Topics of Research and Main Results

The new class of the Suspensions is based on the new method of the sprung mass oscillation damping and as well as on the new method of the stabilization of the dynamic forces acting through the suspension to the sprung body of the Vehicle.
For understanding the gist of these methods it is sufficient to scrutinize the diagram in ***Fig.l,*** where the Amplitude-Frequency Characteristics of the sprung body vertical acceleration in the dimensionless form are shown. Line 1 corresponds to the springy suspensions, which are conditionally considered low damped. Line 2 also refers to the elastic suspensions but the latter is conditionally considered powerfully damped.

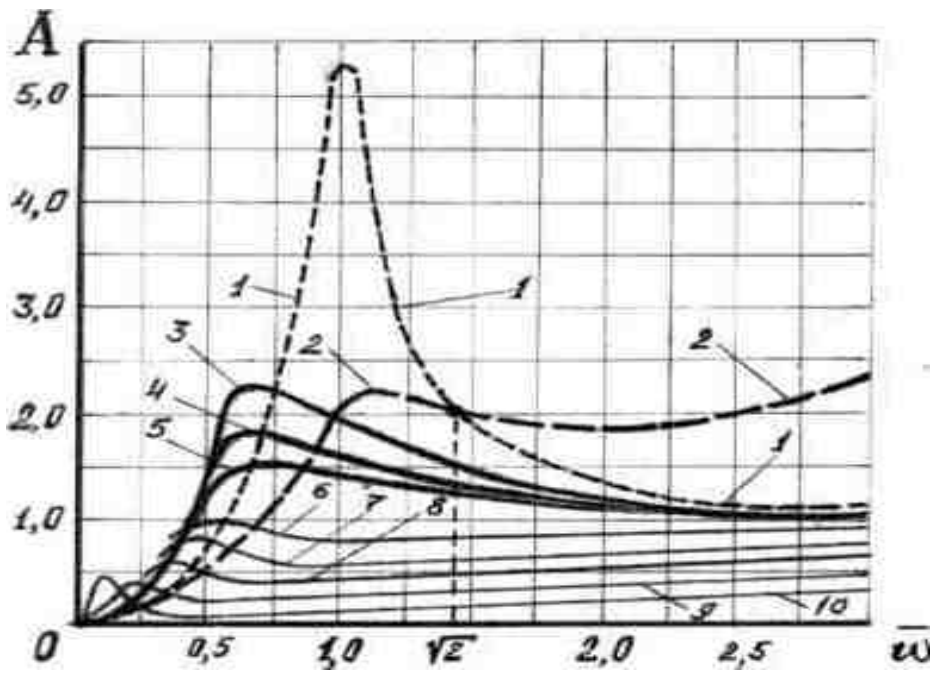

Fig. 1. The sprung body accelerations Amplitude-Frequency Characteristics of some suspension schemes in the dimensionless form.

These two lines demonstrate the main contradiction or main defect of the modern hydraulic shock absorber:

- it decreases the sprung body oscillation amplitude **A** at the relative frequency **ω** range from **0** to $\sqrt{2}$, that's the most important positive quality of the shock absorber;
- it increases the oscillation amplitude A at the relative frequency **ω** range from $\sqrt{2}$ to an infinity, that's the very unfavourable effect of the shock absorber to the ride smoothness.

Under existing conditions the above-mentioned hydraulic shock absorber contradiction is unsolved. However Sharapov's method of the sprung mass oscillation damping will make it possible to create the new damping device without the aforesaid main shock absorber contradiction. As a result the sprung body vertical acceleration characteristics assume the appearance in ***Fig.l*** by lines 3, 4, 5.

This damping method solves the main contradiction of the hydraulic shock absorber. So, the possibility to decrease the oscillation amplitude at the frequency range from 0 to the infinity is becoming real. The energy supply from an additional source is not needed for this method.
The theoretical fundamentals of the new damping method are described in [1,2] and the constructive suspension schemes are expounded in monograph [1] and in the Invention descriptions [5,8].
The above-mentioned damping method without an ordinary hydraulic shock absorber can improve the ride smoothness by itself. But joint employment of this method with the new stabilisation method of the dynamic forces acting through the suspension to the sprung body can raise the ride smoothness of a Vehicle to the new high-quality level.
The amplitude-frequency characteristics of the sprung body accelerations with the active suspension in dimensionless form are presented in ***Fig.l*** by curves 6, 7, 8, 9, 10. The lines 6-10 represent the active suspensions by means of a different amplification factor of the automatic control system. The additional energy source is required for realization of this stabilization method.
The publications [1, 5, 6, 7, 8, 9, 10] are dedicated to the technical realization of the optimal control in the Vehicle active suspension.
The real physical analog of the single-axial transportation mean with the active suspension has been made by the author of this method. The laboratory tests of this analog have demonstrated the good convergence of the theoretical and experimental results.