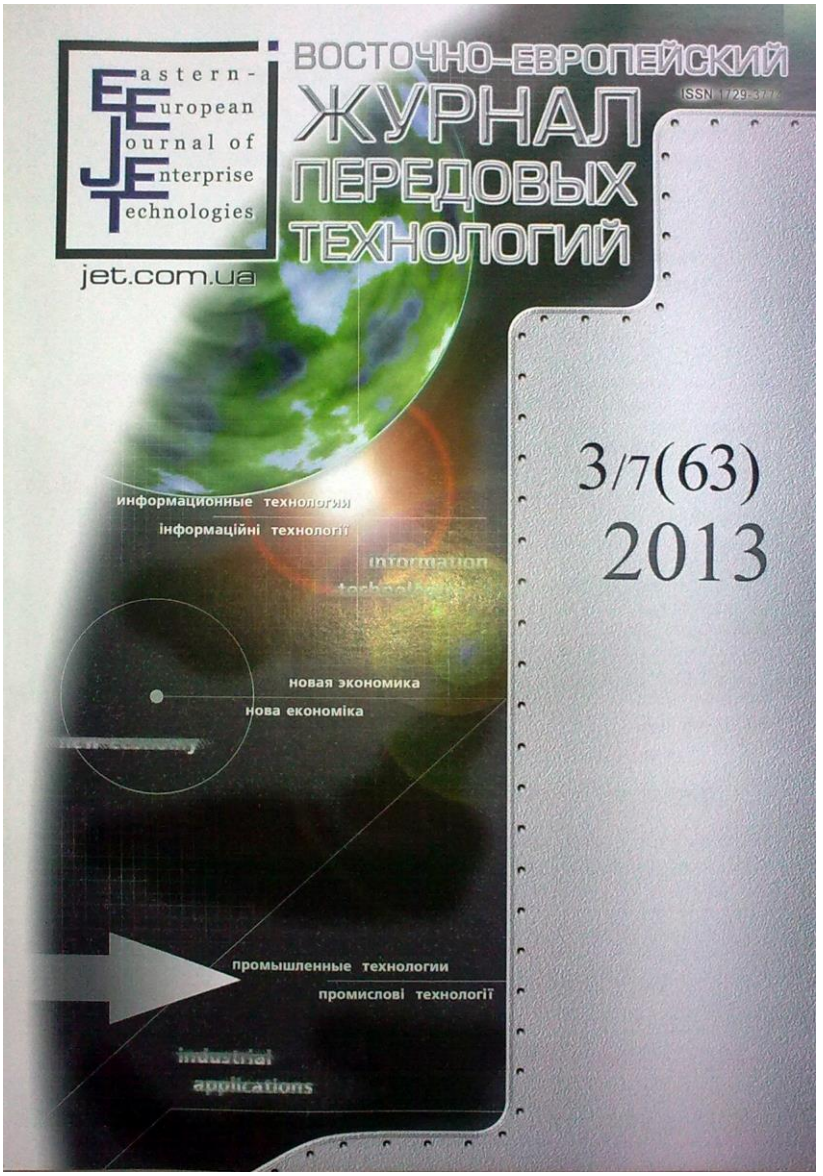
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ПРИКЛАДНАЯ МЕХАНИКА

Главный редактор
И. Г. Филиппенко
Доктор технических наук, профессор.
Украинская Государственная Академия
железнодорожного транспорта. УКРАИНА

Учредители
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Запропонований оперативний спосіб підключення-відключення свічок накалювання двигуна легкового автомобіля із реалізацією функції індикації їх справного стану для розширення функціональних можливостей його управління. Використовуючі функцію підключення-відключення свічок накалювання, ми маємо можливість доцільно їх використовувати при різній атмосферній температурі, що сприяє збільшенню терміну служби свічок накалювання, а світлова індикація дозволяє перевіряти їх працездатність при кожному запуску

Ключові слова: свічки накалювання, дизельний двигун, індикатор роботи, діагностика,оперативний спосіб, підключення-відключення

Предложен оперативный способ подключения-отключения свеч накаливания двигателя легкового автомобиля с реализацией функции индикации их исправного состояния для расширения функциональных возможностей его управления. Используя функцию подключения-отключения свеч накаливания, мы имеем возможность целесообразно их использовать при разной атмосферной температуре, что способствует увеличению срока службы свеч накаливания, а световая индикация позволяет проверять их работоспособность при каждом запуске

Ключевые слова: свечи накаливания, дизельный двигатель, индикатор работы, диагностика, оперативный способ, подключение-отключение

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THE HEATING CANDLES CONNECTION-DISCONNECTION CONTROL WITH INVERSE CONECTION IN A PASSENGER CAR

