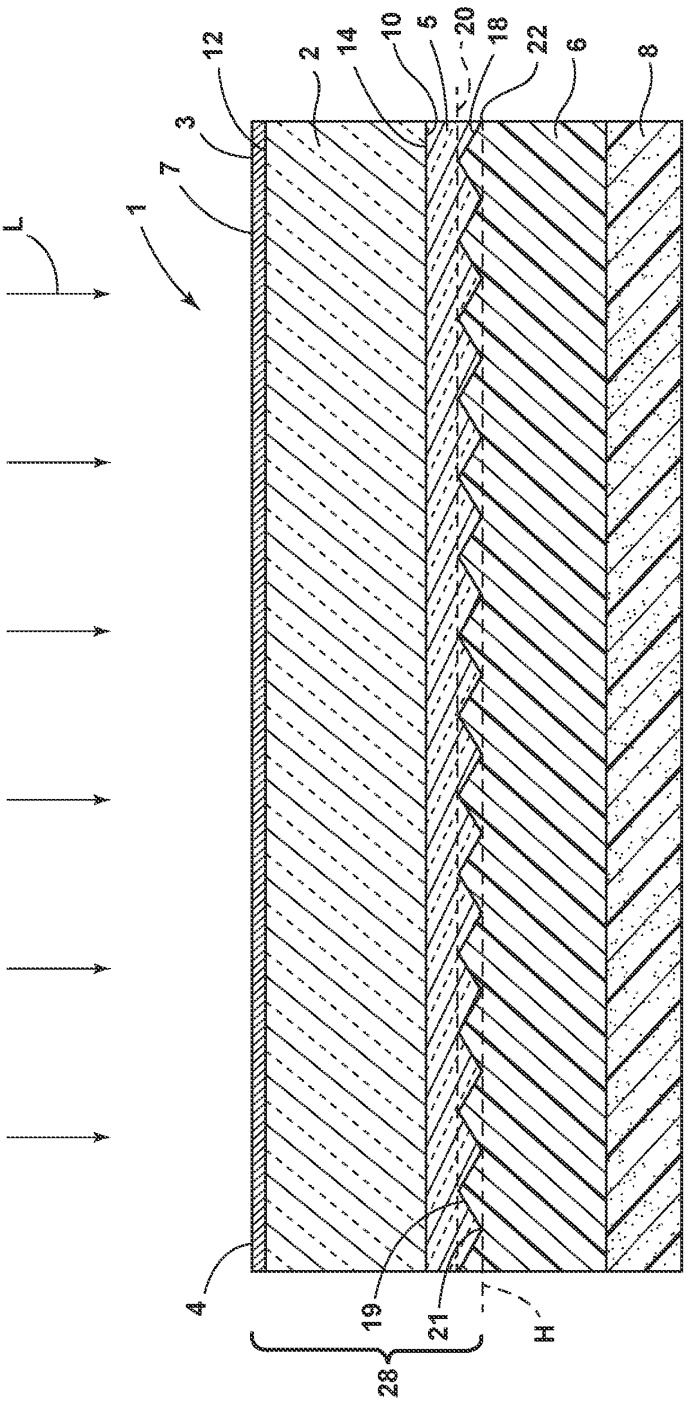


FIG. 1

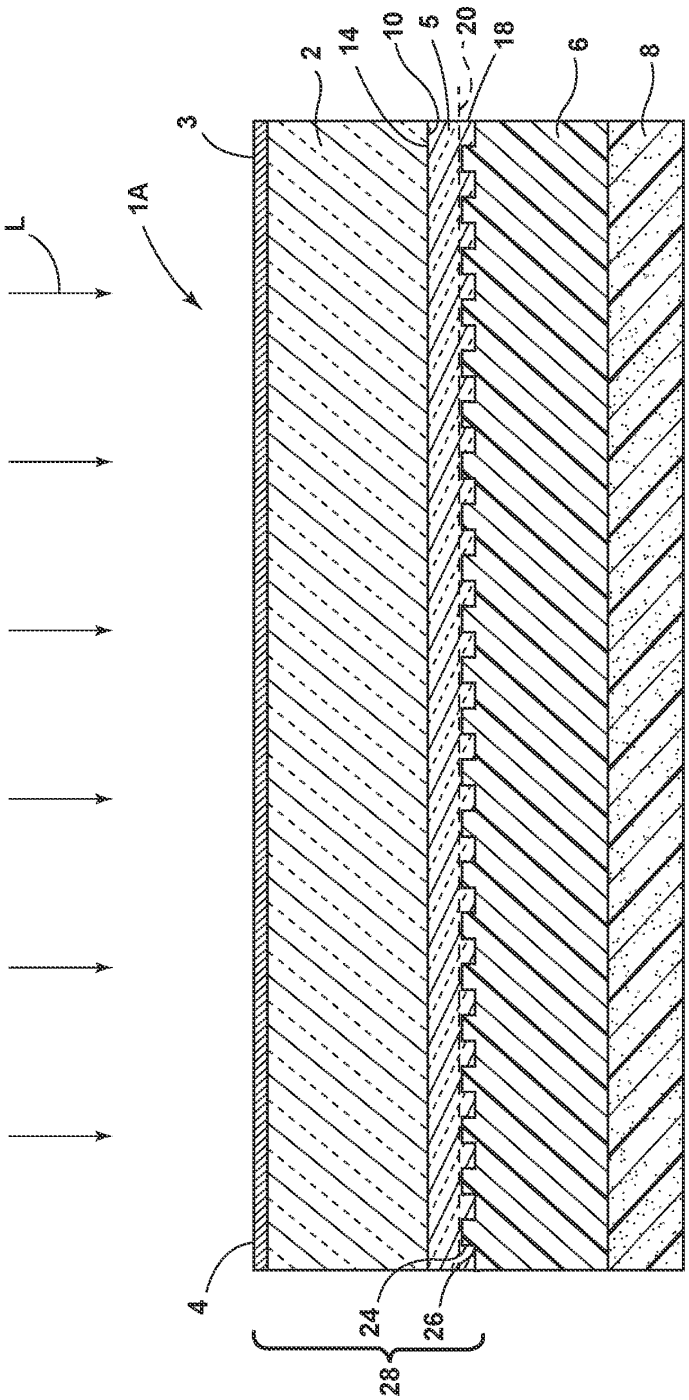


FIG. 2

