UDC 621.43.045

V.M. Mel'nick, d.t.n. (Igor Sikorsky KPI)
V.V. Karachun, d.t.n. (Igor Sikorsky KPI)
S.V. Fesenko, PhD (Igor Sikorsky KPI)

Forming pillars of volts using configuration of Cassini ovals

It analyzes the possibility of increasing the surface of an electric discharge in the ignition devices of a working mixture of internal combustion engines. The change in the shape of the lower end of the central electrode of the plug of ignition from the plane to the current, carrying the ovals of Cassini.

Research relates to engineering, in particular to the electrical equipment of internal combustion engines, namely to the ignition devices of the working mixture.

During the compression stroke, the seal of the working mixture appears in the engine cylinder that serves to increase the pressure and temperature. When high voltage is applied to the central electrode, ionization of the spark gap begins. At some point in time, a breakdown of the spark gap occurs.

The spark discharge current has a high temperature, which leads to the formation of a plasma ball and the ignition of the working mixture. Burning develops only in the internal cavity of the spark plug.

At the end of the compression stroke, the spark plug fires the accumulated thermal energy in the form of a powerful expanding plasma torch. When the torch reaches the center of the chamber, the combustion spreads symmetrically and fairly quickly.

The disadvantage of this technical solution is that the combustion of the mixture arises asymmetrically and on an elongated trajectory, and in the case of a spark discharge a considerable fraction of the energy is expended on radiation and the formation of a shock wave. This spark plug design does not allow the efficient use of spark energy, since its part is dissipated in the volume of the combustion chamber of the engine. This reduces the energy potential of the spark plug in the understanding of rapid and qualitative ignition of the working mixture, in turn, does not allow to create a reliable ignitability of the working mixture in the combustion chamber.

The technical solution is based on the task of reducing the necessary power of the electric current supplied to the spark plug and, at the same time, increasing the spark gap by changing the shape of the surface of the lower end of the central electrode, which will increase the engine power and reduce emissions to the atmosphere, eliminate premature electrochemical destruction of the electrode surface, and also eliminates the threat of detonation.

A known spark plug comprising a body with a side electrode, an insulator with a central electrode installed in its central opening, the end of which forms a spark gap with the side electrode, and a nozzle connected to the body, which has an internal, outwardly widening conical surface, and a channel for the side electrode, The nozzle is fixed in the central opening of the body and the side electrode is located outside the nozzle, the end of the side electrode that forms a spark gap located on the attachment that contains no ventilation apertures [1,2].

The drawback of this technical solution is the inexhaustible maximum engine power. Improvement of the spark plug for internal combustion engines is possible by increasing the spark discharge potential of the spark and forming zones of thermal energy concentration [3].

The technical realization of the optimum surface of a cylindrical voltaic pile on the surface of curves of the fourth order is analyzed in. The possibilities of semi-automatic regulation of the ignition system by the driver in the car interior are revealed [4].

The essence of the technical realization is change of the surface of the lower end of the central electrode from the flat to the current-carrying "CASSINI" ovals. Due to this technical realization, the surface of the electrical discharge is formed as a set of cylindrical voltaic piles with a cross-section in the form of "CASSINI ovals", which makes it possible to create two additional axes for the concentration of thermal energy, to increase the spark gap and thereby increase the efficiency of the flammability of the working mixture.

The spark plug is used to ignite the working mixture in internal combustion engines and contains a body 1 with a cavity 2 in which a central electrode 3 is disposed shielded from the body by an insulator 4 (Fig. 1). The side electrode 5 is welded to the outer surface of the body 1, which forms a spark gap δ with the end of the central electrode in the form of current-carrying "CASSINI" ovals 6, 7, 8 (Fig. 1, Fig. 2).

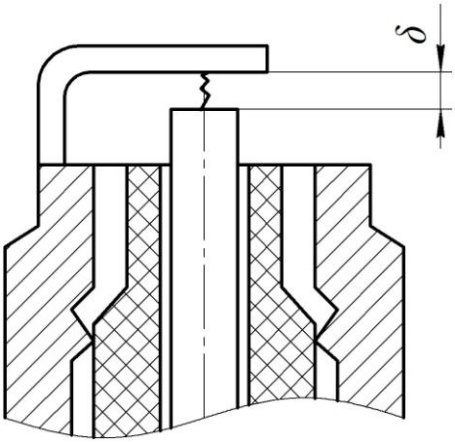

Figure 1. Spark plug

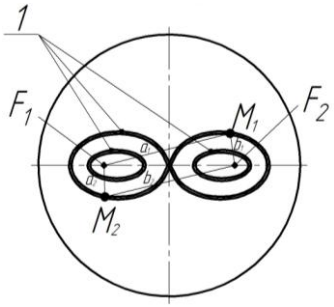

Fig. 2. Spark plug with Cassini ovals

When the working mixture of the combustion chamber of the engine is filled during the compression stroke, a high voltage pulse is fed to the central electrode 3, where its lower end is formed to increase the electric discharge surface in the form of a set of cylindrical voltaic piles with a cross section in the form of "CASSINI ovals," and also create focal Axis F_1 and F_2 of the thermal energy concentration, additionally serves the flammability of the working mixture.

Thus, the use of the claimed spark plug will, with the help of new properties,

significantly increase the surface of the poles, create two additional focal axes for the concentration of thermal energy, reduce the required amount of electric impulse and increase the spark gap, dramatically increase the efficiency of flammability, and, as a result, lead to the complete combustion of the working mixture and a significant increase in engine power, as well as reduce emissions into the atmosphere and eliminate premature electrochemical electrode surface and the engine detonation.

The technical result achieved with this design makes it possible to increase the efficiency of the fuel's flammability, and as a result, to ensure complete combustion of the working mixture, to increase the engine power as a whole, and to reduce emissions of harmful products into the atmosphere due to a more complete combustion of the working mixture. A decrease in the power of the electric pulse applied to the spark plug will eliminate premature electrochemical destruction of the electrode surface and detonation. Conditions are created for further automation of the regulation of the electrical equipment of the engine. The spark plug serves as the basis for creating a digital integrated transport technology in the form of a controlling intelligent system of state sensors that autonomously selects the most economical cruising or force majeure mode of an internal combustion engine and does not require additional maintenance of electrical equipment at a maintenance station.

Conclusions

The technical result achieved by using this design allows to increase the flammability efficiency, and as a result, the complete combustion of the working mixture that will increase the engine power as a whole and will reduce emissions to the atmosphere due to a more complete combustion of the working mixture. A decrease in the power of the electric pulse applied to the spark plug will eliminate the premature electrochemical destruction of the electrode surface and the engine detonation.

It is not superfluous also the possibility of operative regulation of the ignition system in semi-automatic or automatic mode. A sudden change in meteorological conditions, a change in fuel structure, and other undesirable factors that reduce engine power and increase emissions to the environment, with the presence of suitable sensors will automatically switch the spark plugs to the desired "CASSINI oval".

References

1. Bugaets, E.S. Spark plugs (testing spark plugs G01M 19/02). Russian Federation Patent No. 74524. 27 June 2008.

2. Akimov, S.V., Chizhkov, Y.P. (2004). Electrical equipment of automobiles. Moscow, Russia: ZAO "KISI" Driving ".

3. Mel'nick, V.M. (2013). Management area of spatial concentration of spark plugs electricity electrode. Praha, Chez Republic: "PREDNI VEDECKE NOVINKY-2013", 46-50.

4. Mel'nick, V.M., Karachun, V.V., Shybetskiy, V.Y. Spark plug. Ukrainian Patent No. 85 151. 11 Nov. 2011.