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(54) **Title:** A METHOD FOR CONTROLLING A DRIVETRAIN OF A VEHICLE FOR IMPROVED DRIVER COMFORT

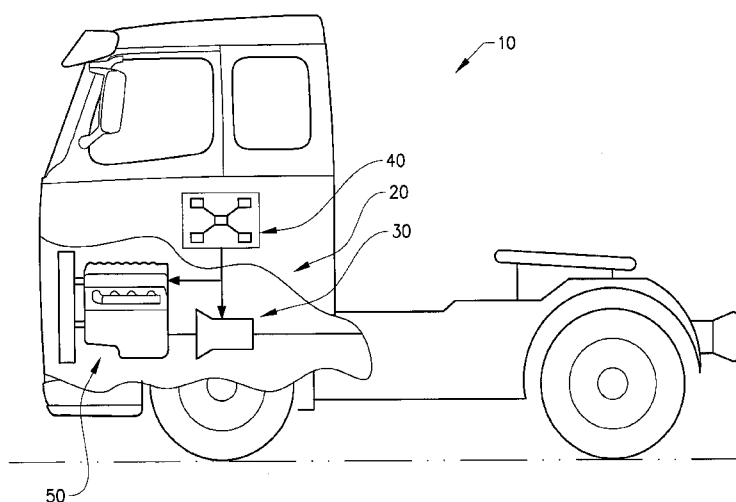


FIG. 1

(57) **Abstract:** The invention relates to a method to control a drivetrain of a vehicle, wherein said drivetrain comprises a multi-clutch transmission adapted to be driven with power shift or with power cut shift dependent on vehicle parameters. Said method comprises the steps of determining a shift-type of a previous shift, determining a shift-type of a first subsequent gear shift and if said subsequent shift is of a different shift-type than said previous gear shift modulating characteristics of said first subsequent gear shift such that the characteristics of said first subsequent gear shift is adapted to the characteristics of the previous gear shift.

A method for controlling a drivetrain of a vehicle for improved driver comfort**TECHNICAL FIELD**

The invention relates to a method for controlling a drivetrain of a vehicle. The invention can be applied in heavy-duty vehicles, such as trucks, buses and construction equipment.

- 5 Although the invention will be described with respect to a heavy-duty vehicle, the invention is not restricted to this particular vehicle. The method of the present invention may also be used in other vehicles such as e.g. passenger cars.

BACKGROUND

- 10 For a multi clutch transmissions such as e.g. a Dual Clutch Transmission (DCT) a gear change can be performed either by conventional power cut shift or by power shift. During power cut shift the torque delivered by the Internal Combustion Engine (ICE) to the wheels is removed before a current, first gear is disengaged. This is done by disengaging the clutch of the current, first gear. This causes a temporarily interruption of torque
- 15 transferred from an ICE to the wheels of a vehicle, something which is noticeable for a driver. Subsequently a new, second gear is engaged by engaging the clutch of the second gear. Once again, when subsequently applying the torque this will be noticed by the driver. During power shift the transition from the current, first gear to the second gear is performed without torque interruption. This is accomplished by that the clutch of the first
- 20 gear slips out while the clutch of the second gear slips in such that both clutches transfer torque during an overlapping period. Thus, power shift without torque interruption is preferred from a driver comfort perspective, but power shift leads to higher wear of the clutches. Also, when applying power shift it is not possible to skip gears which is beneficial from a fuel consumption perspective.

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- If an upcoming gear change of a multi-clutch transmission is performed by power cut shift or power shift can be determined based on a number of parameters such as fuel efficiency, vehicle weight, driver request, road inclination and clutch wear. Typically gear change performed by power cut shift are performed at low range whereas gear change by
- 30 power shift is performed at high range. Power cut shift is also generally favourable when the torque delivered by the engine is constant, such as during high way driving at constant speed, where a torque interruption is not that noticeable for the driver. For gear change during acceleration, or when driving uphill, the change can advantageously be performed

by power shift. If the upcoming gear change is performed by power shift or power cut shift is also dependent on between which gears the upcoming gear change is to be performed. Power shift can only be performed for sequential gear shifts whereas during power cut shift intermediate gears can be skipped.

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Since power cut shift involves an interruption in torque delivery whereas power shift does not the two different shift methods is experienced differently by a driver. This is undesirable from a driveability and driver comfort perspective, especially when two consecutive shifts are performed by different shift-types.

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US 2004/0166990 A1 discloses one method for controlling a dual clutch transmission such that a gear change performed by power shift of the dual clutch transmission is performed smoothly. The method includes the steps of determining when a shift has been commanded, then sensing the speed of the driven member of the off-going clutch, 15 determining the desired clutch torque and slip profile for the changeover of the clutches and sensing the speed of the driven member of the on-coming clutch to determine a target engine speed profile. The method simultaneously controls the torque transfer across each clutch so that the torque output of the transmission will be changed over from the off-going clutch to the on-coming clutch by linearly decreasing the torque transferred 20 across the off-going clutch while linearly increasing the torque transferred across the on-coming clutch in an inversely proportional rate to follow the clutch torque and slip profile and to cause the engine to track the target engine speed profile. Finally, the pressure applied to the on-coming clutch is varied, once the on-coming clutch is transferring all of the output torque, to cause the engine to continue to track the target engine speed profile 25 so that vehicle speed is maintained. US 2004/0166990 A1 only discloses how to perform power shifts smoothly.

Thus, there is still a need for further improvements.

30 SUMMARY

An object of the present invention is to provide a method for controlling a drivetrain of a vehicle comprising a multi-clutch transmission, wherein the method improves the driveability and driving comfort of the vehicle. The object is achieved by a method according to claim 1. Further advantages with the present invention are highlighted in the 35 dependent claims.

