УДК 62.82

COMPARISON OF CONVENTIONAL AND HYDROPNEUMATIC SUSPENSION VEHICLE

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The suspension is designed to provide elastic links between the wheels and the body of the vehicle due to a perception of actors and damping of oscillations. Suspension is a part of the car chassis.

For comparison, we`d like to consider the MacPherson suspension and hydro pneumatic suspension.

Two of the most popular suspensions systems for passenger cars today are the double wishbone suspension system and the MacPherson's strut suspension system. While it is more usual to see the double wishbone system at the rear end of the car, MacPherson's solution normally finds its place at the front end of the car. Both types of suspensions have their own sets of benefits and limitations, thus let us look at both the advantages and disadvantages of both systems, starting with the simpler of the two, the MacPherson struts.

MacPherson Struts are designed with more simplicity, and thus take up less space horizontally. As a result, passengers get more compartment place in the car. They also display low un-sprung weight, an advantage that reduces the overall weight of the vehicle as well as increases the car's acceleration. Lower un-sprung weight also makes your ride more comfortable. Another major advantage of this system is its ease of manufacturing as well as low cost of manufacture compared to other stand-alone suspension systems. Without an upper arm, the suspension system designers can directly block vibration from reaching the passenger compartment.

Nevertheless, the MacPherson struts come with their own drawbacks. Being a long, vertical assembly, you would encounter difficulties if you lower your car as they may be collision with the structure of your car. Thus they do not work well with racing cars that are normally lowered. The MacPherson struts also have problems working with wider wheels that have increased scrub radius, where you would need extra effort to navigate your car in this situation. There is also the problem with the small camber change with vertical movement of the suspension, which could mean the tires have less contact with the road during cornering. This could reduce handling abilities of your vehicle.

McPherson suspension has the following device :

-subframe ;
-wishbone ;
-knuckle ;
-shock absorber ;
-anti-roll bar .

MacPherson had originally intended his strut suspension design to be used on all four wheels. For cost reasons, many production models have MacPherson struts only on the front wheels. In 1957, Lotus's Colin Chapman developed a very similar strut-type rear suspension for the Lotus 12 Formula Two racers, as well as the subsequent Lotus Elite production cars.

As a result, rear strut suspensions are often (somewhat unfairly) called Chapman struts, rather than MacPherson struts, although the designs are basically identical.

Curiously, the MacPherson strut wasn't used on any domestic Ford products until the 1970s. Another of MacPherson's achievements, however — front suspension ball joints, replacing the traditional kingpins — was adopted in the mid-fifties, and became universal on American cars by the end of the following decade. (MacPherson didn't invent the ball joint suspension, which was largely the work of Ford supplier Thompson Products, but he was responsible for the design making it to production, which many contemporary engineers had thought impractical.)

Thanks to these successes, MacPherson was promoted to corporate vice president of Ford engineering in May 1952, succeeding Harold Youngren. He remained in the VP slot for six years, finally retiring in May 1958, at the age of 66. He died in 1960.

