



ROBOT AT WORK

R. B. Johnson, engineer of the International Business Machines Corporation (left) shows how a master answer sheet will control the machine he invented so that it grades examination papers by counting correct answers. Dr. Ben D. Wood, Columbia University psychologist who collaborated in producing the robot (center) is watching as is also Dr. R. D. Allen, Associate Superintendent of the Providence, R. I., public schools.

PSYCHOLOGY-ENGINEERING

Mechanism 'Feels' Answers To Examination Questions

Scores About Twenty Papers a Minute, Finding Averages; May Revolutionize Education and Employment Methods

A NEW machine which can correct up to 20 examination papers a minute—scoring as many as 3000 answers each 60 seconds—has been developed and is now under extensive test. If the enthusiastic approval of educators and employment executives is any indication, it may bring a vast change in the methods of education, vocational guidance and mass employment.

The device "feels" the answers and tells how many are right, how many are wrong and provides the operator with a total score for any given test. If desired it can subtract the number of errors from number right and even convert the result into percentage form.

Think what this would mean to those in charge of employment of large concerns. The United States Civil Service Commission, America's greatest employer, examined 780,000 persons during the past year. Many of these examina-

tions included several different test papers. As many as 201,000 persons have appeared for the examination for a single type of job—that of the railway postal clerk.

Each answer made by each individual—a total for each person running perhaps into the hundreds—is carefully examined and marked if wrong. A total is found of the number of correct answers. This total is combined with that for other tests and the combination manipulated with various weighting systems to find the final percentage score which is the individual's grade on that examination.

This is not the end. The whole process is gone through a second time for meticulous independent checking by another clerk. Before the thousands of papers can be given this careful handling, weeks and months have gone by, and applicants are kept waiting impatiently

for knowledge of their fate. One examination given by the U. S. Civil Service Commission last August was applied for by 25,000 persons. These applicants did not hear what their scores were until March—an anxious suspense lasting more than half a year.

Compared with this the performance of the robot is striking. In the city of Providence, Rhode Island, tests were recently given to 20,000 persons. These included teacher candidates, College of Education students, and junior and senior high school students. The robot completed the scoring of the papers in a single week.

Very Accurate

In New York state, an inquiry into the cost and character of public education involved giving some 400,000 examinations. The robot completed the scoring in 33½ days, working two shifts totaling 13 hours a day.

The accuracy of the machine far exceeds that of the most carefully trained clerk.

The secret of the operation of the robot, known formally as the International Test Scoring Machine, lies in the fact that the graphite of a soft lead pencil is a conductor of electricity. Electric fingers of the robot "feel" out the answers which the examinee has recorded in pencil on his answer sheet. Where the fingers find a mark, an electric current is let through. A master answer sheet sets the machine so that the current from correct answers is shunted to one milliammeter, that from the wrong answers to another. The scale on these meters reads directly in terms of score. If you want to know the number right, you can read the score on the scale. If you want the number of the correct answers minus number wrong, throw a switch and current from the right answers flows into the ammeter from one direction, that from the wrongs from the opposite direction. The resulting reading is the remainder. If you wish the result in percentage form, operation of another switch will give that to you.

Speed of Lightning

All answers are "sensed" by the robot simultaneously, and the score for the entire page is produced at the same time. The paper is scored literally with the speed of lightning. All that limits the speed of grading of the papers is the need for feeding papers into the machine and reading the score.

With such a ma- (Turn to page 314)



PRESENT METHOD

Miss Neva Snell, of the U. S. Civil Service Commission, is scoring one of the thousands of examination papers that must be graded there each year. The stencil sheet, containing correct answers and windows for the examinee's answers to show through, is a great aid in the scoring but still it is a tedious task and involves nervous- and eye-stain.

chine, it will be possible to determine the qualifications of applicants for positions in large companies, and city, state and federal governments with a speed and efficiency heretofore unknown and impossible.

In many cases, it will be possible to hand out the ratings to applicants before they leave the examination room. Employers can be furnished with a list of eligibles within a week after a large competitive examination is held. Men can be placed on the job soon after the opening occurs and before the best of the eligibles have had time to secure other employment, to move away, or to be washed under the morale-depressing tide of unemployment and destitution.

The criticism, well-founded, that has imperiled or defeated the merit system in many government systems is the tedious delay attendant upon the scoring of thousands of examination papers. In ordinary times, the delay is onerous; in emergencies it seems intolerable. With this new machine, it appears to be possible to eliminate most of the delay.

Labor sympathizers may object that the robot will throw examining clerks out of employment. Even in the case of the United States Civil Service Commission, such an objection would be based

upon a misconception. Always the commission is hampered by lack of sufficient personnel to keep abreast of their work. Something like 100,000 examination papers are always waiting to be scored.

The implications for education and vocational guidance are as striking as those for the field of employment. The possibility of daily tests to check the gain of pupils and efficiency of teaching methods. Immediate discovery and quick attention to pupil deficiencies. Relief for teachers of the arduous clerical work of marking papers and obtaining term averages and percentages. These are but a few of the most obvious possibilities promised by the robot.

Developments will probably follow its use that are as far-reaching as those which came after the development of the group intelligence test.

Credit for the invention should be shared by Dr. Ben D. Wood, of Columbia University. In conducting research for the Carnegie Foundation for the Advancement of Teaching, 200,000 tests were given to high school and college students. When faced with the task of grading these papers, Dr. Wood realized the necessity for mechanical aid. After a year of experimentation, he laid the problem before officials of the Interna-

tional Business Machines Corporation. The robot, invented by R. B. Johnson, is the result of many years of further research on behalf of that company.

Science News Letter, May 15, 1937

ASTROPHYSICS

Neon, Gas of Signs, Found Abundant Among the Stars

NEON, the gas that glows redly in modern advertising signs, is rare on earth but very abundant in the starry universe as a whole, it was disclosed at the meeting of the American Philosophical Society following a report presented by Dr. Donald H. Menzel of Harvard College Observatory.

In some of the glowing gaseous nebulae that are included in our own galaxy neon is fully as abundant as oxygen, the most common element on earth, or even more abundant.

Dr. Menzel reported on the results of months of study of photographs of the eclipse observed last summer in Siberia. During this eclipse the corona, or pearly glowing halo that always surrounds the sun but can be seen and photographed only during eclipses, was far brighter than it has been in past eclipses. Earlier observations showed the corona about as bright as the moon, but during the Siberian eclipse it glowed sixty times brighter than the moon.

Science News Letter, May 15, 1937

PUBLIC HEALTH

Industrial Unrest And Poor Health Linked

INDUSTRIAL unrest is closely associated with the poor state of health of the industrial population, Dr. Emery R. Hayhurst, industrial health authority of Columbus, Ohio, told members of the Midwest Conference on Occupational Diseases.

Organized labor, he continued, gives little evidence of interest in industry as a source of disease.

About 45 million workers are employed in the United States today. Of this group the shop employes suffer from 3 to 5 times as much sickness-absenteeism as office staffs.

Illness accounts for 20 times as many cases and 7 times as many days of absenteeism as accidents among industrial workers. The blow, Dr. Hayhurst pointed out, falls especially upon the semi-skilled and unskilled workers.

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