As previously stated, the gear shift of a multi-clutch transmission such as a DCT can be performed either by power cut shift or by power shift. Which shift-type that is selected is dependent on e.g. fuel efficiency and between which gears the shift is performed. Which
5 shift-type that is preferred may e.g. be dependent on vehicle parameters.

According to the present invention when the gear shift is performed by power shift the gear shift is provided with shift characteristics such that if the previous shift was performed by power cut shift the transition in shift characteristics in relation to a most
10 recent shift is smooth. This means that the gear shift is performed in a manner such that the gear shift is experienced more or less similar to the most recent gear shift. In order to obtain such smooth transition said method comprises the steps of:

- determining a shift-type of a previous shift, wherein the previous shift is the most recent shift performed by the multi-clutch transmission, and
- 15 • determining a shift-type of a first subsequent shift, wherein the first subsequent shift is the shift directly following the previous shift.

Further, the method additionally comprises the steps of evaluating if said first subsequent shift is of a different shift-type than said previous shift, and if so:

- 20 • modulating characteristics of said first subsequent shift such that the characteristics of said first subsequent shift is adapted to the characteristics of the shift-type of said previous shift, and
- shifting said multi-clutch transmission, such that said first subsequent shift adopts said modulated characteristics.

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By modulating the characteristics of a subsequent shift after the characteristics of a previous shift, and then adopt those modulated characteristics for the subsequent shift it is possible to make the change of shift-type between consecutive shifts less noticeable for a driver. This is preferable from a driveability perspective and is something that is
30 appreciated by the driver.

There are many different known methods that can be used in order to determine what gear that preferably should be engaged and which shift-type that should be used. It is even possible to look even further and also determine what gear that should be engaged
35 subsequently of the next gear and how that shift should be performed. The more

information regarding upcoming route, traffic and ambient conditions that is available the more accurate are such predictions. The methods for predicting upcoming shifts are considered to be known for a person working within the field of transmission for vehicles. The possible methods for determining the upcoming shifts is not part of the invention per se and is not further discussed herein. Note that if the gear that should be engaged is not the subsequent gear in order, meaning that at least one gear step is skipped, the shift is always performed by power cut shift.

There are a number of shift parameters that can be controlled and adapted in order to control the characteristics of a performed gear shift. According to yet one aspect of the present invention the characteristics of a shift-type comprises at least one of; length of shift sequence (the time during which the shift is performed), length of power cut (the time during which no clutch is engaged and no torque is transferred from the ICE to the wheels), speed of clutch engage and disengage (how fast the respective clutch is engaged/disengaged) and shift torque levels (the torque transferred before and after the shift). Thus, at least one of such characteristics can be controlled and adapted in order to control the characteristics of a performed gear shift.

Thus, according to the present invention if said previous shift is determined to be of power shift-type and said first subsequent shift is determined to be of power cut shift-type the method comprises;

- modulating said power cut shift such that the characteristics of said power cut shift is similar to a power shift.

Such modulation may comprise that the shift is performed with a more aggressive clutch position, wherein a faster torque ramp-up is obtained.

If instead said previous shift is determined to be of power cut shift-type and said first subsequent shift is determined to be of power shift-type the method comprises;

- modulating said power shift such that the characteristics of said power shift is similar to a power cut shift.

Such modulation may comprise that the shift is performed with slower torque ramp and that the torque delivered during gear shift may be temporarily decreased to e.g. 50% of the requested torque. The time during which the gear shift is performed may also be prolonged.

By applying the disclosed method power cut shift can have shift characteristics of a normal power cut shift or have shift characteristics modulated such that the characteristics of the power cut shift is smoother and thereby have characteristics which more or less resembles a power shift. The opposite applies for a power shift. A power shift can be
5 modulated to have characteristics making the shift to be more or less similar to a power cut shift.

As previously has been stated, according to existing methods it is possible to not only predict the next in line upcoming shift but also later following subsequent shifts. According
10 to one aspect of the present invention said method further comprises the steps of:

- determining a shift-type of a second subsequent shift, wherein the second subsequent shift is directly subsequent of the first subsequent shift.

Further, if said first subsequent shift or said second subsequent shift is of a different shift-type than said previous shift the method comprises:

- 15
- modulating characteristics of said first subsequent shift, such that characteristics of said first subsequent shift is adapted to both said previous and said second subsequent shift.

This aspect of the present invention has the advantage that the characteristics of the
20 subsequent shift may be modulated to be adapted not only to the previous shift but also to the second subsequent shift. Even if the previous shift and the first subsequent shift is of the same shift-type the shift characteristics of the first subsequent shift may be adapted to the characteristics of the second subsequent shift, if the first and second subsequent shifts are performed by different shift-types.

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This aspect of the present invention has the advantage that the adaption of shift characteristics is performed over a sequence of shifts, enabling an even lesser difference between subsequent shifts of different shift-types.

30 In one aspect of the method, when said previous shift is determined to be of power cut shift-type, said first subsequent shift is determined to be of power shift-type and said second subsequent shift is determined to be of power shift-type;

- modulating the characteristics of said first subsequent shift of power shift-type, such that the characteristics of said first subsequent shift is:

- adapted to the characteristics of said previous shift of power cut shift-type, and
- that the characteristics of said first subsequent shift also is adapted to the characteristics of said second subsequent shift of power shift-type.

5 Modulating the characteristics of the first subsequent shift of power shift-type such that the characteristics of the first subsequent shift is adapted both to the previous shift of power cut shift-type and to the subsequent second subsequent shift of power shift-type will make the transition from a power cut shift-type to a power shift-type as unnoticeable as possible for a driver.

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In order for the characteristics of the first subsequent shift of power shift-type to be more like the shift characteristics of the previous shift of power cut shift-type the torque transferred during the gear shift of power cut-type may be temporarily reduced and the time during which the gear shift is performed may be longer than for a normal power shift.

