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(54) **Title:** REGENERATION OF DEGRADED SILICON PHOTOVOLTAIC MODULES: INDOOR AND OUTDOOR SOLUTIONS

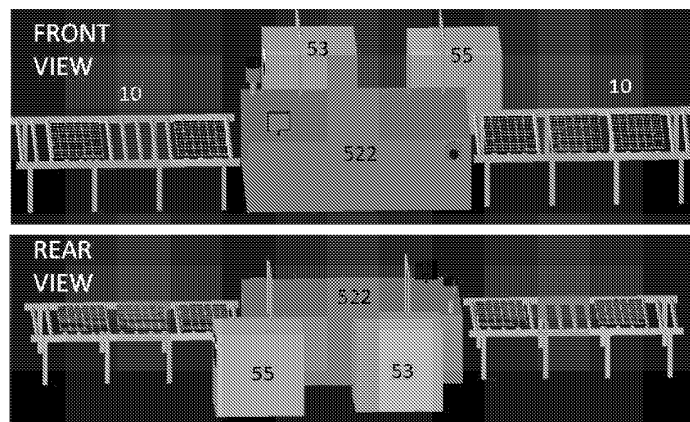


FIG. 6

(57) **Abstract:** Silicon based photovoltaic (PV) systems deployed in the outdoor environment generally exhibit an annual performance degradation of ~0.5% to 1% over its typical 20 to 25 years warranty period. In this invention disclosure, a solar module regeneration tool concept and its various embodiments is described, with its goal to provide PV performance maximization and recovery for both indoor (within the factory) and outdoor (at the installed PV system site) scenarios, in order to mitigate the degradation mechanisms and its impacts. The key benefits includes the following: (1) mitigating future performance drop for brand-new as-fabricated solar modules acting as performance degradation prevention, (2) outdoor performance recovery of degraded solar modules, (3) regeneration of solar modules as required without the need for disassembly, (4) extending solar modules' outdoor usage lifespan, and thus (5) directly reduce the cost of ownership (lower levelized cost of energy, LCOE), while promoting solar photovoltaic as the alternative renewable energy source over the lifespan of the solar modules. (6) the regeneration serves all types of Si based panels, including mono-facial, bifacial in any given size from single cell unit to 240 cell unit.

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