W. B. S. WHALEY.

AUTOMATIC GOVERNING MECHANISM FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JULY 28, 1917.

1,389,801.

Patented Sept. 6, 1921.

5 SHEETS—SHEET 1.

Fig. 3.

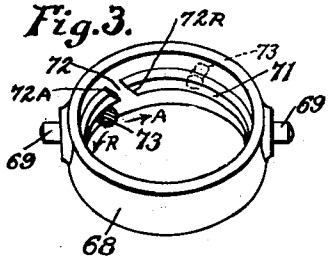


Fig. 4.

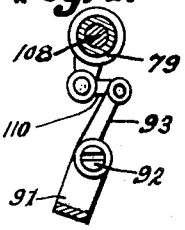


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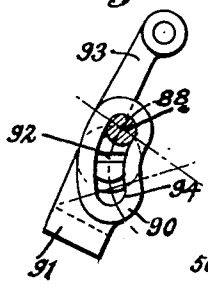
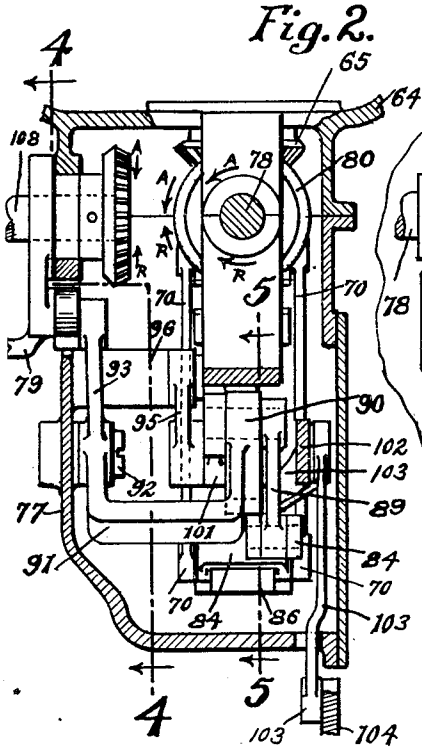


Fig. 1.

Fig. 2.



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5 SHEETS—SHEET 2.

Fig. 7.

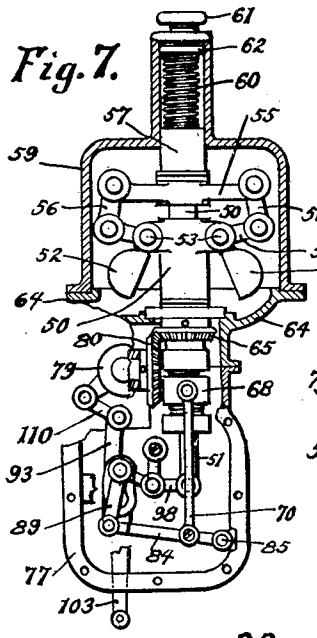


Fig. 9.

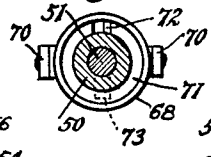


Fig. 10.

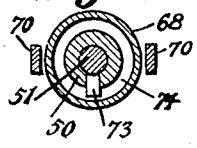


Fig. 8.

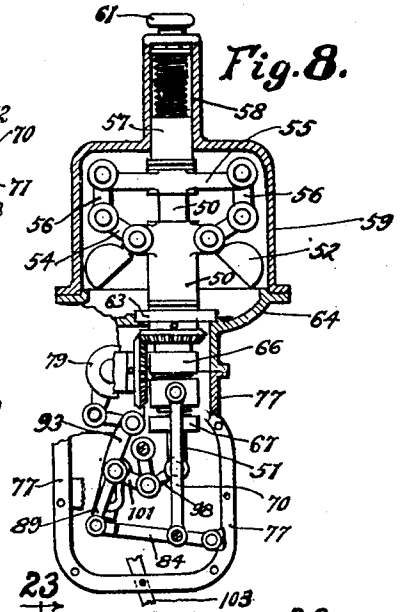
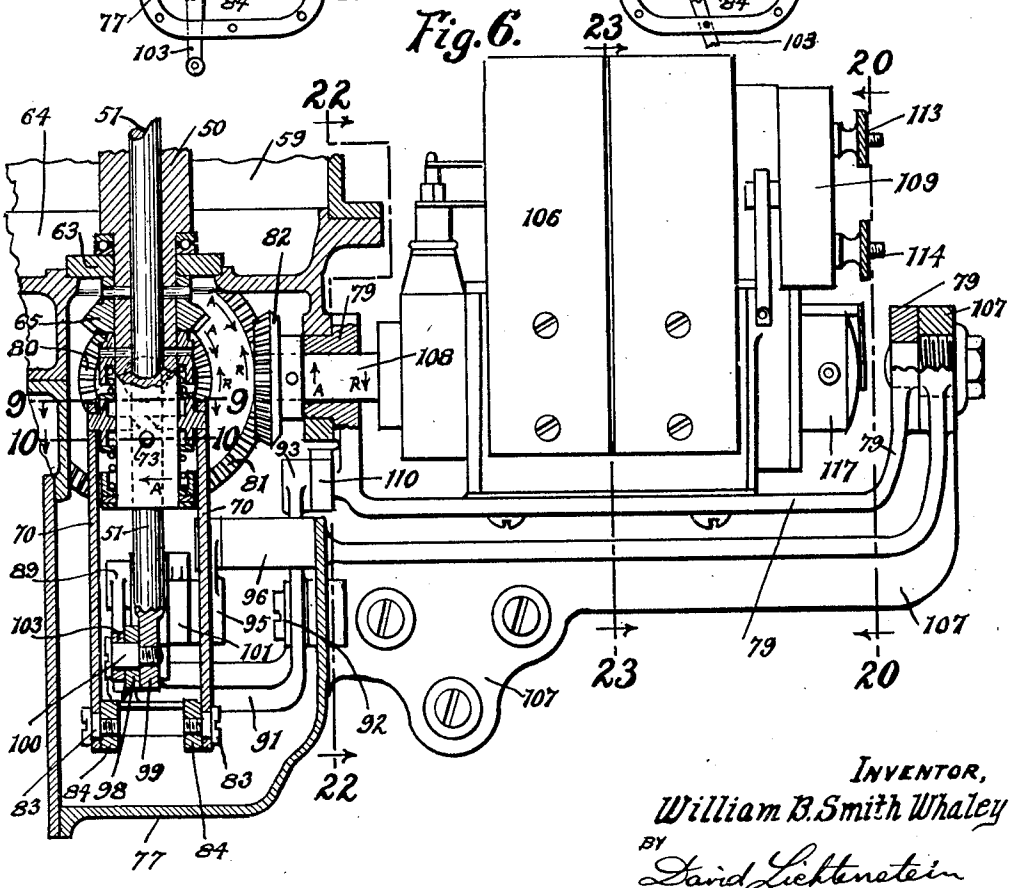


Fig. 6.



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5 SHEETS—SHEET 3.

Fig. 11.

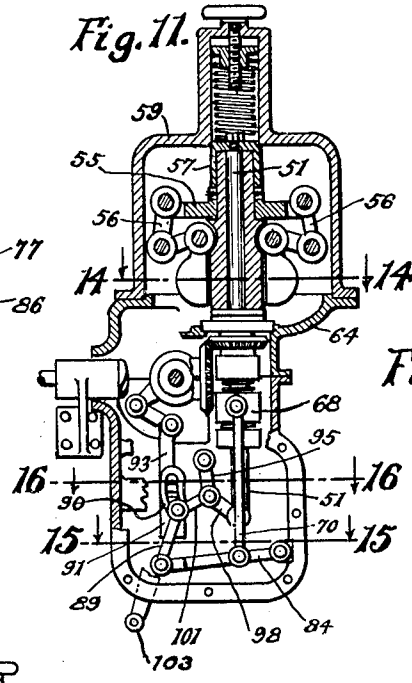


Fig. 19.

