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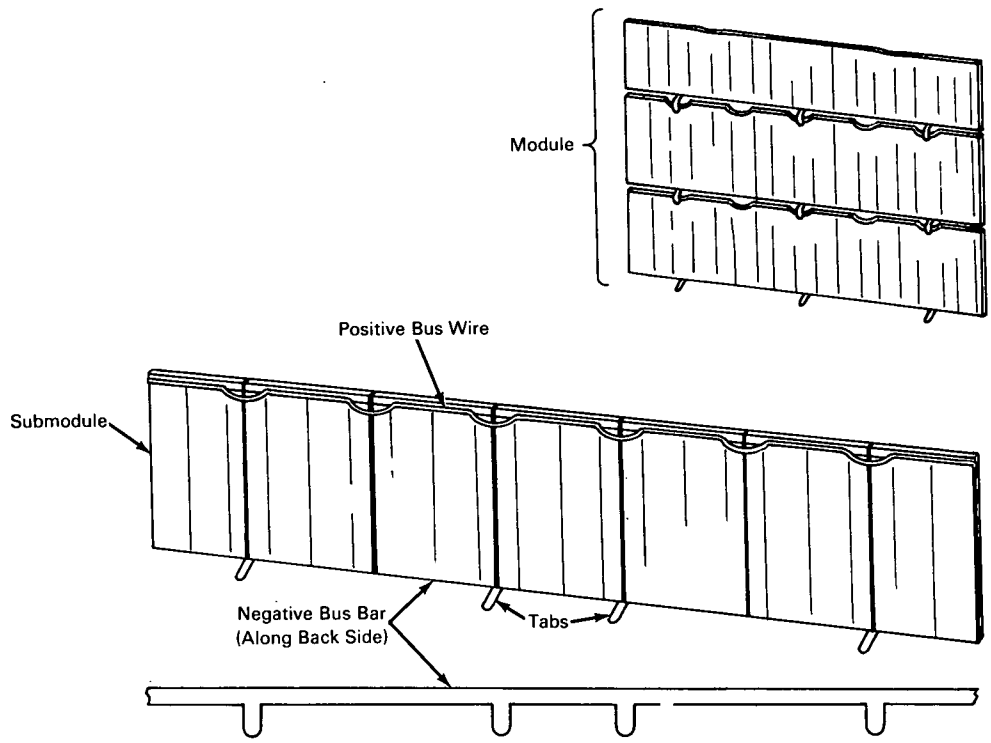
Solar Cell Submodule Design Facilitates Assembly of Lightweight Arrays



The problem:

To design a solar cell submodule that can easily be assembled into lightweight arrays of high reliability. Solar cell submodules, when assembled into arrays, have required a metallic substructure to increase the mechanical strength of the arrays. The substructure increases the weight of the assembly and the complexity of the fabrication process. Previous practice has also required troublesome reheating of the soldered ohmic contacts on individual solar cells in order to assemble parallel and series arrays.

The solution:

Fabricate submodules using bus bars that leave tabs along one end of the submodule and wires with raised portions along the other end. The submodules can be interlocked by bending the tabs on one submodule around the bus wire of an adjacent submodule.

How it's done:

The photovoltaic solar cells are made of type P on N silicon, with three grids along their length and the P contact across one end. The N contact covers the entire rear surface of the cell. The ohmic contacts are

(continued overleaf)

applied by using a photoresist masking process and electroless nickel plating. The nickel-plated ohmic contacts are solder-dipped (60 Sn–40 Pb) to facilitate cell interconnections and reduce contact resistance. Microsheet glass, with a filter deposited on the surface closest to the light-sensitive surface of the cell, is attached to the cell with a silicone adhesive.

Submodules are comprised of several solar cells placed parallel to each other with the P contacts in line. The negative bus bar is soldered on the back sides of the cells at the edge opposite the positive terminals. A piece of wire is bent and spot-soldered to the positive terminals. The wire is bent to leave 1/32-inch-high openings spaced along the length of the wire and directly opposite the tabs protruding from the negative bus bar.

When more voltage than that provided by a single submodule is required, two or more submodules may be connected in series by bending the negative tabs of one submodule around the positive bus wire of another submodule.

Notes:

1. Defective submodules can easily be removed from adjacent submodules.
2. Submodules can be assembled with glass filter covers mounted, electrically measured, and visually inspected prior to panel fabrication. This procedure minimizes uncertainties in electrical mismatching between cell matrices. Final module interconnection is accomplished without applying heat to the ohmic solder contacts, normally the weakest link.
3. Submodules can be assembled using a semiautomated soldering system.
4. The submodule structure is both lightweight and reliable and requires no metallic substructure to increase its mechanical strength.
5. In the case of N on P silicon cells, vapor deposited silver and titanium ohmic contacts may be preferable.
6. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103
   Reference: B66-10231

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

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(JPL-728)