

COLD START OF DIESEL ENGINES

Description

Diesel engine operation becomes more complicated during the cold winter months because of fuel thickening in the engine compartment. The performance of diesel engines are improved by introduction of a cheap heating system to avoid trouble starting in the cold weather.

To help the diesel operate reliably throughout the winter and to increase fuel efficiency, the project proposes a new concept for heating elements to warm up the fuel before and inside engine compartment. These elements are made from the material with positive temperature coefficient of resistivity (PTCR), in particular, from specially developed semiconductor $BaTiO_3$, doped by rare-earth elements, which electrical resistance increases rapidly in a required temperature range. The benefits of this type of heating elements, compared with the conventional materials, are minimum required power,

automatic maintenance of preset temperature, and durability. The heating elements are installed on the critical sites of the automobile or track engines with the minimal efforts and will enable a starting system operate normally.

All elements are brought together into an electric circuit and a special tumbler will provide their sequential switching.

Developed devices for a local heating of a diesel engine are based on the PTCR thermistors, which allows the minimization of the energy consumption as well as the self-regulation of heating temperature. In contrast to the conventional PTCR thermistors, developed by us heating elements are simultaneously tailored for high working temperatures of the diesel engines, low voltages of power supply, and demonstrate low varistor effect - weak dependence of the electric resistance on the voltage applied.

Several modifications of ceramic temperature self-regulating heating elements and the devices based on the developed elements for a local heating of the main crankshaft bearing, oil-intake compartment, and fuel filter are proposed.

Innovative Aspect and Main Advantages

According to the results of the field tests, the utilization of developed devices allows a significant enhancement of the operation of diesel engines in the cold season, in particular, it results in the following:

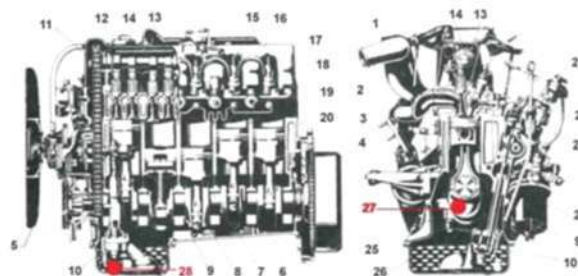
- a decrease of the minimal starting temperature of a diesel engine by 10°C when using only the accumulator of a vehicle for the prestart heating;
- a decrease of the minimal starting temperature of a diesel engine by 20°C when using other external sources of electric power for the prestart heating.

Areas of Application

Heating systems could be utilized in the automobile construction as well as in other areas of possible applications of diesel engines. New PTCR-based heating systems can be implemented in various diesel engines operating at low temperatures or in a cold season including the applications in automobile construction or in autonomous power supply systems.



Fig.1 Posistor heating elements and points of local heating in a diesel engine



For 2, 28 - heating oil-intake compartment
27 - support of crankshaft bearing

Fig. 2 Heated fuel filter



Fig. 3 Heated main crankshaft bearings



Fig. 4 Heated oil intake compartment



Stage of Development

Several Ukrainian patents, and further international patent pending:

Further development, licensing, and technology transfer

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