

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 out-mode 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 inter-

related 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.

Science News Letter, December 3, 1949

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.

than 364 days and 10 hours is one in 20.

Thus, if you are losing, the chances are against you if you stick it out and wait for your bad luck to change, because it is quite unlikely that you will be ahead half the time in the long run. On the other hand, these mathematicians predict that if you quit when you are even, the chances are only one in 5,000 that you will be faced with such a long run of bad luck.

Help to gamblers is not the goal of the

studies of coin tossing by mathematicians Chung and Feller, however. A better knowledge of probability theory, such as may be learned from simple coin-flipping problems, is expected to lead to better communication and radio equipment and to other engineering advances, and these hopes are the reason for the support of the study at Cornell University by the Office of Naval Research.

Science News Letter, December 3, 1949

PSYCHOLOGY

Miners Dislike Mining

► **MINERS** would much rather be farmers, carpenters or machinists than miners. This probably is one of the underlying psychological reasons for repeated strikes in the coal industry, two University of Illinois psychologists report from their intensive study of one typical mining community in Illinois.

Dangers and unhealthy conditions on the job were the reasons given by the men for their deep dissatisfaction with their jobs, when Drs. James Francis Kelly and Thomas W. Harrell interviewed 50 representative miners.

More than half of the men think that miners' wages are high enough, it was found, although 31% feel that the pay is not in line with the difficulties and danger of the occupation. And others qualified their opinions by saying that their pay was not enough for old age; these men feel that the welfare fund is a big help.

The men are not irreconcilably antagonistic to management. Thirty-five out of the 50 interviewed said they believe mine

management is fair.

Nine men out of every ten—45 of the 50 interviewed—said that if they had their lives to live over again they would never be miners. Only four said they would pick mining as a job. Two of the four who would go into it again said they liked the high pay.

The miners are pretty solidly behind John L. Lewis and the United Mine Workers of America. Sixty-four per cent had nothing but praise. Another 24% praised him but qualified their praise with some criticism. With only six men did the blame outweigh the criticism.

Lewis was praised most for his strength and for what he had gained for the men. He was criticized for his personal ambition and dabbling in politics and his ironclad control of the union. Two men said he is too old.

No one criticized the United Mine Workers of America.

Full details of the survey are reported in **PERSONNEL PSYCHOLOGY**.

Science News Letter, December 3, 1949

CHEMISTRY

Fire-Retardant Coatings

► **PAINT** can be made to retard fire instead of causing it to spread, thanks to new chemical and paint research of the past few years. While fire-retardant paint if used on the ill-fated Noronic would not have been the whole answer to preventing the fire, it was the opinion of chemists at the American Chemical Society meeting in Atlantic City, N. J., that it might have helped materially.

Widely used is a Harvard war development, a urea plastic-cellulose mixture, that in effect creates a puffed up coating, like a burned marshmallow, under the effect of heat. The swelling of this glow-proof coating creates air spaces that insulate the wood beneath from the heat that might make it burst into flame faster. Ammonium phosphate, also used to flame-proof fabrics, stops the coating from burning and finely divided carbon takes up flammable gases that are generated by heat in the wood beneath. Called commercially Albi-R, it also contains titanium pigments.

Another fire-retardant coating used by the Navy is a combination of antimony oxide and a chlorinated hydrocarbon, such as paraffin or rubber. This glazes over under heat and the bulkhead of one ship bay would be prevented by it from conducting the heat of a bomb burst to the next section of the ship and setting it afire.

Another fire-retardant coating just now being tested, almost fights fire with fire, since it contains glycerine and nitroglycerine. It, too, forms a retardant coating. Cement paints were developed in England for fireproofing.

There are many successful methods of treating blankets, drapes, clothing and other fabrics to lessen the danger of a match or cigarette setting them aflame, and such flame-proofing properly applied, would prevent many destructive fires and save many lives.

Science News Letter, December 3, 1949

ECONOMICS

Lower Food Prices Are Predicted for Next Year

► **MORE** food at lower prices is predicted next year for the world as a whole. But population changes and unequal benefits will offset much of the gains.

This 1950-51 food prospect and the caution not to interpret it too optimistically were laid before delegates to the Food and Agricultural Organization's fifth annual conference by FAO Director-General N. E. Dodd and his staff.

North America, Europe and the U. S. S. R. will show the largest food production gains according to present development plans. Rice supplies in Southeast Asia are expected to be more plentiful than now. India, Poland and Mexico are cited as notable examples of countries which are striving energetically to make food production outstrip population growth.

But things do not look quite so good in the large underdeveloped areas, say the FAO experts in their survey report to the delegates. Lack of money, equipment and knowhow prevent food stocks from increasing in these areas. To keep ahead of the ever-growing population, it would be necessary to raise from two to three and a half percent more food each year. There is no present plan, say the FAO experts, even to approach such an increase.

The United States and Canada in the last 10 years have become more and more important as food suppliers to other countries. Ten years ago they furnished one-seventh of all world food exports. Today their share is two-fifths. Much of this great gain arose from the war emergency when these two countries stepped up farm production enormously to supply their allies.

This has already led to surpluses in the United States. The FAO notes that steps have been taken to restrict wheat acreage in the United States, and are contemplated for corn and cotton, despite the fact that there is still a shortage of these commodities elsewhere in the world.

Science News Letter, December 3, 1949

On This Week's Cover

► **THE** new Boeing B-50D Superfortress is now equipped with two huge 700-gallon streamlined external fuel tanks, as shown on the outside of the wing in the picture, which can also accommodate 4,000 pound bombs (See *SNL*, Nov. 19). The big bomber has a speed of more than 400 miles an hour and a total bomb capacity of 28,000 pounds. The B-29 and the new B-50 Superforts now form the backbone of all U. S. Air Force medium bombardment and strategic reconnaissance squadrons.

Science News Letter, December 3, 1949