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SPARK ADVANCE GOVERNOR FOR INTERNAL COMBUSTION ENGINES

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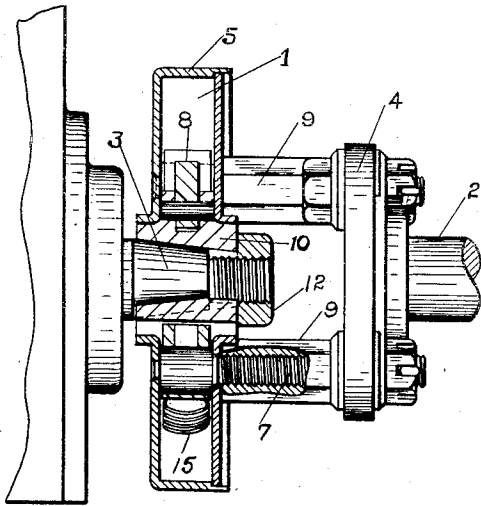


Fig. 1

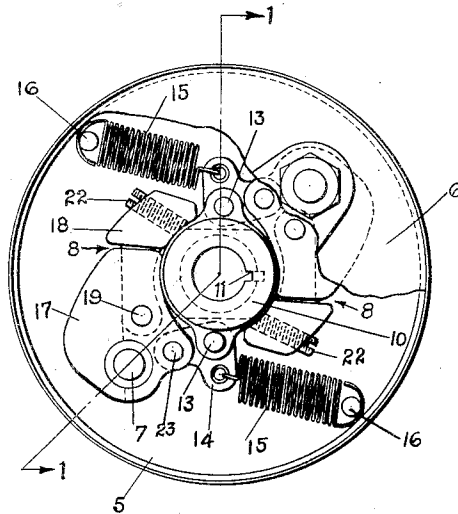


Fig. 2

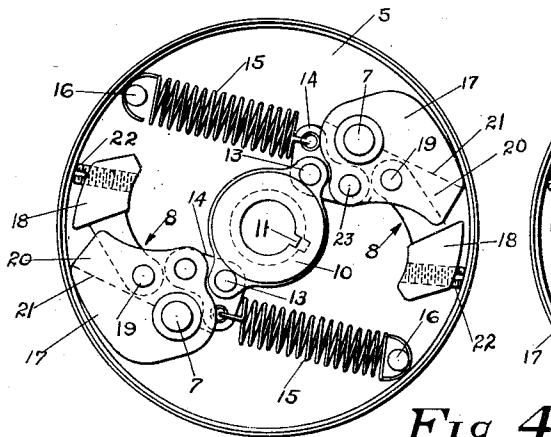


Fig. 4

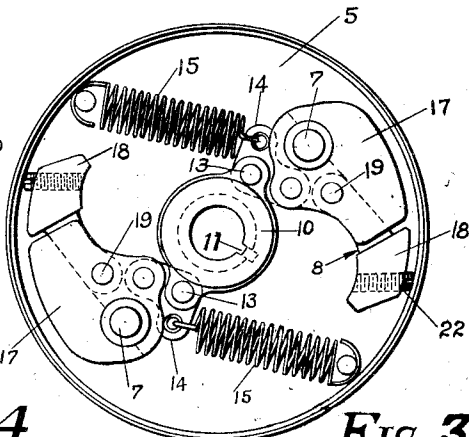


Fig. 3

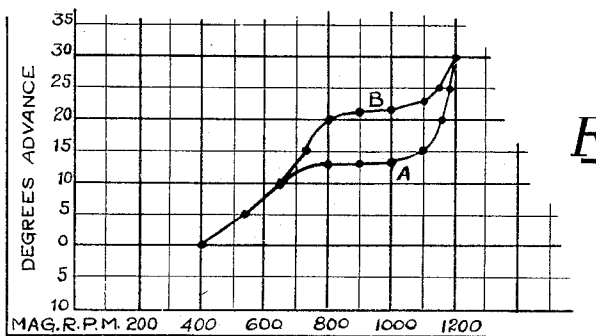


Fig. 5

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SPARK-ADVANCE GOVERNOR FOR INTERNAL-COMBUSTION ENGINES.

Application filed October 7, 1921. Serial No. 506,066.

My invention relates to a speed responsive mechanism for automatically controlling the time of ignition of an internal combustion engine.

It is well known that an internal combustion engine requires an advancement of the time of ignition with an increase of speed of the engine, the degree of advance and the character thereof varying with the design of the engine, the character of roads over which the engine operated vehicle travels and the loads imposed on the engine together with other factors.

