L. H. WATTLES.

SPARKING IGNITER.

APPLICATION FILED JUNE 1, 1910.

990,935.

Patented May 2, 1911.

3 SHEETS—SHEET 1.

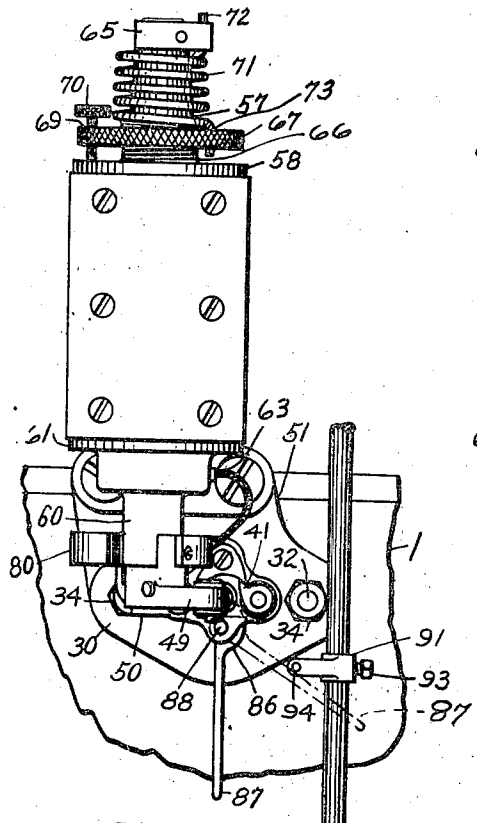


Fig. 1

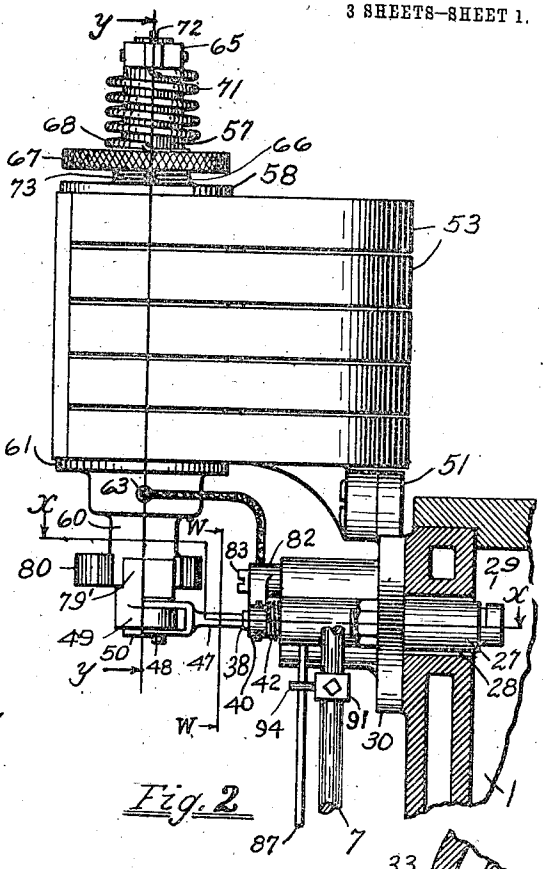
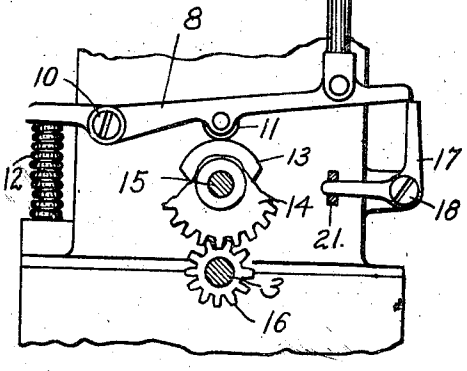


