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(54) ELECTRON AVALANCHE DRIVE CIRCUIT

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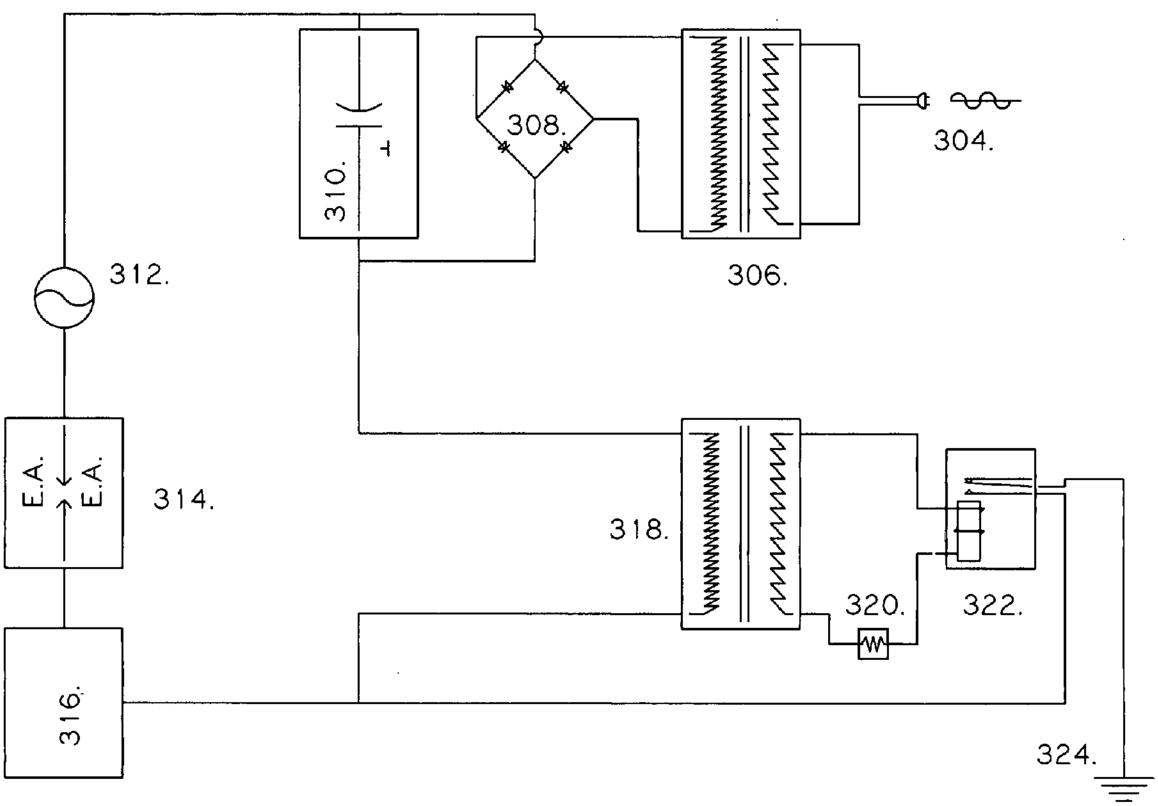
(57) ABSTRACT

Disclosed herein is an electron avalanche drive circuit whereby electron avalanche is produced in a high voltage spark gap exposed to open air or other suitable gaseous medium. The electrochemical process of electron avalanche produces additional current that is delivered to an inductive load.

Also disclosed is an electron avalanche drive circuit that employs a high speed, unidirectional switching circuit. The high speed unidirectional switching circuit allows the additional current developed by electron avalanche in the main circuit to sink to ground.