A. Vasylev
Associate Professor*
E-mail: vas.anatoly@gmail.com
S. Popov
Associate Professor*
*The Chair of Manufacturing Engineering**
E-mail: psv26@mail.ru
S. Sokalskiy
Department of building machines and equipment**
E-mail: sokalskiy.sergey@yandex.ua
**National Technical Yuri Kiondratiuk UniversitySt.
Pershotravnevii building 24, Poltava, Ukraine,
36000

1. Introduction

During start-up of cold engine, especially in winter low-temperature conditions, the absorbed cold air and cold walls of the pipeline, combustion chamber impact the temperature at the end of the pressure tact in the way, that it appear to be lower than it should be for the self- ignition of the gas mixture. Obviously, engine did not start-up.

That is why, it was proposed to place into the combustion chamber or into the admission port of the engine, electric heating element of the heating candles, on the spire of which the electricity was set. However, the technical services and repair of this element is time-consuming and difficult processes.

2. The overview of recent research sources and publications

Exciting control indicator of running conditions of the heating candles is insecure. That is why there is an urgent need to develop additional checking methods. After analysis of existing checking methods of running conditions of the heating candles, it was proposed several additional methods.

There is method, which apply check of the color of the heating element during functioning of the candle. For the check, one should unscrew the candle from the head, and set voltage from «+» of the accumulator to the clamp of the candle, and «-» set to the engine casing.

If the candle is in good running conditions, the heating tube begins warming up at once. So, in 10 seconds the candle begins to shine. In other case, there is a need to change the candles [1].

Moreover, there is a method of or power of current check. The check of the candle must be provided on the special test bench. We introduce safe checking method, which can be applied at home. To apply this method, one should have multipurpose tester or some other equipment to measure dc resistance. Firstly, there is a need to measure dc resistance between the start-up lead and metal casing. It is recommended to clear the thread carefully from all kind of contamination. On the base of the provided check-up we can make conclusions:

- if dc resistance is about ∞ Ohm, it means that the heating spire is broken;
- if dc resistance is lower 5 Ohm, it means that the heating spire is in good running conditions;
- usually, the dc resistance of heating candles is lower 1 Ohm [2].

In addition, there is a method, which applies the measure of the power of a current. Check of the heating candles is provided with cold engine and completely charged battery of the accumulator, the voltage of 11, 5 V should be used. One also need have amperemeter of a constant current. One of its lead should be connected to the insulated wire, and the other to the «+» of the accumulator. The power of a current is measured using induction. Firstly, one should put amperemeter to the chain of the heating candle, then, turn off the wire from the detector of the cooling substance. After that, using the ignition key the heating candles need to be switched on maximum for 15 seconds period. And at last, the current is measured, it should constitute about 60 A.

The current of a one heating candle should be about 12 A. So, if we got value about 48 A, it means that one candle is broken, 36 A- damage of two candles, 24A- damage of three candles, 12A- all four candles are broken. In addition, if ampermeter display zero, absence of current consumption, it demonstrates the damage of all candles.

To locate the damaged candles, firstly the wire and the power lead should be turned off from the heating candles. Then, the wire of the tester is placed to the «+» clamp of the accumulator, and tester is placed to the every candle one by one. If the lamp of the tester will light up, the candle is in a good running condition. However, if the lamp of the tester will not light up, the candle ids broken and must be replaced [3].

Another widely used type of diagnostic equipment – engine testers [3, 4]. The different types of such testers are used for the diagnostic of the modern cars. These devices give opportunity to get different detailed parameters. The special features of these devices are scanners. The core feature of this equipment is П8В oscillograph, which give opportunity to transform personal computer (PC) into the oscillograph. In the process of diagnostic trough the scanners placed on a car information is transmitted to the control block, where it is processed by software of a car. Modern oscillograph register in memory of PC signals from one or several scanners, which are placed on engine. Special protocols of information transmission between control block and scanner is used. Afterwards, one can analyze, check or look through received information using software of the tester of engine. The advantages of such devices are obvious; they are simple and comfortable in everyday use. Moreover, there is no need to place additional wires or detectors.

3. The description of previously unsolved parts of the problem

We considered the main checking methods of the running order of the heating candles and we made next conclusions.

1. The first two methods are not practical. The main complexity of repair constitute in the location of the heating candles. Moreover, because of the close location of the fuel pump of high pressure near the heating candles, the assembling and disassembling of the candles are complicated. Still, even bad running condition of one heating candles negatively influence the start of the engine. The reliability of heating candles aggravate with time, so after five years there is possibility that inner heating spiral will broke down. The broken inner heating spiral is a very fragile and can easily break off. The remaining parts cannot be removed without special equipment and high qualified personal.

