M. P. RYDER.

IGNITER FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JUNE 23, 1910.

**1,067,275.**

Patented July 15, 1913.

2 SHEETS—SHEET 1.

Fig. 1

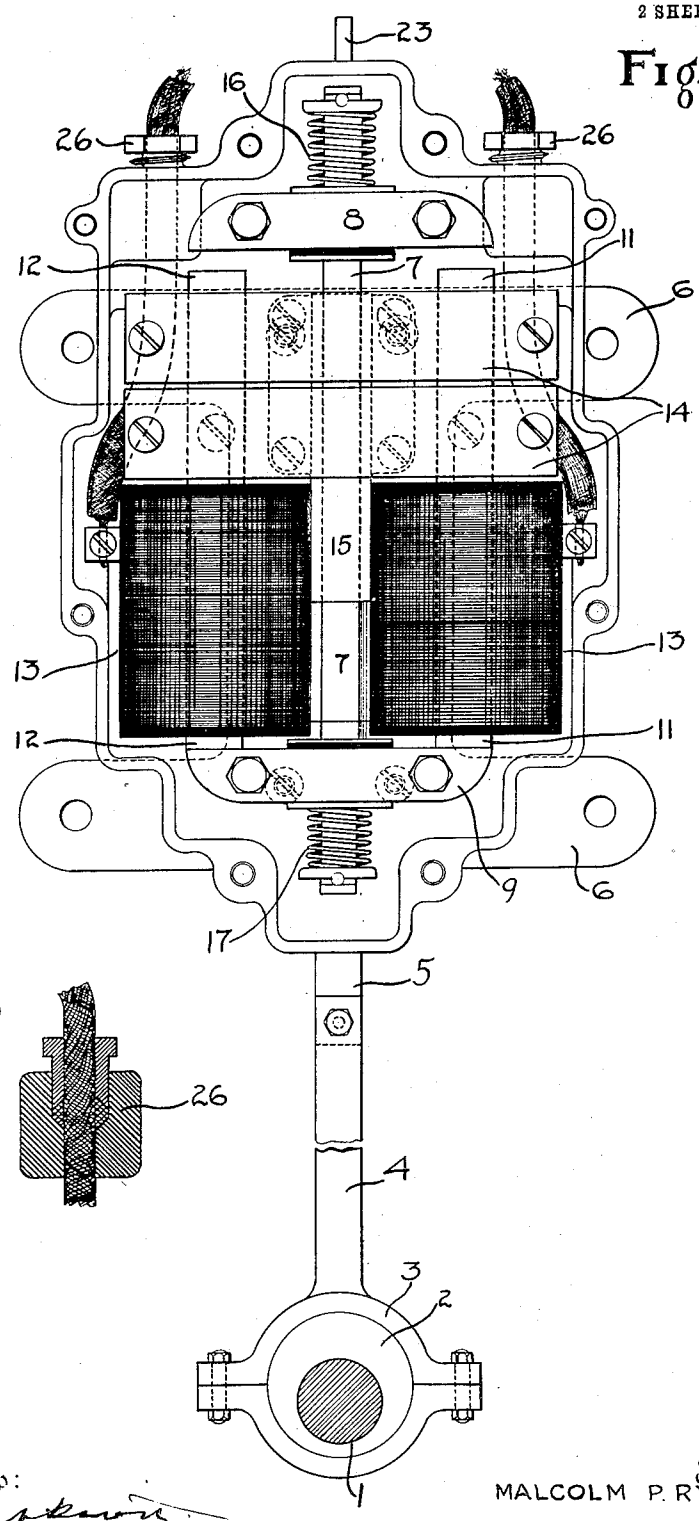



Fig. 6




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2 SHEETS—SHEET 2.