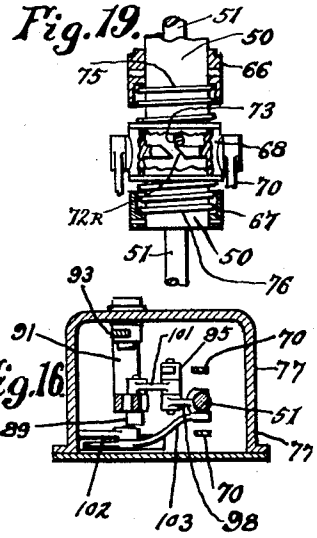


Fig. 15.

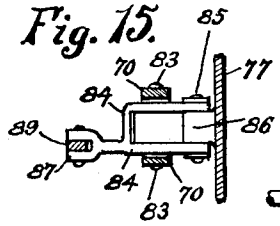


Fig. 16.

Fig. 17.

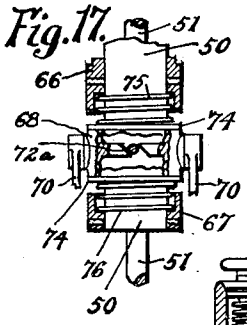


Fig. 12.

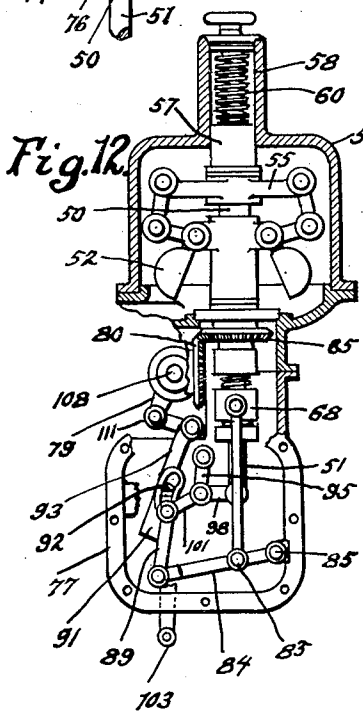


Fig. 14.

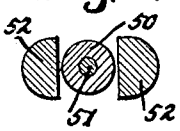


Fig. 18.

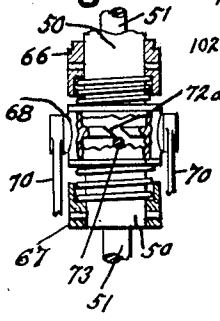
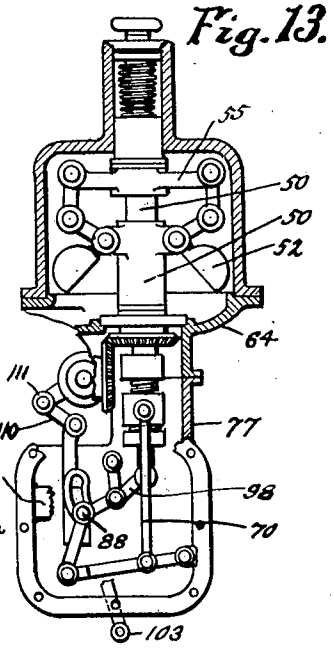


Fig. 13.



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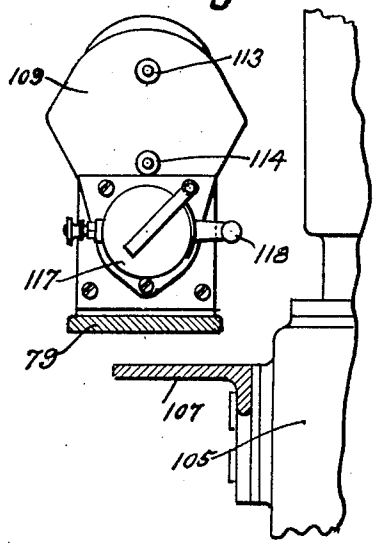
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APPLICATION FILED JULY 28, 1917.

1,389,801. Patented Sept. 6, 1921.

5 SHEETS—SHEET 4.

Fig. 20.



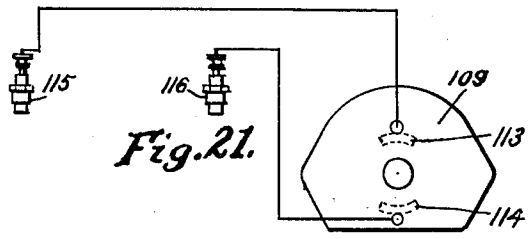


Fig. 21.

Fig. 23.

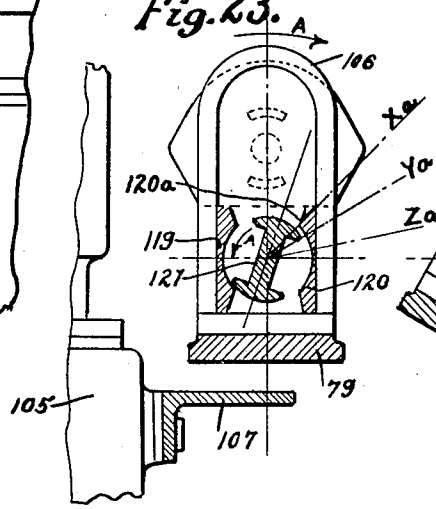


Fig. 24.

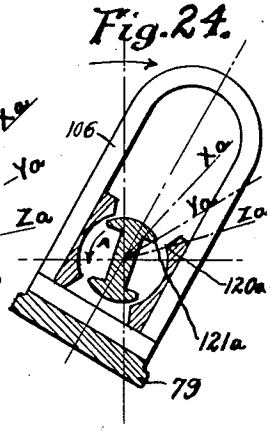


Fig. 22.

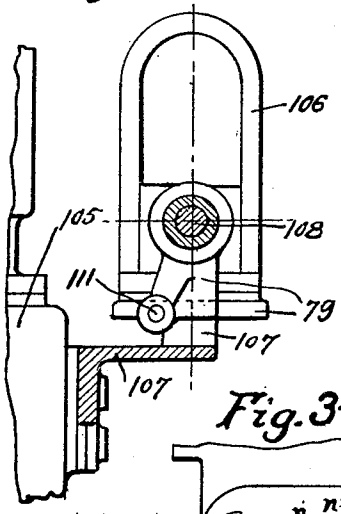


Fig. 25.

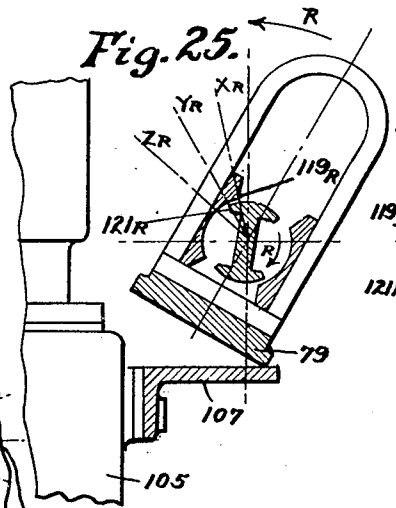


Fig. 26.

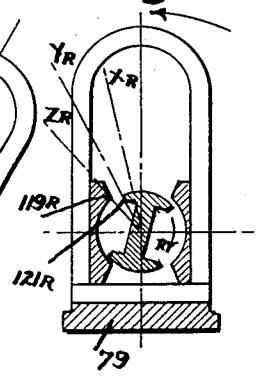
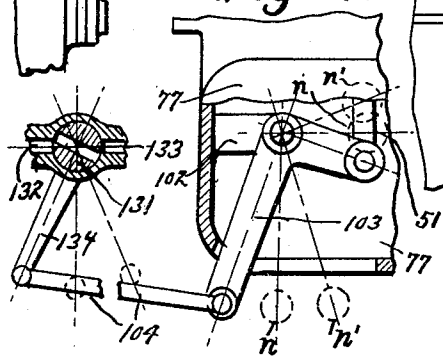


Fig. 34.



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APPLICATION FILED JULY 28, 1917.

1,389,801. Patented Sept. 6, 1921.

5 SHEETS—SHEET 5.

Fig. 27.

