

## ENGINEERING

# Factory Robots Rival Men

**Machines that correct their own mistakes gradually are taking over American industry. They turn out products more quickly than men and they need little supervision.**

By ALLEN LONG

► CONTROL ENGINEERS are whipping up bigger and better robot machines to take the place of factory workers.

The machines are largely automatic. Some even correct their own mistakes. They can control chemical processes better than men can control them. They work faster, produce more and need less supervision than their human counterparts.

But that does not mean, necessarily, that workmen are facing a two-headed dragon eager to devour their jobs. Instead, it may mean that Labor is at the doorway of a brighter and happier future.

Economists predict the future factory workman will be more highly skilled than he is now. He will draw more pay, have more leisure and will be happier in his job. Lots of routine work will be handled by machines that do not feel drudgery.

Labor probably will not be thrown out suddenly on its ear as automatic machines invade the factory. The machines will take over gradually, probably so slowly as to escape notice.

## Require Skilled Workmen

Even if existing factories are converted to automatic plants, the apparent switch from men to machines may not be as serious as it first appears.

H. L. Waddell, editor of *Factory Management and Maintenance*, recently told the American Society of Mechanical Engineers:

"I know of a chemical plant that had about 1,000 employees five years ago. The management decided upon complete modernization plus a 50% expansion in capacity. Today the plant has almost the exact number of employees. But instead of 700 production workers and 300 maintenance men, there are now about 550 production workers and 450 maintenance men."

That seems to bear out the opinion of the experts who foresee a more highly skilled workman in the factories of tomorrow. It will take such very skilled craftsmen to keep the automatic machines running properly.

Most petroleum refining processes already are instrument-controlled. The instruments keep wary switches ready to close the moment something goes wrong. When an error is detected in the refining process, the instruments insert the proper corrections so that the end product will be up to snuff.

Refineries have come to lean heavily on the mechanical watchmen. If the instru-

ments were removed and their jobs were given to men, America would be hit hard right in the gas tank. This is about what would happen:

The now-efficient refining processes would give way to less efficient ones. That in turn would raise further the growing demand for crude oil.

Gasoline quality would plummet. Bustling city streets would become the scene of sputtering autos backfiring their way through traffic. Even automobile engines might have to be redesigned to work on the lower-quality fuel.

To robot controls belongs much of the credit for today's high-quality motor fuel, experts say. If the instruments were removed, many refineries simply would have to shut down.

Automatic machines can be simple or complex. But they all have one thing in common. They work on what is called feedback, which is merely a process of comparing the actual product with the desired product and of making corrections. A thermostat in the living room of a house

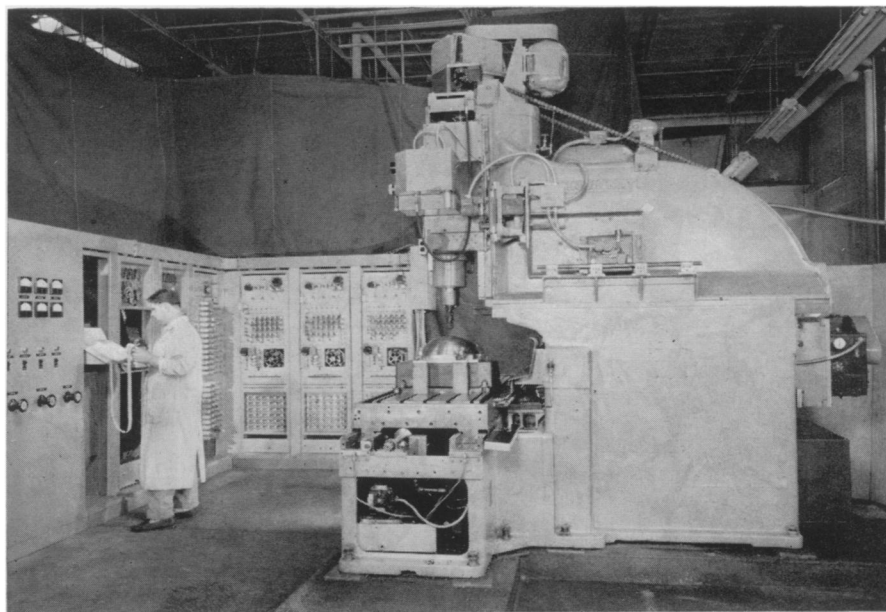
compares the actual temperature there with the desired temperature for which the thermostat has been set. When the house begins to overheat, the thermostat cuts off the stoker. When the house begins to get too cool, the thermostat starts up the stoker.

