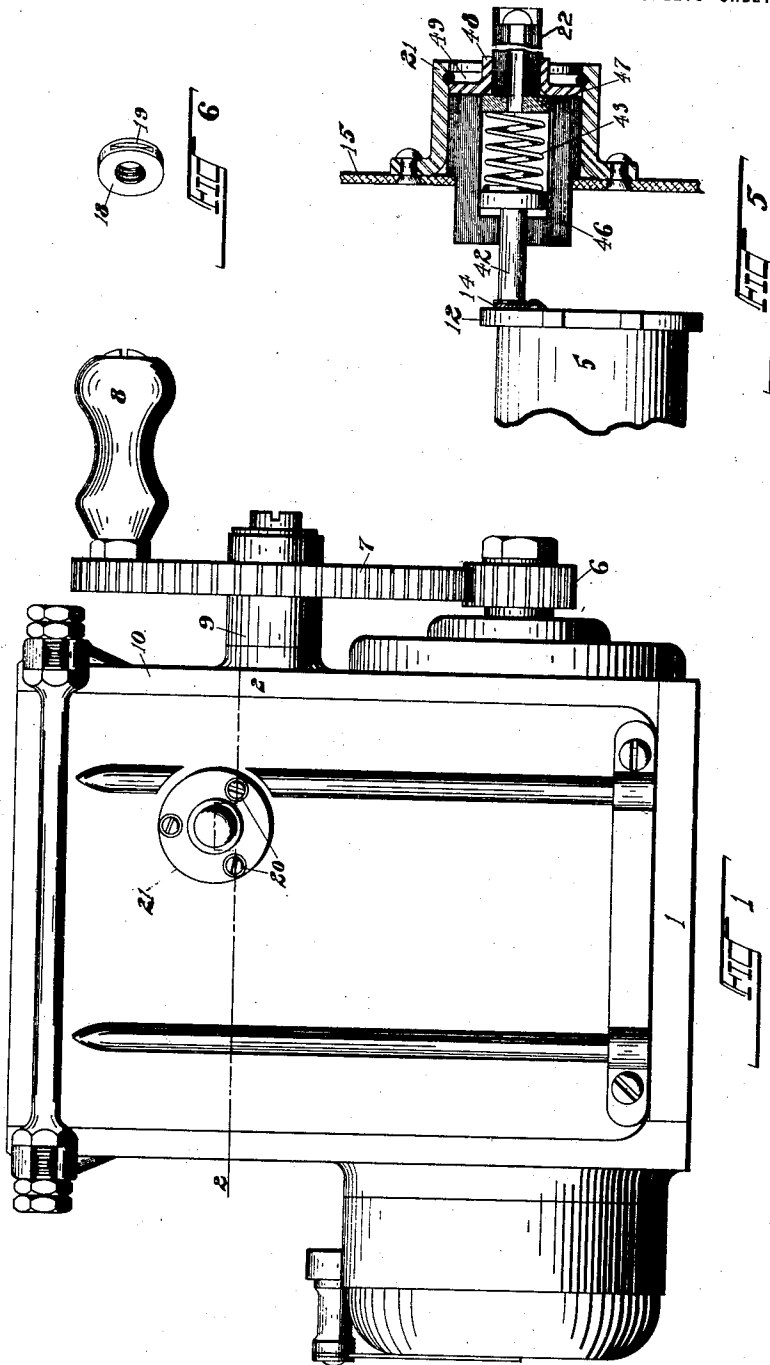


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APPLICATION FILED SEPT. 30, 1918.

1,304,836.

Patented May 27, 1919.
2 SHEETS—SHEET 1.