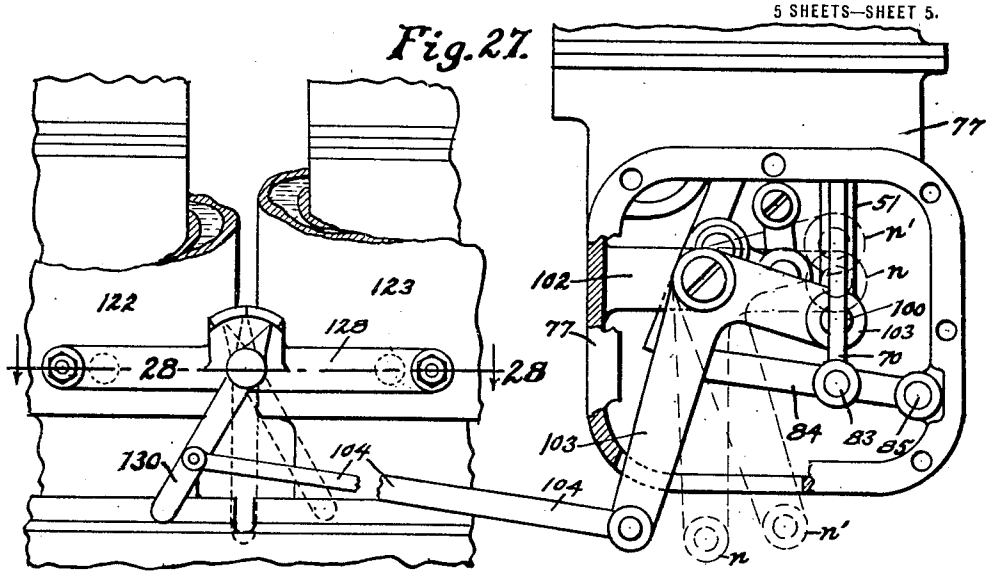


Fig. 28.

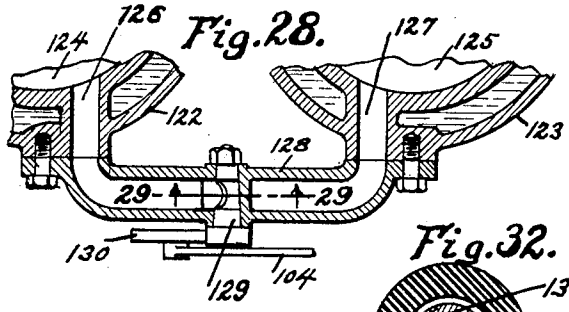


Fig. 29.

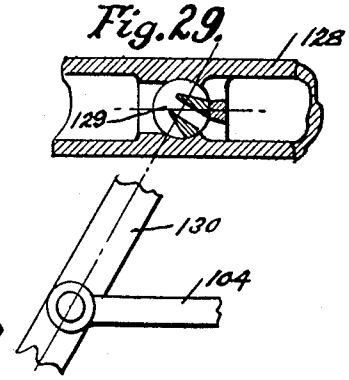
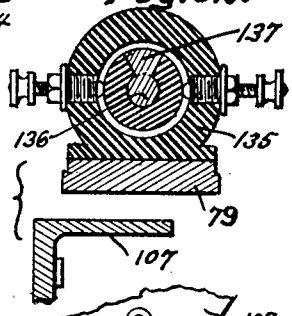


Fig. 32.



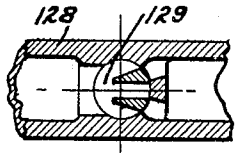
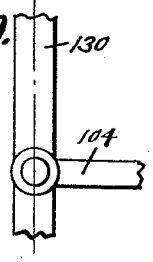


Fig. 30.



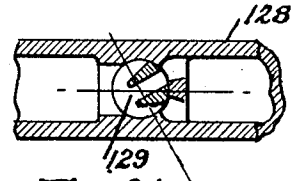
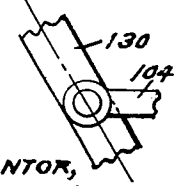


Fig. 31.



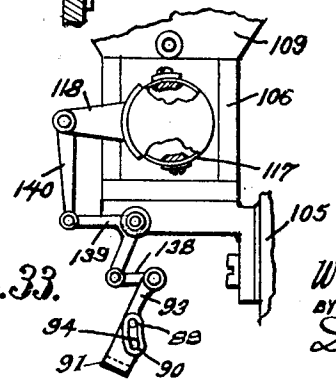


Fig. 33.

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William B. Smith Whaley

BY

David Lichtenstein

ATT'Y.

UNITED STATES PATENT OFFICE.

WILLIAM B. SMITH WHALEY, OF MALDEN, MASSACHUSETTS, ASSIGNOR TO AMERICAN WHALEY ENGINE COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

AUTOMATIC GOVERNING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

1,389,801. Specification of Letters Patent. Patented Sept. 6, 1921.

Application filed July 28, 1917. Serial No. 183,368.

To all whom it may concern:

Be it known that I, WILLIAM B. SMITH WHALEY, a citizen of the United States, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented a new and useful Automatic Governing Mechanism for Internal-Combustion Engines, of which the following is a specification.

My invention relates to governing mechanisms for internal combustion engines, and has for its object to provide automatic governing means for controlling either the timing of the ignition system for the engine, or for regulating the fuel supply of the engine, or both, according as may be desired, for causing the same to automatically and relatively respond to the needs of the engine in the operations thereof.

Another object is to provide a governing mechanism of the character described for reversing as well as for non-reversing engines, the device being designed when employed with reversing engines to be self-reversing for duplicating its functions in either of the running directions of the reversing engine.

Still another object is to provide a governing mechanism which will serve to control and regulate a by-pass valve which is used for regulating compressions in connection with double ended pre-compression types of cylinders operating on the retarded combustion cycle, as for example, the type of cylinder shown in my application for United States Letters Patent for internal combustion engines, filed December 21, 1916, Serial No. 138,207.

Referring to the accompanying five sheets of drawings, which show a specific type of reversing governor mechanism, and without being limited thereto:

Figure 1 represents a part sectional view showing a reversing type of governing mechanism at rest; the driving mechanism therefor; and the co-acting linkage operated by said governing mechanism set for the "ahead" running of the engine.

Fig. 2 represents a sectional view taken on line 2—2 Fig. 1 looking in the direction of the arrows.

Fig. 3 represents a perspective view of the shifting reversing collar of the device.

Fig. 4 represents a sectional view taken on line 4—4 Fig. 2, looking in the direction of the arrows.

Fig. 5 represents a view taken on line 5—5 Fig. 2, looking in the direction of the arrows, showing the elongated arm of the ignition-timing-oscillating-link.

Fig. 6 represents the device coupled with an ordinary reversing type of magneto shown supported on the oscillating bracket and in elevation; and also shows a section taken on line 6—6 in Fig. 1, looking in the direction of the arrows.

Fig. 7 represents a similar view to that shown in Fig. 1 but shows the device in operation instead of at rest, the engine now operating at "normal" speed in the "ahead" direction.

Fig. 8 represents a similar view to that shown in Fig. 7 but shows the device responding to speed which is beyond the "normal" speed of the engine in the "ahead" direction.

Fig. 9 represents a sectional view taken on line 9—9 Fig. 6 looking in the direction of the arrows.

Fig. 10 represents a sectional view taken on line 10—10 Fig. 6 looking in the direction of the arrows, showing the reversing shifting-pin which is secured to rotate with the governor spindle of the device.

Fig. 11 represents a similar view to that shown in Fig. 1, but shows the device at rest, with the co-acting linkage thereof set for the "reverse" running of the engine.

Fig. 12 represents a similar view to that shown in Fig. 11 but shows the device in operation and responding to "normal" speed in the "reverse" running of the engine.

Fig. 13 represents a similar view to that shown in Fig. 11 but shows the device responding to a speed beyond the "normal" speed shown in Fig. 12 for the "reverse" running of the engine.

Fig. 14 represents a sectional view taken on line 14—14 Fig. 11, looking in the direction of the arrows.

Fig. 15 represents a sectional view taken on line 15—15, Fig. 11, looking in the direction of the arrows.

Fig. 16 represents a sectional view taken on line 16—16 Fig. 11, looking in the direction of the arrows.

Fig. 17 represents a view showing the re-

versing-linkage-shifting-collar of the device setting in "neutral" position, as when being shifted by the shifting-pin from one to the other of the running directions of the engine.

Fig. 18 is the same view as Fig. 17 but shows the linkage-shifting-collar shifted to the "ahead" running position of the device.

