(54) Title: VEHICLE CONTROL SYSTEM AND METHOD TO PROVIDE DESIRED WHEEL SLIP

(57) Abstract: The invention relates to a control system and methods for controlling motion of a vehicle over a surface. The control system limits an amount of drive torque that may be applied to one or more wheels of the vehicle to prevent an amount of wheel slip from exceeding a prescribed value. The prescribed value of wheel slip is determined in dependence at least in part on vehicle speed. In addition, method claims 28 and 29 are directed to providing drive torque, independent of vehicle speed, which corresponds to or exceeds the maximum traction force. These methods are suitable for highway driving with high friction or off road driving on soft terrain, respectively.

[Continued on next page]
Published: with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

Date of publication of the international search report: 1 May 2014
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. B6QW30/02 B60K7/00 B6GW59/G8
ADD. B6QW30/18 B6OW10/08 B6OW50/O0

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)
B60W B50K

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)
EPO-I nternal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>X</td>
<td>DE 196 53 855 CI (MANNESMANN SACHS AG [DE]; BAYERISCHER MOTOREN WERKE AG [DE]) 23 April 1998 (1998-04-23) 1, 7, 8, 18, 20-22, 27, 28 1, 2, 5-7, 11, 12, 16, 17, 21-23, 27, 29 1, 2, 5-7, 11, 12, 16, 17, 21-23, 27, 29 paragraph [0027], [0030], [0057] the whole document</td>
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</table>

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
  *E* earlier application or patent but published on or after the international filing date
  *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another invention
  *O* document referring to an oral disclosure, use, exhibition or other special means
  *P* document published prior to the international filing date but later than the priority date claimed

**T** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

**X** document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

**Y** document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

**Z** document member of the same patent family

Date of the actual completion of the international search 25 September 2013
Date of mailing of the international search report 17/03/2014

Name and mailing address of the ISA/European Patent Office, P.O. Box 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel (31-70) 340-2040, 340-3046 Authorized officer
Plenk, Rupert
### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<td>US 2010/161188 Al (TURSKIMICHAELE P [US] ET AL) 24 June 2010 (2010-06-24) paragraph s [0003], [0005], [0016], [0026] - [0028], [0039], [0040], [0049]</td>
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<td>X</td>
<td>US 2012/116641 Al (CROSMAN III ALEXANDER C [US] ET AL) 10 May 2012 (2012-05-10) paragraph s [0013], [0026], [0027]; figure 1</td>
<td>29</td>
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Form PCT/ISA/ST.01 (continuation of second sheet) (April 2005)
INTERNATIONAL SEARCH REPORT

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. □ Claims Nos.:
   because they relate to subject matter not required to be searched by this Authority, namely:

2. x Claims Nos.:
   30
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
   see FURTHER INFORMATION sheet PCT/ISA/2 10

3. □ Claims Nos.:
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 64(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This international Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. □ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. □ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of additional fees.

3. □ As only some of the required additional search fees were timely paid by the applicant, this international search report covers 04/16/2017 onwards; claims 1-10, 16-29 paid, specifically claims Nos.:

4. x No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1 - 8, 11, 12, 16-29

Remark on Protest

□ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

□ Three additional search fees were accompanied by the applicant’s protest but the applicable protest requirement was not met, namely:

□ No protest accompanied the payment of additional search fees.
<table>
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<td>ES 2147108</td>
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</table>
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8, 11, 12, 16-29

   Setting prescribed value of wheel slip depending on vehicle speed, including
   to use only vehicle speed (claim 4)
   to use vehicle speed and other parameters (claims 2, 3, 5, 6),
   to set a value corresponding to a maximum amount of tractive force (claims 7, 8)
   to set a value greater than that for maximum amount (claims 11, 12)

Claims 28 and 29 are linked to a different invention, however, have been searched together with the other claims.

2. claims: 9, 10

   Wheel slip set to a value less than that for maximum amount of tractive force

3. claims: 13, 14

   Limitation of rate of increase of drive torque, with the aim to provide a smooth vehicle behaviour

4. claim: 15

   Determination of coefficient of surface friction
Continuation of Box 11.2

Claims Nos.: 30

Claim 39 refers to the drawings for defining the subject-matter for which protection is sought, contrary to Article 6 and Rule 6.2(a) PCT.

The applicant’s attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.