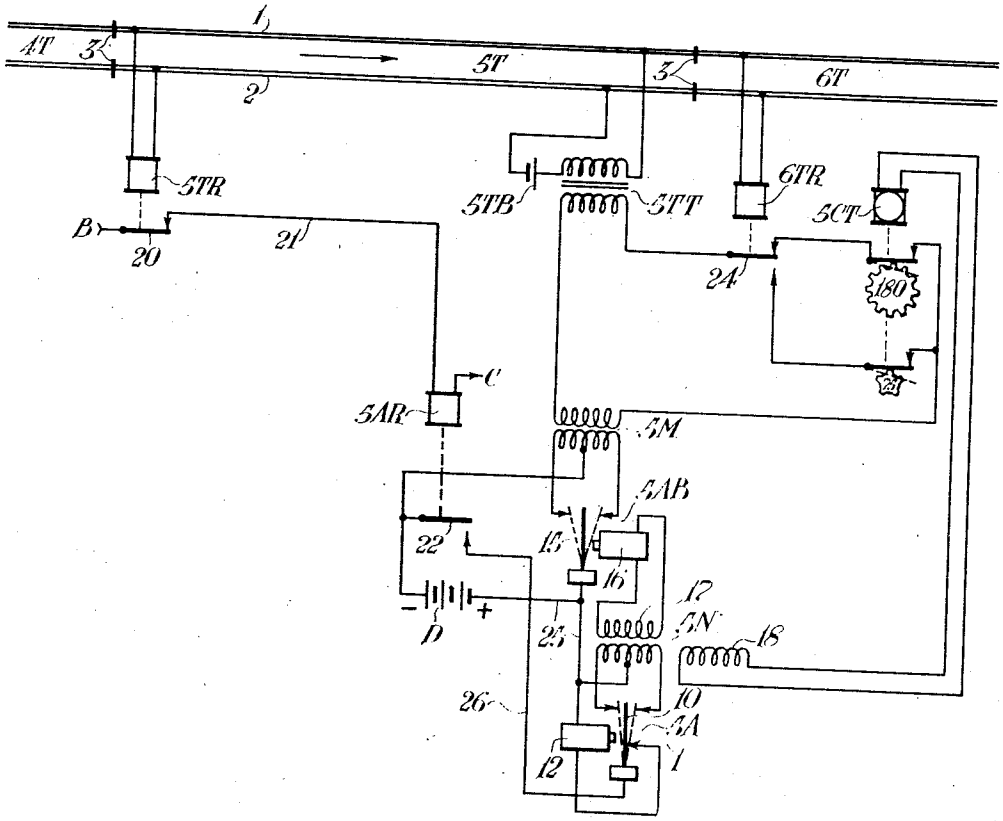
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ALTERNATING CURRENT SUPPLY MEANS

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ALTERNATING CURRENT SUPPLY MEANS

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My invention relates to improved means for generating alternating current from direct current, and particularly to means adapted for use in railway signaling systems and capable of supplying larger values of current than can be obtained from the means heretofore available.

Some types of railway signaling systems employ coded alternating current in the track circuits thereof to control cab signal apparatus carried by locomotives operated over the track rails of the track stretch.

Energy of substantial value is required to operate the vehicle carried apparatus and the alternating current supply means must be able to supply current of sufficient value to the track circuit of a track section to insure operation of the cab signal apparatus on a locomotive in that section. The value of the current which must be supplied to a track circuit to insure operation of a locomotive cab signal apparatus is relatively high in track sections where the ballast resistance is relatively low and exceeds the capacity of the devices heretofore available.

In systems of this type, in order to prevent improper response of the cab signal equipment to foreign current, the equipment is designed to respond to energy of one frequency only, such as 60 or 100 cycles, and it is necessary that the alternating current supply means be constructed so that the energy supplied thereby is substantially of the desired frequency, and so that this frequency will be maintained over a long period of operation.

In addition, in such systems, it is customary in order to reduce current consumption and to minimize wear on the supply means, to maintain the supply means for each section inactive until a train enters the section, and to start the supply means for each section as soon as the section is occupied. In order to prevent momentary display of a danger signal by the cab signal apparatus it is essential that the supply means start promptly and that it quickly reach its proper frequency of operation.