15 This is discussed more in detail in the following sections.

For aspects of the present invention where also the shift-type of the second subsequent shift is known the shift characteristics of the first subsequent shift may be adapted both according to the shift characteristics of the previous shift and the second subsequent shift.

20 Thus, even if the previous shift and first subsequent shift is performed by the same shift-type the shift characteristics of the first subsequent shift can be adapted according to the second subsequent shift if the first and second subsequent shift is predicted to be performed by different shift-types. In this case where both the shift-type of the previous shift and the shift-type of the second subsequent shift is known the shift characteristics of
25 the first subsequent shift can be adapted to be between the shift characteristics of the previous and second subsequent shift such that the shift characteristics differences between respective shifts is minimized. This will be discussed more in detail later.

According to the latter discussed aspects of the present invention only one second
30 subsequent shift is considered. However, according to other aspects of the present invention also a number of thereafter subsequent gear shifts may be considered. The number of subsequent gear shifts considered are dependent on which shift prediction method that is used and how far ahead in time shifts can be predicted.

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The degree of adaption of characteristics of a gear shift in order to resemble the characteristics of a subsequent gear shift or even thereafter subsequent gear shift may be set according to e.g. driver preferences or reliability of the gear shift prediction method
5 used.

Taking not only a first subsequent shift in consideration but also a second subsequent shift enables that the difference in characteristics between power shift and power cut shift can be modulated to be even less noticeable. This will improve the driveability and the
10 driver comfort. This is possible since transition in gear shift behaviour between power shift and power cut shift can be apportioned over a plurality of shifts, making the difference in shift characteristics between consecutive shifts less noticeable.

According to yet another aspect of the present invention the method further involves a
15 combustion engine of the vehicle drivetrain wherein;

- modulating a control scheme of said combustion engine during said subsequent shift, such that it enhance the modulated characteristics of said subsequent shift, and
- controlling said combustion engine during said subsequent shift, according to said
20 modulated control scheme.

By controlling the combustion engine together with the shift characteristics of the multi-clutch transmission it is possible to enhance the effect of the adaption of shift characteristics and get an even smoother and less noticeable gear shift. This improves the driveability of the vehicle even more.

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According to one aspect of the present invention the vehicle is a heavy-duty vehicle, wherein the heavy-duty vehicle is provided with a main transmission and a range transmission. The main transmission is of a multi-clutch type enabling power shift between even and uneven gear steps in the main transmission. The main transmission
30 can also be shifted by using power cut shift. If power cut shift is applied gears can be skipped and shift from an uneven gear to another uneven gear, or from an even gear to another even gear, is possible. The range transmission, for which shift between low register gears and high register gears is performed, is shifted by power cut shift. The method of the present invention is most efficient for multi-clutch transmissions with a large

number of gears, such as 12, 14 or 16 used in multi-clutch transmissions for heavy-duty vehicles, but is also applicable for passenger cars.

The present invention additionally comprises:

- 5 - a computer program comprising program code means for performing the steps of any aspect of a method of the present invention, when said program is run on a computer,
- a computer readable medium carrying a computer program comprising program code means for performing the steps of any aspect of a method of the present
10 invention, when said program product is run on a computer, and
- a control unit for controlling a vehicle provided with a drivetrain at least comprising a dual clutch transmission, the control unit being configured to perform the steps of the method according to any aspect of a method of the present invention.

15 Further advantages and advantageous features of the invention are disclosed in the following description and in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

With reference to the appended drawings, below follows a more detailed description of
20 embodiments of the invention cited as examples.

In the drawings:

Fig. 1 shows a schematic view of a heavy-duty vehicle,

Fig. 2 shows a schematic block diagram over one aspect of the present invention,

25 Fig. 3 shows a schematic block diagram over another aspect of the present invention, and

Fig. 4a-4d explains the difference in time vs. torque characteristics for a power shift and a power cut shift.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS OF THE INVENTION

30 Fig. 1 shows a heavy-duty vehicle 10 comprising a drivetrain 20. The drivetrain 20 comprises a combustion engine 50, a multi-clutch transmission 30 and a control unit 40. The combustion engine 50 is connected to the multi-clutch transmission 30 such that the torque delivered by the combustion engine 50 for propulsion of the vehicle 10 is controllable by the multi-clutch transmission 30. The combustion engine 50 and the multi-

clutch transmission 30 is connected to and controlled by the control unit 40. Fig. 1 shows a very simplified embodiment and fig. 1 should not be seen as limiting.

The multi-clutch transmission 30 is adapted to be controlled to perform gear shifts as either a power shift or as a power cut. Which shift-type that is selected is dependent on vehicle parameters. Typically, if e.g. the driving currently is static, such as when driving at constant speed on a highway, or when gears are skipped power cut shift is preferably used whereas if the driving is dynamic, such as when accelerating during a take-over, power shift is preferably used. A driver will generally anticipate power cut shift with torque interruption to be more noticeably than power shift. According to the present invention the multi-clutch transmission is controlled such that the characteristics of consecutive gear shifts are modulated to be adapted after one another. This will make the difference between shifts of power shift-type and of power cut shift-type less significant for a driver which will improve the driver comfort.

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Fig. 2 schematically shows a block diagram over the method disclosed in claim 1 of the present invention. The method as disclosed in claim 1 is initiated by an operation of determining the shift-type of a previously performed shift, ST1, wherein the shift-type may be either of power shift-type or of power cut shift-type. Subsequently, an operation where the shift-type of a first subsequent shift is determined by utilizing any of the known methods for determination of shift-type of a first subsequent shift, ST2, is performed. The possible methods for determining the first subsequent shifts is not part of the invention per se and is not further discussed herein. Thereafter an operation of evaluating whether the previous shift was performed by the same shift-type as the first subsequent shift, ST2=ST1?, is performed. If the most recent shift was performed by the same shift-type as is determined that the first subsequent shift will be performed according to, thus ST2=ST1, the first subsequent shift is performed without further measures taken at the shift operation, PC/PS. The first subsequent shift is performed either as a shift of power shift-type or of as a shift of power cut shift-type with normal shift characteristics of respective shift-type.

