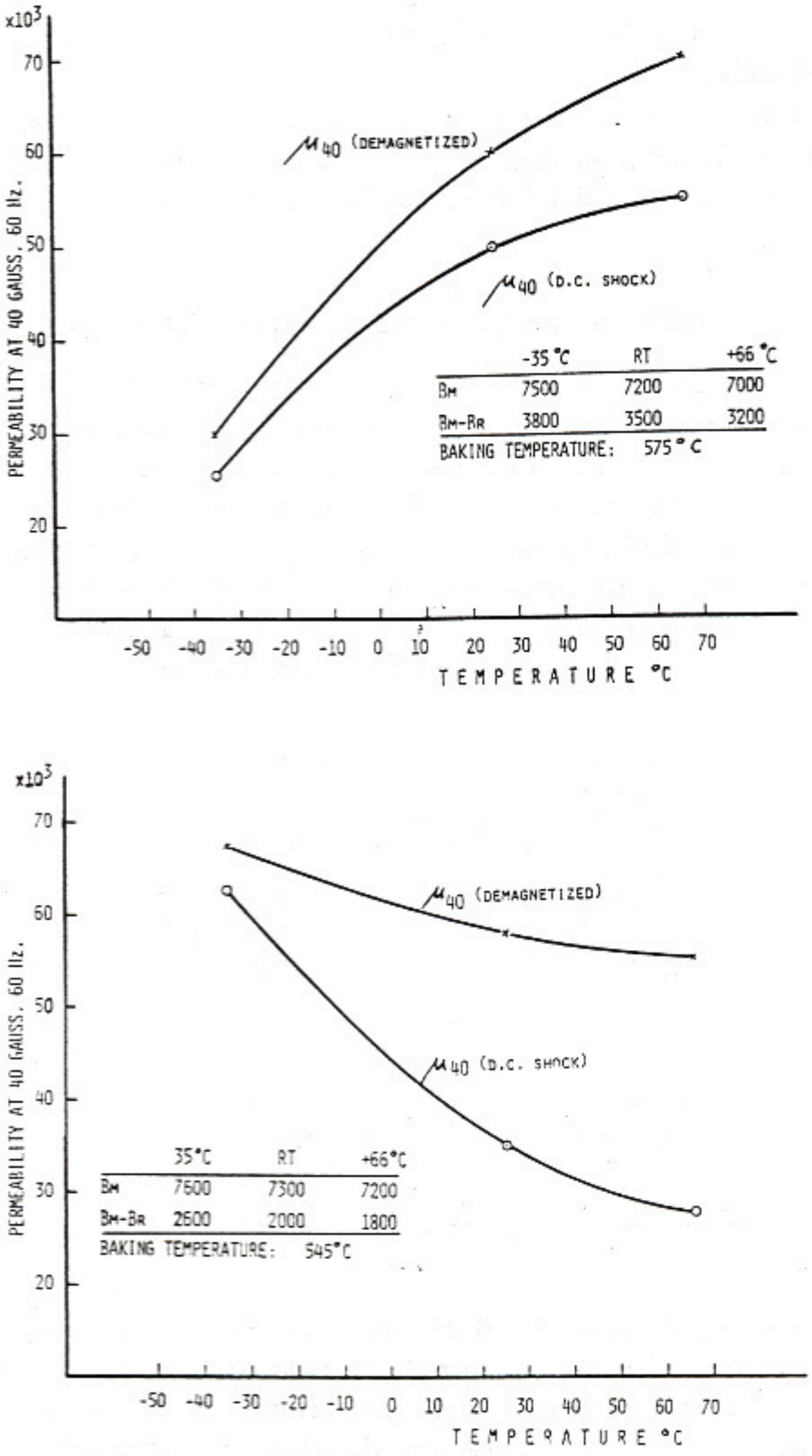

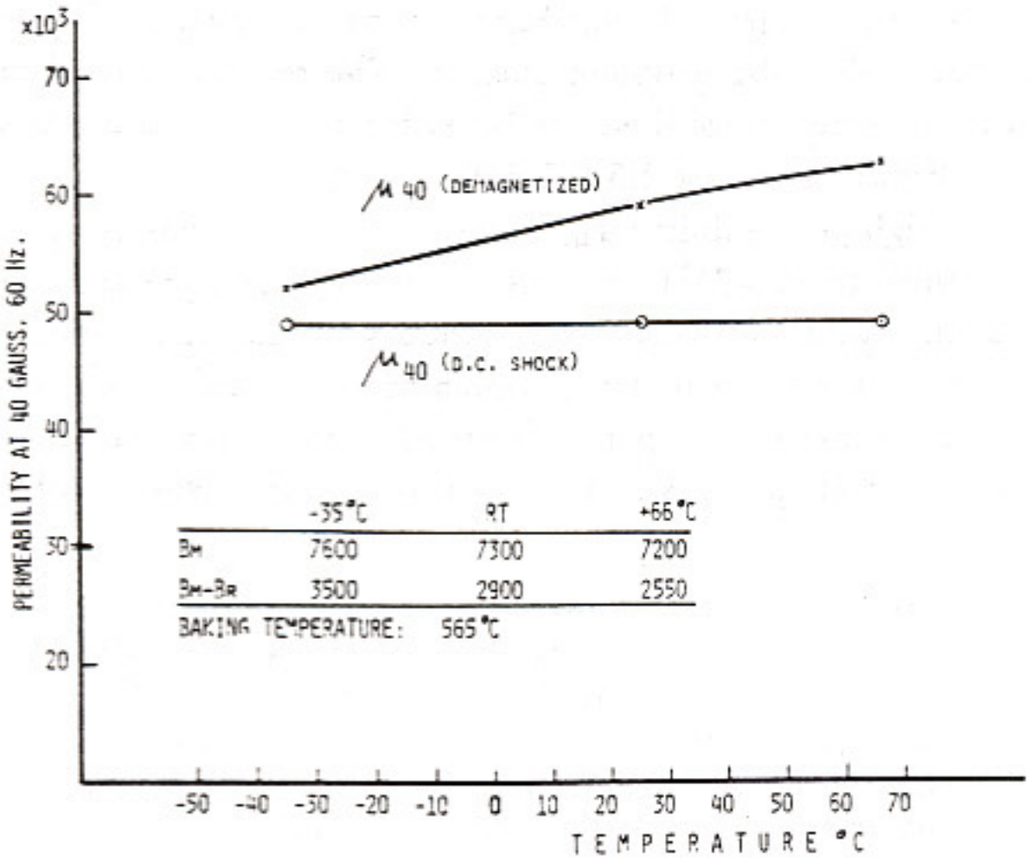

Fig. 7. (a) Permeability versus temperature for normal supermalloy. (b) Permeability versus temperature for stabilized supermalloy. (c) Permeability versus temperature for differential transformer core.

that the purification during the high temperature anneal in hydrogen is uniform throughout the lot. The type of refractory coating on the laminations, the type of hardware used, and the dewpoint of the annealing gas greatly influence the selection of the proper baking temperature.

The permeability and the B_M–B_R describing the squareness of the hysteresis loop for 0.35 mm thick rings after different baking temperatures are shown in Fig. 7(a)–(c). The analysis of this material prior to annealing was Ni-80.06%, Mo-4.25%, Mn-0.49%, Si-0.29%, C-0.014%, S-0.0009%, Re-Fe. The squareness and, therefore, the percentage change of permeability after dc shock increases in all three cases with temperature. The rings in Fig. 7(a) received the standard heat treatment for high initial permeability (baking temperature 575°C); rings in Fig. 7(b) were heat treated for constant permeability versus temperature (baking temperature 545°C); and rings in Fig. 7(c) were heat treated for best differential transformer performance at a baking temperature of 565°C. Again, it should be noted that the baking temperatures can vary greatly for each lot of material and each heat treatment, depending upon the analysis after the heat treatment and the grain size. This is especially true when oxygen or sulphur pickup in quantities of up to 0.0005% occur during the high temperature anneal. These impurities penetrate quickly into the material at the grain boundaries and probably cause stresses or directional ordering. This will shift $K_1 = 0$ to a lower temperature and also produce narrow $\mu(T)$ peaks, making it impossible to heat treat the material properly for the differential transformer requirement.

