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CONSTANT VOLTAGE GENERATOR

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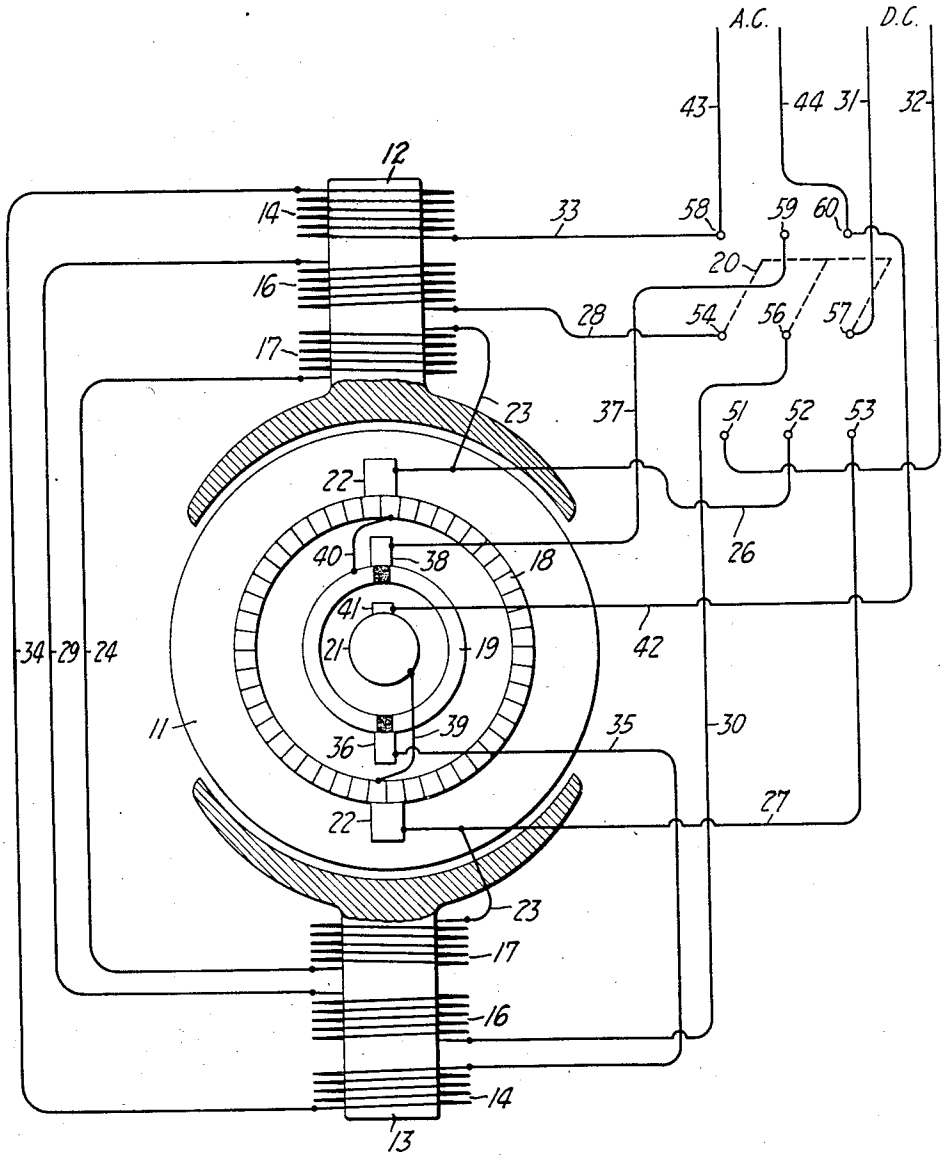


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## CONSTANT VOLTAGE GENERATOR

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8 Claims. (Cl. 171—223)

The invention, in general, relates to combination direct and alternating current generators. More particularly, the invention relates to means and a method of maintaining a constant potential on such type of generators under variable inductive and resistance loads.

