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IGNITION REGULATOR.

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1,004,364. Patented Sept. 26, 1911.

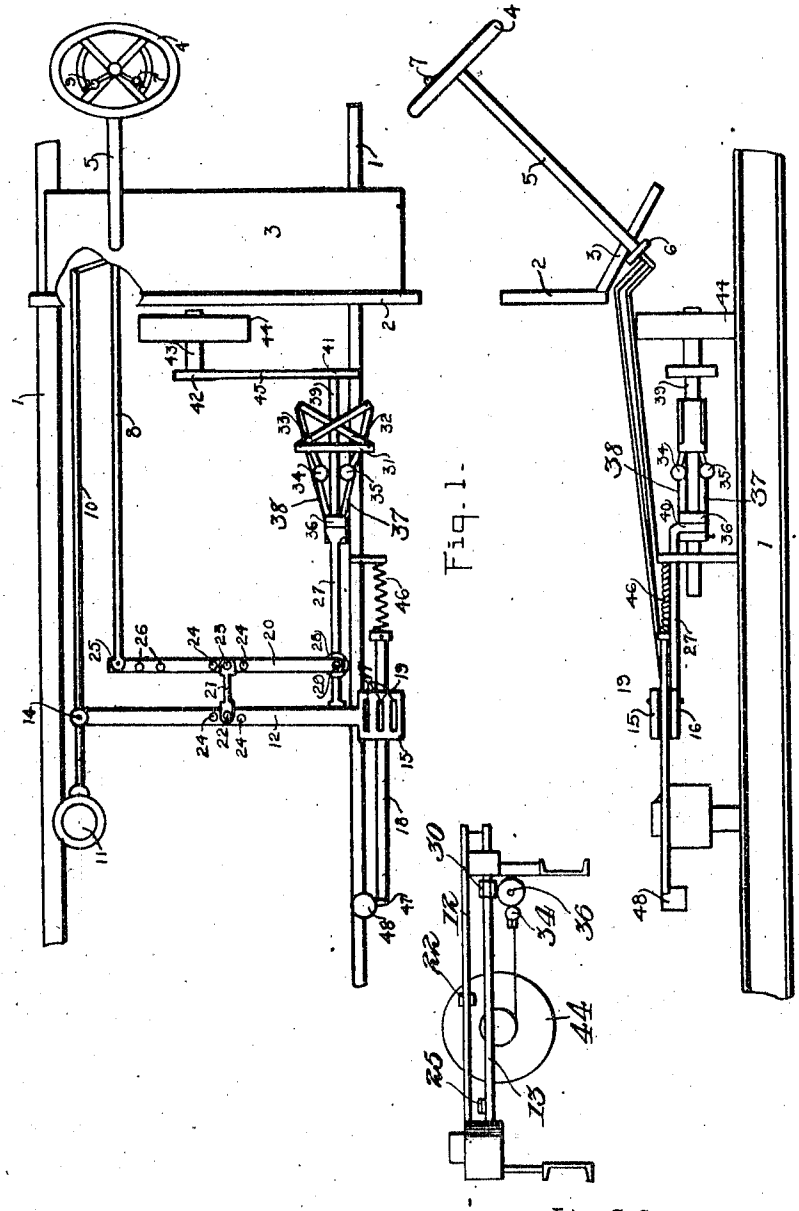

Fig. 1.

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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IGNITION-REGULATOR.

1,004,364. Specification of Letters Patent. Patented Sept. 26, 1911.

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To all whom it may concern:

Be it known that I, JOHN C. CARPENTER, a citizen of the United States, residing at Houston Heights, in the county of Harris and State of Texas, have invented certain new and useful Improvements in Ignition-Regulators, of which the following is a specification.

My invention relates to new and useful improvements in ignition regulators and more particularly to that class of such regulators as are adapted to be used for regulating the ignition of the fuel charge in the cylinder of internal combustion engines.

The accompanying drawings illustrate the application of this device to internal combustion engines, such as are used on automobiles.