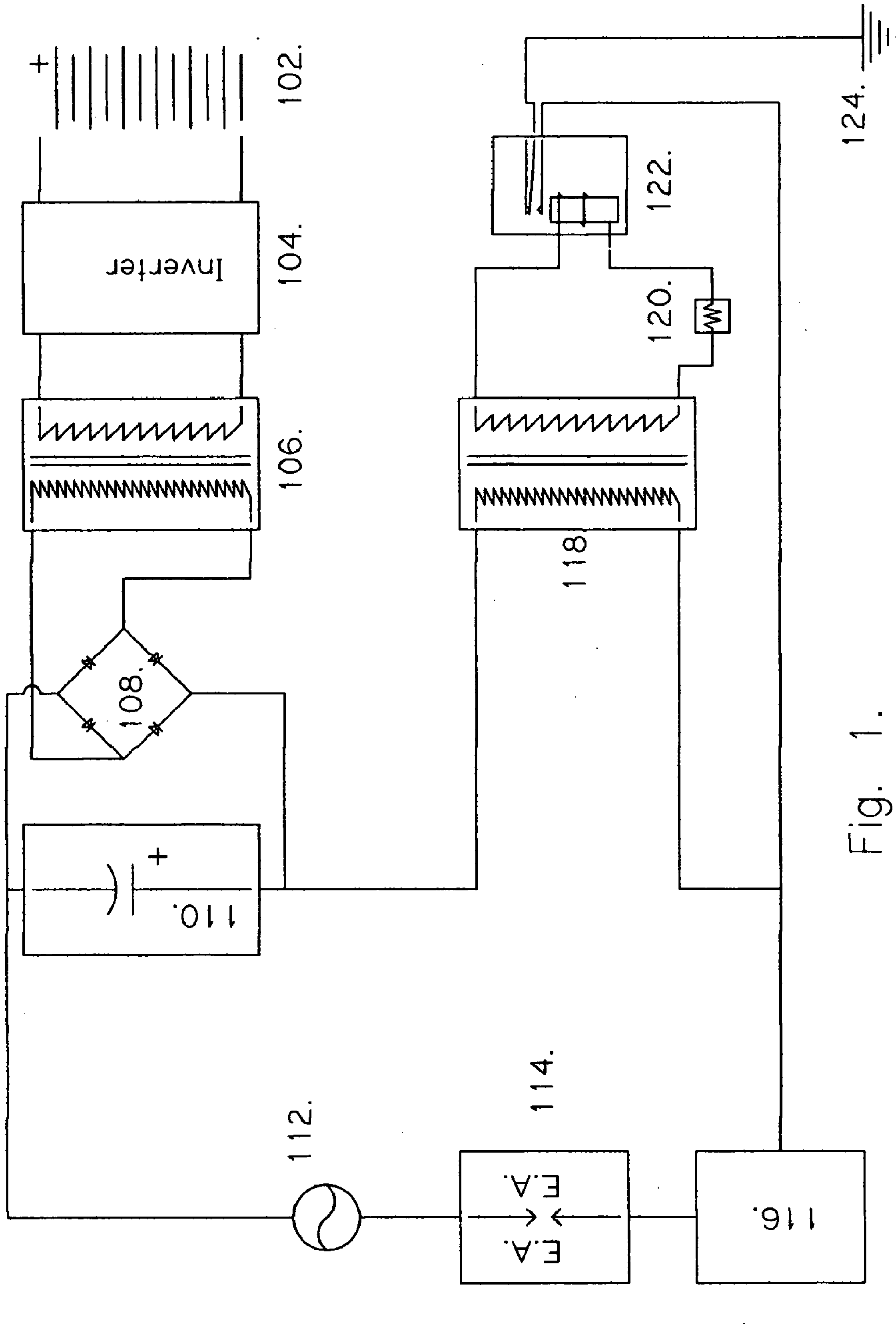


Fig. 1.

