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EXCITING DIRECT CURRENT GENERATOR

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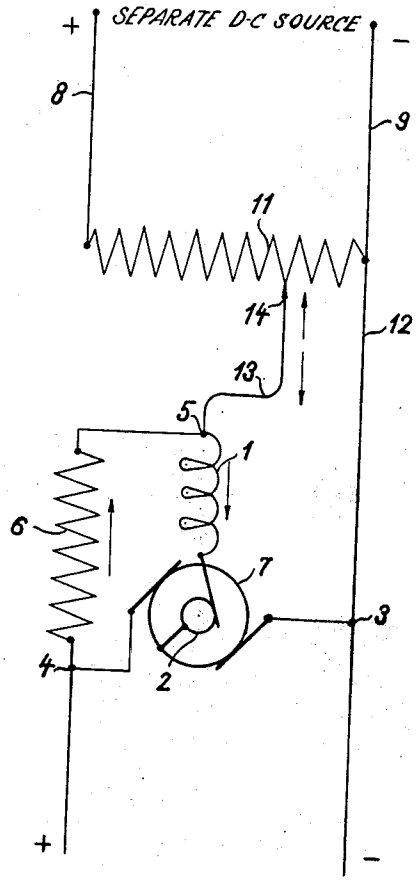

Inventor
Ludwig Schön
by Knight Bros
Attorneys

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EXCITING DIRECT CURRENT GENERATOR

Ludwig Schön, Essen-Margarethenhohe, Germany

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1 Claim. (Cl. 171—229)

The invention relates to circuit arrangements for controlling the excitation of direct current generators, in particular for Ward Leonard drives, of the type in which both a self-exciting circuit and a separate exciting circuit are provided and the self-exciting circuit is designed to have at least approximately the lowest value of resistance which would prevent self-excitation if there were no other exciting circuit in the generator. In known arrangements of this type the exciting winding is subdivided into two halves. One half is arranged in the self-exciting circuit, the resistance of the self-exciting circuit being such that self-excitation is just prevented. The other winding half is excited separately and need comprise only so many ampere turns as required for the production of the flux missing in the self-excitation. The energy required for the regulation is in this case reduced to a small fraction of the value which would be required with entirely separate excitation. In this manner, however, no satisfactory utilization of the exciting copper is obtained.

The invention has for its object to enable a single exciting winding to be employed and to utilize the whole exciting copper.

In order that the invention may be clearly understood and readily carried into effect, an embodiment of the same is illustrated in the accompanying diagrammatic drawing.

In the drawing one end of the exciting winding 1 is connected to a Sengel ring 2, that is, to a slip ring connected to a commutator segment, with the result that the slip ring has the medium or zero potential, that is, it is positive relatively to the negative armature terminal 3, but negative relatively to the positive armature terminal 4. If the free end 5 of the exciting winding 1 is connected as shown, through a resistance 6 to the positive armature terminal 4, a current increasing the voltage of the armature 7 flows in the exciting winding 1, provided the number of turns and the direction of winding are correctly determined. If, however, the free end 5 of the exciting winding 1 were to be connected to the negative terminal 3, an exciting current would flow in the reverse direction, that is, a current tending to reduce the voltage of the armature. Therefore, the positive terminal 4 may be denoted as self-excitation terminal and the negative terminal 3 as suicide terminal. It is possible to connect the free end 5 of the exciting winding 1 through a resistance with each of the two armature terminals 4 and 3, thus giving a self-exciting circuit 5, 1, 2, 7, 4, 6, 5, and a separate exciting circuit composed as follows: Between two direct current mains 8, 9 is a regulating resistance 11, one of the mains, 9, being connected by wire 12 to the terminal 3 of the generator, which has the same sign. The free end of the exciting winding 1 is connected by a wire 13 to a sliding contact 14 which is shiftable along the resistance 11. The result is that in the left-hand end position of the contact 14 the full voltage of the mains 8, 9 prevails in the separate exciting circuit 8, 14, 13, 5, 1, 2, 7, 3, 12, 9 while in the right hand end position of the contact 14 the separate exciting circuit 14, 13, 5, 1, 2, 7, 3, 12, 14 is short-circuited. In the intermediate position of the contact 14 only a fraction of the voltage of the mains 8, 9 prevails in the separate exciting circuit. In this manner a sort of bridge connection is obtained in which the two armature halves, on the one hand, and the two resistances 6 and 11 connected in front of the exciting winding 1 on the other hand constitute the square and the bridge is formed by the exciting winding itself. According to the value of the resistances 6 and 11 this manner of excitation causes self-excitation or destruction of the residual magnetism. The voltage produced by the armature 7 is stabilized by imposing on the part of the resistance 11 connected to the main 9 the separate excitation voltage. According to the value of the self-excitation resistance 6, and thus to the degree of self-excitation, part of the excitation is then produced by self-excitation and the remainder by separate excitation. It can easily be demonstrated that the separate excitation part disappears if the self-excitation resistance is made equal to the tangent of the angle of inclination of the magnetisation curve (no-load characteristic) to the axis of abscissae (exciting current). The described connection thus enables a regulation to be effected without loss of energy within the straight line part of the no-load characteristic.

Besides regulation without loss of energy the connection according to the present invention, for example when applied to exciting windings for low voltage, affords further advantages, without the consumption of regulating energy being appreciably increased. In this manner a quick excitation and simultaneously a very efficacious destruction of the residual magnetism are obtained. This is of particular advantage with regulation operations in connection with Ward Leonard drives, where the possibility of a very fine regulation is obtained, especially at the low speeds. Whilst with the known connections, having regard to the variations of the armature resistance

caused by heating and to the variations of the number of revolutions of the generator, the degree of compounding always has to be made somewhat smaller than corresponds to the compensation of the ohmic voltage drop in the armature circuit, it is possible to fully compound without hesitation with the connection according to the invention. Even overcompounding will not affect the stability of the excitation.

What I claim and desire to secure by Letters Patent is:

In a device of the class described, a direct current generator comprising an exciting winding; an armature comprising a winding and a commutator; brushes bearing on said commutator; lead means permanently connected to one segment of said commutator; a source of variable controlling voltage; means forming a separate exciting circuit including said exciting winding, and said source of variable controlling voltage, in which circuit one end of said exciting winding is connected to said lead means, and said source of variable controlling voltage is connected to the other end of said exciting winding and to one of said brushes; and means forming a self-exciting circuit comprising a fixed resistance having one end connected to said other end of said exciting winding and its opposite end connected to a second one of said brushes, said fixed resistance being of at least approximately the lowest value capable of preventing self-excitation of said generator by said self-exciting circuit when said variable controlling voltage is zero.

LUDWIG SCHÖN.