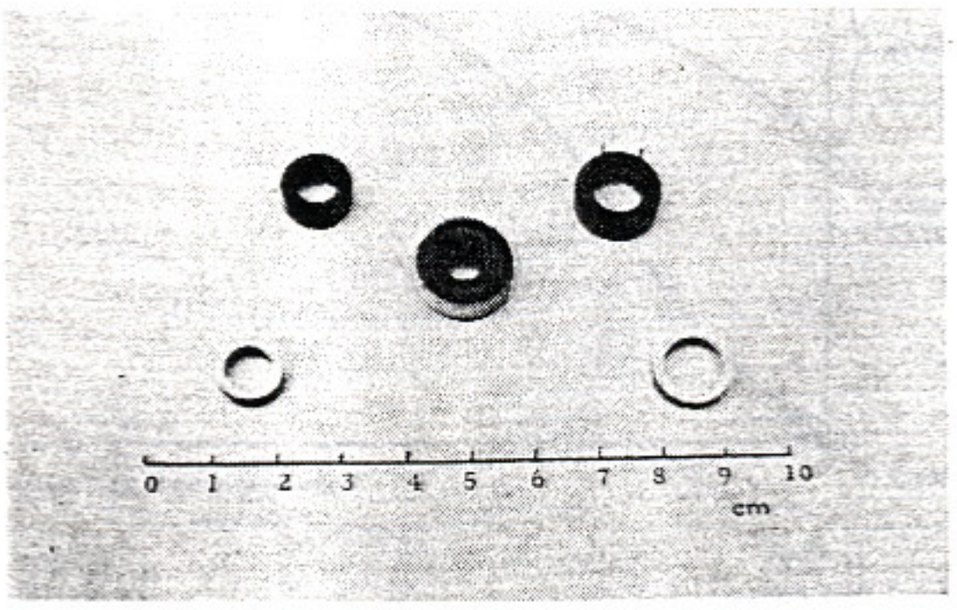

Fig. 8. Typical differential transformer cores.

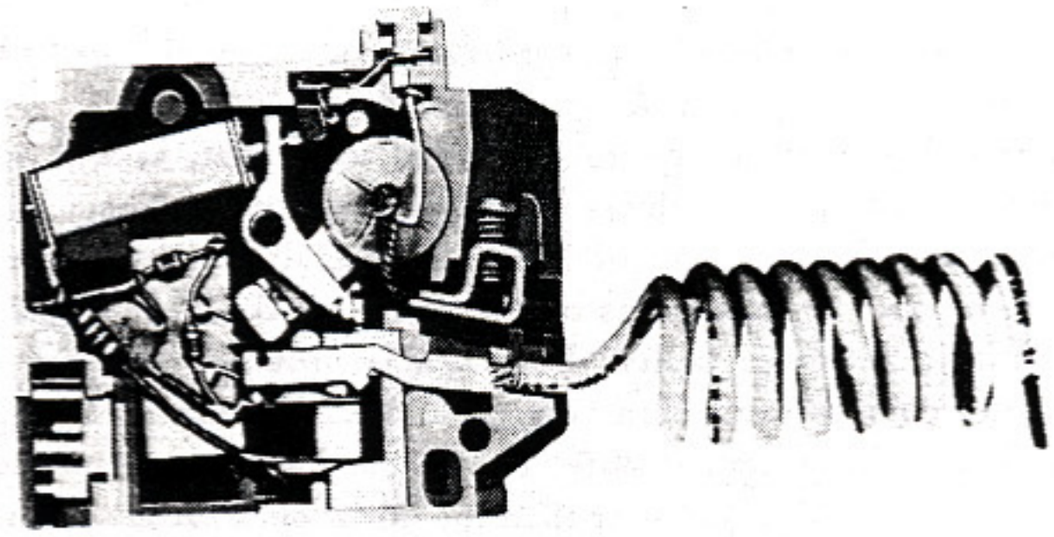

Fig. 9. GFI - breaker (courtesy of Bryant Electric).