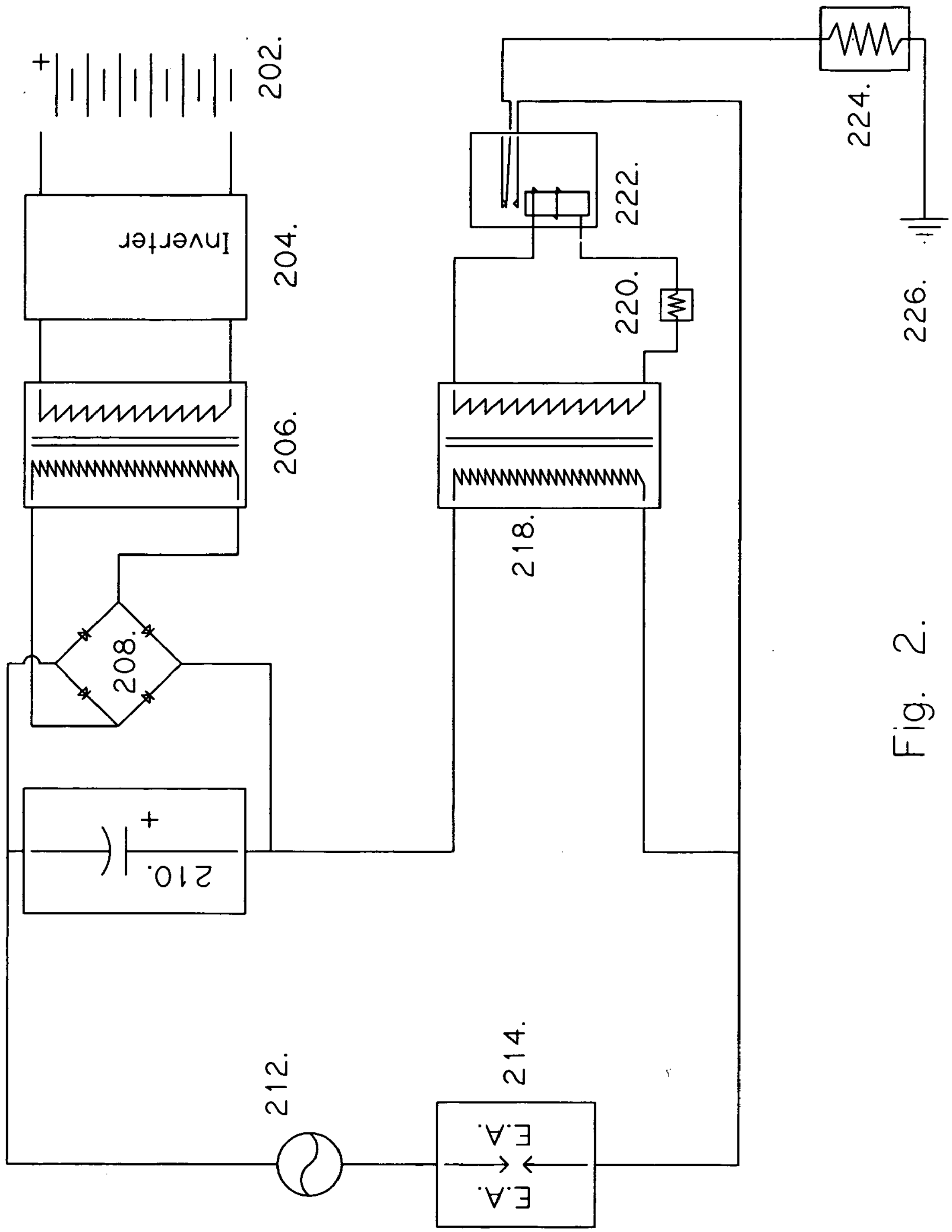


Fig. 2.

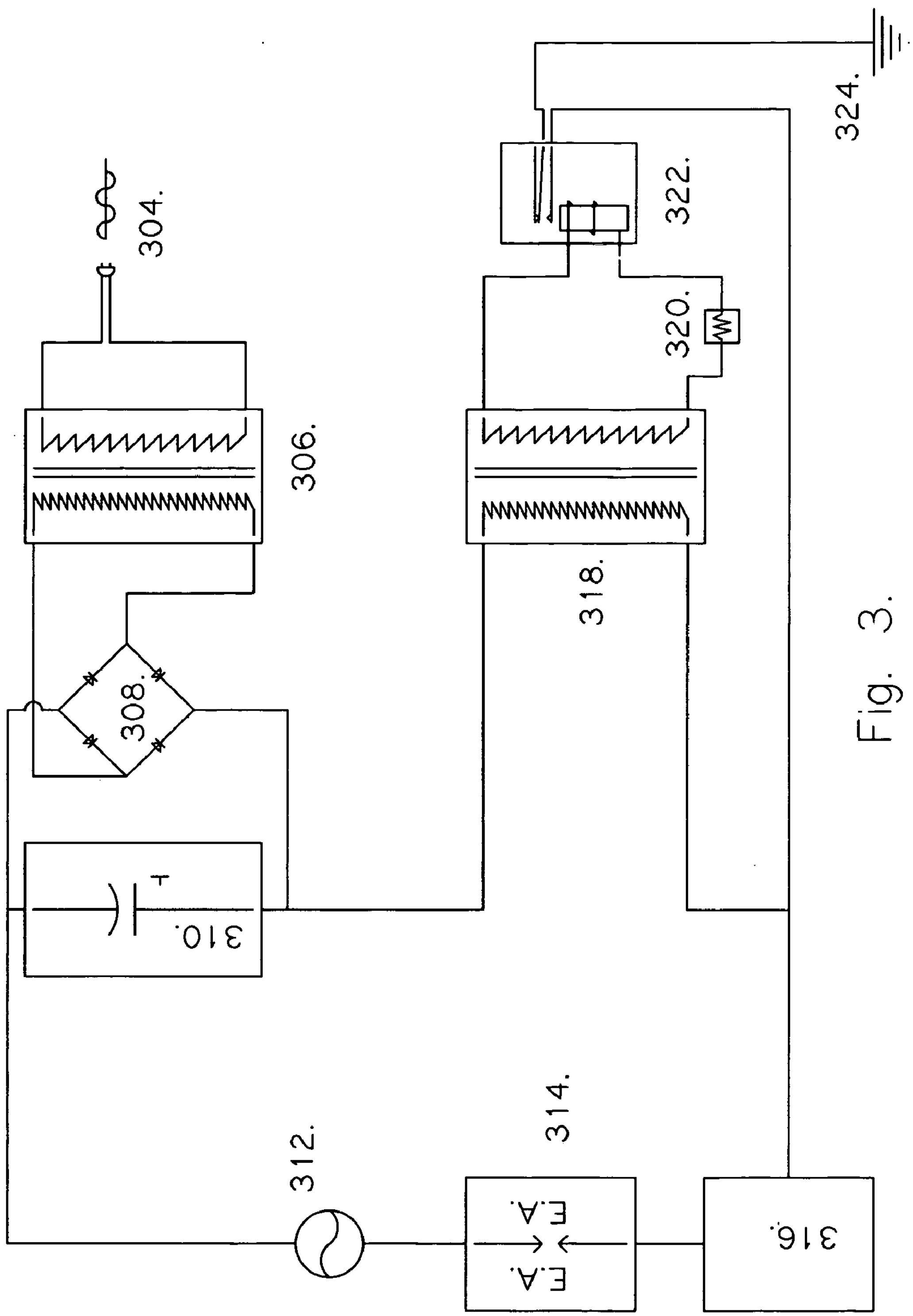


Fig. 3.