2. The third method is limited by the work capacity of the control block. In addition, there is possibility to get fallacious information, in case of breakage of the detectors or connecting wires. However, this method brings opportunity to avoid disadvantage of the first tow methods. Still, it increases work, time consumption and the total cost of the whole process.

There is no purpose to check other heating candles before each start of the engine. Moreover, there is no need to use all candles in different weather conditions. For example, in summer and winter time temperature of air and thus, of fuel is different. So, there is no need to use all heating candles in high temperature conditions.

For solving this problem we propose to use indicating block of running condition of heating candles of diesel engine. This system allows to control running conditions of each heating candle separately and to provide analysis of their running condition in different temperatures.

4. Goal and tasks of the research

The goal of this research was to develop system, which could control running condition of each separate heating candle and to test it in different extreme modeled conditions. So the next tasks were formulated:

- to develop electro scheme to control running conditions of each separate heating candle;
- to assemble the system;
- to test system it in different extreme modeled conditions.

5. Basic material and results

About the running conditions of the heating candles the indicator on the equipment panel will signalize. This indicator will shine, and after some time go out after the increase of the temperature of the heating candles, it is about 2 to 5 seconds, after this the engine can start up.

Directly before start of the engine heating candles disconnect. In some modern engines they can still work for a couple of minutes after start of the engine. The purpose is to decrease amount of harmful emission to the atmosphere during work of cold engine and for stabilization of process of combustion in not fully warmed up engine.

For this purpose the voltage does not stop completely, but decreases. For example, 12V during primary warming up, and after that 7V to support the temperature of the heating candle. Then one should switch off voltage completely [5 – 7].

The work of such system is not controlled by running order of heating candles. Moreover, such detector can light on, even when the safety device is broken and the relay of control of the heating candle did not work in order [8 – 10].

It was proposed to develop block of parallel connection (fig. 1), which includes the light indication of running order of each separate heating candle. This can be done with help of series connection, instead of the parallel connection of general bus-bar.

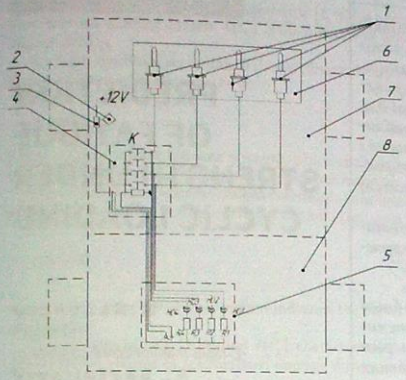

Fig. 1. The scheme of the system location: 1 – heating candles; 2 – hot-wire indicator; 3 – regular relay;4 – control block; 5 – control and indication desk; 6 – diesel engine; 7 – engine section; 8 – car salon

On the isolated slat we place bus-bar «+» power supply. Then we connect contactor for the four groups. The other end of wire we use as clamp for the next connection of heating candles. To regulate the number of working candles the clamps are switched on or opened. Moreover, parallel to each contact group the emitting diode with additional dc resistance (it can be resistor on 1OhM) is connected. Emitting diode is used as indicator of running order of heating candle. Such combination will be separate for each heating candle. The switch is also placed to the system. When startup of engine the switch is placed in position "switched off", heating candles are switched off too. This gives us opportunity to check running order of each heating candle separately. The emitting diodes should light on. When swathing to the position "switch on", the heating candles begin to work, during it we check the running order of relay, and look for work of heating candles. The emitting diodes should not light on. In addition, we propose to include condenser C, which give opportunity to work system, during startup of the engine when the voltage is decreases. The indicator is placed on the panel in the car for the convenience to control running order.

After considering all advantages and disadvantages of the system, it was distinguished that the developed model provides opportunity to control the number of working heating candles and their running order. Simultaneously, there is opportunity to control warming up of the fuel-air mixture in different temperature conditions. As result, the work period of heating candles is increasing, as there is possibility to combine and use one by one heating candles. Moreover, the obtained information about running order of heating candles provides opportunity to make accurate diagnostic.

6. Conclusion

The developed system is time saving and effective for check of running order of the heating candles. More over the system is very simple and convenient in exploitation, as emitting diodes and switch are placed in the salon of the car. In addition, there is opportunity to control of running order and warm up of fuel-air mixture; it is easily placed on the car and low-cost. And the time of exploitation is also prolongs.

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RESEARCH, DEVELOPMENT AND EMBODIMENT OF MULTIFUNCTIONAL VORTEX APPARATUS (p. 32-40)

Roman Galich

Despite the great number of publications related to the research and development of technological equipment with active hydrodynamic modes, little attention was paid to multifunctional vortex devices with cross-swirling flows (VDCRFC) with a cylindrical working box, having controlled active hydrodynamics and mode-design features, which enable to expand their functionality and apply them in many technological processes.