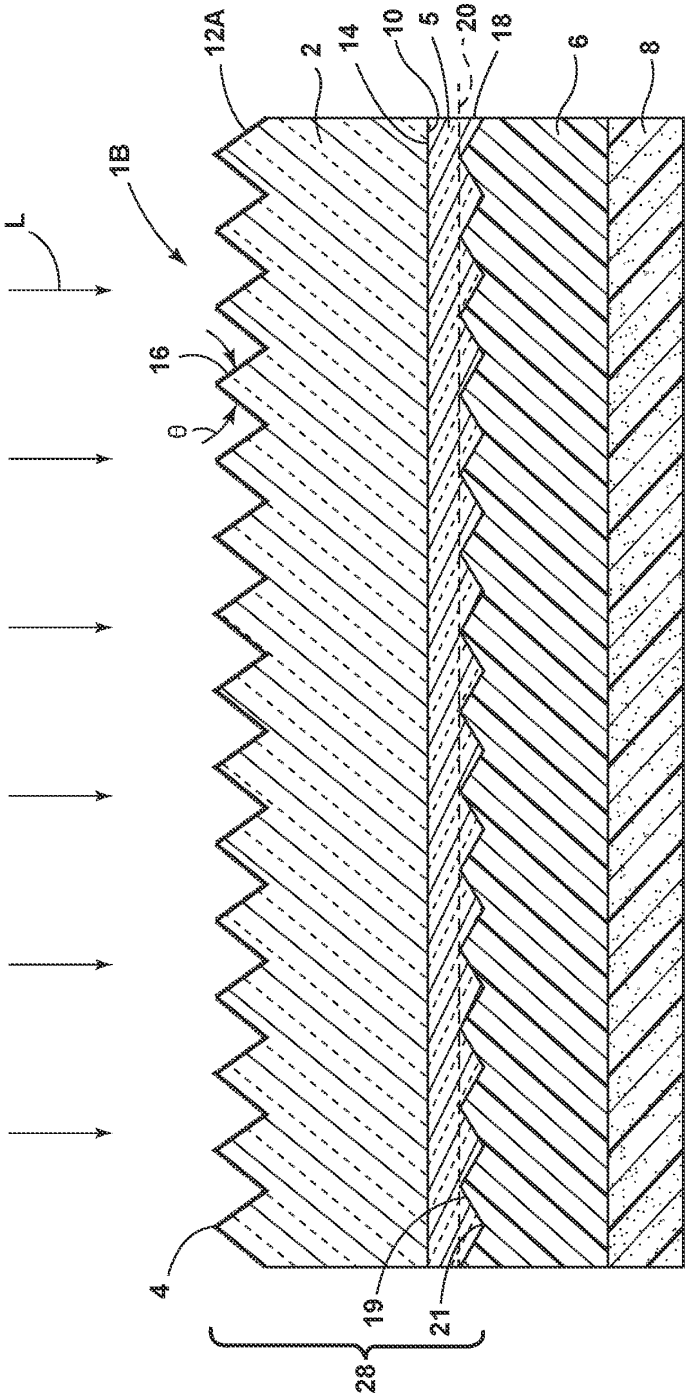


FIG. 3

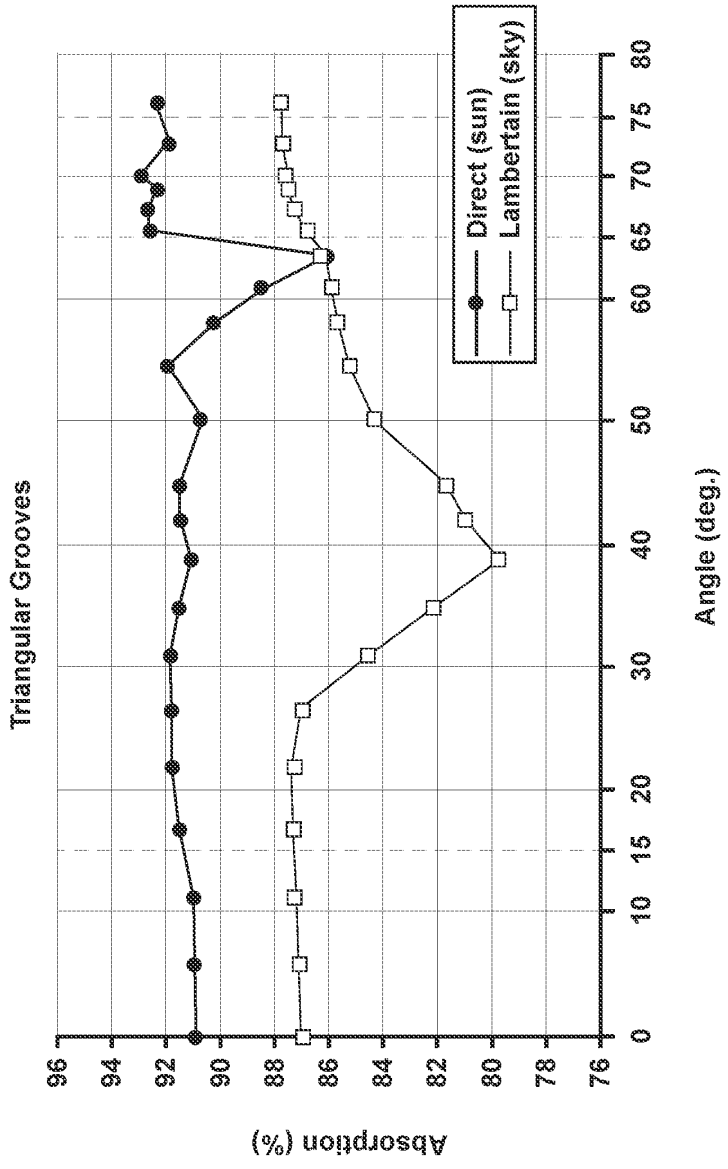

Triangular Grooves
Absorption (%)
96
94
92
90
88
86
84
82
80
78
76
0
10
15
20
30
40
50
60
65
70
75
80
Angle (deg.)
Direct (sun)
Lambertain (sky)