It is an object of this invention to provide improved alternating current supply means in which the frequency is determined by means separate from the power supply means so that the frequency is not affected by wear on the contacts of the power supply means.

A further object of the invention is to provide improved alternating current supply means of the type described.

Another object of the invention is to provide improved alternating current supply means capable of supplying large values of alternating current of a particular frequency for long periods of time.

A further object of the invention is to provide equipment of the type described which is arranged so that it can be governed by a small inexpensive circuit controller.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accompanying drawing.

I shall describe one form of alternating current supply means embodying my invention and shall then point out the novel features thereof in claims.

In the drawing the single figure is a diagram showing a section of railway track equipped with signaling apparatus employing alternating current supply means provided by this invention.

Referring to the drawing there is shown therein a stretch of railway track having track rails 1 and 2 over which traffic normally moves in the direction indicated by the arrow, that is from left to right. The rails of the track stretch are divided by insulated joints 3 into a plurality of track sections for signaling purposes. One complete track section is shown and is designated section 5T, while the adjacent sections are designated 4T and 6T.

Each of the track sections is equipped with signaling apparatus for detecting occupancy of the section, and for supplying coded alternating current to the rails of the occupied sections to actuate vehicle carried cab signal apparatus.

The cab signal apparatus is not a part of this invention and any equipment of this type well known in the art may be employed for this purpose. One form of apparatus which may be employed is shown in Letters Patent of the United States No. 1,956,679, issued January 1, 1935, to L. V. Lewis. This equipment is designed to respond to alternating current of a particular frequency, such as 60 or 100 cycles per second, and operates to give distinctive responses to energy of this carrier wave frequency when coded or periodically interrupted at specified rates, such as 75 or 180 times a minute.

Each section is provided with a track circuit comprising a track battery, designated TB with an appropriate prefix, connected across the section rails at the exit end of the section, and a track relay TR connected across the section rails at the entrance end of the section.

A track transformer TT has its secondary winding connected in series with the track battery,

while a code transmitter CT is provided to control the circuit of the primary winding of the transformer TT. The code transmitter CT has an induction motor which when supplied with energy of the frequency supplied by the tuned alternator 5A operates at a rate such that the contacts 75 and 180 of the device are opened and closed so as to provide 75 and 180 energy impulses a minute which are separated by periods of equal duration in which no energy is supplied.

The equipment at the exit end of the track section includes a principal or pilot alternating current supply device in the form of a tuned alternator 5A, and a subsidiary or driven alternating current supply device 5AB which is governed as to operation and frequency by the alternator 5A and supplies energy to the track transformer.

The alternator 5A may be of any appropriate construction well known in the art. This device includes a resilient vibrating reed 10 which is normally biased to a position in which it engages a contact 11 to establish a circuit to supply energy to the operating winding 12 of the device. The winding 12 when energized causes the reed 10 to be moved away from the contact 11 so that the circuit of the operating winding is interrupted and the reed then returns to its original position. On movement of the reed to each of its two positions it engages contacts to establish connection with an end terminal of the primary winding of the transformer 5N. In the drawing the reed itself is shown as engaging the contacts, but it should be understood that the device may be equipped with contacts mounted as shown in Letters Patent of the United States No. 1,861,641, issued June 7, 1932, to me and H. G. Blosser.

The reed 10 and the other portions of the principal supply device are selected and proportioned so that the reed is sharply tuned with the result that the natural period of its vibration is such that the reed moves between its two positions at a rate to cause energy of the desired frequency to be induced in the secondary windings of the transformer 5N.

The device 5AB is similar in construction to the alternator 5A and has a vibrating reed 15 which moves between two positions to establish connection with the end terminals of the primary winding of the transformer 5M. The device 5AB differs from the device 5A in that the reed 15 of the device 5AB does not control the circuit of the winding 16 of the device. Instead this winding is connected directly to the secondary winding 17 of the transformer 5N.

