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(54) **Electroluminescent iridium compounds with fluorinated phenylpyridines, phenylpyrimidines, and phenylquinolines and devices made with such compounds**

(57) The present invention is generally directed to electroluminescent Ir(III) compounds, the substituted 2-phenylpyridines, phenylpyrimidines and phenylquinolines that are used to make the Ir(III) compounds, and devices that are made with the Ir(III) compounds.

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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 4542

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	DJUROVICH PETER I ET AL: "Ir(III) CYCLOMETALATED COMPLEXES AS EFFICIENT PHOSPHORESCENT EMITTERS IN POLYMER BLEND AND ORGANIC LEDs" POLYMER PREPRINTS, vol. 41, no. 1, March 2000 (2000-03), pages 770-771, XP001052648 * the whole document *	1-14	INV. H05B33/14 C09K11/06 C07F15/00 C07D213/61 C07D213/26 C07D213/68 C07D239/26 H01L51/30
A	CHATANI N; IE Y; KAKIUCHI F; MURAI S: "Ru3(CO)12-Catalyzed Reaction of Pyridylbenzenes with Carbon Monoxide and Olefins. Carbonylation at a C-H Bond in the Benzene Ring" JOURNAL OF ORGANIC CHEMISTRY, vol. 62, no. 8, 1997, pages 2604-2610, XP002201286 * page 2606, column 2 *	1-14	
A	GOSMINI C; NÉDÉLEC J Y; PÉRICHON J: "Electrosynthesis of functionalized 2-arylpyridines from functionalized aryl and pyridine halides catalyzed by nickel bromide 2,2'-bipyridine complex" TETRAHEDRON LETTERS, vol. 41, 24 June 2000 (2000-06-24), pages 5039-5042, XP002201287 * table 2 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) H05B C09K H01L C07F C07D
A	CACCHI S; FABRIZI G; MARINELLI F: "The Palladium-Catalyzed Transfer Hdrogenation/Heterocyclization of beta-(2-Aminophenyl)-alpha,beta-ynones. An Approach to 2-Aryl- and 2-Vinylquinolines" SYNLETT, 24 June 2000 (2000-06-24), XP002201288 scheme 1, scheme 2, table 1, compound 1e	1-14	

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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	17 November 2008	Lehnert, Andreas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
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D : document cited in the application
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A	BALDO M A ET AL: "VERY HIGH-EFFICIENCY GREEN ORGANIC LIGHT-EMITTING DEVICES BASED ON ELECTROPHOSPHORESCENCE" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 75, no. 1, 5 July 1999 (1999-07-05), pages 4-6, XP000850655 ISSN: 0003-6951 * the whole document *	1-14	
A	BALDO M A ET AL: "High-efficiency fluorescent organic light-emitting devices using a phosphorescent sensitizer" NATURE, MACMILLAN JOURNALS LTD. LONDON, GB, vol. 403, no. 6771, 17 February 2000 (2000-02-17), pages 750-753, XP002183466 ISSN: 0028-0836 * the whole document *	1-14	
A	WO 96/03410 A (FROMMBERGER BRUNO ;VOEGTLE FRITZ (DE); HERRMANN RUPERT (DE); ISSBE) 8 February 1996 (1996-02-08) * claims 1,2,20,21 *	1-14	TECHNICAL FIELDS SEARCHED (IPC)
A	DATABASE CAPLUS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; WANG, YUE ET AL: "(Hydroxyphenyl)pyridine derivative, its metal complexes and application a electroluminescence material" XP002201289 retrieved from STN Database accession no. 133:315395 * abstract * -/--	1-14	

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	& CN 1 245 822 A (JILIN UNIV., PEOP. REP. CHINA) 1 March 2000 (2000-03-01)		
A	DEDEIAN ET AL: "A NEW SYNTHETIC ROUTE TO THE PREPARATION OF A SERIES OF STRONG PHOTOREDUCING AGENTS: FAC TRIS-ORTHO-METALATED COMPLEXES OF IRIDIUM (III) WITH SUBSTITUTED 2-PHENYLPYRIDINES" INORGANIC CHEMISTRY, AMERICAN CHEMICAL SOCIETY, EASTON, US, vol. 30, no. 30, 1991, pages 1685-1687, XP001070331 ISSN: 0020-1669 * the whole document *	1-14	

