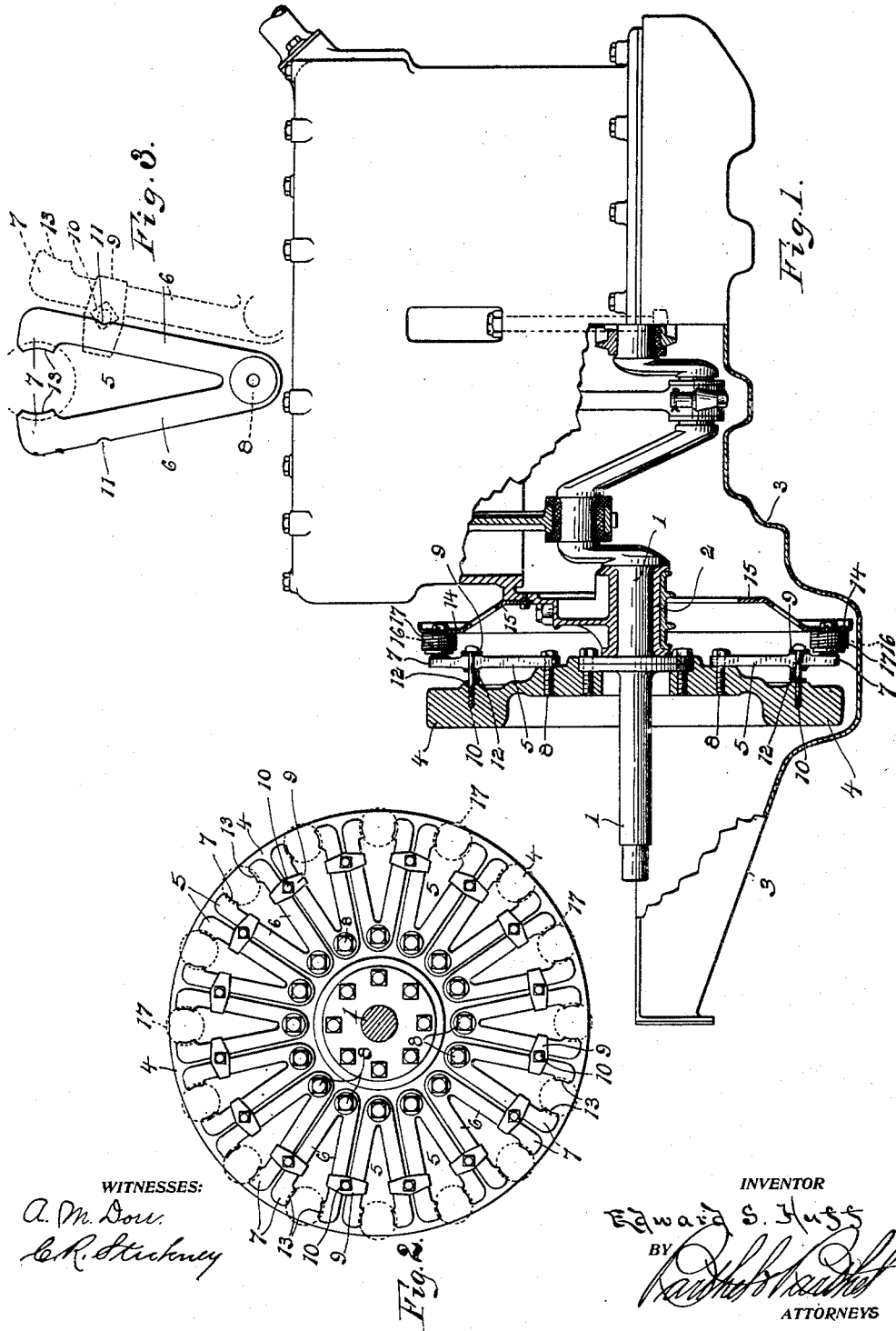


E. S. HUFF.
 FLY WHEEL MAGNETO FOR EXPLOSIVE ENGINES.
 APPLICATION FILED APR. 27, 1908.

1,098,361.

Patented May 26, 1914.

