The Main Generator Field Current Regulating System For Static Switch 2100CP Diesel-Electrical Engines

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Introduction

The very fast electronic power development (cheap, changing up, high current and sticking voltage semiconductors), power compact modules realization containing even the protection and adjusting part, determined an important breakthrough of static switches equipments in industry, these replacing the moving devices structures.

The fast prevalence of "on-chip" computing equipments determined an easy implementation of some complex conduction procedures. These tendencies are also found in the 2100CP diesel-electrical engines modernization preoccupations and materialized as a net superior equipment, because of the high reliability , precision, etc.

Chapter 1. The Present Stage

One of the most occurred solutions for the main generator magnetic field flux regulation of diesel-electrical engines consist in using many stages of heavy-duty resistors, of different values, set in series by the generator operating winding and shortened by the cursor of the diesel engine mechanic controller, respectively by the studs of the start-up stages contactors. Through the generator field, the current varies dependent on a non-linear characteristic, considering the mechanic controller cursor position, so the continuous current generator power coincides with the diesel engine power.

This solution presents the next disadvantages:

- low reliability due to the fact that the main generator high value field current runs through the collector foil brush;
- the large volume occupied by the regulating resistors;
- the high dissipated power of the regulating resistors;
- large use of cooper conducting wires for the connections between the collector foil brushes and the resistors set at a longer distance from them;
- the difficult extension leads setting on the engine;
- the use of power contactor in order to shorten the start-up stages with a low reliability and difficult service;

- the controlling characteristics modification on a large setting range due to the regulating resistors steadiness variation and to the operating winding with the temperature
- the controlling characteristics modification, due to the energizing circuit supply voltage variation;
- it is not providing the short – circuit, in normal order of start-up resistors, who goes to high variations at field current and over voltage in the electric circuit, mechanical shock in linkage;
- it is not providing total range of working for engines equipped with warming – train installation.

Chapter 2. The structure of the field current adjustment system for the main generator of the 2100 CP diesel-electric locomotives with static switch.

The magnetic flux of the main generator of electric traction (fig.1) is composed of static switch (1) (continuous chopper) which supplies the operating winding (2), the traction main generator (3), a current adjustor (4) and a current transducer (5) trough the operating winding who provide a constant keep of this current, considering the prescribed size of the field current in the presence of the interference (variation of the resistance operating winding with temperature, variation of the DC voltage from the locomotive local network), a stabilized voltage regulator(6) and a voltage transducer(7), which , through the PWM (8) module and a static switch provides a voltage limitation on hubs of the main generator (3) by regulating the current from the operating winding, a microcontroller driven architecture (9) in which the control characteristic is stored and which provide the prescribed size for the field current Ie.

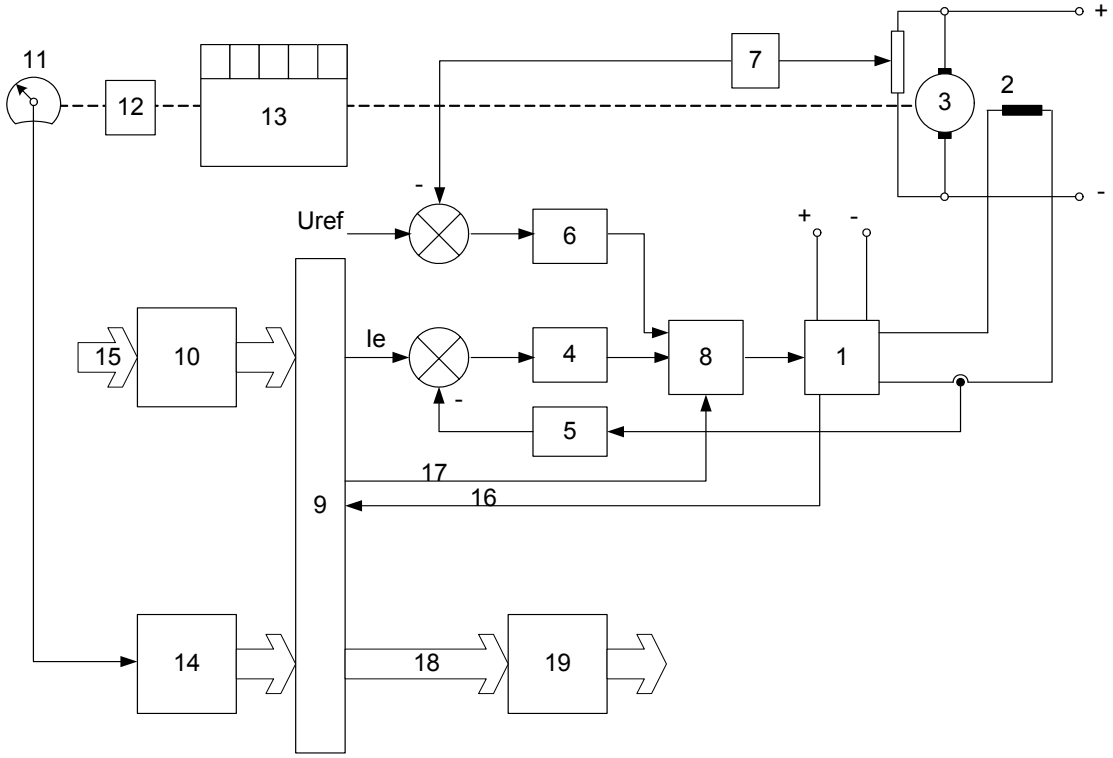

Fig..1. The structure of the field current adjustment system for diesel-electric engines.

