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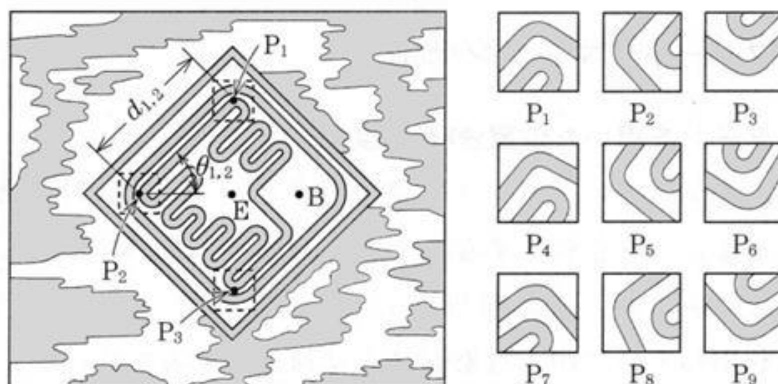
1973
Development of automatic wire bonders for transistors
~ Packaging ~

In 1973, engineers at Hitachi Central Research Laboratory and Musashi Works developed the world's first assembly robot for transfer mold Si transistors. This equipment was called AWE (Automatic Wire-bonder with Eye). The image of the transistor chip was photographed with a TV camera, the positions of the electrodes to be wired were found from the binarized data, and the chip and the lead frame were connected in the averaged of 0.2 seconds with the gold wires. It was to replace the manual works of girls by machine work, and it was awarded the 10th Mechanical Promotion Association Award in 1975 from Machine Promotion Association.
Later, the wire bonder CABS (Computer Automated Bonding System) for ICs with larger numbers of terminals was developed, contributing to the cost reduction of multi-terminal resin mold package assembly such as DIP and QFP, and also to the stabilization of bonding quality. Reliability of the applied semiconductor device was highly valued, leading to the establishment of Japan’s superior position in quality and reliability. This further contributed to the establishment of No. 1 position of Japanese semiconductor, in particular DRAM in 1980s, in the global market.
These bonding technologies also contributed to the acquisition of microprocessor technology such as 8-bit microprocessors from Motorola in the U.S. Hitachi's technology has since been handed over to wire bonder makers such as Shinkawa.

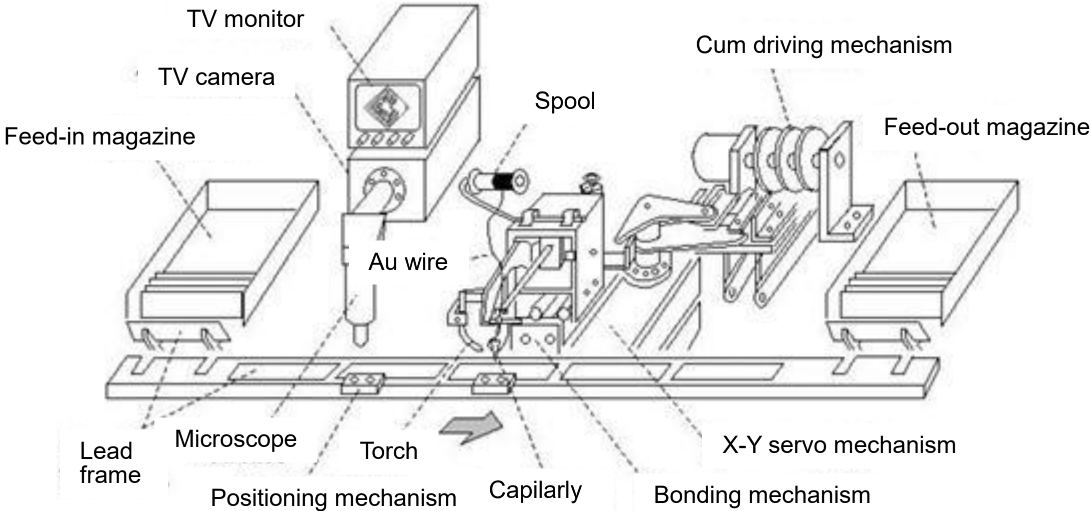
The figures below are, from top to bottom, a camera image binarization pattern diagram, a schematic drawing of automatic assembly machine, and the photograph of the assembled transistor.



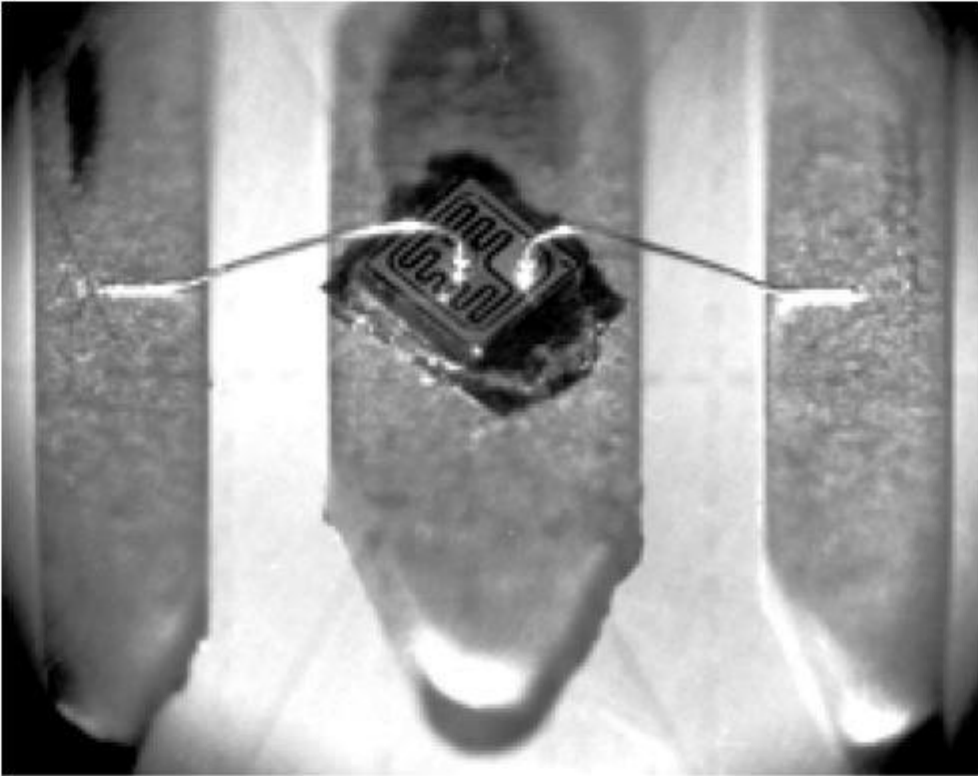
(a) Binarized image pattern and detection of distance and angle

(b) Example of partial patterns

Complex type partial pattern matching method



Outline of mechanical system of automatic wire-bonding machine



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