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WHAT WILL BE THE FUTURE OF HYDROSTATIC TRACTION DRIVES IN WHEELD MACHINES

Essential Thesis

Recently, on the turn of the 20-th century, considerable progress could be seen in the field of the technical development of hydrostatic traction drives for mobile machines propelled with internal combuston engines. The progress was possible due to the introduction of new combined hydrostatic - mechanical drive systems, where high efficiency was achieved simultaneously with the wide span of transmission ratios, with maintaining the ratios continuously variable over the full span. In some mobile machines hydrostatic drives superseded the hydrodynamic systems in certain power ranges, where latter previously predominated, e.g. in wheel loaders. In other machines the application of hydrostatic systems is continuously increasing (let us take the small construction tractors as an example). For a few recent years hydrostatic drive systems have also been introduced in the series production of agricultural tractors.

In situation like this, a question could be asked how the application of hydrostatic drives in mobile machines will develop in future and, moreover, whether the position of such drives would remain safe facing the development of other types of drive systems. Potential competitors can be seen in all continuously variable transmissions, but if we consider the current state of technology, only electrical transmissions and mechanical friction (chain) transmissions may actually be taken into account. Completely new systems, of considerably better characteristics, making use of the possibilities offered by electronic control systems have recently been developed in both those fields. This paper is to compare the features and characteristics of such transmissions and hydrostatic drive systems and thus to provide grounds for making an assesment of the degree to which the hydrostatic drive systems will remain competitive in the nearest future.

Electrical transmissions and attempts to apply such transmissions to mobile machines propelled with IC engines have been known since a very long time. There are a variety of design types of such devices and in term of historical development they may be presented as follows.

A. DC electrical transmissions (Ward Leonard). It consists of a DC generator, a DC motor and a control system. Known attempts to apply such systems to mobile machines were made long ago.
B. AC electrical transmissions. It consists of a AC generator, a control systems and AC motor. In general the control system includes a rectifier and an inverter, the tatter converting the direct current back to alternative current, where voltage, current and frequency are controlled variables. This transmissions type has become very popular in stationary equipment (machine tools). Attemps to apply such systems to mobile machines were made quite recently (fork lift trucks, a prototype of agricultural tractor).
C. AC electrical transmission in split torque gear system. A system like this includes an AC electrical transmission as described in B. above , built into a gear train, which splits the power into an electrical path and a mechanical path paralell to each other. So far no data about practical application of such systems are available. Mechanical friction transmissions. There are a lot of possible designs of continuously variable transmissions of this type and some of them have already been installed in mobile machinery since a long time (variable belt transmissions in combine harvesters and in small motorcars). At present the most intensive work in this field is carried out on variable chain transmissions. The work is being done with huge capital outlay chiefly in automotive industry, where great hopes are cherished that such systems will find wide application in motorcars. Moreover prototype agricultural tractors are built with drive systems of this kind. The following design types may be distinguished here.
D. Chain transmission, simple. The whole power of IC engine is transmitted through the transmission installed in series in the drive system.
E. Chain transmission in split torque gear system. A transmission unit as described in D. above is built into a gear train which splits the power in two parallell paths: friction and gear path.

In this paper a brief review of practically implemented arrangements of hydrostatic transmissions, including the characteriscs thereof is followed by the discussion of schematic diagrams of electrical and friction transmissions and the possible applications of such systems are evaluated in terms of their competitive power as against hydrostatic transmissions for traction drives.