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*H02M 1/32* (2007.01)    *H02M 1/00* (2007.01)

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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, DJ, 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, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG,

[Continued on next page]

(54) Title: MULTI-CHANNEL CINEMA AMPLIFIER WITH POWER-SHARING, MESSAGING AND MULTI-PHASE POWER SUPPLY

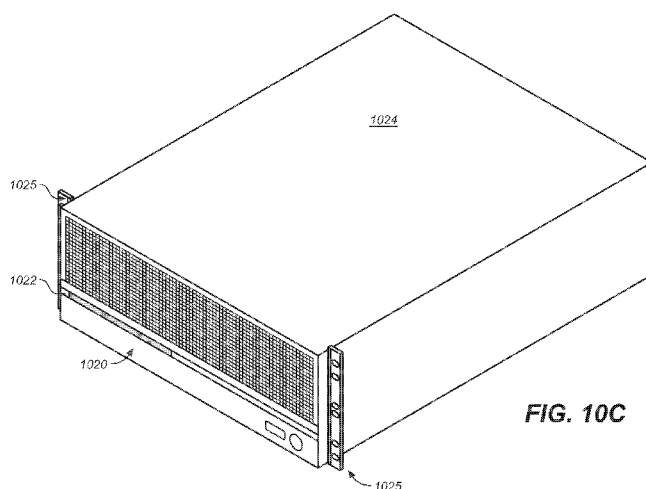


FIG. 10C

(57) Abstract: An integrated cinema amplifier a power supply stage that distributes power over a plurality of channels for rendering immersive audio content in a surround sound listening environment. The amplifier automatically detects maximum and net power availability and requirements based on audio content by decoding audio metadata and dynamically adjusts gains to each channel or sets of channels based on content and operational/environmental conditions. A power supply stage provides power to drive a plurality of channels corresponding to speaker feeds to a plurality of speakers. The amplifier has a front panel having an LED array with each LED associated with a respective channel or group of channels of the multi-channel amplifier, and a control unit configured to light the LEDs according to display patterns based on operating status or error conditions of the amplifier.



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, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, 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).

**Declarations under Rule 4.17:**

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

**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))

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21 September 2017

## INTERNATIONAL SEARCH REPORT

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PCT/US2017/015459

## A. CLASSIFICATION OF SUBJECT MATTER

INV. H04R5/04 H03G3/30 H03G3/00 H05B37/02 H02M1/32  
ADD. H04S7/00 H04R29/00 H03F3/68 H02M1/42 H02M1/00

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)

H04R H03F H03G H04S H05B H02M

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-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.
X	WO 01/26222 A1 (SMITH CARROLL W [US]; JUREK BRIAN EMERSON [US]; HAZLEWOOD HARVEY W [US] 12 April 2001 (2001-04-12)	17
Y	page 2, line 23 - page 6, line 2	1-5,
	page 10, line 5 - page 19, line 5; figures 1-5	7-12,
A	page 23, line 24 - page 24, line 15; figure 7	18-20
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	column 1, line 26 - column 2, line 67; figures 1-3	7-12,
	-----	18-20
	-/--	



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

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"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

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Name and mailing address of the ISA/

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2017/015459

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2009/010056 A1 (TC GROUP AS [DK]; DALBJOERN KLAS AAKE [SE]; TANGE KENT [DK]; SKOVENBOR) 22 January 2009 (2009-01-22) page 24, line 29 - page 26, line 2; figure 4 -----	2
Y	US 2003/138115 A1 (KROCHMAL ANDREW CYRIL [US] ET AL) 24 July 2003 (2003-07-24) paragraphs [0006] - [0022]; figures 1-3 -----	8,20
X	US 2011/091052 A1 (WANG CHAO-LANG [TW]) 21 April 2011 (2011-04-21) -----	17
Y	paragraphs [0005] - [0007], [0015] - [0017] -----	9,18-20
Y	Robert Taylor: "EE Times - Multiphase Power Supplies: Not Just For High Current", EE Times, 22 January 2016 (2016-01-22), XP055361690, Retrieved from the Internet: URL: <a href="http://www.eetimes.com/author.asp?doc_id=1328725">http://www.eetimes.com/author.asp?doc_id=1328725</a> [retrieved on 2017-04-04] the whole document -----	11
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A	WO 2010/075776 A1 (NCW LIGHTING EQUIPMENT DONGGUA [CN]; CHEUNG BANLY [CN]) 8 July 2010 (2010-07-08) page 2, line 25 - page 4, line 17 page 5, line 4 - page 7, line 12 -----	17-20
A	US 2004/184619 A1 (INAGAKI KAZUYA [JP]) 23 September 2004 (2004-09-23) paragraph [0008] - paragraph [0025] -----	17-20
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X	US 3 898 532 A (FRANK HOWARD L) 5 August 1975 (1975-08-05) -----	26
Y	column 4, line 40 - column 5, line 23; figure 1 column 6, line 62 - column 7, line 65 -----	21,27
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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2017/015459

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US 2016/192101 A1 (PARK YONG SOO [KR]) 30 June 2016 (2016-06-30) paragraphs [0057], [0179] - [0181], [0263] - [0267], [0278] - [0280]; figures 19, 22	21,27
A	----- US 2005/017695 A1 (STANLEY GERALD R [US]) 27 January 2005 (2005-01-27) paragraphs [0012], [0059], [0118] - [0122]; figure 7	30-35
A	----- US 2014/265630 A1 (ZHOU HAI-QING [CN] ET AL) 18 September 2014 (2014-09-18) the whole document	30-35
A	----- US 2004/260416 A1 (KELLOM MARC [US] ET AL) 23 December 2004 (2004-12-23) paragraphs [0011] - [0016], [0028] - [0066], [0075] - [0081], [0154] - [0156], [0181] - [0186]; figures 1, 2, 5 -----	1-16, 21-35

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2017/015459

## 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:

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 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.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

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

1. claims: 1-16

Audio amplifier comprising a power supply stage, a monitor component monitoring operating characteristics of the amplifier and an interface to a unit applying channel gains in response to the monitored characteristics.  
The object is to adjust the power of the audio channels based on operational characteristics of the amplifier.

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2. claims: 17-20

Audio playback system comprising an amplifier providing power from the power supply to several speakers through speaker wires, a lighting control component providing power from the power supply to several lights through the speaker wires and an interface to a renderer generating digital audio content with lighting control metadata.  
The object is to provide power to both audio speakers and lights from a single power supply while controlling them independently.

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3. claims: 21-29

Multi-channel amplifier comprising a LED array on a front panel, which is lit according to display patterns based on operating status or error conditions of the amplifier, wherein a display pattern graphically shows the identity of a failed channel.  
The object is to indicate which channel is concerned by a fault condition.

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4. claims: 30-35

Power supply for a multi-channel amplifier, comprising a multi-phase power factor correction circuit with respective boost stages and a fault detection and protection array for each phase, an interface to a controller receiving fault information and a combinatorial circuit summing an output voltage from each boost stage to produce a final PFC output voltage.  
The object is the capability to continue operating properly even after losing a phase, while notifying the operator of the fault.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2017/015459

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0126222	A1	12-04-2001	NONE
US 5940518	A	17-08-1999	EP 0909114 A2 14-04-1999 US 5940518 A 17-08-1999
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