

#### 4. The analysis of experiment outcomes

The conducted experiments, first of all, have revealed high detonative stability of the recommended CC. In fig. 3 there are the curves of adjusting characteristic on ratio of mixture of a single-cylinder engine taken off the serial and newly designed CC at application of cylinder heads. As follows from this picture, if serial CC of ordinary V-formed shape gives its maximum indexes at compression ratio ( $\epsilon=8,2$ ) by activity only on high-octane gasoline АИ-93 (octane value 93), but newly designed CC allows undetonative engine run on low-octane gasoline А-76 (octane value 76) even at the enlarged compression ratio ( $\epsilon=8,9$ ).

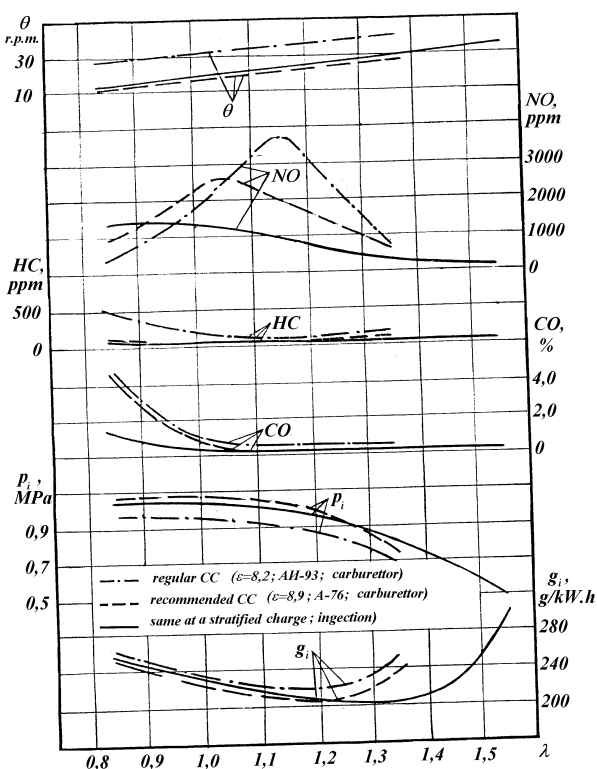


Fig.3. The dependence of specific indicated fuel consumption ( $g_i$ ), mean indicated pressure ( $p_i$ ), emission of some pollutants CO%, HC, NO and advanced ignition angle ( $\theta$ ) on fuel-air ratio ( $\lambda$ ) in single cylinder engine

As it is obvious, in this case on all ranges of the change of air fullness indexes ( $\lambda=0,9\div 1,35$ ) decrease indicator specific fuel consumption and increase of medium indicated pressure  $p_i$  are observed. It is connected with increase of compression ratio and acceleration of the process of combustion due to vortex motions in CC, and also by turbulized effect of the additional camera stipulating high cyclic stability (see fig. 4) and entirety of combustion of the mixture. The latter is confirmed by the data about the structure of EG: as it is seen in fig. 2, the concentration of HC and CO in this case is much lower. The fact that

intensive formation of NO is not observed in these conditions is remarkable.

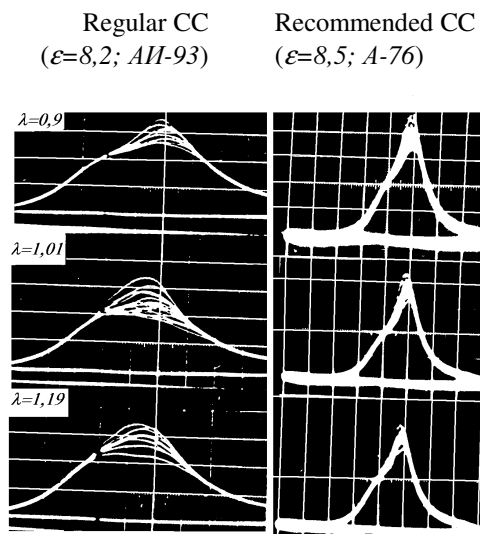


Fig.4. Comparison of indicator diagrams ( $n=2000 \text{ min}^{-1}$ ;  $\eta_v=0,82$ )

The maximum level of exhausting NO takes place at rather rich mixtures and does not correspond to the mode of high profitability ( $g_i \text{ min}$ ). It is also rather relevant advantage of the considered CC. It is explained that the formation of two opposed spinned vortexes, rotating intensity of which is speeded up under influence of a turbulent plume of burning gases at the final stage of combustion process, promotes reduction of a common duration of combustion of the mixture. It allows essentially to lower a required value of advance angle of ignition  $\theta$ , that causes lowering contraction, both products of combustion and circumferential mixture in accordance with combustion of the charge. Under the given circumstance the temperature of products of before burned out part of the charge rises little, i.e. the influence of the Mach-effect becomes minor. It eliminates one of controlling factors for rough progressing of oxidizing reactions of azote which is flowing, basically, behind flame front after completion of the reaction of hydrocarbon combustion.

