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THE AUTOMATIC GEAR'S INVENTION AND DEVELOPMENT

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Annotation. In this work, the emergence of the automatic transmission (AUQ), its design structure, and technological production components were studied. The historical development of additional mechanical transmission systems in automobiles is analyzed, and the evolutionary processes up to modern electronically controlled automatic transmissions are highlighted. In the work, consider the power, creation of an automatic transmission, the operating principle, and technological achievements of different generations. The industry will reveal the importance of innovative solutions in the automotive industry in this area and will also take a look at the trends in the production of automatic transmissions.

Keywords: Automatic transmissions, Transmission system, AT (A), multiple automatic transmission, Hydraulic, Planetary transmissions, Torque converter, History of the automotive industry, Transmission system evolution, Automatic transmission.

Introduction.

Mechanical Gearbox (MG) synchronizers provide ease of gear shifting in various vehicle speeds, but in this case require a high degree of driver attention. The possibilities of automatic transmission are wide to free drivers from such inconveniences and moral burdens, as well as to improve the convenience of driving[1].

In this regard, General Motors' initial automatic transmission was 4-speed, controlled by an automatic system, and equipped with a hydraulic coupling.

It evolved over time into a hydrotransformer, making the connection more smooth and efficient.[2]

Along with turbine and pump wheels, the hydrotransformer also has a reactor, which transmits the torque from the engine very smoothly through the working fluid - oil. In this case, the magnitude of the torque changes automatically (depending on the speed of the vehicle and road conditions). The pump wheel of the AUQ is connected to the engine crankshaft, and the turbine wheel to the drive shaft of the UQ (Fig. 1) [3].

Figure 1. Automatic gearbox

At the same time, AUQs have the following drawbacks:

A vehicle equipped with a gearbox has higher fuel consumption compared to a vehicle equipped with a MUQ;

A vehicle equipped with a gearbox can only be towed in exceptional cases with strict observance of all safety measures. In such situations, it is advisable to use the services of an evacuator[4].

Sequential-type AUQ

Sequential-type automobile transmissions differ little from mechanical UQs. In it, the gears are automatically controlled by a special hydromechanical system. The control is controlled by the machine's electronic system, and there is no need for a clutch pedal. Sequentiality (sequential, Eng.) in a transmission implies a strict sequence of gear transmissions, i.e., transmissions must be driven from bottom to top and vice versa in a strict sequence across each step [5].

Such AUQs are also widely used in tractors, since they use multiple transmissions with a wide range of torque changes [6].

Robotic (automatically controlled manual transmission) UQ

The structure and operating principle of the robotic UQ largely correspond to the technical characteristics of the standard mechanical transmission. It also has three main shafts (driven, driven, and intermediate), with similar gears and gear ratios. The term "robot" means that all processes are controlled by special devices - "servo drives" and "actuators," which perform the function of connecting and disconnecting the transmission at the required time. Control of these processes is carried out using a special electronic unit, which transmits control commands to an electric motor with a reducer or hydraulic drive (Fig. 2) [7].

Figure 2. Automatically controlled manual transmission

A driver of a vehicle equipped with a robotic UQ can hand over automatic control of the vehicle, relying on a computer, or manually control it using a lever or leaf-shaped selector placed under the steering wheel to switch gears [8].

Disadvantages of a robotic UQ:

in difficult driving conditions, the clutch is not smoothly controlled, as frequent gear changes cause discomfort;

The prolonged separation of the driving and driven discs during transitions from one gear to another reduces the engine's flexibility and leads to a slight decrease in the machine's speed [9].

Robotic UQ equipped with two clutches

To eliminate the aforementioned shortcomings, the robotic UQ was equipped with two clutches. The use of such a design has significantly increased the capabilities of the unit, i.e., along with the currently operating drive, it is possible to select the drive that needs to be connected next and connect it in advance (Fig. 3).

Figure 3. Robotic gearbox equipped with two gears

As a result, the transition time from one gear to another is significantly reduced, the maneuverability of the vehicle increases, and its control becomes more convenient.

The variator type of transmission is considered stepless. The worm of such a transmission has the ability to smoothly transmit torque (Fig. 4).

In essence, a variator is a stepless "automatic" that does not have a constant transmission ratio.

Figure 4. Variator AUQ

As an automatic transmission unit, the variator has the following advantages:

there are no gears and shafts in its design, since it is not necessary to systematically change a certain value of the torque by disconnecting the engine from the transmission;

it does not have transition stages with a given gear ratio;

The torque transmitted to the drive shaft through the variator constantly changes depending on how the wedge-shaped belt is positioned relative to the conical pulleys;

The smoothness and softness of the transmission, equipped with a variator, are practically ideal.

Despite the fact that these achievements of variators are revolutionary designs in the automotive industry, they are currently used in low-power vehicles. Their main disadvantages are limited resources (about 200 thousand *km*) and high cost of maintenance.

Tiptronic

The term "Tiptronic" should be used in relation to the emergence of its functional capabilities through the installation of an additional device in the UQ's design, and not some kind of UQ (Fig. 5) [10].

Figure 5. Tiptronic Function AUQ Control Lever

The standard form of the AUQ used in motor vehicles does not allow for the control of some dynamic parameters, such as high (rapid) acceleration, engine braking, or forced transition to a low gear, etc. In these cases, the "typtronic" function solves these problems through an auxiliary speed control system associated with electronic control using a lever selector (Fig. 6).

Conclusion.

Modern automatic transmissions are produced in various types (hydraulic, robotic, variable) and have such advantages as fuel efficiency, smooth operation, and accuracy in gear shifting. Their development was an important stage in the automotive industry, which not only created convenience for drivers, but also gave impetus to the overall advancement of automotive technology.

In general, the creation and improvement of automatic transmissions have served to increase the ergonomics and safety of vehicles and have become one of the integral technologies in modern automotive manufacturing.

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