HUMIDIFIERS AIR FOR AN INTERNAL COMBUSTION ENGINE

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It is known that one of the ways of increasing the efficiency of internal combustion engines are adding water to the fuel before combustion in the cylinders of the engine. This improved energy, economic and environmental performance of the engine.

There are many ways of adding water to the fuel. The main ones are - direct injection of water, creating fuel-water emulsion and its use, or adding water to the fuel vapor. However, they all have their drawbacks - it costs more energy when adding water to the fuel use of expensive distillate, and more. This paper proposes an air humidifier duttovoho through the use of heat engine cooling, which can work on nedystylovaniy water.

The purpose of research - creation device for humidifying the air in duttovoho ICE, which eliminates the main drawbacks of existing methods of adding water to the engine.

Materials and methods of research. The methodology of the study is a comparative analysis of existing methods of adding water to the fuel in internal combustion engines, as well as a pilot study suggested duttovoho air humidifier for ICE.

Adding water to the fuel before combustion in the cylinders of reciprocating engines is one of the known ways of increasing the efficiency of the engine. This improved energy as well as economic and environmental performance of the engine. The presence of water in the fuel-air mixture leads to its active mixing in the ignition and combustion of the mixture. Resulting in increased contact area of fuel and oxidant and thus increases the rate of combustion and heat released during combustion per unit time, that increases engine power. The increase in engine power at a constant rate of compression results in increased speed of the motor shaft and thus to an increase in fuel consumption. That is, in this case, an increase in engine power is accompanied by additional fuel consumption and improved only energy and environmental performance of the engine.

Adding water to the fuel increases its detonation resistance, thus improving the compression of the fuel-air mixture and thus increase engine power without additional fuel consumption. The growth of electric power in addition to 20% of water is about 10-15%. In constant compressed adding water to the fuel allows you to get economic benefit by switching to fuel with lower octane, which is a cheaper fuel.

Significant increase in octane number fuel reduction is explained by some authors temperature combustion of fuel-air mixture by evaporation of water added. Other authors attribute the Anti-knock properties of water not only to the lower temperature of the process, but also with the direct participation of water in the combustion process. The water in certain concentrations inhibits the development of chain reactions peredpolum'yanoho oxidation of hydrocarbons. Between peroxide radicals and hydroxyl group formed hydrogen bonding of water. This radical activity is reduced, and this in turn increases the stability of detonation fuel mixtures.

Also, adding water to the fuel improves environmental performance of the engine - reduced emissions to the environment, reduces the concentration of nitrogen oxides and carbon formation. Experiments for pure isooctane and isooctane 10% - tive water content, for example, show that such water content in the mix amount of CO in the exhaust gases of the engine falls to 6% NOh - 8%.

There are some ways to add water.

1. Injection of water in duttove air, fuel and air mixture or directly into the cylinders of the engine.
2. Preparation of the fuel-water emulsion and its subsequent use as fuel.
3. Conversion of water and add a couple of pairs to air or fuel-air mixture.

Each of the above methods of adding water to the fuel has its drawbacks.

In terms of performance engines with injection water are not entirely stable. This is due to the uneven distribution of water in the cylinders of the engine. In addition, the water drops more than 5 microns, which fall into the engine cylinders do not have time to evaporate during combustion and carry out the bombing of the working surfaces of the cylinder-piston internal combustion engines, leading eventually to their physical deterioration.

The use of fuel in a fuel-water emulsions allows to circumvent these difficulties. But there are others. Cooking fuel and water emulsion requires the use of surface-active agents (surfactants) for metastable emulsion of two substances have different densities. Even brief use of such emulsions as fuel leads to deposits on the surface of the cylinder-piston, causing sticking piston rings and, eventually leading to engine failure. In addition, surfactants and their degradation products should be non-toxic and does not reduce the stability of detonation fuel. These additional requirements complicate the already difficult task of creating a stable fuel-water emulsions. Therefore, attempts to prepare emulsions car immediately prior to use: dispersant developed onboard devices to using hidrorozpylyuvachiv or ultrasonic generators obtain a dispersion medium droplets smaller than 5 microns. However, due to significant differences in the density of fuel and water completely dispense with the use of surfactants in the preparation of the fuel-water emulsion can not. The engine to the failure of this increases, but it can not get rid of fat.

