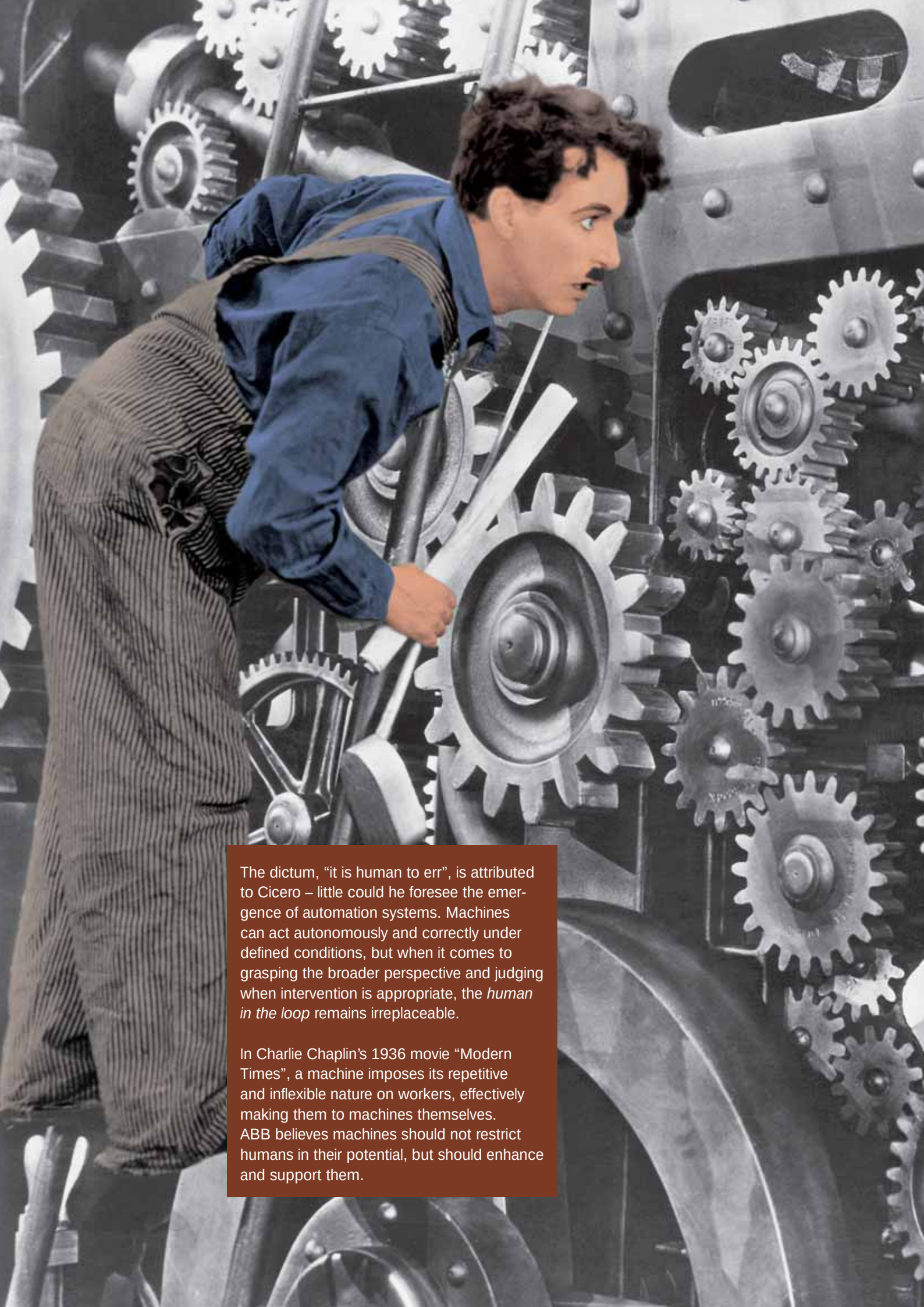

The dictum, “it is human to err”, is attributed to Cicero – little could he foresee the emergence of automation systems. Machines can act autonomously and correctly under defined conditions, but when it comes to grasping the broader perspective and judging when intervention is appropriate, the *human in the loop* remains irreplaceable.