The device 5AB further differs from the device 5A in that the reed 75 is not sharply tuned, nor is it resonant at the frequency of the tuned alternator 5A. It follows that reed 15 can be caused to vibrate at the desired amplitude by alternating energy in winding 16, and the frequency of this operation will be exactly that of the frequency of the energy in coil 16. The device 5AB also differs from the device 5A in that it has a larger and stronger reed which carries larger contacts than are carried by the reed of the device 5A, while the various parts of the device 5AB are arranged and proportioned so that the amplitude of movement of the reed 15 is relatively large so that on movement of the reed between its two positions the contacts of the device are widely separated.

When the winding 16 of the device 5AB is deenergized the reed 15 of the device assumes a central position in which the contacts carried by the reed are out of engagement with the associated stationary contacts. As the reed 15 is relatively stiff and rigid it will be accurately and firmly held in its central position, while as the reed has a large amplitude of movement the contacts carried by the reed are certain to be out of engagement with the stationary contacts and the circuits of the two portions of the primary winding of the transformer 5M are certain to be interrupted as long as the winding of the device is deenergized.

As the contacts carried by the reed 15 of the device 5AB can be depended upon to interrupt the circuit of the primary winding of the transformer 5M it is unnecessary to provide other means to interrupt the circuit and the terminals of the battery D may be connected directly to the reed 15, and to the mid terminal of the transformer primary winding.

The reed 10 of the device 5A, on the other hand, is relatively light and flexible while its range of movement is relatively small and the contacts carried by this reed cannot be depended upon to interrupt the circuit of the primary winding of the transformer 5N when the operating winding 12 of the device is deenergized. Accordingly, the circuit of the apparatus is arranged so that the relay 5AR, which controls the circuit of the operating winding 12 of the device 5A, also controls the circuit of the primary winding of the transformer 5N.

The energy consumed by the operating winding 12 of the device 5A and by the primary winding of the transformer 5N is relatively small. As the relay 5AR controls only the supply of energy to the primary winding of the transformer 5N and to the operating winding 12 of the device 5A this relay may be much smaller and lighter than would be necessary if the relay were required to also control the circuit of the transformer 5M which consumes a large value of current.

The equipment is shown in the drawings in the condition which it assumes when the track stretch is vacant. At this time track relay 5TR is picked up and its contact 20 establishes a circuit to supply energy to the approach relay 5AR. This circuit is traced from terminal B of a source of current, such as a storage battery, not shown, through front contact 20 of relay 5TR, wire 21 and winding of relay 5AR to terminal C. Accordingly, relay 5AR is energized and its contact 22 is picked up and interrupts connection from one terminal of the battery D to the primary winding of transformer 5N, and to the operating winding 12 of the alternator 5A, while at this time the reed 15 of the device 5AB occupies its central position in which the circuit of the primary winding of the transformer 5M is interrupted.

As energy is not supplied to the winding 12 of alternator 5A this device is inactive and energy is not induced in the secondary windings 17 and 18 of the transformer 5N. As energy is not induced in the winding 17 energy is not supplied to the winding 16 of the supply device 5AB and this device is inactive, while as energy is not induced in the winding 18 of transformer 5N energy is not supplied to the code transmitter 5CT and this device is inactive.

At this time, as section 6T is assumed to be vacant, contact 24 of relay 6TR is picked up and establishes the circuit of the contact 180 of the code transmitter 5CT. However, at this time

device 5AB is idle so energy is not induced in the secondary winding of the transformer 5M and energy, therefore, is not supplied to the track transformer 5TT.

When a train moving in the normal direction of traffic, that is, from left to right, enters section 5T the track relay 5TR releases and its contact 20 interrupts the circuit of the approach relay 5AR so that contact 22 of this relay releases.

On release of contact 22 of relay 5AR energy is supplied from the battery D to the operating winding 12 of the alternator 5A over the circuit which is traced from the positive terminal of the battery through wire 25, winding 12 of device 5A, contact 11, and reed 10 of the device, wire 26, and contact 22 of the relay 5AR to the negative terminal of the battery. Accordingly, the reed 10 operates in the customary manner, while as a result of this movement of the reed 10 energy is alternately supplied to the two portions of the primary winding of transformer 5N. At this time the positive terminal of the battery is connected to the center terminal of the primary winding of the transformer 5N, while connection is established from the negative terminal of the battery to the end terminals of the transformer primary winding through back contact 22 of relay 5AR, wire 26, and reed 10 of the alternator.