ELECTRON AVALANCHE DRIVE CIRCUIT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

FEDERALLY SPONSORED RESEARCH

[0002] Not Applicable

SEQUENCE LISTING OR PROGRAM

[0003] Not Applicable

BACKGROUND OF THE INVENTION

[0004] 1. Field of Invention

[0005] This invention relates to power drive electric circuits. The invention specifically relates to a new circuit that employs electron avalanche as developed in a high voltage spark gap exposed to open air. The process of electron avalanche produces an increase in current that is delivered to the load.

[0006] 2. Prior Art

[0007] Electric drive circuits provide power to loads. All electric circuits providing power to loads have losses due to the inefficiency of components.

[0008] Many improvements have been made in electronic and electrical components to improve the efficiency of delivering power to the load. A few attempts at employing a high voltage spark gap exposed to open air for the purpose of improving circuit efficiency have been partially developed. A proper understanding of the process of electron avalanche as developed in a high voltage spark gap exposed to open air is essential to this invention.

[0009] Electron avalanche and electron multiplication during an electric spark discharge is a well established scientific principle. The major contribution to the establishment of the scientific phenomenon of electron avalanche is the work of L. B. Loeb and J. M. Meek as explained in *The Mechanism of the Electric Spark*, Stanford University Press, 1941.

[0010] A spark discharge developed in a high voltage spark gap exposed to open air results in the multiplication of electrons which are absorbed by the spark gap's anode. This increase in electrons forms additional current delivered to the load.

[0011] In order to properly understand the development of increased current in an electric circuit by means of electron avalanche, Chapter 2, *The Streamer Theory of Spark Discharge,* 1. *Anode Space-Charge Field Due to Avalanche* is directly quoted,

[0012] "One may begin by considering a plane-parallel gap of 1 cm length in which a cathode is illuminated by ultraviolet light to the extent that one electron per microsecond leaves one square centimeter of cathode area. Assume that in air at atmospheric pressure the potential across the plates is 31,600 volts, which is the conventional sparking potential V_s.

[0013] Let us calculate what happens to one of these electrons. It starts across the gap, quickly acquiring an average random energy of some $E=mc^2=3.6$ electron volts and a drift velocity (v) in the field direction of about 1.5 to 2 times 10^7 centimeters per second as measured by White and Raether. As it moves it creates new electrons at (a) per centimeter in the field direction so that in a distance (x) it and its progeny amount to ($e^{(ax)}$) electrons, forming an electron avalanche. Therefore, ($e^{(ax)}$) positive ions have been left behind by the electron group.

[0014] The first ion pair is created at 0.047 cm from the cathode. At 0.5 cm from the cathode there are 4914 ions, at 0.75 cm there are 3.66 times 10^5 ions, and within 0.0407 cm from the anode there are 1.2 times 10^7 ions. Most electrons will be drawn into the anode except for some few that are bound by positive ions, making a sort of conducting plasma in the avalanche path."

[0015] Nikola Tesla was issued a U.S. Pat. No. 787,412 on Apr. 18, 1905 entitled Art of Transmitting Electrical Energy Through The Natural Medium. Tesla employed a high voltage spark gap exposed to open air so that the electric current in the secondary system was greatly magnified by the inductive action of the primary.

[0016] The apparatus was intended to transmit communications over great distances. The very high voltage necessary for the operation of the device made it impractical.

[0017] Edwin V. Gray employed a high voltage spark gap exposed to open air in his U.S. Pat. No. 3,890,548 entitled, Pulsed Capacitor Discharge Electric Engine issued Jun. 17, 1975. The purpose of the spark gap was to provide accurate timing for the discharge of capacitors. At the time, those skilled in the art were unaware that electron avalanche, as developed in a high voltage spark gap exposed to open air, could increase the current to the inductive load. Carefull examination of the placement of the spark gap in the patent drawings show the spark gap after the inductive load rather that before it. This prevented additional current from electron avalanche from being employed to the inductive load.

[0018] At present there is no known electric power drive circuit operated on the principle of electron avalanche as developed in a spark gap exposed to open air in order to increase the current delivered to the load. The employment of electron avalanche as developed in a high voltage spark gap exposed to open air for the delivery of additional current to an inductive load is unobvious to all skilled in the art. The result achieved by the employment of the invention for the delivery of increased current to the inductive load is new, unexpected and superior to all prior art.

