No. 643,087. Patented Feb. 6, 1900.

D. DRAWBAUGH.

ELECTRIC GENERATOR FOR SPARKING APPARATUS OF GAS ENGINES.

(Application filed May 6, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

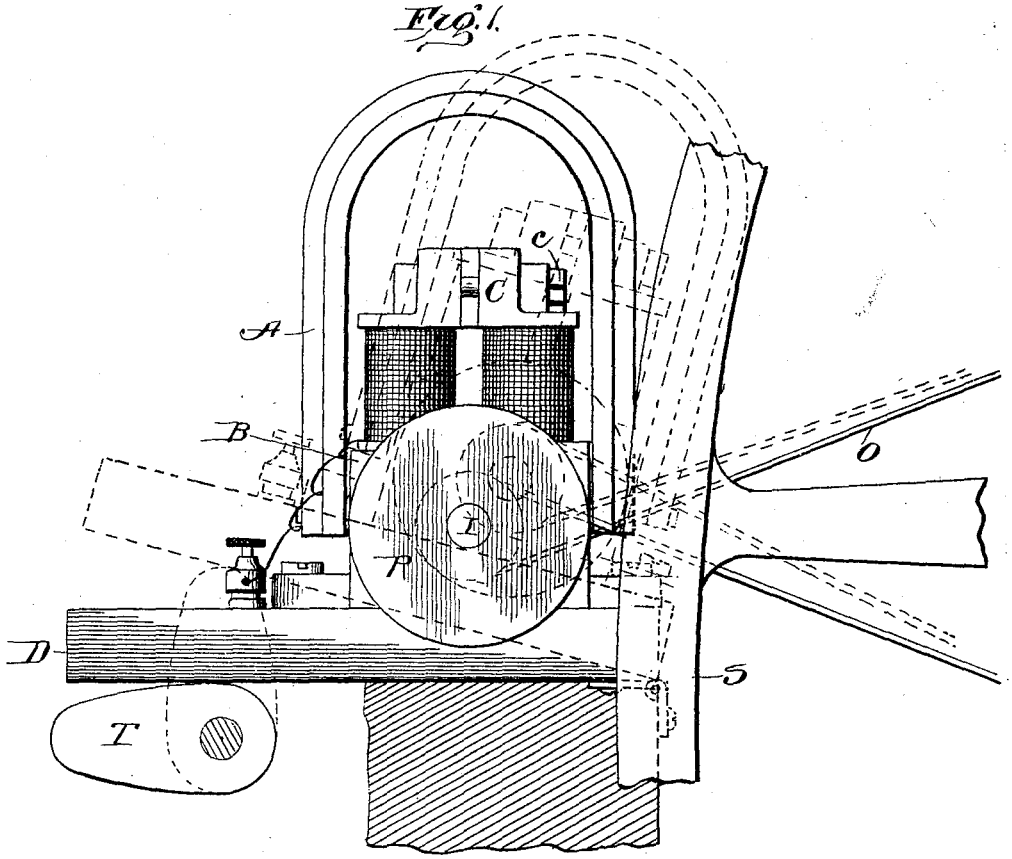

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Fig. 2.

