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ELECTRICAL APPARATUS

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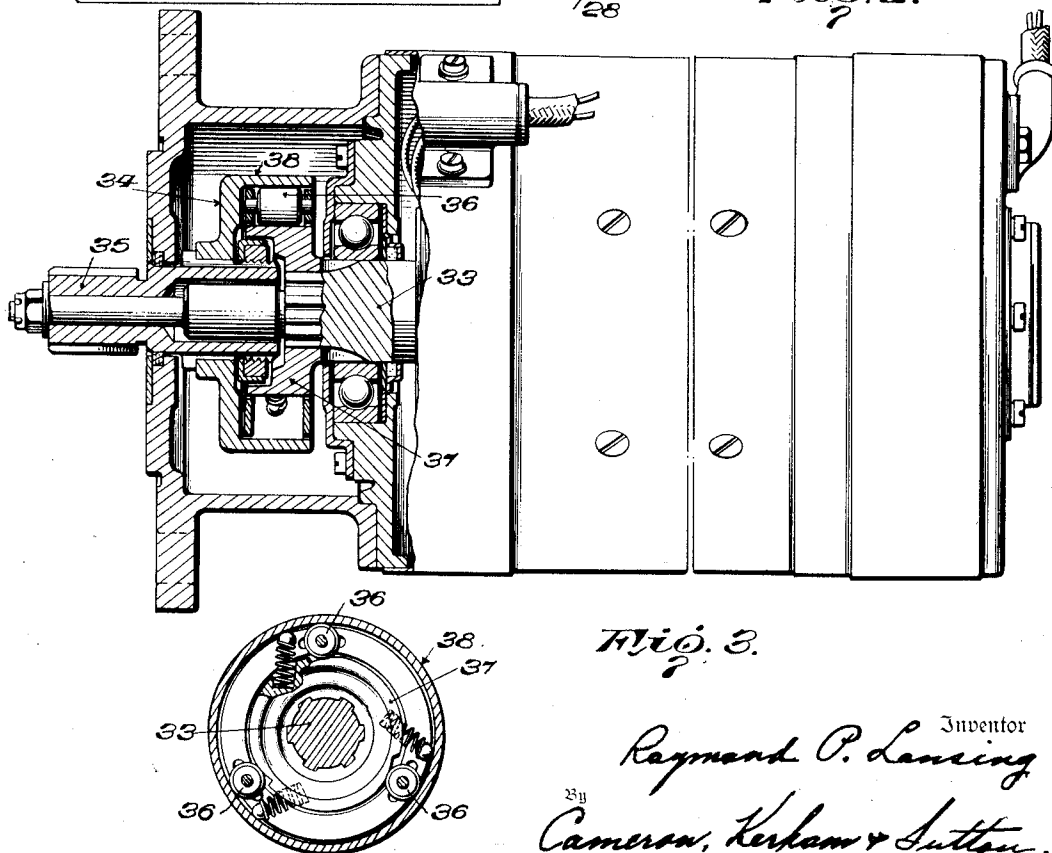
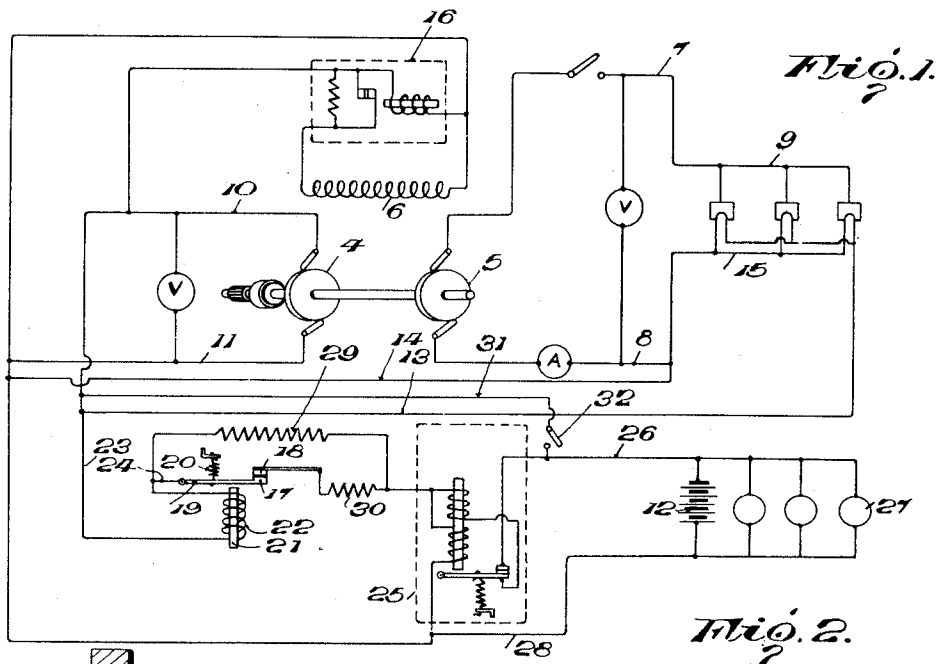


