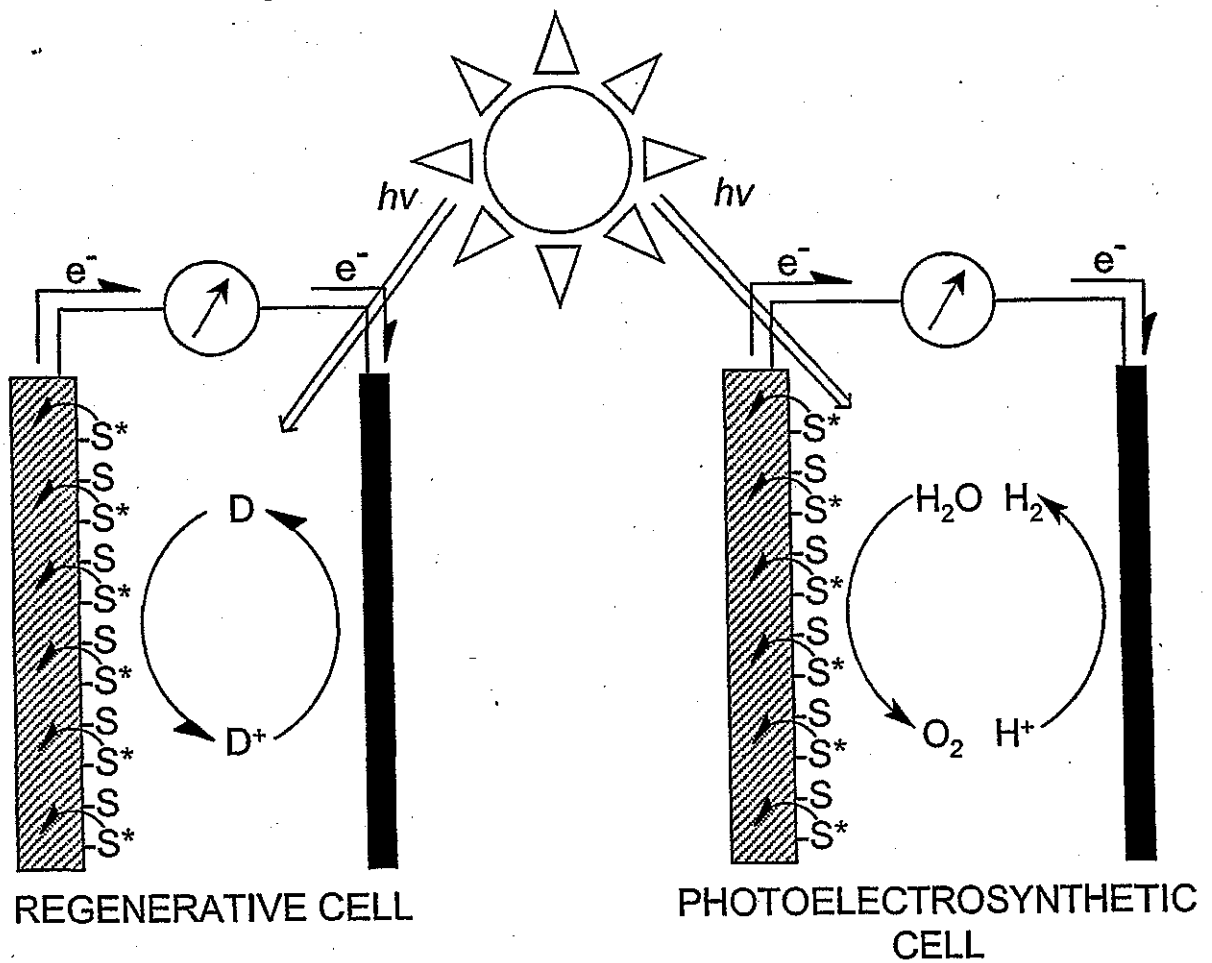
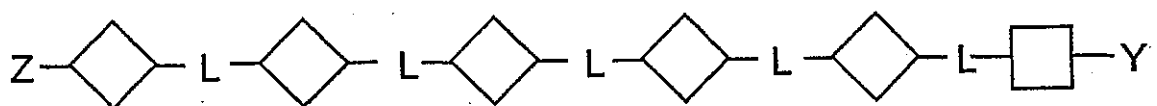


FIG. 1

◇ PIGMENT

L = LINKER

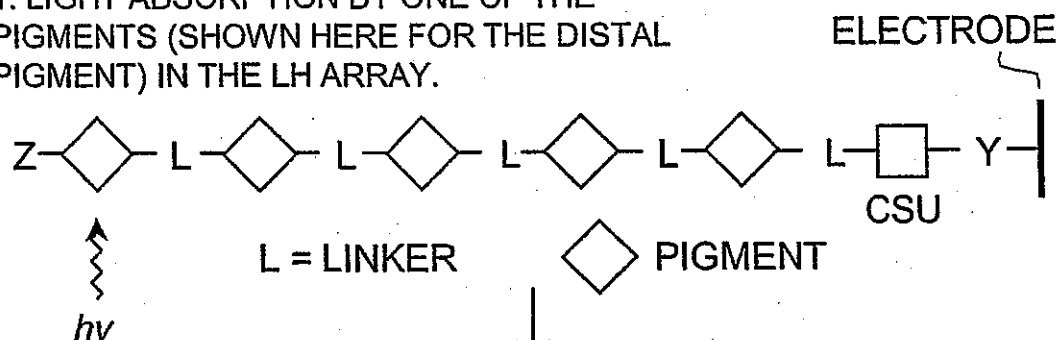
□ CSU

Y = ATTACHMENT GROUP FOR ELECTRODE

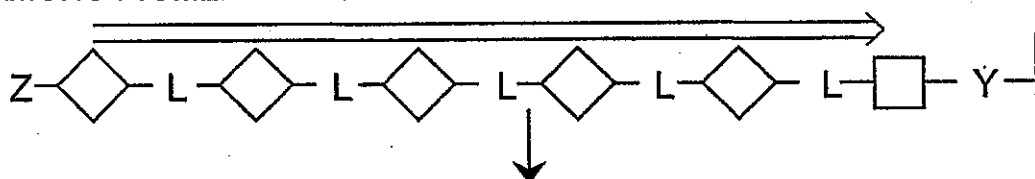
Z = CAPPING GROUP OR ATTACHMENT GROUP FOR ELECTRODE

FIG. 2

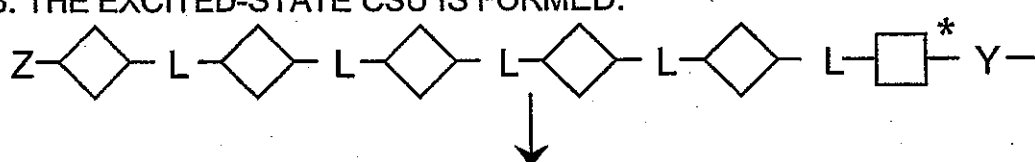
1. LIGHT ABSORPTION BY ONE OF THE PIGMENTS (SHOWN HERE FOR THE DISTAL PIGMENT) IN THE LH ARRAY.



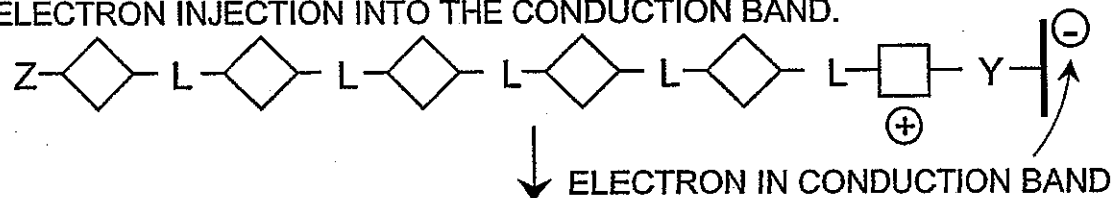
2. ENERGY MIGRATION FROM THE SITE OF ABSORPTION AMONG PIGMENTS IN THE LH ARRAY TO THE CSU.



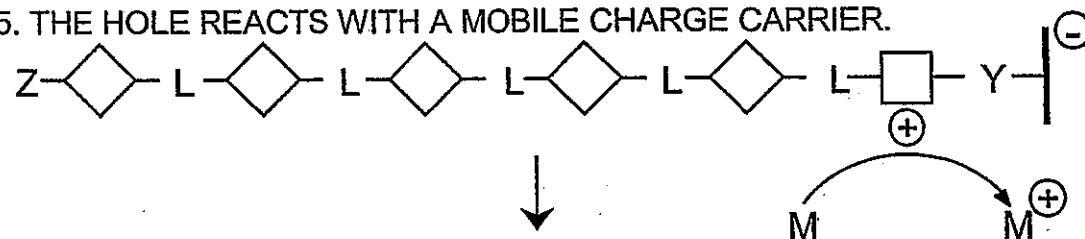
3. THE EXCITED-STATE CSU IS FORMED.



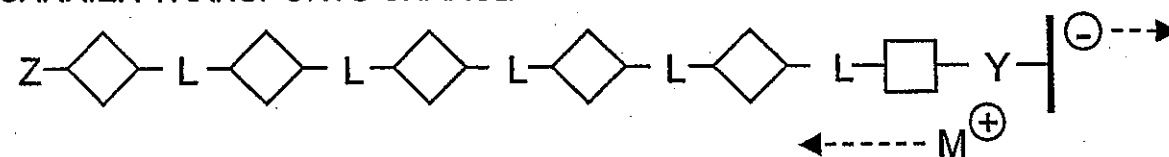
4. CHARGE SEPARATION IN THE CSU RESULTS IN ELECTRON INJECTION INTO THE CONDUCTION BAND.



5. THE HOLE REACTS WITH A MOBILE CHARGE CARRIER.



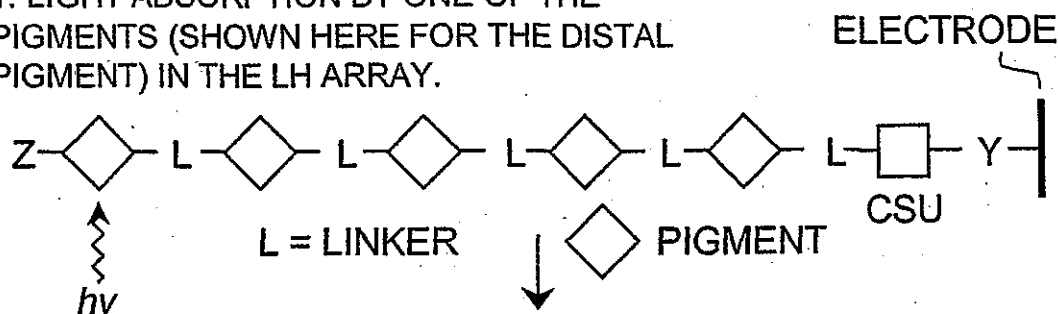
6. THE CSU IS REGENERATED AND THE MOBILE CHARGE CARRIER TRANSPORTS CHARGE TO THE OTHER ELECTRODE.



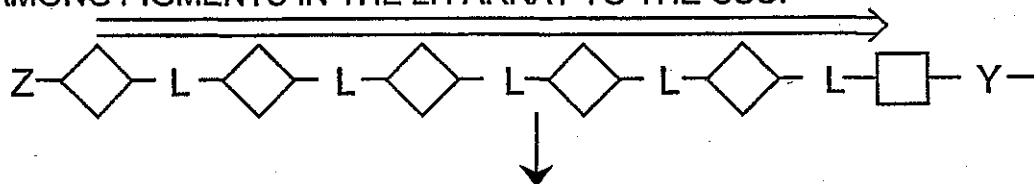
DESIGN I

FIG. 3
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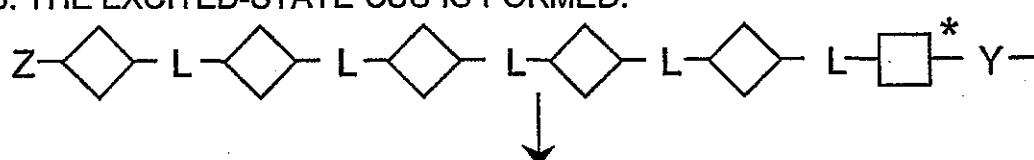
1. LIGHT ABSORPTION BY ONE OF THE PIGMENTS (SHOWN HERE FOR THE DISTAL PIGMENT) IN THE LH ARRAY.



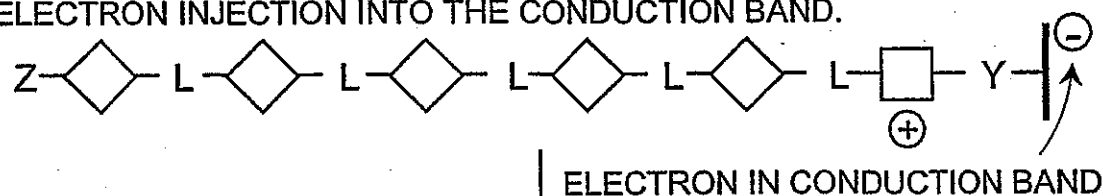
2. ENERGY MIGRATION FROM THE SITE OF ABSORPTION AMONG PIGMENTS IN THE LH ARRAY TO THE CSU.



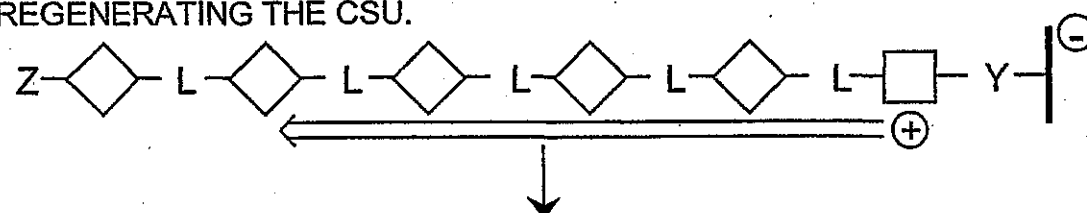
3. THE EXCITED-STATE CSU IS FORMED.



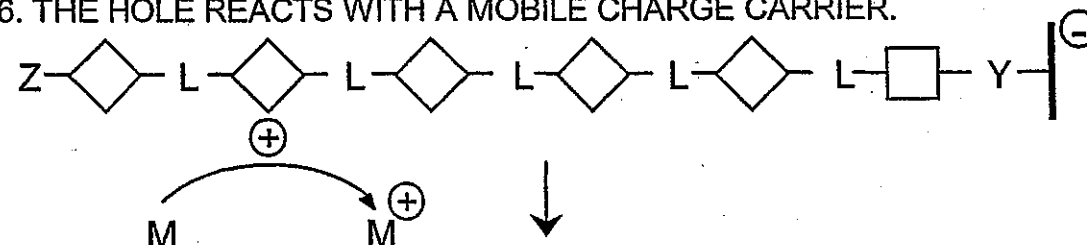
4. CHARGE SEPARATION IN THE CSU RESULTS IN ELECTRON INJECTION INTO THE CONDUCTION BAND.



5. THE HOLE MIGRATES AMONG PIGMENTS IN THE LH ARRAY, REGENERATING THE CSU.



6. THE HOLE REACTS WITH A MOBILE CHARGE CARRIER.



7. THE MOBILE CHARGE CARRIER TRANSPORTS CHARGE TO THE OTHER ELECTRODE.

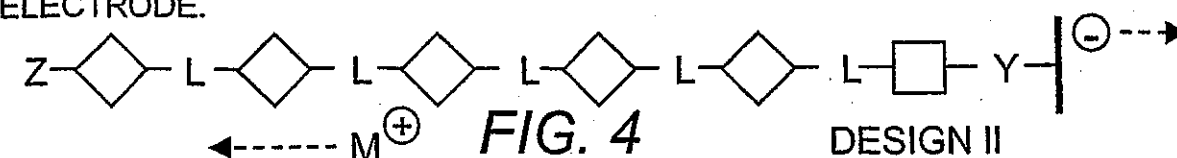
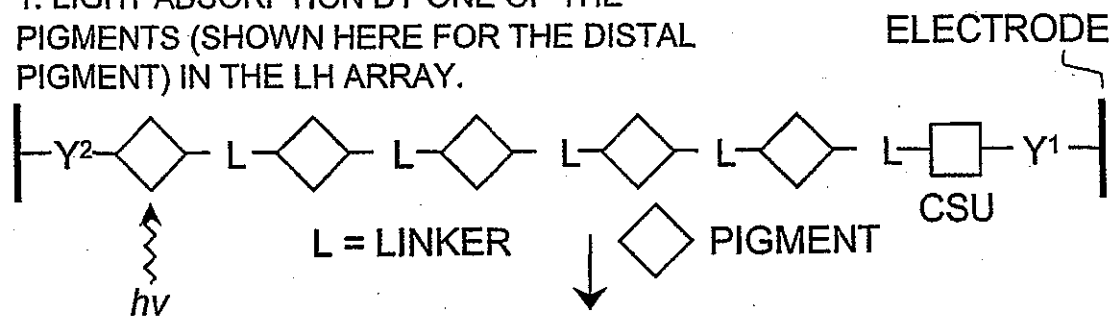


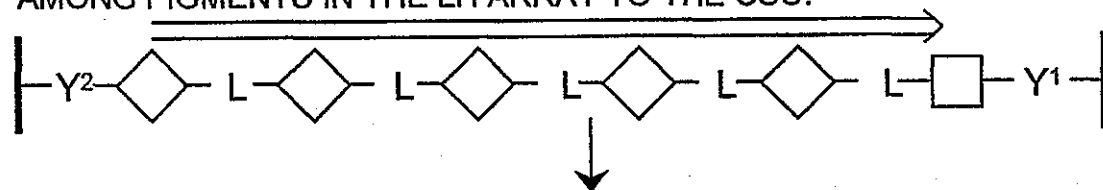
FIG. 4

DESIGN II

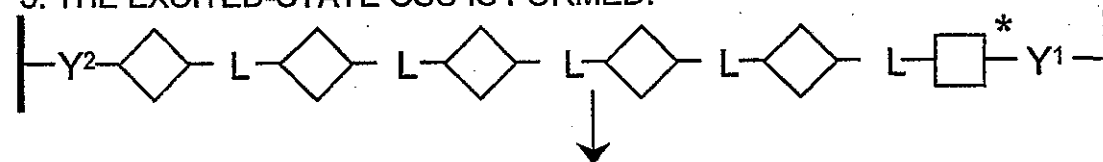
1. LIGHT ABSORPTION BY ONE OF THE PIGMENTS (SHOWN HERE FOR THE DISTAL PIGMENT) IN THE LH ARRAY.



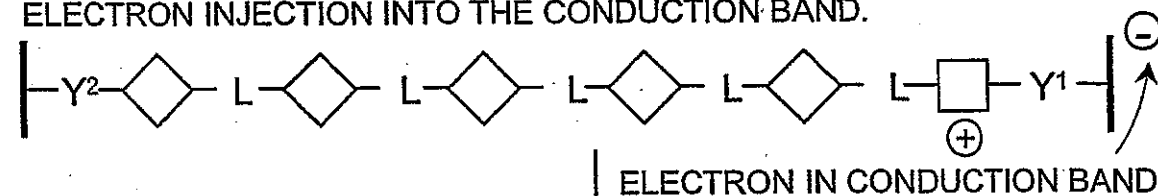
2. ENERGY MIGRATION FROM THE SITE OF ABSORPTION AMONG PIGMENTS IN THE LH ARRAY TO THE CSU.



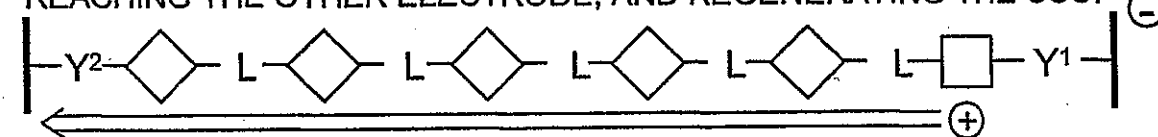
3. THE EXCITED-STATE CSU IS FORMED.



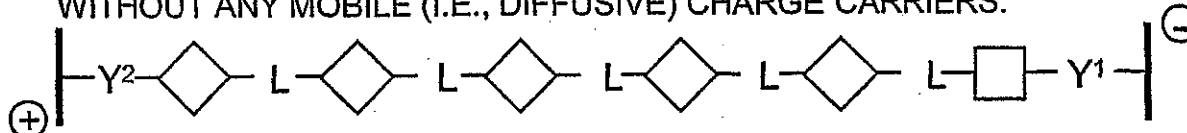
4. CHARGE SEPARATION IN THE CSU RESULTS IN ELECTRON INJECTION INTO THE CONDUCTION BAND.



5. THE HOLE MIGRATES AMONG PIGMENTS IN THE LH ARRAY, REACHING THE OTHER ELECTRODE, AND REGENERATING THE CSU.



6. THE HOLE AND ELECTRON REACH THEIR RESPECTIVE ELECTRODES WITHOUT ANY MOBILE (I.E., DIFFUSIVE) CHARGE CARRIERS.



DESIGN III

FIG. 5

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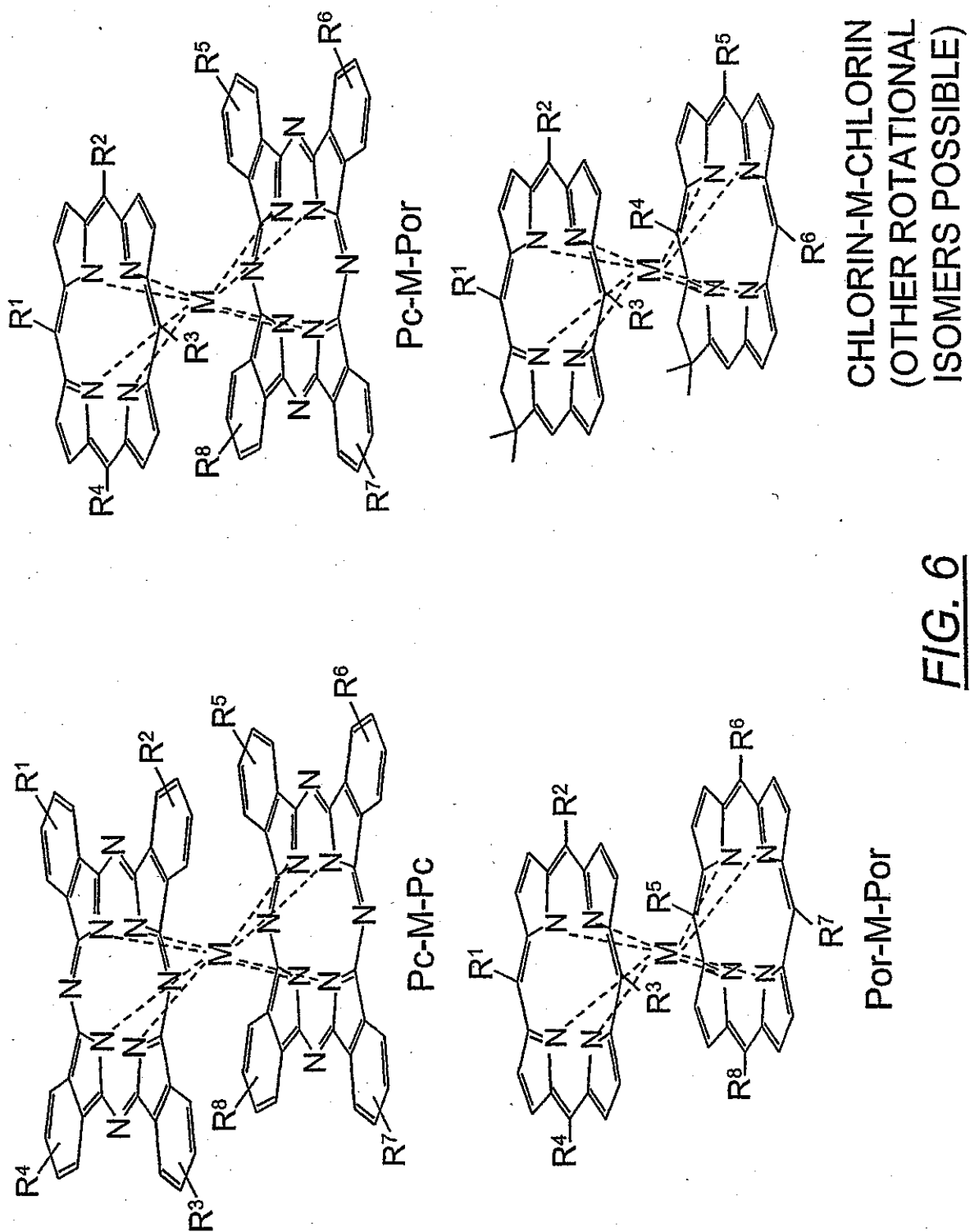
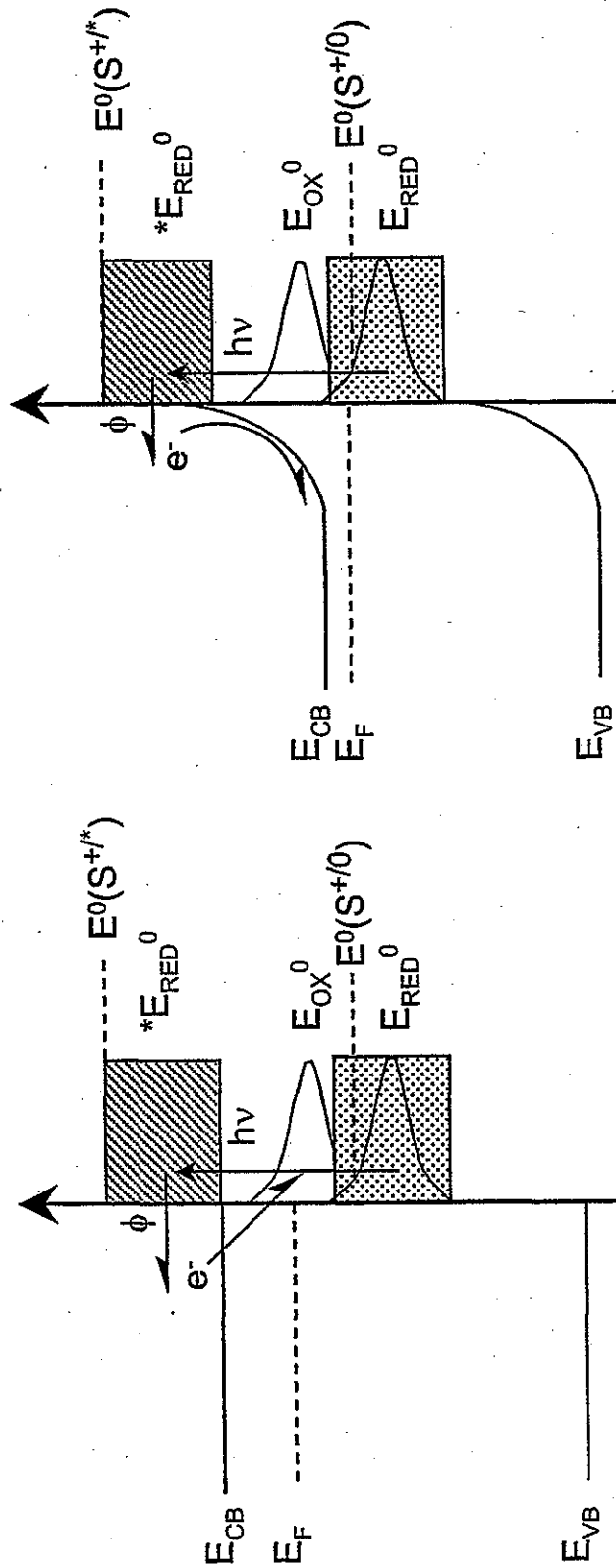