Fig. 19 is the same as Fig. 17 but shows the linkage-shifting-collar set for the "reverse" running of the engine.

Fig. 20 represents a view taken on line 20—20, Fig. 6, looking in the direction of the arrows, showing the distributing-end of the magneto coupled with the device.

Fig. 21 represents a diagrammatic view of a reversing type of magneto employed for a two-cylinder engine.

Fig. 22 represents a sectional view taken on line 22—22, Fig. 6, looking in the direction of the arrows, showing the driving end of the magneto.

Fig. 23 represents a diagrammatic view taken on line 23—23 looking in the direction of the arrows, Fig. 6, corresponding to the position assumed by the magneto when the engine is at "rest" and the coacting linkage of the device is set for the "ahead" running of the engine, as shown in Fig. 1, and also corresponding to the position assumed by the magneto for the "abnormal" running of the engine shown in Fig. 9.

Fig. 24 represents the same view as Fig. 23 but shows the magneto set in the position corresponding to the "normal" running of the engine represented by Fig. 7.

Fig. 25 represents a diagrammatic view showing the magneto shifted to the "resting" or "abnormal" reverse positions, as the case may be, corresponding to Figs. 11 and 13, respectively.

Fig. 26 is the same view as Fig. 25 but shows the magneto shifted to the normal "reverse" running position, corresponding to Fig. 12.

Fig. 27 represents a diagrammatic view showing the throttle regulating means of the device coupled to control and regulate a by-pass valve working between the pre-compression chambers of a two-cylinder engine operating on the retarded combustion cycle.

Fig. 28 represents a sectional view taken on line 28—28 Fig. 27, looking in the direction of the arrows.

Fig. 29 represents a sectional view taken on line 29—29, Fig. 28, looking in the direction of the arrows, showing the by-pass valve "open" as would be the case when the engine is at rest and ready to start up in either direction corresponding to Figs. 1 and 11.

Fig. 30 represents the same view as Fig. 29 but shows the by-pass valve shifted to the "closed" position; corresponding to the "normal" running of the engine in either of its directions as indicated by Figs. 7 and 12.

Fig. 31 represents the same view as Fig. 29 but shows the by-pass valve shifted to the "open" position corresponding to the "abnormal" running of the engine in either of its directions, as indicated by Figs. 8 and 13.

Fig. 32 is a modification and represents in section an ordinary distributing member used in battery ignition systems coupled to operate with my device instead of the magneto shown in Fig. 6.

Fig. 33 is a modification and shows my device coupled with the timing-member of the magneto, which is stationary for operating said timing-member instead of oscillating the magneto proper for varying the timing thereof to obtain the desired variable ignition functions therefrom.

Fig. 34 is a modification and represents my device coupled with an ordinary fuel regulating valve instead of the by-pass mechanism shown in Fig. 27.

Like numerals refer to like parts throughout the several views of the drawings.

The numeral 50 represents the rotatable governor-spindle which is bored to accommodate the lifting-rod 51 and is provided with the governor-weights 52 which are pivotally secured to said governor-spindle at 53 and are provided with the arms 54 which are preferably made integral therewith or rigidly secured thereto, according as may be desired. 55 represents a yoked-member which is slidably mounted on the governor-spindle and is coupled with the arms 54 of the governor-weights 52 by means of the connecting-links 56 which cause said yoked-member 55 to rotate together with said governor-spindle 50.

57 represents a governor-spindle-bonnet which forms a bearing for the governor-spindle 50 and slidably fits the same, being preferably guided in the bore 58 of the governor-casing-member 59 and is secured to the lifting-rod 51 in any suitable manner for the purpose of traveling therewith.

60 represents an expansion-spring which contacts with the governor-spindle-bonnet 57 and exerts its pressure against the same, tending to keep it down. The tension of the expansion-spring 60 may be regulated by means of the regulating-screw 61 which manipulates the spring-regulating-collar 62. 63 represents the governor-spindle-supporting and bearing-plate which is held in the intermediate governor-supporting-casing-member 64 and is rigidly secured thereto. The governor-spindle 50 is provided with the governor-spindle-gear 65 which is secured thereto to rotate therewith, the upper-collar 66, and the lower-collar 67 which are also secured thereto to rotate therewith. Between said collars 66 and 67 and slidably supported on the governor-spindle, is the shifting and reversing-collar 68 which is provided with the projecting-lugs 69 for the

shifting-arms 70 and the inner flange 71 which is provided with the angular-shifting-slot 72 through which the governor-spindle-shifting-pin 73 (which is secured to said governor-spindle to rotate therewith) works and slidably shifts the collar 68 along the governor-spindle for the setting of the linkage to correspond to the "ahead" or "reverse" running directions of a reversing engine. The shifting-collar 68 is provided with the washers 74 and is sandwiched between the upper and lower expansion-springs 75 and 76, respectively; said springs being normally designed to produce equal expansion and thus tend to exert equal pressure against the shifting-collar.

77 represents the lower casing which, with the intermediate casing-member 64, form the bearings for the governor mechanism-driving-shaft 78 and the distributer or magneto oscillating bracket 79; the former being provided with the governor-mechanism driving-gear 80 which is rigidly secured thereto to rotate therewith and engages with the governor-mechanism-gear 65, as shown in Fig. 1, and also carries the magneto or distributer-driving-gear 81 which rotates the magneto or distributer gear 82; it being here understood that the ratio between the driving-gear 81 and the gear 82 may be proportioned to suit conditions, that is to say, when employing a four-cycle type of magneto with the device for a four-cycle engine and driving the same from the half time or camshaft of the engine, the ratio of the gears 81 and 82 should be one to one, while when employing a four-cycle type of magneto in connection with a two-cycle, or retarded combustion type of engine, which requires the firing of each cylinder to every stroke of the engine, the ratio of the gears 81 and 82 should be two to one, as shown in Fig. 1.

The shifting-arms 70 are pivotally secured at 83 to the link-shifting-member 84 which is pivotally secured at 85 to the lug 86 provided therefor in the casing-member 77, Fig. 15. The shifting-end 87 of the shifting-member 84 connects with the yoked-timing-link-pin 88 by means of the link 89; the said yoked-timing-link-pin 88 slidably operating in the elongated and slotted shifting-arm 90 of the yoked-timing-link 91 which is pivotally secured at 92 to the casing-member 77, as shown in Fig. 2, and provided with the oscillating-arm 93 and the elongated slot 94 within which the timing-link-pin 88 slidably operates. 95 represents a supporting-rocker-link which is pivotally secured to the supporting-lug 96 provided therefor in the casing-member 77, and serves to pivotally support on the pin 97 the lifting-rod-link 98 which is pivotally secured to the end 99 of the lifting-rod 51, as by means of the stud 100. The supporting-link 95 also supports on the pin 97 the operating-link 101 which connects with the yoked-timing-link-pin 88 and operates the same. 102 represents the supporting-lug provided in the casing-member 77 and to which is pivoted the throttle-operating-bell-crank 103, as shown in Fig. 27, the short arm of which pivotally connects with the lower end 99 of the lifting-rod 51, as by means of the stud 100, as shown in Figs. 6 and 27; the long arm connecting by a suitable link as 104 with the throttle mechanism, as shown in said Figs. 6 and 27. 105 represents an internal combustion engine, to which the device is bolted. 106 represents an ordinary magneto which is rigidly secured, as shown in Fig. 6 to the oscillating-bracket 79 which is pivotally supported in the trunnion-bracket 107; 108 representing the armature-shaft of the magneto which is driven by the magneto gear 82, and 109 representing the magneto-distributer. The trunnion bracket 107 is preferably cast integral with the casing 77, as shown in Fig. 6, and may be bolted, or otherwise rigidly secured, to the engine frame 105, as shown in Figs. 20 and 22 for supporting the governor mechanism in working relation with the engine. 110 represents the connecting-link which pivotally couples the oscillating bracket-arm 111 and the oscillating arm 93 of the yoked-timing-link 91. 112 represents a governor-mechanism driving-shaft-bearing, which is secured to the engine-frame 105, as shown in Fig. 1.