FIG. 4

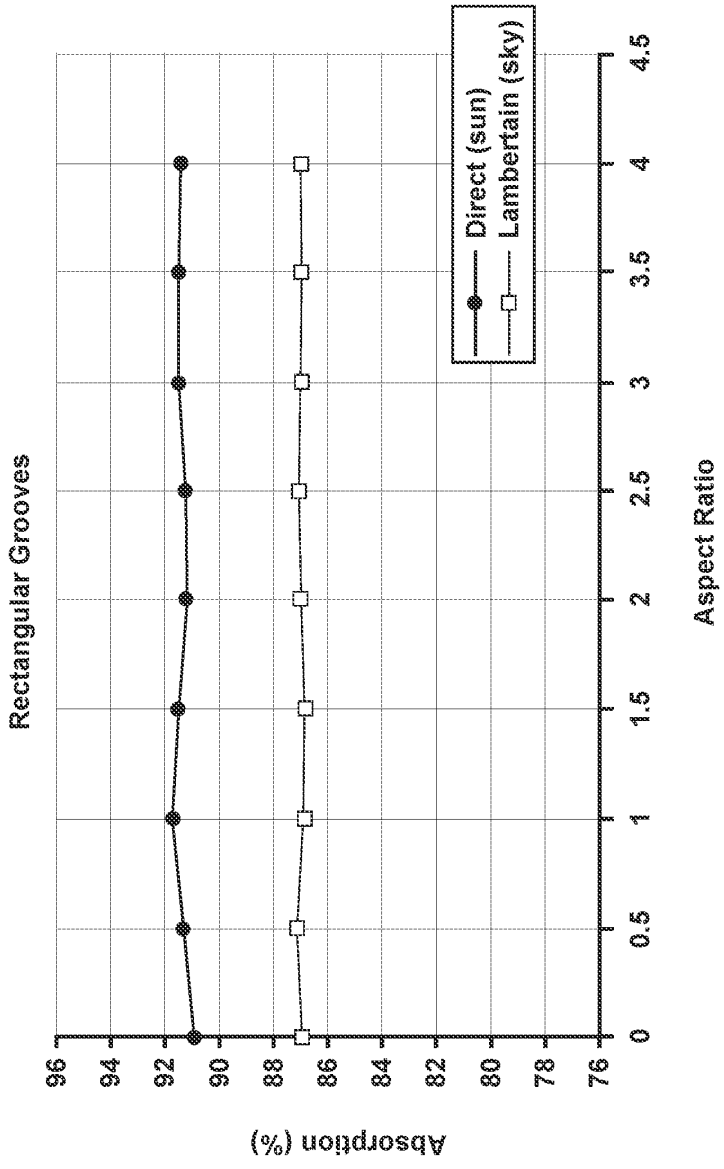

Rectangular Grooves
Absorption (%)
96
94
92
90
88
86
84
82
80
78
76
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
Aspect Ratio
Direct (sun)
Lambertain (sky)

