and wireless devices began to be used to control them. In the 1950s, the first models of manipulative machines with software control were produced.

The pioneers of robotics certainly include a designer Joe Engelberger who, together with his friend George Devol, constructed an angular and squat machine called UNIMATE in 1958.

In 1961, UNIMATE (Fig. 1.1) was incorporated into the technological process at the General Motors plant in Ewing Ternstedt in New Jersey.

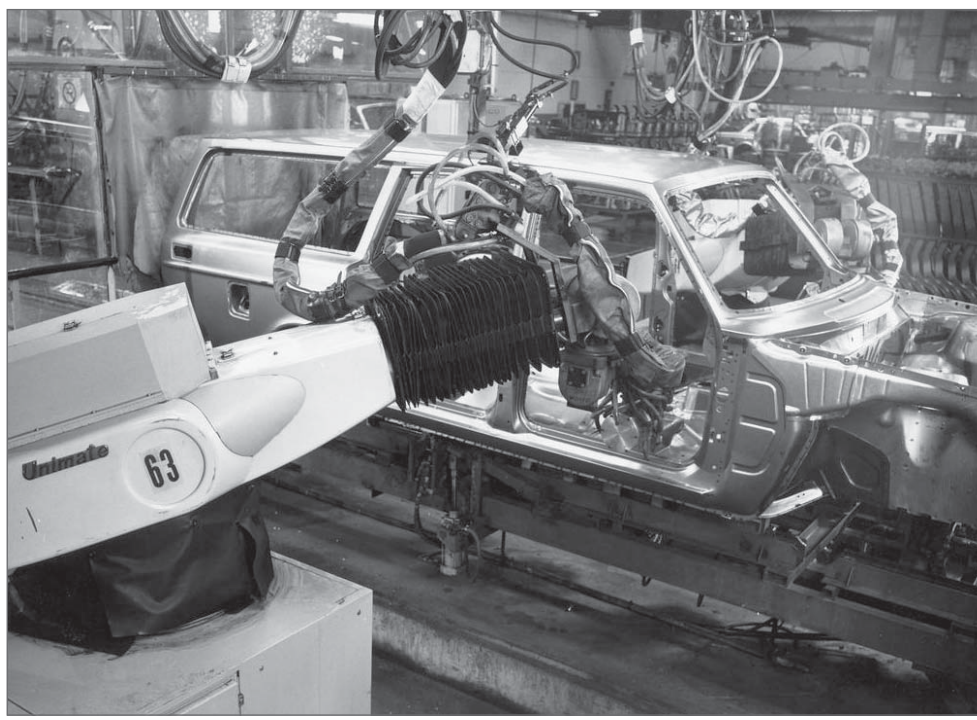

Fig. 1.1. The UNIMATE robot at the Volvo 650 assembly line (source: http://www.volvocargent.be/nl/)

One of the first tasks of the robot, equipped with a telescopic, hydraulic arm with a joint, was to transport die castings from an assembly line and weld these parts on auto bodies. Later, the robot was also used on assembly lines, including the Volvo cars assembly line. For about 50 years it worked approximately 100,000 h and it delineated the new direction for industry.

The possibility of using a machine which can work 24 hours a day without an operator confirmed the sense of equipping production lines with efficient,

programmable machines. The possibility of replacing the three-shift, hard work of the employees triggered mass robotic production for the needs of industry (in the United States in 1963, in Europe and Japan in 1968, in Poland in the early 1970s). Today UNIMATE is an exhibit at the Smithsonian Institution and it is difficult to compare it with robots whose development is currently going along with the avalanche development of microprocessor technology. Today, the widely discussed matter is not a workforce but robot's working environment, the constructors want to empower machines as much as possible, equipping it with sensors that can simulate the human senses. So far, out of the five senses (sight, touch, taste, hearing, and smell) only sight and touch have been widely applied in robotics. Currently, the scientists all over the world are carrying out intensive research on voice control, identification and recognition of a position of the object in three-dimensional space as well as on distance sensors. The full use of three-dimensional systems has become possible thanks to implementing the advanced vision, ultrasonic and laser sensors. Nowadays, the locomotive functions are a great challenge and the scientists are looking for the solution of how to create a grip which would have the properties similar to a human hand? Therefore, the scientists are trying to use electrostatic phenomena and adaptive grippers (adapting their shape to the shape of the object). What devices should be used to replace hydraulic cylinders and electric actuators? How to miniaturize drives? There are still many more questions that today's engineers are trying to answer.

Another separate problem of robotics are control systems in which a simple control of the location is not enough anymore. Today, such multiprocessor systems are being created which allow to create multithreaded applications to cooperate with the surrounding environment, and this stimulates the development of interfaces connecting the two worlds and develops programming techniques. It seems that the best solutions are high-level languages (easily learnt by humans), which allow robots to operate in real time.