TECHNICAL FIELDS SEARCHED (IPC)

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☒ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 04 00 4542

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-11-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9603410 A	08-02-1996	AT 187732 T	15-01-2000
		CN 1152923 A	25-06-1997
		EP 0772616 A1	14-05-1997
		ES 2143059 T3	01-05-2000
		JP 10503485 T	31-03-1998
		JP 3583436 B2	04-11-2004
		US 5981286 A	09-11-1999
CN 1245822 A	01-03-2000	NONE	

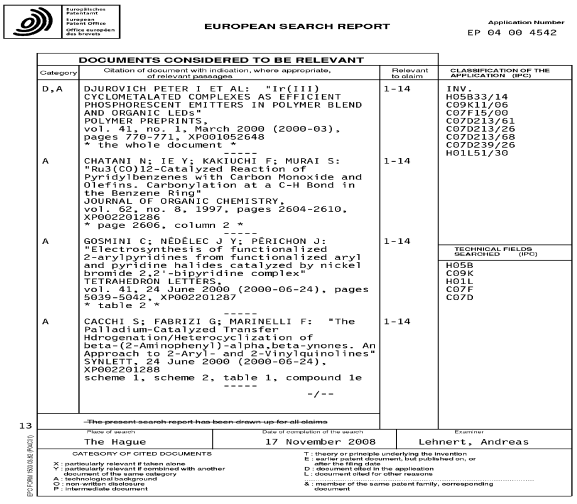
EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

专利名称(译)	具有氟化苯基吡啶，苯基嘧啶和苯基喹啉的电致发光铱化合物和用这些化合物制成的装置		
公开(公告)号	EP1431288A3	公开(公告)日	2008-12-24
申请号	EP2004004542	申请日	2001-06-27
[标]申请(专利权)人(译)	纳幕尔杜邦公司		
申请(专利权)人(译)	E.I.DU PONT DE NEMOURS AND COMPANY		
当前申请(专利权)人(译)	E·I·杜邦和公司		
[标]发明人	PETROV VIACHESLAV A WANG YING GRUSHIN VLADIMIR		
发明人	PETROV, VIACHESLAV A. WANG, YING GRUSHIN, VLADIMIR		
IPC分类号	H05B33/14 C09K11/06 C07F15/00 C07D213/61 C07D213/26 C07D213/68 C07D239/26 H01L51/30 H01L51/50 C07D213/30 C07D215/04 C07D215/12 H01L51/00		
CPC分类号	H05B33/14 C07D213/26 C07D213/30 C07D213/61 C07D213/68 C07D215/04 C07D239/26 C07F15/0033 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1014 C09K2211/1029 C09K2211/185 H01L51/005 H01L51/0084 H01L51/0085 H01L51/50 H01L51/5012 Y10S428/917		
代理机构(译)	TOWLER，PHILIP DEAN		
优先权	60/224273 2000-08-10 US 60/215362 2000-06-30 US		
其他公开文献	EP1431288A2		
外部链接	Espacenet		

摘要(译)

本发明一般涉及电致发光Ir（III）化合物，用于制备Ir（III）化合物的取代的2-苯基吡啶，苯基嘧啶和苯基喹啉，以及用Ir（III）化合物制备的器件。



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A	CHATANI N; IE Y; KAKIUCHI F; MURAI S: "Ru3(CO)12-Catalyzed Reaction of Pyridylbenzenes with Carbon Monoxide and Olefins. Carbonylation at a C-H Bond in the Benzene Ring" JOURNAL OF ORGANIC CHEMISTRY, vol. 62, no. 8, 1997, pages 2604-2610, XP002201286 * page 2606, column 2 *	1-14	
A	GOSMINI C; NÉDÉLEC J Y; PÉRICHON J: "Electrosynthesis of functionalized 2-arylpyridines from functionalized aryl and pyridine halides catalyzed by nickel bromide 2,2'-bipyridine complex" TETRAHEDRON LETTERS, vol. 41, 24 June 2000 (2000-06-24), pages 5039-5042, XP002201287 * table 2 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) H05B C09K H01L C07F C07D
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