One of the major factors entering into the efficacious use of electrical generating machines consists of regulation of voltage under variable power loads. This factor is particularly outstanding with respect to the use of alternators, while it does not, altho present, appreciably enter into the efficiency of direct current generating machines. The issue has in the past been dodged, rather than solved, by the expedient use, in generating plants, of machines of large capacities which are seldom called upon to deliver more than sixty percent of their rated output. In small, portable alternators where the generation of the greatest amount of current is desirable from the smallest machine possible, control of the potential has not heretofore been made possible without the use of auxiliary equipment thereby increasing cost and weight.

It is a primary object of my invention to provide a portable, combination direct and alternating current generating machine which is equipped with means for maintaining a constant potential under variable resistance and inductive loads.

Another object of my invention is to provide a machine of the aforementioned character which is of simple and inexpensive construction and particularly adaptable for work in the mobile field.

A still further object of the invention is to provide a constant voltage generator which is characterized by the maintenance of substantially exact phase relationship between current and voltage under inductive loads thereby producing substantially unity power factor.

Another object of the invention is to provide means for distributing the field and armature flux to reduce distortion to a minimum.

A still further object of the invention is to provide a novel method of maintaining a constant potential on direct and alternating current generating machines under all conditions of variance in power loads.

Other objects of the invention, together with some of the advantageous features thereof, will appear from the following description of the preferred embodiment thereof which is disclosed in the accompanying drawing. While the preferred embodiment of my invention is illustrated in the drawing, it is to be understood that I am not to be limited to the embodiment shown, as the invention, as defined in the appended claims, may be embodied in a plurality and variety of forms.

Referring to the drawing:

The accompanying drawing is a diagrammatic view of an embodiment of the invention with electrical circuits diagrammatically illustrated.

In its preferred form, the constant voltage generator of my invention preferably comprises an electrical current generating means, means enabling said current generating means to create a voltage of predetermined value at no load, together with means electrically connected to said last named means for maintaining said voltage at said predetermined value under variations of loads placed on said current generating means.

In accordance with the invention, I provide a conventional armature 11 which conveniently may carry two separate windings for producing both alternating and direct current or which, if desired, may carry a single winding, as shown, tapped at points 180° apart for taking off the alternating current at such points. The armature is supported between a pair of diametrically opposed field poles 12 and 13 having arcuate bases, as shown, and upon which I preferably arrange three separate and distinct windings or field coils 14, 16, and 17. The field coils 14 and 17 are connected by suitable conductors and brushes to a pair of commutators 18 and 19 as well as to load circuits through a suitable three pole, double throw switch 20. A conductor ring 21 also is provided in the generator. Field coils 17 are made of high resistance to current flow while field coils 14 and 16 are of relatively low resistance to current flow. Field coils 14 and 16 are so arranged on the field poles 12 and 13 that they produce magnetic lines of force in opposite directions when current flows through the coils in one direction only.

Commutator 18 is designed so as to take the alternating current produced in the armature winding and rectify the current so as to move the same through an electrical circuit in one continuous direction. Commutator 19 comprises a pair of segments insulated from one another and is so designed as to take the alternating current produced in the armature winding and to direct this current alternately through two separate and individual electrical circuits or, in other words, is so designed as to cause the alternating current from the armature recurrently to

flow through one circuit for a period of time equivalent to the completion of one half of an alternating current cycle and then through another circuit for a corresponding period of time.

As illustrated in the drawing, field coils 17 are connected in shunt to rectifying commutator 18 by means of brushes 22 and conductors 23 and 24. Conductors 26 and 27 are provided for connecting the brushes 22 of the commutator 18 to the contacts 52 and 53 respectively of the switch 20. Field coils 16 are connected by means of conductors 28, 29, and 30 to different contacts 54 and 56 of the same switch, while conductors 31 and 32 leading to a direct current load are connected across contacts 57 and 51 respectively of the switch 20.

With switch contacts 51 to 57 inclusive closed, the machine can be operated as a direct current generator and the device becomes a standard compound wound generator employing field windings 16 and 17, the circuits being arranged so that field coils 17 are connected in parallel with the armature and load circuit while the field coils 16 are connected in series with the armature and the load circuit, as illustrated. It is apparent that field coils 14 together with commutator 19 and collector ring 21 are not used when the machine is operated as a direct current generator.