This device is particularly designed to work automatically being so arranged that the governor and throttle connecting rod will act upon the ignition timer in such a manner as to secure the highest volumetric efficiency of the explosion immediately after the crank has passed the dead center.

The object of the invention is to so control the spark or other means of ignition as to secure ignition at the proper time under varying loads and at varying speeds of the engine. As is well known the spark may advance relatively to the speed of the engine with economy of fuel, only so long as the engine is under substantially full load; but under light load the spark needs to be further advanced. My device is intended to effect this advancement automatically; and is provided with means for attachment to the governor stem, the spark lever, ignition timer and the throttle connecting rod, motion being transmitted through these agencies.

Another feature resides in the provision of means whereby the spark or other means of ignition may also be manually controlled in the ordinary way and the manual spark lever may be operated while the motor is running in order to correct faulty adjustment or to aid in determining the correct method of adjustment.

Another object of the invention is to provide means for positively assuring the production of the electric spark or means of ignition for igniting the charges in the cylinders of internal combustion engines at the desired period, said means being controlled either by the speed of the engine or manually.

A still further object of my device is to govern the point of ignition so that the combustion will be completed when the crank is just past dead center thus giving the highest expansion from the combustion.

With the above and other objects in view my invention has particular relation to certain novel features of construction and operation an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 is a plan view of my device as used on an automobile engine. Fig. 2 is a side elevation of the same, and Fig. 3 is an end elevation thereof taken from the front of the car.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the drawings, the numeral 1 refers to a portion of the frame of an automobile, 2 the dash-board and 3 the foot board. The steering wheel 4 is of the usual form and is carried on the shaft of steering post 5 which is mounted on a suitable bearing 6. This steering post carries the spark lever 7 which controls the action of the spark lever connecting rod 8. The steering post also supports the throttle lever 9 which has connection with the throttle connecting rod 10. This rod controls the movement of the throttle valve of the carbureter 11 and preferably passes between the primary lever 12 and the secondary lever 13 at their extremities serving as a washer between them and is hingedly connected to these levers preferably by means of a pivot hinge 14. The levers 1 12 and 13 lie parallel to each other when the machine is at rest and the position may be termed their "normal" position. At their other extremities these levers are each enlarged into T heads 15 and 16. Each of these heads is provided with a plurality of oblong transverse slots 17, the slots of each head being directly opposed and parallel to the corresponding slots in the other head. These levers are thus constructed in order to provide an independent hinge connection between said levers and the ignition timer operative rod 18. This independent joint is formed by passing a cotter pin 19 through the ignition timer operative rod 18 and extending the same through a slot in one of

the T heads and through it opposing slot in the other T head, said heads being on opposing sides of the rod 18. A plurality of slots are provided in order to provide for better adjustment of the independent joint. It is to be observed that these slots are of sufficient length to permit the T ends of these levers to perform their maximum movement in opposite direction without the cotter pin interfering with the movement of either.

When the lever 12 is in its normal position it lies parallel also to its coöperating lever 20 to which it is connected preferably by means of link 21. This link is hingedly connected to both lever 12 and 20 by means of clamp hinges 22 and 23 and each of said levers is provided with a number of corresponding holes 24 to admit of the lateral adjustment of the link 21 on the levers. The lever 20 is hingedly connected at one end thereof to the spark lever connecting rod 8 by means of an adjustable clamp hinge 25, holes 26 being provided in said lever for its adjustment. The distance between the holes 26 is equal to twice the distance between the holes 24. At its other end this lever 20 has a hinge connection with the governor stem 27. This hinge is preferably formed by passing the stem diametrically through a flat cylindrical block 28. The end of the lever 20 lies upon the flat side of this block and is movably secured thereto by means of a capstan screw 29 which passes through said lever and is secured in a tapped hole in said block. This tapped hole extends to the transverse hole through which the governor stem passes and the capstan screw is designed to screw down against said stem and hold the same against movement through the block. This arrangement readily permits the adjustment of said block upon the governor stem. The governor stem also has a hinge connection with the secondary lever 13 by means of a clamp hinge 30.