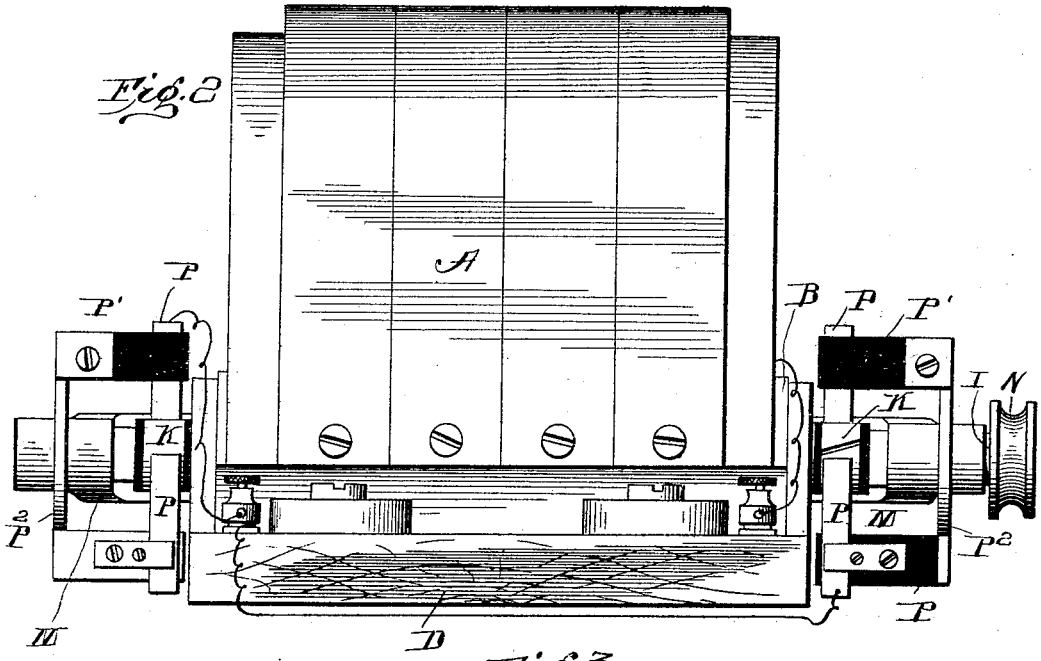

Fig. 3.

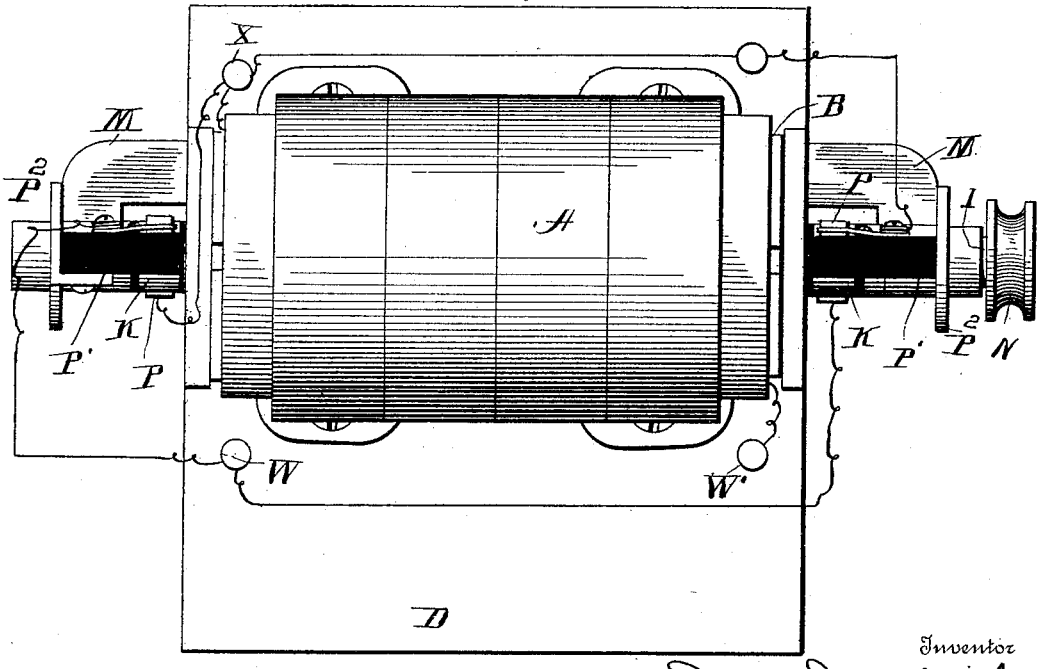

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Fig. 4.