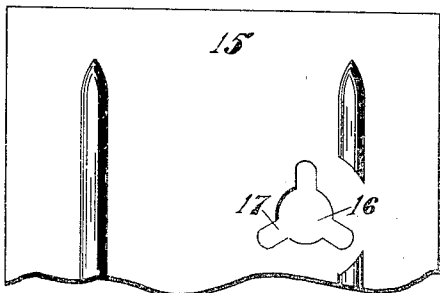
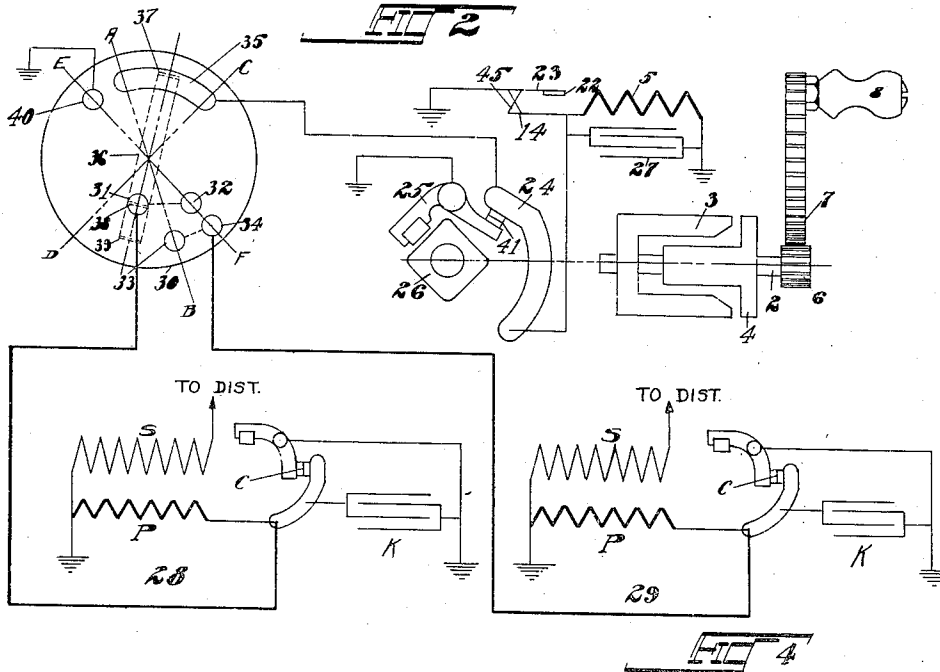
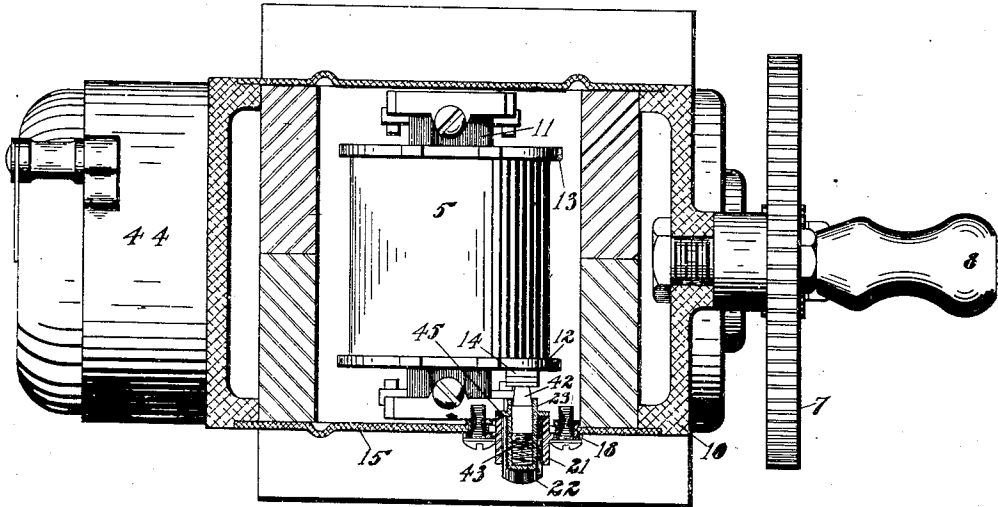


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IGNITION SYSTEM.

1,304,836.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, LEO J. WERNER, a citizen of Russia, residing at Arlington, in the county of Hudson and State of New Jersey, U. S. A., have invented certain new and useful Improvements in Ignition Systems, of which the following is a specification.

This invention relates to an ignition system adapted for use on large, high compression engines which are hard, or not adapted to be started, with a hand crank, but which are started "on compression." It is particularly adapted for use in connection with engines used on airplanes that are usually started by priming the cylinders or drawing in charges of fuel by turning the engine over, through the medium of the propeller, at which time the ignition system is out of operation. It is usual to equip such engines with duplicate ignition generators and a double set of spark plugs for the purpose of getting the maximum power out of the engine and increasing the reliability. After the engine has been primed, as above set forth, ignition is usually obtained through the operation of a hand starting ignition generator which supplies the initial ignition impulse or impulses, while the service ignition generators and engine are at rest. Several schemes have been used, one of which involves the use of a high tension starting ignition generator which supplies secondary current to the engine spark plugs through the medium of a trailing brush in the distributor of one or both of the service generators, at a period of time somewhat later than the service generator. Another scheme is to provide a low tension starting generator, that is, one having a low tension winding only, and connect this generator to the primary of the service generators which are preferably of the high tension type. The introduction of current from the low tension starting generator into the primary of either of the service generators causes the secondary winding to produce a spark in the cylinder adapted to receive it. In many ways this latter scheme is preferable to the first, in that the starting generator is simpler to make, on account of one low

tension winding, and is less likely to "break down" or get out of order. My invention relates particularly to a system of the latter kind and is directed to certain improvements therein.