[0019] The prior art referenced were inoperative in that they did not employ electron avalanche in a practical way for the delivery of increased current to the load. The prior art referenced were also inoperative in that they were impossible to succesfully be reconstructed. Another novel mechanism associated with the invention is the use of a high speed, unidirectional switching system to release the additional current developed by electron avalanche from the main circuit.

OBJECTS AND ADVANTAGES

[0020] Accordingly the objects and advantages of the Electron Avalanche Drive Circuit described in the patent are;

(a) To provide a means of employing electron avalanche as developed in a high voltage spark gap exposed to open air for the delivery of increased current to the inductive load.

(b) To provide a power drive circuit capable of utilizing the additional current generated by the process of electron avalanche.

(c) To provide a means of releasing to ground the additional current generated by electron avalanche thus preventing damage to electric circuit components from current transients.

SUMMARY

[0021] In accordance with the present invention, an Electron Avalanche Drive Circuit is comprised of a battery, battery bank or other low voltage power supply, an inverter, a high voltage transformer, a full wave bridge, a diode or diode bank, commutation, a high voltage spark gap exposed to open air or other suitable gaseous medium, an inductive load, a step-down transformer, a high speed, unidirectional, switching circuit and grounding.

[0022] The Electron Avalanche Drive Circuit employs electron avalanche as developed in a high voltage spark gap exposed to open air for the production of additional current above the initial current necessary to produce the arc. The additional current generated by electron avalanche enters the main circuit at the spark gap anode. The initial and additional current are employed to power an inductive load. The additional current developed by electron avalanche is then released to ground from the main circuit by means of a high speed, unidirectional switch.

DRAWINGS

Figures

[0023] FIG. **1** shows the components of an Electron Avalanche Drive Circuit.

[0024] FIG. **2** shows the components of an Electron Avalanche Drive Circuit with a resistive type heating element load.

[0025] FIG. **3** shows the components of an Electron Avalanche Drive Circuit that employs standard residential electric power as an initial power source.

DRAWINGS

Reference Numerals

[0026] FIG. **1**—Electron Avalanche Drive Circuit with inductive load.

102	battery or battery bank	104	inverter
106	high voltage transformer	108	full wave bridge
110	capacitor or capacitor bank	112	commutation
114	spark gap	116	inductive load
118	step-down transformer	120	resistor
122	high speed, unidirectional switch	124	ground rod

[0027] FIG. **2**—Electron Avalanche Drive Circuit with a resitive heating element load.

202	battery or battery bank	204	inverter
206	high voltage transformer	208	full wave bridge
210	capacitor or capacitor bank	212	commutation
214	spark gap	218	step down tranformer
220	resistor	222	high speed, unidirectional switch
224	resistive heating element	226	ground rod

[0028] FIG. **3**—Electron Avalanche Drive Circuit for residential power.

304	plug	306	high voltage transformer
308	full wave bridge	310	capacitor or capacitor bank
312	commutaion	314	spark gap
316	load	318	step down transformer
320	resistor	322	high speed, unidirectional switch
324	ground rod		

DETAILED DESCRIPTION

FIG. 1—Preferred Embodiment

[0029] The preferred embodiment of an Electron Avalanche Drive Circuit is illustrated in FIG. **1**. The Electron Avalanche Drive Circuit has a battery, battery bank or other low voltage power supply **102**. The battery **102** powers an inverter **104** which utilizes the low voltage, direct current power input to produce a medium voltage, alternating current output. The output of the inverter **104** is connected to the primary of a high voltage transformer **106**. The high voltage transformer **106** secondary produces a high voltage, alternating current output.

[0030] The high voltage, alternating current output of the high voltage transformer **106** is then rectified to a high voltage, direct current by means of a full wave bridge **108**. The high voltage, direct current output of the full wave bridge **108** is then stored in a capacitor or capacitor bank **110**.

[0031] The current stored in the capacitor **110** is then pulsed for the correct duration at the appropriate time by means of a commutator **112**.

[0032] The pulse of current from the commutator **112** is then supplied to the cathode of the high voltage spark gap **114** exposed to open air or other suitable gaseous medium. The high voltage spark gap **114** width is determined by the breakdown potential of air and the working voltage of the main circuit. The initial current pulse is then multiplied by means of electron avalanche to produce additional current which enters the main circuit at the high voltage spark gap **114** anode.

[0033] The initial current from the capacitor **110** and the additional current produced by electron avalanche in the high voltage spark gap **114** is then delivered to an inductive load **116**.

[0034] The initial current is then directed back to the positive potential of the capacitor **110** through the primary windings of a step-down transformer **118**.