Fig. 3.

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## UNITED STATES PATENT OFFICE

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## ELECTRICAL APPARATUS

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5 Claims. (Cl. 250—27)

This invention relates to electrical apparatus and more particularly to an electrical power system adapted for use in radio apparatus.

One of the objects of the invention is to provide a novel power system embodying a multi-current generator adapted to supply the electrical power required in radio apparatus of the type embodying vacuum tubes.

Another object is to provide a novel power system comprising a multi-current generator in combination with means whereby the low voltage end of the generator may be employed under certain conditions as a motor to actuate the high voltage end of the generator.

A further object includes the provision of a multi-current generator in combination with means for mechanically driving the generator and with means for supplying current to one commutator of the generator whereby the generator may be operated as a motor-generator and this without the necessity for manually disconnecting the generator from the mechanical drive.

A still further object includes the provision of a multi-current generator in combination with means for actuating one end thereof from two power sources, one of said sources being available at all times for this purpose.

In providing radio transmitting apparatus for use in aeroplanes, it is not only desirable that the weight of the apparatus be maintained at a minimum, but it is further desirable that means, independent of the aeroplane engine, be provided for actuating the transmitting apparatus, in order that signals may be sent when said engine is not in operation, as when a forced landing has been made, for example. Accordingly, one of the objects of the present invention is to provide novel radio transmitting apparatus adapted to be actuated by an aeroplane engine and also adapted for use in the event that the operation of said engine must be discontinued.

The above, and other objects, will appear more fully hereafter in the detailed description of the invention, one embodiment of which is shown in the accompanying drawing. It is to be understood, however, that the drawing is for purposes of illustration only and is not designed as a definition of the limits of the invention, references being had for this purpose to the appended claims.

Referring to the drawing, wherein like reference characters refer to like parts throughout the several views:

Fig. 1 is a diagrammatic view of the elements included in the novel combination of the present invention.

Fig. 2 is a side elevation, partly in section and with parts broken away, illustrating one form of coupling means which may be provided in the generator drive of the present invention, and

Fig. 3 is a transverse sectional view of the coupling means shown in Fig. 2.

The invention embodies a generator which is preferably of the direct current four-pole type, having an armature drum carrying two separate windings, and a commutator at each end thereof, the windings being of such a character, when the generator is employed in combination with radio apparatus, that a high voltage is delivered by one commutator and a low voltage by the other. The low voltage end of the generator is diagrammatically shown at 4, and the high voltage end at 5. A shunt field winding 6, which is common to both of the armature windings, is employed for excitation of the generator field. The high voltage end of the generator is adapted to supply current through suitable leads 7 and 8 to a substantially constant load 9 such as the plate circuit of a radio transmitting set. The low voltage end of the generator is adapted to supply current through leads 10 and 11 to a variable load constituted by a battery 12 and through leads 13 and 14 to a substantially constant load 15, such, for example, as the filament circuit of the radio transmitting set.