As a result of the supply of energy to the primary winding of transformer 5N energy is induced in the secondary windings 17 and 18 of the transformer. The frequency of this energy is determined by the rate of movement of the reed 10.

The energy induced in the winding 17 of transformer 5N is supplied to the winding 16 of the device 5AB, and the alternating current energy supplied to this winding causes the reed 15 of the device 5AB to vibrate or move between its two positions at a rate determined by the frequency of the energy supplied to the winding 16.

As a result of this movement of the reed 15 of the device 5AB energy is alternately supplied to the two portions of the primary winding of the transformer 5M. At this time the positive terminal of the battery is connected to the end terminals of the transformer primary winding through wire 25 and reed 15 of the device 5AB, while the negative terminal of the battery is connected to the center terminal of the transformer primary winding.

On the supply of energy to the primary winding of the transformer 5M energy is induced in the transformer secondary and is supplied therefrom to the primary winding of the track transformer 5TT over the circuit which includes contact 180 of the code transmitter 5CT and front contact 24 of track relay 6TR. Accordingly, energy is supplied from the secondary winding of the track transformer 5TT to the rails of the track section over the circuit which includes the track battery 5TB in series therewith.

On operation of the alternator 5A and resultant supply of energy to the primary winding of transformer 5N energy is included in the secondary winding 18 and is supplied therefrom to the motor of the code transmitter 5CT so that this motor operates and causes the contacts 180 and 75 to be opened and closed. Accordingly, the contact 180 of the code transmitter interrupts and establishes the circuit of the track transformer 5TT so that the alternating current supplied to the track circuit of section 5T is coded at the 180 code rate and this energy will cause the cab signal apparatus on the locomotive which entered the track section to operate to provide its clear indication.

When the train advances into section 6T the track relay 6TR releases and its contact 24 interrupts the circuit of the contact 180 and establishes the circuit of the contact 75 of the code transmitter 5CT so that the energy supplied from transformer 5TT to the rails of section 5T will be coded at the 75 code rate as long as section 6T is occupied.

When the train vacates section 5T track relay 5TR picks up and its contact 20 establishes the circuit of the relay 5AR so that contact 22 of relay 5AR picks up and interrupts the supply of energy from the battery D to the winding 12 of alternator 5A, and to the primary winding of the transformer 5N. Accordingly, the alternator 5A ceases to operate while energy is no longer supplied to the winding 16 of device 5AB and this device ceases to operate so that the reed 15 again assumes its central position in which the supply of energy to the transformer 5N is interrupted. In addition, energy is no longer supplied to the code transmitter 5CT so that it ceases to operate.

From the foregoing it will be seen that when the track section 5T is vacant the alternator 5A and the supply device 5AB are both deenergized. When a train enters section 5T energy is supplied to the operating winding of the alternator 5A and this device starts to run so that energy is supplied to the operating winding of the supply device 5AB and causes this device to operate so that energy is supplied to the track transformer 5TT. In addition, when the alternator 5A starts energy is supplied to the code transmitter 5CT so that the motor of this device operates and causes the contacts of this device to code the energy supplied from the track transformer to the track circuit.

The only current which the alternator 5A and the associated transformer 5N must supply is that required to energize the operating winding 16 of the supply device 5AB and the motor of the code transmitter 5CT, and the current required for these is relatively small.

As the current supplied over the circuits governed by the contacts of the alternator 5A is of relatively small value the contacts of this device may be relatively small and still have long useful life, while it is satisfactory if they are held in engagement with relatively light pressure.

As the alternator contacts may be of moderate size, and as the contacts of the device need only be pressed together lightly, the reed of the device may be made relatively light and flexible and still be strong enough to carry the contacts and to exert sufficient force on the contacts carried thereby to press them against the stationary contacts of the device with the necessary pressure.

As the reed of the alternator 5A may be light and flexible it will start to vibrate promptly on the supply of energy to the winding 12 and will reach its normal operating rate almost instantaneously. This will be true even though the energy supplied to the operating winding of the device is of lower than normal voltage and insures that the device will start under all operating conditions.

The rate of movement of the sharply tuned armature or reed of a device of this type is affected by changes in the weight of the contacts carried thereby, and by changes in the amplitude of movement of the reed occasioned by wear

on the contacts of the device. Since the load on the alternator is relatively small there is little wear on the contacts of the device and its contacts will not change in size and weight and its armature or reed will operate at a substantially constant frequency for a long period.