FIG. 2

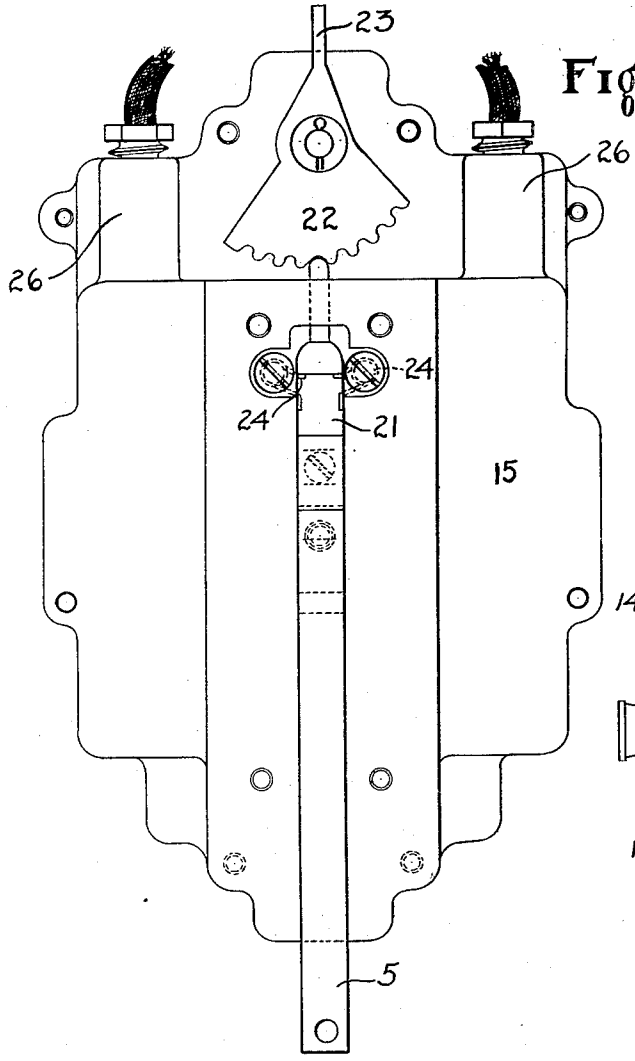



FIG. 3

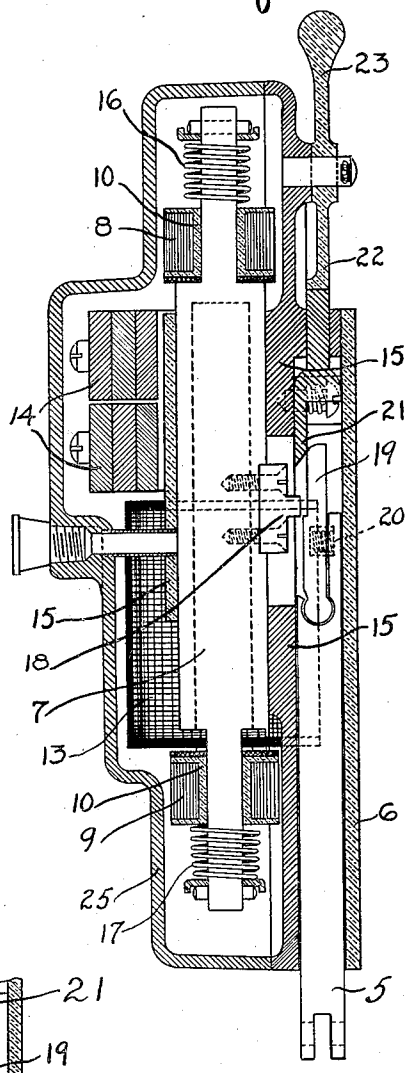



FIG. 4

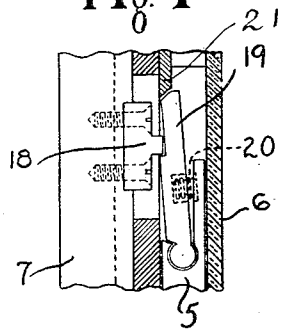
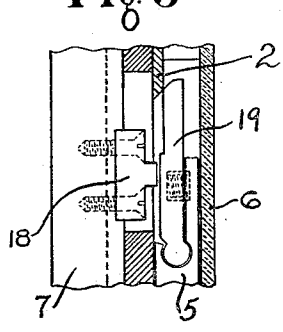



FIG. 5




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# UNITED STATES PATENT OFFICE.

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## IGNITER FOR INTERNAL-COMBUSTION ENGINES.

1,067,275. Specification of Letters Patent. Patented July 15, 1913.

Application filed June 23, 1910. Serial No. 568,467.

