PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvement in Regulating Devices for Internal Combustion Engines.

I, Roy William Ide, Engineer, of 311, North 5th Street, Springfield, County of Sangamon, State of Illinois, United States of America, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention relates to internal combustion engines and has particular reference to such engines of the kind which are provided with an electro-magnetic governing device energized by a generator operated by the engine and adapted to control the movement of the butterfly or throttle valve that controls the admission of engine operating gas to the engine, so as to control or regulate the speed of the engine. The object of the invention is to provide an improved electro-magnetic governing device adapted to control the butterfly or throttle valve so as to produce more satisfactory running of the engine.

It has been found advantageous to give governing devices a greater degree of sensitiveness over a predetermined range of lower or starting speeds than over the normal running speeds. This has been accomplished in the case of mechanical governors by providing several springs which come into action successively during increase of speed, so that the resistance to movement of the governor is increased, and according to my invention I accomplish the same result by providing the electro-magnetic device with a movable armature and with means adapted to be engaged by the said armature to serve as a load when the speed of the engine exceeds a predetermined limit.

I will explain my invention more fully by reference to the accompanying drawings showing the preferred embodiment thereof and in which:—

Figure 1 is a view in sectional elevation of an engine and a carburettor constructed in accordance with my invention;

Figure 2 is a view on line 2—2 of Figure 1;

Figure 3 is a sectional elevation of the electro-magnetic throttle valve governing mechanism which I prefer to employ;

Figure 4 is a view similar to Figure 3 with parts in a different relation; and

Figure 5 is a sectional plan view on the line 5—5 of Figure 1.

Like parts are indicated by similar characters of reference throughout the different figures.

The engine illustrated, but to the employment of which the invention is not to be limited, is inclusive of an engine shaft 1 that carries a fly wheel, not illustrated, and which shaft is provided with a crank structure 3 for turning it. This crank structure is connected with the inner end of a pitman 4 whose outer end is swingingly connected with a piston 5, all in accordance with well known practice.

The outer portion 6 of the engine casing is desirably made cylindrical and is coaxial with an inner cylinder 7, spacing 8 intervening between the inner cylinder 7 and the outer cylinder 6 for the reception of engine cooling fluid that may be circulated through said spacing, as will be understood by those skilled in the art. The working cylinder 13 of the engine receives the piston 5 and, as here shown, functions as a valving cylinder, to which end it is provided with ports 14 and 15 each adapted to serve, first, as an intake port and, second, as an exhaust port, the valving cylinder shown being arranged to

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operate in a counter-clockwise direction as it is viewed from above. Each of the ports 14 and 15 is in turn brought into alignment with the admission or intake port 16 and the exhaust port 17 and inasmuch as there are two ports 14 and 15 in the form of engine shown the valving cylinder is caused to turn a half revolution (during which one or other of the ports 14 or 15 operates through a complete cycle that embraces the intake, compression, expansion and exhaust periods) during two revolutions of the engine shaft. The gearing by which the valving cylinder is thus driven at quarter engine speed includes the worm wheel 18 co-axial with and driven by the shaft 1, the worm 19 upon the vertical shaft 20 meshing with the worm wheel 18, the pinion 21 upon the upper end of the shaft 20 and the circular rack 22 carried upon the lower end of the cylinder 13 meshing with the pinion 21. The mixture produced by the carburettor is governed in its passage through the admission port 16 by a butterfly valve 23. This butterfly valve is fixedly mounted upon a shaft 24 that extends through the carburettor casing wall 25. A pinion 26 is fixed upon the outer end of the shaft 24 and meshes with a vertically reciprocable rack 27 whose upper end is united with the core or armature 28 of a solenoid 28^1.

The electro-magnetic responsive device—the solenoid 28^1—is in circuit with a source of current which is regulated by the speed of the engine. This source of current is in the form of a generator (not shown) which is driven by the engine, the solenoid responding to the voltage output of the generator. As the voltage increases in response to the increased engine speed the armature 28 rises and the valve 23 opens to supply additional mixture until it reaches its maximum open position when the engine will be running at normal speed. Upon further increase of the engine speed the armature 28 will continue to rise and the valve 23 will commence to close again until it would finally completely throttle off the supply of mixture should the speed of the engine continue to increase.

