GENERAL SCIENCE

Toys Aid Research

Models Submitted to Ingenious Tests Take the Guess Out of Engineering; Also Demonstrate Physical Forces

By EMILY C. DAVIS

IT'S A GOOD old Christmas joke—that one about Father buying Junior an electric train, because he (Father, of course) does like to play with trains.

But there are pleasant places in this workaday world where grown-up men play with beautifully made trains and boats, and with balloons and marbles and doll-sized "dishes," too, and they devote their days to it with no apologetic air at all. For their childish-looking toys are important.

As they tinker with perfectly proportioned miniatures, "doing it again" with a tireless repetition that would delight young Junior if he could ever get the grown-ups to be so accommodating, these sedate play-boys of science are demonstrating scientific principles or gauging weak danger points in diminutive models that will some day grow up into giant realities. It's Christmas all the year for them, people tell them; and nice work for those who get it.

How many ways of playing with toys scientists contrive to find, is rather impressive to those of us who keep in touch with the laboratory and museum world.

Most important, of course, are models of giant dynamos, dams, ships and other large-sized and costly equipment. Taking the guesswork out of industry is the mission of these toy-sized models. Nobody knows how much expense or how many lives these playthings save.

Toy-sized trains have helped engineers study the dangerous snake-like weaving motion of a high-speed locomotive tearing down a straight track. Far cheaper and easier to change structural design in these models than to change the trains themselves.

Can Watch Interior

By the ingenious idea of making models of telescope supports and other complex equipment out of plastic, engineers have found that they can not only test the works but see inside while they do it. They have to allow for differences in specific gravity and strength and elasticity which the light plastic displays under weight. But figuring this, they can measure what will happen to the same equipment when it is turned out in heavy materials on a great scale, and subjected to loads. And seeing inside is a big advantage.

Of national interest is the model basin outside the national capital, in Maryland, where the Navy will soon be testing 20-foot model ships for the fleet of the future. The government has long had its quota of scientific employees who spend their days watching small airplanes in wind tunnels, and small boats in the old model basin at the Navy Yard, and miniature dams. The new model basin is one of the most strategically valuable scientific miniatures ever constructed. It will reproduce conditions to test the maneuvering power of ships, their speed, and other factors, saving many times the expense of its construction through the precautionary lessons learned.

Another government "toy" outstanding for completeness and usefulness is the 1,100-foot-long model of a 602-mile stretch of the Mississippi River. Using this remarkable small-scale imitation, Army engineers at Vicksburg can reproduce a Mississippi flood on miniature scale but with sinister reality, to test out effectiveness of flood control plans. To work this model requires 42 engineers.

Plays With Mud

Playing with mud pies and balloons is the occupation of one Bureau of Mines scientist. Sounds childish. But he is testing the strength of that amazing stuff called bentonite. Once best known as beauty pack clay, bentonite has recently revealed far more—or we might say even more—important possibilities.

Bentonite has the queer property of absorbing three to seven times its volume of water and expanding more than six times its original volume. You could seal dams and reservoirs with that, thought engineers. So, bentonite has become the modern prototype of Holland's boy who stuck his finger in the dike hole. Bentonite also is war-important. It seems capable of replacing mica in insulating electrical motors and dynamos, thereby answering the worry problem of where enough insulation is coming from.

Smaller than most doll dishes are the flasks, beakers, and crucibles of scientists who engage in microanalysis. A whole set of equipment can rest in one hand. But with these toy-sized containers and with Bunsen burners and other equipment on equally small scale, a microchemist does the delicate work of making minute bits of matter reveal their chemical composition and their history.

Why juggle with this equipment that makes human fingers seem like Gulliver's in Lilliput land?

Because there are many instances in which only tiny amounts of material are available for test. G-Men at work on evidence from a crime, for instance, may have a few grains of dust or a trace of blood to work with. Schools soon may be using this doll-sized laboratory equipment. It saves material.

Marbles for Science

What looks like some new parlor game with marbles and an inclined runway leading toward a hummock-goal in a ring, is actually a physicist's invention to demonstrate what happens when scientists smash the nucleus of an atom. It is used to make a higher physics lesson intelligible to university students.

Marbles huddled on the hummock represent the atomic particles inside the nucleus of an atom. Marbles rolling down the runway to bombard the nucleus are like the bullets of a big atom-smashing machine in a physical laboratory. If the marbles have enough energy, they knock out nuclear particles, changing the atom. With too little energy, the marbles roll around the slope of the goal, missing it, just as real bombardments of the atoms are often repelled by the nucleus.

In real atom-smashing laboratories, this bombardment of atomic nuclei is used in making radioactive materials for treating cancer. It is used in transmuting elements. Tremendous forces are involved. But for school demonstrations, the marble game serves nicely.

A deceptively simple looking toy-man is Willie Vocalite, Westinghouse laboratory stooge, who looks like a tin man out of a fairy tale but who can do tedious jobs to save less efficient humans the bother. Willie's metal brain and body are controlled by photo-electric tubes—the same device that opens doors when your shadow falls on them or starts a drinking fountain bubbling when you bend over it. Demonstrating the magiclike possibilities of this photo-electric cell, Willie will even get out of a chair when spoken to. Special feature of his anatomy is his taster, an "electrynx" so sensitive that it can record acidity of fruits by registering the action of one-millionth of an ampere.