In Fig. 21, the magneto distributing member 109 is shown provided with the two distributing contact members 113 and 114 which are shown diagrammatically and electrically coupled with the spark-plugs 115 and 116, respectively, the distributer 109 being designed for a two-cylinder engine, a two-cylinder engine being adopted for the purpose of explaining my device in the simplest form, it being understood that the device will operate in connection with engines having more than two cylinders to equal advantage. In Figs. 20 and 33, 117 represents the ordinary timing-collar provided on the ordinary types of magnetos, and 118 represents the timing-lever by means of which the timing-collar is manipulated for varying the timing of the ignition, said timing-collar being the ordinary means provided on the magneto for accomplishing that feature.

In the diagrammatic views shown in Figs. 23 to 26 inclusive, 119 and 120 represent the pole-pieces of an ordinary magneto used for ignition purposes in connection with internal combustion engines, and 121 represents the armature of the magneto. In Fig. 27, which diagrammatically shows the application of my governing mechanism so far as the throttling feature thereof is concerned, 122 and 123 represent two cylinders of a two-cylinder pre-compression type of retarded combustion engine which is designed to op-

erate on the retarded combustion cycle disclosed in my application for Letters Patent for internal combustion engines hereinabove referred to; said cylinders 122 and 123 being designed along the lines of the cylinder shown in said application; 124 and 125 (Fig. 28) representing the pre-compression ends of the cylinders 122 and 123, respectively, and 126 and 127 (same figure) representing the by-pass ports for the cylinders 122 and 123, respectively. 128 represents the by-pass member which communicates with the by-pass ports 126 and 127, as shown in Fig. 28, and is provided with the throttling-by-pass-valve 129 which is pivotally secured in said by-pass member 128 and is provided with the operating-lever 130 which may be pivotally connected, as by means of the connecting-rod 104, with the long arm of the throttling-bell-crank 103 which is operated by the governing mechanism, said compression by-pass feature being subject-matter of my application for Letters Patent Ser. No. 183,369 filed July 28, 1917.

In Fig. 34 the throttling-member of the device is shown coupled with an ordinary fuel-supply-valve 131 which controls the fuel supply for the engine. 132 represents the supply-end of the valve, and 133 represents the delivering-end which discharges into the inlet pipe of the engine. 134 represents the operating-lever of the valve 131 which is shown connected with the long arm of the throttle-bell-crank 103 by means of the connecting-rod 104. In Fig. 32 135 represents an ordinary distributer-member employed with internal combustion engines, where the ignition system is operated by means of batteries instead of magnetos, in which event the distributer-member 135 may be secured to the oscillating bracket 79 and the gear 82 may be coupled with the distributing shaft 136 which carries the ground contact 137 and completes the circuit for the system when making contact with the contact-members of the distributer-member 135. Fig. 33 represents a modified application of the governing mechanism in connection with an ordinary type of magneto, the same being rigidly secured with the engine, instead of being set on the oscillating bracket 79, as heretofore explained, for oscillating the magneto proper, the yoked-timing-link 91 of the governing mechanism in this case being connected by the link 138 with the bell-crank 139 which in turn is coupled with the timing-arm 118 of the magneto by means of the link 140, thus utilizing the linkage of the governor-mechanism for shifting and manipulating the ordinary timing-member associated with magnetos and which is used ordinarily for varying the timing of the magneto instead of manipulating the magneto proper so that the varying of the angularity of the poles in relation to the armature of the magneto is responsible for the varying of the timing functions of the system, as occurs when oscillating the magneto as will be more fully explained.

Having thus described the parts of my invention in detail, the manner in which the same is operated, is as follows:

The engine having been brought to a stop, as represented by the governor-mechanism in Fig. 1 after the engine had been running in the "ahead" direction in which the governor-mechanism driving-shaft was caused to rotate in the direction of the arrows marked "A" Figs. 1 and 2, resulting in carrying with it the gears 80 and 81 in the same direction, which in turn caused the governor-spindle 50 and the magneto-armature-shaft 108 to rotate in the directions of the arrows marked "A" in said Figs. 1, 2 and 6, it will be observed that the shifting-collar 68 is in the raised position, in which event the shifting-pin 73 of the governor-spindle 50 will be positioned as shown in Figs. 3, 6 and 18 on the underside of the shifting-flange 71 of the shifting-collar 68, which results in supporting the link-shifting-member 84 in the "up" position, as shown in Figs. 1, 7 and 8, and which corresponds to "ahead" running of the engine. With the governor-mechanism thus at rest, it will be observed that the governor-weights 52 are down as well as the yoked-member 55, and consequently the lifting-rod 51 is in its "down" position, as shown in Fig. 1.

The engine being started up again in the "ahead" direction, will cause the governor-spindle 50 and the magneto-armature-shaft to rotate in the same directions as just described, namely, as indicated by the arrows marked "A." With the rotation of the governor-spindle 50, which carries the governor-weights 52 therewith, the latter through the action of the centrifugal force thereof will be caused to fly outward and away from the governor-spindle, as shown in Figs. 7 and 8, the distance depending upon the speed of the engine—naturally the greater the speed, the greater the centrifugal force and therefore the greater will be the tendency of the weights to move to their outward position. The flying outward of the governor-weights 52 when the governor-spindle is being rotated, results in raising the yoke-member 55, as shown in Figs. 7 and 8, and forces the same upward against the action of the expansion-spring 60. The lifting of the yoke 55 results in carrying the lifting-rod-bonnet 57 therewith, which in turn raises the lifting-rod 51, as shown in said Figs. 7 and 8, from the "down" position shown in Fig. 1. The raising of the lifting-rod from the "down" position shown in Fig. 1, causes the yoked-timing-link 91 to oscillate about its pivoting-center 92 through the action of the links 98 and 101 acting upon it, and

consequently results in the shifting of the oscillating port-bracket from its resting position, represented by Fig. 23, toward the position thereof indicated in Fig. 24, which position provides for the change of the position of the poles in relation to the armature in the magneto to give maximum "lead" for the ignition of the "ahead" running of the engine; Fig. 23 representing the engine at rest shows the poles setting of the magneto with maximum "lag" for the ignition. It will here be understood that since the time of sparking in the case of magnetos is usually figured as occurring at the point when the rear or following edge of the armature as 121^a when rotating in the "ahead" direction indicated by the arrow marked "A" Fig. 23, passes the following edge 120^a of the pole-piece 120, that by changing the angular position of the point 120^a in relation to the armature the time of sparking may be varied to occur late or early according as may be desired. To that end it will be observed that the device shown in the drawings provides for a 30° swing to the oscillating-bracket 79, thus allowing for the magneto a variation of 15° early or "lead" and 15° late or "lag," it being here understood that the governing mechanism may be designed to give any required swing, whether more or less than 30°. Hence it will be understood from the diagrams in Figs. 20 and 24 that the former shows the relative relationship between the armature and pole-pieces for providing maximum "late" or "lag"; line "X*a*" represents the position of the edge of the pole-piece yielding maximum "lag;" line "Y*a*" represents the position thereof yielding sparking on dead-center; while line "Z*a*" represents the point yielding maximum "lead." Thus the latter Fig. 24, when the magneto is oscillated to cause the position of the edge 120^a to coincide with line "Z*a*," provides for maximum "lead" for the ignition system of the engine.

Now, in a similar manner, for the reverse running of the engine the armature 121 is rotated in the direction of the arrows marked "R" in Figs. 25 and 26 and this time it will be observed that the armature edge 121_R becomes the following edge of the armature and the pole-piece edge 119_R is the edge which figures in the timing of the magneto. Line "X_R" represents the position of the edge 119_R of the pole-piece 119 which yields maximum "lag;" line "Y_R" represents the point at which the pole-piece-edge 119_R will yield sparking on dead-center; while line "Z_R" represents the point at which the edge 119_R will yield maximum "lead;" thus it will be observed for "reverse" running of the magneto that the position of the magneto, as shown in Fig. 25, yields maximum "lag" while the position thereof shown in Fig. 26, yields maximum "lead," and that intermediate positions of the magneto yield corresponding effects on the timing of the ignition system for the engine.