In order to place the field coils 14 in the armature and alternating current load circuit, a conductor 33 is provided for connecting one of the fields 14 to a switch contact 58 leading to one side of the distributing circuit, a conductor 34 connects the two windings 14, and a conductor 35 leads from the other of the fields 14 to a brush 36 on the commutator 19. In addition, a conductor 37 is provided for taking off current at a brush 38 of the commutator 19, spaced 180° from the brush 36, and leads to a switch contact 59. To complete the circuit, conductors 39 and 40 lead from the armature winding to the collector ring 21 and a segment of the commutator 19, respectively, and current is taken from the collector ring by means of a suitable brush 41 and fed directly to the other side of the distributing alternating current circuit by means of a conductor 42 connecting the brush 41 and a switch contact 60. Conductors 43 and 44 lead from the alternating current load to the switch contacts 58 and 60 respectively. The brushes 36 and 38 of commutator 19 are so placed that the segment of the commutator 19 to which the winding of the armature is connected by means of the conductor 40 spans, in one of its positions, both brushes by approximately one-half of their width and, accordingly, the flow of current in the armature winding when the segment is in this position, will be practically zero, since the current tends to flow through fields 14 and 16 in the same direction, and these fields, being opposed to each other, set up a neutral effect.

With switch contacts 54 to 60 inclusive closed, the machine is operable as an alternator with field windings 14, 16 and 17 all being utilized, altho windings 17 are used merely to bring up the desired potential at no load. Upon inspection of the drawing it will be observed that current flowing from the collector ring 21 to the distributing alternating current circuit must return first thru field coils 16 on one-half of the cycle and then thru field coils 14 on the other half of the cycle. Bearing in mind that field coils 14 and 16 are so arranged as to produce magnetic lines of force in opposite directions when current flows therethrough in one direction only, it will be apparent that if current is caused to flow thru coils 16 on one-half of the cycle so as to produce magnetic lines of force moving in a given direction, the current flowing thru coils 14 upon the return of the half cycle, altho flowing in the opposite direction, will produce magnetic lines of force moving in the same direction as they did when the current flowed thru coils 16 on the first half of the cycle.

In view of the circuit arrangements as hereinabove described and as illustrated in the drawings the voltage will not be affected regardless of the variations in inductive and resistance loads placed on the machine. Moreover since the field strength is in proportion to the load carried and inasmuch as the field strength is reduced to practically zero at every half cycle by reason of the position of the brushes 36 and 38 on the commutator 19, the current and voltage are kept in exact phase relationship under all inductive loads, thereby producing substantially unity power factor. Furthermore, since the field strength varies from maximum to practically zero every half cycle, the field and armature magnetic flux are more evenly distributed and distortion therefore is reduced to a minimum.

It is to be understood that the appended claims are to be accorded a range of equivalents commensurate with the scope of the prior art.

1. A constant voltage generator comprising a pair of field poles, an armature having a winding thereon, an alternating current circuit, a collector ring connected to one side of said circuit and to said winding, and two pairs of field coils wound upon each of said poles and connected to the other side of said circuit and to said winding; one pair of said pairs of coils being wound so that current flowing therethrough in one direction will produce magnetic lines of force moving in a given direction, and the other pair of said pairs of coils being wound so that current flowing therethrough in the opposite direction will produce magnetic lines of force moving in said given direction.

2. A constant voltage alternator for feeding an alternating current load circuit; said alternator comprising a pair of field poles, an armature having a winding thereon, means for creating a magnetic flux of predetermined value upon said field poles whereby the alternator produces a voltage of predetermined value at no load, and means for maintaining the voltage at said predetermined value under load variations; said last named means including a collector ring connected to one side of said load circuit and to said winding, and two pairs of field coils wound upon said poles and connected to the other side of said circuit and to said winding; one of said pairs of coils being wound so that current flowing therethrough in one direction will produce magnetic lines of force moving in a given direction and the other of said pairs of coils being wound so that current flowing therethrough in the opposite direction will produce magnetic lines of force moving in said given direction.

