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Declarations under Rule 4.17:

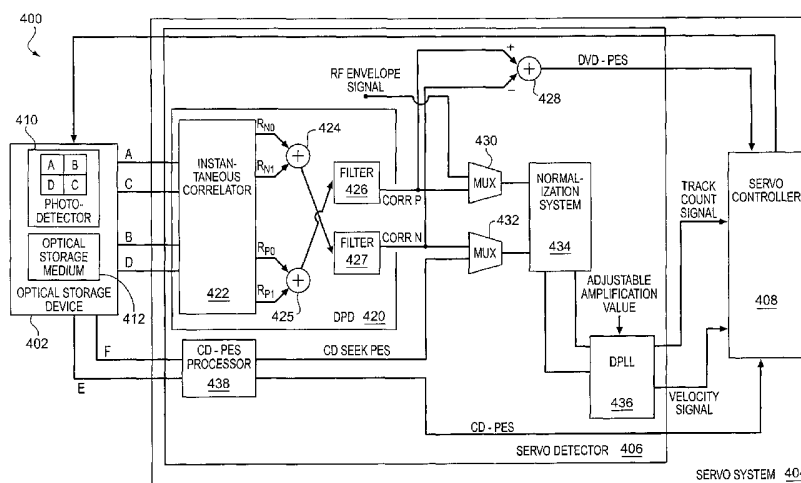
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for all designations
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

Published:

- with international search report

[Continued on next page]

(54) Title: SERVO CIRCUITRY FOR COUNTING TRACKS ON AN OPTICAL STORAGE MEDIUM



(57) Abstract: Servo circuitry (406) for counting tracks on an optical storage medium (412) is disclosed. The servo circuitry is comprised of a differential phase detector (420) and a digital phase-locked loop (436). The differential phase detector receives four signals (A-D) from a quad-photodetector (410) and correlates the four signals into a first correlation signal (CORR P) and a second correlation signal (CORR N). The digital phase-locked loop receives an adjustable amplification value along with the positive correlation signal (CORR P) and the negative correlation signal (CORR N). The digital phase-locked loop generates a track count signal based on the adjustable amplification value, the positive correlation signal, and the negative correlation signal. The track count signal represents track crossings on the optical storage medium. The digital phase-locked loop advantageously has an adjustable bandwidth based on the amplification value. The servo circuitry counts tracks on both CDs and DVDs.



WO 02/035531 A3



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24 April 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

Inter Application No
PCT/US 01/48044

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G11B7/085

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 7 G11B

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 956 304 A (FEYH GERMAN S ET AL) 21 September 1999 (1999-09-21) the whole document	1-39
A	EP 0 822 542 A (THOMSON BRANDT GMBH) 4 February 1998 (1998-02-04) abstract; figure 1	1,8,15, 23,32,36
A	EP 0 401 973 A (IBM) 12 December 1990 (1990-12-12) abstract page 12, line 52 -page 13, line 36; figure 4	1,8,15, 23,32,36
A	EP 0 429 421 A (ERICSSON TELEFON AB L M) 29 May 1991 (1991-05-29) the whole document	1,8,15, 23,32,36

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

☒ Patent family members are listed in 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 document 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

26 July 2002

Date of mailing of the international search report

27. 01. 2003

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/48044

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 any additional fee.
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.:

1-39

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-39

Method and servo circuitry for generating a track count signal.

2. Claims: 40-51

Method and circuitry for normalizing a signal.

INTERNATIONAL SEARCH REPORT

 Inter: Application No
 PCT/US 01/48044

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5956304	A	21-09-1999	JP 3065993 B2 JP 11149649 A	17-07-2000 02-06-1999
EP 0822542	A	04-02-1998	DE 19630887 A1 CN 1173702 A EP 0822542 A2 JP 10069654 A US 6084835 A	05-02-1998 18-02-1998 04-02-1998 10-03-1998 04-07-2000
EP 0401973	A	12-12-1990	US 5038333 A CA 2012800 A1 DE 69016269 D1 DE 69016269 T2 EP 0401973 A2 JP 2519339 B2 JP 3068004 A	06-08-1991 05-11-1990 09-03-1995 13-07-1995 12-12-1990 31-07-1996 25-03-1991
EP 0429421	A	29-05-1991	AT 120318 T AU 633658 B2 AU 6746590 A CA 2044257 A1 CN 1053334 A DE 69018023 D1 DE 69018023 T2 DK 429421 T3 EP 0429421 A1 ES 2073009 T3 FI 105619 B1 IE 904019 A1 JP 2987202 B2 JP 4503142 T NO 912566 A ,B, PT 95866 A WO 9107823 A1 US 5095288 A	15-04-1995 04-02-1993 13-06-1991 14-05-1991 24-07-1991 27-04-1995 20-07-1995 24-07-1995 29-05-1991 01-08-1995 15-09-2000 22-05-1991 06-12-1999 04-06-1992 28-06-1991 31-07-1992 30-05-1991 10-03-1992