Fig. 7 shows the relation of the governor-mechanism when the engine is operating at "normal" speed, when it will be observed that the link 98 has been carried from the lower angular position assumed thereby in Fig. 1 to the horizontal position shown in Fig. 7, in which position of said link it will be observed that the yoked-timing-link 91 is shifted to the extreme "out" position from the extreme "in" position shown in Fig. 1, and which results in the shifting of the oscillating bracket 79 which carries therewith the magneto 106 rigidly secured thereto to the extreme position indicated in Fig. 24 where maximum "lead" for the ignition is provided by the angular relationship existing there between the armature and the poles of the magnet due to the angular shifting of the pole-pieces of the magnet which naturally varies the timing of the spark generating function of the magneto. So it will be observed, as the engine is started up from rest, that the timing function of the magneto is automatically advanced by the action of the governing mechanism (depending upon the speed of rotation thereof and which is controlled by the speed of rotation of the engine) from maximum "lag" to maximum "lead" for the normal running of the engine indicated in Fig. 7.

Now, as the engine begins to run with the speed going beyond the normal speed, the governor weights 56 tend to fly out beyond the position indicated in Fig. 7, and results in raising the yoke-member 55 still higher than that shown in said Fig. 7, when it will be observed from Fig. 8 that the link 98 assumes an upper angular position, which results in its travel from the horizontal position shown in Fig. 7 to the one shown in Fig. 8 in withdrawing the yoked-timing-link 91 backward toward the position shown in Fig. 1, in which event the timing of the magneto is being varied to change the timing of the ignition system for the engine from the maximum "lead" yielding for the normal speed of the engine shown in Fig. 7, toward the maximum "lag" for checking the speed of the engine, so that it will assume the normal speed again. It will be observed that in the movement of the lifting-rod from the position indicated in Fig. 7 to that indicated in Fig. 8 the result will be to shift the position of the poles of the magneto from the maximum "lead" position indicated by Fig. 24 back toward the position indicated by Fig. 23.

Now, if it is desired to start the engine up in the reverse direction from the resting position shown in Fig. 1, which indicates my device at rest after operating in the "ahead" running direction of the engine,

the engine is first started in the reverse direction when the governor-mechanism driving-shaft 78 will be caused to rotate in the direction of the arrow marked "R" which is the reverse direction to the "ahead" running direction and results naturally in rotating the governor-spindle and the magneto-armature-shaft 108 in the reverse directions indicated by the arrows marked "R" Figs. 1 and 2 when the shifting-pin 73 will be caused to travel with the governor-spindle in the reverse direction to what it was operating in for the "ahead" running of the engine. It will now be observed that for the "ahead" running of the engine, the shifting-pin 73 traveling in the direction of the arrow marked "A" Fig. 3, will naturally jump across the gap caused by the cam-slot 72, while rotating with the governor-spindle, every time it reaches the angular or helical slot 72, and will always remain in contact with the underside of the flange 71 while running in that "ahead" direction, and will consequently support the shifting-collar 68 in the "up" position corresponding to that shown in Figs. 1, 7 and 8. But it will be observed, however, that upon reversing the direction of rotation of the governor-spindle, as when the engine is caused to rotate in the reverse direction, that the shifting-pin 73 now running in that reverse direction, as indicated by the arrow marked "R" when reaching the angular or helical cam-slot 72 will not now jump across the slot as it did in the "ahead" running direction of the governor-spindle, but it will immediately work itself into the slot 72 and will ride up on the cam surface 72^a, as shown in Fig. 17, and will force the shifting collar 68 downward against the pressure of the spring 76 until the shifting-pin 73 will assume a position this time on the top of the flange 71, as indicated in Fig. 19 and as indicated by the dotted lines in Fig. 3, and will in a similar manner continue to ride on the top surface of the flange 71 as long as the governor-spindle will run in the reverse direction marked "R," which corresponds to the running of the engine in the reverse direction.

The shifting of the shifting collar 68 to the lower position indicated by Fig. 19, results in the shifting of the link-shifting-member 84 to its lower position, as shown in Figs. 11, 12 and 13, which represent the device set for the reverse running of the engine. The shifting of the link-shifting-member 84 to the lower position results in shifting the yoked-timing-link-pin 88 to the lower section of the elongated slot 94 of the shifting-arm 90 of the yoked-timing-link 91, which positions the yoked-timing-link-pin 88 this time below the oscillating center 92 of the yoked timing-link 91 and causes the yoked-timing-link to assume the position indicated in Fig. 11 as the starting position, and which position it will be observed is the maximum position reached by the yoked-timing-link in the "ahead" running of the device; so that with the shifting of the link-shifting-member 84 to its lower position for the reverse running of the engine, the linkage of the device is shifted and set for reverse running with the consequent change of the position of the magneto, as is indicated in Fig. 25 and where the magneto is set by the action of the shifting of the linkage for reverse running to the maximum "lag" position.

It will now be observed that in approaching the normal speed for the engine, as represented in Fig. 12, that the yoked-timing-link 91 oscillates in the opposite direction to that occurring with the "ahead" running of the device; and for normal "reverse" running of the engine, as indicated in Fig. 12, which corresponds to the "ahead" normal running indicated by Fig. 7, the magneto assumes the position shown in Fig. 26, which provides for the maximum "lead." It will be here observed that this maximum "lead" position of the magneto for the "reverse" running of the device corresponds to the maximum "lag" position of the magneto shown in Fig. 23 in the "ahead" running of the device. Similarly, as the engine speeds up beyond the normal speed (shown in Fig. 12) in the "reverse" direction, which is indicated in Fig. 13, the yoked-timing-link 91 is caused to assume the "reverse" oscillating direction for varying the timing of the ignition system for maximum "lead" provided for the "normal" running of the engine (represented by Fig. 12) to maximum "lag" (represented by Fig. 13 and corresponding to the diagram shown in Fig. 25).

It will be observed that in the stopping of the engine, which results in the stopping of the governor-mechanism, that the shifting-pin 73 of the governor-spindle 50 will remain either at the top or at the bottom of the shifting-flange 71, according as the engine had been running before stopping. So that, since the device had been running in the "reverse" direction, when the engine is brought to a stop, the shifting-pin 73 will be positioned at the top of the flange 71 as shown in Fig. 19. If the engine is to be started up again in the "reverse" direction, there will be no shifting of the shifting-collar 68, since the pin 73 will be carried around in the same manner as it had been working when the engine had been previously running in the "reverse" direction, jumping across the cam-slot 72 as it reached it in each revolution of the governor-spindle. But if the engine should be started up in the "ahead" direction instead of the "reverse" direction, the shifting-pin being caused to turn in the "ahead" direction along with the governor-spindle, will immediately, upon reaching the cam-slot 72,

this time engage with the cam-surface 72_R and will lift the same as the pin is being rotated, against the action of the upper neutralizing spring 75 until it (the pin 73) again assumes the position on the underside of the flange 71, as shown in Figs. 6 and 18, and will continue to remain on the underside of the flange with the shifting-collar in the "up" position as long as the governor-spindle rotates in the "ahead" direction. This shifting upward of the shifting-collar 68, as will be understood, results in raising the link 84 which in turn shifts the yoked-timing-link-pin 88 back to the "up" or "ahead" position shown in Fig. 1. Thus the shifting-collar 81 will automatically position itself in accordance with the direction of rotation of the governor-spindle; the "ahead" running direction of the governor-spindle will cause it to assume the "upper" position shown in Figs. 6 and 18, while the "reverse" running direction will cause it to assume the "lower" position shown in Fig. 19, and provides an absolutely automatic shifting means for reversing types of governing mechanisms, which in connection with the reversing type of linkage, as shown in the drawings, provides for a governing mechanism which duplicates its functions in either of the running directions of the engine,—the device being absolutely positive in its operations and sensitive to respond to the varying running conditions of the engine with which it is associated and capable of operating either for the shifting of the positions of the poles of the magneto by supporting the magneto on an oscillating bracket, as indicated in Figs. 23 to 26 inclusive, manipulating the bracket to give the desired result, namely, the controlling of the timing of the ignition system for the engine, or by similarly shifting the distributing member of a battery ignition system indicated by Fig. 32 in which the distributing member may be secured to the oscillating bracket in a similar manner to that explained in connection with the magneto, for varying the timing functions of the battery ignition system for the engine; or may be coupled as indicated in Fig. 33, to the ordinary manipulating lever of the ordinary type of magneto for operating the same direct for varying the timing functions of the ignition system for the engine.