FIG. 6



B. BAND BENDING

A. FLAT BAND

FIG. 7

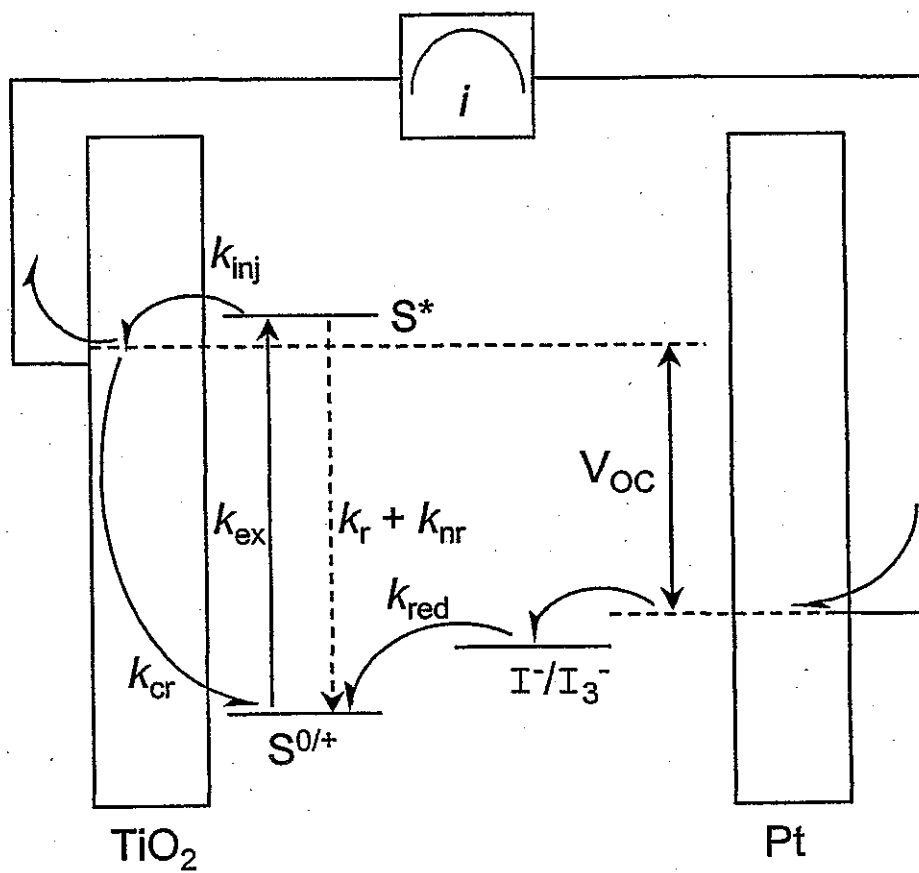


FIG. 8

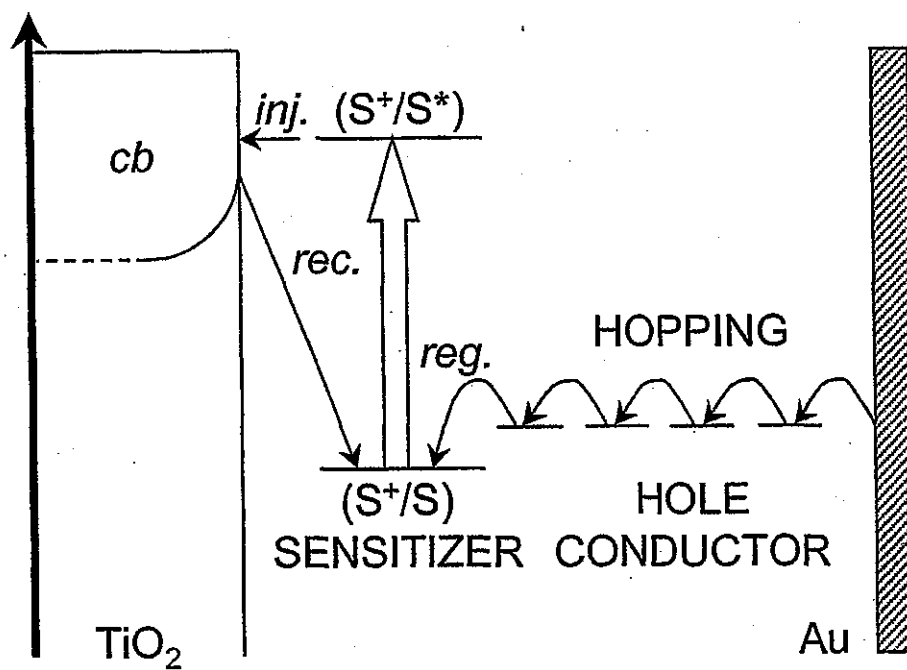


FIG. 9

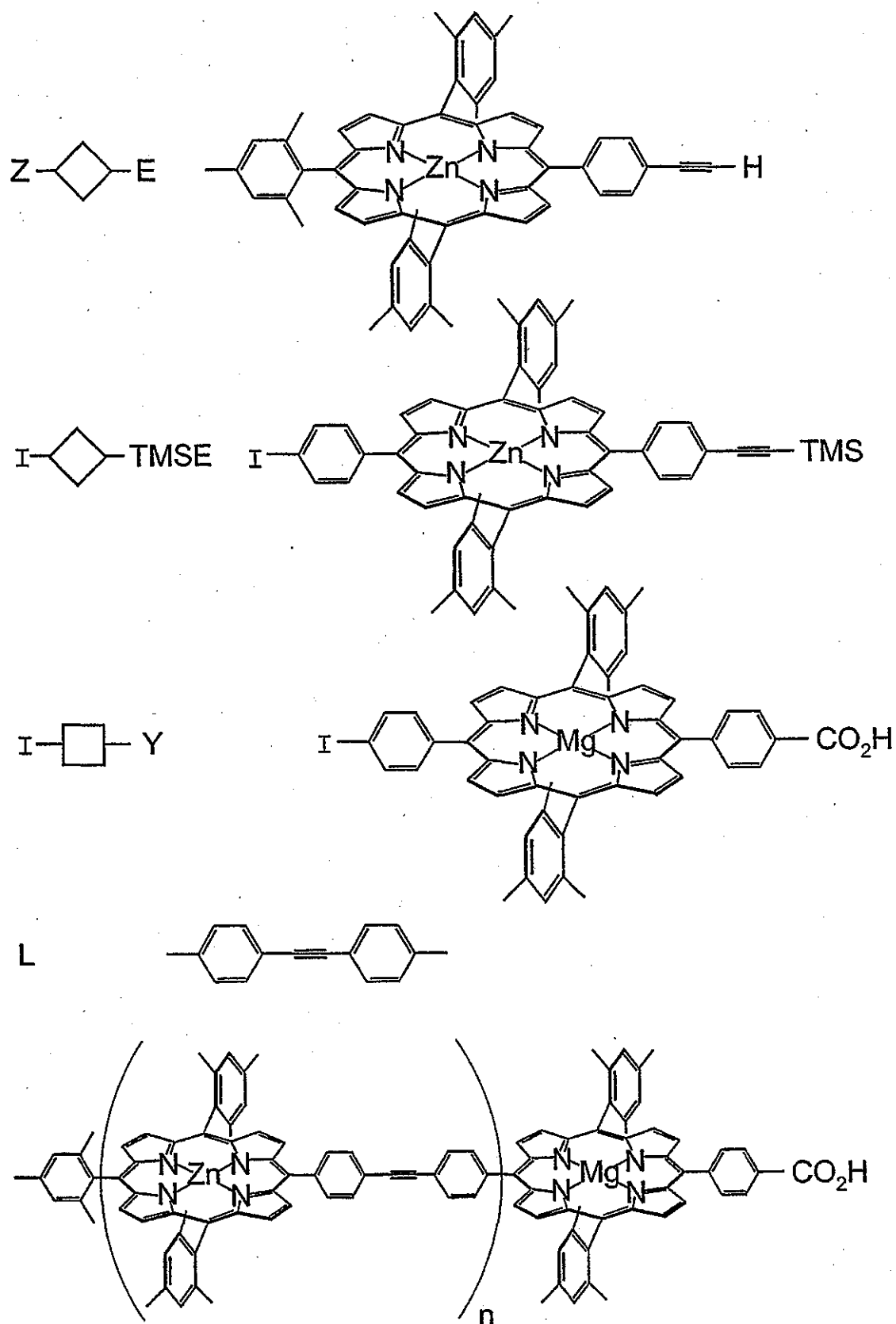


FIG. 10
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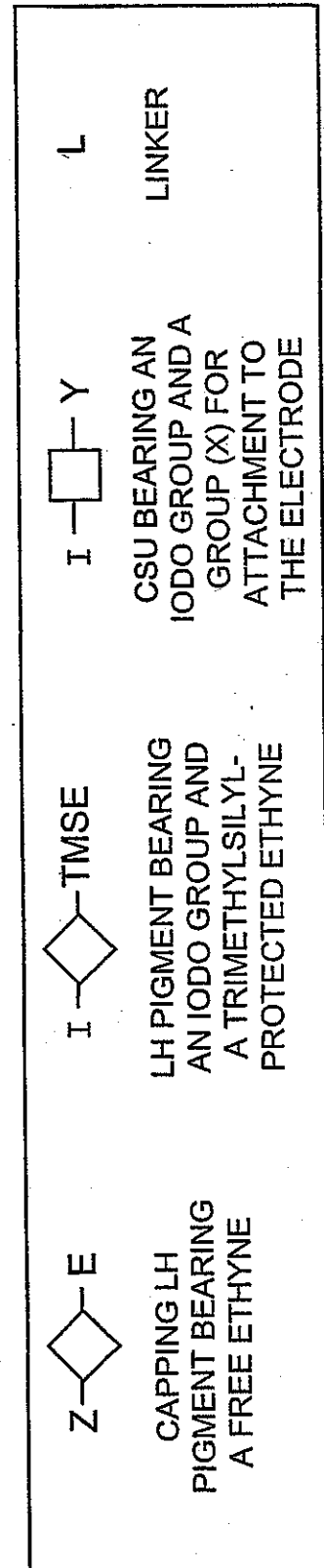