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If the most recent shift was performed according to a shift-type other than what is determined that the first subsequent shift will be performed according to, thus $ST2 \neq ST1$, a shift characteristics modulating operation is initiated, $sc-ST2 \Rightarrow sc-ST1$. This means that the previous shift was either performed as a shift of power shift-type, and that said

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first subsequent shift is determined to be performed as a shift of power cut shift-type, or that the previous shift was performed as a shift of power cut shift-type, and that the first subsequent shift is determined to be performed as a shift of power shift-type. During the shift characteristics modulating operation, $sc-ST2 \Rightarrow sc-ST1$, the characteristics of the first subsequent shift is modulated such that the characteristics is adapted to the characteristics of the previous shift. The shift is subsequently performed in the gear shift operation, PC/PS, wherein the shift is performed with the modulated shift characteristics. By performing the gear shift with modulated characteristics, the difference in shift comfort when changing shift-type will be less noticeable for the driver.

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Fig. 3 schematically shows a block diagram over an aspect of the present invention where the method also considers a second subsequent shift. The second subsequent shift may be determined according to any known method. By also determining the second subsequent shift it is possible to adapt the shift characteristics of the first subsequent shift also to the shift characteristics of the second subsequent shift which will give an even smoother transition over the shift sequence and even better driver comfort. Thus, according to the embodiment of the method shown in fig. 3 subsequently of the operation of determining the shift-type of the previously performed shift, ST1, and the operation of determination of shift-type of the first subsequent shift, ST2, an operation of determining a shift-type of a second subsequent shift, ST3, is performed. Unlike the embodiment of the present invention shown in fig. 2, it is not required that the previous shift and the first subsequent shift are of different shift-types if the aspect of the present invention shown in fig. 3 is applied. For the embodiment shown in fig. 3 it is sufficient that the shift-type of the previous shift and/or the shift-type of the second subsequent shift is different than the shift-type of the first subsequent shift in order for the method to be executed. Hence, an operation of evaluating whether the previous shift was performed by the same shift-type as the first or second subsequent shift, $ST2=ST1=ST3?$, is performed. If $ST2=ST1=ST3$ the shift is performed as a normal shift of respective shift-type. If the first subsequent shift is different from the previous and/or second subsequent shift, thus if $ST2 \neq ST1$, $ST2 \neq ST3$ or $ST2 \neq ST1$ and $ST3$, the shift characteristics of the first subsequent shift is adapted according to what previously has been disclosed. If $ST2 \neq ST1$, the characteristics of the first subsequent shift ST2 is modulated to be adapted to the shift characteristics of the previous shift, if $ST2 \neq ST3$, at least the characteristics of the first subsequent shift ST2 is modulated to be adapted to the shift characteristics of the second subsequent shift and if $ST2 \neq ST1$ and $ST3$, at least the characteristics of the first

subsequent shift ST2 is modulated to be adapted to the shift characteristics of both the previous shift and the second subsequent shift. The modulation of shift characteristics operation is performed at a shift characteristics modulating operation, sc-ST2 => sc-(ST1,ST3). The shift is subsequently performed in the gear shift operation, PC/PS, 5 wherein the shift is performed with modulated shift characteristics.

Fig. 4a shows a gear shift sequence, SS, of a heavy-duty vehicle multi-clutch transmission comprising the following gear shifts; gear 4 to gear 5, gear 5 to gear 6 and gear 6 to gear 7.

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Fig. 4b shows a time versus applied torque percentage %T behaviour for said gear shift sequence SS of fig. 4a wherein the gear shifts are performed by power cut shifts. Fig. 4c shows a time versus applied torque percentage %T behaviour for said gear shift sequence SS wherein the gear shifts are performed by power shifts, except for the gear 15 shift from gear 6 to gear 7 which is performed by power cut shift. The embodiment of the present invention shown in fig. 4a-4d applies for a heavy-duty vehicle with a multi-clutch transmission with 12 gears (of which only the gear shift sequence of gear 4 to 7 is shown in fig. 4a-4d). 6 gears in the low range and 6 gears in the high range. The gear shift from the low range to the high range is always performed by power cut shift. Thus, for the 20 embodiment shown in fig. 4a-4d the gear change from gear 6 to gear 7 is always performed by power cut shift.

The applied torque percentage %T expresses to what percentage the clutch transferring the torque from the engine to the wheels is engaged. For a power cut shift the clutch is 25 completely disengaged during the gear change, thus the torque transferred is ramped down to 0 temporarily. During power shift the torque transfer is essentially constant during the gear change. However, in reality a gear shift is always associated with small loss in transferred torque. Thus, also when using power shift the torque transferred is slightly lowered. For clarification purposes fig. 4c-4d shows ideal power shifts with no such losses 30 and where no lowering of the torque transferred during respective gear shift is shown.

Fig. 4d shows a time versus applied torque percentage %T behaviour for said gear shift sequence SS where an aspect of the present invention where the method considers the previous and the second subsequent shift is applied. In fig. 4d the shift of gear 4 to gear 5

is performed by power shift and the gear shift of gear 5 to gear 6 performed by power shift with adapted shift characteristics. In fig. 4a-4d no gears are skipped.

As can be seen in fig 4b, for gear shifts performed by power cut shift the sequence of events comprises; disengaging a clutch of the multi-clutch transmission such that the torque transferred from the engine to the wheels is ramped down from a first torque transfer level T1 to a zero torque transfer level T0. No torque is transferred at the zero torque level. Subsequently a clutch is engaged such that the torque transfer level is ramped up back to the torque transfer level T1 where the clutch is fully engaged.