Choosing a control characteristic of the family (fig.2) is done automatically by the microcontroller (9), considering the signals received through the input module.
For the chosen characteristic, the value of the prescribed field current Ie is conditioned by the signal received from the transducer (11), which is driven-by the mechanical regulator (12) of the Diesel engine (13) and adjusted by the transducer module (14).

The avoidance of the large stage variations in field current, caused by forbidden combinations of the signals (15) and the protection in case of fault state in the energizing circuit, is assured by the microcontroller (9), which detects the fault state through the back-coupling circuit (16).
The microcontroller (9) sends a command to the PWM module (8) through the circuit (17), which then blocks the static switch (1).

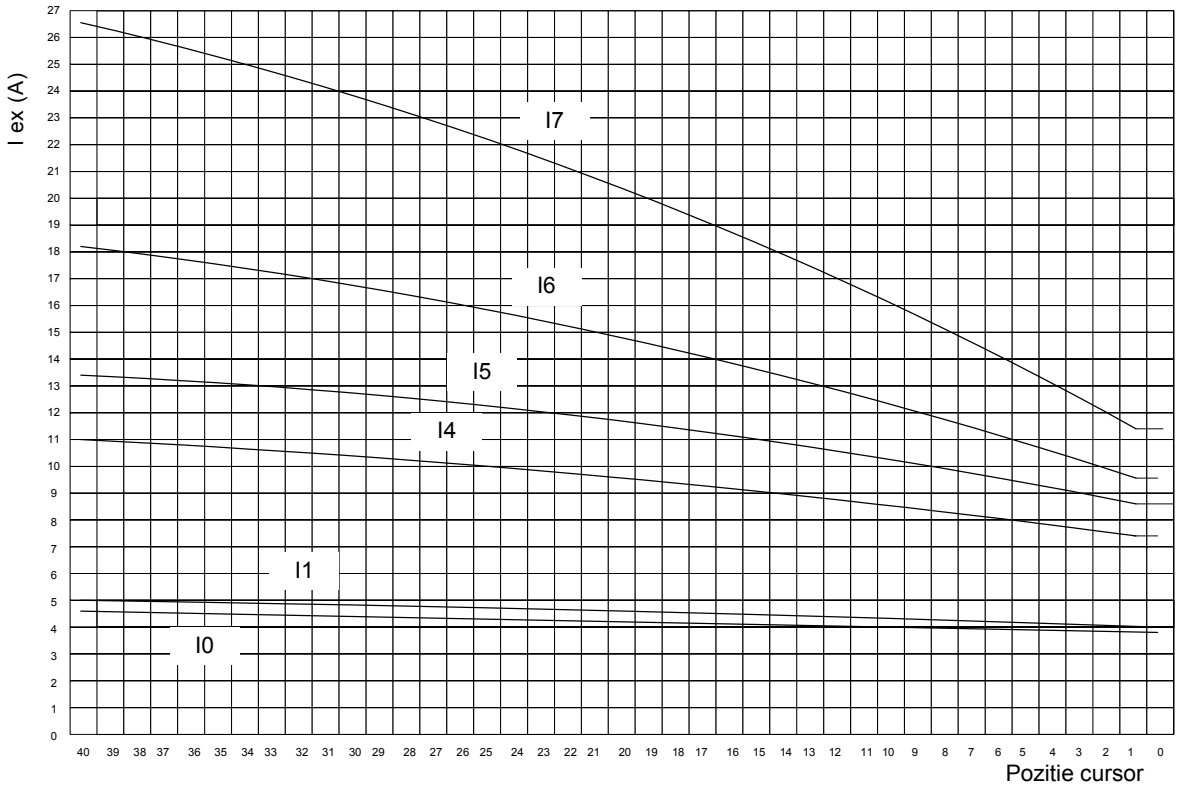

Fig.2. The controlling characteristics family

The microcontroller architecture (9), depending on the operating conditions of the engine, transmits commands (18) through the output module (19) to the switching relay and protection relay on the engine.

The suggested value for the field current Ie varies with a characteristic dependent on signals (15).

The adjustment system for the field current presented above has the following advantages:

- because of the construction details the system can be connected to other information displaying or storage equipments on the engine.

- High reliability because are used stationary electronic components for the main generator field current, rather than moving components like „the collector foil brush";
- The stability of the adjustment characteristics at the power voltage supply and temperature variation;
- The construction is modular the service is very easy, as the replacement of the unfunctional modules can be executed directly on the vehicle;
- The system is protected in case of shortening, on the operating winding;
- The controlling characteristic family is strictly observed using a current loop and keeping the references in a non-volatile memory;
- The input and output data modification and easy adjustment, and also the system logical command due to the microcontroller architecture and dedicated software.

Conclusions

By using the static switches in the power circuits and the microcontrollers at objectifying the command procedures, determine the obtaining of reability and stability performances, allows minimal service costs and a fast debug, even on the vehicle. Interconnecting with other digital equipments with the purpose of functioning monitorizing and long distance information transmition is possible due to the digital character of the signals

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