After the engine has been started, it is highly advantageous to be able to switch "off" and "on" either one of the service ignition generators in order to see that the other one is firing the engine properly, after which test has been made the controlling switch is so thrown that both service generators are in "commission."

In certain arrangements using the low tension starting generator in the combination as set forth, trouble has been experienced, due to the fact that at the time the engine is started the starting generator winding is left connected with the primary winding of one of the service generators and this will function to a considerable extent through the starting generator winding as the circuit breaker or controller of the latter generator may stop in open position so that the proper test cannot be obtained on either of the service generators.

It is the principal object of my invention to provide means to eliminate this trouble by a very simple mechanism preferably placed on the casing of the starting generator.

In airplane work the starting generator is so placed that it can be readily operated by the pilot and on account of the small space allowed to him it sometimes happens that in getting in or out of the machine he accidentally moves the operating means on the starting generator so that this may, under some conditions, cause a premature start of the engine with disastrous results and it is therefore another object of my invention to provide an arrangement which will overcome this particular trouble.

Other and further objects will be apparent to one skilled in the art after a study of this specification and drawings, in which—

Figure 1 is a side elevation of the starting generator showing one means of operating it.

Fig. 2 is a part sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a detail of one of the casing members.

Fig. 4 is a diagrammatic view of my ignition system.

Fig. 5 is a modified form of switch which may be used in place of that shown in Fig. 2.

Fig. 6 is a detail used in connection with Fig. 3 for mounting the switch shown in Fig. 2.

Referring now to the details, wherein like numbers refer to corresponding parts in the various views, 1 illustrates a generator, preferably of the permanent magnet type, having a rotor shaft 2 which, in my preferred form carries rotors 3 and 4 which operate in a well known manner between field poles carrying a generating winding 5 on the core 11. A gear 6 is carried on the shaft 2 and meshing with it is another gear 7 having an operating handle 8. The gear 7 is fastened to a support 9 attached to the end plate 10. The winding 5 is supported on the core 11 between the coil heads 12 and 13, the inner end being grounded to the core 11 and the outer end being brought to a terminal 14 on the head 12. The casing member 12 has a hole 16 punched therein together with notches 17. A threaded bushing 18, having grooves 19 cut therein is adapted to slide into the notches 17 and due to the grooves 19 are prevented from turning. The bushings 18 receive the screws 20 which support a switch body 21 on to the casing member 15. The body 21 carries an insulating plunger 22 within which is carried a brush holder 23 and brush 42 and a spring 43 which presses the brush 42 against the terminal 14 and this in turn presses the brush holder 23 against the body 21 which, being connected to the casing member 15, grounds the terminal 14.

As shown in the diagrammatic arrangement in Fig. 4, the rotors 3 and 4 are of the two lobe type so that the starting generator is capable of delivering four current impulses per revolution of the shaft 2. Mounted within the breaker or controller end 44 of the generator 1 is the usual circuit breaker or controller having a stationary member 24 and a movable member 25 and cam 26, which is adapted to operate the movable member 25 four times per revolution to correspond with the current impulses generated by the generator. The generating winding 5 is connected to the stationary and insulated contact 24 and a condenser 27 is connected across the controller in the usual way. 28 and 29 illustrate two service generators, preferably of the high tension magneto type, each having primary windings P and secondary windings S with circuit breakers or controllers C and condensers K. 30 is a controlling switch having contacts 31 and 32 which are

connected together and to the primary of the generator 28. 33 and 34 are two contacts connected together and to the primary of generator 29. The stationary contact 24 of the starting generator is connected to a segment 35. 36 illustrates a switch lever carrying switch blades 37, 38 and 39 which are all electrically connected together. 40 is a ground contact.