It will be here noted that for non-reversing types of engines a non-reversing type of governor-mechanism may be employed, in which event the device will be designed without the shifting-collar outfit, that is to say, the governor-mechanism will be minus the shifting-collar 68, the collars 66 and 67, the springs 75 and 76, the washers 74, the rods 70, the member 84 and the link 89; and the oscillating link 91 will not now need to be provided with the slot 94 but the pin 88 will be secured to the arm 90 for pivotally engaging with the link 101.

It will be here understood that the device, while being explained principally as controlling the ignition system of the engine, in connection with non-reversing or reversing types of engines, is also possessed of auxiliary throttling functions, for automatically regulating the fuel supply of the ordinary type of engine, for example, or for automatically regulating throttling devices associated with engines, as for example, a by-pass device as indicated in Fig. 27. This governor throttling means may also be employed in connection with reversing or non-reversing engines, and is designed to regulate its coacting throttling device functions simultaneously with the ignition timing functions hereinabove explained, and will similarly perform said throttling functions automatically, according as the needs of the engine may require.

It will be observed that the throttling functions of the device will perform through an independent linkage from that described in connection with the ignition functions of the device; and also, that the reversing mechanism heretofore explained in connection with the ignition-timing-linkage of the device, is not employed therewith, the throttling mechanism being composed simply of a supporting-lug 102 which is preferably made integral with the casing-member 77 or rigidly secured thereto in any suitable manner, and provides a pivoting bearing for the bell-crank 103, the small arm of which is pivotally coupled (ample clearance being allowed) with the lower end 99 of the lifting-rod 51, as by means of a stud 100; while the long arm of the bell-crank 103 is connected by the connecting-rod 104 to the throttling device to be operated thereby, as shown in Figs. 27 and 34.

It will be observed that in the resting position of the governor-mechanism, when the throttling member thereof is coupled with the device, as shown in Fig. 27, which requires that the by-pass valve be "open" as shown in Fig. 29 which corresponds to the position of the valve shown in Fig. 27, the compression mixture will pass from one cylinder to the other in the starting up of the engine, as heretofore explained; but that when the engine is running "normally" and the throttling member reaches the normal position marked "*n*" indicated by the dotted lines in Fig. 27, the by-pass valve will be closed, as shown in Fig. 30, and when the engine is running beyond the normal speed, the by-pass valve will again be open as shown in Fig. 31, corresponding to the dotted position marked "*n*."

It will be observed by referring to Fig. 27, that with the raising of the lifting-rod 51 from the resting position of the govern-

ing-mechanism, which is shown indicated in full by the throttling bell-crank 103, to the subsequent positions "n" and "n'" that the functions required to correspond to the normal and abnormal running of the engine, so far as the throttle-controlling and regulating means of the device is concerned, is being performed and may be absolutely relied upon. It will be observed, however, when the device is coupled for throttling purposes with an ordinary "fuel-supply" valve, that for the resting position of the governing-mechanism, as shown in Fig. 34, the valve should be "closed" as against the "open" position required in the device shown in Fig. 27; but that the normal position indicated by the dotted line "n" Fig. 34 provides for "full open" of the supply-valve and the abnormal position indicated by "n'" Fig. 34 yields a "closed" position of the valve as can readily be understood.

Thus it may be observed that the governing mechanism may be designed for the purpose of automatically regulating the ignition system of a reversing or non-reversing engine, or may be designed for the purpose of regulating and controlling the throttling mechanism of the engine, or may be designed for the purpose of regulating and controlling the throttling mechanism of the engine, or may be designed for the purpose of handling both said ignition and throttling functions of the engine simultaneously either for non-reversing or reversing types of engines, and may be absolutely relied upon to positively perform its functions to good advantage, overcoming the need for the constant attendance of operators in connection with the operation of internal combustion engines; and further provides a means for controlling internal combustion engines automatically, thereby overcoming the drawback heretofore commonly existing in various applications of the internal combustion engines with different kinds of work requiring regular and constant action on the part of the engine, especially so in connection with the coupling of internal combustion engines with electric generators.

It will also be observed that my device is simple in construction, positively reliable in its operation, readily adjustable to suit conditions, and may be employed in connection with two or four-cycle engines of any size.

While the preferred embodiments of my invention have been described in detail, it will be understood that I do not wish to be limited to the particular construction set forth, since various changes in the form, material, proportions, and arrangement of parts and in the details of construction may be resorted to without departing from the spirit and scope of the invention, or destroying any of the advantages contained in the same, heretofore described and defined in the subjoined claims.

What I claim is:

1. In combination with a governor member, a movable member operated thereby adapted to operate on either side of a neutral point established therefor; a lever member adapted to be coupled with an ignition device for regulating the timing of same; an intermediate rocker arm pivotally coupled with said lever member; and a connecting link pivotally coupling said rocker arm with said movable member for oscillating said crank arm and yielding a correspondingly similar function thereto on either side of said neutral point of said movable member.

2. In combination with a reversing governor member, a movable member actuated thereby and provided with a shiftable member adapted to be automatically shifted in accordance with the direction of rotation of said governor member, said movable member operating about a neutral point established therefor; a lever member adapted to be coupled with an ignition device for regulating the timing thereof; shifting means coupling said shiftable member with said lever member adapted to set the latter accordingly for either of the operating directions of said governor member; an intermediate rocker arm; a shiftable connecting link pivotally coupled at one end to said rocker arm and at the other to said shifting means at the point of engagement with said lever member; and a second shiftable connecting link pivotally coupled at one end with said rocker arm and at the other end with said movable member and adapted to operate with same at either side of said neutral point of said movable member.

3. In combination with a reversing internal combustion engine, a reversing rotatable governor member adapted to be coupled with said reversing engine to be rotated thereby; an angularly movable bracket member operating about an offset axis; a magneto mounted on said bracket member and having the armature of said magneto coupled to rotate with said engine and centered with the axis of said bracket; and intermediate reversible actuating means automatically and variably operated by said governor member and coupled with said bracket for changing the setting thereof to automatically influence and vary the time of ignition of said magneto in accordance with the working requirement of the engine.

4. In combination with an internal combustion engine, a rotatable governor member adapted to be coupled with said engine to be rotated thereby; an angularly movable bracket member operating about an offset axis; a magneto mounted on said bracket and having the armature of said

magneto coupled to rotate with said engine and centered with the axis of said bracket; and means coupling said governor member with said movable bracket for angularly positioning the latter for angularly setting said magneto supported thereon to vary the position of the poles thereof in relation to the armature for accordingly variably controlling the ignition timing of the engine.

5. In combination with an internal combustion engine, a rotatable governor member adapted to be coupled with said engine to be rotated thereby; a bracket member having an offset axis and adapted to angularly move about same; a magneto mounted on said angularly movable bracket and having the armature of said magneto coupled to rotate with said engine and centered with the axis of said bracket; means coupling said governor member with said movable bracket for angularly positioning the latter for angularly setting said magneto supported thereon to vary the position of the poles thereof in relation to the armature for variably controlling the ignition timing of the engine; and means for adjusting said rotatable governor member.

6. In combination with an internal combustion engine, a governor mechanism coupled with said engine and adapted to be operated thereby; a swinging bracket member; a magneto supported on said bracket member having the armature thereof coupled with said engine and adapted to rotate therewith and centered with the swinging axis of said bracket member; and bracket actuating means coupled with and operated by said governor mechanism adapted to automatically control said swinging bracket for angularly setting said magneto supported thereon in relation with the armature of the magneto for varying the ignition timing of said magneto.

7. In combination with an internal combustion engine, a governor mechanism coupled with said engine and adapted to be operated thereby; a swinging bracket member; a magneto supported on said bracket member having the armature thereof coupled with said engine and adapted to rotate therewith and centered with the swinging axis of said bracket member; bracket actuating means coupled with and operated by said governor mechanism adapted to automatically control said swinging bracket for angularly setting said magneto supported thereon in relation with the armature of the magneto for varying the ignition timing of said magneto; and means for adjusting and regulating said governor mechanism.

