ENGINEERING

"Brain" Missile Recorder

The new "brain" will predict and record every movement that a giant missile would make without shooting the missile into the air. Use of it will cut field experiment costs.

➤ ANOTHER giant computing machine of the electronic type, was revealed by the Boeing Airplane Company, Seattle, Wash. It will study probable flight of a wartime missile. Scientists call such a machine an analogue computer and it is somewhat similar to the digital "electronic brains" of the ENIAC, BINAC or MARK III types.

This new Boeing "brain" will predict and record every movement that a giant missile would make in the air from take-off to landing without even shooting the missile into the air. It will record every waver, dip and spiral the bomb would take if actually fired, and not only is the landing recorded, but also the where and when of the landing.

BEMAC is the name selected for the new device. It does not completely outmode the traditional gathering of information by actual test flights of missiles, but its use for numerous problems will save many thousands of dollars in time and material required in field experimentation.

It was designed for use in conjunction with Boeing's GAPA ground-to-air pilotless missile project for the U. S. Air Force. The computer was developed by George Stoner, Robert Illman, Bill Galloway, Carl Crumb and Douglas Wilson, all of the Boeing Physical Research unit.

The record of the imaginary flight of a particular missile is made with a rapid-acting motion picture camera which photographs a moving series of dots on the screen or oscilloscope of the computer. The computations are recorded in such a manner that they actually look like a missile flight in the viewer, or in the permanent record of the visual scope made by the camera.

It takes a human "electronic" brain to understand the workings of these mechanical computers, often called "electronic brains," but which are not brains at all. They do no thinking. With the use of many hundreds of electronic tubes and special mechanisms, they follow instructions fed into them in code to find the answers of problems, also fed into them in code, which may be mathematical or physical. The BEMAC is fundamentally non-arithmetic.

A missile is capable of doing only a limited number of basic things in flight, Boeing engineers explain. It can pitch, so an integrator in the electronic portion of the computer is assigned the missile's pitch characteristics through analogous alternating current voltages. These voltages are based on law-of-motion formulas. Each of the other changes of motion, of which the missile is capable, such as roll, yaw and acceleration, is similarly assigned to different integrators. The sum of all these possible motions represents the missile itself.

At this point BEMAC simulates only the motionless missile, these scientists continue. If a missile were in motion, the original propelling force would set all these interrelated movements into action. A control surface deflection might cause some yaw and pitch and some change in the angle of flight. The combination of these changes might alter such variables as its velocity and slant range.

In the simulated system, each integrator is connected with each other integrator in much the same manner as the nerve systems in the human body. A change in the yaw integrator thus will be transmitted to the pitch integrator and to all the other integrators for simultaneous reaction. The machine starts to operate with conditions corresponding to those at some known point in a missile flight. Then, as time passes, the analogues will go through the same variations as the corresponding problem variables.

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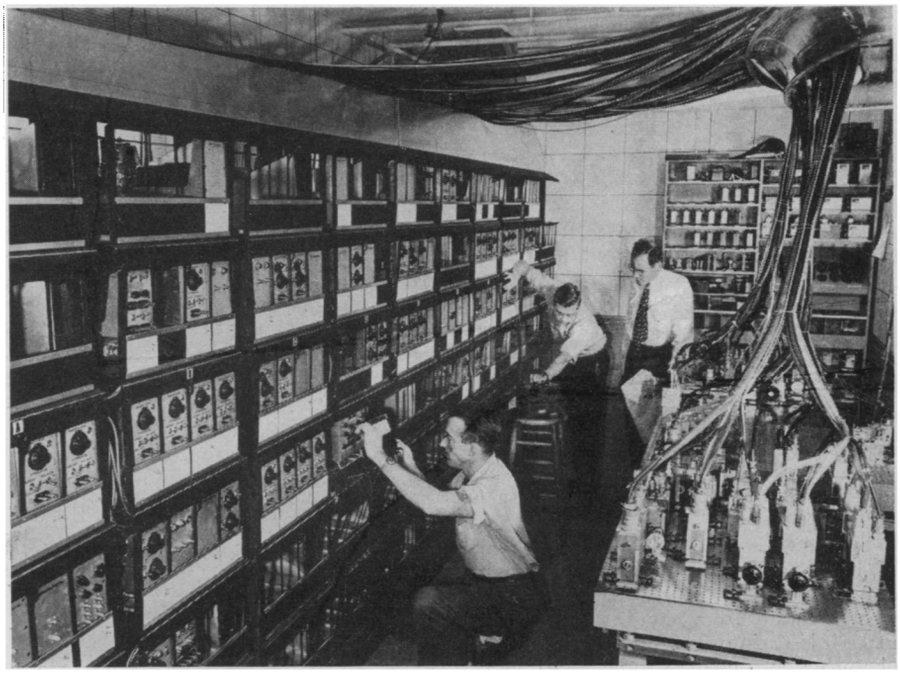
MATHEMATICS

Gambling Luck No Myth

➤ GAMBLERS' lucky streaks are more than just a superstition among the sporting crowd, the latest work of hard-headed mathematicians discloses.

Studies of the simple gambling game of coin-tossing have shown that even when the coin is perfectly "fair", with equal chances for heads and tails, it is most likely that one of the players will lead in an overwhelming large proportion of the time. The chances that each player will lead about half the time are much smaller.

Whether or not these new results can be used for a "system" of winning was not announced by mathematicians Kai Lai Chung and W. Feller of Cornell University, Ithaca, N. Y., in their paper in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Oct.). They did give an example of how extreme is the possibility of runs by stating that if a coin is tossed once a second for a total of 365 days, the probability that one of the players will lead for more



BEMAC COMPUTER—The entire computing portion of the BEMAC appears above with electronic components at left and mechanical section at right. Both sections are set up in "building block" fashion so that two or more relatively simple problems can be worked simultaneously.