I desire to call special attention to the form of governor which I have shown in the drawings. The governor is constructed of a fixed transverse brace 31, to either end of which bell cranks 32 and 33 are pivotally connected. These bell cranks are similar in shape and construction and to one arm of either crank weights 34 and 35 are attached while the other ends are connected with the sliding sleeves 36 by means of links 37 and 38. These links are pivotally attached to both the bell cranks and the sliding sleeve. This sleeve is designed to slide on the governor shaft 39 and the governor stem is connected to said sleeve by means of a yoke 40. The governor shaft carries a pulley wheel 41 to which motion is transmitted from pulley 42 which is carried by the fly wheel shaft 43 which in turn is operated by fly wheel 44, motion is transmitted from one pulley to the other by pulley cord 45. The brace 31 is fixed to the governor shaft 39 and the weights are normally held against the rod by coil springs, (not shown). The special advantage of a governor device of the kind shown and described resides in the fact that in this device the weights have a more sensitive control over the movements of the sleeve than in the ordinary governor and also any wear in the other parts of the governor will not have a very appreciable effect upon the movement of the sleeve until the wear becomes decided.

The operation of my device is as follows: When the motor is at rest, if the throttle lever is advanced the ends of the secondary and primary lever attached thereto are also advanced and the secondary lever operating upon the governor stem and the primary lever operating on link 21 as fulcrums cause a retard of the T heads of the levers and the spark, and give a negative lead. This retard movement is accomplished by the action of pull spring 46 operating upon the ignition timer operative rod 18 which has a hinge connection with the arm 47 of the timer 48. The retard movement of the T heads of these levers merely carries them out of engagement with the cotter pin 19 and permits the rod 18 to yield to the pull of the spring 46 and thus retard the spark. When the motor starts the governor is set in motion and centrifugal force causes the governor weights to separate and the governor sleeve and stem connected therewith advance and the stem carries along with it the secondary lever and also coöperating lever connected therewith which secondary lever operating upon the hinge 14 as a fulcrum advances the ignition timer operative rod and the spark. This is the same as the advance of the governor stem when they are each attached to the secondary lever at equal distances from the fulcrum and is greater or less accordingly as the ignition timer operative rod is attached to said secondary lever beyond the point of attachment of the governor stem thereto or between said point of attachment and the fulcrum 14, regardless of the action of the throttle connecting rod. With low speed and limited throttle opening the spark may not be sufficiently advanced by the governor, then by advancing the spark lever the spark lever connecting rod 8 advances the lever 20 which operating upon the governor stem as a fulcrum advances the primary lever 12 acting through link 21, and causes the primary lever to assume control of the ignition timer operative rod and consequently the spark, so long as the mean average advance of the throttle connecting rod and governor stem, as modified by the effect of the throttle connecting rod 10 upon the ignition timer connecting rod 18, while acting upon the governor stem

as a fulcrum, does not exceed the advance of the spark lever connecting rod and if this mean average advance does exceed the advance of said connecting rod, the secondary lever again assumes control.

If the ignition timer operative rod 18 is attached to the secondary lever at a point which is the same distance from the hinge 14 as the point of attachment of the governor stem to said lever, and the spark lever connecting rod 8 and the governor stem 27 are both advanced the spark will be advanced to a degree equal to the sum of the total advance of spark lever connecting rod and governor stem diminished by the advance of the throttle connecting rod 10, if the same is advanced; and if the rod 10 is stationary during the advance of rod 8 and stem 27 the advance of the ignition timer operative rod 18 and the spark will equal the joint advance of rod 10 and stem 27.