FIG. 11

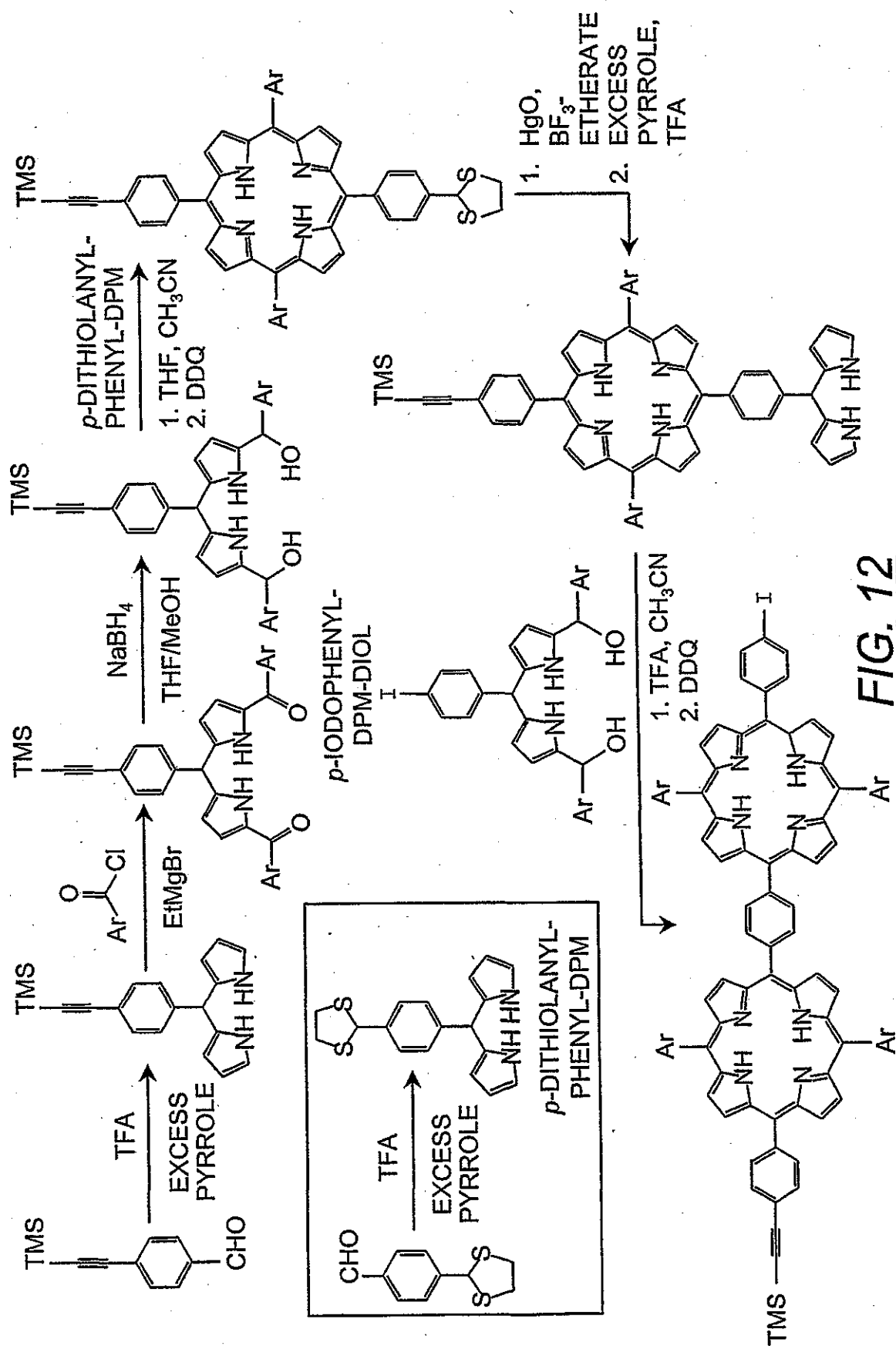


FIG. 12

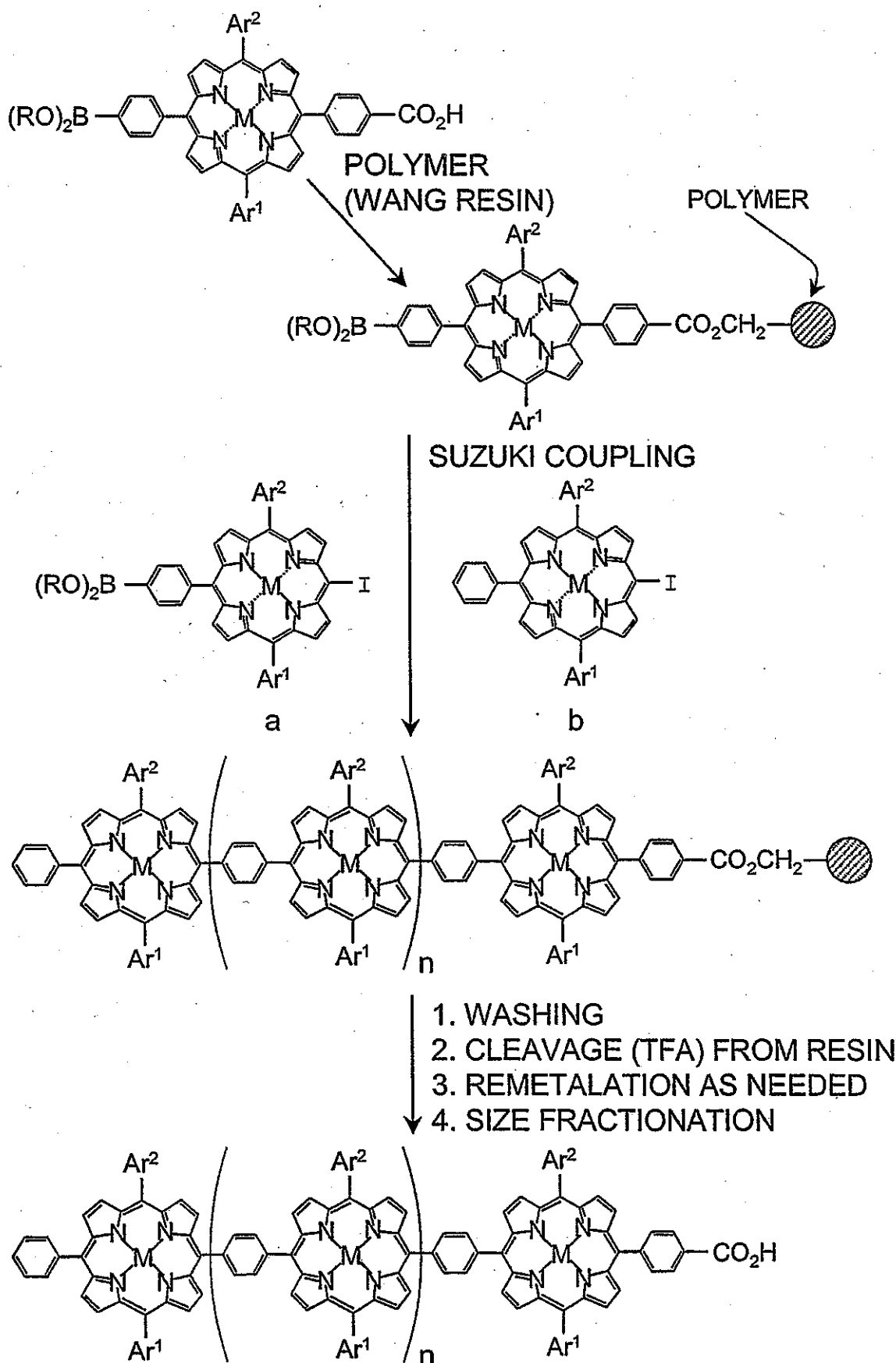


FIG. 13

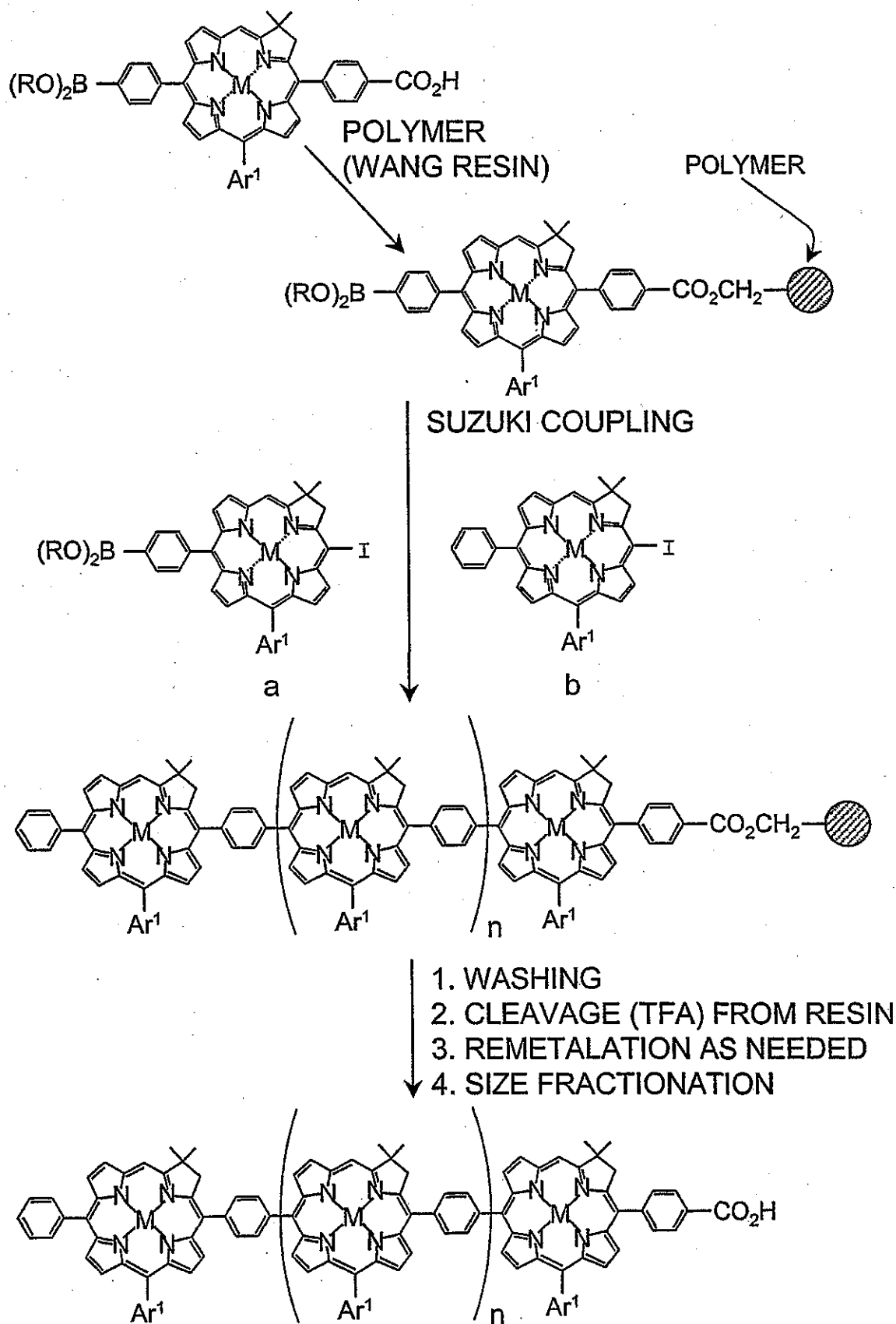


FIG. 14

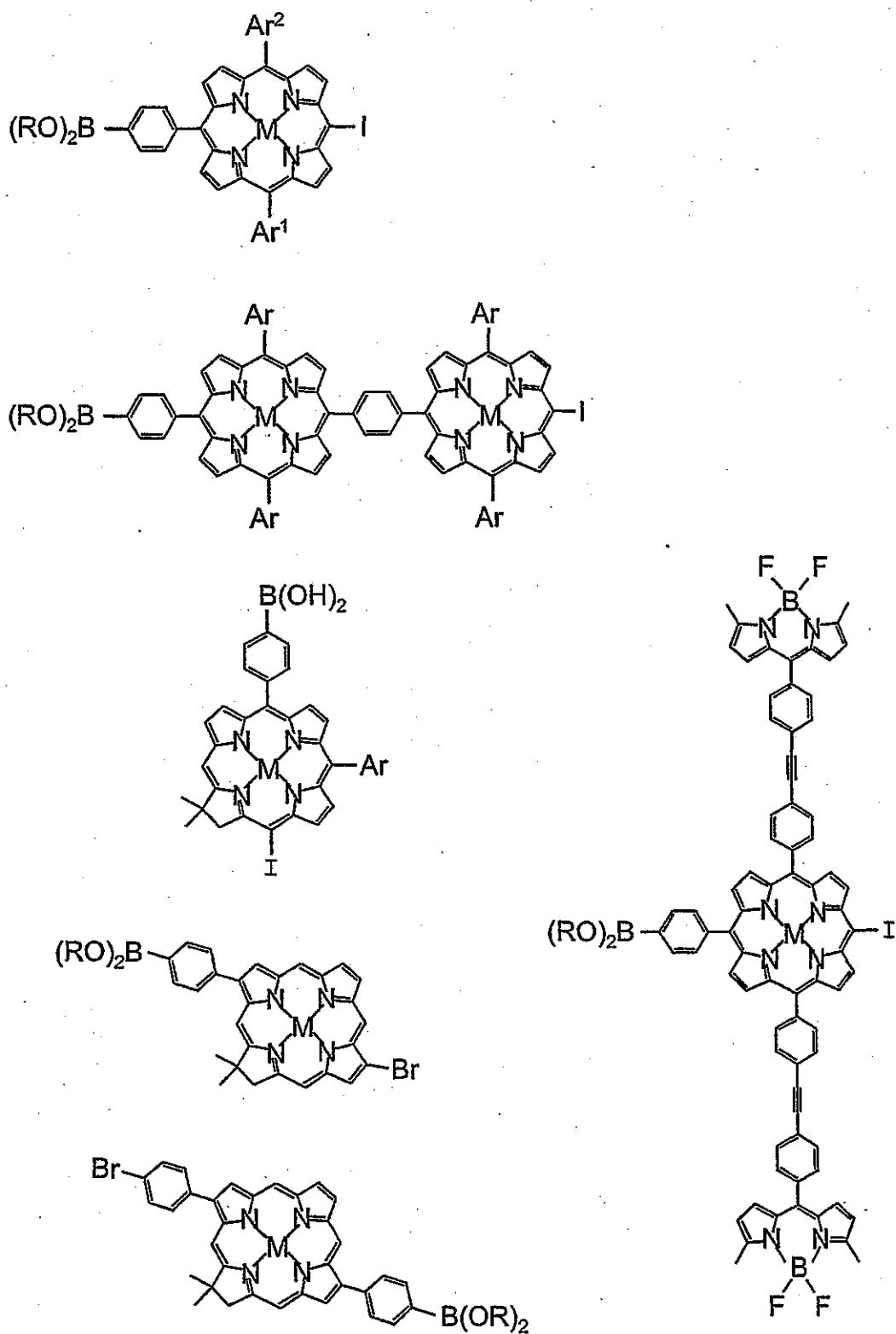
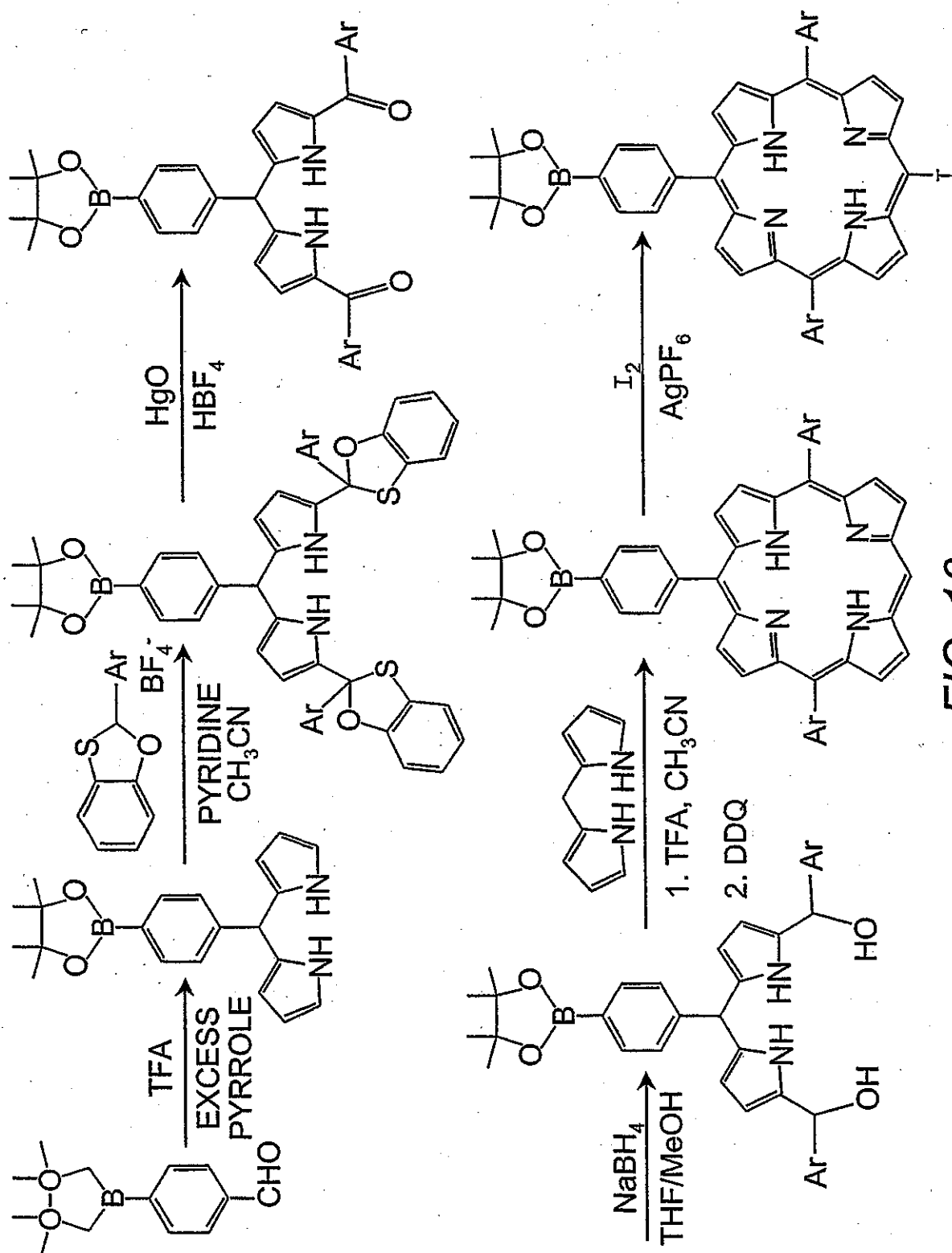


FIG. 15
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**FIG. 16**

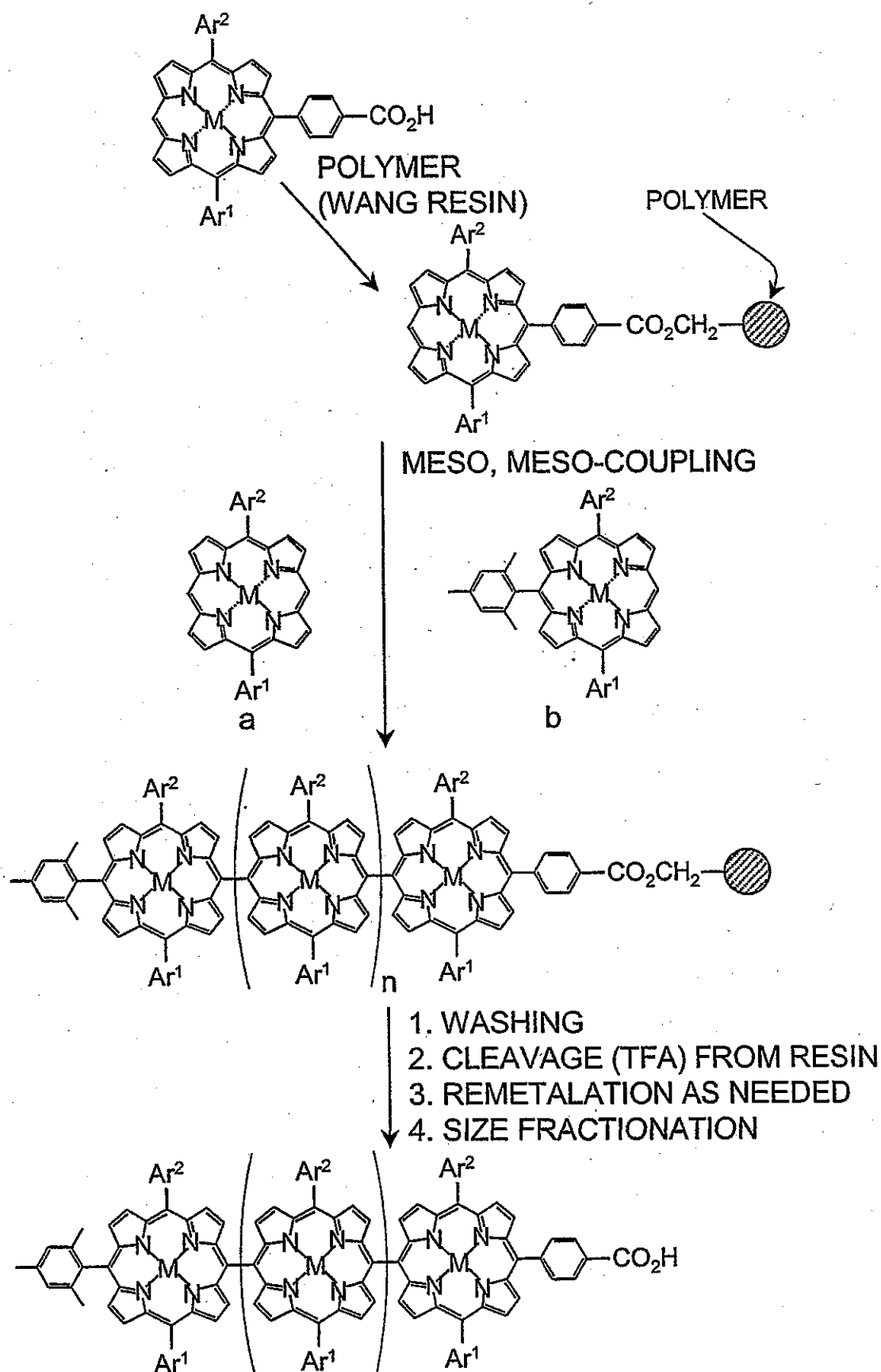
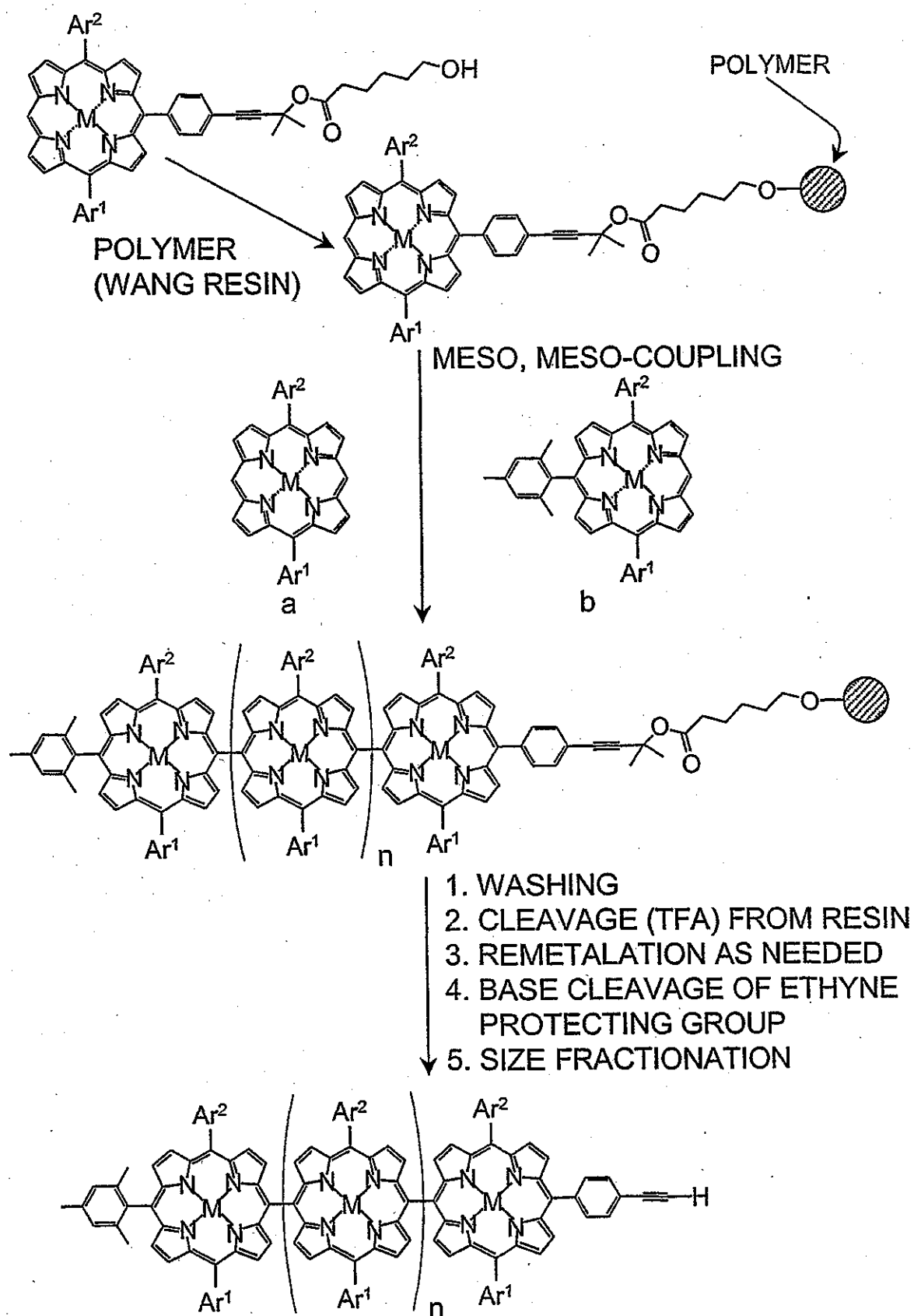


FIG. 17
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ETHYNE-SUBSTITUTED OLIGOMER READY FOR SUBSEQUENT COUPLINGS

FIG. 18

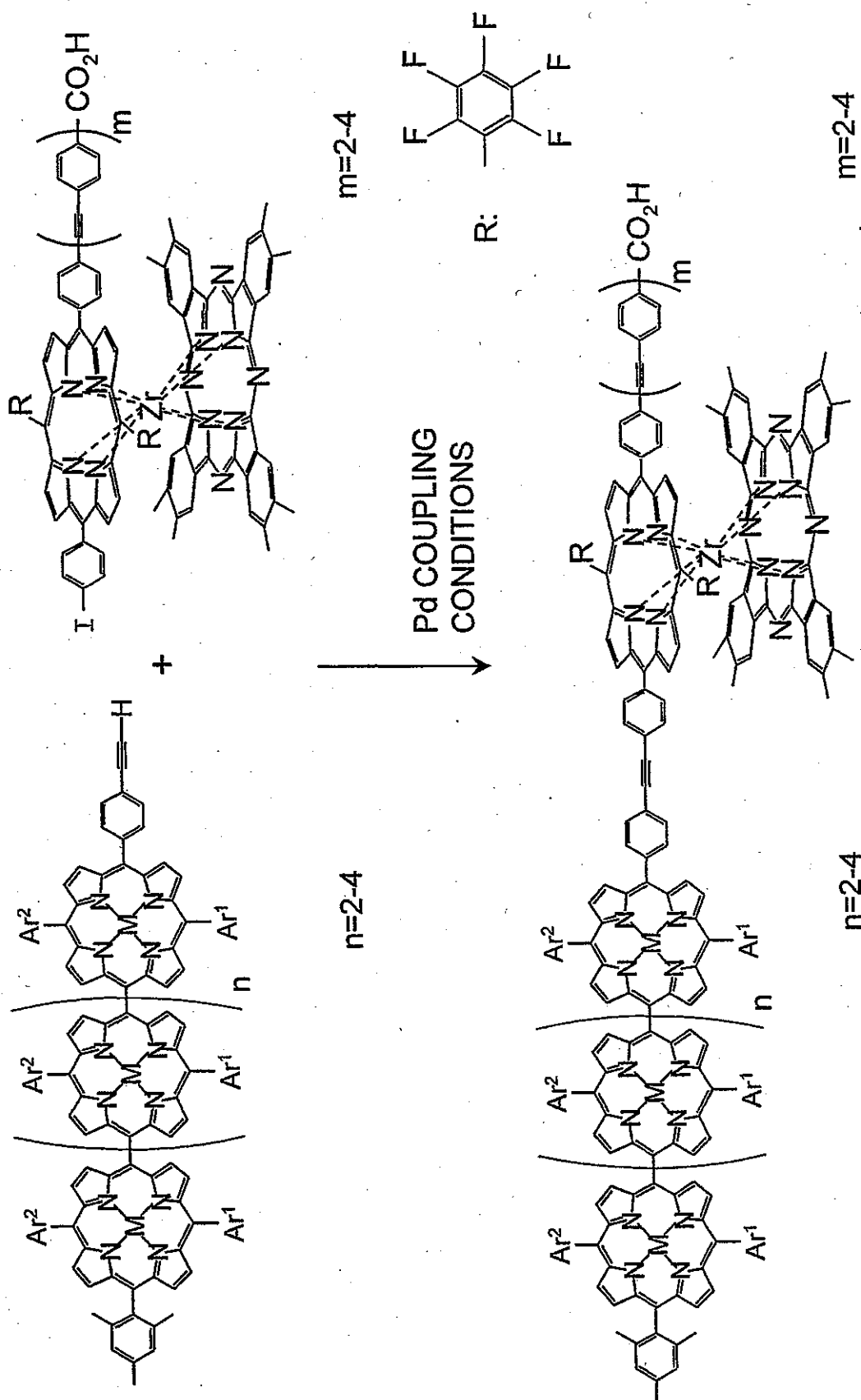
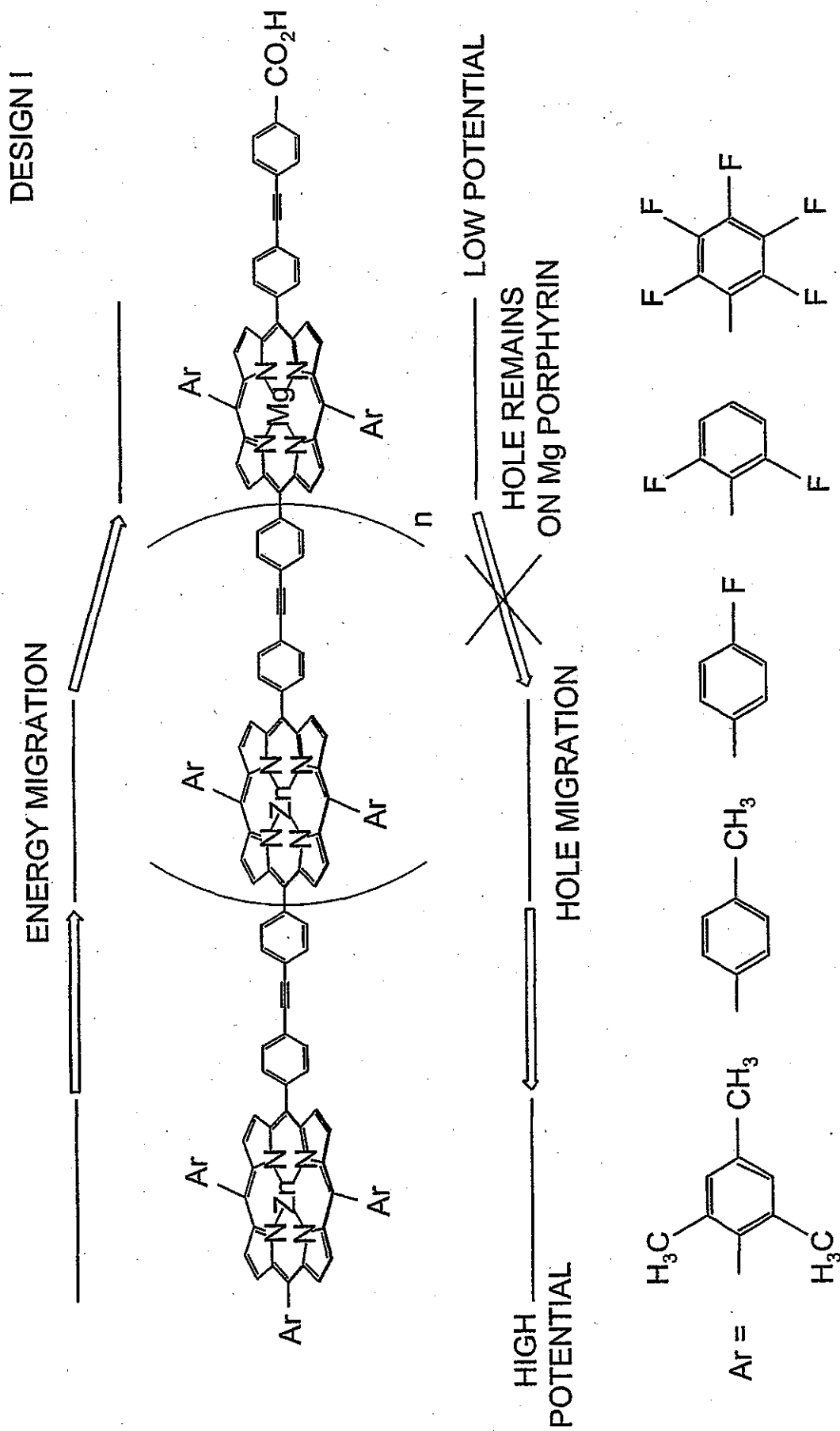
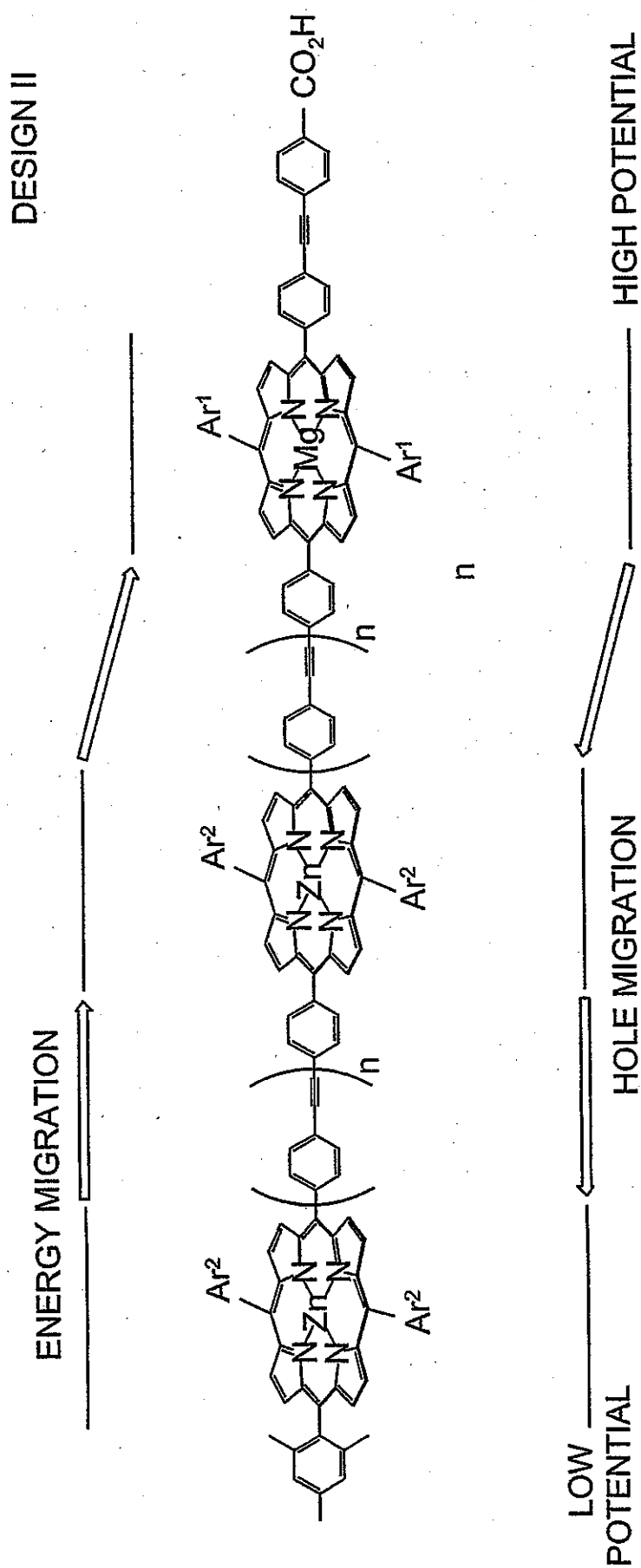
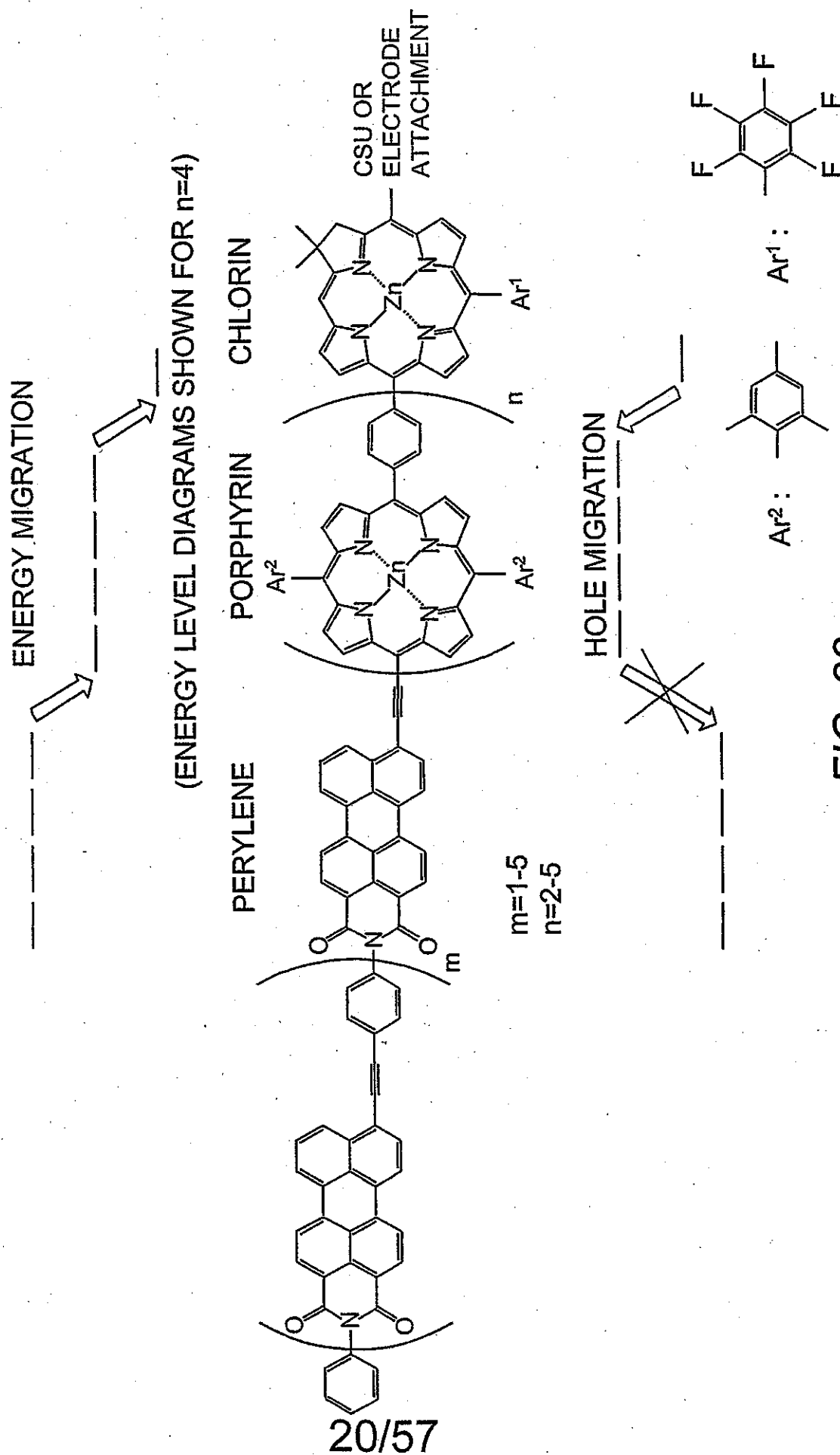


