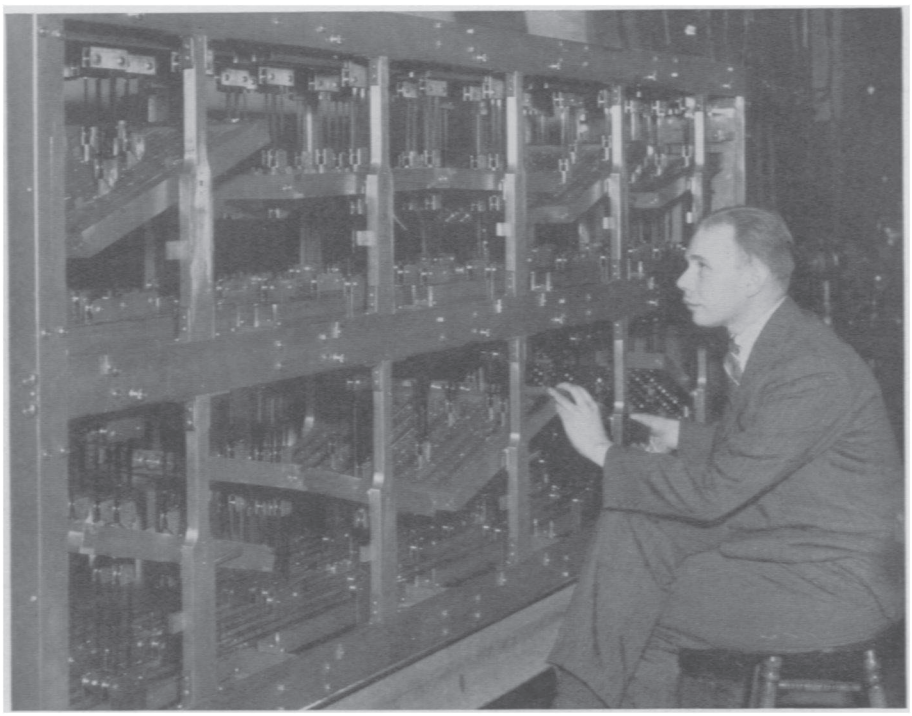

DR. JOHN B. WILBUR AND THE "ROBOT EINSTEIN"

MATHEMATICS

Robot Mathematician Solves Nine Simultaneous Equations

A ONE-TON machine that in a single action can solve nine simultaneous equations with nine unknowns so complicated in form they might well require days of laborious computation by trained mathematicians has been developed at the Massachusetts Institute of Technology.

Known as the simultaneous calculator, the machine is the product of three years' research by Dr. John B. Wilbur of the department of civil engineering. Cooperating with him has been Dr. Vannevar Bush, vice-president of technology and dean of engineering, who under the Institute's program to eliminate delay and complications in engineering and research, has previously made important contributions to the mechanical solution of mathematical problems, including the famous differential analyzer.

The simultaneous linear algebraic equations solved by the new machine occur constantly over a wide range of engineering and scientific analyses. Thus although the calculator was originally designed for the solution of problems in civil engineering, such as those involved in the construction of skyscrapers, it is expected to prove equally useful in such diverse fields as nuclear physics, geodetic surveying, genetics and psychology. The mathematician will be able to use it for the evaluation of determinants especially and in several other fields, since the machine under some circumstances can solve for even more than nine unknowns.

The machine weighs approximately 2,000 pounds and has more than 13,000 separate parts, including 600 feet of flexible steel tape and almost 1000 ball-bearing pulleys. The outgrowth of an experimental model built by Dr. Wilbur two years ago, the new machine has undergone exhaustive tests and is now in active operation.

The simultaneous equations which constitute the basis of the machine's operation are mathematical expressions relating a number of unknown quantities in such a way that the value of each unknown may be determined by a simultaneous consideration of the relations involved as expressed by the equations.

In the design of a suspension bridge, for example, the stresses on each part depend on the stresses on other parts. In addition, each of these stresses depends on the physical elastic properties of the parts themselves. Yet the value of the stresses can be calculated by solving a set of simultaneous equations which show the relations between these various stresses.

In the usual analytical solution this process involves considerable laborious manipulation of the factors. With Dr. Wilbur's new machine, however, it is necessary only to set a series of tilting plates to account for the various coefficients and constants and a single movement of the mechanism mechanically performs in a few seconds computations that might take days by ordinary methods.

Construction was made possible by a fund established by Sir Douglas Alexander of New York City.

Science News Letter, February 13, 1937

ASTROPHYSICS

Sunspots More Numerous; Radio Range Increases

THOSE commanding police calls on short-wave radio that strike terror into the hearts of criminals and speed officers to crime scenes are now frequently heard across the Atlantic. Two years ago they could be received only 30 to 40 miles away.

The increased number of sunspots is the cause, Dr. L. V. Berkner, Carnegie Institution of Washington physicist, explained. The activity on the sun produces its effect by increasing the density of the electrically charged layers 65, 130 and 190 miles above the earth that reflect radio waves.

When the police radio stations were first established, the high frequency (short wave) radio signals used penetrated these ionosphere layers and were lost in space. Now owing to the increased density of ions in the layers, they are reflected back to earth and their echoes are received at great distances.

Electrical conditions in the earth's outer atmosphere vary radically not only from day to night but also with the seasons, an intensive research program of the Carnegie Institution's Department of Terrestrial Magnetism has shown. Many vagaries of radio transmission and fluctuations in the earth's magnetism can be explained by changes in the ionosphere.

There are three well-defined regions of electrification that exist in the upper atmosphere, on a typical summer day at Washington about noon. In the lowest, 65 miles aloft, called the E-region,