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In fig. 4c the gear shift sequence SS by ideal power shifts (and power cut shift for the gear shift from gear 6 to 7) is disclosed. For the gear shifts of gear 4 to gear 5 and gear 5 to gear 6 power shift is used wherein the first torque transfer level, T1, is held essentially constant over respective gear shift. The torque transfer level can be held essentially constant over the gear shift due to that the clutch slip during disengagement and engagement of respective clutch overlap. No losses in transferred torque during respective gear shift are considered. As previously stated, the gear shift from gear 6 to gear 7 is according to the embodiment shown performed by power cut shift.

Fig. 4d discloses the gear shift sequence SS where an aspect of the present invention where the method considers the previous and the second subsequent shift is applied. In fig. 4d the gear shift of gear 4 to gear 5 and the gear shift of gear 5 to gear 6 are performed by ideal power shifts and the gear shift of gear 6 to gear 7 is performed by power cut shift. According to the aspect of the present invention where the method considers a second subsequent shift the characteristics of a first subsequent shift is modulated to be adapted to the characteristics of a previous shift, if said previous shift and said first subsequent are performed according to different shift-types, and modulated to be adapted to the characteristics of a second subsequent shift, if the first subsequent and the second subsequent shifts are performed according to different shift-types.

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Looking at the shifting of gear 5 to gear 6:

- the previous gear shift of gear 4 to 5 is performed by power shift,
- the first subsequent shift of gear 5 to 6 is determined to be performed by power shift, and

- the second subsequent gear shift of gear 6 to 7 is determined to be performed by power cut shift.

Thus, said first subsequent shift is of the same shift-type as the previous shift, wherein according to the aspects of the present invention for which the method does not consider
5 a second subsequent shift of the present invention the characteristics of the gear shift of gear 5 to gear 6 is not affected. The first subsequent shift and the second subsequent shift is determined to be performed by different shift-types. Thus, the shift characteristics of the first subsequent shift will be modulated to be adapted according to the shift characteristics of the second subsequent shift. This is shown in fig. 4d in that during the
10 gear shift the characteristics of the first subsequent shift is adapted such that the torque transferred during the gear shift is ramped down to a second torque transfer level, T2, wherein said second torque transfer level T2 is between the first torque transfer level T1 and the second torque transfer level T0.

15 By applying an aspect of the present invention where the method considers a previous and a second subsequent shift the difference in shift characteristics between the previous shift and the first subsequent shift, and subsequently between the first subsequent shift and the second subsequent shift, can be minimized.

20 It is to be understood that the present invention is not limited to the embodiments described above and illustrated in the drawings; rather, the skilled person will recognize that many changes and modifications may be made within the scope of the appended claims.

CLAIMS

1. A Method to control a drivetrain (20) of a heavy duty vehicle (10), wherein said drivetrain (20) comprises a multi-clutch transmission (30) adapted to be driven with a power shift shift-type or a power cut shift shift-type dependent on vehicle parameters,
5 wherein a power shift-type is provided with shift characteristics of a smooth transition
characterised in that said method comprises the steps of:
- determining a shift-type of a previous shift,
 - determining a shift-type of a first subsequent shift,
- and if said first subsequent shift is of a different shift-type than said previous shift;
- 10 • modulating characteristics of said first subsequent shift, such that the characteristics of said first subsequent shift is adapted to the characteristics of the shift-type of said previous shift, and
- shifting said multi-clutch transmission (30), such that said first subsequent shift adopts said modulated characteristics.
- 15
2. A method according to claim 1, wherein the characteristics of a shift-type comprises at least one of; length of shift sequence, length of power cut, speed of clutch engage and disengage, torque increase, torque decrease and shift torque levels.
- 20 3. A method according to claim 1 or 2, wherein when said previous shift is determined to be of power shift shift-type and said first subsequent shift is determined to be of power cut shift-type;
- modulating said power cut shift, such that the characteristics of said power cut shift is similar to a power shift shift-type.
- 25
4. A method according to claim 1, 2 or 3, wherein when said previous shift is determined to be of power cut shift-type and said first subsequent shift is determined to be of power shift shift-type;
- modulating said power shift, such that the characteristics of said power shift is
- 30 similar to a power cut shift-type.
5. A method according to any of the previous claims 1 or 2, wherein said method further comprises the steps of;
- determining a shift-type of a second subsequent shift,

and if said first subsequent shift or said second subsequent shift is of a different shift-type than said previous shift;

- modulating characteristics of said first subsequent shift, such that characteristics of said first subsequent shift is adapted to both said previous and said second subsequent shift.

6. A method according to claim 5, wherein when said previous shift is determined to be of power cut shift-type and said first subsequent shift is determined to be of power shift shift-type and said second subsequent shift is determined to be of power shift shift-type;

- modulating the characteristics of said first subsequent shift of power shift shift-type, such that the characteristics of said first subsequent shift is:
 - adapted to the characteristics of said previous shift of power cut shift shift-type, and
 - that the characteristics of said first subsequent shift is further adapted to the characteristics of said second subsequent shift of power shift shift-type.

7. A method according to any of the preceding claims, wherein said drivetrain (20) further comprises a combustion engine (50), the method further comprises the steps of;

- modulating a control scheme of said combustion engine (50) during said subsequent shift, such that it enhance the modulated characteristics of said subsequent shift, and
- controlling said combustion engine (50) during said subsequent shift, according to said modulated control scheme.

8. A computer program comprising program code means for performing the steps of any of claims 1-7, when said program is run on a computer.

9. A computer readable medium carrying a computer program comprising program code means for performing the steps of any of claims 1-8, when said program product is run on a computer.

10. A control unit (40) for controlling a vehicle (10) provided with a drivetrain (20) at least comprising a dual clutch transmission (30), the control unit (40) being configured to perform the steps of the method according to any of claims 1-7.