The rate of operation of the reed 15 of the supply device 5AB is governed by the frequency of the energy supplied to the winding 16 of the device, and it is neither necessary, nor desirable, therefore, for the reed of this device to be tuned or adjusted to operate at the frequency of the tuned alternator 5A. Instead the device is constructed in such manner that its reed is not sharply tuned, but will operate freely at the rate determined by the frequency of the energy supplied to the operating winding 16 of the device.

As the reed of the device 5AB does not need to be tuned this reed may be as large and strong as desired so that the contacts carried thereby may be both large and numerous. Furthermore, the reed may be made relatively stiff so that it exerts relatively great pressure on the contacts carried thereby to press them against the stationary contacts of the device, while the range of movement of the reed may be made as large as is desirable to insure adequate opening of the contacts of the device, and to insure that the contacts carried by the reed will be out of engagement with the stationary contacts when the winding of the device is deenergized.

As the reed of the device is not sharply tuned its rate of operation will not be affected by changes in the weight of the contacts carried thereby, or by changes in the amplitude of movement of the reed occasioned by wear of the contacts. Instead the reed of this device will continue to operate at the rate determined by the frequency of the energy supplied by the alternator 5A, and, as pointed out above, the frequency of this energy will remain susbtantially constant through long periods of operation of the alternator.

In addition, as the supply of energy to the operating winding 16 of the supply device 5AB is controlled by the alternator 5A this winding exerts force on the reed 15 of the device to compel it to operate at the proper speed, and if for any reason the reed 15 should start to operate too fast or too slow the operating winding of the device will exert force on the reed to make it operate at the correct speed.

The supply means provided by this invention is arranged so that on release of the approach relay the supply device 5AB is certain to start regardless of how stiff or rigid the reed 16 may be. When the approach relay 5AR releases the alternator 5A is started and energy is supplied through the transformer 5N to the winding 16 of the supply device 5AB. Even if the first impulse of energy supplied to the winding 16 does not cause the reed 15 to move all of the way into engagement with one set of stationary contacts, the reed will soon be caused to move throughout its full range of movement as a result of the force exerted thereon by the successive impulses of energy supplied to the winding 16. These impulses are independent of movement of the reed 15 and, therefore, continue to be supplied regardless of whether the reed 15 moves or not so that the reed 15 is certain to start promptly and to operate at the rate determined by the alternator 5A.

From the foregoing it will be seen that the alternating current supply means provided by this invention is arranged so that the frequency of the alternating current supplied thereby is maintained at the desired value for long periods of time. This is advantageous as it insures that the energy supplied to the track circuit will be of the proper frequency to operate the signaling system, while it also insures that the coding device will operate at the proper speed so that the energy supplied to the track circuit is coded in the proper manner.

While the alternating current supply means provided by this invention is particularly designed for use in a railway signaling system and has been illustrated and described in connection with such a system, the supply means is not limited to use in such a system and may be employed wherever it is desired to generate substantial values of alternating current of a predetermined frequency from a source of direct current.

Although I have herein shown and described only one form of alternating current supply means embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In apparatus of the class described, in combination, a supply device having a winding and having a non-tuned vibrating reed governed by said winding and movable at a rate determined by the frequency of the energy supplied to said winding, contacts carried by said reed and controlling supply circuits over which energy may be supplied from a source of direct current, a converter of the tuned vibrating reed type for converting direct current into alternating current, and means for supplying energy from said converter to the winding of said supply device.

2. In apparatus of the class described, in combination, a principal and an auxiliary converter of the vibrating reed type for converting direct current, the reed of the principal converter being tuned to operate at a predetermined rate and carrying a contact controlling the supply of energy to the operating winding of said converter and also carrying contacts which control circuits over which direct current energy may be supplied, the reed of the auxiliary converter being non-tuned and being responsive to the frequency of the energy supplied to the winding of said converter, and means independent of the reed of the auxiliary converter for supplying energy from said principal converter to the winding of said auxiliary converter.