Concerning the operation of my ignition system, let it be assumed that the switch 30 is thrown to the position shown which connects the winding 5 of the starting generator to the service generator 28. Since the contact 45 is normally closed the winding 5 is rendered inert, due to its being on a short circuit through the contact 45 thereby also rendering the controller contact 41 inoperative to produce current impulses from the winding 5. It will, therefore be seen that any premature movements of the starting means on the starting generator, such as the handle 8 being accidentally hit with the foot or hand, will not cause the starting generator to function and send current through the primary P of the generator 28. After the operator is in position and everything in readiness he presses the plunger 22 which breaks the contact 45 and then operates the starting generator which sends current impulses in a well known manner through the service generator to which it is connected. After the engine has been started the operator removes pressure from the plunger 22 and the contact 45 is restored thereby cutting out the controller contact 41 and the winding 5 as well as rendering inert the service generator 28 so that the engine may be operated off of the service generator 29, thus giving a test on the same, after which the switch arm 36 is moved to the position A—B thereby connecting the starting generator to the service generator 29 so the service generator 28 will furnish all of the ignition current and a test obtained on said generator. When the switch lever 36 is thrown to the position C—D both service generators 28 and 29 are furnishing current. When it is desired to stop the engine the switch lever 36 is thrown to the position E—F where it is seen that both generators are grounded and put out of action in the usual way.

In the modified form of switch mechanism, shown in Fig. 5, the brush 42 and spring 43 are inclosed within an insulating member 46 and the plunger 22 carries a metallic member 47 which contacts with a bushing 48 held in the body 21 which is riveted to the casing member 15, the bushing 48 being held in place by a snap ring 49. From this construction it will be seen that the terminal 14 is grounded through the brush 42, spring 43, member 47, bushing 48, body 21 and casing member 15. When the

plunger 22 is operated the connection between the member 47 and the bushing 48 is broken and hence the ground connection from the insulated end of the primary winding is removed.

While I have shown a starting generator of one particular type, it will be understood that other types of generators are capable of being used and while I have shown certain details of starting and controlling mechanism, I do not wish to be limited to the exact forms shown and described.

Having thus described my invention, what I claim is:—

1. An ignition system for internal combustion engines comprising ignition means including a service generator driven by the engine and having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding normally inoperative, means for connecting said winding to the primary of the service generator for delivering current thereto, and means for rendering the starting generator winding operative.

2. An ignition system for internal combustion engines comprising ignition means including a service generator driven by the engine and having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding normally inoperative, a controller to control said winding normally inoperative, means for connecting said winding to the primary of the service generator for delivering current thereto and means for rendering both the winding and controller operative.

3. An ignition system for internal combustion engines comprising ignition means including a service generator driven by the engine and having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding normally inoperative, a controller to control said winding normally inoperative, means for connecting said winding to the primary of the service generator for delivering current thereto and a common means carried on the starting generator for rendering both the winding and controller operative.

4. In an ignition system for internal combustion engines comprising ignition means including service generators driven by the engine and each having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding, switching means for connecting said winding to the primary of either service generator for delivering current thereto and means preferably carried on the starting generator for normally rendering it and the service generator to which the starting generator is connected

inoperative, said means being operative to allow the starting and service generators to function for the purpose described.

5. In an ignition system for internal combustion engines comprising ignition means including service generators driven by the engine and each having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding, and a controller to control said winding, switching means for connecting said winding and controller to the primary of either of said service generators for delivering current thereto and means preferably carried on the starting generator for normally rendering inoperative the starting generator winding, controller and service generator to which the winding is connected, said means being operative to render all said devices operative for the purpose described.

6. An ignition system for internal combustion engines comprising ignition means including service generators driven by the engine and having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding, means for connecting said winding to the primary of either of the service generators for delivering current thereto, means for operating the starting generator and manually operable means preferably attached to the casing of said starting generator for rendering its winding and the service generator to which it is attached active or inert as desired.

7. An ignition system for internal combustion engines comprising ignition means including service generators driven by the engine and having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding, means for connecting said winding to the primary of either of the service generators for delivering current thereto, means for operating the starting generator and means for preventing the winding on the starting generator sending current into the service generator to which it is connected should the said operating means be prematurely moved.

8. An ignition system for internal combustion engines comprising ignition means including service generators driven by the engine and having primary and secondary windings for furnishing sparking current, a starting generator having a generating winding, and a controller to control said winding, means for connecting said winding to the primary of either of the service generators for delivering current thereto, means on the starting generator for operating the same and its controller, and a switch on the casing of the starting generator having contacts and connections for grounding that

end of its winding connected to the insulated contact of the controller so that the starting generator can be functioned only after said switch is operated to remove said
5 ground.

9. An ignition system for internal combustion engines comprising ignition means including a service generator driven by the engine and having primary and secondary
10 windings for furnishing sparking current, a starting generator having a generating winding, means for connecting said winding

to the primary of the service generator for delivering current thereto, manual means for operating the rotative parts of the starting
15 generator and further manual means operable to allow the rotative parts of the starting generator to produce current impulses in its winding and to automatically render
20 inert the starting and service generator when the manual force is removed.

In witness whereof, I affix my signature.

LEO J. WERNER.