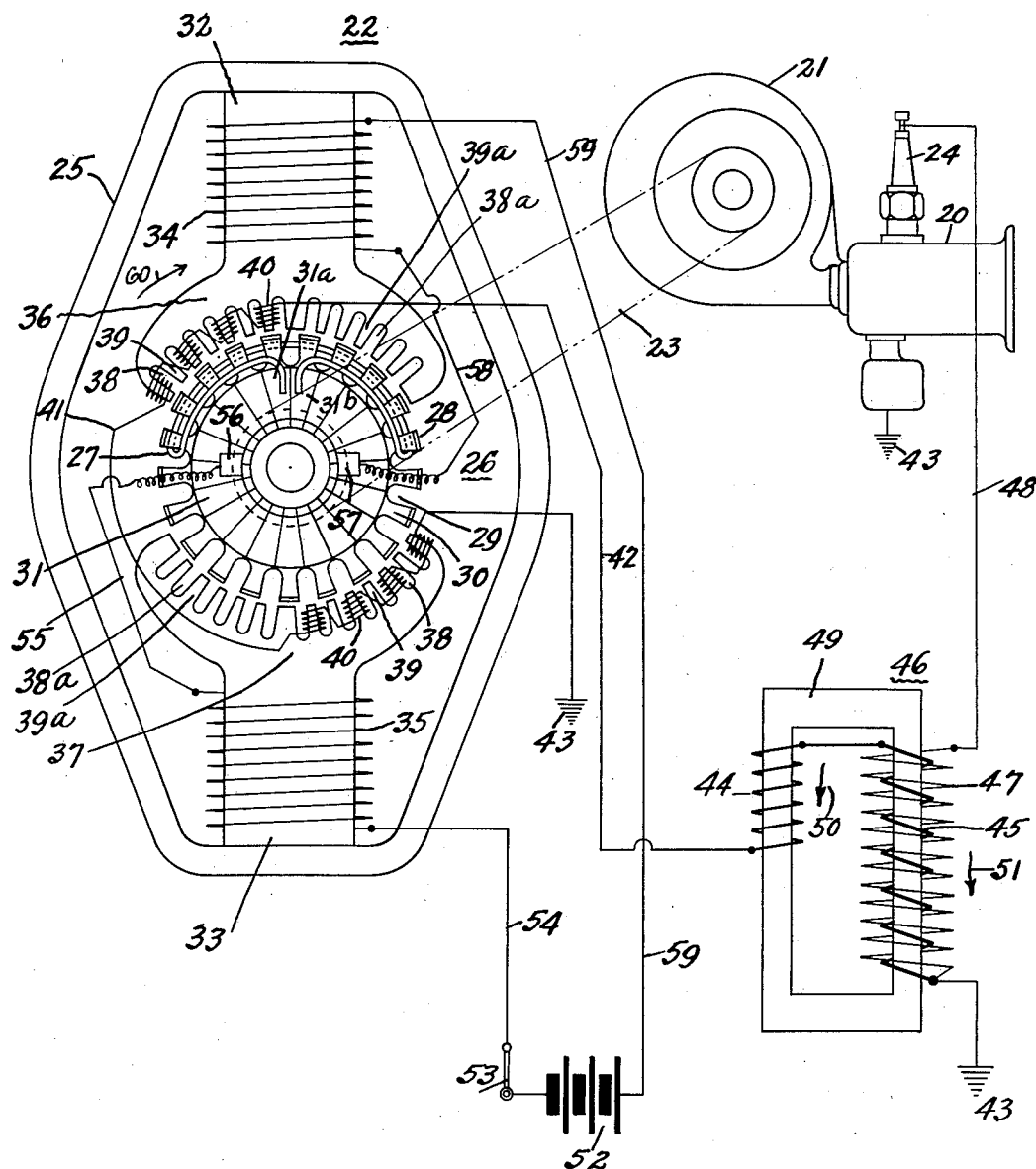


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J. H. HUNT ET AL
REGULATOR FOR IGNITION SYSTEMS
Filed July 16. 1921



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UNITED STATES PATENT OFFICE.

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REGULATOR FOR IGNITION SYSTEMS.

Application filed July 16, 1921. Serial No. 485,356.

