

## ENGINEERING

# Machine 'Thinks' for Itself

An automaton that is half-beast, half-machine is able to 'think' for itself while surviving on electrical charges in the hallways of a physics laboratory.

By ELIZABETH HALL

► A NEW MACHINE at the Johns Hopkins University Applied Physics Laboratory, Laurel, Md., "thinks" for itself.

It "eats" when it gets hungry, "plays" when it feels good, "sleeps" when it's tired and "panics" when it gets into trouble.

Scientifically it is described as a mobile automaton, but its proud developers affectionately call it the Beast. They built the machine, believed to be the only one of its kind in the world, to survive in a natural environment without any human help. That is exactly what it does.

It roams the halls of the laboratory and wanders into offices, surprising secretaries and engineers as it "knocks" on the door. When the Beast is hungry, it seeks out electrical wall outlets, plugs in and recharges its 12 silver cadmium battery cells.

The machine, which looks like a king-size hatbox, has a retractable giraffe-like head, which bangs against the wall in search of outlets.

## Beast Feeds Self

When its tiny sensors, which follow along the wall's surface, "feel" the outlet, the machine's head positions itself and two prongs lock into the socket. The Beast thus feeds until the batteries are fully recharged and then wanders off in a playful mood, until it is time for dinner once more.

Its developers believe this machine paves the way for electronic devices that could explore the ocean floor, caves and other planets. The Beast has shown that machines can be made to react in complex behavior patterns to a varied environment. The sole purpose of this machine is to survive, the most fundamental desire of every living thing.

In the Beast's electronic logic elements has been stored an ability to avoid obstacles, such as a tangle of electrical cables, people and stairways. When the Beast approaches a stairway, it shudders and backs away. This reaction comes from eight little white "shoes" around its circumference. The shoes indicate holes in the floor or a loss of support.

As the machine nears the edge of a step, one little shoe that normally rests on the floor drops down, causing the brain to react and the machine to draw back.

Should the machine get tangled up in a railing with its head caught between two poles, it wiggles its head back and forth like a child's hand caught in a fence railing. Then it completely stops and goes into a "panic" mode, before trying another maneuver to get free. To an observer, the machine looks completely human as it bangs along

its merry way, stopping to think or decide on the next move.

The Beast is actually the second automaton that was built. The first was a shy little creature called Ferdinand that weighs about 35 pounds. When the two are put together, they look like a large collie and a small cocker rolling down the halls, sniffing at the walls for plugs and occasionally banging together. The Beast can move in high or low gear—a foot a second or three inches a second—and can brake, back up or coast.

The Beast has been in operation almost a year and has over 400 hours of operating time. More than three-fourths of the time has been spent in feeding at the outlets.

## Stores Commands in Memory

When it is time for the machine to go to sleep, it receives a command via a telemetering-command system which it stores in its memory. It will retain this command for several hours before finally carrying it out.

The telemetering system enables engineers to follow its forward progress through the halls and know what it is doing at every step of the way.

In addition to the command-telemetering system and its touch sensors, the Beast has recently been equipped with two ears—a sonic system that enables it to coast freely down the center of the hall when it is in a playful mood, avoiding people and other obstacles by pulses bounced off the walls and reflected back.

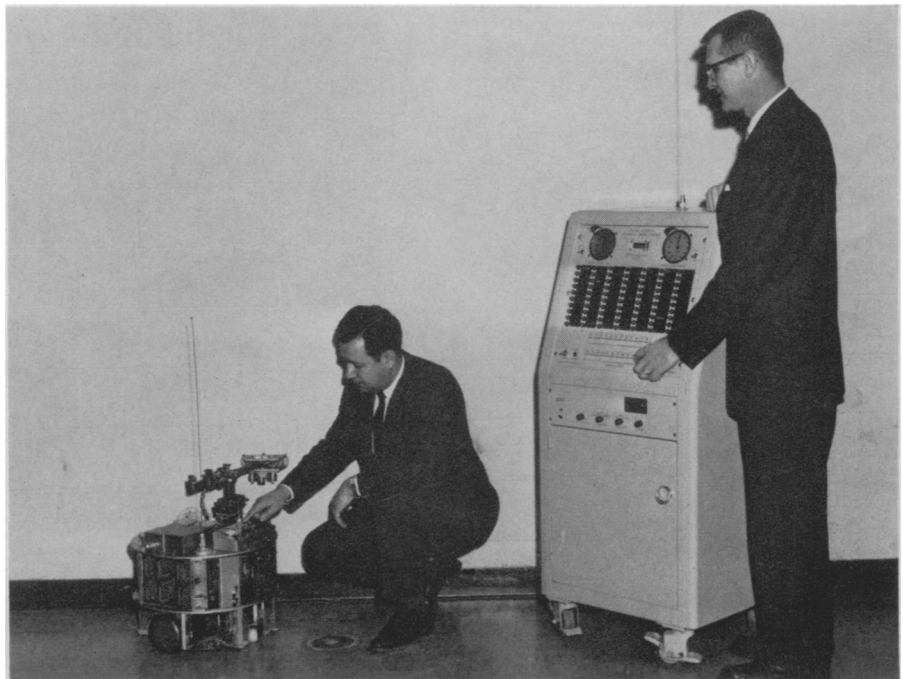
Hopkins engineers are also working on an eye for the beast—an optical scanning system that would spot electrical sockets at mealtime.

## Intelligence Similar to Ant's

"The Beast's intelligence is similar to that of an ant," George Carlton, supervisor of the Adaptive Machines Group which developed the automatons, told SCIENCE SERVICE. "Ants get along very well, even if they're not very bright, and they have a set pattern of responses in a varied environment."

A third automaton more closely resembles the human nervous system in that it relies on artificial neurons for sensing its surroundings. The continuous sensors in this machine result in smoother movements instead of the jerky banging action of the other two.

The first two machines are composed of standard electronic equipment similar to the logical basis of a computer. But unlike a computer, these machines receive many inputs or sensations all the time and must sort through them and decide on a course of action.



Johns Hopkins University Applied Physics Laboratory

**COMMUNICATING WITH THE BEAST**—Reading the Beast's mind while it feeds at a wall socket are Leonard Scheer (left), of the Applied Physics Laboratory's adaptive machines group that developed the beast, and Edgar Fischer of the Instrumentation development group that built the command-telemetering system shown at the right.

How near it is to the wall, how smooth is the surface on which it rides and the approach of obstacles are constant problems that the machine must solve instantly, just as humans do. Occasionally it gets mad and its habitual wheezing noise sounds more like a snarl as it "panics" and stalls while deciding what to do next.

The device, which currently has a U.S.

patent pending, is a group effort on the part of Mr. Carlton, John Chubbuck, assistant group supervisor, Leonard Scheer, James Jacks, William Whitmore, Ronald McConnell and Richard Bitner, all of the Applied Physics Laboratory.

The research is supported by the U.S. Navy Bureau of Weapons.

• Science News Letter, 85:170 March 14, 1964

## INVENTION

## Patents of the Week

**A new projector system shows slides that have a sound track around the outside of the slide; a rotating needle plays the "record" while the slide is being shown.**

► **AMATEUR PHOTOGRAPHERS** can soon show home slides that "talk" with a newly patented projector system.

The slides can be shown in any order since the sound track is contained on the slide itself. Each one resembles a square phonograph record in which the slide replaces the label and the hole in the middle. In this projector, the needle instead of the record goes round and round as the slide is being shown.

The U.S. Patent Office issued patents 3,122,053 and 3,122,054 for this system, intended either for use by amateur photographers or for industrial advertising purposes.

Photographers buy the record discs along with the film. After the slides are developed, a person cuts his own narrative for each slide with an inexpensive home recorder. He then pops the slide into the middle of the record.

The projector itself resembles conventional projectors in size and appearance, except for the record-playing needle.

Invented by Panayotis C. Dimitracopoulos and Constantine D. Pizaris, both of Montreal, Canada, the projector and system have been licensed for commercial production in the U.S. and Canada. It is expected to cost no more than conventional projectors.

### Diaper Rinser

An invention that rinses and rids diapers of waste matter before they are put in the washing machine earned patent 3,122,011 for Walter L. Martin of Buena Park, Calif. The apparatus, which can be installed by a non-plumber, hooks up to the supply line for the toilet's water tank.

The diaper is suspended inside the device from the lid and simultaneously sprayed from both sides. The waste is drained through a tube into the toilet bowl.

### Honeybee Repellent

Two clear, colorless pungent acids have been found to give honeybees "the vapors" faster than smoke, Dry Ice or pine oil, when it is time for the beekeeper to remove honey from the hives.

A cloth saturated with a diluted solution of either propionic acid or acetic acid was found to clear a heavy colony of bees from the hive within minutes. The non-toxic vapors do not contaminate the honey, and

the beekeeper does not have to wear protective clothing.

Jonathan W. White Jr., Ambler, Pa., Alan W. Woodrow, Tucson, Ariz., and Clayton L. Farrar and Floyd E. Moeller, both of Madison, Wis., assigned rights to patent 3,122,473 to the U.S. Department of Agriculture, which has the right to issue royalty-free sublicenses.

### Collapsible Boat

A lightweight, collapsible boat capable of supporting an outboard motor and towing water skiers earned patent 3,121,887 for Patrick A. Baretta of Oklahoma City, Okla. The boat folds up into a small package that can be carried in a car, eliminating the need for a trailer and an extra storage garage.

The framework of the boat is covered with a flexible, waterproof skin and provided with inflatable compartments that keep the boat afloat if the skin is ruptured. It is manufactured by Packageable Boat Co., also of Oklahoma City.

### Cardiac Catheter System

Dr. William Parry Murphy Jr. of Miami, received patent 3,122,136 for a mechanism that simplifies the measurement of body pressure while doctors study the inside of a beating heart with a catheter. He assigned rights to Cordis Corporation, also of Miami. The air-driven mechanism replaces the classical method of measuring with columns of water.

### Other Significant Patents

The same technique that enables boats to lift their hulls up out of the water and "fly" at high speeds on underwater "wings" (hydrofoils) has been applied to water skis by Joseph F. Rumsey Jr. of Oklahoma City. He earned patent 3,121,890 for his skis, which lessen the amount of water drag and enable a skier to be lifted and towed at relatively low speeds.

Short rotating reels mounted over the edge of a poultry feeding or watering trough that prevent chickens from roosting on the edge won patent 3,122,131 for Howard C. Warren of North Manchester, Ind. Rights to the patent were assigned to the Warner Brooder Corp., also of N. Manchester.

• Science News Letter, 85:170 March 14, 1964

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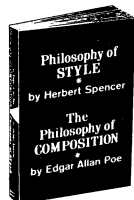
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