(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 September 2014 (25.09.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/152003 A3

(51) International Patent Classification:
G06T 17/00 (2006.01) *G06T 15/00* (2011.01)

(21) International Application Number:
PCT/US2014/026799

(22) International Filing Date:
13 March 2014 (13.03.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/831,309 14 March 2013 (14.03.2013) US

(71) Applicant: **DREAMWORKS ANIMATION LLC** [US/US]; 1000 Flower Street, Glendale, CA 91201 (US).

(72) Inventor: **SMYTH, Evan, P.**; c/o DREAMWORKS ANIMATION LLC, 1000 Flower Street, Glendale, CA 91201 (US).

(74) Agents: **YIM, Peter, J.** et al.; Morrison & Foerster LLP, 425 Market Street, San Francisco, CA 94105-2482 (US).

(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, LT, 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.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

[Continued on next page]

WO 2014/152003 A3

(54) Title: CONSERVATIVE PARTITIONING FOR RENDERING A COMPUTER-GENERATED ANIMATION

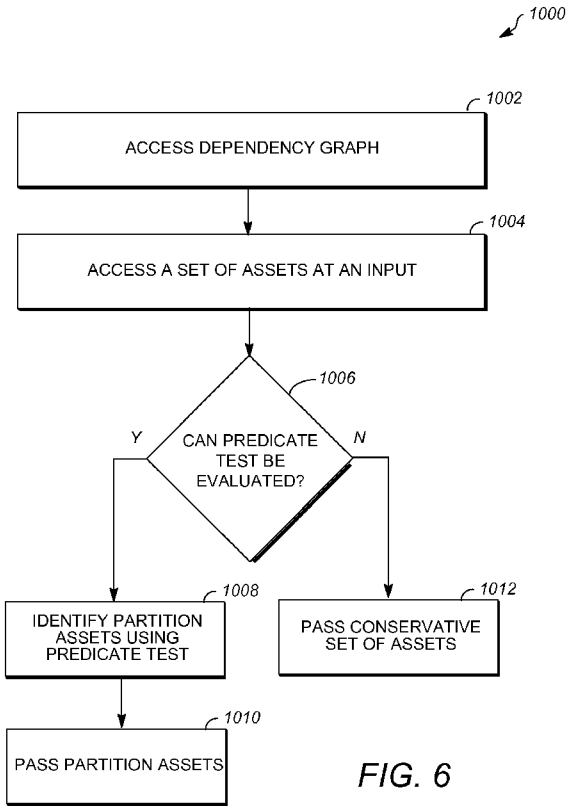

FIG. 6

(57) Abstract: A system for partitioning a set of assets, where each asset represents a computer-generated object associated with a computer-generated scene. A dependency graph comprising a plurality of interconnected nodes including an organizer node is accessed. The set of assets identified by an input of a predicate test of the organizer node are accessed. It is determined if the at least one predicate test can be evaluated using the set of assets. If the at least one predicate test can be evaluated, one or more partition assets are identified and passed to a next node. If the at least one predicate test cannot be evaluated, a conservative set of assets is identified and passed to the next node, wherein the conservative set of assets is the same set of assets identified by the input of the predicate test.

EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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))*

(88) Date of publication of the international search report:
4 December 2014

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US14/26799

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06T 17/00, 15/00 (2014.01)
USPC - 345/473, 419
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) Classification(s): G06T 17/00, 15/00, 19/00 (2014.01)
USPC Classification(s): 345/473, 419; CPC Classification(s): G06T 13/20, 13/00; G06F 3/00

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)
MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); ProQuest; IEEE/IEEEXplore; Google/Google Scholar; Dependency graph, predicate test, partition, set, memory, geometry, animation, graphics

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/0123723 A1 (COLLARD, B et al.) 20 May 2010; figures 1, 4, 5; paragraphs [0035], [0037], [0059], [0060], [0067], [0086]	1-10, 13-16, 18, 19
Y	US 2011/0106843 A1 (PAN, Y et al.) 05 May 2011; figures 1, 2, 3A, 5A-5F; paragraphs [0022]-[0024], [0047], [0057], [0059]	1-10, 13-16, 18, 19
Y	US 2012/0166446 A1 (BOWMAN, I et al.) 28 June 2012; paragraph [0071]	6
Y	WO 2012/174128 A1 (FRANK, S et al.) 20 December 2012; page 13, fourth paragraph; page 27, third paragraph	7
Y	US 2010/0214284 A1 (RIEFFEL, E et al.) 26 August 2010; paragraphs [0061], [0062], [0092]	8, 9
A	US 2008/0028414 A1 (COUTURE-GAGNON, J et al.) 31 January 2008; entire document	1-10, 13-16, 18, 19

☐ Further documents are listed in the continuation of Box C. ☐

* 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	Date of mailing of the international search report
10 September 2014 (10.09.2014)	26 SEP 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US14/26799

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:
Group I: Claims 1-10, 13-16, 18-19; Group II: Claims 11-12, 17, 20

-***-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.:
1-10, 13-16, 18-19

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/US14/26799

-***-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 fee must be paid.

Group I: Claims 1-10, 13-16, and 18-19 are directed toward a partitioning a set of assets by determining if at least predicate test can be evaluated.

Group II: Claims 11-12, 17, and 20 are directed toward a partitioning a set of assets by computing a rendered image based on a second pass through a dependency graph.

The inventions listed as Groups I-II 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 organizer node having at least one predicate test; determining if at least one predicate test can be evaluated using a set of assets; if the at least one predicate test can be evaluated, passing a conservative set of assets at the output of the organizer node to the next node, wherein the conservative set of assets is the same set of assets identified by the input of the predicate test which are not present in Group II.

The special technical features of Group II include identifying a render node; identifying a set of nodes of the dependency graph that are connected to the render node and are upstream from the render node; performing a second pass through the dependency graph; and computing a rendered image based on the second pass though the dependency graph, which are not present in Group I.

The common technical feature shared by Groups I-II is a computer-implemented method, an apparatus comprising a computer processor and a memory configured to store data, and a non-transitory computer-readable storage medium comprising computer-executable instructions, the computer-implemented, apparatus and computer-executable instructions for partitioning a set of assets, wherein each asset represents a computer-generated object associated with a computer-generated scene, comprising: accessing a dependency graph, the dependency graph comprising a plurality of interconnected nodes; and performing a pass through operation on the set of assets to identify one or more partition assets.

However, this common feature is previously disclosed by US 7,414,626 B1 (PICOTT). Picott disclose a computer-implemented method, an apparatus comprising a computer processor and a memory configured to store data, and a non-transitory computer-readable storage medium comprising computer-executable instructions (a computer executing a graphics creation system; column 3, lines 10-13), the computer-implemented, apparatus and computer-executable instructions for partitioning a set of assets (system provides a mapping (partitioning) that allows parameters (assets) of a function to be reordered to match the source and destination function requirements), wherein each asset represents a computer-generated object associated with a computer-generated scene (system passes algorithms between dependency nodes in a graphic creation (computer-generated scene) in a creation system such as Maya; Abstract and column 3, lines 10-14), comprising: accessing a dependency graph (a dependency graph is evaluated; column 2, lines 50-53), the dependency graph comprising a plurality of interconnected nodes (dependency graphs contain interconnected nodes; Figures 1 and 4); and performing a pass through operation on the set of assets to identify one or more partition assets (an evaluation process associated with the graph includes an ability to distinguish between passed parameters based on type where one of the types allowed is a function type and types are identified dynamically as the dependency graph is executed; Abstract).

Since the common technical feature is previously disclosed by the Picott reference, this common feature is not special and so Groups I-II lack unity.