In my prior Patent 1,283,863, issued November 5, 1918, and 1,388,743, issued August 23, 1921, I have described and claimed a mechanism for securing an advance of time of ignition with an increase in engine speed, and in my Patent 1,363,745, issued December 8, 1920, I have described and claimed a governor for securing a large advance in time of ignition with an increase in engine speed. The construction of the latter patent however requires two pairs of controlling weights, and a rather thick casing which, while rendering satisfactory service, is complicated compared to the present invention.

In automotive vehicle construction, certain parts have become standardized as to size and certain distances have become fixed. Thus while it is conceivable that one of my devices of the prior art may be made large enough to give any desired degree of advance, yet because of the maximum diameter of governor allowed, the desired degree of advance may not be attained. This maximum diameter is determined by the height of the magneto shaft above its mounting plate, this height having become standardized in the trade.

It is an object of this invention to provide a mechanism of small dimensions to secure a large advance in time of ignition.

Another object of the invention is to provide means whereby the time of advance may be broken up into two stages, which, in one form of my device may be varied at will.

It is another object of the invention to make a simple and inexpensive device for securing large increases in time advance of ignition.

Other and further objects will be apparent after reading the following specifica-

tion and claims in connection with the accompanying drawings, in which—

Fig. 1 is a cross sectional view of my governor, along the line 1—1 of Fig. 2, showing the governor coupled to the driving and the driven shafts,

Fig. 2 is a plan view of the governor in its normal position, a portion of the cover being broken away to disclose interior mechanism,

Fig. 3 is a view similar to Fig. 2 showing the position of parts at one speed of the engine,

Fig. 4 is a similar view showing the position of parts at another and higher speed of the engine, and

Fig. 5 is a plot showing the performance of my governing device under two different adjustments.

As is well known in the art, to secure an advance in the time of ignition, it is sufficient to advance the angle of the spark controlling shaft relative to the engine shaft. In this instance, a spark advance governor 1 is interposed between the engine shaft 2 and a magneto shaft 3, the engine shaft being suitably secured to a coupling disc 4, which may be of the flexible coupling type, which in turn is secured to the governor.

The governor comprises essentially a casing 5 having a cover 6, said casing having mounted therein two studs 7 on each of which are mounted a two part weighted arm 8. These studs serve as means to secure the cover to the casing as for example by securing thereon coupling nuts 9. Mounted centrally within the casing is a hub 10 having a tapered bore provided with a keyway 11 for attachment in driving relation to the magneto shaft 3. A suitable nut 12 retains the hub in place on the shaft. The hub is further provided with ears in which are pins 13 on which pins are fulcrumed bell-crank levers 14. One end of the bell-cranks is pivotally attached to the arm 8 by means of a pin 23 and to the other end is attached a coil spring 15.

The free end of the coil spring encompasses a pin 16 secured in the casing 5. The pivot pins 13 and 23 and the stud 7 are all in a straight line during the normal position of the governor so that at zero or even low rotative speeds the weights are locked, so to speak, so far as torque applied to the driven member 10 is concerned, whereby

hunting toward and away from the hub is prevented, thus eliminating objectionable sounds. The springs 15 also function to keep the weights quiet at low speeds.

5 The arms 8 each comprise two members 17 and 18 pivoted together at 19. The member 18 has a long shank fitting within a milled groove 20 in the member 17 the outline of which is shown by dotted line 21 in
10 Figure 4. The extreme end of the member 18 is provided with a stop which may be in the form of an adjustable screw 22 for a purpose which will be presently described.

15 Normally the parts are disposed as shown in Fig. 2. The springs 15 are then pulling on the links 14 to retain the hub 10 in the position shown and the pivots 13, 23 and stud 7 are in a straight line to lock the weights in place against impulses commu-
20 nicated to the hub 10 as for example when the magneto rotor is snapping away from the pole pieces at low rotative speeds of the magneto. The springs also function to rotate the links on the pivots 13 so as to cause the
25 arms 8 to fit snugly against the hub 10. After the engine shaft has reached a critical speed of rotation, the centrifugal force overcomes the force of the springs 15 and the drag of the magneto on the hub 10, and the
30 arms 8 begin to move outwardly, the two members 17 and 18 moving as a unit. As these arms move, they rotate the hub 10 with respect to the casing, thus rotating the one shaft which is attached to the casing
35 with respect to the other one which drives the magneto and which is splined within the hub. As the speed of the engine increases an increasing centrifugal force is applied to the weighted arms, which overcomes the in-
40 creasingly greater restraining forces of the springs and of the magneto shaft, to further move them outward to thereby increase the angle between the two shafts. This continues until the stop 22 in the member 18 en-
45 gages the wall of the casing 5, as shown in Fig. 3. At this time the turning moment of the arms 8 is greatly reduced and for a certain further increase of engine speed there is no appreciable rotation of the hub.
50 This is illustrated by curve A in Fig. 5. In this figure the ordinates represent the degree of advance of the magneto shaft over the engine shaft and the abscissa represent the speed of the magneto or the engine shaft.
55 It will be noted that at 400 R. P. M. the two shafts will begin to rotate with respect to each other. At about 550 R. P. M. one shaft will have been displaced angularly by about 5 degrees; at 650 R. P. M. the displacement
60 is 10 degrees; at about 750 R. P. M. the screw 22 engages the wall of the casing and there is no further appreciable displacement of the shafts until about 1000 R. P. M. when it will be seen there is a further rapid in-
65 crease in angle with increase of speed. This

