor, and means mounted upon said vehicle adapted upon the speed thereof being changed automatically to tend to change the current supplied to said motor in inverse proportion to the rate of change of said speed.

36. In combination, a vehicle, an electric motor adapted to propel the same, a controlling switch adapted to complete a circuit through said motor, and inertia-controlled means adapted automatically to regulate the rate of increase of current supplied to said motor.

37. In combination, a vehicle, an electric motor adapted to propel the same, a controlling switch adapted to complete a circuit through said motor, and inertia-controlled means adapted to render substantially uniform the rate of increase of current supplied to said motor.

38. In combination, a vehicle, means adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon the rate of movement thereof being increased, means adapted to prevent a forward movement of said lagging means, and means controlled by said lagging means adapted to control said first-mentioned means.

39. In combination, a vehicle, electrically-operated means adapted to propel said vehicle, means adapted to lead current to said electrically-operated means, means movably mounted upon said vehicle adapted to swing with reference thereto, inertia-controlled means mounted upon said third-mentioned means and adapted upon the speed of said vehicle being increased to lag with respect thereto, means adapted to prevent a forward movement of said inertia-controlled means,

and means controlled by said inertia-controlled means adapted to affect said current.

40. In combination, a vehicle, an electric motor mounted thereon and adapted to propel the same, a variable resistance device in the circuit of said motor, manually-operated controlling means, means mounted upon said vehicle adapted to swing with reference thereto, a weight flexibly mounted upon said swinging means connected with said variable resistance device and adapted to change the resistance thereof, and spring-pressed means adapted to resist the action of said weight.

41. In combination, a vehicle, an electric motor mounted thereon and adapted to propel the same, a manually-operated controller in circuit with said motor, a variable resistance in circuit with said motor adapted upon the pressure thereon being changed to vary in resistance, adjustable means adapted normally to press said variable resistance, inertia-controlled means mounted upon said vehicle adapted upon the speed thereof being increased to lag with respect thereto, and a connection between said inertia-controlled means and said variable resistance adapted upon the lagging thereof to decrease the pressure upon said variable resistance.

42. In combination, a vehicle, an electric motor mounted thereon and adapted to propel the same, manually-controlled means adapted to vary the current supplied to said motor, means mounted upon said vehicle and adapted to swing with respect thereto, means adapted to retard said swinging movement, a plurality of contacting members in the circuit of said motor, means adapted adjustably to compress said contacting members, a weight mounted upon said swinging means adapted upon the speed of said vehicle being increased to lag with respect thereto, and means adapted upon said weight lagging to decrease the pressure upon said contacting members and increase the resistance in series with said motor.

43. In combination, a vehicle, and inertia-controlled means mounted upon said vehicle adapted upon the speed thereof decreasing to control the rate of decrease of speed.

44. In combination, a vehicle, inertia-controlled means movably mounted upon said vehicle adapted upon the speed of said vehicle decreasing to move with respect thereto, and means controlled by said inertia-controlled means adapted to govern the rate of decrease of speed.

45. In combination, a vehicle, inertia-controlled means movably mounted upon said vehicle adapted upon the speed of said vehicle decreasing to advance with respect thereto, and means controlled by said inertia-controlled means adapted to control the rate of decrease of speed.

46. In combination, a vehicle, inertia-controlled means movably mounted upon said vehicle and adapted upon the speed of said vehicle decreasing to move with reference thereto, and means controlled by said inertia-controlled means adapted to render substantially uniform the rate of decrease of speed.

47. In combination, a vehicle, inertia-controlled means mounted upon said vehicle and adapted to move with reference thereto upon the speed of said vehicle decreasing, and adjustable means controlled by said inertia-controlled means adapted to render substantially uniform the rate of decrease of speed.

48. In combination, a vehicle, means adapted to retard the movement thereof, and inertia-controlled means upon said vehicle adapted to partially counteract the effect of said retarding means.

49. In combination, a vehicle, means adapted to retard the same, inertia-controlled means movably mounted upon said vehicle and adapted upon the speed thereof decreasing to move with respect thereto, and means controlled by said inertia-controlled means adapted to render substantially uniform the effect of said retarding means.

50. In combination, a vehicle, means adapted to retard the same, inertia-controlled means movably mounted upon said vehicle and adapted to move with reference thereto upon the speed of said vehicle decreasing, and means controlled by said inertia-controlled means adapted to oppose said retarding means.

51. In combination, a vehicle, means adapted to retard the same, means adapted to propel said vehicle, and inertia-controlled means mounted upon said vehicle adapted to tend to increase the power of said propelling means to render the effect of said retarding means substantially uniform.

52. In combination, a vehicle, means adapted to retard the same, means adapted to propel said vehicle, inertia-controlled means movably mounted upon said vehicle and adapted to advance with respect thereto upon the speed of said vehicle decreasing, and means controlled by said inertia-controlled means adapted to tend to increase the power of said propelling means to render substantially uniform the effect of said retarding means.