FIG. 19



FIG. 21



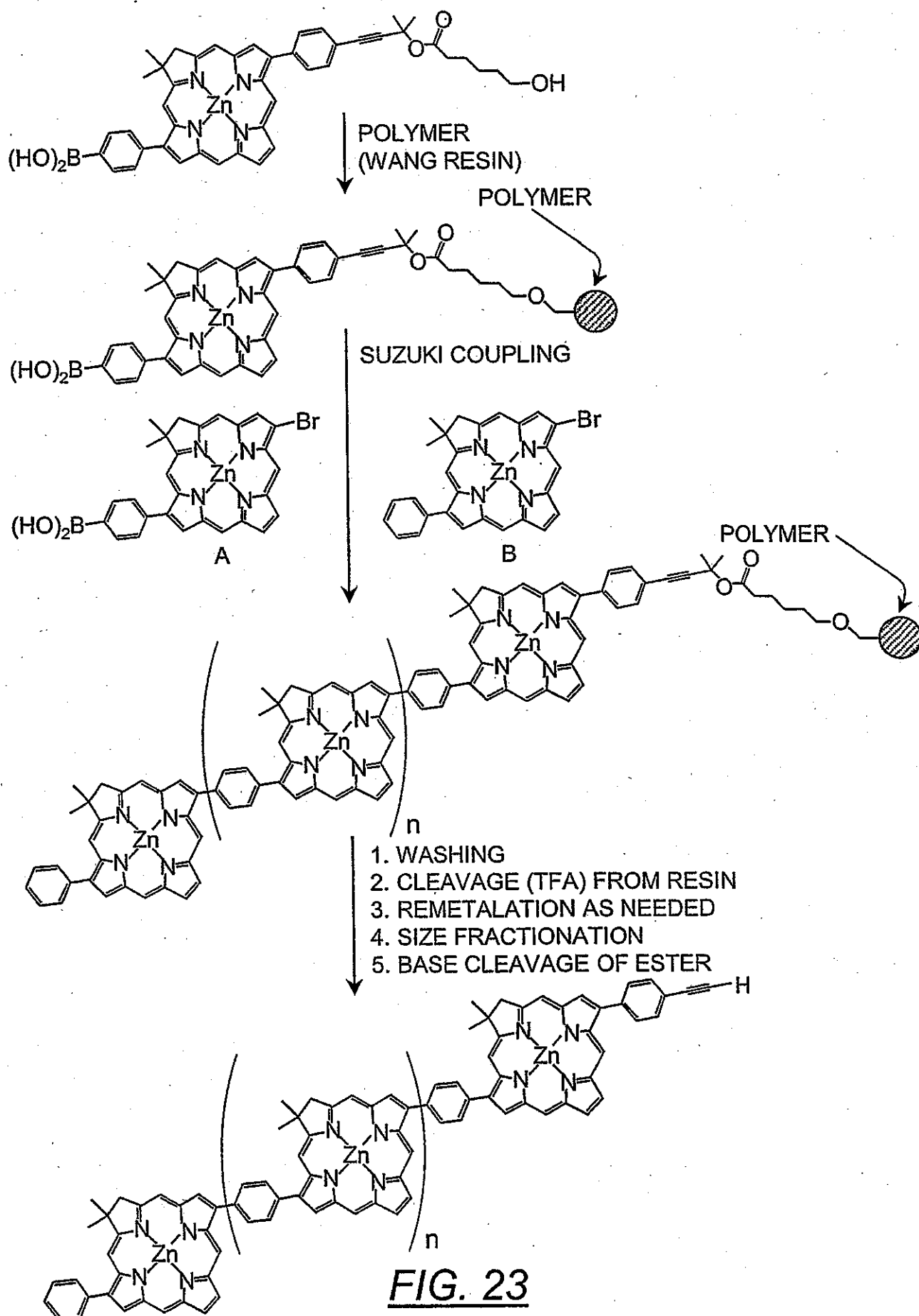


FIG. 23
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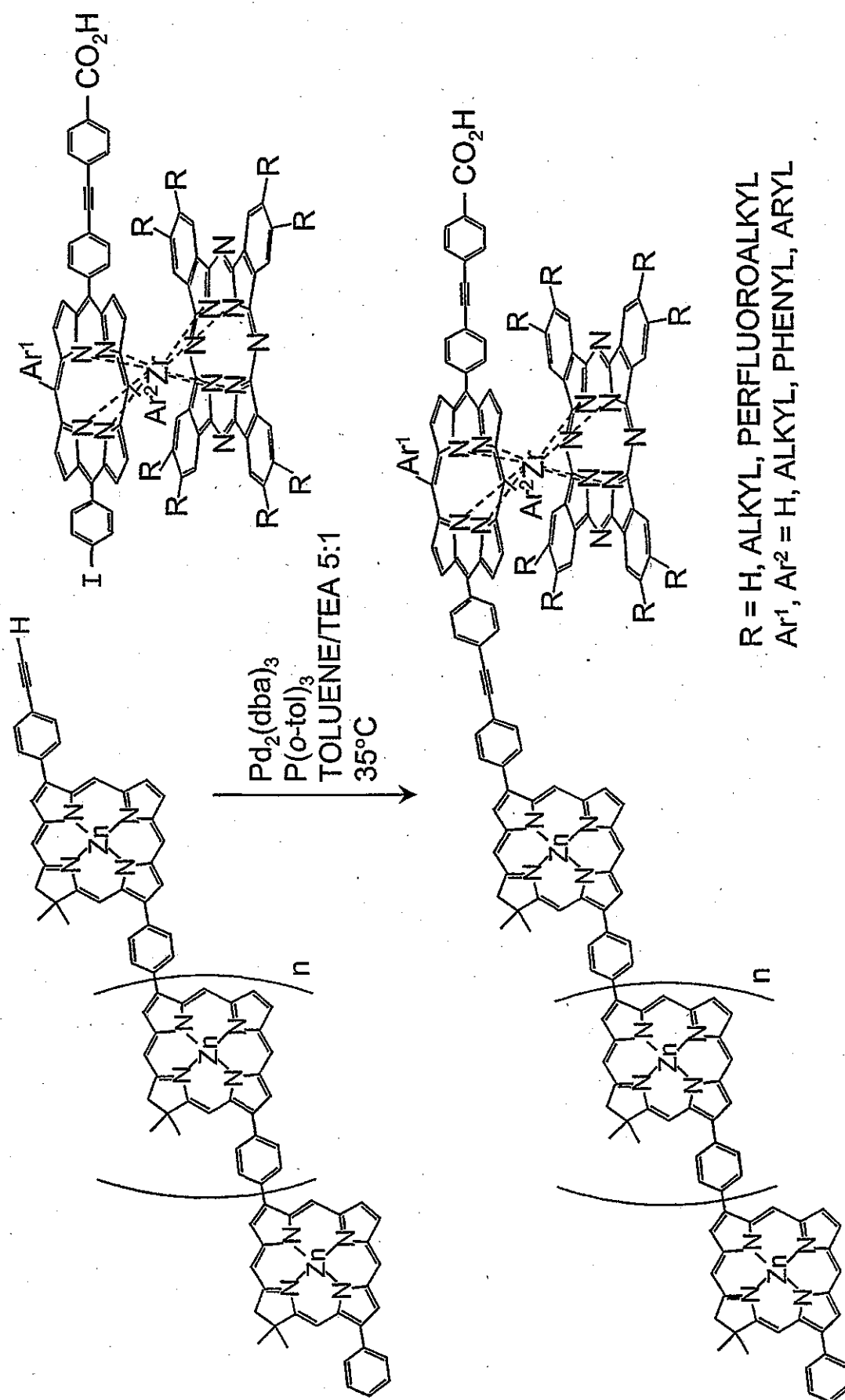


FIG. 24

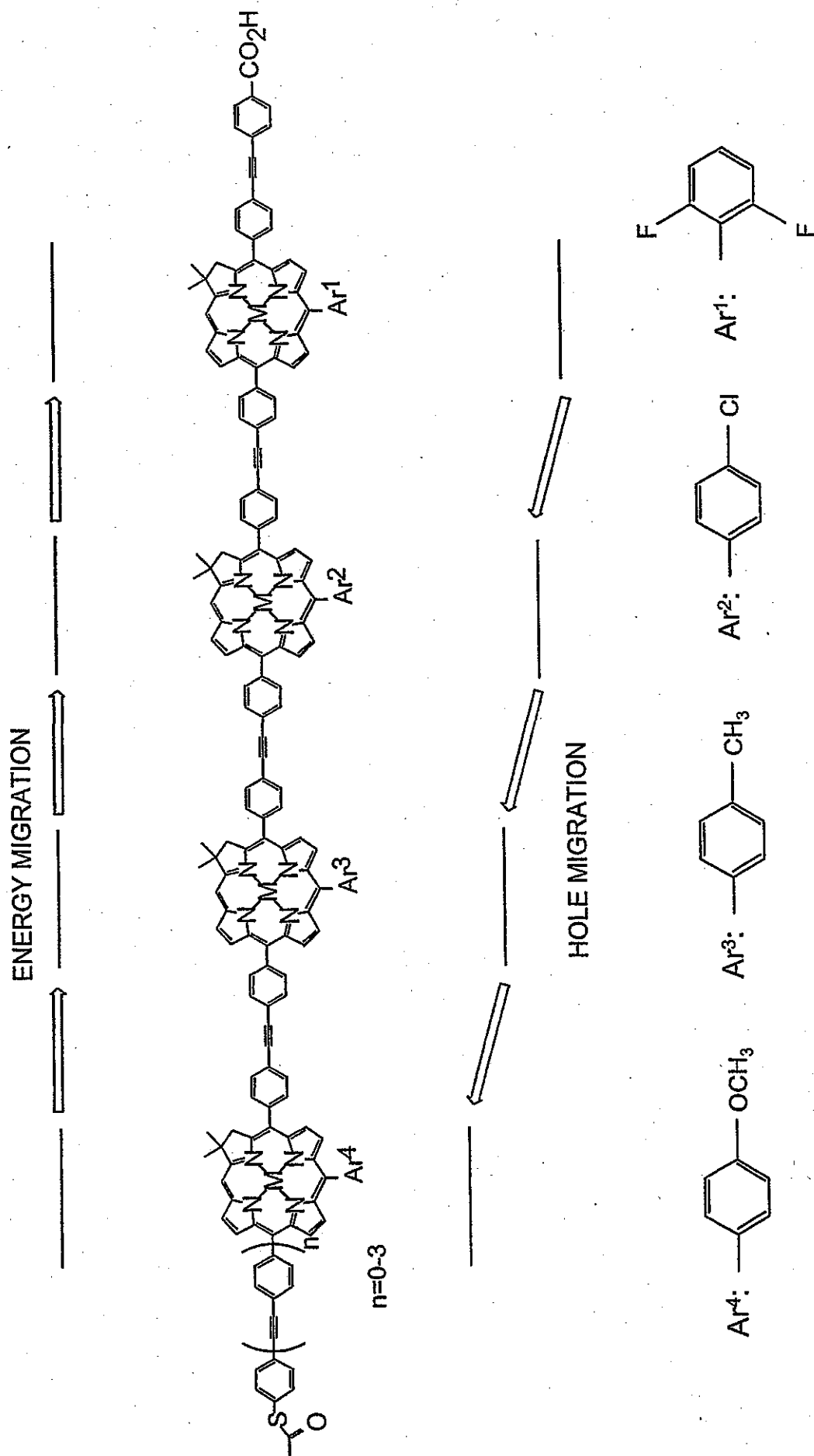


FIG. 25

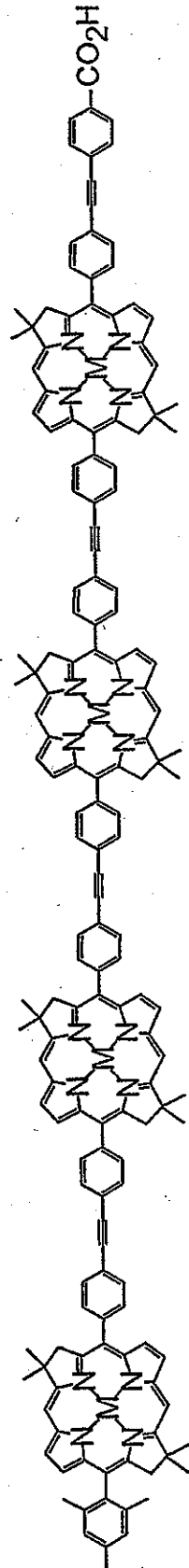
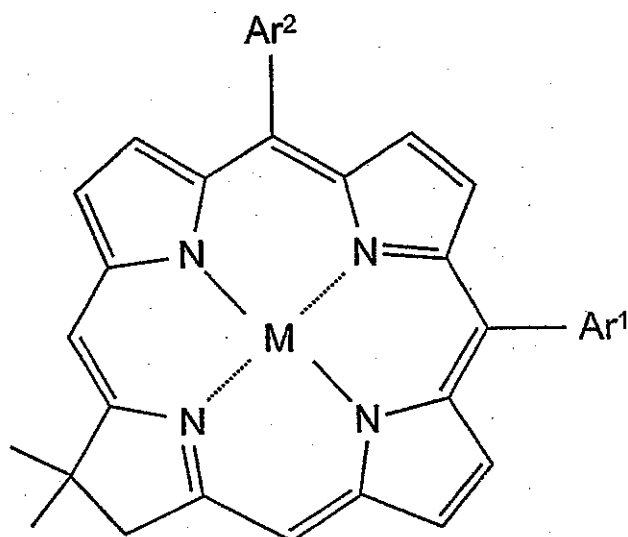
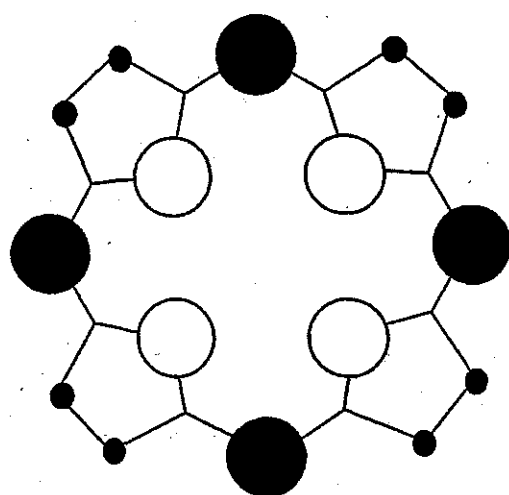
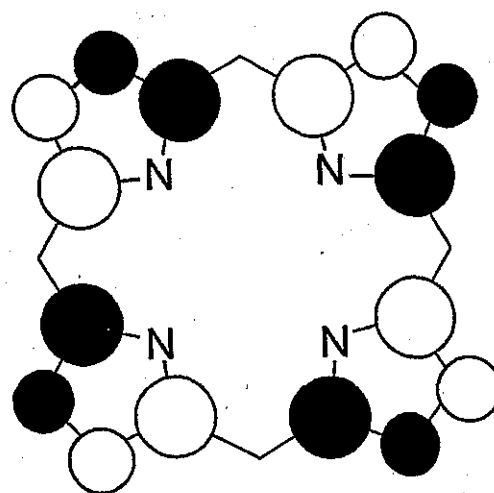


FIG. 26



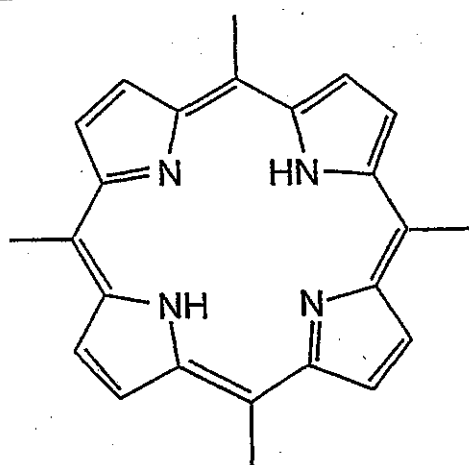
<u>M</u>	<u>Ar¹</u>	<u>Ar²</u>
H, H	Ms	<i>p</i> -TOLYL
Zn	Ms	<i>p</i> -TOLYL
Cu	Ms	<i>p</i> -TOLYL
H, H	C ₆ F ₅	C ₆ F ₅
Zn	C ₆ F ₅	C ₆ F ₅
H, H	4-IODOPHENYL	<i>p</i> -TOLYL
Zn	4-IODOPHENYL	<i>p</i> -TOLYL
H, H	4-(TMS-CC)PHENYL	<i>p</i> -TOLYL
Zn	4-(TMS-CC)PHENYL	<i>p</i> -TOLYL

 a_{2u}  a_{1u}

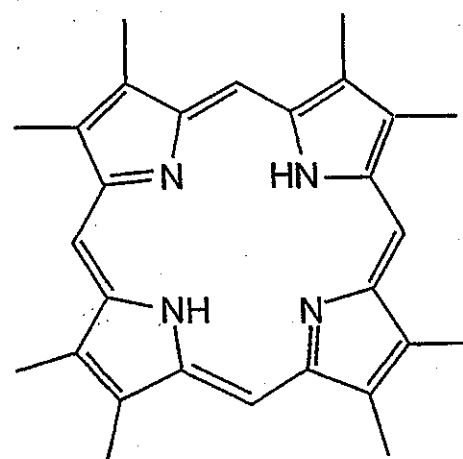
HIGHEST OCCUPIED
MOLECULAR ORBITALS

(THE ELECTRON DENSITY AT THE β POSITIONS
IN THE a_{2u} ORBITAL IS EXAGGERATED FOR CLARITY)

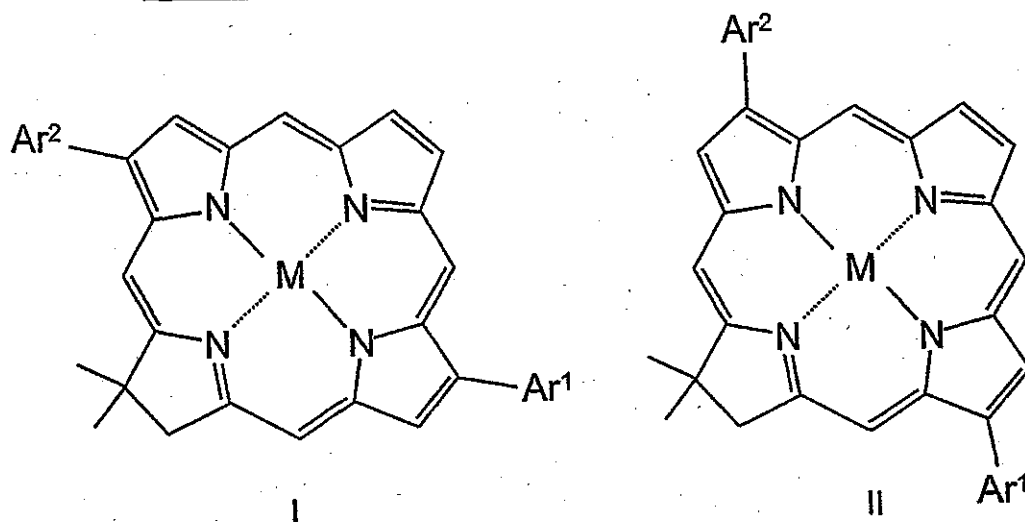
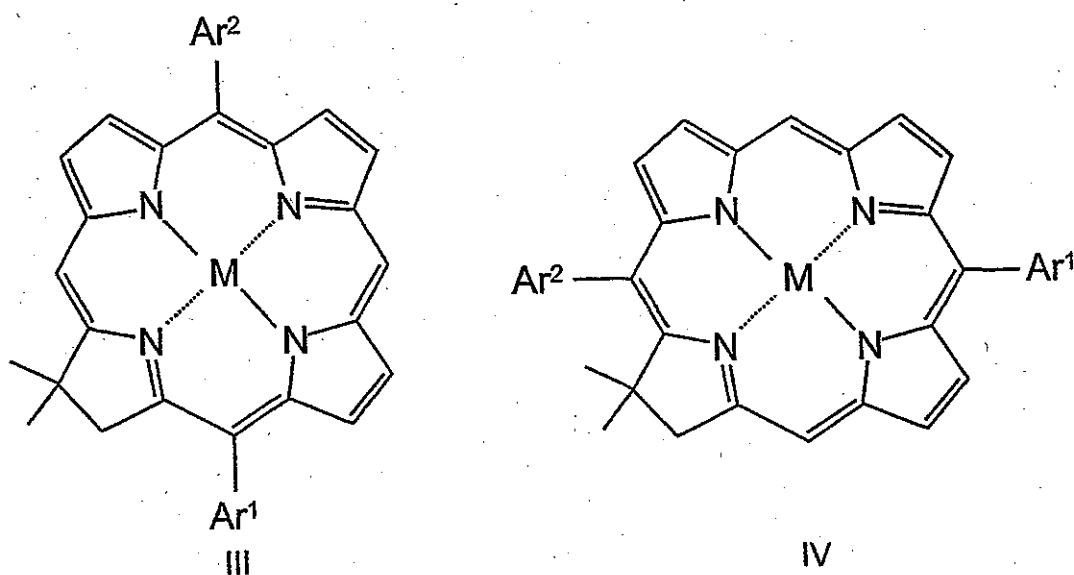
TERMINOLOGY:



A MESO-SUBSTITUTED
PORPHYRIN



A β -SUBSTITUTED
PORPHYRIN

TRANS-CHLORINS WITH TWO β SUBSTITUENTSTRANS-CHLORINS WITH TWO MESO SUBSTITUENTS

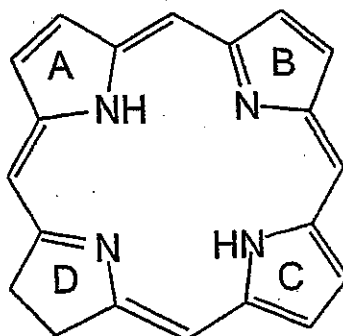
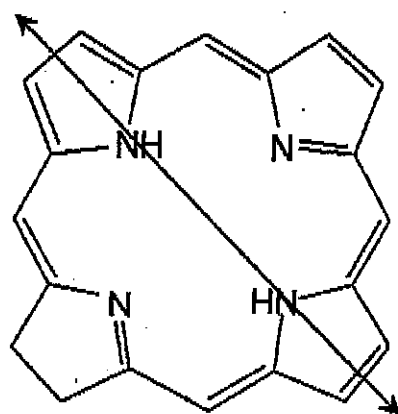
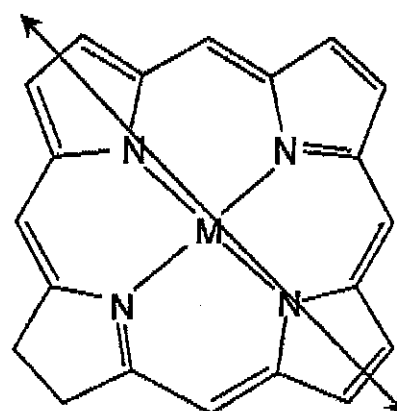
CHLORIN NOMENCLATURE SHOWING IUPAC-IUB
RING LABELS A-D