Means are provided in the output circuit of the low voltage end of the generator for controlling the electrical output from both of the commutators of the generator. For this purpose a voltage regulator 16 of any suitable type, such as the vibrating contact type, is operatively connected to the field winding 6. Since the details of this regulator form no part of the present invention, and since the construction and operation of the same are well understood in the art, no detailed description of the regulator or its connections is necessary.

Any increase in the voltage, delivered by the low voltage end of the generator, due for example to an increase in armature speed, is effectively controlled by regulator 16, but since the output circuit of the low voltage end of the generator includes a battery to be charged, the regulator 16 may not be entirely effective to control the current output in said circuit due to the variation in load resulting from a change in the state of charge of the battery. It will therefore be apparent that even though the voltage in coil 6 be maintained constant, the field flux of said coil will vary if the flow of current to the battery varies, and hence, the voltage delivered by

the high voltage end of the generator will vary.

In many installations the battery load is such a small percentage of the total low voltage load that the variations in field flux due to variations in current flow to the battery will not result in undesirable changes in the output of the high voltage end of the generator, but in the event that these changes are objectionable, a current regulator of any suitable type may be provided in the output circuit of the low voltage end of the generator. The current regulator will coact with the voltage regulator to maintain the field flux constant, whereby the voltages delivered at the opposite ends of the generator are maintained constant at all times.

Where a current regulator is desirable, it preferably comprises a pair of contacts, 17 and 18, the contact 17 being carried by a pivoted arm 19 and being normally maintained in engagement with contact 18 by means of a resilient member 20. An electro-magnet embodying a core 21 and a coil 22, is positioned adjacent arm 19 and when energized said magnet opposes the action of spring 20 and opens contacts 17 and 18 in the event that the output in the low voltage end of the generator exceeds a pre-determined amount.

Coil 22 is connected through leads 23 and 10 to the positive side of the low voltage end of the generator, and is also in circuit through lead 24 and arm 19 with contacts 17 and 18. The latter is connected through a cutout switch 25 and lead 26 with the positive side of battery 12 and with the lamps 27, the return circuit for the battery and lamps being indicated at 28. In parallel with contacts 17 and 18 is a control resistance 29, and, if desired, a resistance 30 may be placed in series with contact 18 to reduce the amount of current flowing through the contacts when the same are closed. Lead 26 is connected through a lead 31 and switch 32 with the lead 10 and the positive side of the low voltage end of the generator.

In operation, the high voltage output winding of the generator delivers 400 volts, for example, to the plate circuit 9. The low voltage output winding of the generator delivers, for example, 2 amperes at 15 volts for charging battery 12 and 4 amperes at 10 volts to the filament circuit 15, suitable resistances or other means being provided as desired to secure this output in the low voltage end.

In aircraft installations, the generator will be driven by an internal combustion engine, and as the speed of said engine varies, speed of the armature of the generator will vary. The change in voltage produced by the change in speed of the armature is effectively controlled by the co-action of the current regulator and the voltage regulator, and radio signals can be effectively transmitted under these conditions.

In installations heretofore provided the driving connection between the internal combustion engine and the generator shaft has rendered it impossible to employ the generator for transmitting signals when the engine is not in operation. In accordance with the present invention, a one-way driving connection is provided between the engine and the armature shaft of the generator and when the engine is not in operation, battery 12 may be employed to supply the filament current and to drive the low voltage end of the generator, which now serves as a motor, whereby the high voltage end will be actuated to supply the plate current and signals can be effectively transmitted.