In fig. 2 it is also seen, that the highest technical, economic and ecological indexes of the engine are gained at the stratification of the mixture achievable by implementation of injection of gasoline in an induction pipe.

In a fig. 5 the velocity characteristics of a engine are rotined outwardly - at application nominal ( $\epsilon=6,8$ ) and designed ( $\epsilon=9,15$ ) combustion chamber. As the maximum engine capacity is visible at  $n=4500 \text{ min}^{-1}$  with the upgraded head of the unit on 4 kW more, than with the production head, and the value of a torque is more on  $5\div 8 \text{ Nm}$  in a range  $n=2500\div 4500 \text{ min}^{-1}$ . On all velocity modes some lowering

(approximately  $5 \div 7$  g/kW.h) effective specific consumption of fuel  $g_e$  is observed also.

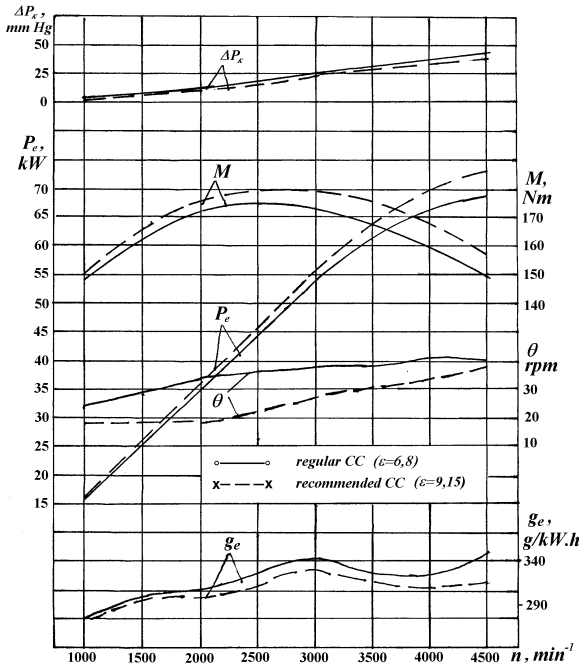


Fig. 5. The velocity characteristics of a engine UMZ-417 with carburetor K-151

Fig. 6 shows the change of concentration of toxic components of EG under the outwardly - velocity characteristic of the engine UMZ-417, from which it is visible, that the recommended CC provides essential reduction of all toxic components (specially NO).

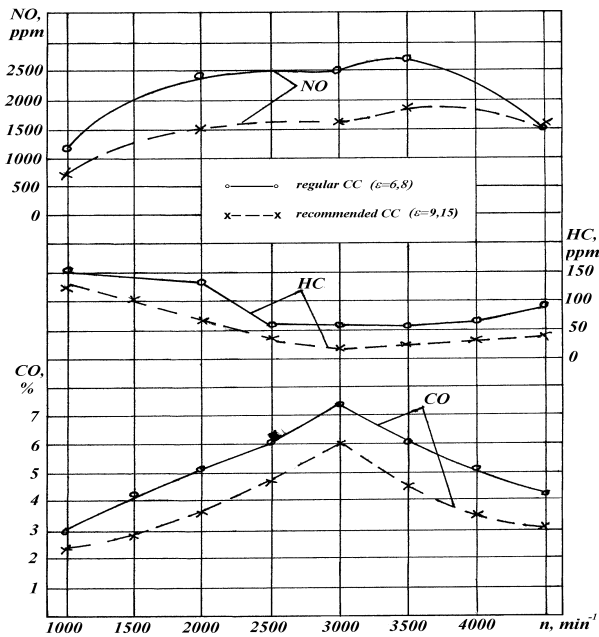


Fig. 6. The change of concentration of toxic components

Fig. 7 shows the characteristics of idle motion of the engine UMZ-417, which were taken off at application of different heads of cylinders on the same carburetor K-151. As it is visible, the application of recommended CC provides lowering consumption per hour of fuel  $G_f$  idling with rise of rotational speed of a crankshaft  $n$ . At minimum rotational speed ( $n \leq 800$  min<sup>-1</sup>) the consumption of fuel has turned out practically identical. However on these modes the fall-off of concentration both CO and HC is observed. So, for example, at  $n = 800$  min<sup>-1</sup> the concentration of carbonoxide (CO) is reduced from 2 % up to 0,2 %, and not burned-out hydrocarbon HC - from 400 up to 80÷90 ppm.