*To all whom it may concern:*

Be it known that I, MALCOLM P. RYDER, a citizen of the United States, and a resident of Springfield, in the county of Hampden and State of Massachusetts, have invented certain new and useful Improvements in Igniters for Internal-Combustion Engines, of which the following is a specification.

My present invention relates to devices for generating and controlling an electric spark and is particularly useful as an igniter for exploding the charge in the cylinder or cylinders of an internal combustion engine.

This invention, in part, constitutes an improvement on that class of generators shown and described in my prior United States Patent No. 814,083, dated March 6th, 1906, in which the generation of the electric current for igniting the charge in the cylinder is controlled by the action of a rotary cam. The apparatus shown in this patent is objectionable in that it can only be operated in one direction and therefore cannot be employed with reversible engines. Furthermore in generators operating as described in said patent to generate a spark through detachment of an armature from a magnet brought about by a hammer which strikes the armature and is in turn lifted and then released by a rotating cam, it may happen that at very high speed of rotation of the cam the hammer will act less forcibly upon the armature owing to the fact that as the cam rotates the hammer rod will be caught on the rise of the cam. Hence when rotating at high speeds the apparatus is liable to generate sparks of less strength than when operated at slow speed.

One of the objects of my invention is to secure uniformity in the strength of spark when generated in this manner by the action of a hammer on an armature irrespective of the speed of rotation of the main operating shaft and at the same time to provide means whereby the generator may be actuated by a reciprocating drive and thereby permit it to run in either direction to generate the necessary current for ignition purposes. By so constructing the device, the generator is particularly adapted for use with any type of internal combustion engines whether reversible or not.

In some two cycle engines, particularly of the marine type, it is customary to start the engine by rocking it backward until a spark occurs in the cylinder, that is by rocking it in the opposite direction to which it is intended to start, the spark being set to occur ahead of the center. When the explosion takes places it reverses the motion of the engine, thus starting it in the right direction. This method of starting is in common practice, especially with engines with make and break ignition, and by my present invention this practice can be adhered to when employing generators of the class set forth in the patent above referred to.

This invention further relates to the timing or controlling of the generation of the spark and consists in a means for controlling and varying the time of release of a spark controller from the means for actuating it.

The invention consists further in the novel devices, combinations of parts and details of construction hereinafter more particularly described and then specified in the claims.

In the accompanying drawings, Figure 1 is a front elevation of an apparatus constructed in accordance with this invention, the front cover being removed. Fig. 2 is a rear elevation of the same, the attaching plate for the apparatus being removed. Fig. 3 is a vertical central section through the apparatus, parts being shown in elevation. Fig. 4 is a detached view of a detail. Fig. 5 is a similar view showing the parts in a subsequent position. Fig. 6 is a section illustrating a detail of construction.

By this invention, the generator might be placed in any desired location with respect to the engine and connected thereto by suitable links or otherwise but will, for convenience, be herein shown as in proximity to an actuating shaft 1 which is driven by the engine as for instance, the crank shaft. 2 indicates an eccentric fixed to the shaft 1 and provided with an eccentric strap 3 of the usual type adapted to rotate loosely on the eccentric 2. A connecting rod 4 secured at one end to the strap 3 is pivotally connected to a bar 5 at its upper end. The said bar 5 works in guides suitably formed in the back plate or frame 15 of the generator and is reciprocated by the motion transmitted thereto from the rotary movement of the shaft 1 through eccentric 2 and connecting rod 4, the said reciprocating bar be-

ing held in place by a plate 6 secured to the frame at the back and which also serves as a means for mounting the generator on any suitable support. The said bar 5 acts, through mechanism to be presently described, on a bar or rod 7 operating, in the nature of a hammer, on the devices for producing changes in the magnetic flux through the generator coils in a manner similar to that set forth in my prior patent above referred to and which operation will be herein briefly set forth. The said bar or rod 7 passes upward through the center of the apparatus and plays between two armatures 8 and 9 loosely mounted upon it. At suitable points on the bar, shoulders are provided, as shown, for engaging the armatures or bushings carrying the same at their upper and under sides respectively.

