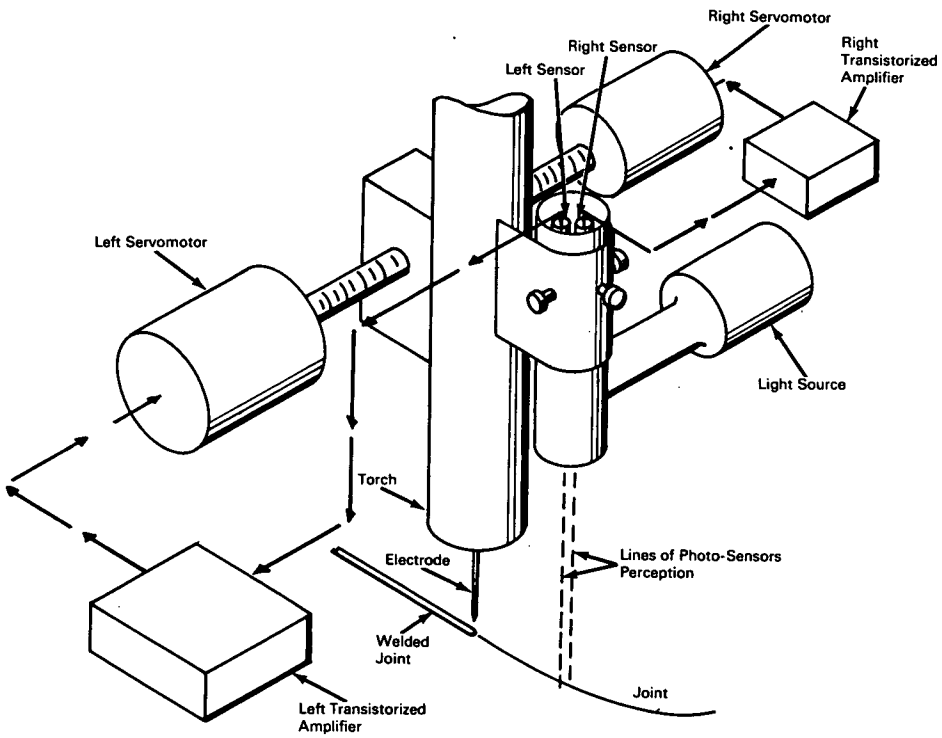
NASA TECH BRIEF

Photosensors Used to Maintain Welding Electrode-to-Joint Alignment



The problem: Normally, in automatic precision arc welding, electrode-to-joint alignment is feasible only for straight line or true circle joints. Other patterns require template control involving the problems of dimensional differences between hardware and template in addition to mechanical linkage tolerances between template and welding head.

The solution: A system that uses photosensors to detect the presence and relative position of a joint to be welded and actuates a servomechanism to guide the welding head accordingly.

How it's done: The device controls the direction of a welding setup that incorporates automatic electrode feed and travel. With the apparatus in place to begin the welding process, the system optics package is centered over the joint to be welded. The light source beam is transferred by the optics in a plane normal to the joint and reflected back to the optics so that the reflected light impinges on two photodiodes. Each photodiode is connected to a transistorized amplifier driving a servomotor that is connected to the system carriage. Output voltage to the motors controlled by

(continued overleaf)

the sensors is originally equalized by tuning potentiometers provided in the amplifier circuits so that the opposed servomotors are mutually stalled, maintaining the welding head in position, centered above the joint. If the joint changes direction so that the joint moves beneath one of the sensors, light reflected to that sensor drops off, output voltage to the servomotor associated with it is reduced, the opposed servomotor drives the welding head laterally in the direction that restores the joint between the sensors, restoring the original voltage to the affected sensor and restoring equilibrium between the drive motors. The lead distance from sensors to welding head is adjusted to coincide with servomechanism response time related to welding speed.

Notes:

1. This method would be advantageous in situations requiring precision welding with high reliability, especially where weld penetration must be closely controlled.
2. This innovation represents a considerable saving in setup time over previous methods involving the use of templates and mechanical linkages.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   P.O. Box 1537
   Houston, Texas, 77001
   Reference: B65-10401

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

Source: Joseph B. Bowen of
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under contract to
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(MSC-243)