is due to centrifugal force acting on the other member 17 pivoting on the stud 7 while the member 18 remains practically stationary, the member 17 being permitted to move because of the articulated joint 19
70 between the members 17 and 18. The advance continues until about 1200 R. P. M. at which speed the member 17 also engages the casing wall as shown in Fig. 4 and no further advance is possible. 75

While curve A may suit the requirements of one type of engine, in another type it may be desirable to secure a larger advance in the first stage. In that case, the screw 22 may be driven into the member 18 to se-
80 cure as large an advance as is desired, such advance being limited only by the member 18 itself engaging the wall of the casing. Curve B shows the character of advance when the screw 22 is driven in flush with
85 the surface of the member 18. It will be noted that with any adjustment of the screw that the advance takes place in two distinct stages, one limited by the engagement of the member 18 with the casing wall and the
90 other limited by similar engagement of the member 17 and that there is an intermediate stage where no appreciable advance occurs.

Having thus described my invention what I claim is:—

1. A governing mechanism including a part connected to a driving shaft and a part connected to a driven shaft, devices respon-
95 sive to centrifugal force connected between said parts, said devices being provided with return springs, each of said devices consist-
100 ing of two sections, one being wholly carried by the other and having relative movement with respect thereto, means for stopping the outward movement of one of said sections
105 before the other whereby two appreciable stages of movement between the driving and driven members are obtained.

2. A governing mechanism including a part connected to a driving shaft and a part
110 connected to a driven shaft, devices responsive to centrifugal force connected between said parts, said devices being provided with return springs, each of said devices consist-
115 ing of two sections, one being wholly carried by the other and having relative movement with respect thereto, means for stopping the outward movement of one of said sections before the other whereby two appreciable
120 stages of movement between the driving and driven members are obtained and ready means for adjusting the limits of movement of one of said movement stages.

3. In a governor, a casing, a part rotatable relative to said casing, a speed responsive de-
125 vice pivotally mounted on said casing and having a connection to said rotatable part to rotate said part relative to the casing, said device comprising two members pivoted to one another, a spring acting between the cas-
130

ing and that part of the speed responsive device pivotally mounted on the casing, said members being shaped so that upon engagement of one of said members against a part of the casing the other member may still continue to move to further rotate said relatively rotatable part, and a stop in said one member to limit the movement thereof.

4. In a governor, a casing, a hub rotatably mounted in said casing, weighted arms pivotally mounted in and connected to said casing and links joining said arms and hub, each arm comprising two members pivotally connected together, movable as a unit through a predetermined angle to rotate the hub, one member being further movable relative to the other to still further rotate the hub the limit of movement of said members being determined by the casing.

5. In a governor, a casing, a hub rotatably mounted in said casing, speed responsive arms pivotally mounted on said casing, links connecting said arms and hub, the pivots of each of said arms, of the arm and its link, and of the link and the hub, being in a straight line at low rotative speeds of the governor, and springs secured to the casing

and said links, said springs assisting to maintain said pivots in a straight line under the specified condition.

6. In a governor, a casing, a hub rotatably mounted in said casing, a pair of weighted arms pivotally mounted in said casing, links connecting said arms and hub, said links being in the form of a lever with the hub pivoted intermediate the ends thereof, and springs secured at one end to the levers and at the other end to the casing.

7. In a governor, a casing, a hub rotatably mounted in said casing, a pair of weighted arms pivotally mounted in said casing, links connecting said arm and hub, said links being in the form of a lever with the hub pivoted intermediate the ends thereof, springs secured at one end to the levers and at the other end to the casing, said arms being each comprised of two members articulated so as to move as a unit to rotate the hub until one member abuts the casing and thereafter movable separately to further rotate the hub.

In testimony whereof, I affix my signature.

EDWARD MOORE.