[0035] The additional current produced by electron avalanche is then routed to ground **124** by means of a high speed, unidirectional switching system **122**. The high speed, unidirectional switch is controlled by the secondary power of the step-down transformer **118**. The current necessary for the activation of the high speed, unidirectional switch **122** is regulated by a resistor **120**.

[0036] The additonal current generated by electron avalanche is then directed to a ground rod **124**.

Operation

FIG. 1.—Preferred Embodiment

[0037] The manner of operation for the Electron Avalanche Drive Circuit as illustrated by FIG. **1**. is herein described. A battery, battery bank, or other low voltage power supply **102** supplies direct current to an inverter **104**. The inverter **104** converts the direct current to alternating current. The low voltage, alternating current is then stepped-up to a medium voltage, alternating current by means of a step-up transformer internal to the inverter **104**.

[0038] The medium voltage, alternating current ouput of the inverter **104** is then supplied to the primary of a high voltage, step-up transformer **106**. The alternating current supplied to the primary of the high voltage transformer **106** induces a high voltage, alternating current output from the secondary.

[0039] The high voltage, alternating current output from the secondary of the high voltage transformer **106** is then rectified to direct current by a full wave bridge **108**. The full wave bridge **108** is comprised of four diodes that provide a one way path for the current thus converting alternating current to direct current.

[0040] The high voltage, direct current output of the full wave bridge is then stored in a capacitor or capacitor bank **110**. The direct current from the capacitor **110** provides the initial current necessary for the initiation of electron avalanche in the high voltage spark gap **114** exposed to open air or other suitable gaseous medium.

[0041] The direct current from the capacitor **110** is conditioned by a commutator **112** to provide a pulse of direct current for the proper duration at the proper time for the load **116**. The commutation **112** may be mechanical or electronic.

[0042] The initial current pulse from the commutator **112** is then supplied to a cathode of the high voltage spark gap **114** exposed to open air. The initial current pulse initiates electron avalanche in the spark gap exposed to open air resulting in the multiplication of electrons as a result of the electrochemical process. The multiplication of electrons creates additional current which is absorbed by the anode of the spark gap **114**.

[0043] The initial current and the additional current generated by electron avalanche are then delivered to the inductive load. **116**.

[0044] The initial current is then directed through the primary of a step-down transformer **118** to the positive potential of the capacitor **110**. The initial current pulse delivered to the primary of the step-down transformer **118** induces a medium voltage, current pulse in the secondary. The secondary of the step-down transformer provides the power necessary to activate and control a high speed, unidirectional switch **122**. The current necessary for the proper functioning of the high speed, unidirectional switch is limited by a resistor **120**. The high speed, unidirectional switch can be selected from high speed relays, diodes and silicon controlled rectifiers.

[0045] The additional current produced by electron avalanche is then directed to ground **124**. The ground rod **124** acts as a sink for the excess current thus preventing cumulative current transients from damaging the main circuit components.

Description

FIG. 2—Additional Embodiment

[0046] While the above description of the preferred embodiment contains many specifications, these should not be construed as limitations on the scope of the invention, but rather as an exemplification of one preferred embodiment thereof. Many other variations are possible. For example, the additional current generated by electron avalanche may be employed to power a resistive type heating element as illustrated in FIG. **2**.

[0047] As illustrated in FIG. **2** a low voltage power supply such as a battery or battery bank **202** supplies power to an inverter **204**.

[0048] The inverter **204** supplies a medium voltage, alternating current to the primary of a high voltage transformer **206**. The output of the secondary of the high voltage transformer **206** is a high voltage, alternating current.

[0049] The output of the high voltage transformer **206** is then rectified to a high voltage, direct current by a full wave bridge **208**.

[0050] The high voltage, direct current output of the full wave bridge is then stored in a capacitor or capacitor bank **210**.

[0051] The current stored in the capacitor **210** provides the initial current necessary for the initiation of electron avalanche in the high voltage spark gap **214** exposed to open air or other suitable gaseous medium.

[0052] The initial current supplied by the capacitor **210** is conditioned by commutation **212** to form a direct current pulse for the proper duration at the correct time as determined by the duty cycle. The initial current pulse from the commutator **212** is then delivered to the cathode of the high voltage spark gap **214** exposed to open air.

[0053] The initial current from the cathode initiates electron avalanche in a high voltage spark gap **214** exposed to open air. The electrochemical process of electron avalanche results in the multiplication of electrons which are absorbed by the anode of the spark gap **214** to form additional current in the main circuit.

[0054] The initial current is then directed through the primary of a step-down transformer **218** to the positive potential of the capacitor **210**. The initial current pulse directed through the primary of the step-down transformer **218** induces a medium voltage current pulse in the secondary of the step-down transformer. The medium voltage current pulse of the secondary provides the power necessary to operate a high speed, unidirectional switch **222**.

[0055] The current necessary to control the high speed, unidirectional switch is regulated by a resistor **220**.