Fig. 2



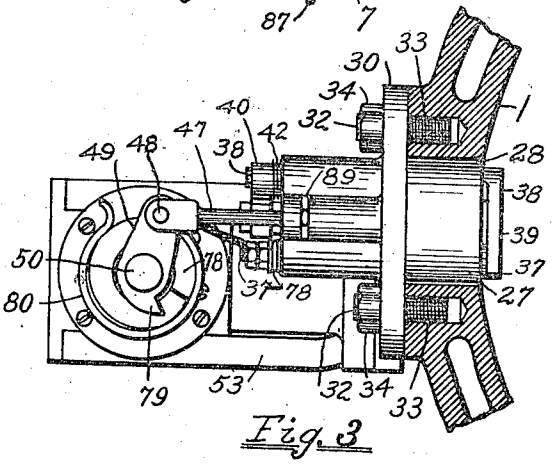


Fig. 3

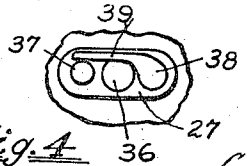


Fig. 4

Witnesses:
Alfred H. Whatley
George H. McLaughlin

Inventor
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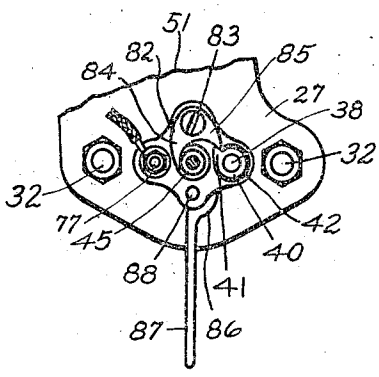

Fig. 5

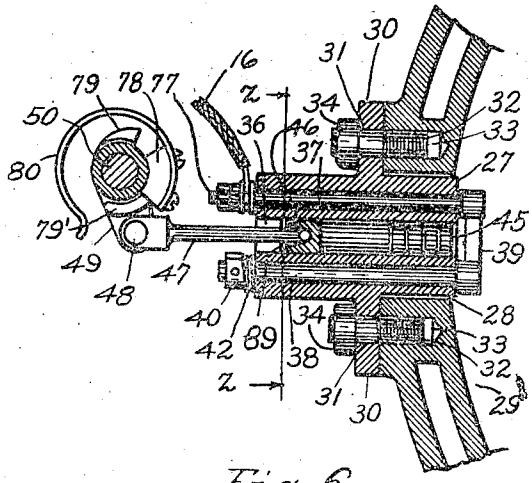

Fig. 6

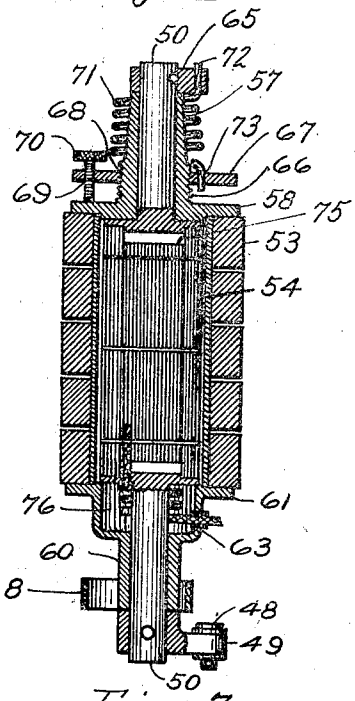

Fig. 7

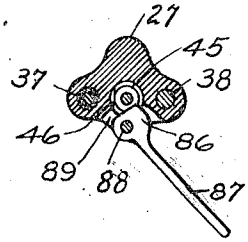

Fig. 8

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3 SHEETS—SHEET 3.