Considering the effects of adding water to the fuel, and it should be noted that in both cases applied distillate, which is due to the receipt of additional significant energy consumption and the availability of appropriate equipment. Therefore, replacement of the fuel with water makes the corresponding fuel economy as to produce distilled water is also required to spend a certain amount of fuel. If you use nedystylovanu water, then the cost of its recommended to add to the fuel dissolved salts must necessarily lead to the formation of carbon deposits in the combustion chamber and serious disturbances in the engine after 100-200 hours of work. After the burning of 10 liters of fuel to the engine is brought to 2 liters of water, and with it, 200 mg of various salts. In order to prepare the fuel-water emulsions as well as to obtain the required pressure in the injection of water also have to spend extra energy. Therefore, in both cases, talk about significant fuel savings by replacing part of the fuel with water is not necessary.

Most of the disadvantages of the use of water, while maintaining its positive effects on the combustion process can be eliminated if we use water as water vapor. In this case, the cylinder will not get water particles greater than 5 microns, the distribution of water in the fuel mixture more uniform, which provides stable and

reliable operation of the engine. Also, no need for South Africa and, accordingly, no deposits in the engine associated with them. In addition, the use of moist air does not lead to salt deposits in the cylinders of the engine, which positively affects its trouble-free operation. But the use of water vapor requires high energy costs associated with a significant magnitude of latent heat of vaporization of water (about 2500 kJ / kg) and corresponding steam generating equipment.

Another thing, when water vapor for a part duttovoho moist air is thermal waste energy engine - coolant heat or heat exhaust. In this case, the addition of water to the fuel does not require additional energy. Designed duttovoho air humidifier is a contact heat exchanger in which the bottom of the water is heated in a tubular heat exchanger protytechiynomu from the engine cooling system, in the middle of heated water enters the shell side simple, which is absorbed through the slotted holes in the air cylinder piston engine is taken from the environment through the filter. The amount of air that goes to the wetting is adjusted with the throttle. In the annulus is bubbling air through the heated water, so that the air is heated and humidified. The upper contact heat exchanger humidified air passes through krapleulovlyuvach and served in the air-inlet tube, and then - through the inlet valve in the engine cylinders.
Chilled water flows through the central tube to the bottom of the contact heat exchanger, where he again falls into the tubular heat exchanger, which is heated by the engine cooling system. The driving force for water to moisten the air, there is a difference of density in the central tube and annulus where it moves with the air bubbles.

In humidifiers for ICE provides:

1) continuous feed moisture evaporated water by means of the water level 9;

2) periodic draining waste water through a suitable valve 10 at the bottom of the contact heat exchanger;

3) regulate the amount of moisture in the air that is sucked into the engine cylinders, through the creation of a parallel flow nezvolozhenoho air is mixed with the main stream of moist air.

Number nezvolozhenoho air is adjusted with the throttle 11 depending on the mode of the engine and the type of fuel used, in order to obtain the highest efficiency of internal combustion engines.

To add fuel to the water in an amount of 20-25% is sufficient to heat the air in contact duttove Heat Exchanger 10-15 degrees respectively. For example, if the heat exchanger inlet air temperature is 20 ° C and relative humidity of 60%, it is enough to have the output - 30 ° C and 90% (respectively) to get adding water to the fuel in the amount of 23% (taking into account the fact that the combustion of 1 kg of gasoline to about 14.7 kg air). Due to the parallel flow nezvolozhenoho air can adjust the amount of fuel added to the water from 0 to 23%. Thus the overall cost of heat for humidification not require additional fuel. To heat the water that hydrates used the heat of the engine cooling system. Additional hydrodynamic resistance of air absorbed, less than 2 kPa. Moreover, to moisten the air duttovoho water can be used almost any degree of contamination, ie no need for an expensive distillate.

Presented duttovoho air humidifier was installed on a mobile vehicle VAZ 2101 with an engine cylinder capacity of 1200 cm3.

Results. Adding fuel to the water in an amount of 15-25% by air humidifier duttovoho allowed without processing engine switch to gasoline A-76 instead of the AI-92, which is required in accordance with the instruction manual. The average cost of fuel per 100 km using gasoline AI-92 without wetting and the use of gasoline A-76 with humidifying air duttovoho and cost savings (in UAH and percentage), which can be obtained by replacing a fuel other taking into account their current value.

The use of air humidifier air allowed to use the car VAZ 2101 instead of gasoline AI-92 fuel with lower octane. This detonation in any engine operating modes were observed. Average fuel consumption decreased by only 2,5-4%, but due to the lower cost of low fuel savings could reach 8,7-10% when adding water to the fuel in an amount of 15-25% .Chas Acceleration to 80 km / h at use AI-92 gasoline with no moisture and A-76 with moisture was almost the same, ie the use of wet fuel with lower octane have resulted in a reduction in engine power.

Conclusions

1. The proposed humidifier air or ICE allows you to add water to the fuel without additional energy costs by utilizing the heat of the engine cooling.

2. The proposed air humidifiers duttovoho water can be used almost any degree of contamination, thus there is no need to use expensive distillate.