3. In apparatus of the class described, in combination, a principal and an auxiliary converter of the vibrating reed type for converting direct current into alternating current, each of said converters having a transformer associated therewith, the reed of each of said converters carrying contacts which govern the supply of energy from a source of direct current to the primary winding of the associated transformer, the reed of the principal converter being tuned to vibrate at a predetermined rate and also carrying a contact which controls the supply of energy from a source of direct current to the operating winding of said converter, the reed of the auxiliary converter being non-tuned and being adapted to operate at a rate determined by the frequency of the energy supplied to the operating winding of said converter, and means

independent of the reed of the auxiliary converter for supplying energy from a secondary winding of the transformer associated with the principal converter to the operating winding of said auxiliary converter.

4. In apparatus of the class described, in combination, a source of direct current, a principal and an auxiliary converter of the vibrating reed type for converting direct current into alternating current, each of said converters having a transformer associated therewith, the reed of each of said converters carrying contacts which govern the supply of energy from said source of direct current to the primary winding of the associated transformer, the reed of the principal converter being tuned to vibrate at a predetermined rate and also carrying a contact which controls the supply of energy from said source of direct current to the operating winding of said converter, the reed of the auxiliary converter being non-tuned and being adapted to operate at a rate determined by the frequency of the energy supplied to the operating winding of said converter, means independent of the reed of the auxiliary converter for supplying energy from a secondary winding of the transformer associated with the principal converter to the operating winding of the auxiliary converter, and common means for controlling the supply of energy from said source of direct current to the operating winding of the principal converter and to the primary winding of the transformer associated with said principal converter.

5. In combination, a principal and an auxiliary converter of the vibrating reed type for converting direct current into alternating current, each of said converters having a transformer associated therewith, the reed of each of said converters carrying contacts which govern the supply of energy from a source of direct current to the primary winding of the associated transformer, the reed of the principal converter being tuned to vibrate at a predetermined rate and also carrying a contact which controls the supply of energy from a source of direct current to the operating winding of said converter, the reed of the auxiliary converter being adapted to operate at a rate determined by the frequency of the energy supplied to the operating winding of said converter, means independent of the reed of the auxiliary converter for supplying energy from a secondary winding of the transformer associated with the principal converter to the operating winding of the auxiliary converter, a coding device having a contact which is opened and closed at a rate governed by the frequency of the energy supplied to said device, a circuit including said coding device contact in series therewith for supplying energy to a load from the secondary winding of the transformer associated with said auxiliary converter, and means for supplying energy to said coding device from a secondary winding of the transformer associated with said principal converter.

6. In combination, a source of direct current, a principal and an auxiliary converter of the vibrating reed type for converting direct current into alternating current, each of said converters having a transformer associated therewith, the reed of each of said converters carrying contacts which govern the supply of energy from said source of direct current to the primary winding of the associated transformer, the reed of the principal converter being tuned to vibrate at a predetermined rate and also carrying a contact which controls the supply of energy from said direct current source to the operating winding of said converter, the reed of the auxiliary converter being adapted to operate at a rate determined by the frequency of the energy supplied to the operating winding of said converter, means independent of the reed of said auxiliary converter for supplying energy from a secondary winding of the transformer associated with the principal converter to the operating winding of said auxiliary converter, a coding device having a contact which is opened and closed at a rate governed by the frequency of the energy supplied to said device, a circuit including said coding device contact in series therewith for supplying energy to a load from the secondary winding of the transformer associated with said auxiliary converter, means for supplying energy to said coding device from a secondary winding of the transformer associated with said principal converter, and means controlling the supply of energy from said direct current source to the operating winding of the principal converter and to the primary winding of the transformer associated with said principal converter.