FIG. 29
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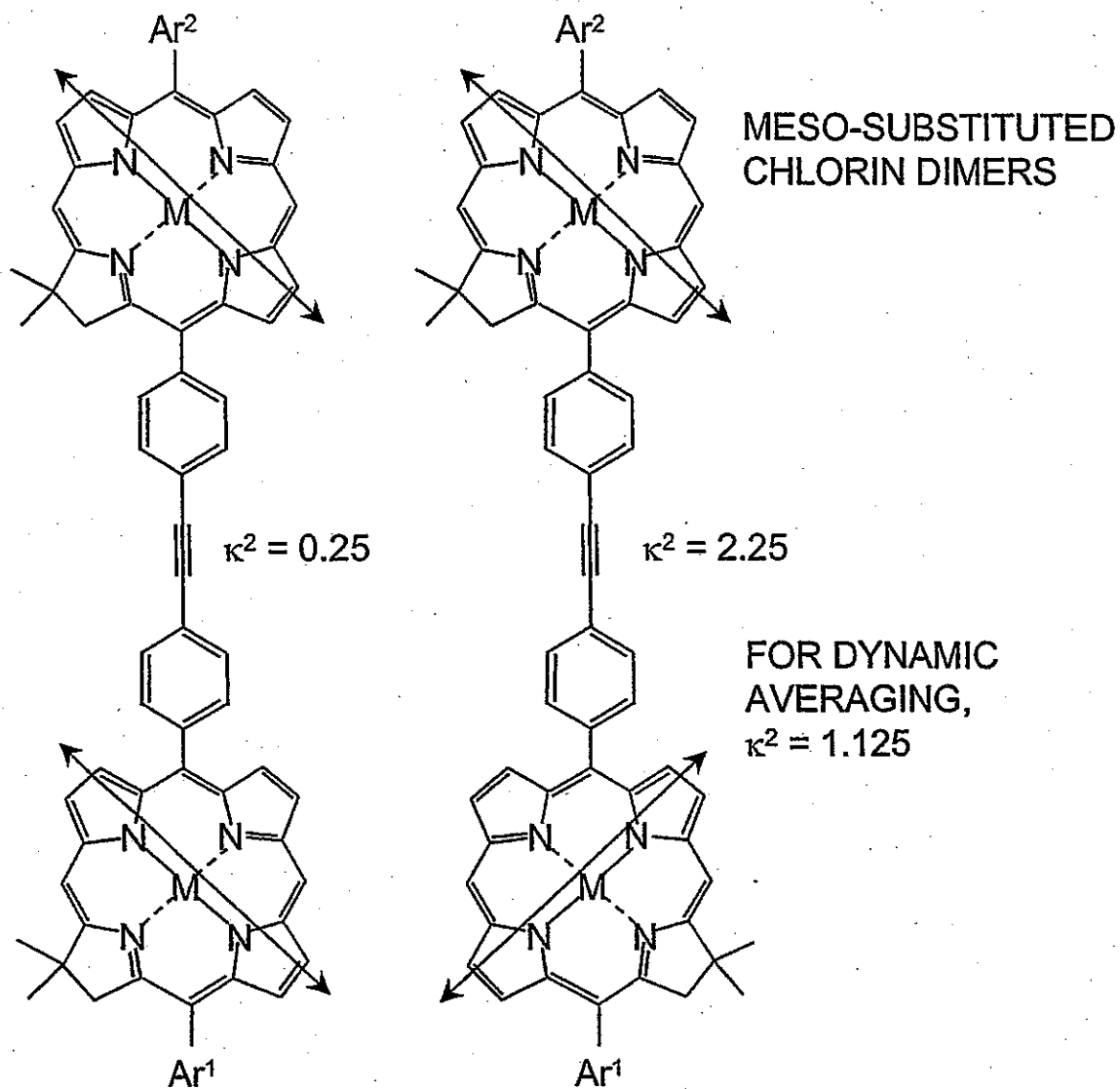


FREE BASE CHLORIN



METALLOCHLORIN

ORIENTATION OF THE TRANSITION DIPOLE
MOMENT OF THE LONG-WAVELENGTH
ABSORPTION BAND



β -SUBSTITUTED
CHLORIN DIMERS

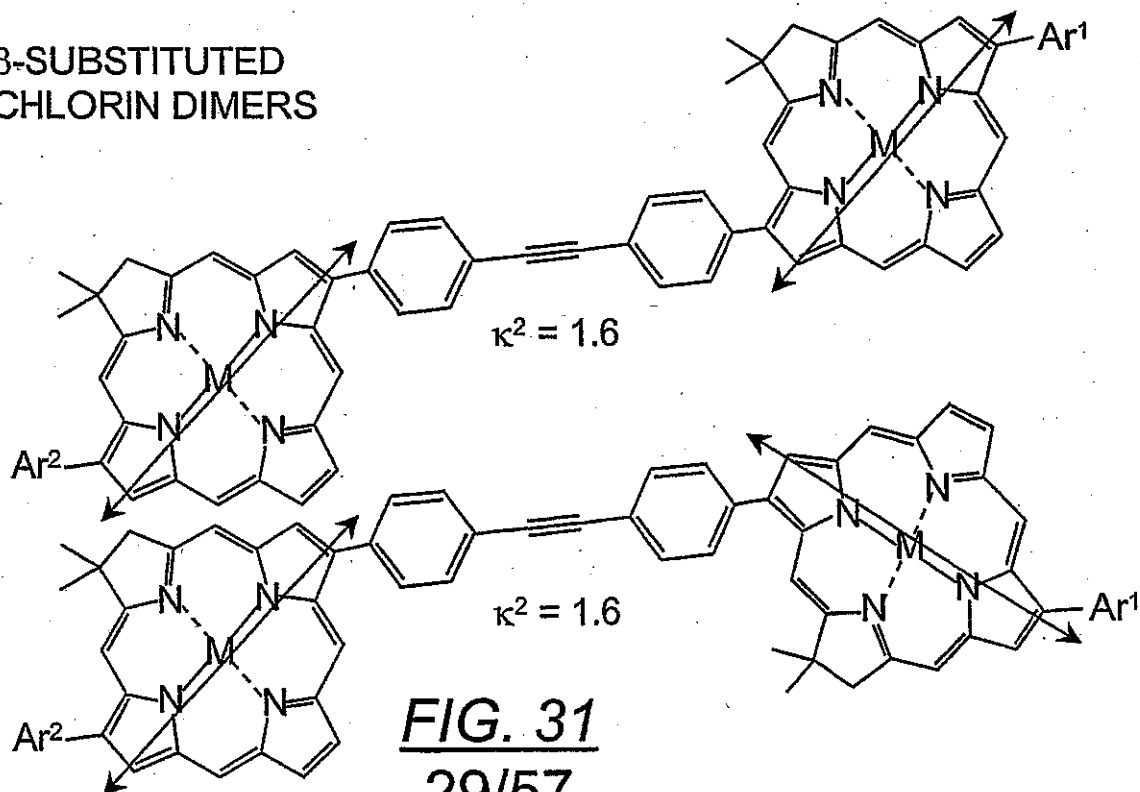


FIG. 31
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CHLORIN HOMO

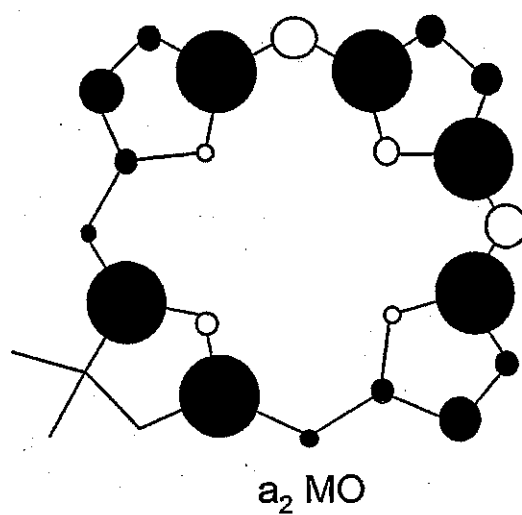
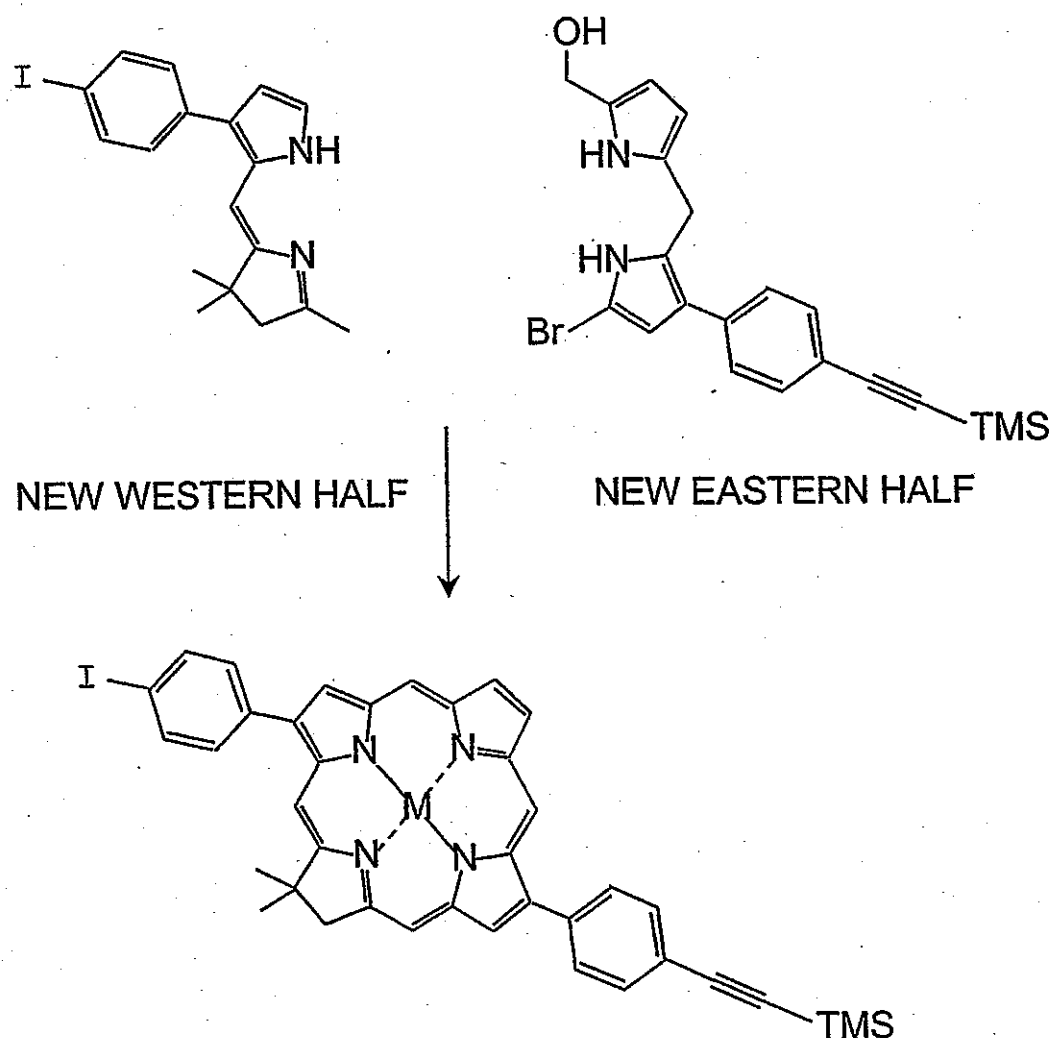


FIG. 32
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TRANS-CHLORIN BUILDING BLOCK WITH TWO β SUBSTITUENTS

(M = A DIVALENT METAL OR TWO PROTONS)

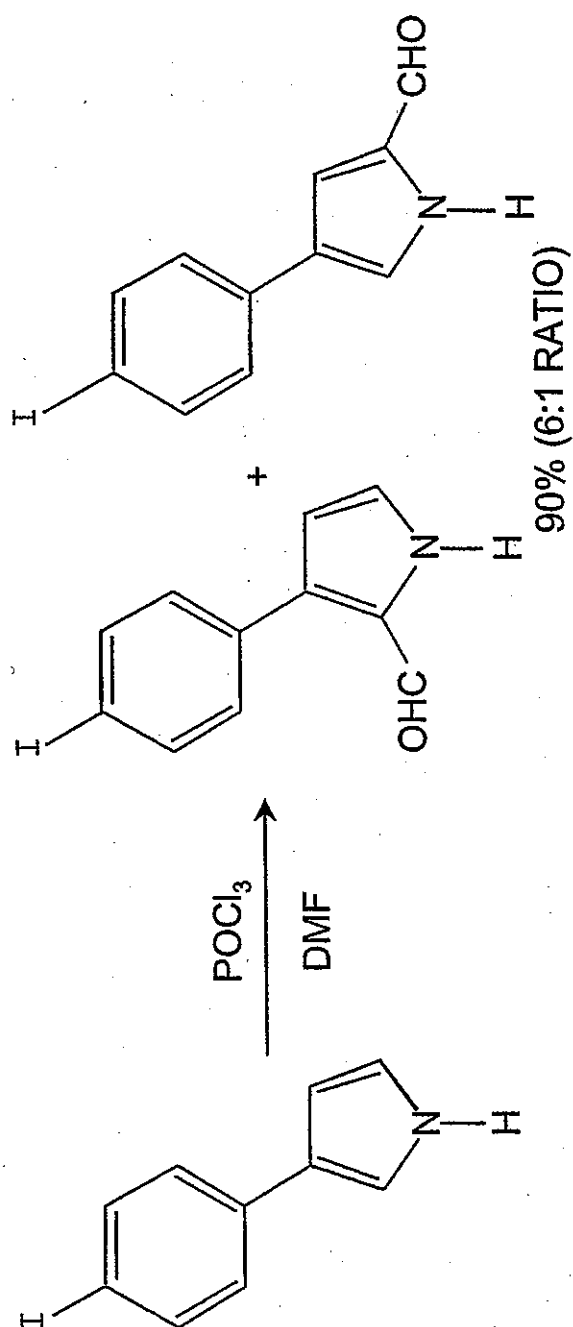
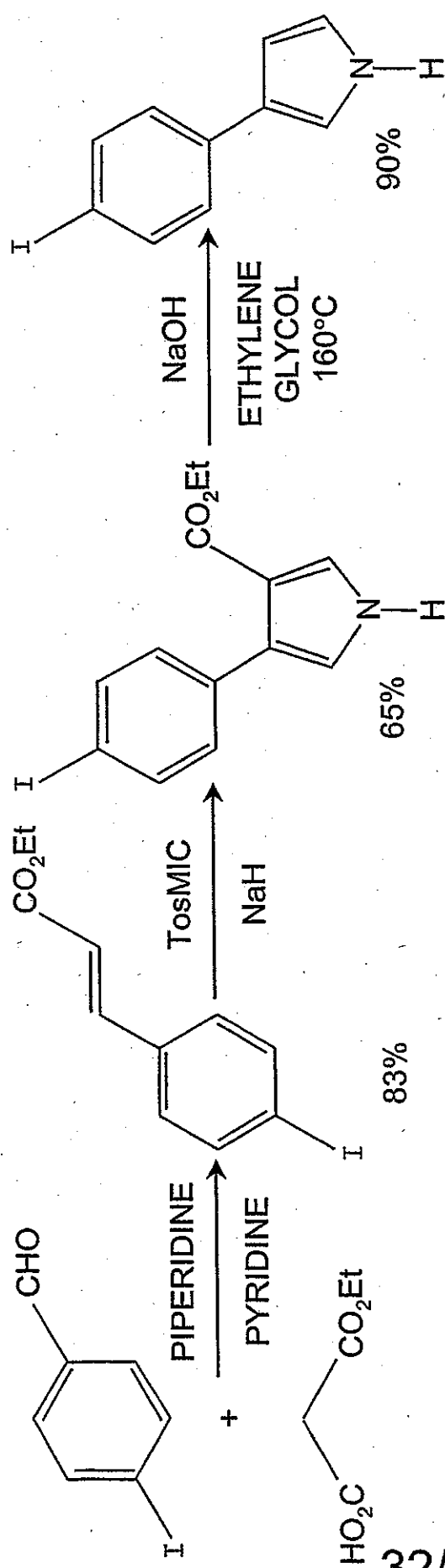
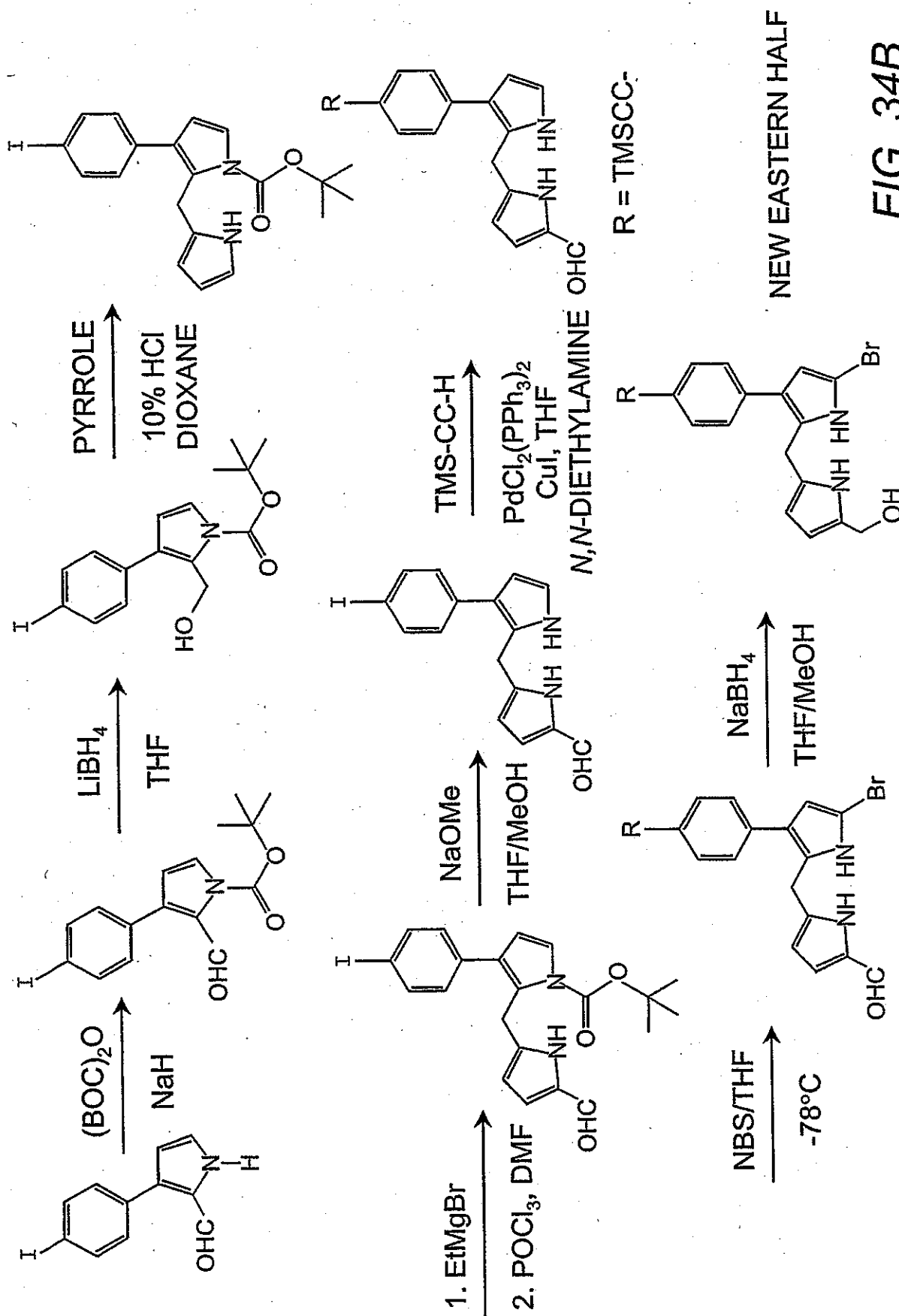


FIG. 34A



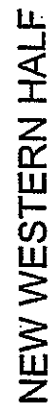
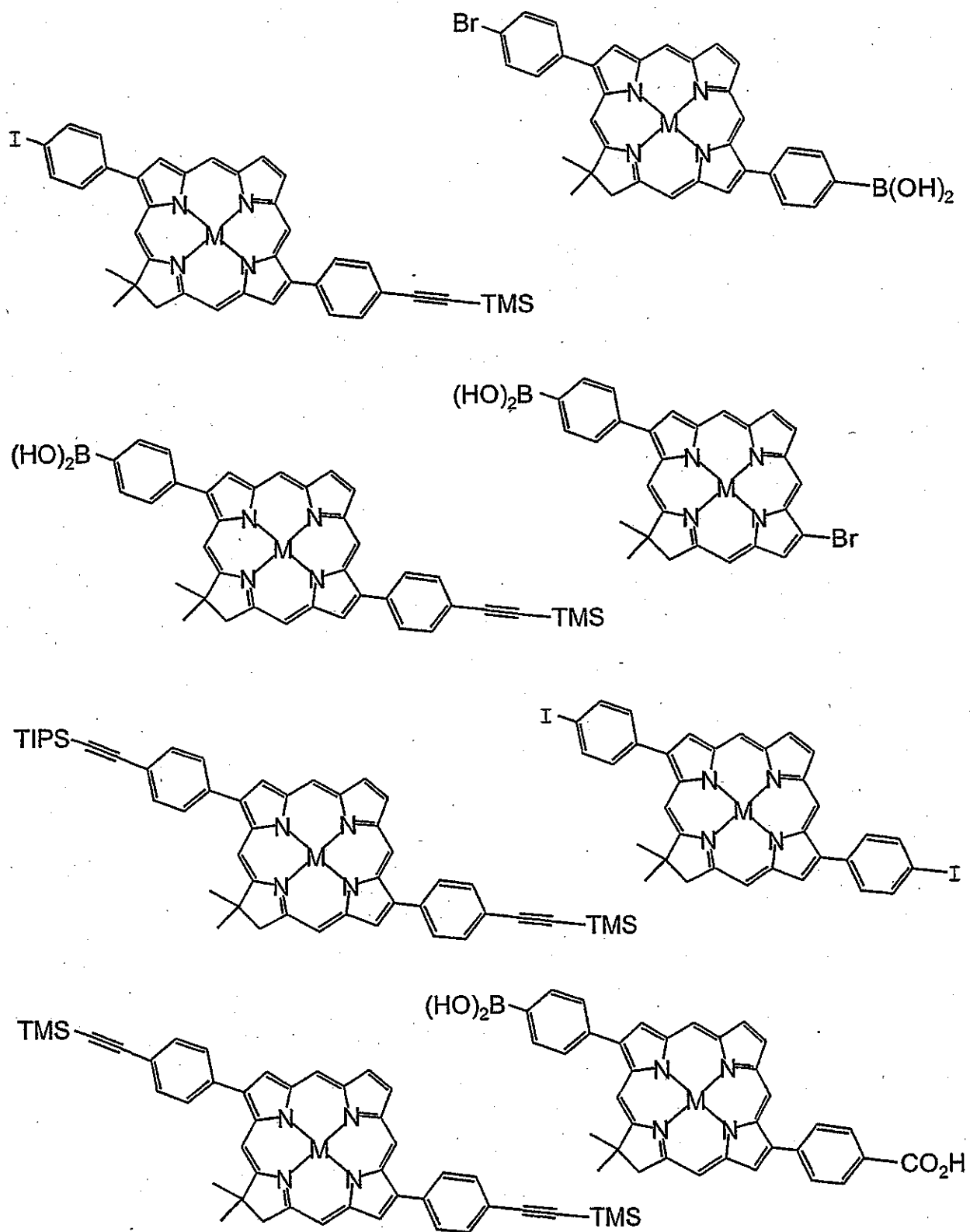


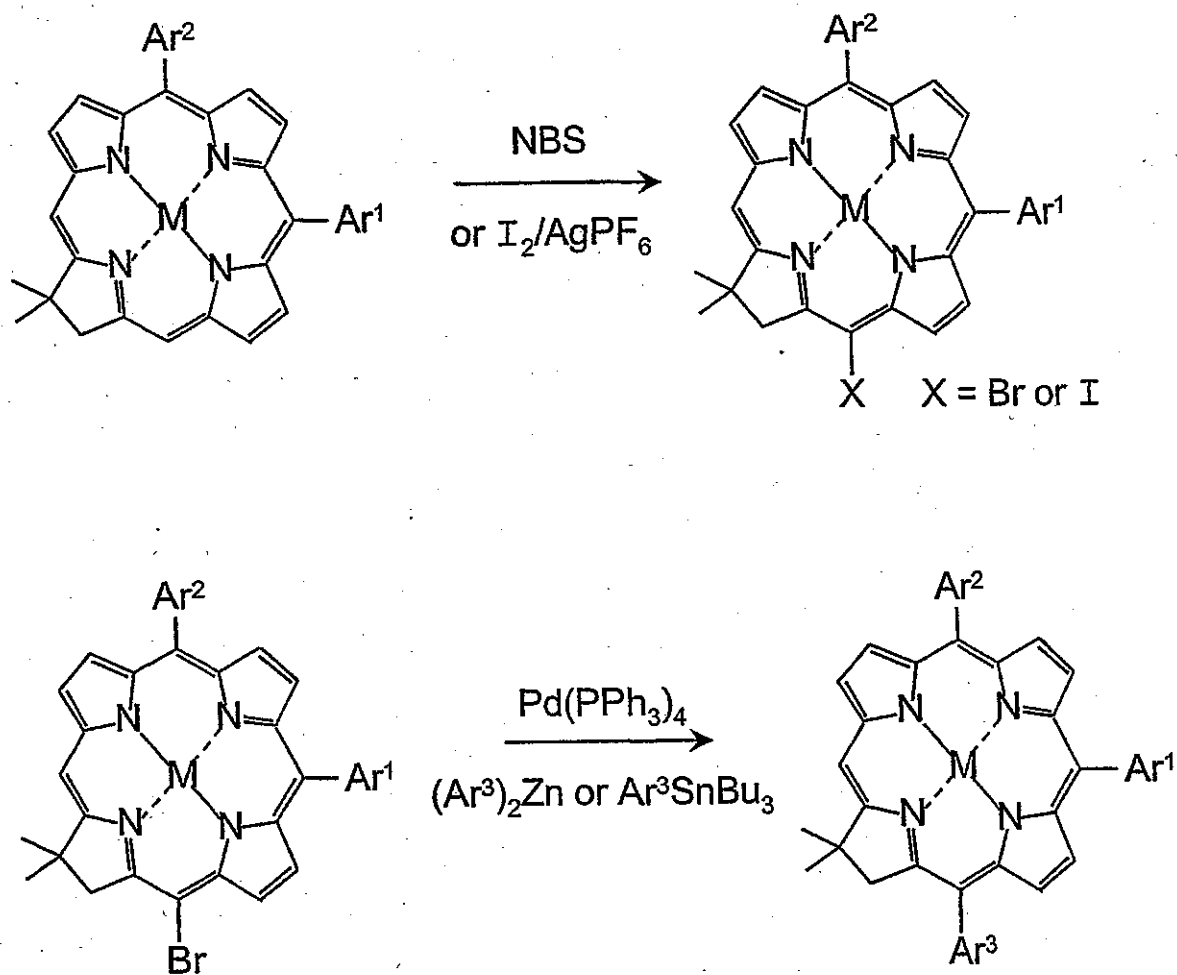
FIG. 35



TRANS-CHLORIN BUILDING BLOCKS WITH TWO β SUBSTITUENTS
(M = A DIVALENT METAL OR TWO PROTONS)