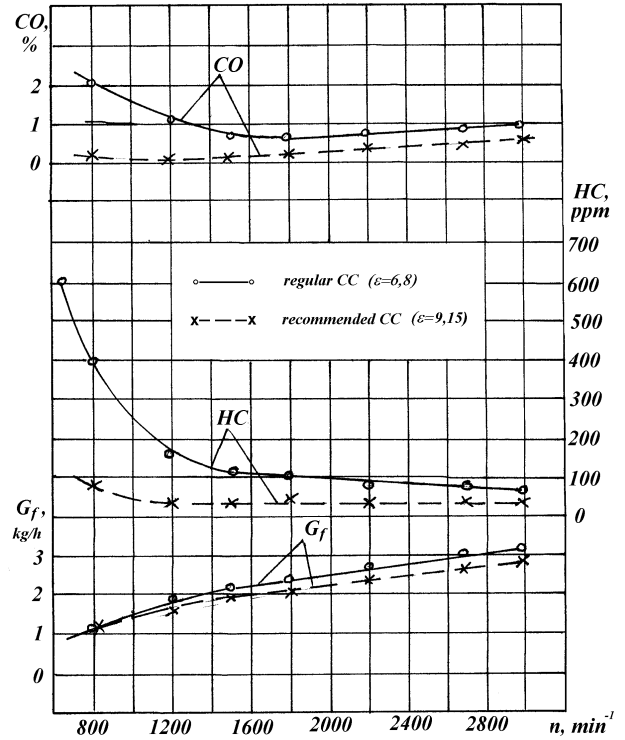


Fig. 7. The characteristic of idle motion of the engine

It is known, that main defect of petrol carburetor engines is that the ejections of CO and HC in idle operational mode become high. Thus, the designed CC allows successfully to solve this problem.

Summarizing the outcomes of comparative bench test of the engine UMZ-417, it is possible to conclude that the application of the considered CC in serially produced automobile engines, for what it is not required radical change of constructions of a engine and carburetor, and also the renovations of an existing production equipment, provides with essential improvement both technical, economic and ecological indexes of automobiles.

## 5. Conclusion

By comparative bench tests of the engine UMZ-417 in a package with the carburetor K-151 with factory regulation and two versions of heads of cylinders: by serial CC ( $\epsilon=6,8$ ) and mock-up sample of the designed CC ( $\epsilon=9,15$ ), is determined that at application the new CC:

- the minimum value of effective specific consumption of fuel on a load characteristic is reduced from  $g_e=225$  up to  $210 \text{ g/kW.h}$ . Lowering specific consumption of fuel is observed in all range of the external velocity characteristic approximately on  $7\div 8\%$  (is observed at  $n=2500 \text{ min}^{-1}$  with  $g_e=240$  up to  $230 \text{ g/kW.h}$ );
- the maximum engine capacity at  $n=4500 \text{ min}^{-1}$  is  $4 \text{ kW}$  more ( $P_e=73$  against  $68 \text{ kW}$ ), the value of a torque is more on  $5\div 8 \text{ Nm}$  in a range  $n=2500\div 4500 \text{ min}^{-1}$  as well;
- at all velocity and load engine power settings the reduction of all toxic components of exhaust gases is observed. The reduction of concentration of CO on outwardly velocity

characteristic compounds: CO - from 5 up to 3,5 % (at  $n=2000 \text{ min}^{-1}$ ), HC - from 130 up to 70 ppm, NO - from 2500 up to 1500 ppm. Especially major scoring takes place on an idling: at  $n=800 \text{ min}^{-1}$  concentration of CO is reduced from 2 % up to 0,2 %, and HC - with 400 up to  $80\div 90 \text{ ppm}$ .

## References

1. Mehdiyev R. Internal combustion engine with stratified charge. «Archivium combustions», vol. 17 (1997) No. 1-4 p.p. 47-55.
2. Mehdiyev R, Wolanski P. Bi-Modal Combustion Chamber for a stratified Charge Engine. «SAE techn. pap. ser.», 2000-01-0196, 9 p.p.
3. Spicher U., Kollmeier H.-P. Direktion of flame propagation during knocking combustion by optical fiber diagnostics. «SAE Techn. Pap. Ser.», 1986, No. 861532, 12 p.p