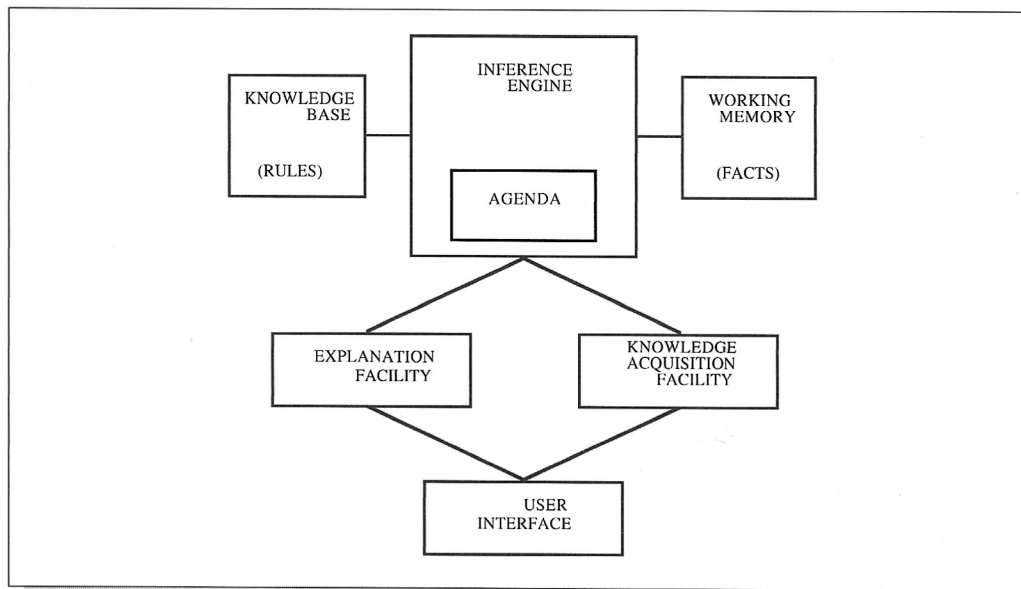**Figure 1.6 Structure of a Rule-Based Expert System**

The knowledge acquisition facility is an optional feature on many systems. In some expert systems tools, the tool can learn by rule induction through examples and automatically generate rules. Other methods such as ID3, C 4.5, C 5.1, artificial neural networks, and genetic algorithms have been used in machine learning to generate rules. The major problem with machine learning to generate rules is that there is no explanation as to why this was created. Unlike a human who can explain the reason for a rule, machine learning systems have never been able to explain their actions and so unpredictable results may occur. However, the examples are generally from tabular- or spreadsheet-type data better suited to decision trees. General rules constructed by a knowledge engineer can be much more complex than the simple rules from rule induction.

Depending on the implementation of the system, the user interface may be a simple text-oriented display or a sophisticated high-resolution, bit-mapped display. High-resolution displays are commonly used to simulate a control panel with dials and displays.

The knowledge base is also called the **production memory** in a rule-based expert system. As a very simple example, consider the problem of deciding to cross a street. The productions for the two rules are as follows, where the arrows mean that the system will perform the actions on the right of the arrow if the conditions on the left are true:

```
the light is red  → stop
the light is green → go
```

The production rules can be expressed in an equivalent pseudocode IF-THEN format as: