

TECHNOLOGY

Robots Help World's Work

On moon, under oceans, in atomically "hot" nuclear reactors and laboratories, on factory production lines, and even in auto traffic, automatic devices are coming into use.

By WATSON DAVIS

► "LOOK, MAMMA, no hands!" Mother was horrified when she saw her darling daughter riding on a bicycle steering it by changing her weight from side to side. That was very elementary, and a generation ago.

In the present era of sports cars and "hot rods" when bicycle riding is very old fashioned, the twitch of a muscle in Los Angeles experiments holds the promise of steering automobiles. An armless driver is expected to guide a vehicle in the future even through complicated traffic. Perhaps even a wink of an eye could function in the same way.

Automatic Guidance

Automation has not yet entered everyday service with the possibility of substituting for the marvelously expert reactions and judgments that every automobile driver makes almost every second that he is on the road. But cars and highways are being designed to allow driving on special highways without use of human hands or even eyes. Whether such electronic automatic guidance will be in practical use in the near future is a question.

To replace human hands, feet, and muscles, technology has developed a large variety of automation mechanisms that duplicate the function of age-old human skills.

There are robots doing everyday work in laboratories and factories, extending control into places too radioactively "hot" or too remote for human hands and arms.

Substitute for Hands

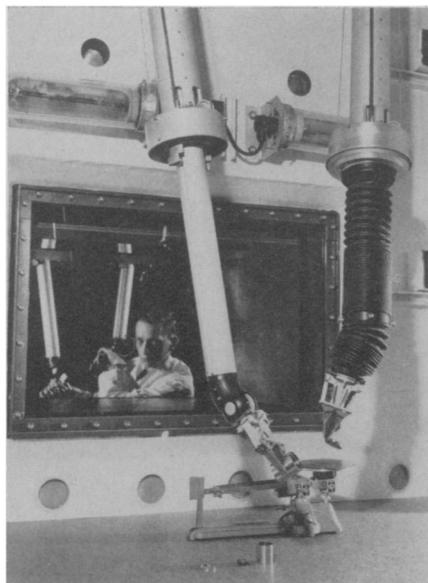
Robots, tough and precise, are in training to land on the moon and sample what is there. Mechanical and chemical sense organs will investigate and report what they find via electrical signals telemetered to earth.

On the bottom of the sea too, many fathoms deep, a mechanical arm extending from a diving vehicle, can be manipulated to pick up specimens, guided by television.

At almost every atomic "show" there are remotely controlled hands of a master-slave manipulator such as is used to handle highly radioactive materials in laboratories and within reactors and other atomic energy locations that are dangerously radioactive. The operator by manipulating devices with controls very similar to those that his hands would use if he were actually handling the objects, can cause the "slave" device to do all the things that could be done with his own hands. In the atomic shows for the public, the two ends of the manipulator

are in open air so they can be easily seen. When in actual use, the remote control device would be sealed off to shield the operator from radiation. The "slave" apparatus can be guided by viewing it through thick glass windows or remotely by television.

Many of these remote controlled devices are delicate scientific instruments. But others do heavy work needed in repairing the radioactive interiors of large atomic reactors. At the Babcock & Wilcox Company's research and development center in Alliance, Ohio, there is a fork with two arms that can easily lift a half-ton object while a third arm duplicates most functions of the human wrist and arm. There is a pipe welder that can make a fine six-inch weld in 30 seconds and a pipe cutter that can sever a ten-inch pipe. The technicians that control such



Picker X-Ray Corporation

TO HANDLE highly dangerous radioactive material, like cobalt-60, atomic by-product, scientists have the use of remotely controlled "hands" of a master-slave manipulator like the one shown in this picture. The technician, working behind the safety of a liquid-filled double-paned glass five feet thick, guides the cleverly contrived device, which can pick up a disk of radioactive cobalt, put it in a stainless steel cup, seal it with an automatic welding machine and drop it in a heavy lead container for its journey to medical or industrial users.

instruments are protected by a four-foot-thick lead glass window and aided also by a television system. Such robots are required to maintain reactors which use circulating liquid metal as the atomic fuel.

Not all the mechanical robots do their work in a hazardous situation. One portable automatic mechanical hand called a "Fleximan" is programmed mechanically to work on small production lines where the quantity of items made and frequent changes in the product have heretofore made automation impractical and overly expensive. It can feed drill presses, assemble parts, feed conveyors, run parts through punch presses and welders and do many repetitive chores. In demonstration stunts manufacturers have programmed it to deal cards in a bridge game, light cigarettes and pick up pins.

Engineers have dreamed of having roads and automobiles which steer themselves safely and expeditiously along the highways without collisions and traffic jams. This is theoretically possible through the use of automated roads and arranging it so that the control apparatus is installed in every automobile and truck that uses them.

Railroads Run Automatically

For railroads and subways where the tracks are more clear and unimpeded by cross traffic, automatic trains are possible. A subway train which literally runs itself, makes the proper stops and travels at the predetermined speeds has already been tested in the New York subways. For many years the railroads of the nation have had automatic train control which does keep a train from entering a track which is already occupied by another train, a procedure which was developed to prevent wrecks and disasters.

Many of the airplanes on our transport routes fly themselves, to a large extent, by means of automatic pilots. When altitude has been attained, the robot can take over. The pilot is there to see that everything goes well but he does not have to control manually the giant vehicles in the air except to change their direction in an emergency. There are even devices which do a limited amount of takeoff and landing of airplanes.

Electronic Highway

An electronic highway with an automatic pilot for cars and control for traffic safety has been demonstrated but not put into practice. The Radio Corporation of America in cooperation with General Motors showed that it is possible to drive, automatically, specially equipped cars on a test track. The cars accelerate and brake and maintain safe spacing between each other in response to electrical signals from the road. The driver can be talked to by a control center, which tells him of intersections that he is approaching, roadside service areas or hazardous conditions ahead. Such an automated high-