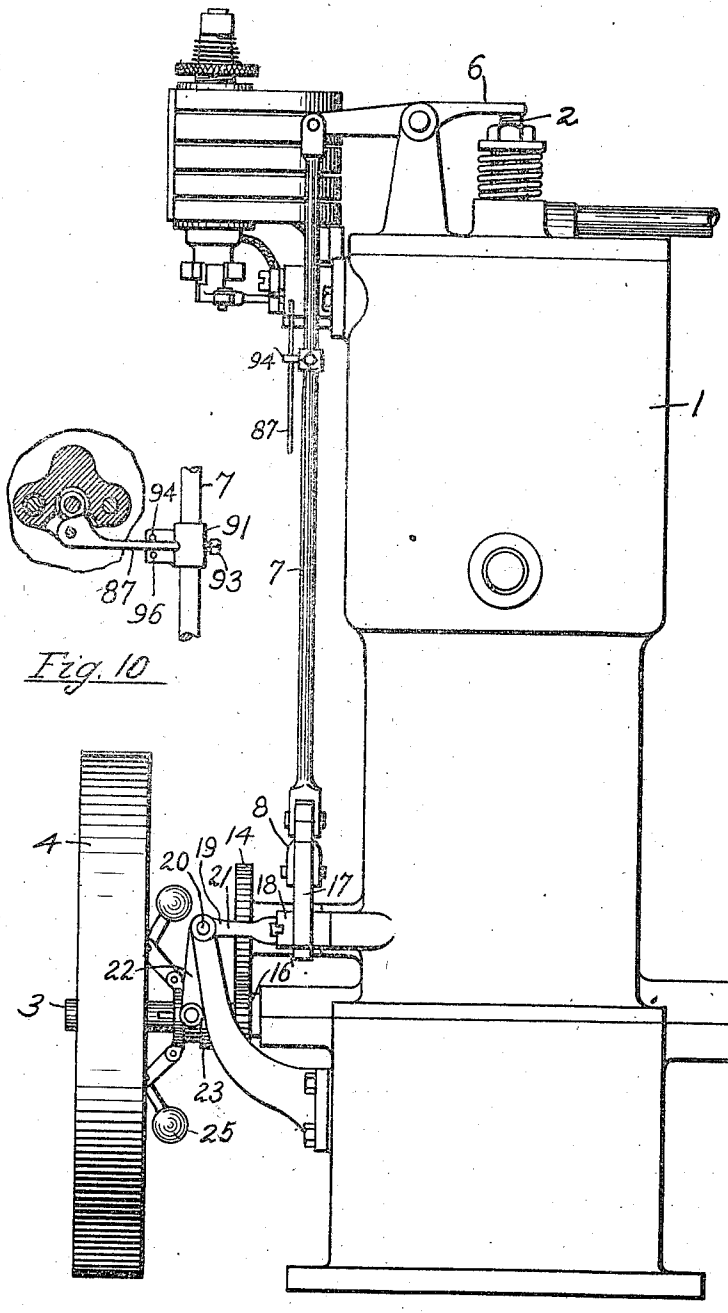

Fig. 9

Fig. 10

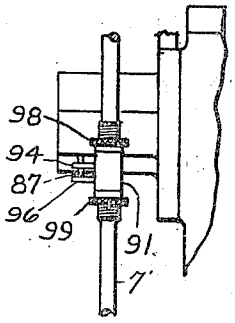

Fig. 11

Witnesses:

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UNITED STATES PATENT OFFICE.

LUTHER H. WATTLES, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR OF ONE-HALF TO MATIE C. MESSLER, OF PAWTUCKET, RHODE ISLAND.

SPARKING IGNITER.

990,935. Specification of Letters Patent. Patented May 2, 1911.

Application filed June 1, 1910. Serial No. 564,272.

To all whom it may concern:

Be it known that I, LUTHER H. WATTLES, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Sparking Igniters, of which the following is a specification.

My invention relates to sparking ignition devices for internal combustion engines. In my prior Patent No. 909,264 issued Jan. 12, 1909, is shown a device of this character wherein a sparking current is generated by the unignited compressed engine charge.

The essential objects of the present invention are to regulate the instant of sparking; to secure a maximum efficiency of the engine charge; to prevent, when starting the engine, injury to the operator due to the initial expansion of the compressed charge while manipulating the fly wheel; to afford a positive and direct electrical communication between the electrodes and the magneto armature; to cushion the outward stroke of the piston; to make it possible to dispense with elaborate mechanism for returning the piston to original position, and to dispense with the generator piston valve; to simplify and cheapen the structure; and to render the same available upon engines of various types without reorganization.

Other objects will be hereinafter pointed out.

To the above ends primarily my invention consists in the construction, combination, and mode of operation of parts set forth in and falling within the scope of the claims hereto appended.