3. A constant voltage alternator for feeding an alternating current load circuit; said alternator comprising a pair of field poles, an armature having a winding thereon, means for creating a magnetic flux of predetermined value upon said field poles whereby the alternator produces a voltage of predetermined value at no load, and means for maintaining the voltage at said predetermined value under load variations; said last named means comprising a collector ring connected to one

side of said load circuit and to said winding, two pairs of field coils on said poles and connected to the other side of said circuit and to said armature, and means for causing current to flow in one direction thru one pair of said coils during one-half of an alternating current cycle and to flow in the opposite direction through the other of said pairs of coils during the other half of said alternating current cycle.

4. A constant voltage alternator for feeding an alternating current load circuit; said alternator comprising a pair of field poles, an armature having a winding thereon, means for creating a magnectic flux of predetermined value on said field poles whereby the alternator produces a voltage of predetermined value at no load, and means for maintaining the voltage at said predetermined value under variations of load; said last named means comprising a collector ring connected to one side of said load circuit and to said winding, two pairs of field coils wound upon said field poles and connected to the other side of said load circuit and to said armature, and a commutator in the field coils circuits for directing the current in one direction through one pair of coils during one-half of an alternating current cycle and in the opposite direction through the other pair of coils during the other half of the alternating current cycle; said commutator comprising a pair of segments insulated from one another, one segment being connected to said armature winding.

5. A constant voltage alternator for feeding an alternating current load circuit; said alternator comprising a pair of field poles, an armature having a winding thereon, a first commutator electrically connected to said winding, a pair of field coils of relatively high resistance to current flow wound on said poles and connected in shunt to said first commutator; said field coils creating a magnetic flux on said field poles whereby the alternator produces a voltage of predetermined value at no load, and means for maintaining the voltage at said predetermined value under load variations; said means comprising a collector ring connected to one side of said circuit and to said winding, two pairs of field coils of relatively low resistance to current flow wound on said poles and connected to the other side of said circuit and to said armature, and a second commutator having a pair of segments insulated from each other with one segment connected to said winding; said commutator being interposed in a circuit including said winding and said one commutator segment together with one pair of said field coils for energization during one-half of an alternating current cycle, and being interposed in another circuit including said winding and said one commutator segment together with the other pair of said field coils for energization during the other half of the alternating current cycle.

6. A constant voltage generator comprising a pair of field poles, an armature having a winding thereon, a first commutator electrically connected to said winding, a pair of brushes spaced 180° apart on said first commutator, a second commutator having a pair of segments insulated from each other, a conductor leading from said winding to one segment of said second commutator, a pair of brushes spaced 180° apart on said second commutator, a first pair of field coils of relatively high resistance to current flow wound on said field poles and connected in shunt with said armature, a second pair of field coils of relatively low resistance to current flow wound on said field poles and connected in series with said armature through said brushes, and a third pair of field coils of relatively low resistance to current flow wound upon said field poles and connected in series with said armature through said brushes.

7. In a constant voltage alternator for feeding an alternating current load circuit, a pair of field poles, an armature having a winding thereon, means for creating a magnetic flux of predetermined value upon said field poles whereby the alternator produces a voltage of predetermined value at no load, and means for maintaining the voltage at said predetermined value under load variations; said means comprising a commutator having a pair of segments insulated from each other, a pair of brushes spaced 180° apart on said commutator, a conductor leading from said winding to one segment of said commutator, and two pairs of field coils of relatively low resistance to current flow wound upon said field poles; said field coils being connected to said commutator through said brushes by separate circuits so that current is caused to flow alternately through one circuit including one pair of field coils during one-half of an alternating current cycle, and through another circuit including the other pair of field coils during the other half of the alternating current cycle.

8. A constant voltage generator comprising a pair of field poles, an armature having a winding thereon, a direct current circuit, an alternating current circuit, a first commutator electrically connected to said winding, a pair of brushes spaced 180° apart on said first commutator, a second commutator having a pair of segments insulated from each other, a conductor leading from said winding to one segment of said second commutator, a pair of brushes spaced 180° apart on said second commutator, a first pair of field coils of relatively high resistance to current flow wound on said field poles and connected in shunt to said brushes of said first commutator, a second pair of field coils of relatively low resistance to current flow wound on said field poles and connected in series with said armature and said direct current circuit, and a third pair of field coils of relatively low resistance wound on said field poles and connected in series with said armature and said alternating current circuit.

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