In Charlie Chaplin’s 1936 movie “Modern Times”, a machine imposes its repetitive and inflexible nature on workers, effectively making them to machines themselves. ABB believes machines should not restrict humans in their potential, but should enhance and support them.

Human in the loop

The global process industry loses $20 billion, or five percent of annual production, due to unscheduled downtime and poor quality. ARC[1)] estimates that almost 80 percent of these losses are preventable and 40 percent are primarily the result of operator error. Blackouts in the power sector and meltdowns in nuclear plants are ominous words we have heard all too often during the last few decades. Rolling blackouts, resulting in heavy production losses within the affected region, give operators no chance to act because of the speed at which such disturbances propagate throughout an electrical network. The Three Mile Island accident in 1979 occurred because operators did not have all the information necessary to understand the real situation. The automation of industrial processes has evolved into large and sophisticated systems giving the operators structured and ergonomically presented information for decision support. No one would like to fly on a passenger jet without pilots. Hence the responsibility to oversee the safe and efficient performance of complex processes remains with the operators for now and the foreseeable future.

How then can we prevent productivity losses caused by operator errors, industrial explosions and blackouts due to hurricanes and other devastating events? By providing better and more accurate information to the human in charge in a form easily accessible for quick decision making. Issues concerning the *human in the loop* are now seriously researched and are at the top of the agenda in many businesses including ABB's. Exception management theories deal with the human issue related to long spells of inactivity with sudden burts of high level actions; a typical scenario for many operators including pilots. Ergonomics and information visualization, decision support and ease-of-use are all areas that have developed over the years in response to finding better ways to communicate between man and his machine. Academic research in behavioral sciences and practical experiences are being fused into solutions for the optimal support of the *human in the loop*.

In this issue of ABB Review we look at the research and development effort going on in these fields that are so vital to our portfolio of products and solutions. After a general overview of the science involved, this issue is organized into five sections; the first one of these, *Operational profitability*, is concerned with decision support. This section uses examples from the power sector (storm outages) and from process industries (electromagnetic stabilizers for galvanization). Smart alarming is a key research domain: Means are discussed of identifying and presenting only the most relevant alarms to the operator, permitting time-critical decisons to be based on the right information. A case study from the oil and gas industry is presented to illustrate this. Forecasting methods are needed to avoid unwanted events from occurring, especially if the propagation of such events is too fast for the human to act upon. A case study from Eastman Kodak is presented here to illustrate a possible solution.

The next section, *Capital productivity*, reviews visualization as the crucial vehicle in presenting information in ergonomic fashions for ease of comprehension. A lead-in article presents criteria adapted for system design with the *human in the loop*, and is followed by a number of articles describing how our own technology has advanced in this particular area. Examples from process and power industries are used. A look at how 3D graphics can enhance the understanding of the process information in the future is also included.

In the section on *Ease-of-use*, we explore the way in which drive technology from ABB epitomizes how the rapid development of ease of use in complex products can improve and broaden markets. Ambient intelligence is discussed in an article which also introduces the Smart&Lean product range from Busch Jaeger. Ease of use is also reflected in the development of tools permitting efficient identification of areas with improvement potential in plants, and also of tools for the enhancement of productivity in the engineering of substation standards. This section is concluded with the description of packaging technology in power semiconductors.

Research activities of academic nature or in cooperation with universities are exemplified in the next section, where an area of great interest is related to technologies for natural language querying of automation systems for different sets of information such as loop status and alarm inquiry. Professor on Drummond of Cambridge University, UK reviews how Augmented Reality can solve the issue of connecting the topological description of a plant with its real components – the binding problem as this is referred to.

The final section, *Perpetual pioneering*, introduces a series of historical articles covering the development of key ABB products over the last century. The initial historical overview presents the evolution our breaker technology has gone through since the early 20th century. We intend to present a historical review of a group of products in every issue in 2007 and 2008.

Enjoy your reading

Peter Terwiesch
Chief Technology Officer
ABB Ltd.

Footnote
1) ARC Advisory Group, News 2006