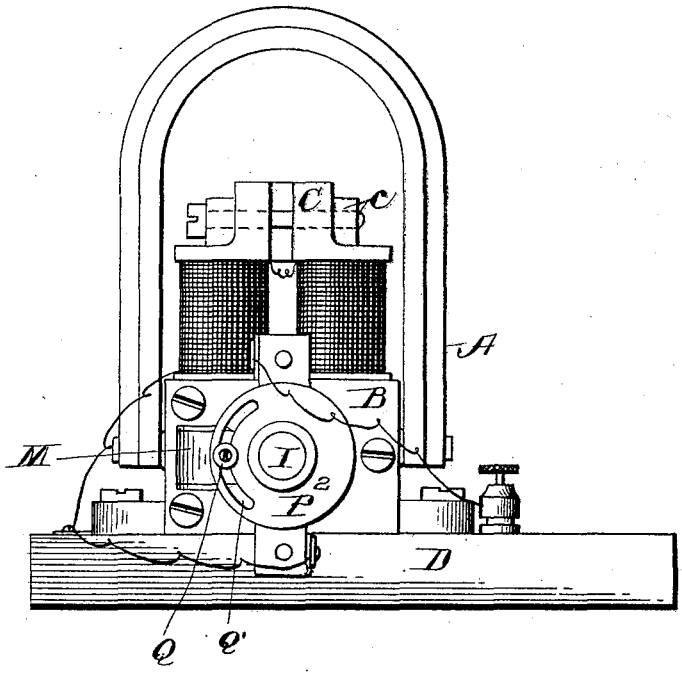
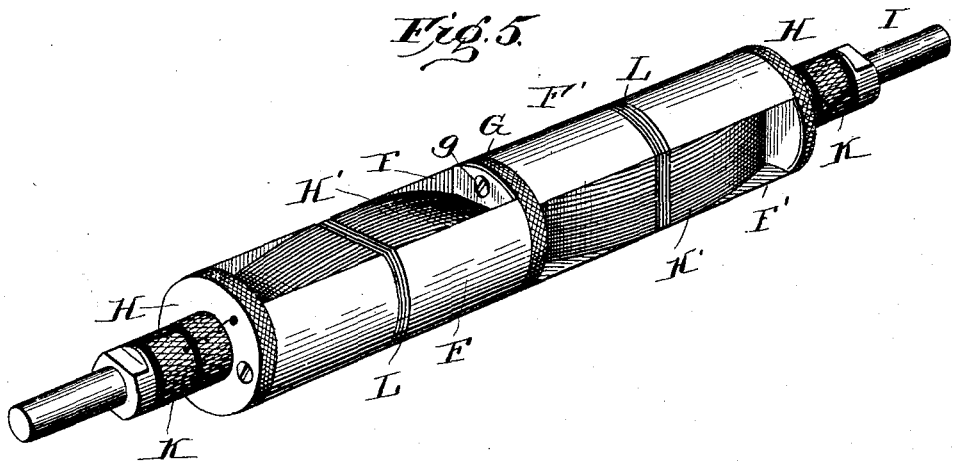


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ELECTRIC GENERATOR FOR SPARKING APPARATUS OF GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 643,087, dated February 6, 1900.

Application filed May 6, 1899. Serial No. 715,864. (No model.)

To all whom it may concern:

Be it known that I, DANIEL DRAWBAUGH, a citizen of the United States, residing at Eberly's Mills, in the county of Cumberland and State of Pennsylvania, have invented certain new and useful Improvements in Electric Generators for Sparking Apparatus of Gas-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to improvements in apparatus designed especially for use in generating electricity for producing an igniting-spark in gas-engines. Generators of electricity for the purpose mentioned have usually been in the form of batteries, either primary or storage batteries, which will deliver a continuous and uniform current, and difficulty has been experienced in providing a mechanical or magneto generator for the purpose, due, primarily, to the fact that there is danger of a failure to spark at a critical moment because of the possible separation of the sparking-contacts at an instant when there is either a reversal of the current or at an instant when the brushes of the generator and commutator are passing from one commutator-segment to another or when there is no effective current on the line, for, obviously, at such times a spark would fail altogether or be of such nature as to fail in its function of igniting the explosive mixture within the chamber of the engine.

One of the objects of the invention is to provide a mechanical or magneto generator which will overcome this defect and deliver a continuous and uniform current in which there will be no possibility of a failure to spark or a failure to produce an igniting-spark at any time.

A further object of the invention is to provide a structure wherewith in starting the engine the generator may be given a relatively more rapid movement in order to produce the necessary current with a relatively short or small movement of the engine itself, or such a movement as is usually imparted by hand in starting the engine.