7. In apparatus of the class described in combination, a source of direct current, a principal and an auxiliary converter of the vibrating reed type for converting direct current into alternating current, each of said converters having a transformer associated therewith, the reed of the principal converter carrying contacts which govern the supply of energy from said source of direct current to the primary winding of the associated transformer, the reed of the principal converter being tuned to vibrate at a predetermined rate and also carrying a contact which controls the supply of energy from said source of direct current to the operating winding of said converter, one terminal of said source of direct current being connected to the reed of said auxiliary converter, the other terminal of said source of direct current being connected to the mid-terminal of the primary winding of the transformer associated with said auxiliary converter, means independent of the reed of said auxiliary converter for supplying energy from a secondary winding of the transformer associated with the principal converter to the operating winding of said auxiliary converter, the reed of the auxiliary converter being non-tuned and being adapted to operate at a rate determined by the frequency of the energy supplied to the operating winding of said converter, the reed of the auxiliary converter being movable between a first position in which it establishes connection with one end terminal of the primary winding of the associated transformer and a second position in which it establishes connection with the other end terminal of said transformer primary winding, the reed of said auxiliary converter being arranged so that when the operating winding of said converter is deenergized the reed occupies an intermediate position in which it does not establish connection with either end terminal of said transformer primary winding, whereby when the operating winding of said auxiliary converter is energized with alternating current the reed of said converter moves between its two positions and the portions of the primary winding of the transformer associated with said converter are alternately energized and when the operating winding of said converter is deenergized the reed interrupts the supply of energy to said transformer primary winding, and common means for

controlling the supply of energy from said source of direct current to the operating winding of the principal converter and to the primary winding of the transformer associated with said principal converter.

8. In apparatus of the class described in combination, a source of direct current, a principal and an auxiliary converter of the vibrating reed type for converting direct current into alternating current, the reed of the principal converter being tuned to vibrate at a predetermined rate and carrying a contact which controls the supply of energy from said source of direct current to the operating winding of said converter, the auxiliary converter having a transformer associated therewith, one terminal of said source of direct current being connected to the reed of said auxiliary converter, the other terminal of said source of direct current being connected to the mid-terminal of the primary winding of said transformer, means independent of the reed of the auxiliary converter for supplying to the operating winding of said converter alternating current energy the frequency of which is determined by the rate of movement of the reed of the principal converter, the reed of the auxiliary converter being non-tuned and being adapted to operate at a rate determined by the frequency of the alternating current energy supplied to the operating winding of said converter, the reed of the auxiliary converter being movable between a first position in which it establishes connection with one end terminal of the primary winding of said transformer and a second position in which it establishes connection with the other end terminal of said transformer primary winding, the reed of said auxiliary converter beng arranged so that when the operating winding of said converter is deenergized the reed occupies an intermediate position in which it does not establish connection with either end terminal of said transformer primary winding, whereby when the operating winding of said auxiliary converter is energized with alternating current the reed of said converter moves between its two positions and the portions of the primary winding of said transformer are alternately energized and when the operating winding of said converter is deenergized the reed interrupts the supply of energy to said transformer primary winding, and common means for controlling the supply of energy from said source of direct current to the operating winding of the principal converter and to the circuit over which energy at the frequency determined by the rate of movement of the reed of the principal converter is supplied to the operating winding of the auxiliary converter.

9. Alternating current supply means comprising a supply device including a winding and a reed which when said winding is supplied with alternating current will vibrate at the frequency of said current, contacts carried by said reed and controlling circuits for generating from a source of direct current alternating current having the same frequency as the frequency of vibration of said reed, means independent of said supply device for generating from a source of direct current a pilot source of alternating current of a particular frequency, and means for supplying said winding with alternating current from said pilot source.

10. Means for generating alternating current from direct current comprising a pilot and a second converter of the vibrating type each provided with circuit controlling contacts, the contacts of said second converter being capable of controlling relatively larger amounts of power than the contacts of said pilot converter, said pilot converter being energized from a source of direct current over one of its own contacts and being effective to generate alternating current of a particular frequency, said second converter having a winding energized by alternating current generated by said pilot converter and being constructed so that the reed thereof accurately follows the frequency of the energy supplied to said winding, and means controlled by the contacts of said second converter for generating alternating current from a source of direct current.

11. A system for generating alternating current comprising a pilot alternator of the vibrating reed type energized from a source of direct current and provided with contacts for generating alternating current of a particular frequency from said source, a second alternator of the vibrating reed type energized by alternating current supplied by said first alternator and constructed to accurately follow the frequency of the current supplied thereto, said second alternator being provided with contacts for generating relatively large amounts of alternating current from a source of direct current and being capable of operating at an energy level which insures a long life of said first alternator, whereby the frequency of the alternating current generated by said second alternator will remain constant for long periods of time and will be independent of contact wear of said second alternator.

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