When the engine is being cranked to start it the response of the solenoid to the voltage then generated should be quicker relatively to the response of the solenoid to changes in voltage that arise when the engine is running normally. To this end the core of the solenoid is provided with a load which is removed therefrom during cranking or starting speed and is added thereto when the speed commences to exceed cranking or starting speed, a further increase in speed at this period over a definite range being required before further movement of the core is effected. This load is shown as being in the form of a plunger 30 that operates in the bore of the solenoid core and has a head 31 which rests upon a shoulder 32 in the bore of the solenoid spool 33 when the engine is operating at starting or cranking speed. When the engine is running sufficiently in excess of such speed the increased voltage is sufficient to energize the solenoid sufficiently to enable it to draw up its core 28 against the weight of the load 30, the load then being lifted from its seat 32 and moving in the space above the shoulder 32 according to the generated voltage. The effective weight of the solenoid core is thus increased to normal when the engine is operated at running speed but is reduced below normal when the engine is being started so that the operation of the valve 23 is more sensitive under the latter condition.

The position of the rack 27 is thus governed, subject to the influence of the load 30, by the voltage impressed upon the solenoid and therefore by the speed of the engine, and as this rack moves it turns the pinion 26 to turn the throttle valve 23. The range or arc of travel of the throttle valve 23 during starting speed is indicated by the portion 34 of the opening arc shown in Figure 3 and the range for normal running by the arc 34^1. A throttling or governing range for engine speeds beyond the normal is indicated by the closing arc 35 in Figure 4, this arc succeeding the normal running arc 34^1. When the speed (and consequent voltage) rises above normal or running speed the rack 27 is correspondingly lifted and the throttle valve 23 is turned in a clockwise direction from the full open position, shown by full lines in Figure 4, towards the closed position shown in dotted lines so as correspondingly to reduce the flow of mixture into the engine, and as such speed and voltage becomes reduced towards the normal the rack 27 will be lowered correspondingly to turn the throttle valve in a counter-clock-wise direction so as correspondingly to permit an increase in the flow of mixture to the engine. It will be observed that the maximum opening of the valve 23 throughout its range of operation for starting is less than the opening for normal running so that there is increased vacuum in proportion to the

engine speed for pulling upon the incoming mixture during starting, whereby a richer gas mixture is produced in proportion to the engine speed during starting than is normally the case.

Although it forms no part of the present invention in the embodiment of the invention herein shown, the gasoline or other liquid fuel is supplied to a mixing chamber 37 through a nozzle 36 and mixed with air drawn in through pipe 39, crank case 38, and pipe 40, the mixture then passing to the throttle valve 23.

While I have herein shown and particularly described the preferred embodiment of my invention I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An internal combustion engine of the kind specified wherein the electromagnetic device is provided with a movable armature and means adapted to be engaged by said armature to serve as a load when the speed of the engine exceeds a predetermined limit.

2. An internal combustion engine according to Claim 1 wherein the electromagnetic device is adapted to be governed by the engine in such manner as to operate the throttle valve mechanism throughout a limited predetermined range when the engine is starting or turning below the lowest running speed and throughout a different range when the engine is operating above the highest starting speed, the sensitiveness of said electromagnetic device being different for the said different ranges.

3. An internal combustion engine according to Claim 2 wherein the throttle valve is rotatably mounted and is moved by the electro-magnetic device through a limited predetermined arc when the engine is starting or turning below the lowest running speed and in a succeeding arc when the engine is operating above the highest starting speed, the sensitiveness of said electromagnetic device being greater during the first mentioned arc than during the last mentioned arc.

4. An engine according to Claim 3 wherein the rotatably mounted throttle valve is connected with a pinion for enabling it to be turned, the valve operating means including a rack in actuating relation to said pinion.

