The schematic diagrams of implementation of the technical means for extinguishing fires in the vehicles

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It was analysed the production of vehicles in the world, and the number of fires in transport. Proved insufficient efficiency of hand-held fire extinguishers during this type of extinguishing fires and proposes fundamental schemes of fire-fighting installations on vehicles.

Keywords: vehicle, setting fire fighting, fire.

The world vehicle fleet is constantly and rapidly increasing as it is seen in Figure 1, and the world production of vehicles is also increasing. Only in 2012, according to the statistical data of the World of Automobile Manufacturers (OICA), had produced over 84 million pieces of vehicles and about 75% of its are cars. According to the forecast by 2035, this number will double and reach 2 billion. The Ukrainian vehicle fleet also has an increasing tendency, the production of the Ukrainian vehicles is displayed in Figure 2.

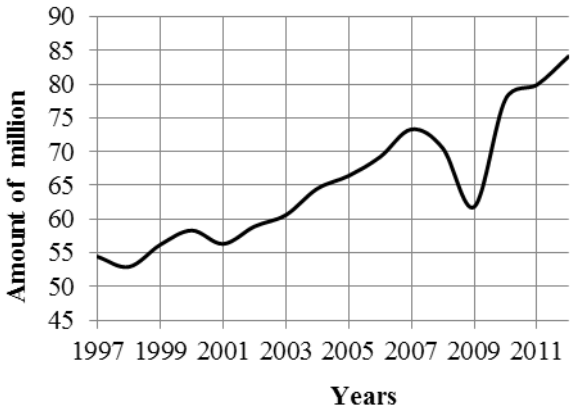

Fig.1 Production of vehicles in the world

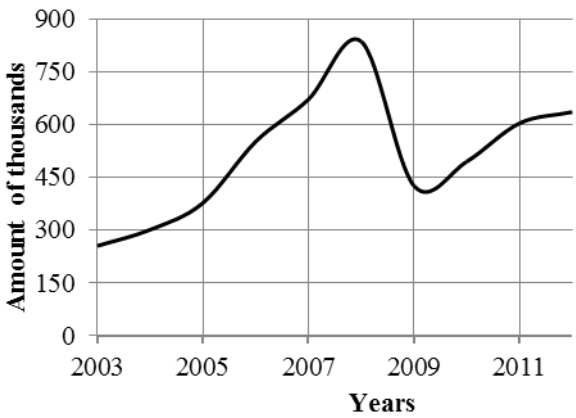

Fig.2 Production of vehicles in the Ukraine

However, the number of fires in the vehicles is also growing. According to the annual World Fire Statistics Centre CTIF, every year in the world occurs 1.1-1.2 million fires in all vehicles which comprises 18% of the fires, which killed 2,8-3 thousand people. So every year in the United States occurs 65 thousand of fires, which kill 600 of people, injure more than a thousand, material losses amount to $ 1.1 billion. [1]

On the territory of Ukraine for 9 months in 2013 there have been 48,344 fires, of which 2827 - on vehicles, accounting for 5.8% of the total, while 22 people were killed and 39 people injured. Among all the types of the vehicles very often burned cars (75.3%), trucks (11.3%) and buses (5.7%) [1].

It should be noticed that in Ukraine in 2013 the number of fires on vehicles has increased by 29% compared with 2005.

Of all the fires on the vehicles 86% comprise the fire passenger vehicles (cars, buses, trolleybuses) 7% - trucks and 3% the fire of the agricultural and engineering vehicles. According to the U.S. Fire Administration 65% of fires on vehicles occurs in the engine compartment and 12% in the dashboard and only 7% in the cabin. That's why the ensuring of the fire safety on vehicles is an urgent task today.

Based on the analysis of the sources [2-4] and others legal acts relating to the requirements of the vehicles, it was issued that their use is permitted only in accordance with the requirements of traffic safety, labor protection and the environment, and the availability of the completed and the working fire extinguisher.

However, the fire statistics shows that using of the fire extinguishers are not effective, because :

- *Insulation of space where the fire occurred (motor , fuel , luggage compartment);*
- *Inaccessibility to local fires as a result of blocking the doors, hood, which is typical during an accident when the body of the vehicle is deformed;*
- *Rapid development of fire and as a result difficulty , and sometimes impossibility to use a fire extinguisher in the initial stage of combustion ;*
- *The inability to use a fire extinguisher in case of the fire during driving , and in the absence of the driver when the vehicle is parked in parking lots.*

The most common causes of the fires in vehicles during their operation are the malfunction of the fuel system and the on-board power supply. Seldom the fires arise as a result of the fire tightness of the elements of hydraulic equipment and exhaust systems of the engine. The fires during the operation of the vehicles comprise the increased danger not only for passengers but also for environmental objects. If there is a fire in the engine compartment while driving of the vehicle, the combustion products can enter the salon and lead poisoning before the driver stops the vehicle to evacuate passengers.