Referring to the accompanying drawings, Figure 1 is an end elevation of a generator, showing diagrammatically one means for speeding it up in starting the engine. Fig. 2 is a side elevation. Fig. 3 is a top plan view, and Fig. 4 an end elevation, of the generator alone. Fig. 5 is a perspective view of the armature and commutators.

Like letters of reference in the several figures indicate the same parts.

In the form of apparatus shown field-magnets A, preferably permanent magnets, are employed to excite the pole-pieces B of the generator, and, in addition, in the preferred form of apparatus field-magnets C are also employed to supplement the action of the magnets A, the field-magnets C being, however, electromagnets adapted to be excited by the current generated by the machine itself. As a convenient arrangement the magnets A are of the horseshoe type and extend over or form a housing for the magnets C, which latter are directly upon the top of the pole-pieces B, while the said magnets A contact with the outer faces of the pole-pieces. The magnets C and pole-pieces may be cast in integral sections divided on a vertical line between the pole-pieces, and in assembling the parts the upper ends of the magnets C may be united by bolts *c* or otherwise, if preferred.

The pole-pieces B are preferably made relatively long and are adapted for the accommodation between them of the armature, which in the present instance is of the Siemens type and is compound for a purpose which will be now explained.

The construction of the armature will be readily understood by reference to Fig. 5, wherein it will be seen that, in effect, two armatures, with their poles F F′ arranged at right angles to each other, taken in a plane transversely of the armature, are provided, and these two armatures are attached end to end, preferably by means of an intermediate

non-magnetic section G. To the outer ends of the poles F and F′ non-magnetic rings or sections H are secured, to which in turn the ends of the shafts I are centrally attached and constitute the supports for the armature. The commutator-segments K are of any preferred or ordinary type and are suitably insulated from the shaft or other metal portions of the armature, as is usual in this class of machinery.

A convenient method of forming the armature is to cast the two magnetic sections, having the pole-pieces F F′, separately and wind the coils H′ between the pole-pieces, and then attach the pole-pieces together by means of the central non-magnetic ring G and screws *g*. The end pieces H are then applied, when the whole structure may be mounted in a lathe and ground or dressed down to the proper size, which operation will also true the parts up for use in the machine. The tie-pieces L, lying in grooves, may be applied before or after the parts are dressed to prevent any possible spreading of the center portion of the coils under the influence of rapid rotation. When the parts have been thus assembled and finished, the ends of the coils in the armature may be electrically connected with the respective commutator-segments K and the armature mounted in the machine ready for use. The pole-pieces of the armature-cores being arranged at right angles in a transverse plane, the commutator-segments are preferably correspondingly arranged with relation to each other. Thus in the machine illustrated, having substantially vertical brushes, the left-hand commutator (shown in Fig. 5) for use in connection with the left-hand core and coil has the division-line between its segments in a plane at substantially right angles to the plane of the pole-pieces F, taken longitudinally of the armature, and the commutator-segments at the opposite end of the armature are arranged similarly with respect to the pole-pieces at that end of the armature, the result being that the commutators are arranged with the lines of separation of the segments at right angles to each other, and while these commutator-segments are shown for convenience and by preference at opposite ends of the armature it will be understood, of course, that they may be located at the same end, it being only necessary in such instance to extend the electrical connections from the farther coil past the other coil to the proper commutator-segments. The armature as thus constructed is mounted in bearings M, preferably of non-magnetic metal, attached to the pole-pieces of the field-magnets, as shown in Figs. 3 and 4, and on one end of the armature there is mounted a driving-pulley N, through which the power for driving the armature may be applied by means of a belt O, Fig. 1, or otherwise.

The brushes P for taking the current from the commutator-segments may be conveniently mounted in insulating-blocks P′, which blocks are in turn supported by adjustable disks P^2, carried by the bearings M and adjustably connected therewith by set-screw Q, working through slots Q′ in the disks. This manner of mounting the brushes is exceedingly cheap, and the brushes may be easily adjusted, even by those unskilled in the handling of electric machinery—such, for instance, as engineers, into whose hands devices of this character are liable to be placed for running gas and gasolene engines.

