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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,

DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

Published:

— with international search report (Art. 21(3))

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19 November 2015

(54) **Title:** ROADWAY MAINTENANCE STRIPING APPARATUS

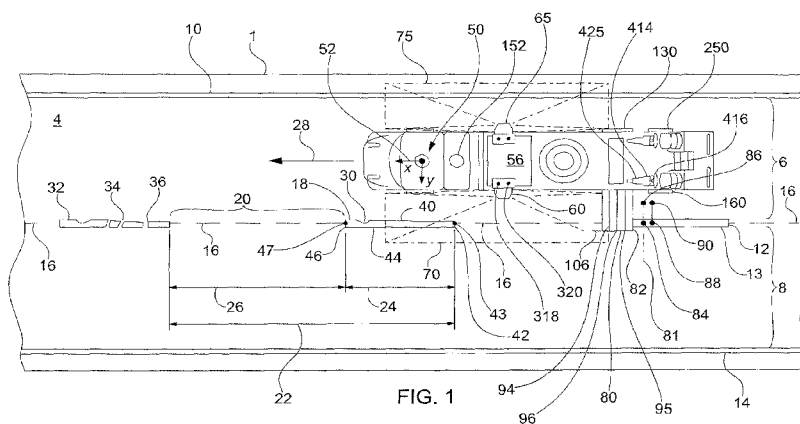


FIG. 1

(57) **Abstract:** A control system for positioning a marker over a pre-existing roadway surface mark. The control system has an electromagnetic radiation source attached to the marker for producing a mark pattern on the roadway surface. An imager permits the control system to image both the pre-existing roadway surface mark and the mark pattern produced by the electromagnetic radiation source. A computer is responsive to the imager for producing an error signal based upon the location difference between (a) the image of the pre-existing roadway surface mark and (b) the image of the mark pattern produced by the electromagnetic radiation source. An actuator is responsive to the error signal for positioning the marker over the pre-existing roadway mark.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/17034

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. Claims Nos.:
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:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(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:

-Please See Supplemental Page-

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 additional fees, 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 only those claims for which fees were paid, specifically claims Nos.:

4. 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.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/17034

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - E01C 23/16;G01P 3/80; G05D 1/02 (2015.01)

CPC - E01C 23/163; G01P 3/803; G05D 1/02

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)

IPC(8): G05D 1/02; G01C 15/04; E01C 23/01, 23/06, 23/16; G08G 1/054; G01M 17/00 ; G01P 3/68, 3/80 (2015.01)

CPC: G05D 1/02; G01C 15/04; E01C 23/16, 23/163; G08G 1/054; G01P 3/68, 3/806;USPC : 356/630; 73/146; 701/31.4

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)

PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google; Google Scholar; ProQuest; IP.com; keywords: laser, filter, error, paint, mark, road, street, pave, camera, magnet, hall sensor, speed, calibrate, sensor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 5,296,256 A (HARTMAN WH) March 22, 1994; figures 1, 3, 5; column 1, lines 20-25; column 5, lines 65-68; column 6, lines 1-5, 25, 30; column 7, lines 1-10; column 8, lines 20-25; column 9, lines 55-65	7 — 9
X	US 2008/0091315 A1 (KROKEL D et al.) April 17, 2008; figures 1a, 1b, 2; paragraphs [0002], [0003], [0006]; [0018], [0027]; [0036]	18-20 — 21-23
Y	US 2013/0190981 A1 (LIMNTECH LLC.) July 25, 2013; figure 4; paragraphs [0040], [0105]	9
Y	US 5,828,585 A (WELK DL et al.) October 27, 1998; column 2, lines 20-35; column 10, lines 25-45; claim 1	21-23
Y	DE 10 2011 119 312 A (GM GLOBAL TECHNOLOGY OPERATIONS LLC.) May 23, 2013; figure 4; paragraphs [0018], [0037], [0039], [0044]	22
A	US 8,467,968 B1 (DOLINAR DD et al.) June 18, 2013; entire document	1-23
A	US 6,330,503 B1 (SHARP KAI et al.) December 11, 2001; entire document	1-23
A	US 2013/0167385 A1 (LEICA GEOSYSTEMS AG.) July 04, 2013; entire document	1-23
A	US 2004/0160595 A1 (ZIVKOVIC A et al.) August 19, 2004; entire document	1-23
A	US 2007/0081695 A1 (FOXLIN E et al.) April 12, 2007; entire document	1