Referring now to the relative action of the primary and secondary levers upon the ignition timer operative rod and the spark when the force is exerted upon said lever by the movement of the throttle connecting rod we get the following results: (1) The secondary lever with the ignition timer operative rod 18 and governor stem attached to it at points equally distant from hinge 14 has no control of spark through the action of the throttle connecting rod. (2) The primary lever with the ignition timer operative rod and governor stem together as above, gives a movement to the ignition timer operative rod and spark, contrary in direction to the movement of the throttle connecting rod and varying inversely as the link 21 which acts as a fulcrum is moved toward or from the point of force exertion. (3) With the ignition timer operative rod attached to the secondary lever at a point a greater distance from hinge 14 than the distance of the point of attachment of governor stem to said secondary lever, from said hinge, the throttle connecting rod movement has a greater effect on the ignition timer operative rod and consequently on the spark, through the primary lever than through the secondary lever until the distance from ignition timer operative rod to governor stem equal distance from governor stem to throttle connecting rod.

With the above described device the spark or another means of ignition is automatically advanced or retarded, effecting a saving in fuel, a better combustion of the charge thus preventing overheating the engine and consequent wear, absolute automatic control of the spark irrespective of loads and speeds without necessity for use of manual lever, thus leaving the hands of the operator free from other duties and relieving operator from the necessity of manipulating manual lever. Through the operation of the means herein set forth the time of ignition is advanced either by the reduction of the throttle opening or by increased motor speed or by manual lever, and is retarded by a contrary movement of either of these agencies.

While I have shown a specific form of my device I do not wish to limit myself to this form as shown and described but desire to be permitted to vary the form and construction of the same so long as the spirit of the invention is not departed from. And it is to be specially observed that any of the various methods of ignition of the fuel charge in the cylinder of internal combustion engines may be used in connection with my device. It is to be further observed that the references in this specification to the "advance" and "retard" of the spark specially mean the "advance" and "retard" of "time of ignition" of the fuel charge in that class of engines above referred to.

What I claim is:—

1. In an ignition regulator, the combination with a rod for operating a throttle valve, a governor responsive to engine speed, and an ignition timer, of a lever, connected with said throttle valve operative rod, said governor and said ignition timer, and operatively interconnecting said elements so that the two first mentioned elements shall respectively operate upon said lever alternatively as power and fulcrum and thereby regulate said ignition timer.

2. In an ignition regulator, the combination with a manual rod for operating a throttle valve, an ignition timer, and a manual rod for adjusting said ignition timer independently of said throttle valve operative rod, of a lever, connected with said throttle valve operative rod, said ignition timer and said manual rod for adjusting said ignition timer and operatively connected with said three elements in such a manner that the throttle valve operative rod and the manual rod for adjusting said ignition timer shall respectively operate upon said lever alternatively as power and fulcrum and regulate said ignition timer.

3. In an ignition regulator, the combination with a device for controlling a throttle, a device responsive to engine speed and a device for controlling an ignition timer of a lever, having connection at its extremities with said throttle control and ignition timer controlling devices and intermediate the ends thereof with said speed responsive device, whereby said lever may operate upon said throttle controlling and speed responsive devices alternatively as fulcrums and actuate said ignition timer controlling device.

4. In an ignition regulator, the combina-

tion with a rod for operating a throttle valve, a governor responsive to engine speed, and an ignition timer, of a lever, connected with said throttle valve operative rod, said governor and said ignition timer in such a manner. that, when the throttle is operated; the said throttle valve operative rod shall operate upon said lever as a power and cause said lever to operate upon said governor as a fulcrum and regulate said ignition timer, and, when the governor operates, it shall operate upon said lever as a power. and cause said lever to operate upon said throttle valve operative rod as a fulcrum and regulate said ignition timer.

5. In an ignition regulator, the combination with a throttle control device, a speed responsive device and an ignition timer control device; of a primary lever and a secondary lever, having their corresponding ends connected with said throttle control and ignition timer control devices, said secondary lever having connection with said speed responsive device; and a coöperating lever, fulcrumed at one end and having connection with said speed responsive device at its other end, said primary and coöperating levers having a hinge connection with each other at points intermediate the ends thereof; whereby said primary lever, in conjunction with said coöperating lever, may operate, alternatively with said secondary lever, upon said throttle control and speed responsive devices alternatively as fulcrums and actuate the said ignition timer control device.