In the accompanying drawings which form a part of this specification and in which like reference characters indicate like parts throughout the views, Figures 1, 2, and 3, are front, side and bottom plan views respectively of my novel apparatus mounted in the side of an engine cylinder, showing in Fig. 1 also a usual engine valve operating mechanism, Fig. 4, a bottom plan view of the plug, Figs. 5, 6, and 7, sections on line *w*, *w*, *x*, *x*, and *y*, *y*, of Fig. 2, Fig. 8, a section on line *z*, *z*, of Fig. 6, Fig. 9, a side elevation of an upright four cycle internal combustion engine equipped with my device, and Figs. 10 and 11, detail views of modified means for actuating the piston locking member.

In the illustrated construction the engine comprises a cylinder or casting 1, exhaust valve, 2, crank shaft 3, fly wheel 4, and the usual valve operating mechanism, consisting of the valve lever 6, valve connecting rod 7, cam lever 8, stud 10, cam roll 11, cam lever spring 12, cam 13 integral with driven gear 14 loose on stud 15, driving gear 16, bell crank lever 17 upon its stud 18, connecting bell crank lever 19 pivoted on stud 20 and whose forked arm 21 engages lever 17 and whose other arm 22 is connected with the sliding sleeve 23, controlled by the fly ball governor 25. It is in conjunction with the above described familiar parts that my novel device is in this instance set forth.

My device comprises a plug 27 extending into an opening 28 in the casting 1 to which it is engaged in any convenient manner with its end face exposed in the compression area of the combustion chamber 29. In the present instance the plug is provided with an external flange 30 with perforations 31 for screws 32 entering threaded openings 33 in the casting and secured by nuts 34. The plug 27 preferably extends beyond the face of the casting and is longitudinally bored to form a chamber 36. Fixed within the plug and insulated therefrom is an electrode 37, and axially movable in the plug is the grounded electrode 38 having its outer end extending beyond the face of the plug and provided with a contact arm 39 within the combustion chamber. Integral with or fixed to the outer end of the electrode 38 is a collar 40 provided with a peripheral lug 41. A spring 42 surrounding the electrode has its ends fixed in the collar and in the plug respectively. Mounted in the chamber 36 is a piston 45 provided with a beveled outer end as at 46. A connecting rod 47 connects the piston through a crank pin 48 with a crank arm 49 fixed to an armature shaft 50 of an electric generator supported by a bracket arm 51 fixed to the plug.

The generator or magneto may be of any usual construction and in this instance comprises horse shoe magnets 53 surrounding a core 54 whose armature 50 has an upper vertical bearing 57 provided with a flange or base 58 fixed to the top of the magnets. The lower end of the armature shaft is journaled in a bearing 60 provided with a flange 61 fixed to the bottom of the magnets, and provided with an opening 63 in its side wall.

Fixed to or integral with the upper end of the shaft 50 is a collar 65. The exterior of the bearing 57 has threads 66. An annular disk 67 has threads 68 engaging threads 66 and is provided with a threaded perforation 69 to receive a thumb screw 70 whose end engages the flange 58. Surrounding the bearing 57 is a spring 71 whose upper end 72 is fixed to the collar 65, and whose lower end 73 is fixed to the disk 67. One terminal 75 of the winding is grounded in the core while the other terminal 76 is formed in a loose spiral around the shaft 50 and passes through the opening 63 to the binding post 77 upon the outer end of the electrode 37, thus completing the circuit through the sparking finger 39 and thence back through the magneto to the armature.

In order to limit excessive travel of the crank arm 49 a block 78 fixed to the side of the bearing 60 extends into the path of lugs 79 and 79′ upon the arm. The outward stroke of the piston is in this instance cushioned by a curved spring 80 fixed to the block 78 and whose free end is in the path of the arm 49. The spring 80 may be omitted when the spring 71 is sufficiently stiff. A member for actuating the electrode 38, as shown in Fig. 5, consists of a lever of the first principle 82 pivoted by a pin 83 to the outer face of the plug 27 and comprises an arm 84 in the path of the beveled portion of the piston 45, and an arm 85 in contact with the lug 41 upon the collar of the electrode 38.