8. An automatic governor-mechanism for reversing-internal-combustion engines, comprising a hollow rotatable governor-spindle provided with governor-weights pivotally secured thereto and adapted to be rotated thereby and a projecting cam-engaging-pin; a slidable co-acting governor-member coupled with said governor-weights and adapted to be actuated thereby; a slidable operating rod slidably supported in said governor-spindle, provided with a projecting end, and adapted to be actuated by said co-acting governor-member; a slidable reversing collar member slidably mounted on said governor-spindle and provided with an inwardly projecting flange having a helical cam-slot cut therein, adapted to engage with said cam-engaging-pin; a link-setting-member pivotally secured to a rigid supporting-member provided on the hereinafter mentioned casing therefor; connecting means coupling said slidable reversing-collar with said link-setting-member; a reversible oscillating linkage coupled with the projecting end of said operating-rod and adapted to be actuated thereby; a co-acting oscillating member coupled with said reversible oscillating linkage and adapted to support and carry the ignition system distributing-member therewith; connecting means coupling said link-setting-member and said reversible oscillating linkage; means for rotating said governor-spindle and the rotating element of said distributing member; and means for inclosing and supporting the aforesaid mechanism in working relation therein, as shown.

9. A combined automatic ignition control and throttle-regulating governor-mechanism for reversing-internal-combustion-engines, comprising a hollow rotatable governor spindle provided with governor-weights pivotally secured thereto and adapted to rotate therewith, and a projecting cam-engaging-pin; a slidable co-acting governor-member coupled with said governor-weights and adapted to be actuated thereby; a slidable operating-rod slidably supported in said governor-spindle provided with a projecting-end and adapted to be actuated by said co-acting governor-member; a slidable reversing-collar-member slidably mounted on said governor-spindle and provided with an inwardly projecting flange having a helical-cam-slot cut therein adapted to engage with said cam-engaging-pin; reversing-collar-neutralizing means mounted on said governor-spindle; a link-setting-member pivotally secured to a rigid supporting-member provided therefor on the hereinafter mentioned casing; connecting means coupling said slidable reversing collar with said link-setting-member; a reversible oscillating linkage coupled with the projecting end of said operating-rod and adapted to be actuated thereby; a co-acting oscillating member coupled with said reversible oscillating-linkage and adapted to support and carry the ignition system distributing member therewith; connecting means coupling said link-setting-member and said reversible os-

cillating linkage; an oscillating bell-crank-member pivotally supported on a rigid member provided therefor in the hereinafter mentioned casing and having one arm thereof pivotally coupled with said projecting end of said operating-rod and adapted to be actuated thereby and the other arm adapted to be coupled with the throttling device of the engine for actuating the same; means for rotating said governor-spindle and the rotating element of said distributing-member; and means for inclosing and supporting the aforesaid mechanism in working relation.

10. A combined automatic ignition control and throttle-regulating governor-mechanism for reversing-internal-combustion engines, comprising a hollow rotatable governor-spindle provided with governor-weights pivotally secured thereto and adapted to rotate therewith, and a projecting cam-engaging-pin; a slidable co-acting governor member coupled with said governor-weights and adapted to be actuated thereby; a slidable operating-rod slidably supported in said governor-spindle provided with a projecting end and adapted to be actuated by said co-acting governor-member; a slidable reversing-collar-member slidably mounted on said governor-spindle and provided with an inwardly projecting flange having a helical-cam-slot cut therein adapted to engage with said cam-engaging-pin; reversing-collar-neutralizing means mounted on said governor-spindle; a link-setting-member pivotally secured to a rigid supporting member provided therefor on the hereinafter-mentioned casing; connecting means coupling said slidable reversing-collar with said link-setting-member; a reversible oscillating linkage coupled with the projecting end of said operating-rod and adapted to be actuated thereby; a co-acting oscillating member coupled with said reversible oscillating-linkage and adapted to support and carry the ignition system distributing member therewith; connecting means coupling said link-setting-member and said reversible oscillating linkage; means for oscillatingly supporting said co-acting oscillating member; an oscillating bell-crank-member pivotally supported on a rigid member provided therefor in the hereinafter mentioned casing and having one arm thereof pivotally coupled with said projecting end of said operating-rod and adapted to be actuated thereby and the other arm adapted to be coupled with the throttling device of the engine for actuating the same; means for rotating said governor-spindle and the rotating element of said distributing-member; and means for inclosing and supporting the aforesaid mechanism in working relation.

11. A combined automatic ignition control and throttle-regulating governor-mechanism for reversing-internal-combustion-engines, comprising a hollow rotatable governor-spindle provided with governor-weights pivotally secured thereto and adapted to rotate therewith, and a projecting cam-engaging-pin; a slidable co-acting governor-member coupled with said governor-weights and adapted to be actuated thereby; a slidable operating-rod slidably supported in said governor-spindle provided with a projecting end and adapted to be actuated by said co-acting governor-member; a slidable reversing-collar-member slidably mounted on said governor-spindle and provided with an inwardly projecting flange having a helical cam-slot cut therein adapted to engage with said cam-engaging-pin; reversing-collar-neutralizing means mounted on said governor-spindle; a link-setting-member pivotally secured to a rigid supporting-member provided therefor on the hereinafter-mentioned casing; connecting means coupling said slidable reversing-collar with said link-setting member; a reversible oscillating linkage comprising an oscillating link pivotally secured to the hereinafter-mentioned casing and provided with a shifting-arm having an elongated slotted arc cut therein, an oscillating link-shifting-pin slidably fitted in said slotted arc, an auxiliary oscillating link actuating-rod coupled at one end with said link-shifting-pin, a main oscillating link-actuating-rod pivotally coupled at one end with the projecting end of said slidable operating-rod, and a rocker-supporting member pivotally supported with said hereinafter-mentioned casing and provided with a supporting-pin on the free end thereof for pivotally supporting the other ends of said auxiliary and main oscillating link-actuating-rods; a co-acting oscillating-member coupled with said reversible oscillating linkage and adapted to support and carry the ignition system distributing member therewith; connecting means coupling said link-setting-member with the oscillating link-shifting-pin of said reversible oscillating linkage; an oscillating bell-crank-member pivotally supported on a rigid-member provided therefor in the hereinafter-mentioned casing and having one arm thereof pivotally coupled with said projecting end of said operating-rod and adapted to be actuated thereby and the other arm adapted to be coupled with the throttling device of the engine for actuating the same; means for rotating said governor-spindle and the rotating element of said distributing-member; and means for inclosing and supporting the aforesaid mechanism in working relation.

12. A combined automatic ignition control and throttle-regulating governor-mechanism for reversing-internal-combustion-engines, comprising a hollow rotatable governor-spindle provided with governor-weights pivotally secured thereto and adapted to rotate

therewith, and a projecting cam-engaging-pin; a slidable co-acting governor-member coupled with said governor-weights and adapted to be actuated thereby; a slidable operating-rod slidably supported in said governor-spindle provided with a projecting end and adapted to be actuated by said co-acting governor member; regulatable means for normally holding said co-acting governor-member and said slidable rod in inoperative position; a slidable reversing-collar-member slidably mounted on said governor-spindle and provided with an inwardly projecting-flange having a helical cam-slot cut therein adapted to engage with said cam-engaging-pin; reversing-collar-neutralizing means mounted on said governor-spindle; a link-setting-member pivotally secured to a rigid supporting-member provided therefor on the hereinafter-mentioned casing; connecting means coupling said slidable reversing-collar with said link-setting-member; a reversible oscillating linkage coupled with the projecting end of said operating rod and adapted to be actuated thereby; a co-acting oscillating member coupled with said reversible oscillating-linkage and adapted to support and carry the ignition system distributing member therewith; connecting means coupling said link-setting member and said reversible oscillating linkage; an oscillating bell-crank-member pivotally supported on a rigid member provided therefor in the hereinafter-mentioned casing and having one arm thereof pivotally coupled with said projecting end of said operating-rod and adapted to be actuated thereby, and the other arm adapted to be coupled with the throttling device of the engine for actuating the same; means for rotating said governor-spindle and the rotating element of said distributing-member; and means for inclosing and supporting the aforesaid mechanism in working relation.

WILLIAM B. SMITH WHALEY.

Witnesses:
HENRY A. STEBBINS,
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