6. In an ignition regulator, a primary lever, a secondary lever, said levers normally lying substantially parallel and both having their corresponding ends hingedly attached to a throttle control device and to an ignition timer operative device, respectively, a coöperating lever coördinating with said primary lever and having adjustable hinge connection therewith, means for accomplishing said adjustable connection, means for manually operating said coöperating lever, said means having an adjustable hinge connection therewith, a governor device, rigid means for imparting motion from said governor device to said coöperating lever and said secondary lever and being hingedly connected to said levers, said elements being so disposed as to automatically control the ignition timer.

7. In an ignition regulator, as described, a primary lever and a secondary lever, said levers each having their corresponding ends hingedly connected with a throttle control means and with an ignition timer control means, respectively, a third or coöperating lever operating in conjunction with said primary lever, means for adjustably and hingedly connecting said coöperating and primary levers at points intermediate the ends of each, means hingedly and adjustably attached to one extremity of said coöperating lever for operating the same, the other said lever extremities being attached to a governing device, said governing device having connection also with the secondary lever by an adjustable hinge connection, said means being so disposed as to automatically regulate the time of ignition and at the same time admit of manual regulation of the same.

8. In an ignition regulator, as described, a primary lever and a secondary lever, said levers having hinge connection with a throttle control device at their extremities, an ignition timer operative device having a slidable hinge connection with the other ends of said primary and secondary levers, said ignition timer operative device being provided with other means for holding the same in resistance against the action of said levers, a third or coöperating lever so disposed as to coöperate with said primary lever and hingedly connected therewith by a laterally adjustable link, said link being attached to said levers at points intermediate the ends thereof, said third lever also being connected at one end by a laterally adjustable hinge connection to a manually operated device and at the other end to a governing device, which also has a hinge connection with said secondary lever, the connection between the said governing device, said third lever and said secondary lever being rigid, said elements being so disposed as to automatically advance or retard the ignition timer operative device and the time of ignition and at the same time admit of manual regulation of the same.

9. In an ignition regulator, in combination, a primary lever and a secondary lever, said levers having hinge connection with a throttle control device at their extremities, an ignition timer operative device having a slidable connection with the other ends of said primary and secondary levers, said device being provided with other means for holding the same in resistance against the action of said levers, and a third lever so disposed as to coöperate with said primary lever and hingedly connected therewith by a laterally adjustable link, said link being attached to said levers at points intermediate the ends thereof, said third lever also being connected at one end by a laterally adjustable hinge connection to a manual control device and at the other end to a governor device, which governor device also has a hinge connection with the said secondary lever, the connection between the said governor device, said third lever and said secondary lever being rigid; said elements being so disposed as to automatically advance or retard the ignition timer operative device and the time of ignition, and at the

same time admit of manual regulation of the same.

10. In an ignition regulator, the combination with a means for operating a throttle valve, of a lever having a hinge connection with said means at one extremity of the said lever, an ignition timer operative means having a hinge connection with the other end of said lever, a coöperating lever, said levers being hingedly and adjustably connected at points intermediate the ends thereof, and said coöperating lever operating upon a fulcrum at one end and having connection at its other end with a manual control means; by means of which the time of ignition is regulated.

11. In an ignition regulator, as described, a primary lever, hingedly attached at one end to a throttle valve and at its other end to an ignition timer operative device, a coöperating lever fulcrumed at one point and operating in conjunction with said primary lever, a connecting device for imparting motion from said coöperating lever to said primary lever, a manual control device having connection with said coöperating lever for the purpose of permitting manual operation of said ignition regulator.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN C. CARPENTER.

Witnesses:
ERNEST C. GUY,
LA VERA MILLER.