2 SHEETS—SHEET 1.



WITNESSES:
 A. M. Dow.
 C. R. Stickney

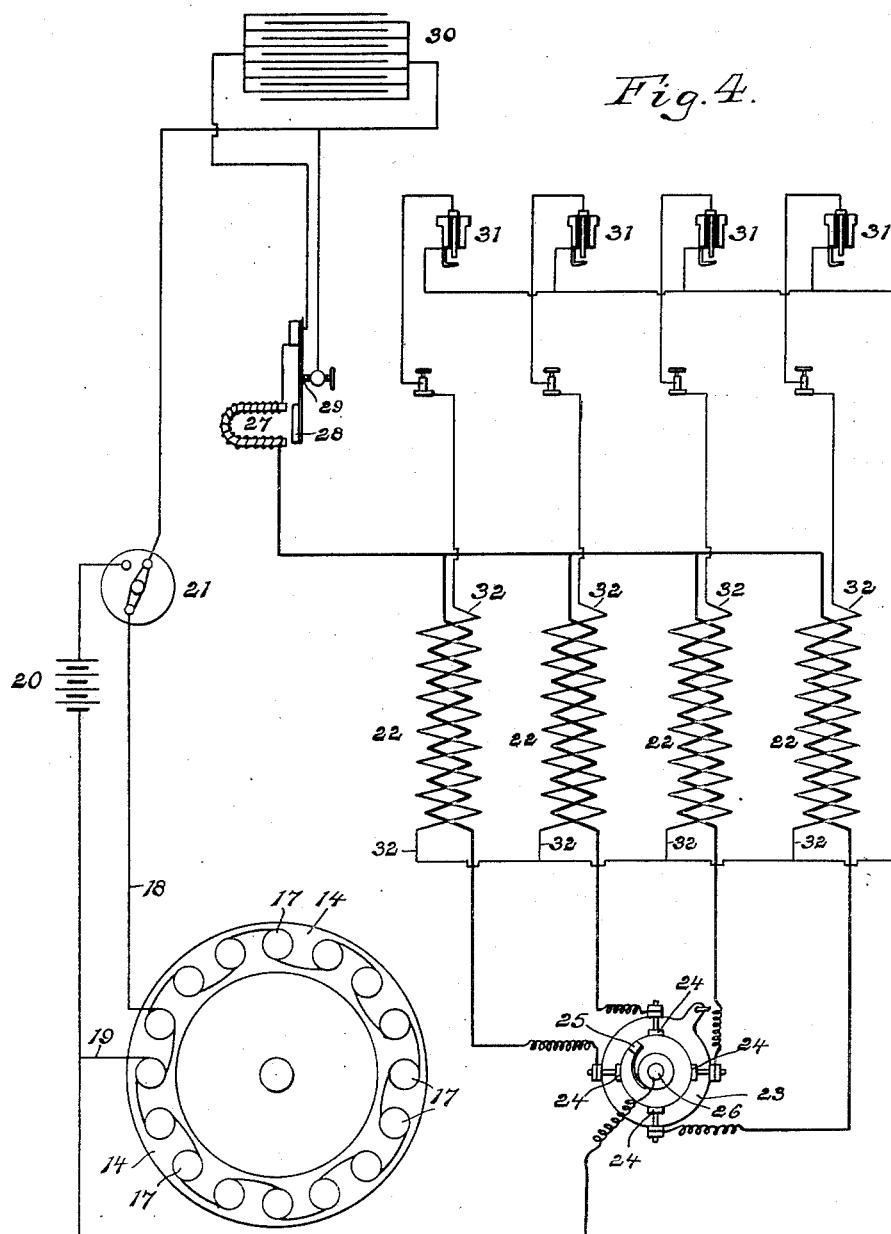
INVENTOR
 Edward S. Huff
 BY
 [Signature]
 ATTORNEYS

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UNITED STATES PATENT OFFICE.

EDWARD S. HUFF, OF DETROIT, MICHIGAN, ASSIGNOR TO HENRY FORD, OF DETROIT, MICHIGAN.

FLY-WHEEL MAGNETO FOR EXPLOSIVE-ENGINES.

1,098,361.

Specification of Letters Patent.

Patented May 26, 1914.

Application filed April 27, 1908. Serial No. 429,330.

To all whom it may concern:

Be it known that I, EDWARD S. HUFF, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Fly-Wheel Magnetos for Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to electric ignition systems for internal combustion engines, and more especially to an electric magneto for generating the electric current.

The object of the invention is to provide a generator that has but few parts and these so constructed as to be readily and permanently adjusted when assembled, thus obviating the necessity of further attention and permitting the generator to be inclosed with the engine and drive gear in a moisture and dust-proof case, so that it is peculiarly adapted for commercial use on automobiles.