Nowadays there are no legal acts and documents that would have required manufacturers to equip the vehicle with the detection systems and fire extinguishing during their operation. Also there are no standardized documents for their designing. That's why the selection, the placement of the elements of the detection and extinguishing fires in vehicles must carry guided design methodologies and the experience that you've got in this field.

In general, the system of the detection and the fire extinguishing can be realized in two structural schemes. The first scheme includes the sensor detecting combustion (fire detector), the manual start and radio-controlled remote start button which is switched in parallel, and the fire suppression module (Fig. 3).

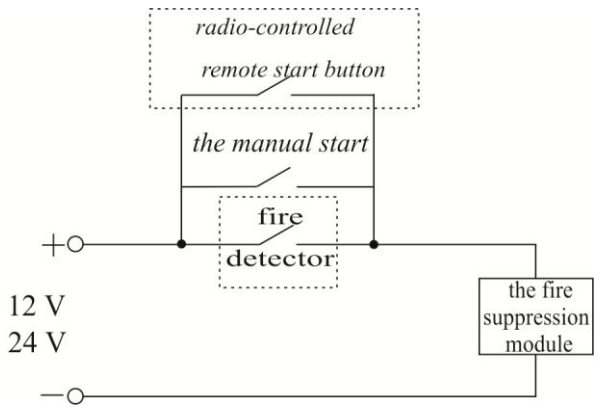

Fig. 3. The organization chart 1 of the realization of the system ditection and extinguishing fires of the vehicle.

In case of fire, the closure of an electrical circuit occurs either automatically with the help of the fire detector and manually or remotely by using the manual start button or radio-controlled remote start. As a result, of the contact closure enabled parallel switching elements is energized 12 volt or 24 volt for locking and starting device that triggers the extinguishing module.

The second organization chart (Fig.4), in addition to the fire detector, the manual start and radio-controlled remote start buttons contains fire alarm control panels (FCIS), communicator, alert system and power supply. The parallel switching elements are turned on continuously provide the information on fire alarm control panels that analyzes it, and in case of fire, delivers current to the starter locking device that triggers the fire suppression module. Also control panels device with the help of the communicator which transmits the information to the remote central observation (ARC) fire coordinates the location of the vehicle. This greatly increases the efficiency of message and eliminates the human error in the case of a fire or accident, which can reduce the time of arrival of the rescue services. Besides the fire alarm control panels includes extinguishing system notifications (CO) as an audio signal and controls the state efficiency of all the system units.

Electric power supply as in the first and in the second case accomplished from the on-board electrical network of the vehicle. Also necessary to provide additional power supply circuits from the backup battery, that is the most secure place.

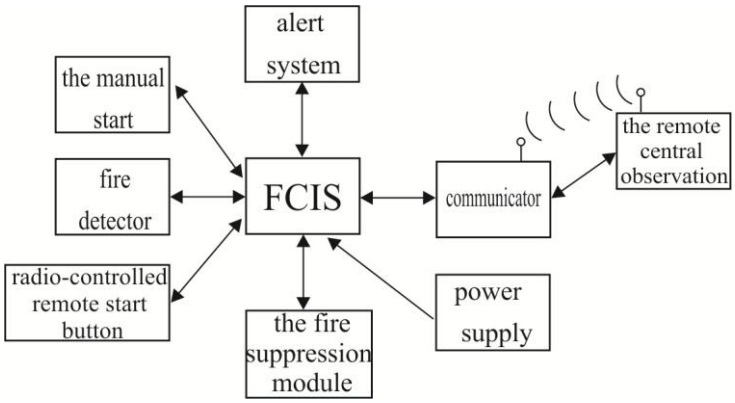

Fig.4. Organization chart 2 of the realization of the system detection and extinguishing fires of the vehicle.

Conclusions:

1. *Fires in vehicles over the years grow and attract public attention, leading to the human and significant material losses, which create a need to develop measures to prevent the occurrence of fires and for their prompt extinction.*
2. *Whereas extinguishers installed in vehicles is not effective, requires the development of other technical solutions that would ensure a rapid and effective fire fighting.*
3. *Based on the analysis of available technical tools and solutions there were proposed structural schemes of systems to detect and extinguish fires in vehicles.*

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Принципиальные схемы реализации технических средств для тушения пожаров на автотранспортных средствах

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Проанализированы производство транспортных средств в мире, а также количество пожаров на транспорте. Обоснованно недостаточную эффективность использования ручных огнетушителей при тушении данного вида пожаров и предложены принципиальные схемы реализации установок пожаротушения на транспортных средствах.

Ключевые слова: транспортное средство, установка пожаротушения, пожар.

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