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 citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other 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

“&” document member of the same patent family

Date of the actual completion of the international search

08 July 2015 (08.07.2015)

Date of mailing of the international search report

24 JUL 2015

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US15/17034

-***-Continued from Box No. III: Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-6 are directed toward a control system for positioning a marker over a pre-existing roadway surface mark, the control system comprising: an electromagnetic radiation source and an error signal.

Group II: Claims 7-17 are directed toward an apparatus for restriping a pre-existing substantially rectangular roadway mark comprising: a vehicle and predicting a roadway mark path.

Group III: Claims 18-20 are directed toward an apparatus for automatically determining the speed of a vehicle travelling along a skip line roadway mark path comprising: trigger signals, triggered images, and determining a time difference.

Group IV: Claims 21-23 are directed toward an apparatus for automatically determining the distance travelled by a vehicle comprising: a signal representative of the distance travelled by the vehicle; determining the equivalent space distance between the similar feature characteristics of the skip line roadway mark images.

The inventions listed as Groups I-VI do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons.

The special technical features of Group I include an electromagnetic radiation source attached to the marker for producing a mark pattern on the roadway surface; an imager for imaging the mark pattern produced by the electromagnetic radiation source; a computer responsive to the imager for producing an error signal based upon the location difference between (a) the image of the pre-existing roadway surface mark and (b) the image of the mark pattern produced by the electromagnetic radiation source; and an actuator responsive to the error signal for positioning the marker over the preexisting roadway mark (which is not present in Groups II-IV).

The special technical features of Group II include: a vehicle for moving along the roadway mark path having a roadway marker for dispensing roadway mark material onto the pre-existing roadway mark; an imager mounted on the vehicle and downwardly focused onto the roadway surface; and a system responsive to the imager (i) for predicting the roadway mark path for aligning the roadway marker over the predicted roadway mark path and (ii) for determining the roadway marker restriping dispensing time from the at least two longitudinal displaced and laterally directed line segment images (which is not present in Groups I, III, or IV).

The special technical features of Group III include: a signal generator for producing time deterministic trigger signals; an object space calibrated imager responsive to the signal generator for producing triggered images of similar feature characteristics of the skip line roadway mark; and a computer responsive to the signal generator for determining the time difference between and object space location differences of similar feature characteristics of the skip line roadway mark between triggered images, and determining the speed of the vehicle from the time and object space location differences (which is not present in Groups I, II, or IV).

The special technical features of Group IV include: an imager for imaging a sequence of images of the skip line roadway mark pattern; a transducer for producing a signal representative of the distance travelled by the vehicle; a computer responsive to the transducer having (a) a program for determining the equivalent space distance between the similar feature characteristics of the skip line roadway mark images and (b) a program for adjusting the transducer-produced distance signal according to the space distance (which is not present in Groups I-III).

The common technical features of Groups I-IV include: an imager for imaging the pre-existing roadway surface mark; a computer responsive to the imager; and a signal generator.

These common technical features are disclosed by US 2004/0160595 A1 (ZIVKOVIC): an imager (140; paragraph [0025]) for imaging the pre-existing roadway surface mark (102; paragraphs [0025], [0026]); a computer responsive to the imager (116; paragraph [0025]); and a signal generator (178; paragraph [0037], claim 18).

Because the common technical features are disclosed by Zivkovic, the inventions are not so linked as to form a single general inventive concept. Therefore, Groups I-IV lack unity.