FIG. 36

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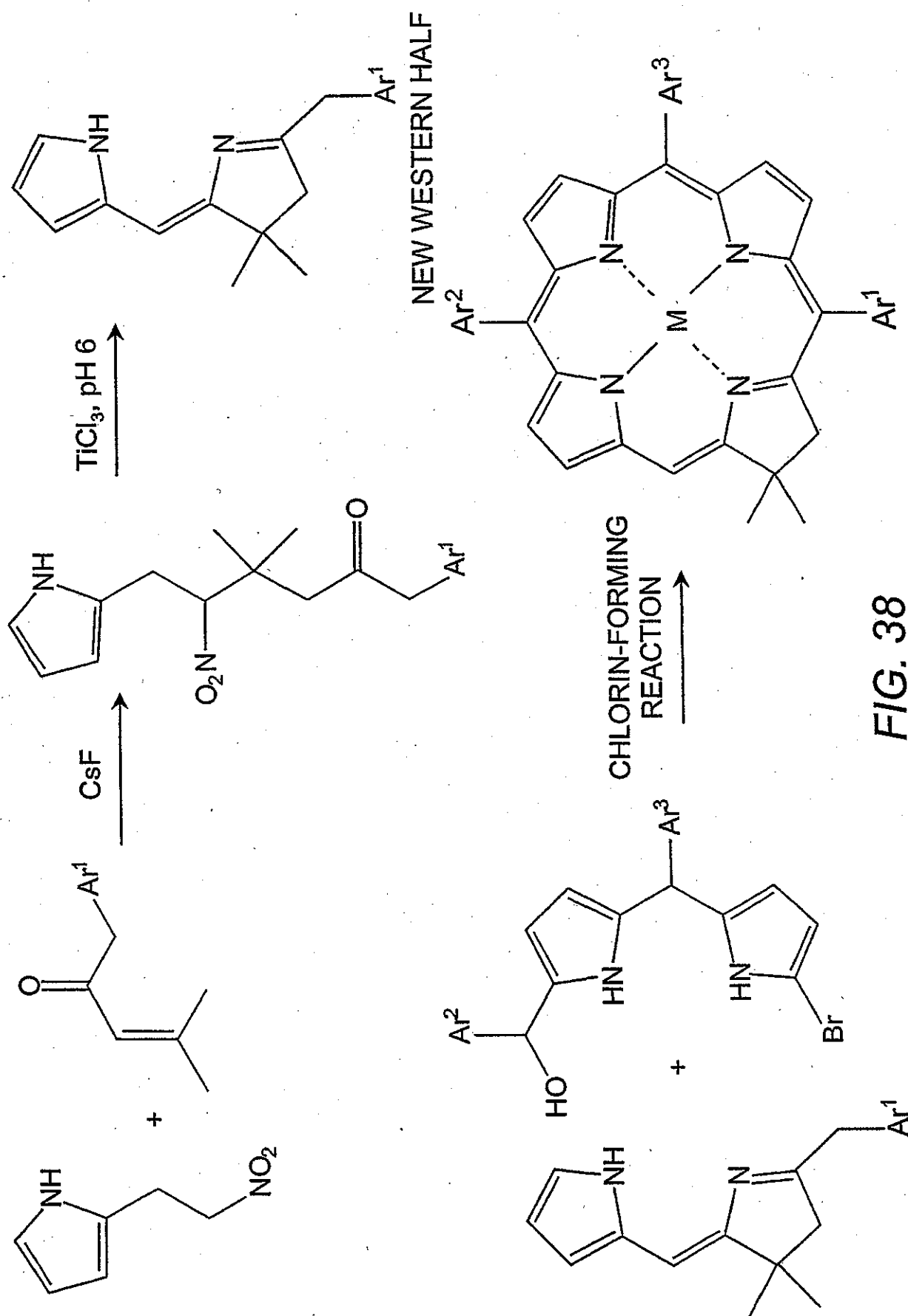


FIG. 38

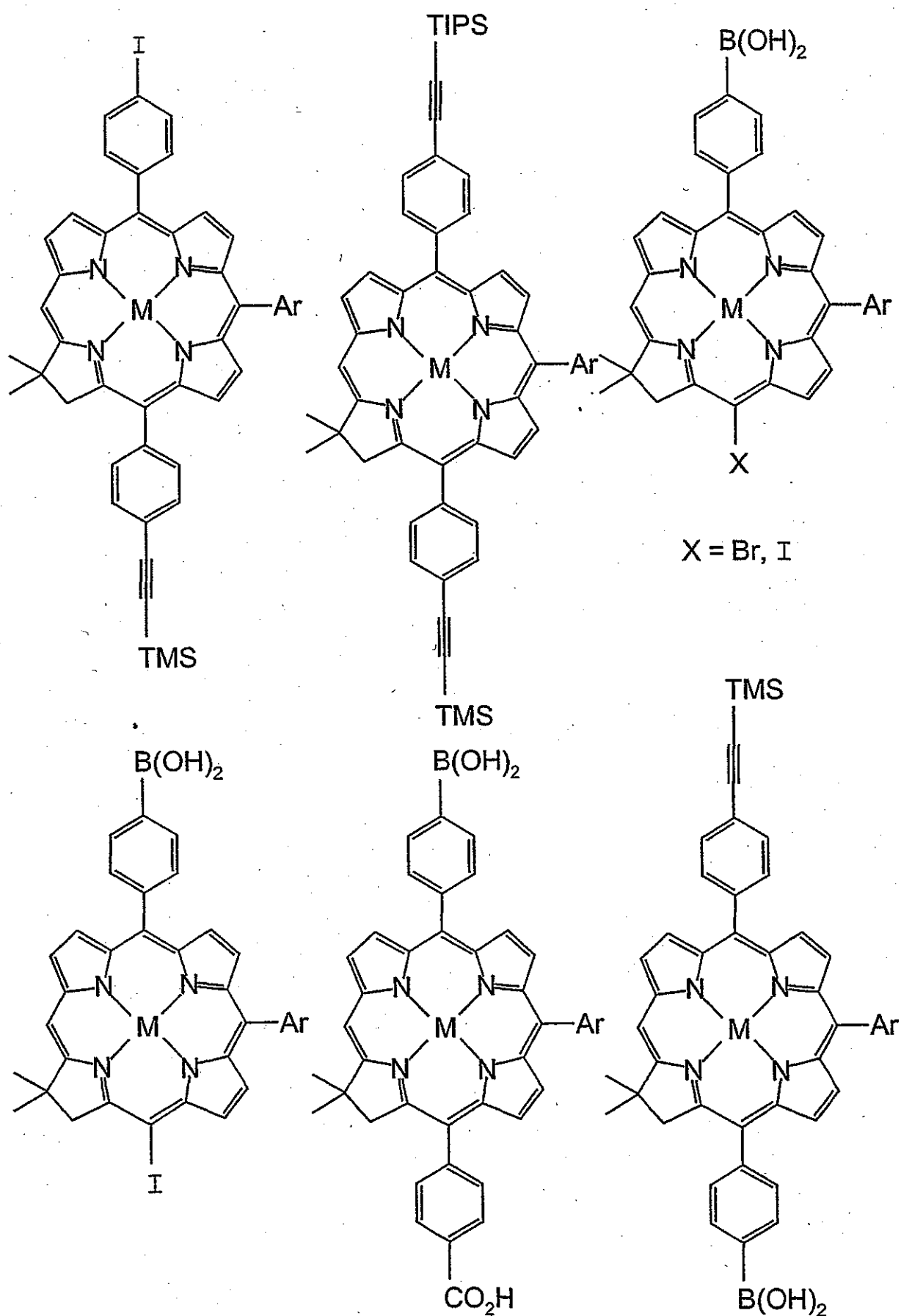


FIG. 39
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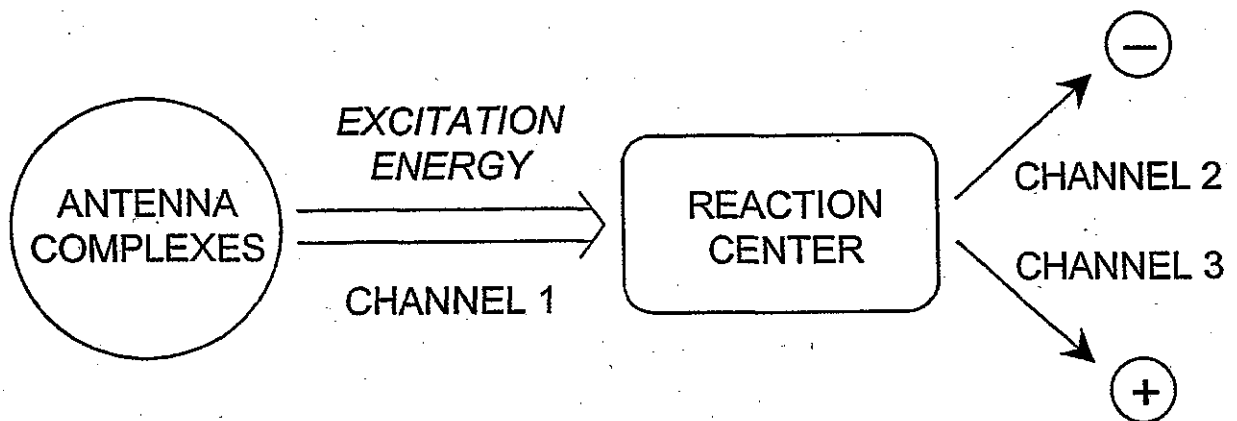
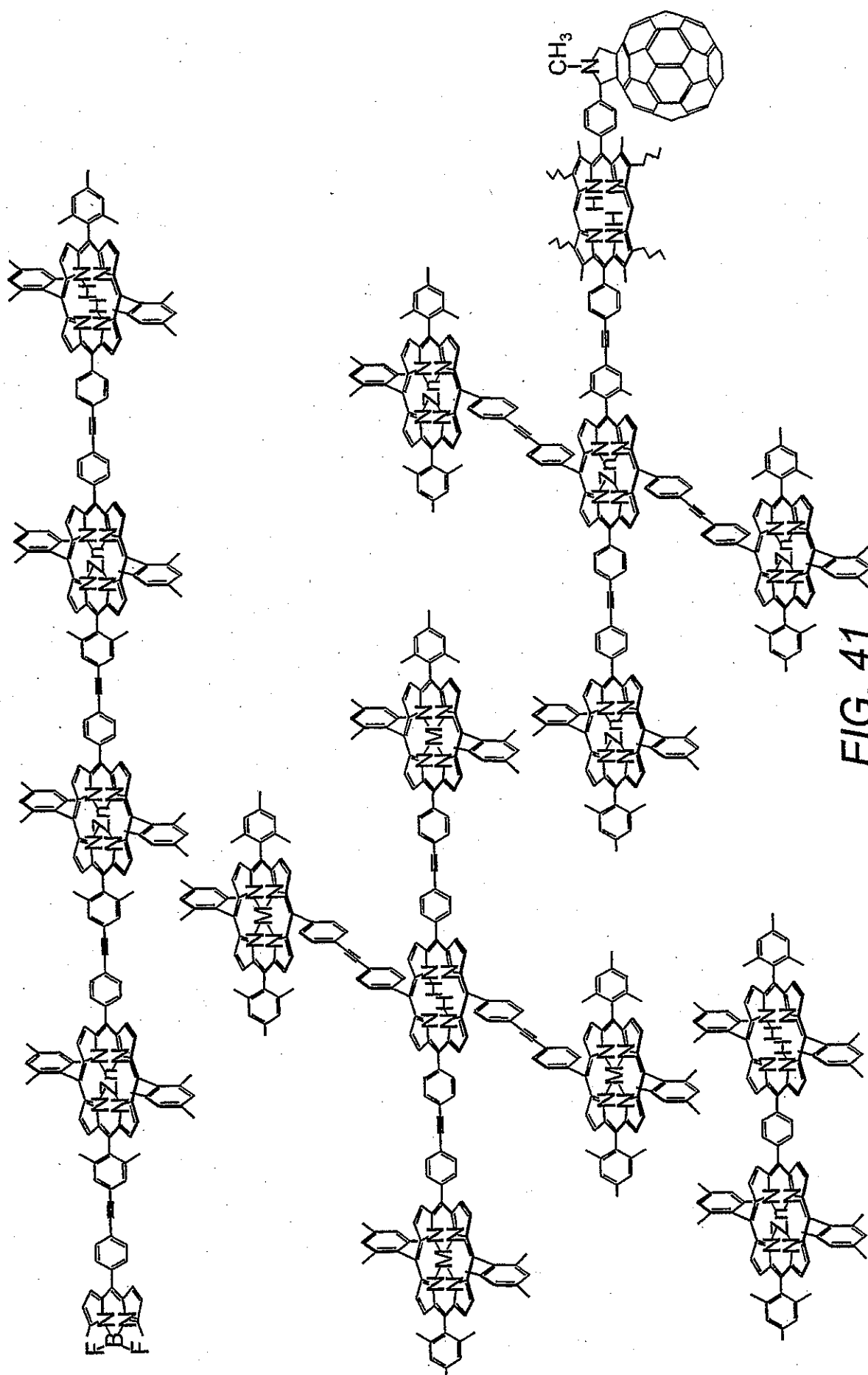
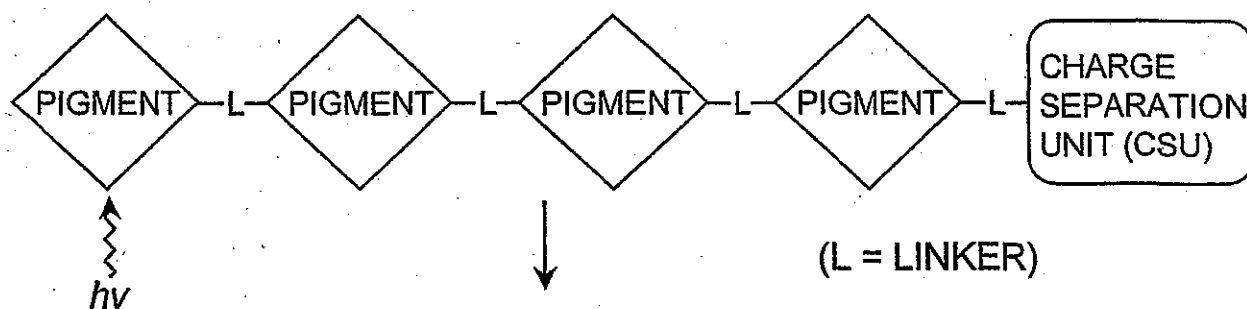


FIG. 40
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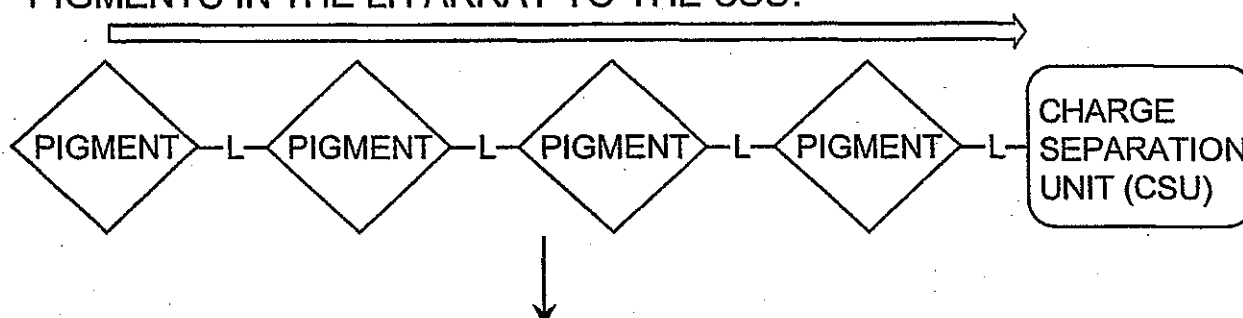
FIG. 41

**FIG. 41**

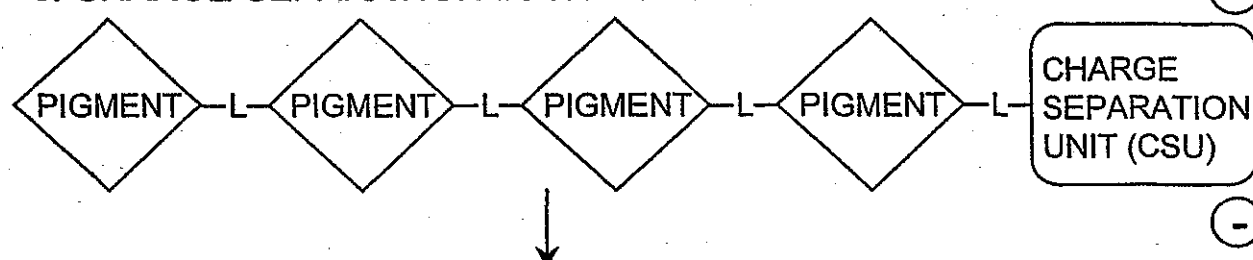
1. LIGHT ABSORPTION BY ONE OF THE PIGMENTS (SHOWN HERE FOR THE DISTAL PIGMENT) IN THE LH ARRAY.



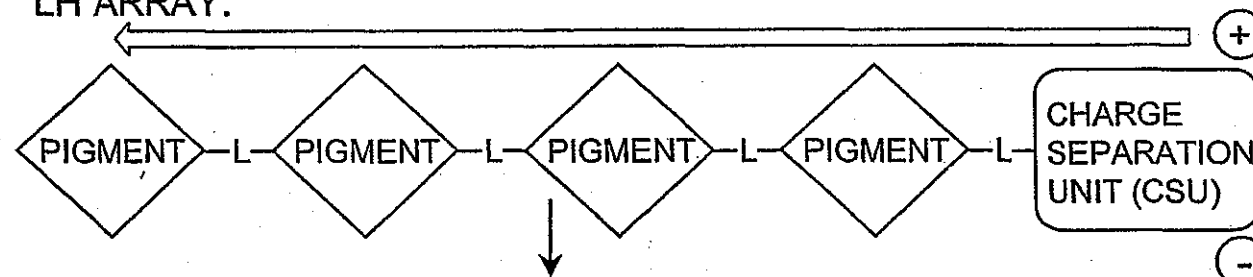
2. ENERGY MIGRATION FROM THE SITE OF ABSORPTION AMONG PIGMENTS IN THE LH ARRAY TO THE CSU.



3. CHARGE SEPARATION IN THE CSU.



4. HOLE MIGRATION FROM THE CSU TO THE DISTAL END OF THE LH ARRAY.



5. FINAL CHARGE-SEPARATED STATE. THE ELECTRON CAN ALSO TRANSFER FROM THE CSU TO ANOTHER ACCEPTOR (NOT SHOWN).

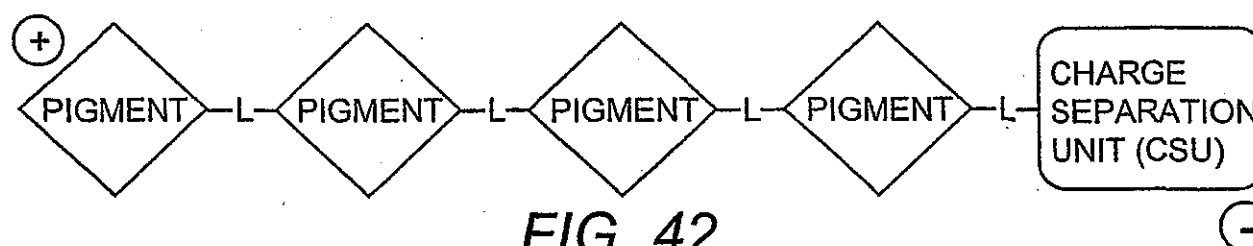
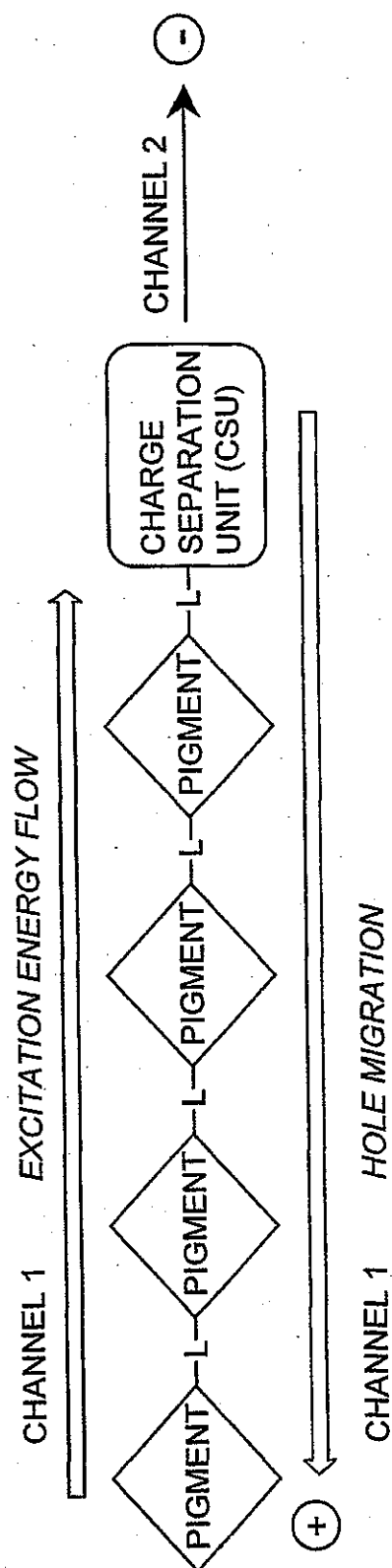
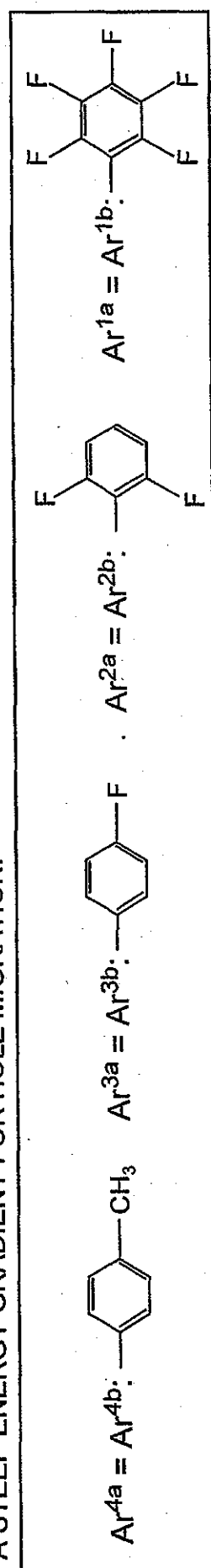
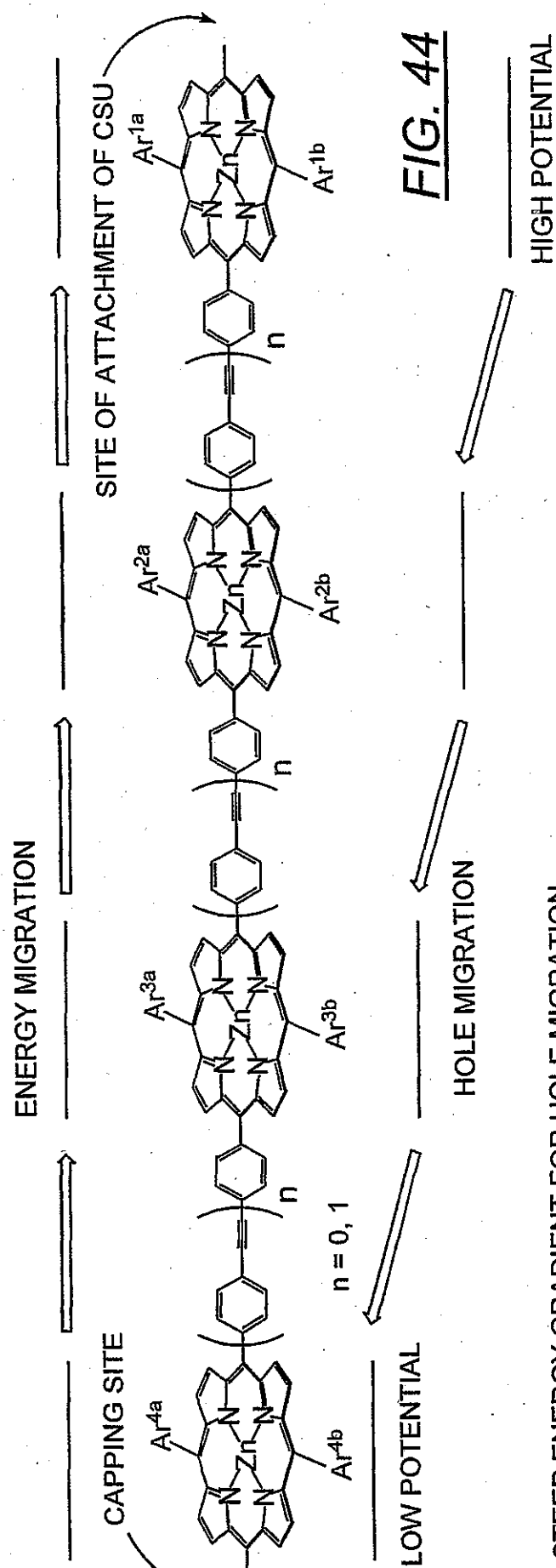
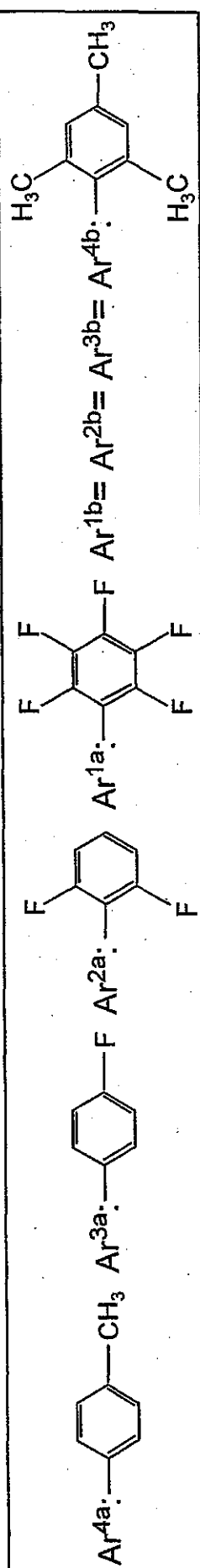