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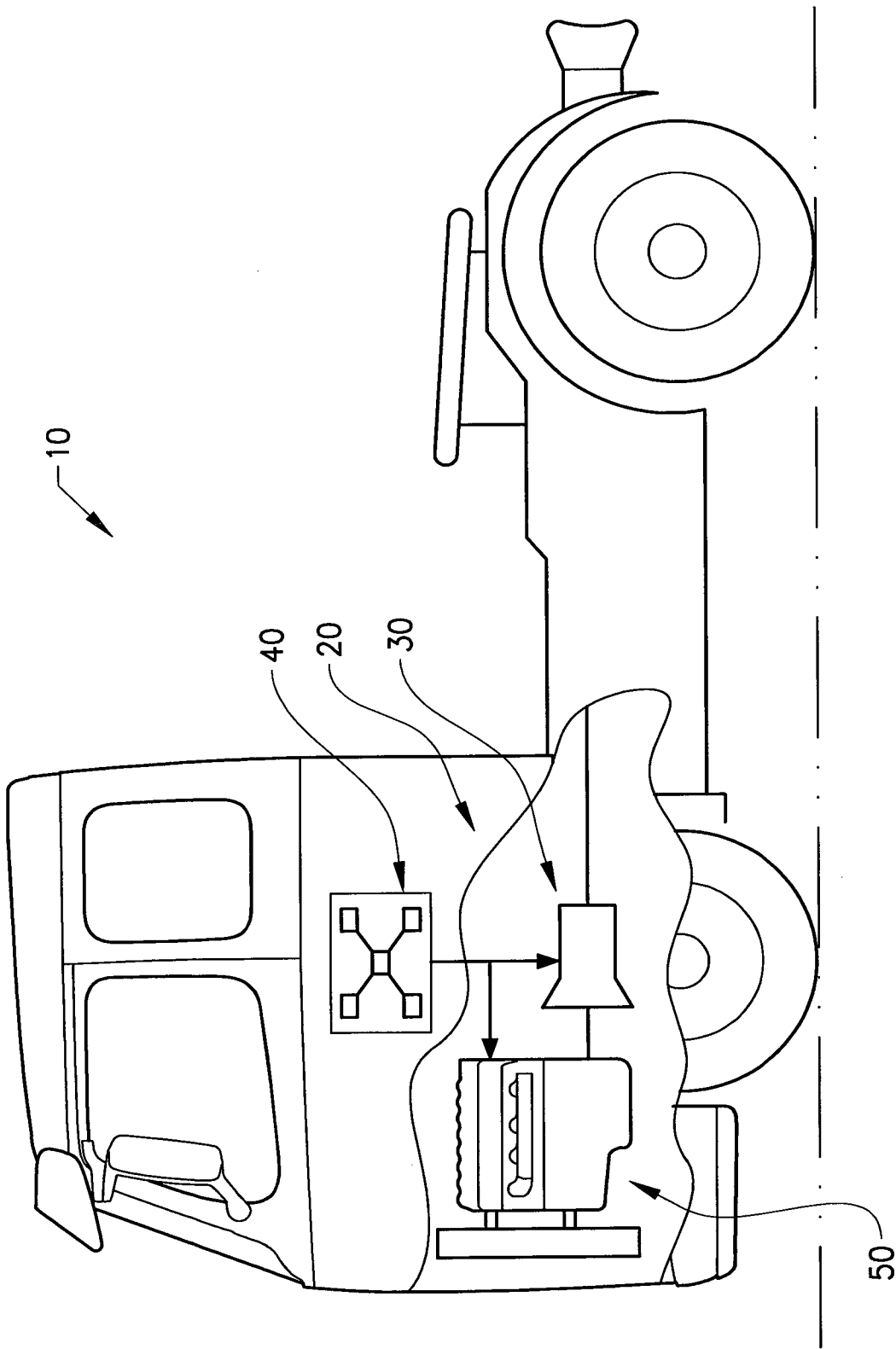


