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translator to RWS Group Ltd, of Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Buckinghamshire, United Kingdom, hereby declare that I am conversant with the English and German languages and am a competent translator thereof. I declare further that to the best of my knowledge and belief the following is a true and correct translation of the accompanying document in the German language.

Signed this 12th day of May 2021

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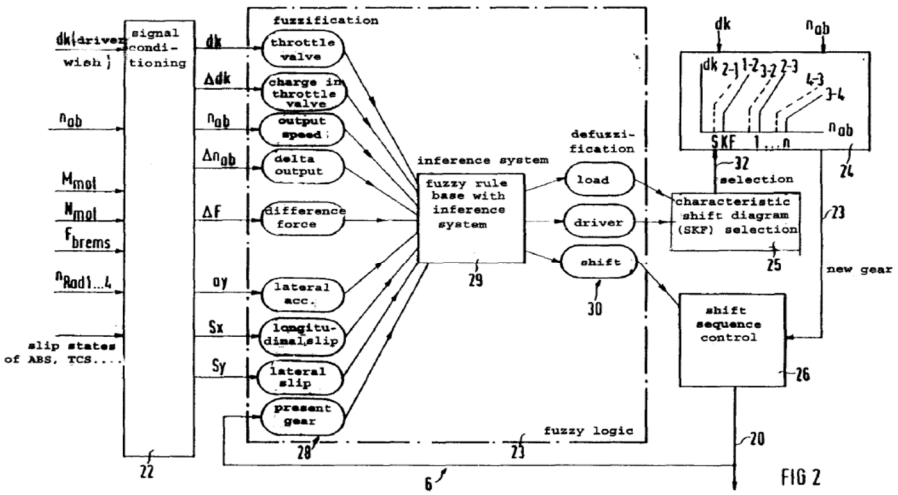
(54) **Transmission control.**

(57) By means of the control (6) for a motor vehicle transmission, the gears are automatically shifted as a function of at least the position of the accelerator and the speed of the vehicle with reference to stored characteristic shift diagrams (SKF1...SKFn). The load state of the motor vehicle and the driving style of the driver are also taken into account. By means of a fuzzy logic controller (23) with a rule base, various signals (DK, n_{ab}) which report the operating states of the motor vehicle are evaluated and the following control signals are produced as a response to this: an adjustment signal (load) which characterizes the vehicle load state and an adjustment signal (driver) which characterizes the driving style, which signals bring about a switch-over of the characteristic shift diagram; and also an inhibit signal (shift), which prevents shifts which would result in a dynamically unfavourable driving state.



EP 0 576 703 A1

The invention relates to a control for a motor vehicle transmission (transmission control) according to the preamble of Claim 1.

In a known transmission control of this kind (DE-C 33 41 652), the gears are automatically shifted as a function of the position of the accelerator and the speed of the vehicle or engine speed with reference to stored characteristic shift diagrams. Here, the load state of the vehicle, i.e. the load of the vehicle and the gradient of the roadway, and the individual driving style of the driver are also taken into account. The taking into account of the respective driving situation takes place by means of characteristic diagram adaptation, i.e. by selecting a characteristic diagram which is suitable for the respective driving situation, the gear shifts then being controlled according to the said characteristic diagram. In order to take into account the various variables which influence the handling characteristics of the motor vehicle, a considerable outlay with known methods of open-loop and closed-loop control technology is made.

In other known automatic transmission controls (US-A 4 841 815; EP-A 0 375 155; A. Takahashi, A method of predicting driving environment, IFSA '91, Brussels, p. 203 - 206) the selection of the respective gear to be shifted is made by means of controllers which operate according to the methods of fuzzy logic. With this logic, expert knowledge which has been acquired from experience is described in the form of a so-called rules base and thus used for the open-loop or closed-loop processes. The controls of the fuzzy logic are however subject to certain uncertainties, they have not gained complete theoretical acceptance. Under certain circumstances, malfunctions can therefore occur which, given the very high safety

requirements which apply in automobile technology, are not tolerable under certain circumstances.

The invention is based on the object of providing a transmission control which takes into account the various variables influencing driving dynamics without a large degree of outlay and yet is operationally reliable without restriction.

This object is achieved by means of a transmission control according to Patent Claim 1.

The advantages of the transmission control according to the invention lie in particular in the fact that many influencing variables can be taken into account easily with the fuzzy logic and yet, thanks to the use of characteristic diagrams, it is always ensured that no unacceptable gear shifts are carried out.

Exemplary embodiments of the invention are explained below with reference to the drawing, in which:

Figure 1 shows the essential components of a motor vehicle with a transmission control according to the invention, in a schematic view,

Figure 2 shows the transmission control of the motor vehicle according to Figure 1 as a block diagram,

Figure 3 shows a fuzzy controller in a continuous control circuit,

Figure 4 shows a throttle valve angle entered over the travel or the route of the motor vehicle (continuous line: fuzzy transmission control; broken line: conventional transmission control)

Figure 5 shows the brake light signal over the travel,

Figure 6 shows the speed of the motor vehicle over the travel,

Figure 7 shows the lateral acceleration of the motor vehicle over the travel,

Figure 8 shows the gears shifted by the transmission control according to Figure 2, over the travel,

Figure 9 shows the gears shifted by a transmission control without fuzzy controller, over the travel,

Figure 10 shows a schematic view of the route travelled through by a motor vehicle according to Figure 1 with fuzzy logic,

Figure 11 shows a corresponding route travelled through by a motor vehicle with a transmission control not according to the invention,

Figure 12 shows a driver detection signal of the transmission control according to Figure 2, over the travel,

Figure 13 shows a load-detection signal of the transmission control according to Figure 2, over the travel,

Figure 14 shows characteristic shift diagram numbers of the transmission control according to Figure 2, over the travel,

Figure 15 shows a shift-up inhibit signal of the transmission control according to Figure 2, over the travel, and

Figure 16 shows a shift-down inhibit signal of the transmission control according to Figure 2, entered over the travel.

A (schematically illustrated) motor vehicle 1 (Figure 1) has an engine 2 which is controlled by an engine control 3. The engine output shaft 4 is connected via a (not separately illustrated here) torque converter with a transmission 5 which is controlled by an electronic transmission control 6 according to the invention. The transmission output shaft 8 is connected to the driven

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