[0056] The additional current generated by electron avalanche is then released to ground **226** by the high speed unidirectional switch **222** through a resistive type heating element **224**.

[0057] The successive pulses of additional current directed through the resisitive type heating element **224** provides the generation of radiant heat.

Operation

FIG. 2—Additional Embodiment

[0058] The operation of the Electron Avalanche Drive Circuit to provide power to a resistive type heating element illustrated in FIG. **2** is described as follows. A battery, battery bank or other low voltage, direct current power supply **202** provides power to an inverter **204**.

[0059] The inverter **204** converts the low voltage, direct current input to an alternating current. The low voltage, alternating current is then stepped up to a mediun voltage, alternating current by a step-up transformer internal to the inverter **204**.

[0060] The medium voltage, alternating current output of the inverter **204** is then supplied to a high voltage, step-up transformer **206** primary. The medium voltage, alternating current of the primary induces a high voltage, alternating current output in the secondary of the high voltage transformer **206**.

[0061] The high voltage, alternating current output of the high voltage transformer **206** is then rectified to direct current by a full wave bridge **208**. The full wave bridge rectifies the alternating current to direct current through four diodes configued to provide a one way path for the current.

[0062] The high voltage, direct current output of the full wave bridge **208** is then stored in a capacitor or capacitor bank **210**.

[0063] The current stored in the capacitor **210** is then conditioned by commutation **212** to form a direct current pulse of the proper duration at the appropriate time. The commutator **212** may be a mechanical or electronic switching device.

[0064] The current pulse from the commutator **212** is then delivered to the cathode of a high voltage spark gap **214** exposed to open air or other suitable gaseous medium. The current pulse from the cathode initiates electron avalanche in the spark gap **214** exposed to open air. The electrochemical process of electron avalanche generates additional current by the ionization of air molecules resulting in the multiplication of electrons.

[0065] The initial current is then routed through the primary of a step-down transformer **218** to the positive potential of the capacitor **210**. The initial high voltage current pulse through the primary of the step-down transformer **218** induces a medium voltage current pulse in the secondary. The secondary provides the power to control a high speed, unidirectional switching device **222**.

[0066] The current in the control circuit of the high speed, unidirectional switching device **222** is regulated by a resistor **220**.

[0067] The additional current generated by electron avalanche is routed through the high speed, unidirectional switching device to a resistive type heating element **224**. The high speed, unidirectional switching device **224** can be but is not limited to high speed relays, diodes and silicon controlled rectifiers.

[0068] The additional current generated by electron avalanche, routed through the resistive type heating element, is then delivered to a ground rod **226**.

Description

FIG. 3—Alternative Embodiment

[0069] While the description of the preferred embodiment contains many specifications, these should not be construed as limitations, but rather as exemplifications of one preferred embodiment thereof. Many other variations are possible. For example, typical residential electric power of 115 volts or 230 volts alternating current may be utilized to power the circuit rather than a battery with an inverter as illustrated in FIG. **3**.

[0070] Shown in FIG. **3** is a typical plug **304** for residential 115 volt or 230 volt alternating current. The residential electric power **304** is supplied to the primary of a high voltage, step-up transformer **306**.

[0071] The secondary output of the high voltage transformer **306** provides a high voltage alternating current to a full wave bridge. **308**. The output of the full wave bridge is a high voltage direct current. The high voltage direct current is then stored in a capacitor or capacitor bank **310**.

[0072] The current stored in the capacitor **310** provides the initial current pulse necessary to produce electron avalanche in a high voltage spark gap **314** exposed to open air. The initial current pulse is conditioned to the correct duration at the appropriate time by commutation **312**.

[0073] The initial current pulse provided by the commutator **312** is then delivered to the cathode of the high voltage spark gap **314** exposed to open air. The initial current pulse initiates electron avalanche in the open air of the high voltage spark gap **314**. The electrochemical process of electron avalanche results in the multiplication of electrons which are absorbed by the anode of the high voltage spark gap **314**.

[0074] The initial current and the additional current generated by electron avalanche are then delived to an inductive load **316**.

[0075] The initial current from the inductive load is then routed through the primary of a step-down transformer **318** to the positive potential of the capacitor **310**.

[0076] The initial current through the primary of the step-down transformer **318** induces a current pulse in the secondary of the transformer **318**. The secondary provides the power for the control of a high speed, unidirectional switch **322**. The current in the control circuit is limited by a resistor **320**.

[0077] The additional current generated by electron avalanche is then routed through the high speed, unidirectional switch **322** to a ground rod **324**.

Operation

FIG. 3—Alternative Embodiment

[0078] The operation of the invention's alternative embodiment as illustrated in FIG. **3** is described below. A typical plug **304** connected to a residential 115 volt or 230 volt, alternating current, electric power outlet provides the power necessary for the primary of a high voltage, step-up transformer **306**.

