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MOUND LABORATORY

MONSANTO RESEARCH CORPORATION • MIAMISBURG, OHIO 45342

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Process Mechanization and Automation

Mound Laboratory has an extensive capability to design, develop and place into production mechanized elements of assembly or fabrication. Where feasible, controls are supplied to mechanized operations to make them automatic. This capability was developed to meet demands of uniformity, reliability, and reproducible performance vital to special precision products. Mechanization eliminates the process variables introduced by human manipulation. Automation reduces human attendant duties to caretaker status. The option of locating an operation remotely from its controls may afford safety from a hazardous process or enable safeguarding strategic material. In addition, cost savings may result from improvement over manual production with respect to quality and quantity of products.

Designed and fabricated by Monsanto Research Corporation at Mound Laboratory, this computer directed transport and positioning system functions through three dimensions to automatically pick up a container, move it to another precise position, leave it there, then travel on to move other containers as required. The main application of the system is to move containers of plutonium between storage and measuring stations in a glovebox line, thus performing a critical function in the Automated Plutonium Assay System (APAS) at Mound Laboratory.

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The Concepts of Mechanization and Automation

The mechanization function is to design and build workable mechanisms that perform operations that otherwise would be performed by hand. For example, the process of manually bending a wire to a given shape with the aid of pliers can be mechanized with a wire bending device. The ultimate aim is to automate the process, which is to provide controls for the mechanism to perform a task without human direction. In the case of the wire bending example, cut lengths of wire contained in a magazine are fed one at a time to the bending device, pressed to shape, ejected from the device, and the process repeated over and over without operator control other than pressing a button to start the process. Operations may be automated with mechanical or electrical process controls, or with memory-based systems incorpo-

rating digital computers, microprocessors, programmable controllers, or programmable calculators. Although all automated systems have the advantages of increased production level, reduced operator attention, and reduced exposure to hazardous environments, the memory-based systems have the additional advantages of data recording, on-line data reduction and information feedback for constant process control. Mechanization insures a uniform product or operation without differences accruing from the human element. Automation provides closer control than usually obtained with human skill.

Existing and Potential Capabilities

The capability to carry out the functions of mechanization and automation consists of the expertise of personnel and a well equipped, independent facility to complement this expertise.

- Personnel include machine design specialists, electronic, electrical, and mechanical engineers, engineering technicians, and model makers. Their experience covers applications of a wide variety of computers, servo-mechanisms, programmable controllers, and complex inspection and test equipment.

- The facility contains a complete electronics laboratory, full drafting resources, technical and product reference files, and a complete machine shop for the fabrication of automated prototypes. This independent facility ensures the continuity of mechanization and automation functions without undue delays. It also ensures better system performance through the close liaison of engineers, scientists, and model makers during development testing and evaluations.

Although it is equipped to function as an independent unit, the mechanization and automation organization may take advantage of a wide variety of other capabilities that are available at Mound Laboratory:

- A larger machine shop fully equipped with precision tooling and unique fabrication materials. Other shops are staffed with highly skilled craftsmen experienced in sheet metal working, sophisticated electrical wiring, high precision grinding and polishing, and glass-blowing to accommodate state-of-the-art research and development projects.

This system automatically loads pyrotechnic components. The entire operation involves dispensing, weighing, transferring and pressing. The system also provides a printout of pertinent process data.

- A complete Standards Laboratory for measuring and calibrating the latest optical, electrical, mass, dimensional, and environmental systems. All of these measurement standards are traceable to the U.S. National Bureau of Standards.

- Hydroforming machinery and associated expertise in nuclear heat source programs.

- Unique joining, bonding and welding expertise in the fields of adhesives, ultrasonics, resistance and laser welding, and other micro-attachment techniques.

- Thin film technology and expertise in protective and dielectric coatings.

- Injection molding of thermoplastic or thermosetting components.

- Complete environmental testing facilities for evaluating the physical effects of long term storage at high or low temperatures, shock, vibration, and a variety of other destructive tests.

- Nationally recognized calorimetry expertise.

This apparatus automatically scans absolute type air filters to determine if they could be penetrated by particulate matter. The system is used to verify the quality of High Efficiency Particulate Absorber (HEPA) filters that are used in clean room and clean hood applications at Mound Laboratory.

Accomplishments

In addition to the systems illustrated in this leaflet, other examples of mechanization and automation projects designed, developed and implemented at Mound Laboratory include:

- Automatic pressing and gaging systems for explosive pellets;

- A remotely-located pelleting machine to make pre-forms of pyrotechnics.

- An x-ray gage to measure the density of pressed explosive materials.

- A numerically controlled welding machine to perform and check a sequence of welds.

- A system measuring electrical resistance at room temperature and printing out corresponding 20°C resistance values.

- Crimping machines to fasten thin-walled metal cups to grooved plastic plugs.

- Systems to dispense finely divided solids and to weigh with precisions of ± 1 mg.

- Modular data collection terminals to record and transmit production data.

- A system to precision cut and gage metal-sheathed explosive cord.

- Image and waveform digitizing and testing systems.

Further information may be obtained by contacting:

Monsanto Research Corporation
Mound Laboratory
Att: Automation Development
Manager
Miamisburg, Ohio 45342

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