As shown, the armature shaft 33 (Fig. 2) is provided with a one-way clutch 34 for establishing a driving connection with an engine driven shaft 35. Preferably the clutch is of the roller type embodying a plurality of cylindrical rollers 36, which are yieldingly wedged between the inner and outer elements 37 and 38 respectively, of the clutch, whereby motion is transmitted from shaft 35 to the armature shaft. In the event that the outer clutch member 38 is held against movement, as when the engine is stopped, the inner clutch member 37 is free to rotate in the normal direction due to the movement of cylinders 36 in the inclined recesses provided in the inner clutch member 37. Accordingly, battery 12 may be employed to drive the low voltage end of the generator, which latter is now operated as a motor-generator, whereby the high voltage end of the generator is effective to supply current to the plate circuit of the transmitting set. Preferably the lead 31 is employed to bypass the current regulator and cutout switch in the battery charging circuit. By closing the switch 32, battery 12 is connected directly across leads 10 and 11 to drive the low voltage end 4, and to supply current to the filament circuit 15 through leads 13 and 14.

The use of the present invention effects a large saving in weight over installations of the character heretofore provided, wherein an electrical motor has been employed to drive the high and low voltage ends of a generator, the motor being driven by a battery. This saving in weight, and the attendant saving in cost, is of prime importance in aeroplane installations. Signals can be sent after a forced landing has been made and the operation of the engine has been discontinued, and this feature is of great importance, particularly since this result is secured without an increase in weight of the apparatus. While the invention has been particularly described in connection with radio transmitting apparatus for aeroplanes, it will be understood by those skilled in the art that the novel apparatus herein set forth is capable of a wide variety of uses, and that various changes may be made in the arrangement of the elements thereof. The terms "high" and "low voltage" ends have been used to facilitate description, and where desired the generator may be so constructed that the output windings will deliver current at substantially equal voltages. Switch means of suitable type are to be provided as desired in the various output circuits. In certain installations the voltage control means may be unnecessary, and in others the current regulator may be eliminated. Moreover, either end of the generator may be employed as a motor to drive the other end by providing suitable leads and switches from the battery to said ends. Reference, therefore, will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. In combination with a generator having two output windings, means including one-way clutch means for driving said generator, circuits connected to each of said windings, means in one of said circuits for controlling the voltage outputs of the generator, and a battery in the last mentioned circuit, the generator being adapted to charge the battery in normal operation and being adapted to be operated as a motor-generator by the battery when the driving means is not in operation.

2. In radio apparatus, a generator having a plurality of output windings, means including a

one-way clutch for driving said generator, means including a radio circuit connected to one of the windings of the generator, means including a battery and a second radio circuit connected to another of the windings of the generator, said battery being adapted to be charged during normal operation of the generator and adapted to actuate the generator as a motor-generator when the first-named means is not in operation, and voltage control means in circuit with one of said output windings for controlling the voltage of said plurality of output windings.

3. The combination with an internal combustion engine, of a multi-wound direct current generator having a high voltage end and a low voltage end, means including a one-way clutch for drivably connecting said engine to said generator, a substantially constant load circuit connected to the high voltage end of the generator, a circuit including a battery to be charged and a substantially constant load connected to the low voltage end of the generator, and means in said last mentioned circuit for controlling the voltage output of both ends of the generator, said battery being adapted to operate the low voltage end of the generator as a motor to actuate the high voltage end of said generator when the engine is not in operation.

4. The combination with an internal combustion

engine, of a multi-wound direct current generator having a high voltage end and a low voltage end, means including a one-way clutch for drivably connecting said engine to said generator, voltage regulating means for said generator, a substantially constant load connected to the high voltage end of said generator, a circuit connected to the low voltage end of said generator and including current regulating means and a battery to be charged, and means including a shunt for said current regulating means whereby said battery may operate the low voltage end of said generator as a motor to actuate the high voltage end of said generator.

5. In an electrical load supply system for use on vehicles, in combination with a dynamo electric machine having an output winding of relatively high voltage current, and a second output winding of relatively low voltage current, a battery adapted to operate said machine through energization of said low voltage winding, a load in circuit with said high voltage output winding, and means for recharging said battery through operation of said motor generator while acting as a generator only, said means including a mechanical connection which is operative only while the power plant of the vehicle is in operation.

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