To this end the invention embodies an electric magneto generator of the general type in which the fly-wheel of an engine is the motor and by which an alternating current is produced at normal engine speed of sufficient maximum intensity and high frequency to induce a spark producing current in the secondary circuit of an induction apparatus, whenever the circuit is closed by a mechanical circuit breaker that is timed wholly with reference to the requirements of the engine regardless of the period of the current, all as more fully hereinafter described in the drawings, in which—

Figure 1 is a view, partially in section and partially in elevation, of an engine together with a magneto generator embodying features of the invention; Fig. 2 is a view in detail of the engine fly-wheel and field magnet thereon; Fig. 3 is a view in detail of a field magnet; and Fig. 4 is a diagrammatic representation of the ignition circuit as arranged for a four-cylinder engine.

As shown in the drawings, 1 indicates the crank shaft of an engine, 2 the crank shaft bearing, 3 the crank case and 4 the fly-wheel, all of standard conventional construction, the crank shaft bearing 2, however, having end flanges 33 which cooperate with disks or collars 34 on the shaft to hold the latter against longitudinal movement.

A series of V-shaped permanent field magnets 5 are secured on the fly-wheel adjacent the crank case with their arms 6 in substantially radial position and their poles 7 concentric with the shaft near the fly wheel periphery. They are preferably disposed in pairs, the positive poles of each pair adjacent, and are magnetically insulated each from each by air gaps. Their inner neutral portions at the bends are rigidly held by suitable means, as studs 8, against an annular shoulder concentric on the wheel near its hub a shoulder 35 being formed on the inner face of the wheel as a bearing place for the neutral portions of the magnets so that there is a wide air-space between the inner faces of the arms of the magnets and proximate face of the wheel adjacent the shoulder. The arms are secured by non-magnetic fastenings which preferably consist of clips 9 of brass or the like, each bridging a pair of adjacent arms, and cap-screws 10 passing therethrough and between the arms, into the wheel, marginal notches 11 in the arms affording clearance for the screws, and a strut 12 apertured to receive the screw being inserted between each pair of arms and the wheel, if the latter be dished as herein indicated. The poles 7 preferably are slightly inturned with their adjacent faces 13 concaved.

An armature is provided in juxtaposition to the magnet poles which constitute in effect a circular multipolar field, and consists of a magnetically continuous iron ring 14 provided with brackets 15 by which it is secured to the crank case concentric with the shaft. A series of soft iron cores 16 are secured to this ring so as to register with the field poles, preferably in axial coincidence with the common center of curvature of the pole faces 13. The cores are provided with generating coils 17 connected in series, the external circuit leading therefrom.

The generator being constructed as described, it follows that in the normal operation of an internal combustion engine equipped with this generator and of the kind used on self-propelling vehicles where the crank-shaft rotates at a relatively high speed, an alternating current of high intensity and very rapid alternation is obtained, and in utilizing this current for jump-

spark ignition, any of the known means applicable to work in connection with primary or secondary battery currents may be used. A preferable arrangement is that shown in Fig. 4 in diagram, as applied to a four cylinder engine wherein 18 and 19 are the leads from the generator, 20 a battery in a shunt around the generator adapted to supply current for starting the engine, 21 a switch for cutting either the generator or the battery out of circuit, 22 induction coils corresponding in number to the cylinders, 23 the stationary member of a mechanical circuit breaker, 24 the fixed contacts thereof, 25 the revolving contact member of the circuit breaker, 26 the shaft carrying the same, and revolving it at the proper rate of speed by suitable connection with the engine shaft, 27 the electromagnet of an interrupter, 28 and 29 the contacts thereof, 30 a condenser in shunt around said contacts, 31 the spark plugs and 32 the secondaries of the induction coils. The electrical connections between the parts are conventionally represented in the diagram, but, as is usual in installation of these devices, the engine cylinders and frame may form part of the circuits, if convenient. By this arrangement the circuit breaker opens and closes the circuit successively through the primaries in the order in which the spark is required, and since the alternating current waves from the generator are of higher frequency than the closing periods of the breaker, there is always a primary current therethrough at such periods which is rendered intermittent by the interrupter, thereby inducing a secondary current which produces the proper spark at the plug.

One feature of the machine is the arrangement of the multiple field magnet, built up of units which are readily magnetized to full extent before assembling and when mounted do not affect the balance of the motor as the magnetic field is symmetrical and the stress on the armature is evenly distributed and occurs only through a fraction of time each revolution, while the range for timing the spark is unlimited.

Another feature is the form of the magnets, that not only closely approaches the horse-shoe in efficiency but is also adapted to be secured on the wheel without loss of space or wide gaps or breaks in the magnetic field and with a minimum number of fastening members.