Even Junior's Christmas train, mounted on a circular track, may and does give a lesson in science. A George Washington University physicist mounts a little train on a circular track suspended so that the track can move freely. Swing the track round at the right speed, and the train will stand perfectly still on the moving rails. And when you watch that, fascinated—as most observers are—you are getting an idea of how centrifugal force operates.

On a train, centrifugal force is what throws you against the seat, as you walk down the aisle and suddenly the train rounds a curve. Centrifugal force is a railroading problem in applied physics. It causes displacement of rails and wears out ties. Inertia is also demonstrated by the swirling track; showing how the train pushes back as it moves forward. Letting the track move freely makes it possible to show with how much force the train wheels push—something that could not be shown by simply running the train around on an ordinary immovable track. It is a nice experiment for Father to try, when he is tired of showing Junior how the Christmas train runs on the ground—if the train runs.

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METALLURGY

New Process for Alloying Coatings on Carbon Steel

METALLIC sparks from research: A new process for alloying coatings of stainless steel and other metals upon carbon steel sheets developed by Robert E. Kinkead, Cleveland consulting engineer. It fuses into a slab of steel by carbon arc chromium, molybdenum, nickel, titanium or silver.

The U. S. A. is building a tin smelting industry, pilot smelters getting under way, although we produce no tin. The idea is that it will be safer to get ore concentrates where we can, Bolivia for example, than to rely upon ore being shipped from southeastern Asia and South America to Holland or England or Singapore for refining and parcelled out to us as metal. One reason for Soviet acquisitiveness in Finland is Finland's nickel and copper production.

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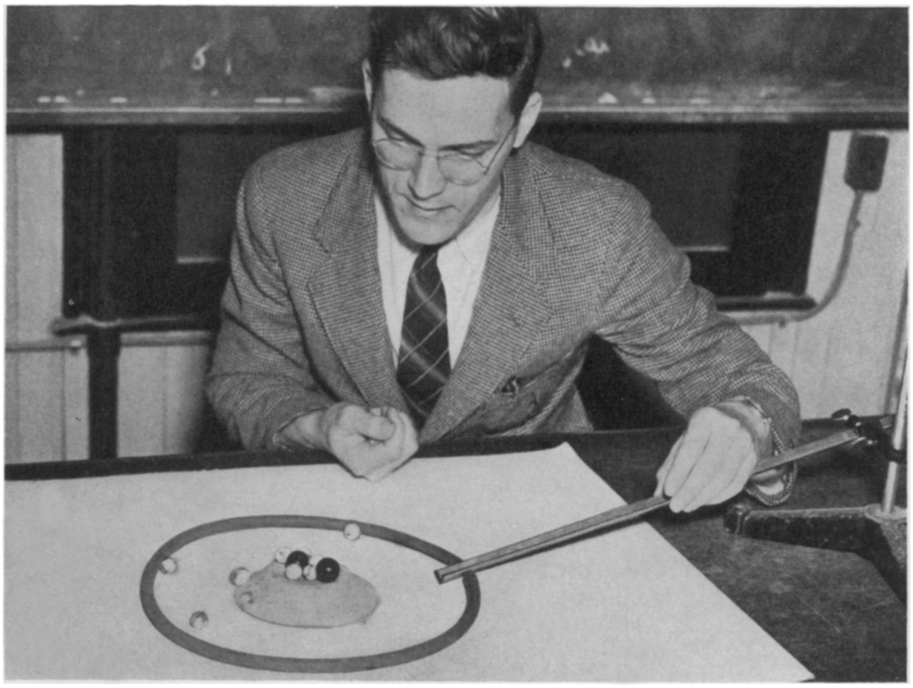

SERIOUS GAME

It looks like marbles but it's really a demonstration model of an atom showing how the nucleus, containing many particles, (in center) can be bombarded and transmuted by other particles flung at it with high energy. The bombarding particles, in the model, are marbles rolled down the incline.

CONSERVATION—ARCHAEOLOGY

Soil Expert Studies Ideas Of Prehistoric Indians

With Irrigation Ditches, Check Dams, Semi-Terracing They Farmed In a Climate Worse Than the Dust Bowl

HOW America's prehistoric Indians managed to farm Southwestern country in a climate more rigorous than that of the Dust Bowl is being investigated by Dr. Guy R. Stewart of the U. S. Soil Conservation Service.

Dr. Stewart has discovered that Indian cliff dwellers who inhabited Mesa Verde Canyon, Colorado, in the Middle Ages had far more planning of their agriculture than any one suspected. Speaking before the Biological Society of Washington, he told of detecting traces of a three-mile ditch which ingenious cliff-dwellers dug along a four per cent. grade to bring down water, apparently from a reservoir, to spread over their corn-fields. Primitive check dams made of boulders controlled the flow of the water spreading to the fields. Indians who occupied Spruce Tree House, one of Mesa Verde's now-famous and much-visited cliff-dwellings, benefited mainly by this foresighted planning. A twenty-year drought finally routed Mesa Verde's inhabitants.

Dr. Stewart has examined remnants of irrigation ditches, check dams, semi-terracing and other devices by which Hopi and Zuni Indians tried to conserve and control their precious water supplies. He doubts whether the Indians realized that they were also reducing erosion and saving the soil. But some fields abandoned by Zunis have since developed gullies 30 feet deep and 50 to 75 feet wide.

Studies of the old agricultural engineering add to knowledge of Indian experiences, and also may give information on the way certain soils and gradients behave when in agricultural use.

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