One of the earliest forms of feedback was exemplified by flyball governors. As the load on a steam engine increased and its speed fell off, the whirling flyballs dropped down a bit. Linked to the steam valve, the dropping flyballs opened the valve a little more. That let the engine carry the bigger load at the proper speed.

## Feedback System in Radio

From the flyball governor, feedback control has spread to all sorts of devices. Most ordinary radios, for instance, have a feedback system that radio engineers call the automatic volume control. The AVC circuit makes the radio's vacuum tubes more or less sensitive as the signal strength changes from the station to which the radio is tuned. How much volume control jiggling the AVC saves the listener cannot be appreciated unless he can switch it off for a startling comparison.

In the category of the more-complicated machines is the device invented by Prof. W. M. Pease of the Massachusetts Institute



**GIANT FACTORY ROBOT**—The entire system of the electronically controlled milling machine at Massachusetts Institute of Technology is shown in this picture. The machine tool at right works from information sent to it by the control panels at the left. The controls use about 270 vacuum tubes, 170 telephone-type relays and 300 germanium diodes.

of Technology Servomechanisms Laboratory. The machine can take a strip of punched tape and automatically mill a complete machine part. If the product begins to vary from the product "described" by holes in the tape, the machine makes corrections.

The advantage of many of the complex automatic machines lies in their versatility. They can be switched from the production of one part to another merely by changing the tape that instructs them.

Although American industry still is far from being "automatized," it nevertheless seems headed in that direction. Machines now are being thought about, talked about and experimented with that even may be

able to do paper work which up to now could be done only by humans. Such machines may come in handy in payroll and accounting departments of medium-sized and large companies.

Other machines have been devised to predict the weather, to control the flow of a big city's traffic, to count paper money, to sort lemons according to color, to solve test mazes set up for them in the laboratory, and to play ticktacktoe.

One British-built electronic device, affectionately known as the Madam II, can even sing "God Save the Queen," when given a coded version of the score. No record or phonograph is in the machine.

Science News Letter, February 7, 1953

#### METEOROLOGY

## Sun Affects Weather

► **TERRIFIC BURSTS** of energy from the sun in the form of solar flares must have an effect on earth's weather, but nobody knows just what that effect is.

This was the consensus of the opinions of meteorologists, astronomers and other scientists who spent a full day discussing solar-weather relationships at the meeting of the American Meteorological Society in New York.

Dr. Donald H. Menzel, Harvard College Observatory astrophysicist, pointed out that the quality and quantity of solar radiation vary appreciably through the sunspot cycle, and that the energy sent out during these fluctuations certainly reaches the upper layers of the earth's atmosphere.

A pronounced effect is observed on the earth's magnetic field which can be seen in the aurora borealis, he said. However, so far as direct effects on the weather at the earth's surface are concerned, Dr. Menzel said that it is too early for these effects to be determined. He called for more studies of the relationships between solar activity and the weather.

Dr. Bernard Haurwitz, head of the meteorology department at New York University and a long-time student of solar weather relationships, was pessimistic about the ability now to establish such a direct

relationship. A theory he propounded six years ago that the energy resulting from solar flares may heat the ozone high in our atmosphere which in turn heats the air we breathe is, he said, probably no longer valid.

Two recent cases of remarkable increases in temperature immediately following solar flares make his theory no longer good precisely because the increases were so large. Solar flares could not by themselves have brought about these changes in the earth's temperature, he said.

Dr. Haurwitz emphasized that, so far, there are few, if any, acceptable observations which show direct relationships between solar activity and the weather.

However, Dr. Joseph Kaplan and Hilda Kallman of the University of California at Los Angeles described what they said was a new mechanism by which increases in ultraviolet radiations from the sun are felt low in the earth's atmosphere. In this process, they said, the ultraviolet is transformed into absorbable infrared.

Science News Letter, February 7, 1953

#### GENETICS

## Resistance to Leukemia In Mother Mouse's Milk

► **LEUKEMIA, CANCER** of the blood, is influenced, in mice at least, by a maternal resistance factor, or MRF.

This was reported by Dr. L. W. Law of the National Cancer Institute, Bethesda, Md., to the New York Academy of Sciences conference on parental age and characteristics of the offspring.

The leukemia-resistance factor is contributed both before birth and through the mothers' milk by the mother mouse low in tendency to get leukemia, Dr. Law said. However, no factor that tends to bring on leukemia, similar to the factor in the milk of mother mammals that is tumor-inducing, has been found in the low-leukemia mice.

Science News Letter, February 7, 1953

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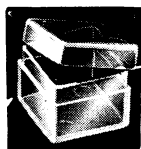
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