Another feature of the invention is the wide air space afforded between the magnet arms and the fly wheel as well as between the inner portions of the arms and the supporting brackets of the armature ring so that there is ample space for free circulation of air, oil, or other fluid around the magneto while at the same time the poles rotate very closely to the armature, and as the

casing bearing prevents endwise movement of the shaft, the poles may be made to almost sweep the armatures and thus greatly increase the efficiency of the magneto.

Obviously changes in the details of construction may be made without departing from the spirit of the invention and I do not limit myself to any particular form or arrangement of parts.

What I claim as my invention is:—

1. In an electric ignition system for an explosive engine, the combination with the fly wheel of the engine, of a series of permanent magnets secured in symmetrical, magnetically separated relation on the fly wheel with the poles thereof disposed concentric with the wheel axis, and a stationary ring armature on the engine in operative relation to the pole of the magnet, the like poles of each pair of magnets being adjacent.

2. The combination with an explosive engine having a crank shaft bearing, a crank shaft and fly wheel thereon, of a generator consisting of a series of permanent substantially horse-shoe shaped magnets arranged in symmetrical, magnetically insulated relation on the fly wheel face adjacent the bearing, non-magnetic securing means holding the outer portions of the magnets near the pole ends in spaced relation to the outer annular face of the fly wheel, a continuous magnetic ring supported on the engine crank case concentric with the shaft and in parallel spaced relation to the outer side faces of the field magnets, and coil wound cores supported on the ring and connected in series with the outer end faces thereof adapted to sweep closely to and across the side face portions of the poles of the magnets, the adjacent poles of the respective magnets being of like polarity and acting upon the same coil in conjunction with each other.

3. The combination in an engine having a crank casing, a main shaft bearing and a main crank shaft, of a fly wheel rigidly secured to the shaft adjacent the bearing having an annular shoulder concentric with the shaft, permanent substantially horse-shoe shaped magnets arranged symmetrically in insulated relation on the fly wheel face adjacent the bearing, means securing the magnets to the annular shoulder, a strut interposed between the adjacent arms of each pair of magnets near the poles thereof and the adjacent side of the fly wheel, means securing said pairs of arms to each strut, and a stationary ring armature consisting of a plurality of core pieces whose axes are parallel to the axis of the fly wheel and generating coils each encircling a core, the cores having their unsupported ends adjacent the inner faces of the pole end portions of the magnets, the adjacent poles of the respec-

tive magnets being of like polarity and acting upon the same coil in conjunction with each other.

4. In an engine crank casing, a main shaft bearing therein, a main crank shaft journaled in the bearing, a fly wheel rigidly secured to the shaft adjacent to the bearing and provided with an annular shoulder concentric with the shaft, a series of permanent substantially horse-shoe shaped magnets symmetrically disposed in magnetically insulated relation on the fly wheel face adjacent the bearing, studs clamping the neutral portions of the magnets against the annular shoulder of the wheel, a strut supporting the adjacent arms of each pair of magnets of each pole on the side of the wheel, a clip bridging each pair of arms, means securing the clip and strut to the fly wheel, a magnetically continuous iron ring, brackets securing the ring to the crank case concentric with the shaft and in parallel relation with the plane of rotation of the pole pieces and magnet, and coil wound cores supported on the ring with the outer end faces thereof in juxtaposition to the adjacent side faces of the permanent magnets, the coils being connected in series, the adjacent poles of the respective magnets being of like polarity and acting upon the same coil in conjunction with each other.

5. The combination with an explosive engine and fly-wheel thereon, of a generator consisting of a continuous magnetic ring secured on the engine in spaced relation to the face of the fly-wheel, coil-wound cores se-

cured on the ring adjacent to the wheel and connected in series, and a series of substantially horse-shoe-shaped permanent magnets secured in symmetrical magnetically insulated relation on the fly-wheel to sweep closely to and across the end faces of the coils, the adjacent poles of the respective magnets being of like polarity and acting upon the same coil in conjunction with each other.

6. The combination with an explosive engine, and fly wheel thereon, of a generator consisting of a series of permanent substantially horse-shoe-shaped magnets in symmetrical, magnetically insulated relation to the fly-wheel face, non-magnetic securing means holding the outer portions of the magnets near the pole ends in spaced relation to the outer annular face of the fly-wheel, a continuous magnetic ring supported on the engine and in parallel spaced relation to the outer side faces of the magnets, and coil wound cores supported on the ring and connected in series, with the outer end faces thereof adapted to sweep closely to and across the side face portions of the poles of the magnets, the adjacent poles of the respective magnets being of like polarity and acting upon the same coil in conjunction with each other.

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

EDWARD S. HUFF.

Witnesses:

OTTO F. BARTHEL,
C. R. STICKNEY.