FIG. 1

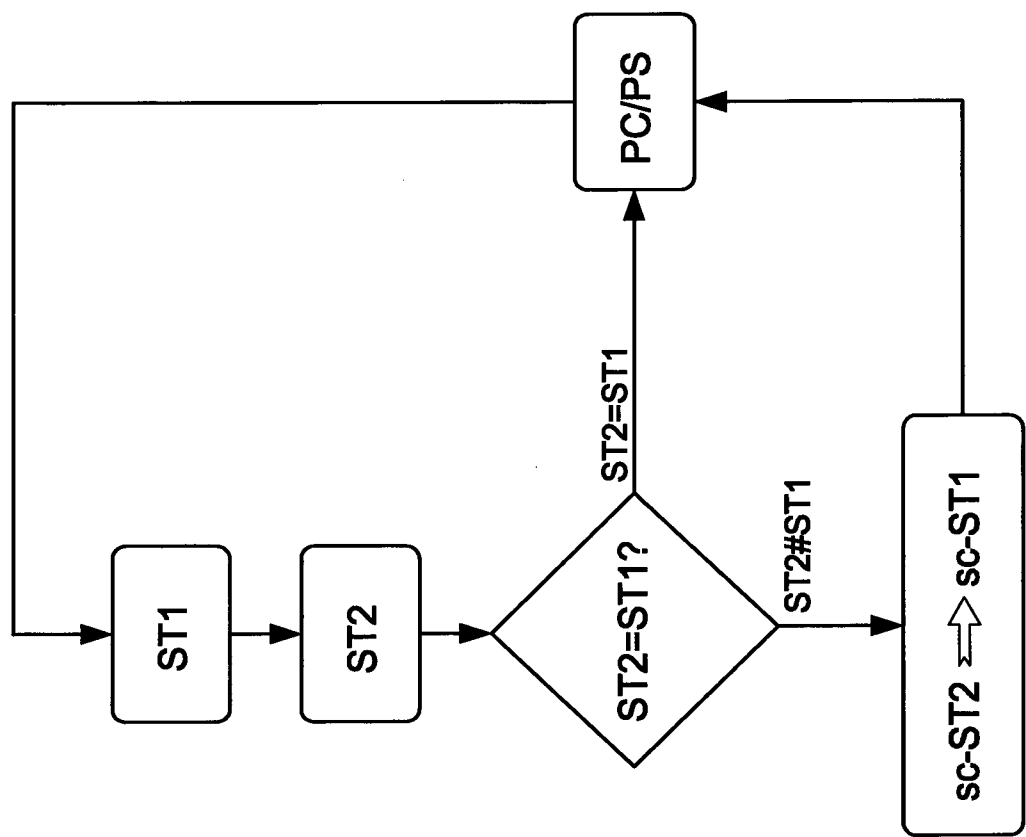


FIG. 2

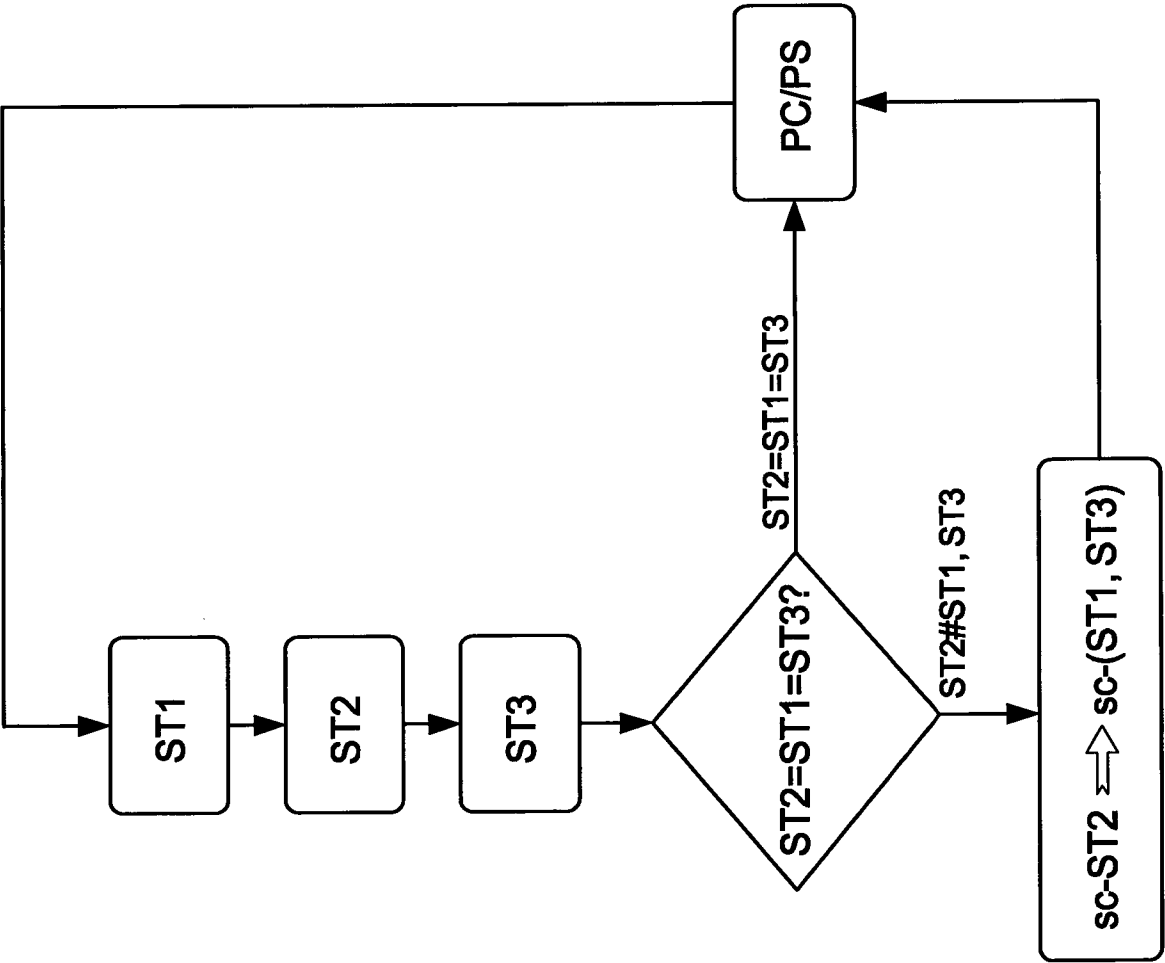
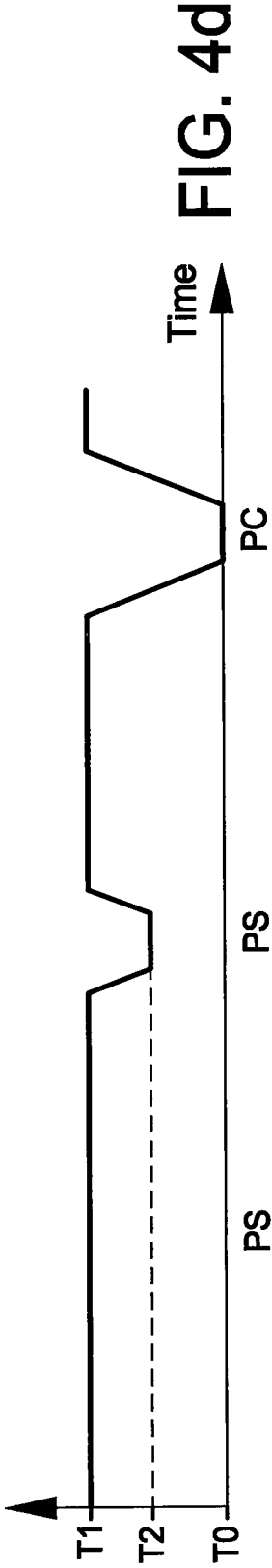
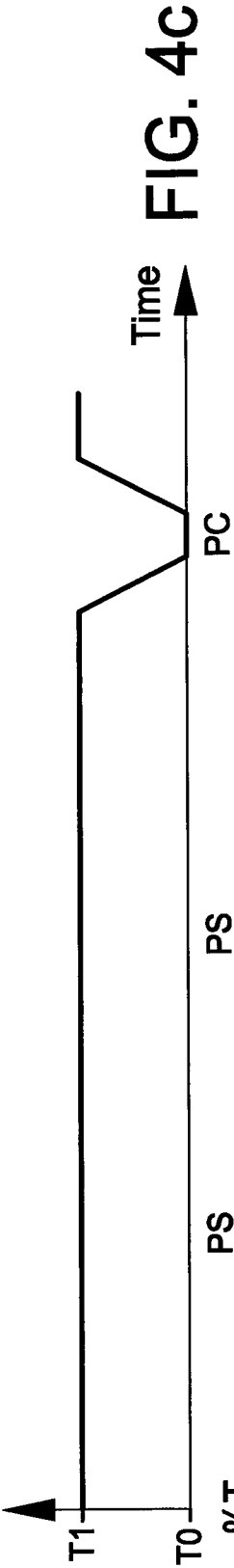
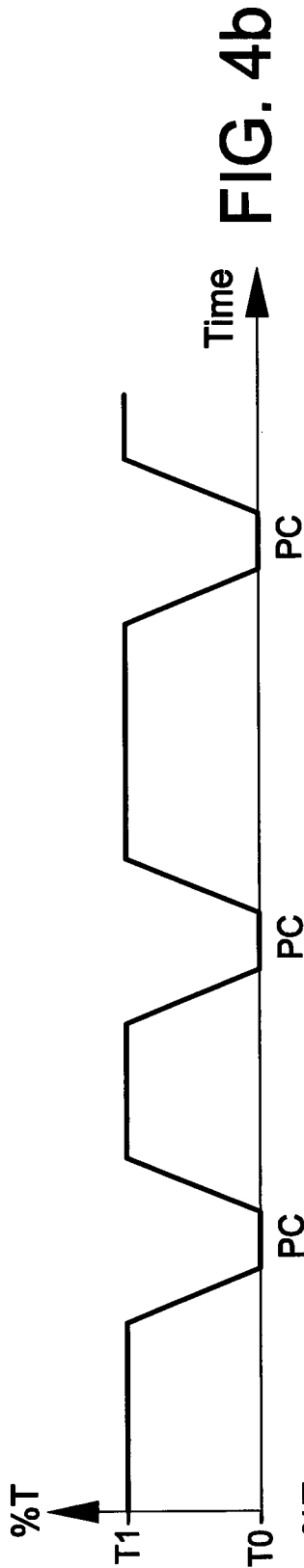
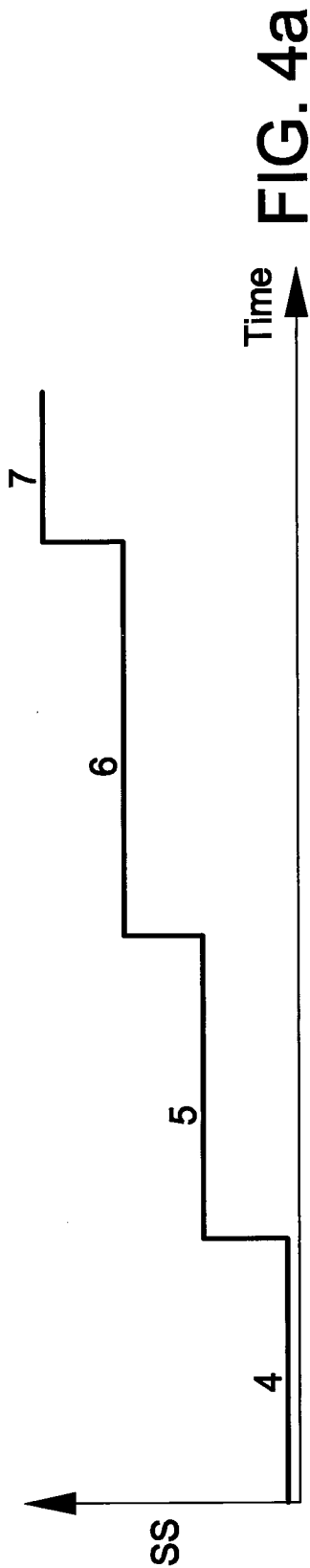


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/001758

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16H61/688 F16H61/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 149 728 A1 (HOERBIGER & CO [DE] HOERBIGER DRIVETRAIN MECHATRONICS B V B A [BE]) 3 February 2010 (2010-02-03) abstract; figures 1,3-6 paragraphs [0010] - [0013], [0019] -----	1-10
A	EP 1 304 510 A2 (ZAHNRADFABRIK FRIEDRICHSHAFEN [DE]) 23 April 2003 (2003-04-23) abstract; figure 1 paragraphs [0004], [0006], [0008], [0009] ----- -/--	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

25 February 2015

Date of mailing of the international search report

11/03/2015

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/001758

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 10 2005 052824 A1 (ZAHNRADFABRIK FRIEDRICHSHAFEN [DE]) 22 March 2007 (2007-03-22) abstract paragraphs [0008] - [0020] -----	1-10

INTERNATIONAL SEARCH REPORT

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International application No

PCT/EP2014/001758

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			EP 1304510 A2 23-04-2003
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