53. In combination, a vehicle, means adapted to move said vehicle, and means mounted upon said vehicle adapted upon the movement of said vehicle departing from a substantially straight line to counteract the effect of said vehicle-moving means.

54. In combination, a vehicle, means adapted to move the same, means adapted to control said moving means, and means mounted upon said vehicle adapted to con-

trol said controlling means in accordance with the rate of change of direction of said vehicle.

55. In combination, a vehicle, means adapted to move the same, means movably mounted upon said vehicle adapted upon said vehicle moving in a curved path to move with reference thereto by virtue of said curvilinear movement, and means controlled by said movable means adapted to reduce the speed of said vehicle-moving means.

56. In combination, a vehicle, means adapted to move the same, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curvilinear path to move with reference to said vehicle, and means controlled by said second means adapted to decrease the speed of said vehicle-moving means.

57. In combination, a vehicle, means adapted to move the same, means controlled by centrifugal force mounted upon said vehicle and adapted upon said vehicle moving in a curved path to diminish the speed of said vehicle-moving means.

58. In combination, a vehicle, an electric motor adapted to propel the same, means movably mounted upon said vehicle adapted upon said vehicle moving in a curved path to move with reference thereto by virtue of said curvilinear movement, and means controlled by said movable means adapted to cut down the current within said motor.

59. In combination, a vehicle, an electric motor adapted to propel the same, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curvilinear path to move with reference to said vehicle, and means controlled by said movable means adapted to cut down the current within said motor.

60. In combination, a vehicle, an electric motor adapted to propel the same, movable means mounted upon said vehicle and adapted to be moved with reference thereto by centrifugal force upon said vehicle moving in a curvilinear path, and means controlled by said movable means adapted to cut down the current in said motor.

61. In combination, a vehicle, an electric motor adapted to move the same, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curved path to move with reference thereto, and means controlled by said movable means adapted to cut down the voltage at the terminals of said motor.

62. In combination, a vehicle, means adapted to move the same, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curved path to move with reference to said vehicle, means controlled by said movable means adapted to cut down the speed of said vehicle-moving means, and means adapted to render said movable means substantially unaffected by changes in the inclination of said vehicle.

63. In combination, a vehicle, an electric motor adapted to propel the same, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curved path to move with reference thereto and cut down the voltage at the terminals of said motor, and means adapted to render said movable means substantially unaffected by changes in the inclination of said vehicle.

64. In combination, a vehicle, an electric motor adapted to propel the same, means controlled by centrifugal force and rendered operative upon said car moving in a curvilinear path adapted to diminish the speed of said electric motor, a means adapted to render said means substantially unaffected by changes in the inclination of said vehicle.

65. In combination, a vehicle, an electric motor adapted to propel the same, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curved path to move with respect thereto, a variable resistance in the circuit of said motor, and means controlled by said movable means adapted to control said variable resistance.

66. In combination, a vehicle, an electric motor mounted upon said vehicle and adapted to propel the same, an adjustable, variable resistance within the circuit of said motor, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curvilinear path to move with reference to said vehicle, and means controlled by said movable means adapted to vary said variable resistance.

67. In combination, a vehicle, an electric motor mounted upon said vehicle and adapted to propel the same, an adjustable, vari-

able resistance within the circuit of said motor, means movably mounted upon said vehicle adapted to move with the same in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curvilinear path to move with reference to said vehicle, means controlled by said movable means adapted to vary said variable resistance, and means adapted to render the said variable resistance substantially unaffected by changes in the inclination of said vehicle.

68. In combination, a vehicle, an electric motor mounted upon the same and adapted to propel said vehicle, a member flexibly mounted upon said vehicle and adapted upon said vehicle moving in a curved path to move laterally with respect thereto, and means controlled by said member adapted to control said electric motor.

69. In combination, a vehicle, an electric motor mounted upon the same and adapted to propel said vehicle, a member flexibly mounted upon said vehicle and adapted upon said vehicle moving in a curved path to swing laterally with respect thereto, means controlled by said member adapted to control said electric motor, and means adapted to render said member substantially unaffected by changes in the inclination of said vehicle.

70. In combination, a vehicle, an electric motor mounted thereon and adapted to propel the same, means mounted upon said vehicle adapted to swing with reference thereto, means movably mounted upon said swinging means adapted to move with said vehicle in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curved path to move with reference to said vehicle, a variable resistance in circuit with said motor and a connection between said movable means and said variable resistance adapted upon said vehicle traveling in a curved path to increase said variable resistance.

71. In combination, a vehicle, an electric motor mounted thereon and adapted to propel the same, means mounted upon said vehicle adapted to swing with reference thereto, means movably mounted upon said swinging means adapted to move with said vehicle in a substantially rectilinear line during the travel of said vehicle in a substantially rectilinear line and adapted upon said vehicle moving in a curved path to move with reference to said vehicle, a variable resistance in circuit with said motor, a connection between said movable means and said variable resistance adapted upon said vehicle traveling in a curved path to increase said variable resistance, and means adapted to adjust said variable resistance.