As described in the patent above referred to, each of the armatures consists of a number of sheets of soft iron built up into a solid block and closely fitting to a bronze or other suitable bushing 10, which slides freely on squared ends of the rod or bar 7. Between the ends of the armatures are two stationary cores 11, 12, each built up of a number of sheets of soft iron and firmly secured to the frame 15 of the machine which supports the cores, coils &c. of the apparatus. Each core is surrounded by a coil of insulated copper wire 13 in which the sparking current is generated, the said coils being wound on a fiber or other spool. Near the upper ends of the cores, cast iron pole pieces are mounted in magnetic contact therewith and which serve to make magnetic connection between the cores and hardened steel magnets 14. Springs 16, 17, at each end of the bar 7 are held compressed between each armature and a collar fixed to the bar and tend to force the armatures in a direction toward each other and against the cores 11, 12.

The bar 7 is free to slide in bearings formed in the frame 15 and is provided with a dog 18 firmly secured to the rear of the bar and which travels in an opening formed in the frame 15 as the bar 7 moves back and forth in the operation of the device. 19 indicates a pivotally mounted latch carried by the reciprocating bar 5 and is provided with a shoulder which is normally held underneath the dog 18 by a spring 20.

To generate the current, the mode of operation is as follows:—As the bar 5 rises due to the rotation of the shaft 1 and eccentric 2, the latch 19 carries the bar 7 upward by means of the dog 18 and the shoulders on the upper end of the bar 7 come in contact with the under side of the top armature 8 and thus force the armature to rise. As the lower armature at this time is in contact with the lower ends of the cores 11, 12, the spring 17 tends to keep it pressed against these ends, while the spring 16 is acting against the upper armature and pressing it against the shoulders on the bar 7, the upward movement of the bar 7 being opposed by the compression of the spring 17. With the parts in this position there is a free path for the magnetic lines from the permanent magnets 14 to flow from the north pole to the core, down through the core to the lower armature, across the armature to the second core and to the south pole of the magnet, thus completing the magnetic circuit. The upper armature 8 does not at this time carry any of the magnetic lines as it is separated from the cores by air gaps of considerable width and therefore it is many times easier for the magnetic lines to follow the path described. As the bar 5 rises higher due to the continued rotation of the eccentric, the upper end of the latch 19 is engaged by a trip 21 which forces the shoulder of the latch free from the dog 18 and the armature bar 7 is suddenly released. The compression of the spring 17 causes the armature bar 7 to move downward very rapidly until the motion of the upper armature (which is held against the shoulders on the bar by spring 16) is stopped by striking the upper ends of the cores 11, 12. At this instant, the shoulders on the bar near its lower end strike the top of the armature 9, which has remained stationary during the movement of the armature 8, and a further movement of the bar 7, due to its momentum, carries the lower armature away from the ends of the cores. The result of this combined action of the two armatures is that the magnetic circuit which previously existed through the portions of the cores which are surrounded by the coils is suddenly broken, and at the same time a shunt path for the magnetic lines is provided through the upper armature and the small portions of the cores that project above the pole pieces. In this manner the magnetic flux through the portions of the cores that are surrounded by the coils is quickly reduced from maximum to zero and a single impulse of electromotive force generated in the coils, which causes a spark of great intensity to flow through the wires from the coils to the spark plug in the engine cylinder. In the apparatus shown, the spark will be generated once for every revolution of the shaft 1 but obviously this might be varied by changing the number of times the rod 5 rises for each revolution of the shaft 1 as by substituting a cam having more than one rise in place of the eccentric 2.

In Fig. 3 the parts are shown in the position of having just been released from the latch 19 but previous to the downward movement of the armature bar 7, which movement, it will be understood however,

is instantaneous with the release of the dog 18 from the latch, the position after release being indicated in Fig. 5.

The timing of the generation of the current to cause the spark, that is the controlling of the time the spark is generated with relation to the position of the piston in the cylinder, is varied by means of the following mechanism:—The trip 21 is slidably mounted in guides in the frame 15 and is provided with a finger which projects upward through the frame. The upper exposed end of the finger is engaged by the notched periphery of a segment 22 eccentrically mounted on a stud secured to some convenient part of the frame. The segment is provided with an operating handle 23 by which the segment may be turned and the vertical position of the trip 21 varied. By raising or lowering the trip 21 the time of engagement of the latch 19 is delayed or advanced, and therefore the time of generation of the spark varied, as the latch 19 has the same amount of vertical movement on each revolution of the shaft 1 and the dog 18 will be held by the latch until the latch strikes the lower inclined edge of the trip 21 and rides upon it at which time the armature bar or hammer 7 is released and the current generated as heretofore described. The trip is pressed upward, so that the finger always presses against the periphery of the segment, by means of spiral springs 24 coiled on fixed studs and whose ends engage a shoulder or other abutment on the trip. By the construction described, very minute changes in the time of igniting the charge can be attained as the variation in the position of the trip 21 for each notch in the segment 22 is very slight and therefore the time of generating the current to create the spark will be varied but very slightly for each movement of the trip 21. Also a wide range from maximum advance to retard can be attained.

