

## **1960's**

### **Photo Repeater**

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In the photolithography technology of the planar integrated circuit (IC) invented in Fairchild Semiconductor in 1959, a step and repeat camera made by Jay Last and Robert Noyce was used . In 1961, based on this principle, David W. Mann (acquired by GCA) commercialized the photo repeater (971 PR). The 10x size chip pattern was reduction projected on the surface of the substrate coated with the photosensitive resin to form equal size pattern of the chip, and the XY stage is moved to repeat the exposure. For the movement of the XY stage, the function of a micro densitometer (micro optical densitometer) that read the relationship of optical density, and a comparator that manually controlled the position coordinates of the pattern were used. In 1967, a photo repeater (1489 PR) which was equipped with automated XY movement function was released. Nikon 's Ultra Nikkor was used for the projection lens.

In the 1960's, contact exposure method came to be used, in which a glass mask with chip patterns was directly contacted to the photoresist on the wafer. Photo-repeaters were used for photomask fabrication until the 1970s. The photomask fabrication gradually sifted to the application of electron beam drawing method from the latter half of the 1970s, but the principle of the photo-repeater was inherited to the reduction projection exposure apparatus.