72. In combination, a vehicle, means adapted to move said vehicle, means adapted to retard the movement of the same, and inertia-controlled means mounted upon said vehicle and adapted to change position with reference thereto in a direction longitudinally thereof adapted upon the speed thereof being decreased to affect the rate of decrease thereof and adapted upon the speed of said vehicle being increased to affect the rate of increase of speed thereof.

73. In combination, a vehicle, means adapted to move the same, and inertia-controlled means mounted upon said vehicle to move longitudinally thereof adapted upon the speed of said moving means being increased to render substantially uniform said increase of speed and adapted upon the speed of said vehicle decreasing to render substantially uniform the rate of decrease of speed.

74. In combination, a vehicle, means movably mounted upon said vehicle adapted upon the increase of speed of said vehicle to lag with respect thereto, means adapted to move said vehicle, means controlled by said movably mounted means adapted to control said moving means, inertia-controlled means mounted upon said vehicle adapted upon the speed thereof decreasing to move with respect thereto, and means controlled by said last-mentioned inertia-controlled means adapted to govern the rate of decrease of speed.

75. In combination, a vehicle, an electric motor adapted to move the same, means mounted upon said vehicle adapted to lag with respect thereto upon said vehicle being put in motion or the speed thereof increased, means controlled by said second-mentioned means adapted to control the rate of change of speed of said motor, retarding means upon said vehicle, means mounted upon said vehicle adapted upon the speed thereof being decreased to change position with respect thereto, and means controlled by said last-mentioned means adapted to oppose said retarding means and control the rate of decrease of speed of said vehicle.

76. In combination, a vehicle, an electric motor adapted to drive the same, a variable resistance in circuit with said motor, means mounted upon said vehicle adapted upon the speed thereof being increased to affect said variable resistance and tend to decrease the current through said motor, and means mounted upon said vehicle adapted upon the speed thereof decreasing to move with respect thereto and increase the current through said motor, said several means being adapted to maintain a substantially constant position relative to said vehicle independent of the speed at which said vehicle is running.

77. In combination, a vehicle, an electric

motor adapted to propel the same, a manually-actuated controller adapted to vary the speed of said motor, braking means upon said vehicle, and inertia-controlled means mounted upon said vehicle adapted upon the speed thereof being increased to change position with respect thereto and tend to decrease the current through said motor and inertia-controlled means mounted upon said vehicle adapted upon the speed of said vehicle being retarded by said braking means to change position with respect thereto and increase the current through said motor.

78. In combination, a vehicle, means adapted to move said vehicle, inertia-controlled means movably mounted upon said vehicle adapted upon the speed thereof being increased to lag with respect thereto and adapted upon the movement of said vehicle departing from a substantially straight line to move with respect to said vehicle, and means controlled by said inertia-controlled means adapted to tend to reduce the speed of said vehicle.

79. In combination, a vehicle, means adapted to move the same, inertia-controlled means mounted upon said vehicle adapted to lag with respect thereto upon the speed of said vehicle being increased or the direction of movement thereof departing from a substantially straight line, and means controlled by the lagging of said second means adapted to tend to decrease the speed of said vehicle.

80. In combination, a vehicle, an electric motor adapted to propel the same, a variable resistance in circuit with said motor, and means operatively connected with said variable resistance adapted to move with respect to said vehicle in a lagging or lateral direction and increase said variable resistance.

81. In combination, a vehicle, an electric motor adapted to propel said vehicle, a variable resistance in circuit with said motor, means mounted upon said vehicle adapted upon the speed thereof being increased to lag with respect thereto and adapted upon the direction of movement of said vehicle departing from a substantially straight line to move laterally with respect thereto, a connection between said means and said variable resistance, and adjustable means adapted to vary the relative effects of lateral and lagging movements of said means upon said variable resistance.

82. In combination, a vehicle, an electric motor adapted to propel said vehicle, a variable resistance in circuit with said motor, means mounted upon said vehicle adapted upon the speed thereof being increased to lag with respect thereto and adapted upon the direction of movement of said vehicle departing from a substantially straight line to move laterally with respect thereto, a connection between said means and said variable resistance, and adjustable means adapted to vary the relative effects of lateral and lagging movements of said means upon said variable resistance, said means being substantially independent of changes in the inclination of said vehicle.

83. In combination, a vehicle, means adapted to propel the same, means adapted upon the speed of said vehicle increasing or the direction of movement thereof departing from a substantially straight line to move with respect thereto and tend to cut down the speed of said vehicle, and means adapted upon the speed of said vehicle decreasing to render substantially uniform the rate of decrease of speed.

In testimony whereof I affix my signature, in the presence of two witnesses.

ROBERT S. BLAIR.

Witnesses:

CHARLES H. WILSON,

HELEN M. SEAMANS.