It will be further seen that after the latch is disengaged from the dog, the hammer will invariably complete its full movement and secure the instant detachment of the armature from the magnet, since the latch 19 has the same amount of vertical movement no matter what the speed of operation and will not reach its lowermost position, which is the position for reëngaging the dog, until after the hammer has completed its downward movement.

It will also be seen that fine gradations of adjustment of the trip may be readily made while the apparatus is in operation and the spark advanced or retarded as may be desired.

The device is so constructed that when the finger of the trip is in the notch at the short side of the segment, the trip is so far withdrawn that it will not cause the latch to free the dog and therefore the engine will come to rest owing to the fact that no spark is generated.

In other ignition systems, when the spark is retarded too much the engine stops due to the inability of the spark to ignite the charge in the cylinder and frequently leads to trouble in again starting. By this system, as long as the latch 19 is tripped away from the dog 18, a spark sufficient to ignite the charge in the cylinder will be obtained. The strength of spark varies somewhat with the amount of travel of the bar 7, the strongest spark being obtained when the tripping action is furthest retarded, which is the position used in starting the engine at which time the strongest spark is needed. The spark is still strong enough for igniting the charge and running the engine when the tripping action takes place at the other extreme position. Also by causing the engine to stop when, or turning it over until, the latch has raised the armature bar 7 to its upper position, the engine may be started by merely throwing over the segment 22 to advance the trip 21 and cause it to release the armature bar from the latch 19, when the engine will start without the necessity of cranking. Also it will be obvious that the timing of the spark might be controlled from a point distant from the generator by the use of suitable links and levers.

All the parts of the generator are mounted on the frame 15 and are inclosed in a liquid-tight casing formed by the frame 15 and a cover 25 whereby if desired the entire case might be filled, partially or wholly, with oil or other lubricant. To effectually seal the casing, the wires from the coils 13 preferably pass through suitably formed stuffing-boxes 26, shown more clearly in the section Fig. 6.

What I claim as my invention is:—

1. In an igniter, the combination of generating coils, a magnet, an armature for said magnet adapted to be moved into and out of engagement with the core of the magnet, a hammer operating on the armature to detach it from the core, a reciprocating latch for lifting the hammer, an adjustable trip for releasing the hammer at each excursion of the latch and means for adjusting the trip at will in either direction while the apparatus is in operation to advance or retard the spark.

2. In an igniter, the combination of generating coils, a magnet, an armature adapted to be detached from the cores of the magnet to generate a spark, a hammer operating on the armature to produce detachment, a reciprocating latch for lifting the hammer and means for releasing the hammer from the latch at each excursion of the latter, as and for the purpose described.

3. In an igniter, the combination of gen-

erating coils, a magnet, an armature adapted by detachment from the magnet to generate current in said coils, a hammer acting on the armature to detach it, a reciprocating latch for lifting the hammer and adapted to operatively connect with said hammer for lifting the same at one extreme of movement of the latch and an adjustable trip for releasing the latch from the hammer during the lifting movement.

4. In an igniter, the combination of a spark controlling device, a reciprocating rod adapted to engage said device, a trip for releasing said device and an eccentrically mounted segment, adapted to vary the time of operation of said trip.

5. In an igniter, the combination of generating coils, a magnet therefor, two armatures adapted respectively to establish a magnetic flux through the coils and a shunt for the flux in alternation, an actuating rod for said armatures, reciprocating means for lifting said rod, a trip for freeing said rod and an eccentrically mounted segment adapted to vary the time of operation of said trip.

Signed at Springfield in the county of Hampden and State of Massachusetts this 17th day of June A. D. 1910.

MALCOLM P. RYDER.

Witnesses:
DAVID B. MILLER,
HARRY S. SAWYER.