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1973
Automatic Wire Bonding Equipment (AWE)
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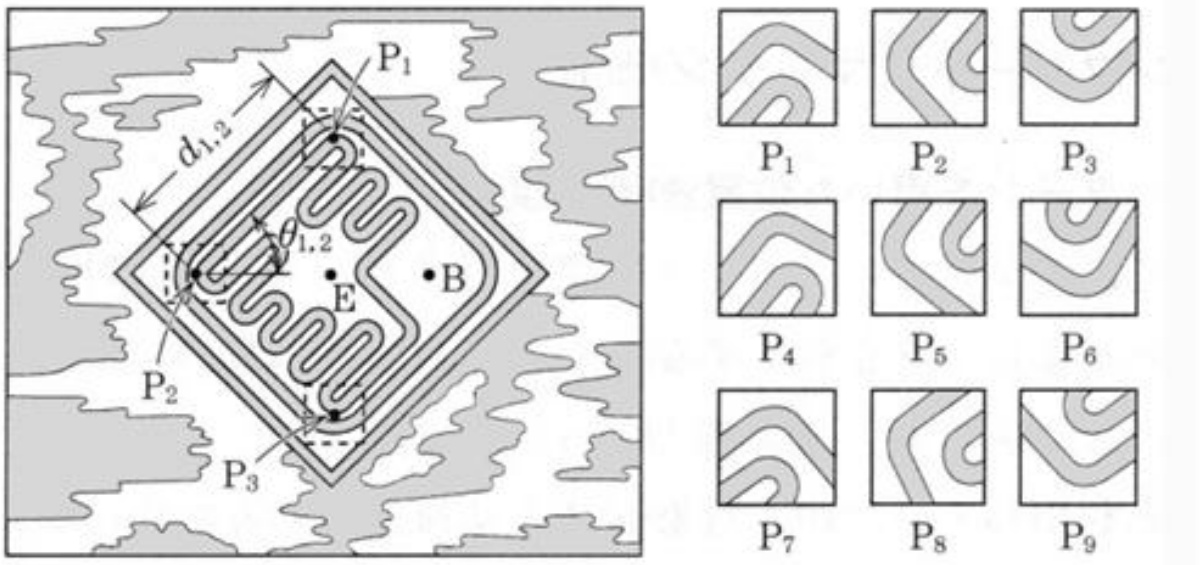
Die attachment of transistors to lead frames and wire bonding processes had been done by female workers until then. The number of workers in these processes reached 1000 per factory and they were called transistor girls in Japan. Hitachi automated the die attachment process, and also the wire bonding process by increasing the wire bonding electrode areas by making the electrode of the transistor into two layers.

An automatic wire bonding apparatus called AWE (Automatic Wire-bonder with Eye) was developed in 1973, by mounting a TV camera on this automatic bonder, providing the function of an eye. An image of a transistor chip is photographed with a TV camera, the position of the electrode to be wired is found by binarized pattern recognition, and the chip and the lead frame are connected in an average of 0.2 second with gold wires. It was also the beginning of application of so-called AI (artificial intelligence) to the semiconductor industry. As a result, the process of assembling the transistors was automated in the normal manufacturing process without making the electrodes into two layers.

Later, IC wire bonder CABS (Computer Automated Bonding System) for multi terminal bonding was developed, contributing to the reduction of assembly cost of plastic packages of multi-terminals such as DIP, QFP, as well as stabilizing bonding quality. This technology contributed much to the high reliability of semiconductor devices, which was highly valued in the global market. High quality and reliability was one of the important factors to put Japanese semiconductor to the were world top position with DRAM as the center of it in the 1980s.

This bonding technology also contributed to Hitachi’s alliance with Motorola, in which MPU technologies such as 8-bit microcontrollers were introduced. Hitachi's technology was later handed over to wire bonder manufacturers such as Shinkawa Co., leading to today’s industry.

The figures are, from top to bottom: ①binarized pattern diagram of camera image, ②schematic drawing of automatic assembly machine ③photograph of assembled die.