To all whom it may concern:

Be it known that we, JOHN H. HUNT and JOHN T. FITZSIMMONS, citizens of the United States of America, residing at Dayton, county of Montgomery, State of Ohio, have invented certain new and useful Improvements in Regulators for Ignition Systems, of which the following is a full, clear, and exact description.

This invention relates to high frequency ignition apparatus and has among its objects the provision of an ignition system including a high frequency generator, an ignition coil and a sparking device connected thereto, and regulating apparatus tending to render the ignition uniform within certain limits of variation of generator speed.

One embodiment of this invention is adapted for electrical ignition apparatus for electric motor driven liquid fuel burners, for example, that type of liquid fuel burner described in the copending application of J. H. Hunt, Serial No. 285,662, filed March 27, 1919. In this application there is disclosed a liquid fuel burner to which air is supplied from a blower under pressure for the purpose of atomizing the fuel within the burner and for supplying a blast of air for combustion purposes. This fuel spray is ignited by spark from a spark plug having its electrodes located within the burner. The blower is driven by an electric motor.

In the copending application of J. H. Hunt, Serial No. 478,142, filed June 16, 1921, there is disclosed apparatus for providing electrical ignition at the spark plug without requiring a source of current in addition to the current for operating the motor and without requiring any make and break apparatus. The motor is provided with high frequency generating windings which are placed upon the faces of the field poles of the motor, and a high frequency induction coil or transformer is connected with these windings and with the spark plug of the burner.

The present invention is disclosed herein in connection with the apparatuses disclosed in the copending applications referred to, but is susceptible of other uses.

Other and further objects of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a pre-

ferred embodiment of the present invention is clearly shown.

The figure of the drawing is a wiring diagram of an ignition system showing the regulator in combination therewith constituting an embodiment of the present invention.

In the drawing, 20 designates a liquid fuel burner to which air under pressure is supplied from a blower 21. Blower 21 is driven by motor 22 in any suitable manner such as by direct connection or by means of a belt illustrated diagrammatically by the dot and dash line 23. Burner 20 is provided with spark plug 24, the electrodes of which are located so as to ignite the fuel spray within the burner. As the particular construction of the burner does not constitute a part of the present invention, it is thought that further description of the burner is unnecessary. The motor 22 includes a frame 25 supporting for rotation an armature 26 including windings, one of which is shown at 27 and a core 28 provided with open slots 29 to provide spaced teeth 30. The commutator 31 includes preferably as many segments as there are slots 29 and each of the conductors 27 is connected preferably in the same manner that the conductor 27 shown in the drawing is connected with segments 31^a and 31^b. The frame 25 supports field poles 32 and 33 supporting field windings 34 and 35, respectively. The poles 32 and 33 are provided with pole shoes or faces 36 and 37 respectively, the leading portions of which are provided with slots 38 to form spaced leading pole-face teeth 39. The pitch of the leading pole-face teeth 39 is preferably one-half the pitch of the armature core teeth 30. Alternate leading pole-face teeth 39 are each provided with a generating pole-face winding 40 and all of the windings 40 are connected in series by means of wires 41 and 42 and ground connections 43 with an inductive regulating circuit 44 and with the primary winding 45 of an ignition coil or high frequency transformer coil designated as a whole by the numeral 46. This coil includes also a secondary winding 47 grounded at 43 and connected by wire 48 with the spark plug 24 which is grounded on the burner 20 having a connection with ground 43. The coil 46 includes also a closed magnetic core

49 one leg of which is surrounded by the regulating inductive circuit 44. This circuit is wound differentially with respect to the primary winding 45 so that as the speed of the motor varies to increase the frequency and voltage of the primary ignition circuit, the quantity of ignition produced at the spark plug 24 will be maintained practically constant in value. This differential relation between windings 44 and 45 is indicated diagrammatically by means of arrows 50 and 51.

The battery 52 is connected by means of a switch 53 with wire 54 leading to field winding 35 which is connected by wire 55 with motor brush 56 engaging with commutator 31. The other motor brush 57 is connected by wire 58 with the motor field winding 34 which is connected by wire 59 completing the circuit to the battery 52. The connections are such as to produce rotation of the motor armature 26 in the direction of the arrow 60, when the switch 53 is closed. The motor then will drive the blower 21 to furnish the burner 20 with a spray of fuel and air for combustion thereof. As the armature core teeth 30 rotate past the pole-face teeth 39, a high frequency current will be generated in the pole-face windings 40 and this current will be transformed in the transformer ignition coil 46 to produce sparking at the spark plug 24.