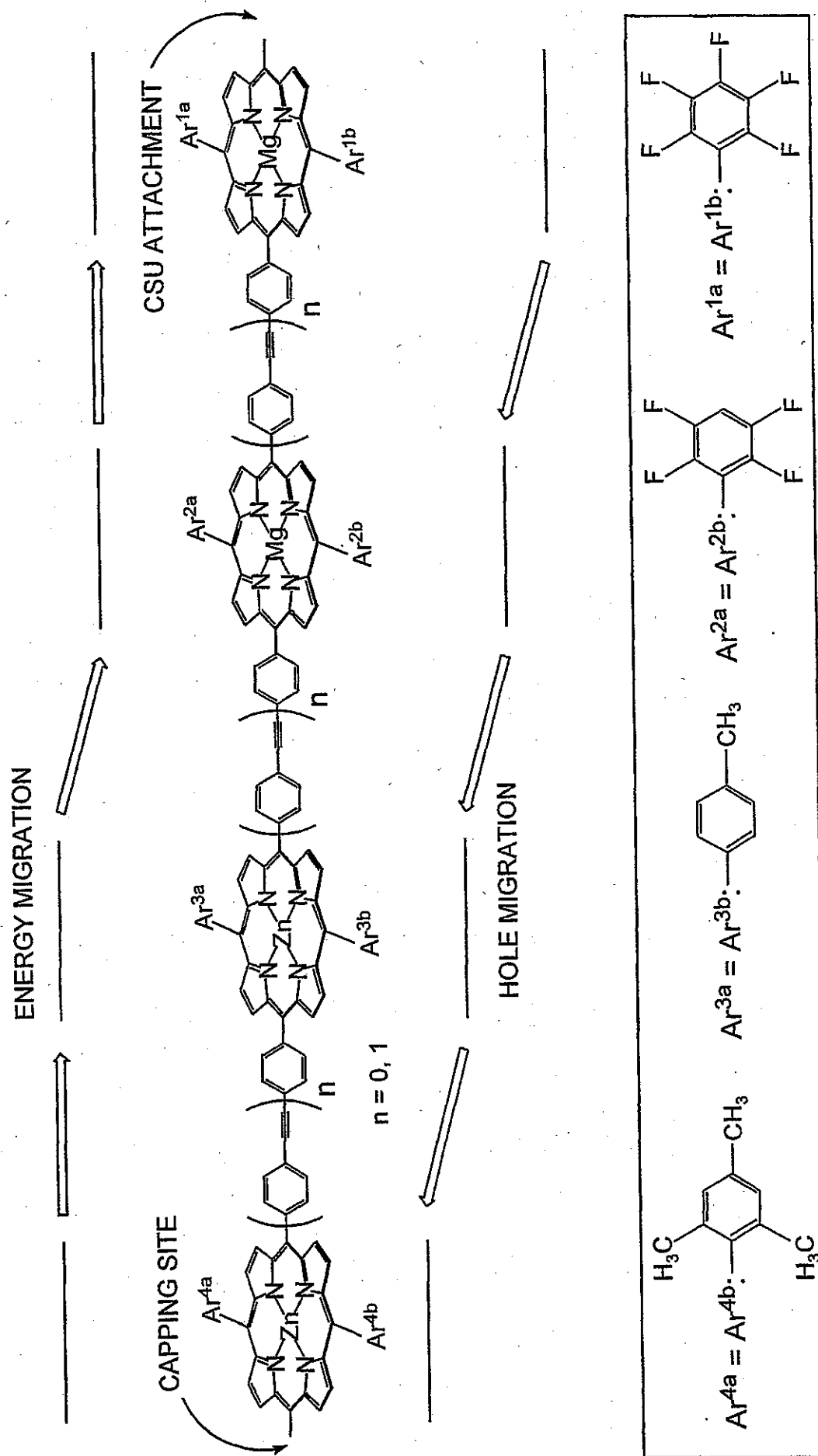
FIG. 42
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FIG. 43



A GRADUAL ENERGY GRADIENT FOR HOLE MIGRATION.





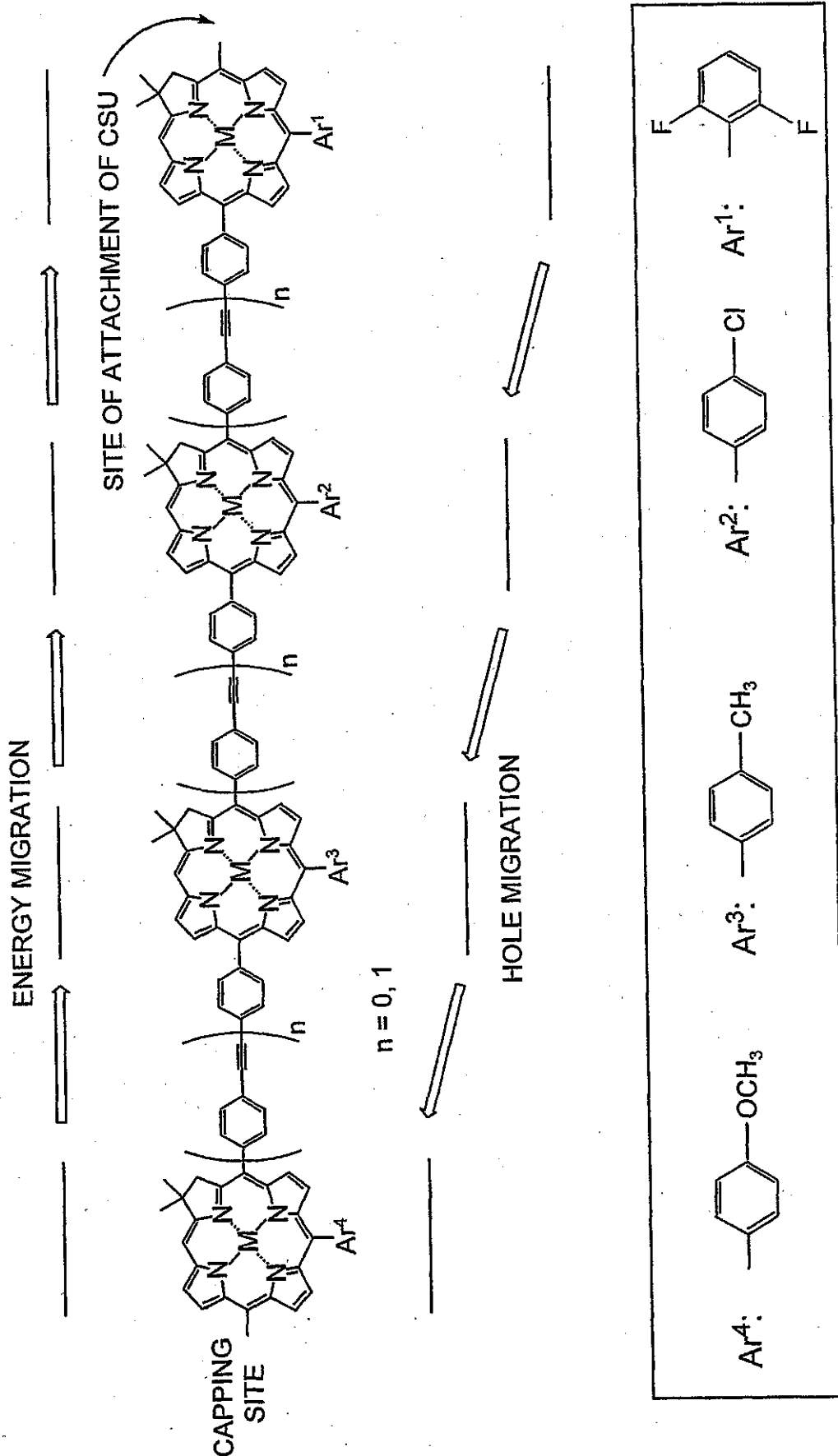


FIG. 46

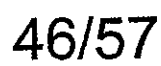


FIG. 47

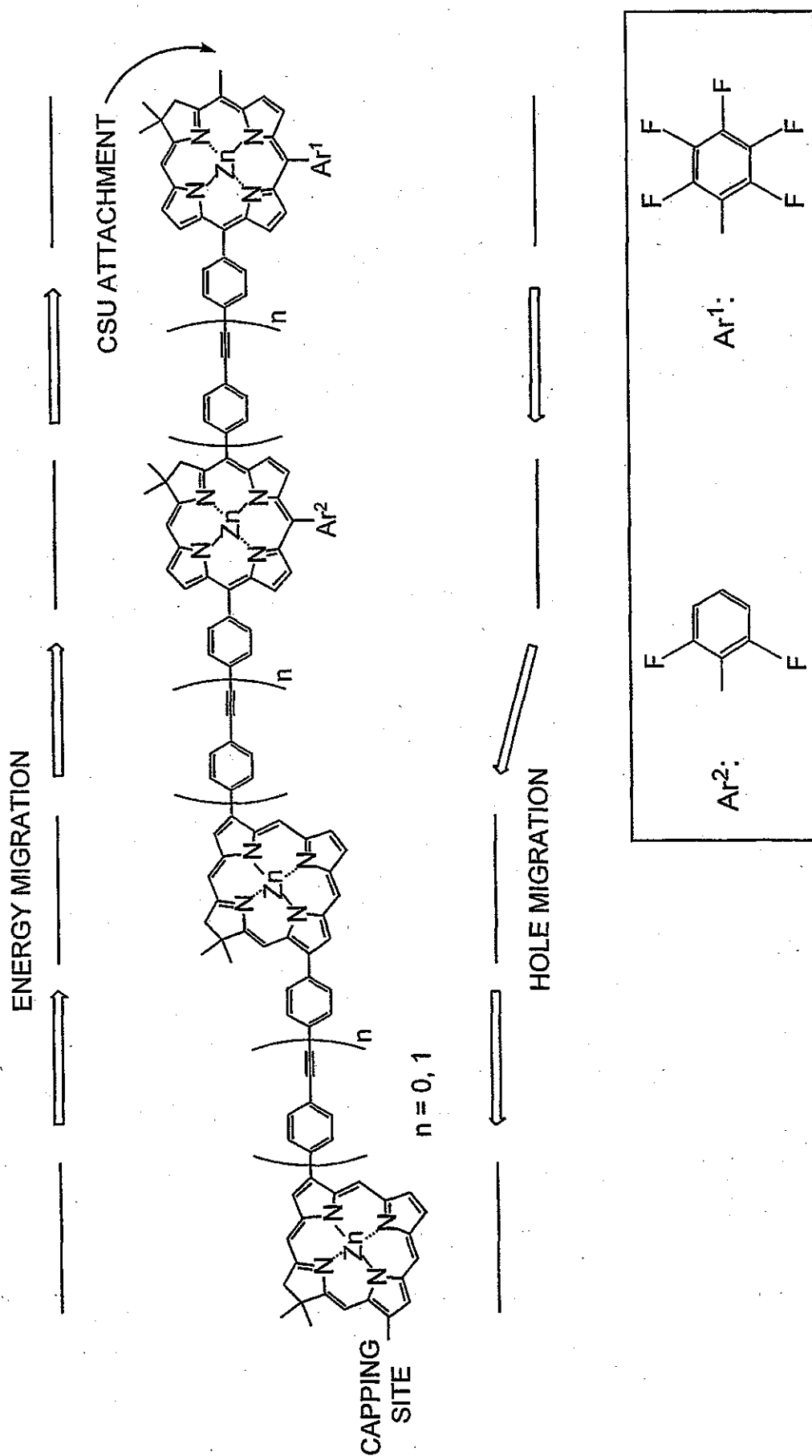


FIG. 48

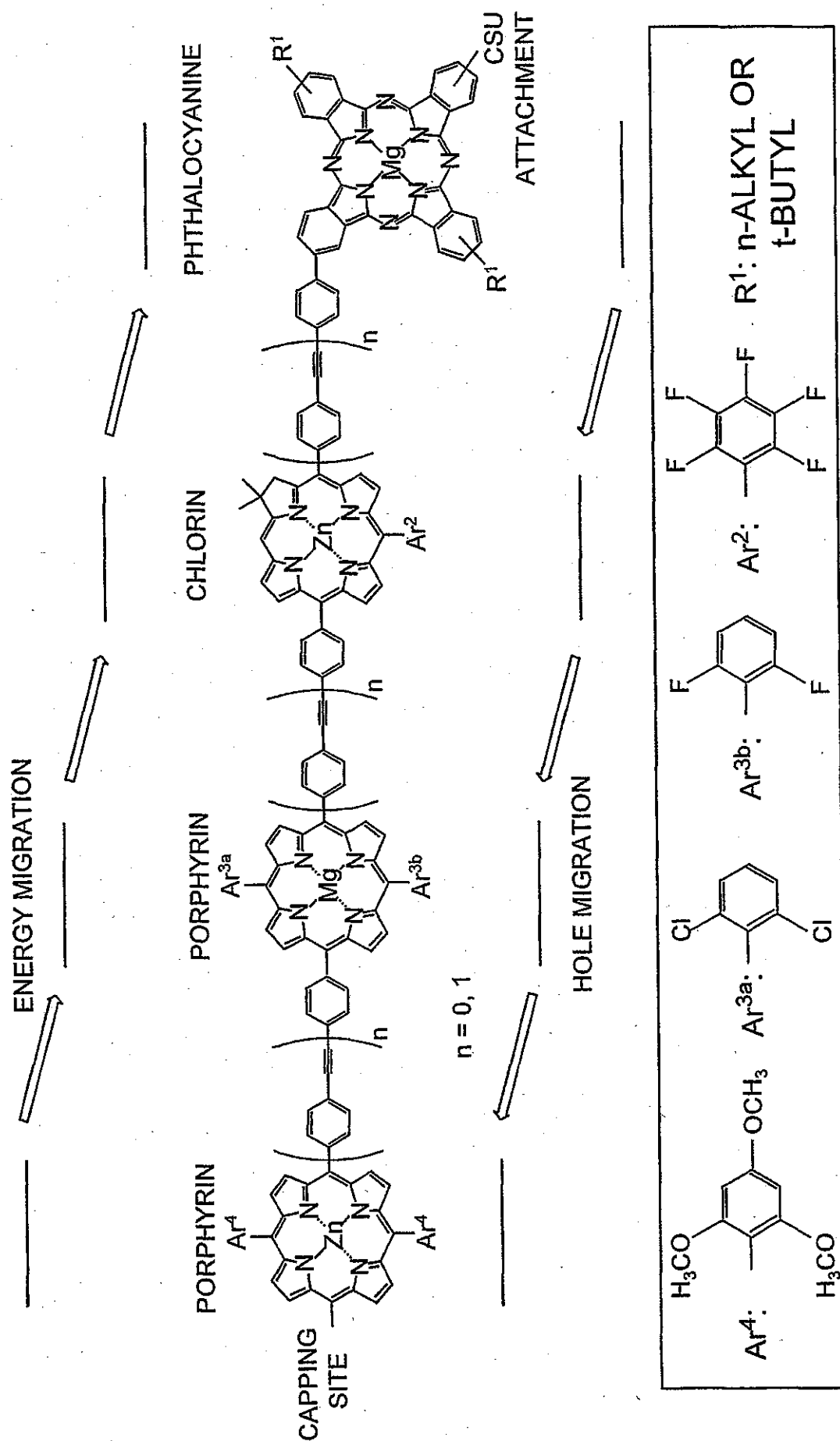


FIG. 49

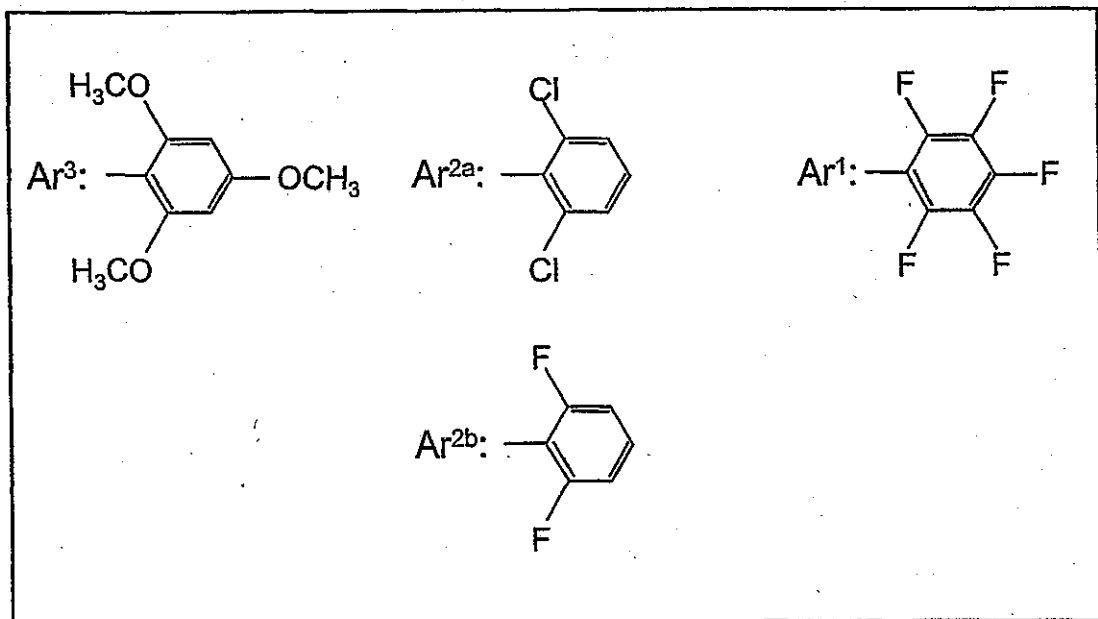
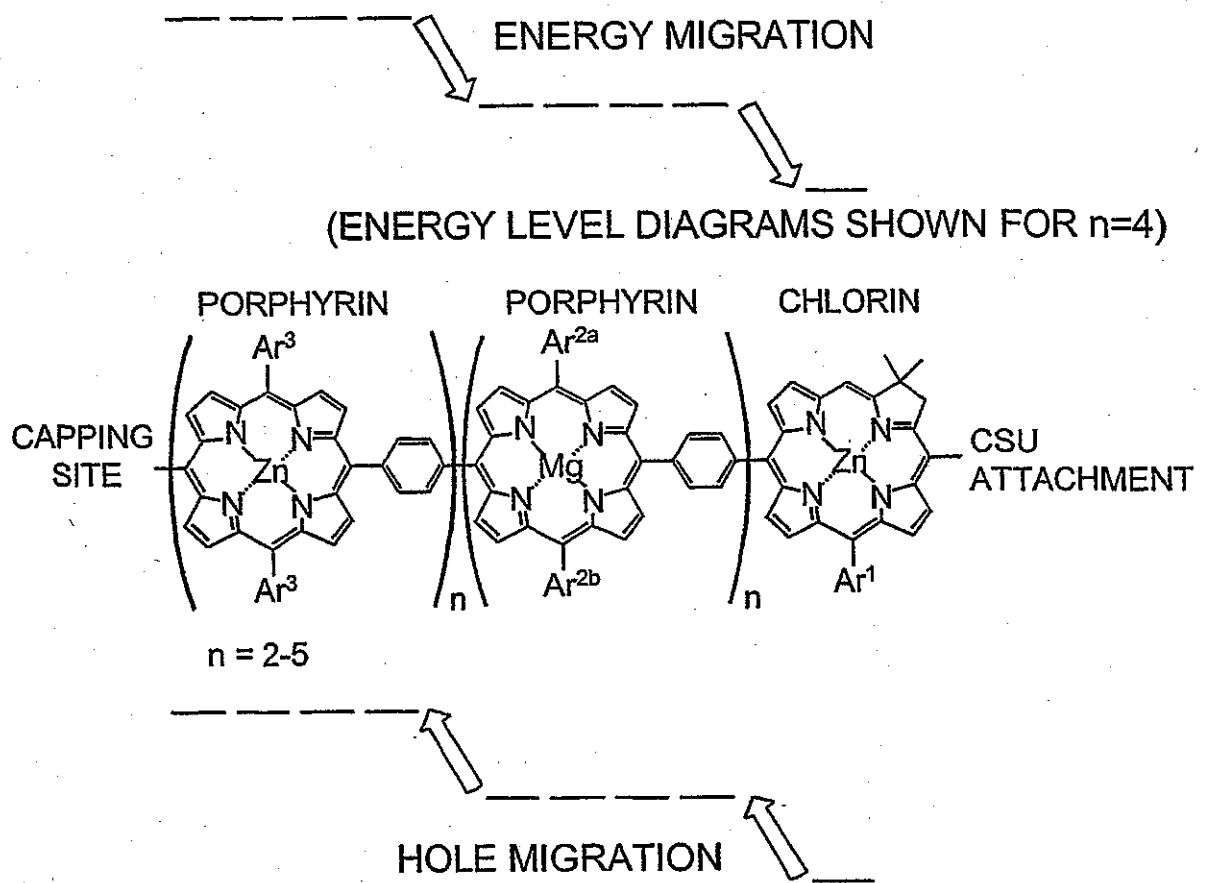
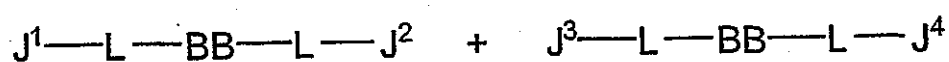


FIG. 50
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<u>J²</u>	<u>J³</u>	<u>REACTION TYPE</u>
-B(OH) ₂	-Cl, -Br, I	SUZUKI
—≡—H	-Cl, -Br, I	SONOGASHIRA
—≡—H	—≡—H	GLASER
—≡—H	—≡—X	CADIOT-CHODKIEWICZ
-CHO	-Br, I	WITTIG
—HC=CH ₂	-Br, I	HECK

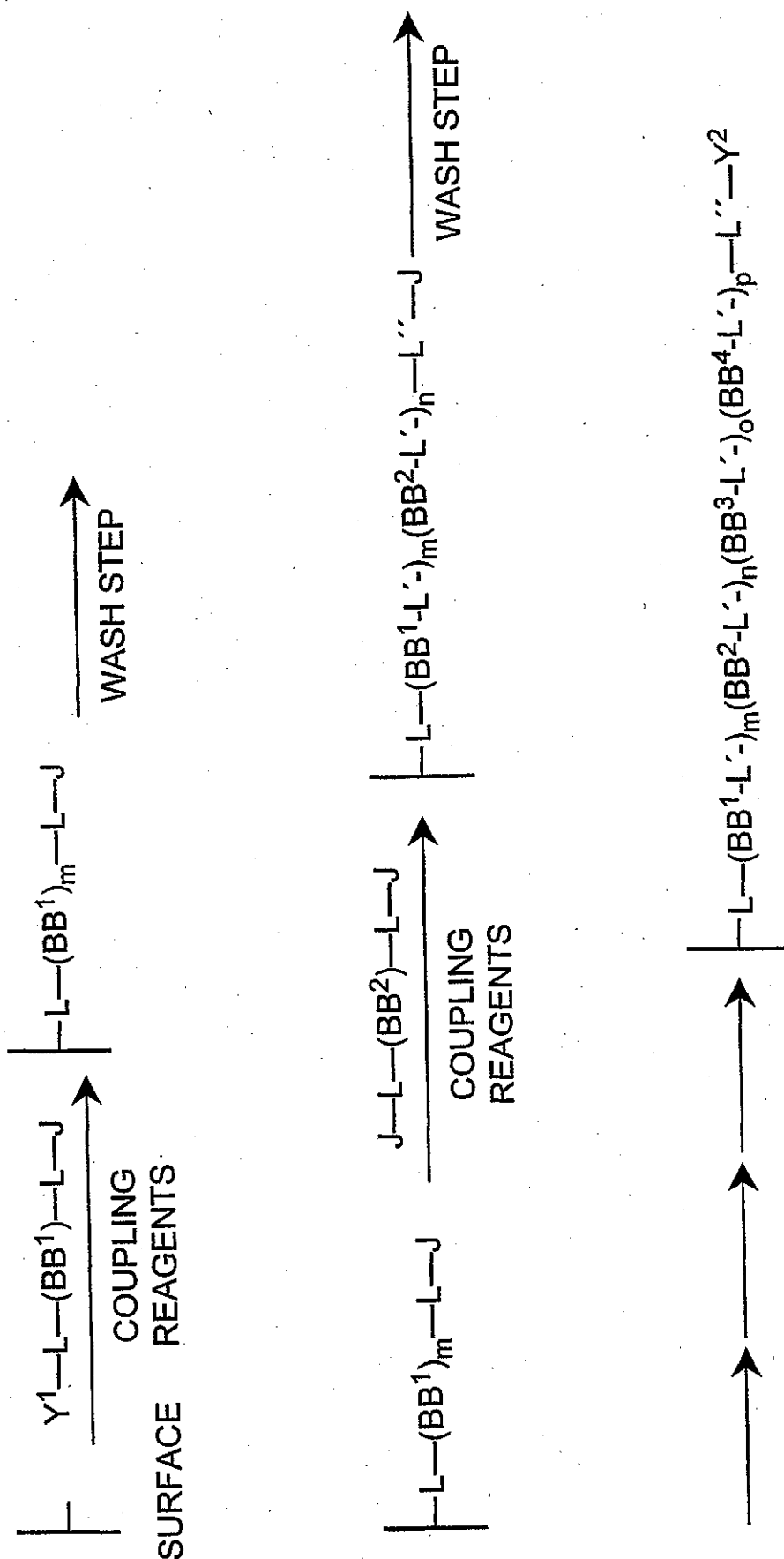
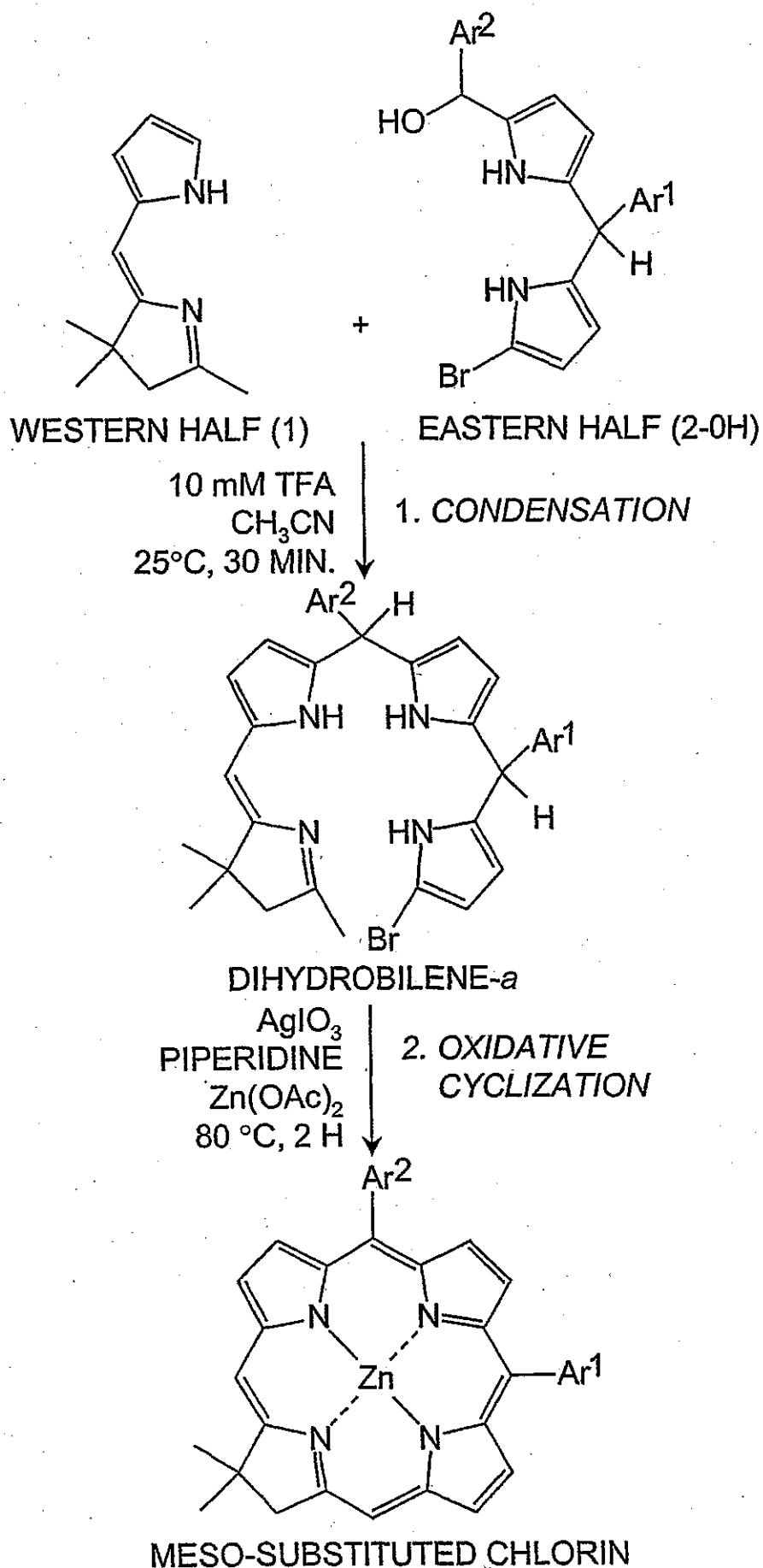


