IBM Deep Blue vs Gary Casprov (1997)

According to the paper, success of Deep Blue can be attributed to three primary factors: The large searching capability, non-uniform search, and complex evaluation function. There were also some secondary factors like creating an endgame database, the extended book and investment in ability to debug and visualize the evaluation function helping in fine tuning it.

Large searching capability:
Deep Blue was built with 480 single-chip chess search engines each chip capable of searching 2 to 2.5 million chess positions per second. While the overall system search speed varied from 100 million to 200 million positions per second based on the nature of the moves, the average system speed observed during the game in searches longer than one minute was 126 million moves per second.

Deep Blue's search was organized in three layers. One set of processors acted as the master and reminder were workers. Master searched top levels of the game tree and then delegated leaf positions to workers for further deep searching.

Non-uniform search:
A very important design choice for search was to make it non-uniform because it was well known that strong human players are able to calculate well beyond the depth reachable by a uniform searcher of any conceivable speed.

Deep blue's search was a hybrid of software and hardware search. While the software search was extremely flexible and can be changed as needed, the hardware search was fast and was only used for shallow searches. There was massive parallelism (for 1997) in search with over 500 processors available to participate.

Complex evaluation function and the chess chip:
The chess chip is divided into three parts: the move generator, the evaluation function, and the search control. For move generation, ordering sequence is an important decision and the sequence picked was: first generating captures (ordered from low-valued pieces capturing high valued pieces to high-valued capturing low-valued), followed by non-capture moves.

The evaluation function was composed of a "fast evaluation" and "slow evaluation. Fast evaluation is responsible of computing a score for a chess position and positional features of each piece. Slow evaluation scans the chess board one column at a time, computing values for chess concepts such as square control, pins, X-rays etc.

Pruning mechanism implemented in both hardware and software was called "no progress". It is based on the assumption that if a move is good for a side, it is best to play it early. If in a search tree, the current position could have been reached by playing an alternate move at some earlier position then this is a bad tree and can be pruned so the deepening is abandoned.