A piston locking member, best shown in Fig. 8, comprises a cam shaped or offset flat head 86 and a shank or handle 87. This member is eccentrically mounted upon a pivot 88 in the plug and moves in a slot 89 opening into the chamber 36 and transversely thereof. When the shank 87 is in normal or vertical position the head 86 is out of the path of the piston 45, but when the shank is elevated the head intersects the path of the piston and prevents the outward stroke of the latter. This arm may be elevated manually at will to the position shown in broken lines in Fig. 1, where it is frictionally held, until released and permitted to fall into vertical position. The release is effected either manually or by any convenient device attached to the engine driven mechanism. Such a device consists of a vertically adjustable sleeve 91 clamped by an adjusting screw 93 to the reciprocating connecting rod 7, and provided with a laterally projecting pin 94 in the path of the shank 87.

The operation of my device is as follows. The unignited compressed engine charge in the combustion chamber 29 impels the armature piston 45 outwardly with great force partially rotating the armature shaft 50 at a high rate of speed thus generating a current in the electric circuit. This circuit is broken to create a spark in the combustion chamber by the contact of the piston 45, in its outward travel, with the lever arm 82 which through arm 85 partially rotates the electrode 38 thereby swinging the arm 39 out of contact with electrode 37. The electrode is returned by the spring 42, and the piston, by the spring 71. It will be noted that in the present instance the terminal 76 runs directly from the winding to the electrode without the intervention of a brush or any moving contact whereby a more positive electrical effect is secured.

In order to utilize the maximum power of the charge provision is made for regulating the instant of sparking relatively to the position of the engine crank, so that when the engine is running at high speed the sparking will occur earlier; and when at a low speed, later. These results are respectively secured by manually turning the disk 67 upwardly or downwardly to increase or decrease the tension of the spring 71. This adjustment can be made while the engine is in operation. The screw 70 binds the disk in adjusted position.

To avoid accident in starting the engine the magneto is held out of operative position by manually elevating the handle 87, thereby checking the advance of the piston 45 during the initial compression revolution of the fly wheel, after which the handle 87 is returned to normal vertical position either manually or automatically thereby releasing the armature piston.

In some engines it is desirable to elevate the shank 87 automatically rather than manually. In "variable quantity" engines alternate strokes of the engine piston produce varying degrees of compression. In such case regularity of movement of the armature piston 45 is insured by the continuous vibration of the shank 87. I prefer for this purpose a device like that shown in Fig. 10 comprising interspaced pins 94 and 96 which loosely engage therebetween the shank 87 which is vibrated by the rod 7. The sleeve 91 is adjustable upon the valve operating rod 7 by the screw 93, but in some instances a preferable adjusting means is that shown in Fig. 11, where this means consists of thumb nuts 98 and 99 threaded to the rod 7 above and below the sleeve 91 whereby the sleeve may be adjusted while the engine is operating.

What I claim is,—

1. In an electric sparking ignition mechanism, the combination with an engine cylinder and an ignition circuit, of an electric generator comprising an armature shaft in the circuit, and a bearing in which the armature is mounted, means actuated by the charge in the cylinder for imparting a generating throw to the armature shaft, and a spring mounted upon the bearing and en-

gaging the armature shaft for returning the armature shaft to original position.

2. In an electric sparking ignition mechanism, the combination with an engine cylinder and an ignition circuit, of an electric generator comprising an armature shaft in the circuit, and a bearing in which the armature is mounted, means actuated by the charge in the cylinder for imparting a generating throw to the armature shaft, a spring mounted on the bearing and engaging the shaft, and means for varying the tension of the spring.

3. In an electric sparking ignition mechanism, the combination with an engine cylinder and an ignition circuit, of an electric generator comprising an armature shaft in the circuit, and a bearing in which the armature is mounted, means actuated by the charge in the cylinder for imparting a generating throw to the armature shaft, a rotatably adjustable member mounted upon the bearing, and a spring upon the bearing engaging both the shaft and the adjustable member.

4. In an electric sparking ignition mechanism, the combination with an engine cylinder and an ignition circuit, of an electric generator comprising an armature shaft in the circuit, and a bearing in which the armature is mounted, means actuated by the charge in the cylinder for imparting a generating throw to the armature shaft, a rotatably adjustable member mounted upon the bearing, a spring upon the bearing engaging both the shaft and the adjustable member, and means upon the adjustable member for maintaining said member in adjustable position.