5. The improved governing means for internal combustion engines substantially as herein described with reference to, and as illustrated by, the accompanying drawings.

Dated this 23rd day of June, 1920.

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[This Drawing is a reproduction of the Original on a reduced scale]

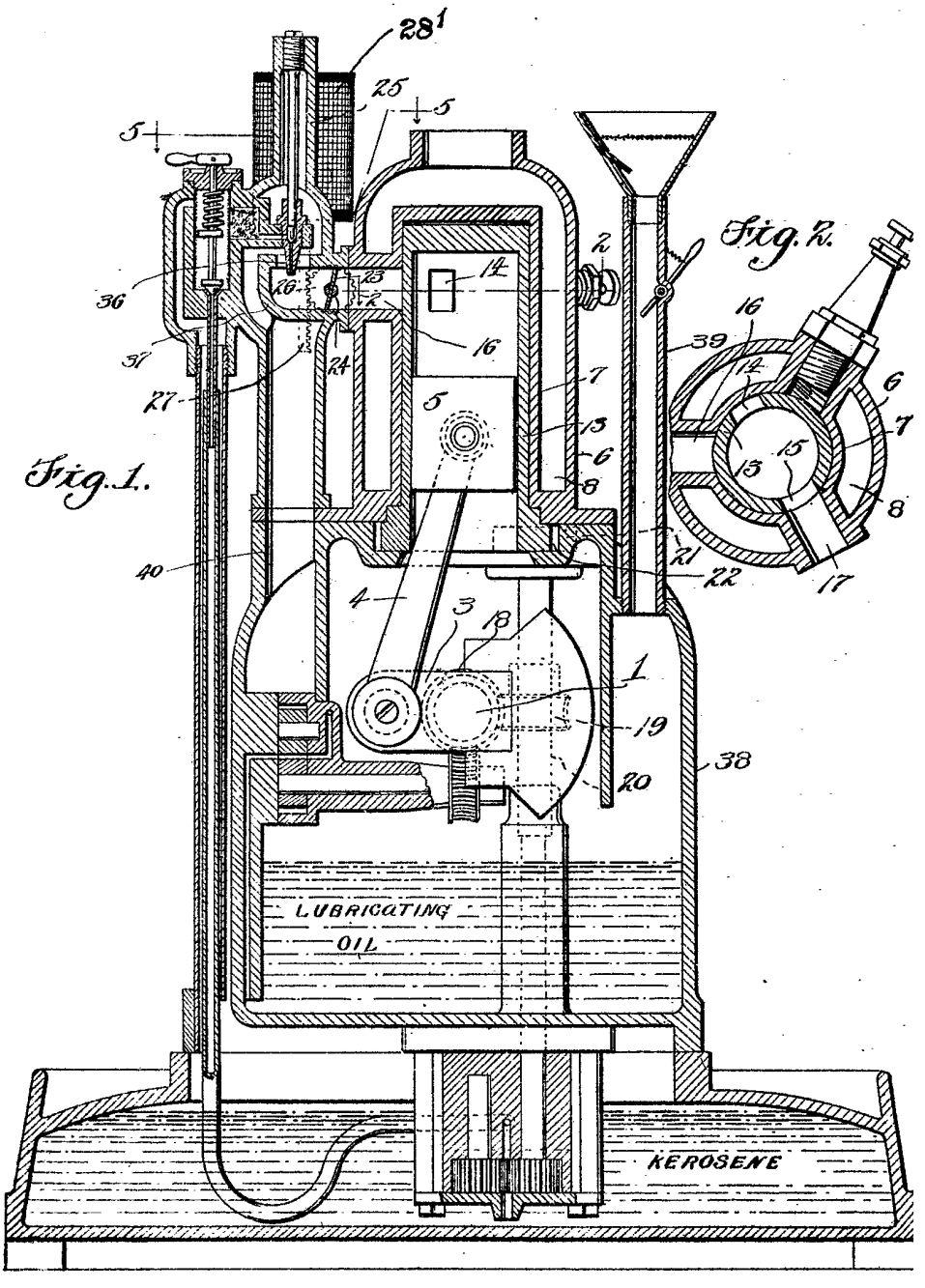


Fig. 1.