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

(a) Example of partial patterns

Figure 1 Complex type partial pattern matching method
(provided by KOKUSAI ELECTRIC)

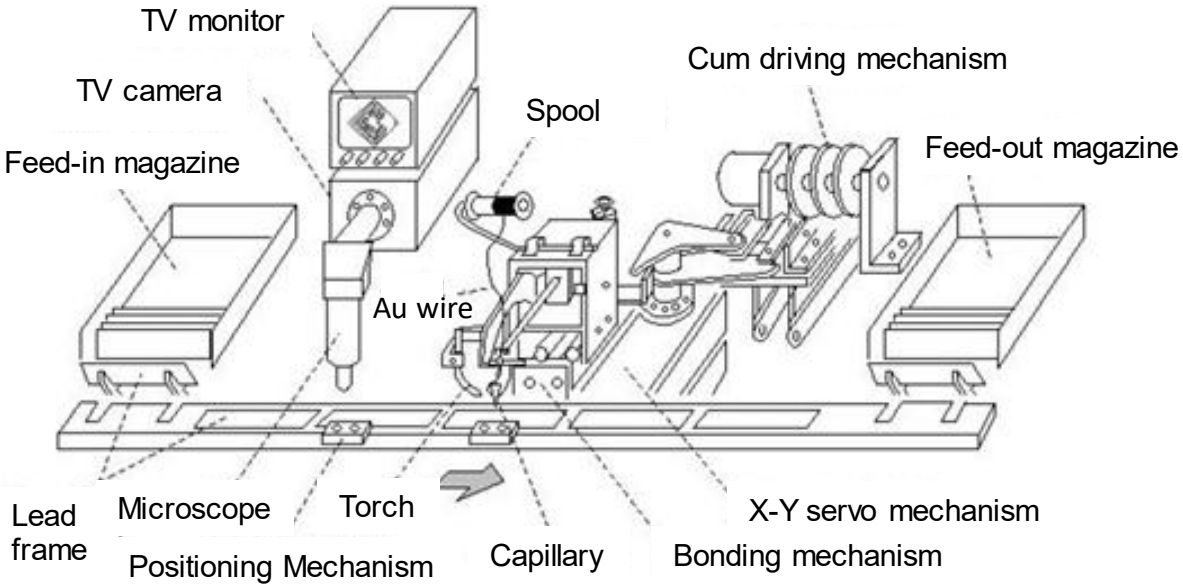


Figure 2 Outline of mechanical system of automatic wire-bonding machine

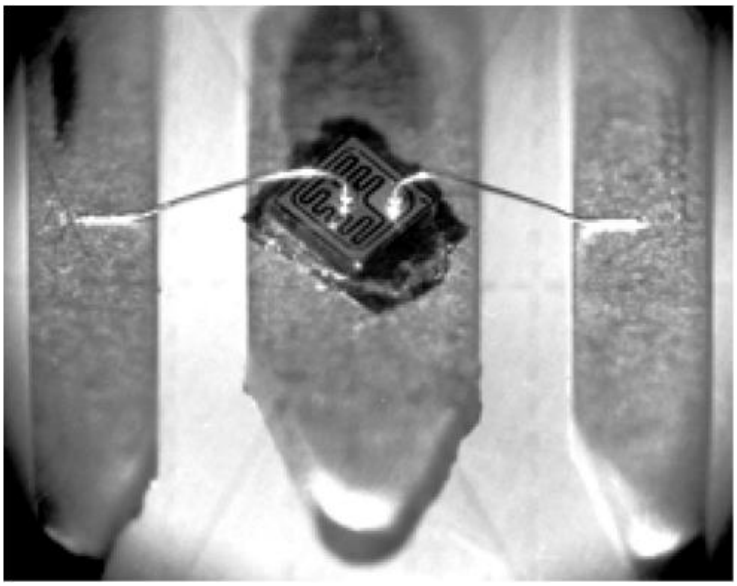


Figure 3 Transistor wire-bonded by AWE

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