5. In an electric sparking ignition mechanism, the combination with an engine cylinder, and a generator having an armature shaft, of a spark plug in the cylinder provided with a piston chamber opening into the cylinder, a piston in the chamber, driving connections between the piston and armature shaft, and means upon the generator and engaging the armature shaft for returning the piston to original position after each stroke.

6. In an electric sparking ignition mechanism, the combination with an engine cylinder, of a spark plug in the cylinder provided with a piston chamber opening into the cylinder, a piston in the piston chamber, a fixed electrode in the plug, an axially movable electrode mounted in the plug, an arm on the second electrode normally in contact with the first electrode, a projection upon the second electrode, a lever provided with two arms pivotally mounted upon the plug, one of the lever arms extending normally in the path of the piston, and the other lever arm engaging the projection upon the electrode.

7. In an electric sparking ignition mechanism, the combination with an engine cylinder, and a generator having an armature shaft and bearing, of a spark plug in the cylinder provided with a piston chamber opening into the cylinder, a piston in the chamber, a crank upon the armature shaft, a rod connecting the piston and crank, a lug upon the crank, and a block upon the bearing in the path of the lug.

8. In an electric sparking ignition mechanism, the combination with an engine cylinder, and a generator having an armature shaft and bearing, of a spark plug in the cylinder provided with a piston chamber opening into the cylinder, a piston in the chamber, a crank upon the armature shaft, a rod connecting the piston and crank, and a spring fixed to the bearing and extending into the path of the crank.

9. In an electric sparking ignition mechanism, the combination with an engine cylinder, of a spark plug in the cylinder provided with a piston chamber opening into the cylinder, an axially movable electrode mounted in the plug, a piston in the piston chamber, means for driving the piston, means actuated by the piston for rotating the electrode, and means in the plug for locking the piston against movement.

10. In an electric sparking ignition mechanism, the combination with an engine cylinder, an ignition circuit, and an electric generator having an armature shaft, of a piston operatively connected with the generator armature shaft and actuated by the charge in the cylinder, and means for locking the piston against movement.

11. In an electric sparking ignition mechanism, the combination with the engine cylinder, the generator, the armature shaft, and the ignition circuit, of a spark plug mounted in the cylinder and provided with a piston chamber communicating with the cylinder, a piston in the chamber, driving connections between the piston and the armature shaft, a swinging locking member mounted in the plug and movable into the path of the piston and means for actuating the locking member.

12. In an electric sparking ignition mechanism, the combination with the engine cylinder, of a spark plug mounted in the cylinder and provided with a piston chamber communicating with the cylinder, and provided with a transverse slot opening into the piston chamber, a piston in the piston chamber adapted to be actuated by a compressed charge in the cylinder, and a piston locking member pivotally mounted in the plug comprising a broad head located in the slot, and a shank upon the head extending outside the plug.

13. In an electric sparking ignition mechanism, the combination with the engine cylinder, the valve connecting rod, the genera-

tor, and the ignition circuit, of a spark plug mounted in the cylinder and provided with a piston chamber communicating with the cylinder, a piston in the chamber operatively connected with the generator, a piston locking member pivotally connected intermediate its length with the plug comprising a head movable into the path of the piston and a shank extending from the plug, and a projection carried by the valve connecting rod in the path of the shank.

14. In an electric sparking ignition mechanism, the combination with the engine cylinder, the valve connecting rod, the generator, and the ignition circuit, of a spark plug mounted in the cylinder and provided with a piston chamber communicating with the cylinder, a piston in the chamber operatively connected with the generator, a piston locking member pivotally connected intermediate its length with the plug comprising a head movable into the path of the piston, and a shank extending from the plug, a sleeve upon the valve connecting rod, means upon the rod adapted to engage the shank of the locking member, and means for adjusting the sleeve.

In testimony whereof I have affixed my signature in presence of two witnesses.

LUTHER H. WATTLES.

Witnesses:
HORATIO E. BELLOWS,
WALTER LOUIS FROST.