Gas and gasolene engines, as is well-known, run approximately at uniform speed, and in driving the generator the size of the pulleys is gaged to accord with the normal speed of the engine; but in starting such engines it is usual to give the power-shaft and fly-wheel a turn more or less by hand in order to effect the first compression and explosion of the combustible within the engine-chamber, and inasmuch as such movement is slow as compared with the normal speed of the engine it is highly desirable to provide a means whereby this initial explosion may be effected by the sparking apparatus. To do this, it would ordinarily be necessary to provide a separate means for driving the electrical generator, as it will not ordinarily produce a sufficient spark when running or starting at a very low speed, and I now provide for accomplishing this end by breaking or relieving the ordinary driving connection and providing a separate driving connection with the engine for rotating the generator at a high rate of speed in starting.

In the simplest embodiment the generator is mounted on a pivoted base D, and at the end of the armature-shaft, preferably adjacent the pulley N, I mount a friction-disk R, which disk R is so positioned relatively to the fly or driving wheel of the engine (indicated by the segment S in Fig. 1) that when the generator is swung up to the position shown in dotted lines the said disk R will contact with the surface of the fly or driving wheel S, and a movement of the latter, even though relatively slow, will impart a rapid rotation to the armature. When the engine starts and attains its speed, the generator is dropped back to its normal position and will be driven by the belt O, as before explained. When the generator is swung up to throw the friction-disk R into contact with the fly-wheel S, the tension on the belt O is relieved, and consequently the latter will offer no appreciable resistance to the rotation of the armature. For swinging the generator and holding it elevated a cam or lever, such as T, may be provided, although I do not wish to be limited in this application to this particular means nor to any particular means for relieving the ordinary driving mechanism of the generator and throwing into action a speeding connection in starting the gas or gasolene engine.

Obviously the manner of connecting up the electrical circuits in the generator may be varied considerably; but in the preferred arrangement one of the brushes for each part

of the armature is connected electrically with one of the line-connectors W, while the other brushes are electrically connected together, as at X, and the circuit carried from this point through the field-magnets C to the other line-connector W'.

With the construction and arrangement described it will be noted that as the current from one section of the armature is decreasing the current from the other section of the armature is increasing in the same ratio, and vice versa, the result being a uniform current to line. Furthermore, the arrangement is such that the resistance offered to the turning of one section of the armature is largely counterbalanced by the attraction of or the motor effect exerted on the other section. Consequently there is but little power required.

The pole-pieces of the armature in the preferred construction, it will be observed from Fig. 5, "overlap," so to speak—that is to say, the pole-pieces of the core at the left-hand end are extended in a plane transversely of the armature a distance more than equal to the space between the pole-pieces of the core at the right-hand end of the armature, and vice versa, thereby securing greater uniformity of action.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States of America, is—

1. In a magneto-electric machine the combination with the pole-pieces, electromagnets for exciting the same and permanent magnets embracing the said pole-pieces, of an armature formed with magnetic cores arranged end to end longitudinally of the axis of rotation, said cores having pole-pieces arranged at right angles to each other; substantially as described.

2. An armature for magneto-electric machines formed of separate magnetic cores open at the ends for the reception of the coil-wire, and a non-magnetic connecting-piece uniting said cores end to end and with the poles in different angular positions; substantially as described.

3. In a magneto-electric machine, the combination with the field-magnets, of an armature formed with independent magnetic cores open at the ends and secured together end to end with their poles at right angles to each other, by an intermediate section, and end sections secured to the outer ends of the cores; substantially as described.

4. In a magneto-electric machine, the combination with the pole-pieces and the electromagnets for exciting the same, of permanent magnets extending over and inclosing the electromagnets and an armature between the pole-pieces; substantially as described.

5. In a magneto-electric machine, the combination with the pole-pieces and the armature located between such pole-pieces, of field-electromagnets extending upwardly from the top of said pole-pieces, and field permanent magnets extending upwardly from the outer faces of the said pole-pieces and inclosing the field-electromagnets; substantially as described.

6. In a sparking magneto-electric machine for gas-engines, the combination with the field-magnets, of an armature of independent high and low speed drive-gear for said armature and means for establishing the connection with the motive power through either, whereby in starting the armature may be speeded up to generate a spark before the engine attains normal speed; substantially as described.

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