Fig. 2.

Fig. 3.

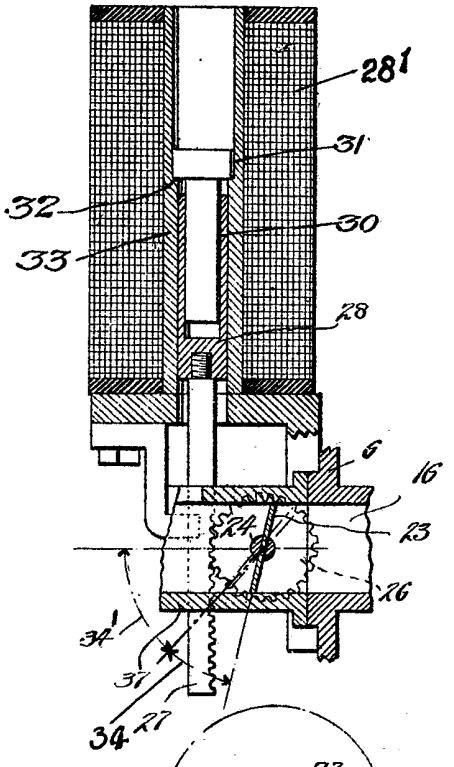


Fig. 4.

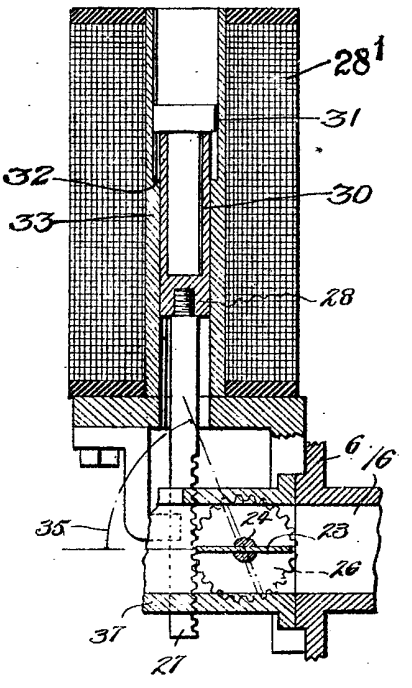
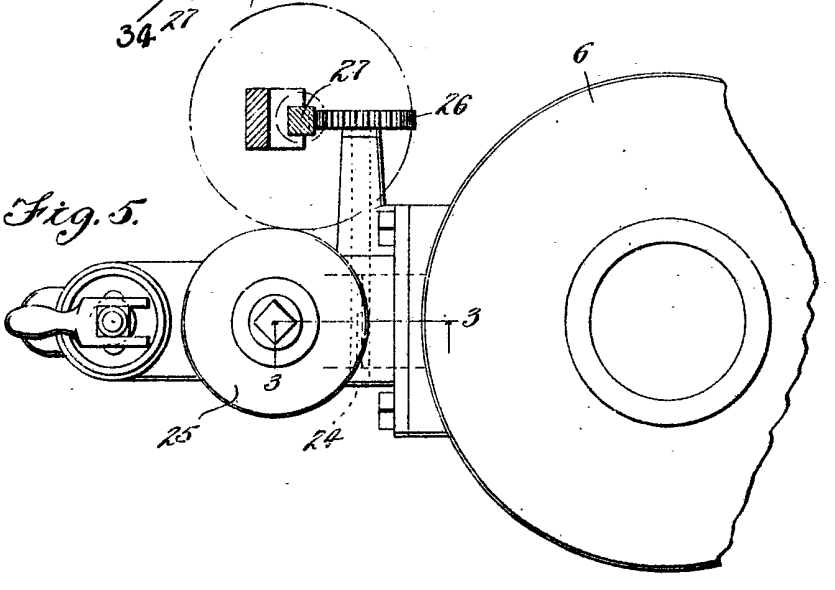


Fig. 5.



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