In this manner the motor, which drives the burner blower, operates as a high frequency generator to provide ignition current for the burner ignition apparatus.

The production of the high frequency current in the pole-face windings is believed to be due to the rapid growth and decay of the magnetic flux in the pole teeth as the armature teeth pass by.

In the copending application of J. H. Hunt referred to it was disclosed that if the entire pole-face area be provided with slots all equally spaced, there would be a great tendency for the motor armature to lock in position requiring a large amount of current to start it. This locking action is reduced very materially by providing the trailing portions of both pole faces with slots 38^a to form teeth 39^a which are out of phase with teeth 39 by the angular distance of one-half the spacing between teeth 39. The spacing of teeth 39^a is the same as teeth 39. No windings are located in slots 38^a.

The windings 40 are in phase and take advantage of armature reaction because located on the leading portions of the pole faces 36 and 37.

One advantage of the regulator of the present invention arises from the fact that the regulator and ignition coil are combined in a single structure, the coil and regulator windings having a common magnetic circuit. It can be readily seen that the apparatus

disclosed may be combined in a single unit, if desired. The motor 22 may be connected directly with the blower 21 and may be supported thereby and the coil and regulator unit 44-49-46 may be mounted upon the generator. This combination provides a unitary structure which may be conveniently assembled and installed upon any structure to be heated by the burner.

Where such a burner unit is installed upon an automobile to heat the engine intake, the current source to run the motor 22 would usually be a storage battery varying in voltage according to its state of charge. On account of these and other conditions the speed of the motor might vary. Hence such a regulator is necessary that ignition may be maintained substantially constant, and also so that the core 49 may not be overheated due to increasing the frequency of the exciting current above a certain value. It is therefore possible to construct the ignition coil or transformer to produce sparking when the battery voltage is low, and which will not put an excessive ignition current load on the motor when the battery voltage is high. The regulator winding tends to keep uniform the ignition current load on the motor between certain limits of voltage of the current source.

While the form of mechanism herein shown and described constitutes a preferred form of embodiment of the invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What we claim is as follows:

1. In an ignition system, the combination with an electric motor including pole-face windings; of a source of current for said motor; a transformer ignition coil connected with said pole-face windings a spark plug connected with said ignition coil; and means for maintaining substantially uniform ignition between certain limits of voltage of the current source.

2. In an ignition system, the combination with an electric motor including pole-face windings; of a source of current for said motor; a transformer ignition coil connected with said pole-face windings a spark plug connected with said ignition coil; and means for maintaining the ignition current load on the motor substantially uniform between certain limits of voltage of the current source.

3. In an ignition system, the combination with an electric motor including pole-face windings; of a source of current for said motor; an ignition coil connected with said pole-face windings; a spark plug connected with said ignition coil; and a regulating inductive circuit energized by said pole-face windings and differentially related to said ignition coil.

4. In an ignition system, the combination
with an electric motor including pole-face
windings; of a source of current for said
motor; an ignition coil having a primary
5 winding connected in series with said pole-
face windings, and a secondary winding;
a spark plug connected with said secondary
winding; and an inductive circuit connected
in series with said pole-face windings and
10 with said primary winding and differen-
tially related to said primary winding.

5. In an ignition system, the combination
with an electric motor including pole-face
windings; of a source of current for said
15 motor; an ignition coil having a primary
winding connected in series with said pole-
face windings, and a secondary winding;
a spark plug connected with said secondary
winding; and an inductive circuit connected
20 in series with said pole-face windings and
with said primary winding and differen-
tially related to said primary winding, the
ignition coil and inductive circuit having a
common magnetic circuit.

6. In an ignition system, the combination 25
with a high frequency generator; of an ig-
nition coil connected with the generator;
and a regulating inductive circuit energized
by the generator and separate therefrom and
differentially related to the ignition coil. 30

7. In an ignition system, the combination
with a high frequency generator; of an ig-
nition coil having a primary winding con-
nected with the generator and a secondary
winding; and an inductive circuit connected 35
in series with the generator and primary
winding and differentially related to the
primary winding, the ignition coil and in-
ductive circuit having a common magnetic
circuit. 40

In testimony whereof we hereto affix our
signatures.

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