[0079] The alternating current applied to the primary of the high-voltage, step-up transformer **306** induces a high voltage, alternating current in the secondary.

[0080] The high voltage, alternating current output of the high-voltage transformer's **306** secondary is then rectified to direct current by a full wave bridge **308**. The full wave bridge **308** employes four diodes to construct a one-way path for the alternating current to become direct current.

[0081] The direct current output of the full wave bridge **308** is then stored in a capacitor or capacitor bank **310**. The initial current stored in the capacitor is the current necessary to initiate electron avalanche in the high voltage spark gap exposed to open air **314**.

[0082] The initial current is conditioned to form a direct current pulse for the proper duration delivered at the appropriate time by commutation **312**. The commutator **312** may be mechanical or electronic. The initial current pulse is then delivered to the cathode of the high voltage spark gap **314** exposed to open air or other suitable gaseous medium.

[0083] The initial current delivered to the cathode of the spark gap **314** initiates the electrochemical process of electron avalanche in the open air between the cathode and the anode. The process of electron avalanche generates multiple electrons to form additional current in the main circuit delivered to the load **316**. The additional current generated by electron avalanche is absorbed by the anode of the spark gap **314**.

[0084] The initital current and the additional current are then delivered to the inductive load **316** increasing the magnetic flux generated by the inductor.

[0085] The initial current is then routed through the primary of a step-down transformer **318** to the positive potential of the capacitor **310**. The initial current pulse through the primary of the step-down transformer **318** induces a medium voltage, current pulse in the secondary of the transformer **318**.

[0086] The secondary of the step-down transformer **318** provides the power necessary for the control of a high speed, unidirectional switch **322**. The current necessary for the proper activation of the high speed switch control circuit is regulated by a resistor **320**.

[0087] The additional current generated by electron avalanche is then routed to a ground rod **324** through the high speed, unidirectional switch **322** when the control circuit is closed. The high speed, unidirectional switch may be, but is not limited to, high speed relays, diodes, and silicon controlled rectifiers.

CONCLUSION, RAMIFICATIONS AND SCOPE

[0088] 1) Provides clean renewable energy.

2) Reduces the United States of America dependence on imported oil.

3) Provides a backup power supply for Federal, State, Local Government and the Military.

4) Affordable heating.

5) Reduces CO2 emissions.

6) Reduces air pollution

7) Increases available electric power in the United States of America.

I claim:

1. An electron avalanche drive circuit with a high voltage spark gap exposed to air or other suitable gaseous medium where the electrochemical process of electron avalanche generates additional current delivered to an inductive load.

2. The circuit of claim **1** wherein is composed of a battery, battery bank or other low voltage, direct current power supply which provides power to an inverter.

3. The circuit of claim **1** wherein is composed of an inverter which converts direct current to alternating current.

4. The circuit of claim **1** wherein is composed of a high voltage, step-up transformer which produces a high voltage, alternating current output.

The circuit of claim **1** wherein is composed of a full wave bridge which rectifies the alternating current to direct current.

The circuit of claim **1** wherein is composed of a capacitor or capacitor bank which stores the high voltage, direct current.

The circuit of claim **1** wherein is composed of a commutator which conditions the initial current to a current pulse of the proper duration at the correct time.

The circuit of claim **1** wherein is composed of a high voltage spark gap exposed to open air. Within the high voltage spark gap exposed to open air the electrochemical process of electron avalanche generates additional current that is delivered to an inductive load.

The circuit of claim **1** wherein is composed of a step-down, transformer which provides the power necessary to activate a high speed, unidirectional switch.

The circuit of claim **1** wherein is composed of a control circuit which employes a resistor to limit the current.

The circuit of claim **1** wherein is composed of a high speed, unidirectional switch which is selected from the group of switching elements composed of high speed relays, diodes and silicon controlled rectifiers. The high speed, unidirectional switch allows the additional current generated by electron avalanche to leave the main circuit and go to ground.

The circuit of claim **1** wherein is composed of a ground rod which allows the additional current to sink to ground.

Whereby the generation of additional current by the process of electron avalanche in a high voltage spark gap exposed to open air is delivered to an inductive load.

2. An electron avalanche drive circuit with a high speed, unidirectional switch that releases to ground the additional current generated by electron avalanche in a high voltage spark gap exposed to open air.

The circuit of claim **2** wherein is composed of a step-down transformer which supplies the power necessary to control the high speed, unidirectional switch.

The circuit of claim **2** wherein is composed of a resistor which limits the current to the high speed, unidirectional switch.

The circuit of claim **2** wherein is composed of a high speed, unidirectional switch which may be selected from the group of switching elements including high speed relays, diodes and silicon controlled rectifiers.

The circuit of claim **2** wherein is composed of a ground rod which allows the additional current generated by electron avalanche to go to ground.

Whereby the generation of additional current produced by electron avalanche in a high voltage spark gap exposed to open air is released from the main circuit to ground.

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