The article analyzes possible hydrodynamic conditions and characteristics of the embodiment of VDCRFC for the separation of solids, based on a mathematical model of hydrodynamics proceeding from the angular momentum conservation law, allowing with a sufficient accuracy to calculate and predict the main mode-design parameters and characteristics of the device at the design stage.

The article presents the results of theoretical and experimental studies, enabling to choose the most effective hydrodynamics and to embody constructively the vortex apparatus for specific processes, taking into account the specific characteristics of the latter.

The examples of alternatives of the embodiment of the vortex devices are given, depending on the functionality and features of the operating conditions

Keywords: vortex devices with cross-swirling flows (VDCRFC), active hydrodynamic regime; separation

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THE HEATING CANDLES CONNECTION-DISCONNECTION CONTROL WITH INVERSE CONECTION IN A PASSENGER CAR (p. 41-43)

Anatolii Vasylev, Stanislav Popov, Serhii Sokalskiy

The heating candles play important role in start-up of diesel engine especially in winter time. However, not enough attention is paid to the diagnostic process without usage of any additional equipment. For the first time the stationer diagnostic equipment is proposed.

This equipment is based on the control block of connection –disconnection of the heating candles; it obtains possibility to indicate the running conditions of the heating candles and it is located in the engine of a passenger car. The diagnostic equipment is located on the base of the connection group. It provides opportunity to monitor running conditions of all heating candles simultaneously and each one independently.

In this paper we present the electric scheme of the equipment and the procedure of it rigging into a passenger car. Moreover, the running condition in different temperature conditions is described. The method of disconnection of the diagnostic equipment in a summer time, when it is not needed, is proposed too. So, the usage of the diagnostic equipment, provides opportunity to increase time of heating candles exploitation and to decrease the time for the diagnostic process. In addition, convenient method of it usage is proposed: a light indicator is placed in a salon of a car, and gives opportunity to control running order of the heating candles during each start-up of an engine

Keywords: heating candles, diesel engine, indication of working order, diagnostics, operating mode, the connection-disconnectio

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PREDICTION OF FATIGUE STRENGTH UNDER CYCLIC LOADING (p. 44-47)

Mamed Akhundov, Alizade Seyfullayev, Afat Yuzbashiyeva

Main part of elements of constructions and machine parts operate under cyclic loading. Their working life cannot be determined on the basis of traditional criteria of strength, which generally do not take into account the process of the defectiveness, which is one of the characteristic and priority processes that occur under cyclic loading.

The article proposes an approach to the assessment of long-term strength under the cyclic uniaxial loading on the basis of the heredity theory of defectiveness. The advantages of this approach are discussed.

The analysis with the effect of the healing of defects was carried out.

An approximate formula for the critical number of cycles of loading to damage in the absence of the effect of the healing of defects was found.

This formula gives an estimate of long-term strength for the inhomogeneous one-dimensional stress state, determining the fatigue strength

Keywords: fatigue strength, cyclic loading, defectiveness, stress, creep, viscoelasticity, healing of defects, damage

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GEOMETRICALLY NONLINEAR LATTICE MODEL OF A CANTILEVER BEAM (p. 48-51)

Dmytro Kolesnyk, Alexander Shamrovsky

The article is devoted to the geometrically non-linear analysis of the bend of a cantilever beam under a uniformly distributed load. The objective of the article is to check out whether the developed discrete lattice model can be used for the calculation of large displacements in the problem of the bending of the cantilever beam under the uniformly distributed load.

The proposed discrete model is a combination of many elements of the lattice consisting of four pairs of nodes connected by six elastic connections with two stiffness, the influence of each of which was determined by the type of deformation, which allows modeling the arbitrary Poisson's ratio.

The calculation of the discrete model was carried out by the method of successive displacements. The paper considers two types of load of the cantilever: a load having a constant direction and a tracking load.

For both cases, the tables with the results of the calculation by the method of successive displacements in a dimensionless form are presented. In addition, the graphs of dependence of the dimensionless displacements on the dimensionless load are presented and compared with the results of other authors. The comparison showed a high degree of accuracy of the calculation using the proposed discrete model.

The results can be used for comparison with the results of other methods of solution of geometrically non-linear problems. In addition, the results provide an assumption about the effectiveness of the proposed discrete model for plane static geometrically non-linear problems of solid mechanics based on simplified beam theory.

Keywords: cantilever beam, load distribution, large displacement, discrete model, lattice model

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