FIG. 52

**FIG. 53**

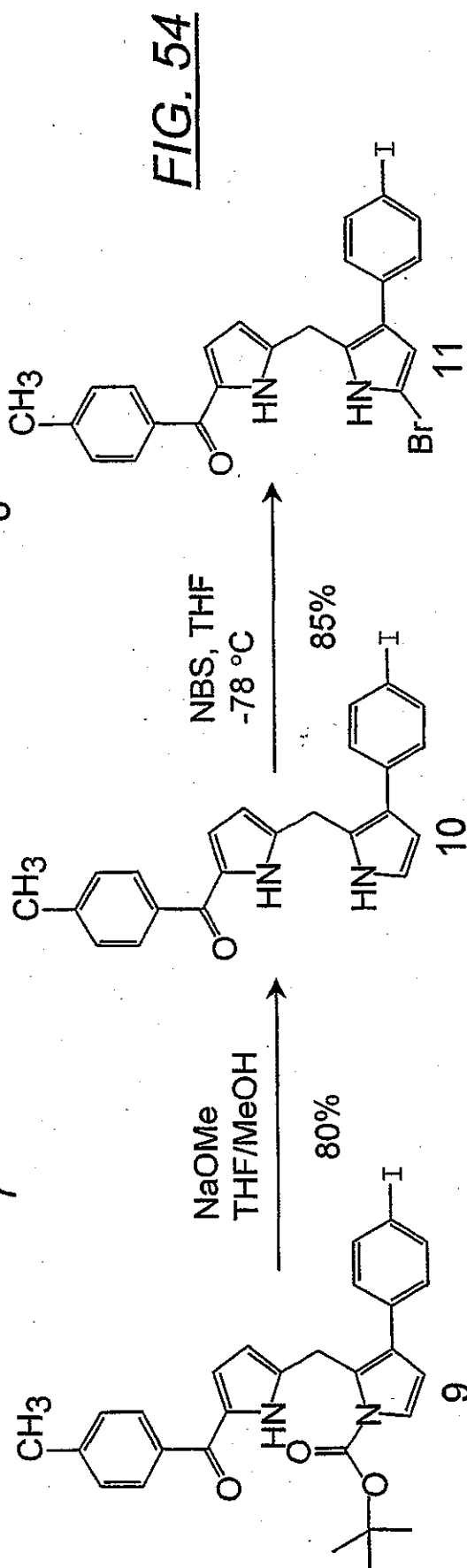
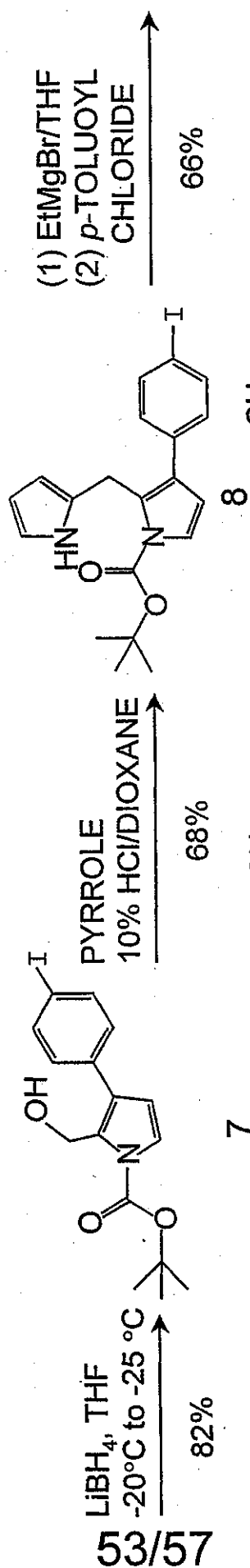
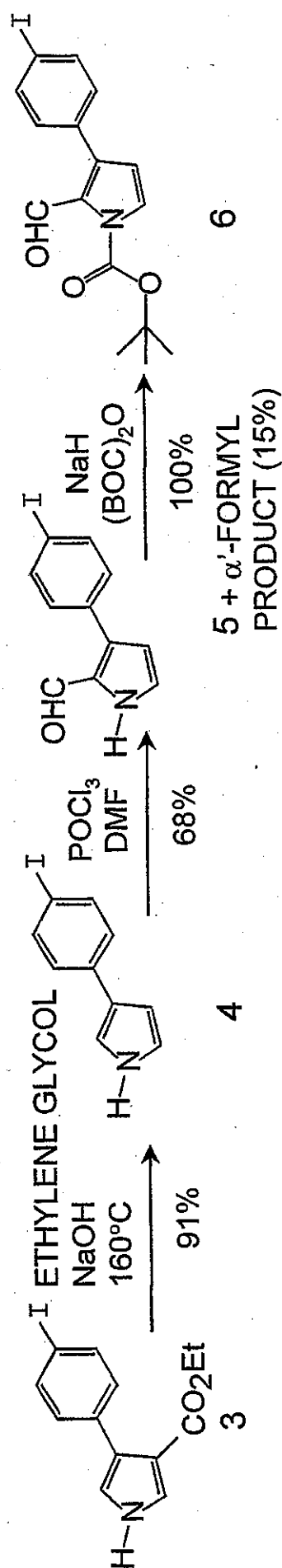


FIG. 54

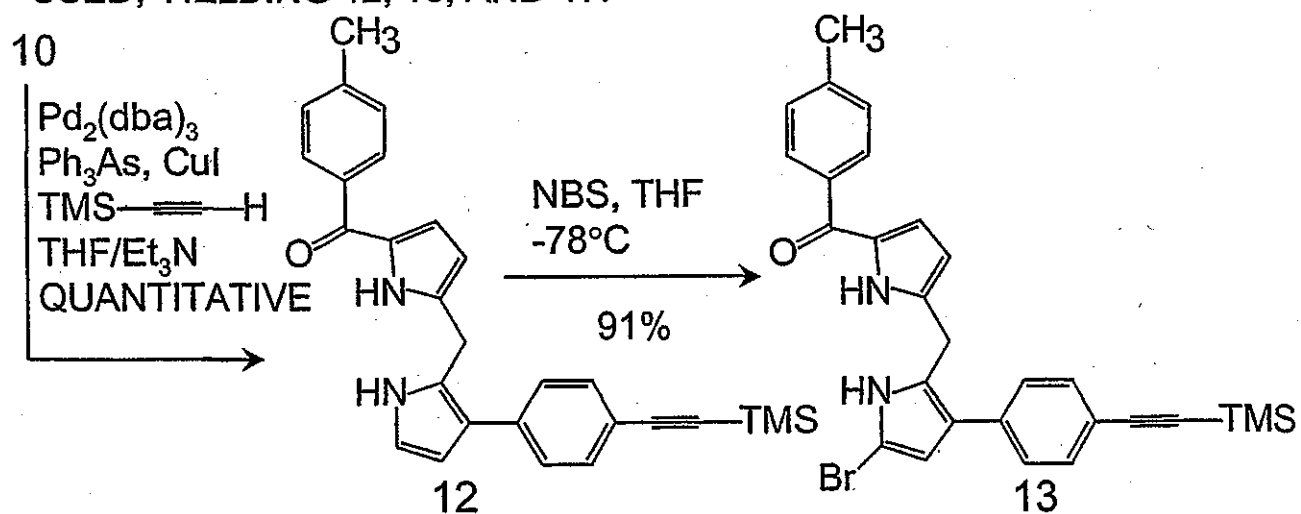
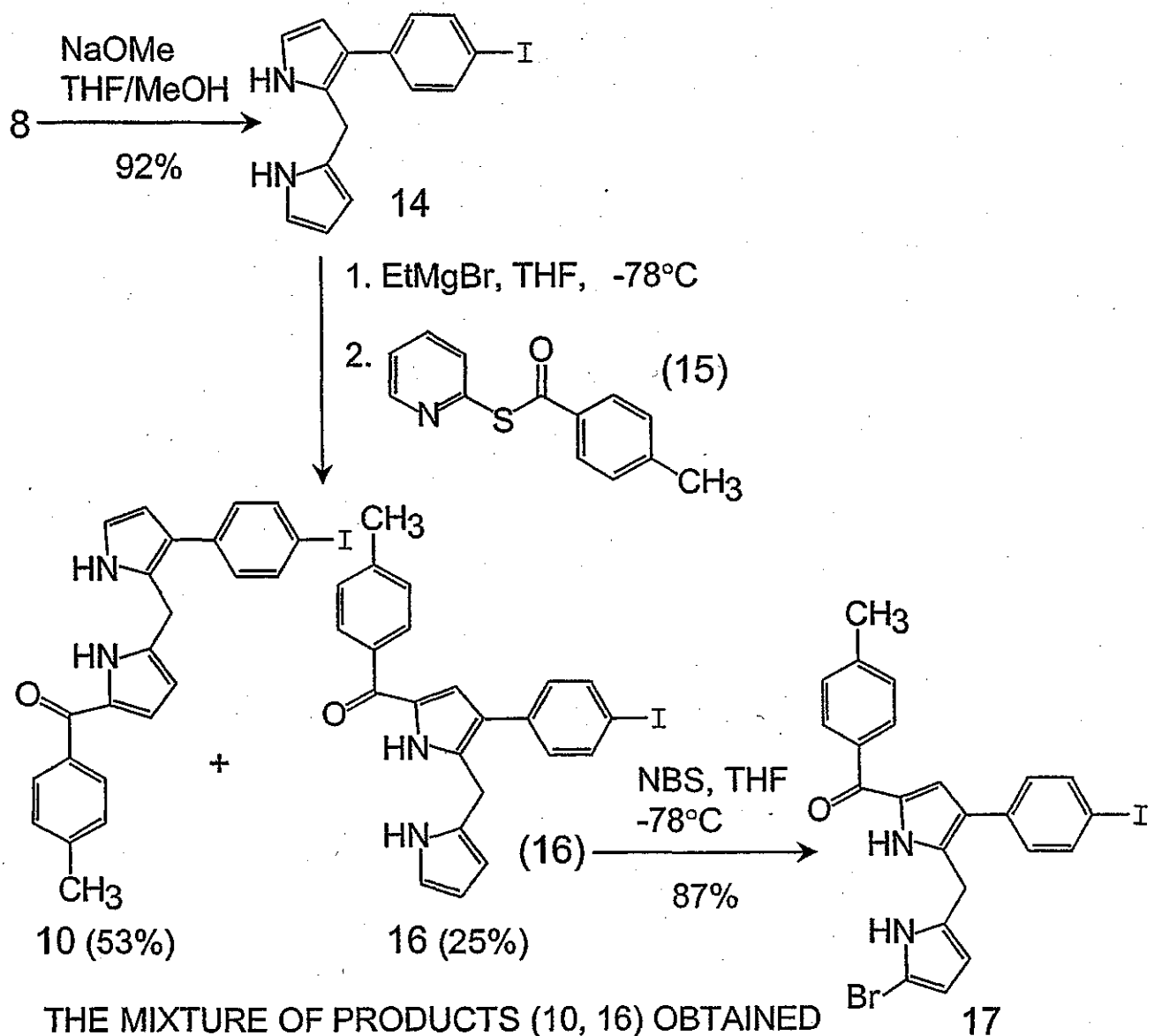


FIG. 55
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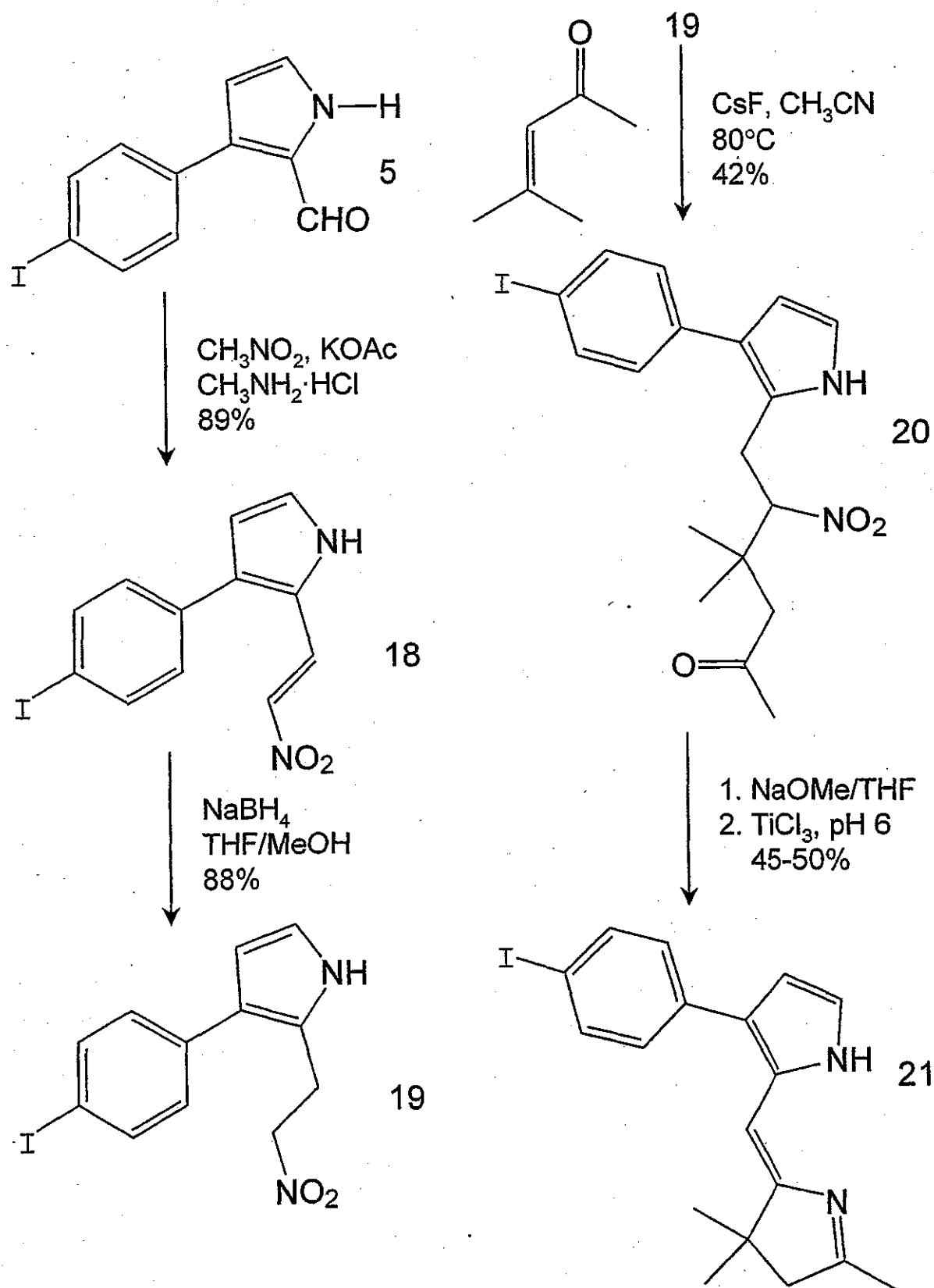
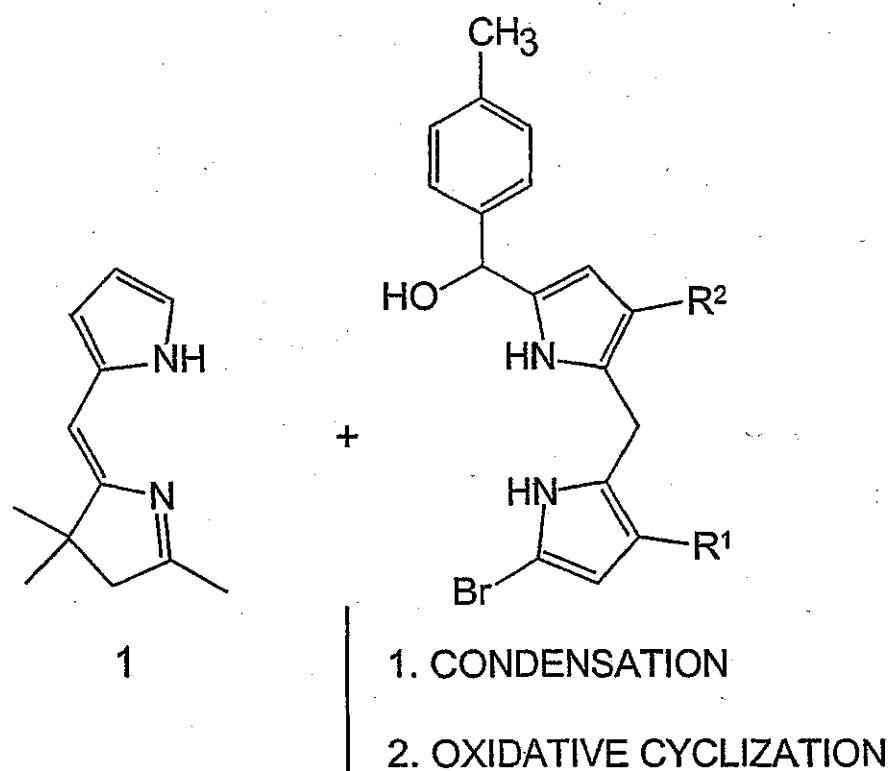


FIG. 56
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β -SUBSTITUTED
WESTERN HALF

17 DEC 2004



<u>EASTERN HALF</u>	<u>R¹</u>	<u>R²</u>	<u>ZINC CHLORIN</u>
11-OH		H	Zn-22 (18%)
13-OH		H	Zn-23 (22%)
17-OH	H		Zn-24 (24%)

FIG. 57
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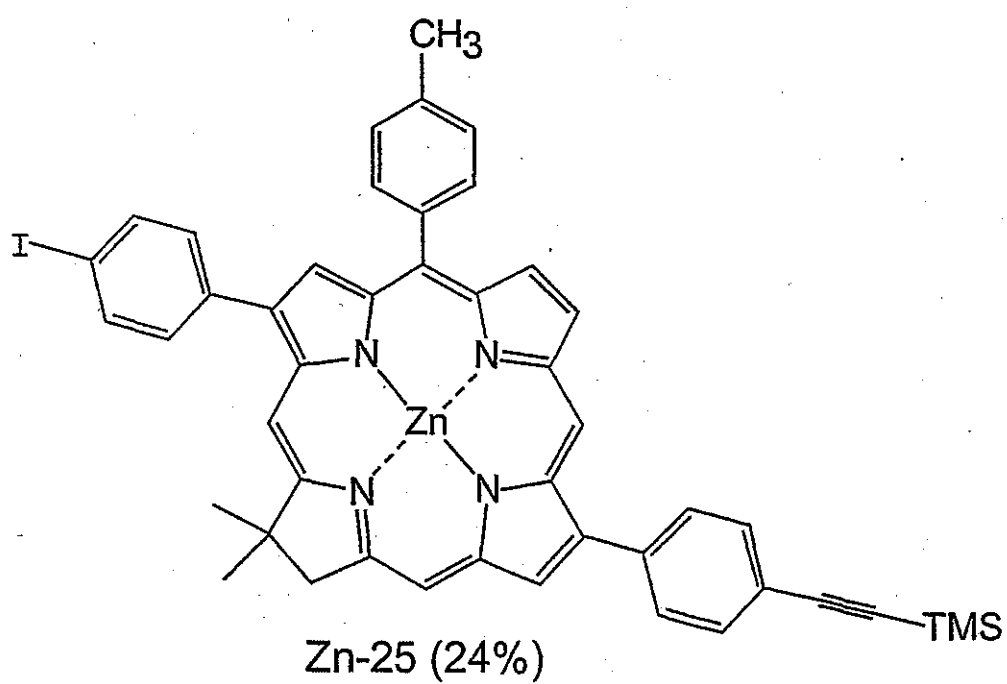
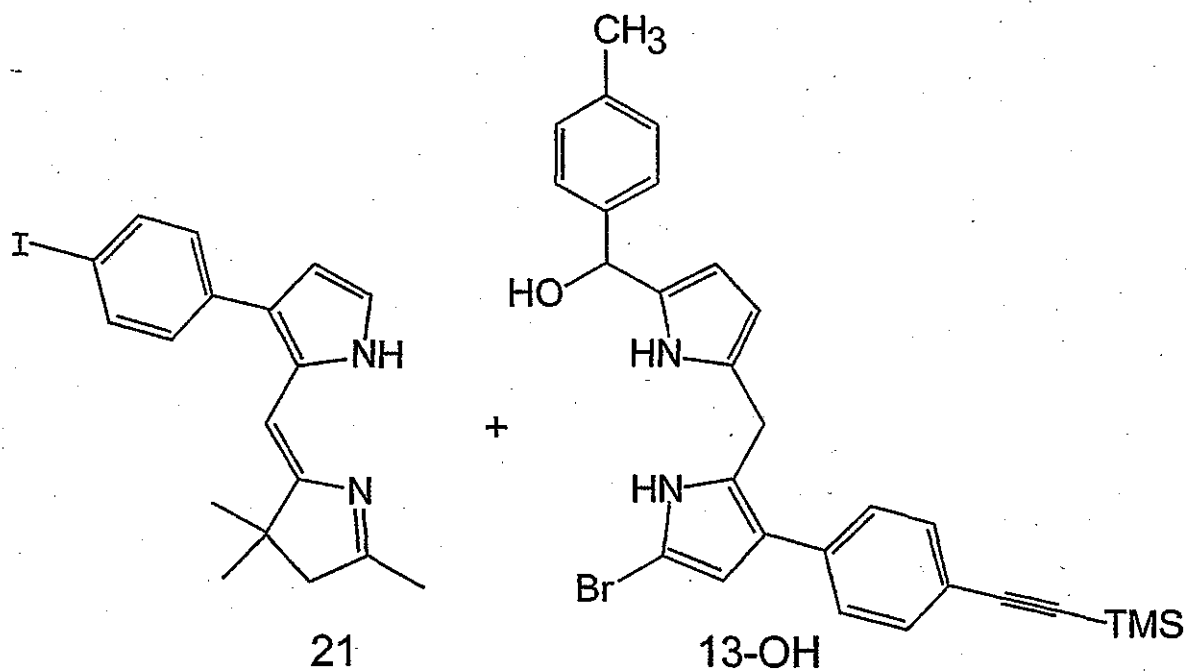


FIG. 58
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