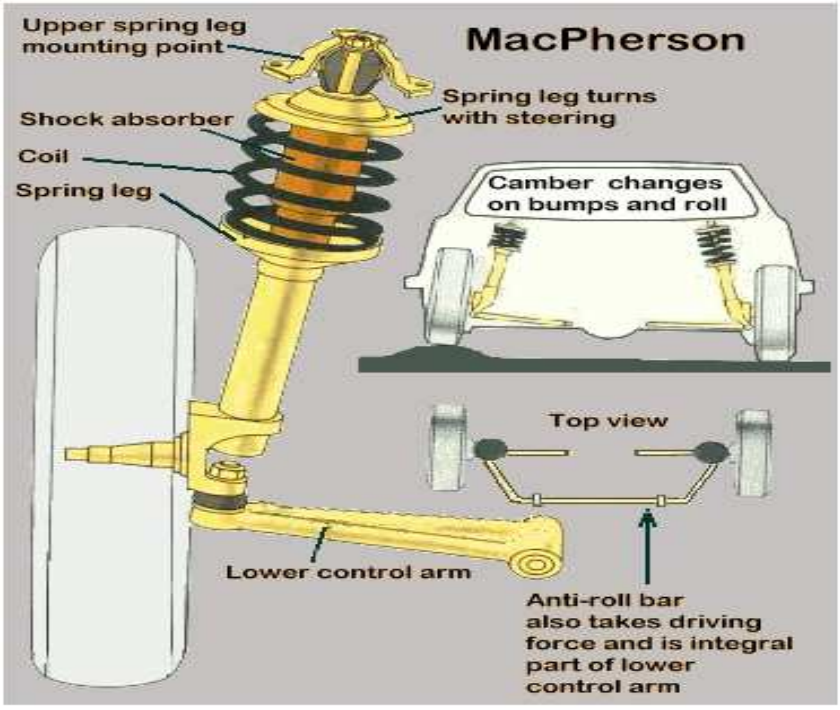

Fig.1. The scheme of the MacPherson suspension

Advantages :
-density
-low weight
-cheapness of manufacture
-large supply of durability
Disadvantages:
-poor driveability
-destruction of the attachment points suspension struts
-folding design
-low level of noise isolation
-bad Longitudinal leveling

Hydro pneumatic suspension

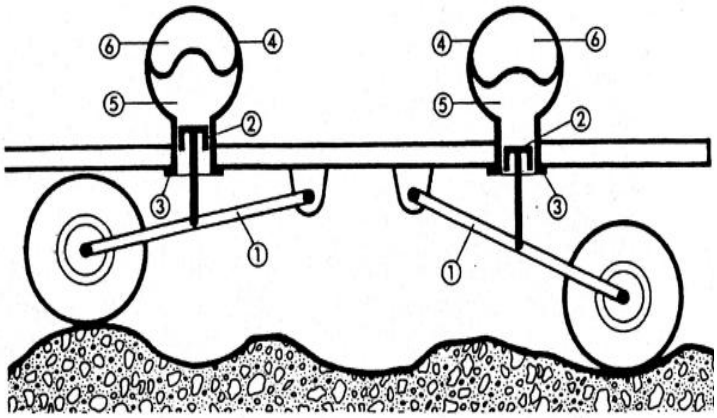

Fig.2. Schematic diagram of the hydro pneumatic suspension:
1 - arm; 2 - piston hydraulic cylinder; 3 - the case of the cylinder; 4 - scope;
5 -oil; 6 - compressed nitrogen

Function

Nitrogen (light blue) provides for particularly sensitive responding of the suspension in combination with the advantages of a level control system. In comparison to steel springs, the indurations are considerably smaller, and the distance towards the roadway remains the same, regardless of the amount of load. The travelling comfort seems to be endless. Additionally, the headlight leveling becomes obsolete, as well as the mechanical or hydraulic jacking equipment. In 1954 the hydro-pneumatics was first used at the rear axle of the Citroen 15 CV.

How it works

The hydraulic pneumatics suspension resembles the gas pressure absorber. Also modern air suspensions copy functions that are already present for quite some time with this technology. Taking the small air space of the single-tube shock absorber into mind, enlarging and replacing it by a larger nitrogen area, exchanging the separator piston for a diaphragm and connecting the absorber oil area to a hydraulic system (e.g. the power steering), makes the suspension function hydro pneumatically. The gas is elastical, and its effect can be adjusted by the inflow or discharge of hydraulic oil. However, the continuing co-operation of a hydraulic pump and a thought out regulation are essential. After scarcely 50 years it has finally found its way to other car manufacturers, being more reliable in service and with an electronic regulation.

The hydraulic pump pumped only little oil to the ball, because the vehicle is nearly completely unloaded. The diaphragm curves to the right and the area filled with nitrogen is very large. When the spring is engaged, the right valve in the absorber piston opens and fully absorbs the job. The diaphragm is shifted a little to the left. When the spring is being released, the diaphragm moves exactly opposite. The diaphragm is moved back to the right. The left valve in the absorber piston opens and absorbs more strongly (traction phase).

The vehicle is loaded up to the permissible pay load. Nevertheless the absorber to the right shows no difference. The only difference is that the system pumped hydraulic oil into the ball, increasing the preload of the nitrogen. The diaphragm still changes little when engaged or disengaged, however, its overall position has strongly shifted to the left and is thus in a completely different position.

We`d like to summarize that the most appropriate and practical option for the suspension of our roads is a Russian Macpherson strut because our asphalt coating is poor, and repair of hydro pneumatic suspensions will be very expensive and difficult.