FIG. 5

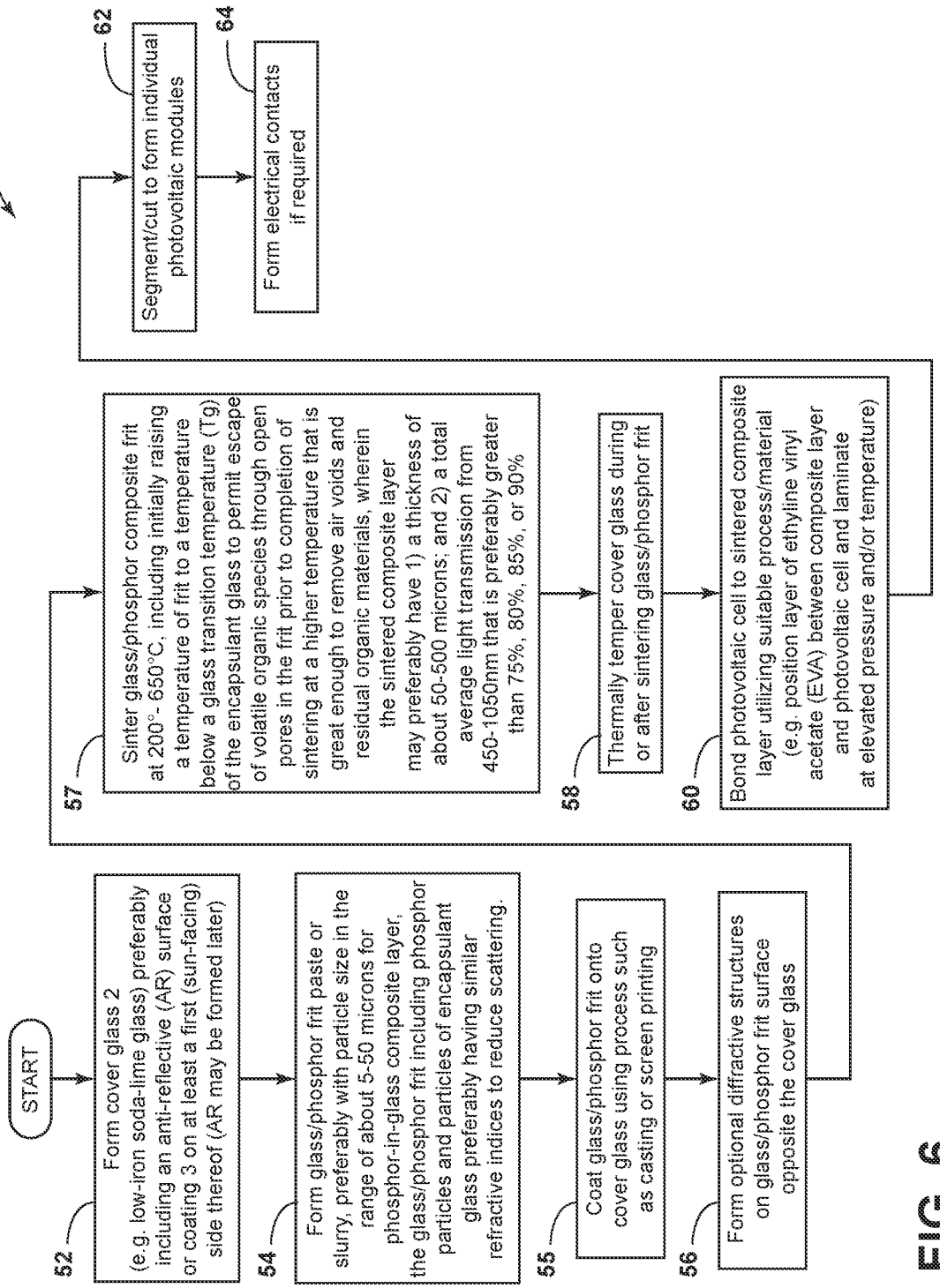

50
START
52
Form cover glass 2 (e.g. low-iron soda-lime glass) preferably including an anti-reflective (AR) surface or coating 3 on at least a first (sun-facing) side thereof (AR may be formed later)
54
Form glass/phosphor frit paste or slurry, preferably with particle size in the range of about 5-50 microns for phosphor-in-glass composite layer, the glass/phosphor frit including phosphor particles and particles of encapsulant glass preferably having similar refractive indices to reduce scattering.
55
Coat glass/phosphor frit onto cover glass using process such as casting or screen printing
56
Form optional diffractive structures on glass/phosphor frit surface opposite the cover glass
57
Sinter glass/phosphor composite frit at 200° - 650°C, including initially raising a temperature of frit to a temperature below a glass transition temperature (Tg) of the encapsulant glass to permit escape of volatile organic species through open pores in the frit prior to completion of sintering at a higher temperature that is great enough to remove air voids and residual organic materials, wherein the sintered composite layer may preferably have 1) a thickness of about 50-500 microns; and 2) a total average light transmission from 450-1050nm that is preferably greater than 75%, 80%, 85%, or 90%
58
Thermally temper cover glass during or after sintering glass/phosphor frit
60
Bond photovoltaic cell to sintered composite layer utilizing suitable process/material (e.g. position layer of ethyline vinyl acetate (EVA) between composite layer and photovoltaic cell and laminate at elevated pressure and/or temperature)
62
Segment/cut to form individual photovoltaic modules
64
Form electrical contacts if required

FIG. 6