

produced no harmful structural changes in the internal organs. Doses from ten to hundreds of times the medicinal dose produced little more than an exaggeration of the remedial effect, and had no lasting ill effects.

#### Fatal Transformation

Like the good fairy who changed the dreadful ogre into stone, X-rays destroy certain kinds of cancer cells by transforming them into abnormal cells with calcified or stony nuclei.

The fatal transformation of cancer cells by X-rays was described by Drs. Perry J. Melnick and Albert Bachem of Chicago.

The transformation is known scientifically as a mutation or variation. It has been known for some time that X-rays could cause mutations in plants and animals, but it remained for Drs. Perry and Bachem to discover that this is one of the ways in which X-rays cure cancer.

With large single doses of X-rays, suitable for treatment of certain tumors, the tumor or cancer cells disintegrate by dying. However, with small repeated doses of X-rays, a method suitable for certain other types of tumors, the X-rays induce changes in the tumor cells resembling lethal mutations.

"The cells," the Chicago scientists explained, "are transformed into abnormal forms which are unable to survive. In a series of rat tumors, the tumor cells were transformed by X-rays into abnormal giant cells which disintegrated in a specific manner by calcification of their nuclei."

#### Won't Cause Cancer

Dusty air, such as miners, stone cutters and many others work in all day long, is a health hazard and may cause diseases like silicosis, but it is probably not in this country a cause of lung cancer.

This is the conclusion of a study reported by Drs. Arthur J. Vorwald and John Karr of Saranac Laboratory, Saranac Lake, N. Y.

The tendency to regard inhaled dust as a cause of lung cancer was prompted, Drs. Vorwald and Karr pointed out, by reports from mining districts in Europe. The number of cases of cancer among miners there is unusually high. The ore dust in these mines is radioactive and therefore induces changes in the lungs which eventually develop into cancer.

These observations do not justify incriminating all dusts as cancer-causing. The great majority of the dusts are not radioactive, the Saranac scientists pointed out, and do not, so far as is

known, contain cancer producing substances. If they did, the amount of lung cancer in men and experimental animals exposed to occupational dusts for long periods of time should be unusually high. A survey of patients suffering from pneumonokoniosis, the lung condition that is due to breathing dusty air, and observations on patients and animals at the Saranac Laboratory, Drs. Vorwald and Karr say, do not support this view.

#### BALLISTICS

## Determine Speed of Shells By Firing Through Light

Series of Light Beams Are Intersected by Projectile,  
Progress of Which is Recorded by Photoelectric Cells

**A**N ARTILLERY shell crashing through invisible curtains of light is the newest means of determining the speed of projectiles developed by scientists at the National Research Laboratories of Canada in Ottawa. Particular merit of the system is its portability which enables it to be used in the field, to bring added accuracy to computations of range in actual combat.

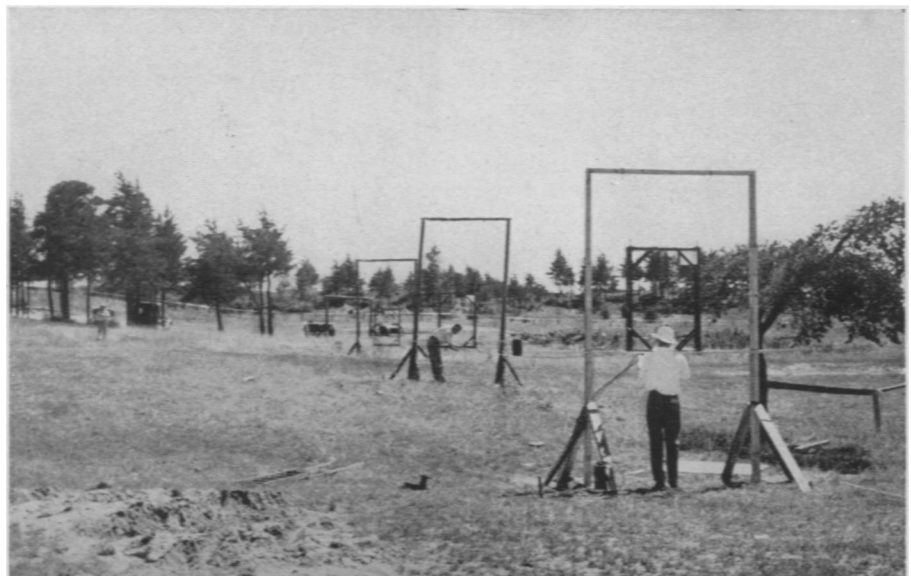
Light beams, mirrors, photoelectric cells and sensitive recording mechanism are the equipment which makes possible

Pneumonokoniosis itself, however, is one of the important occupational hazards in many industries throughout the country. Silicosis is one form of pneumonokoniosis, due to inhaling dust containing particles of silica. Few persons die of pneumonokoniosis or silicosis, but these conditions make the sufferer more liable to develop tuberculosis or other lung infections.

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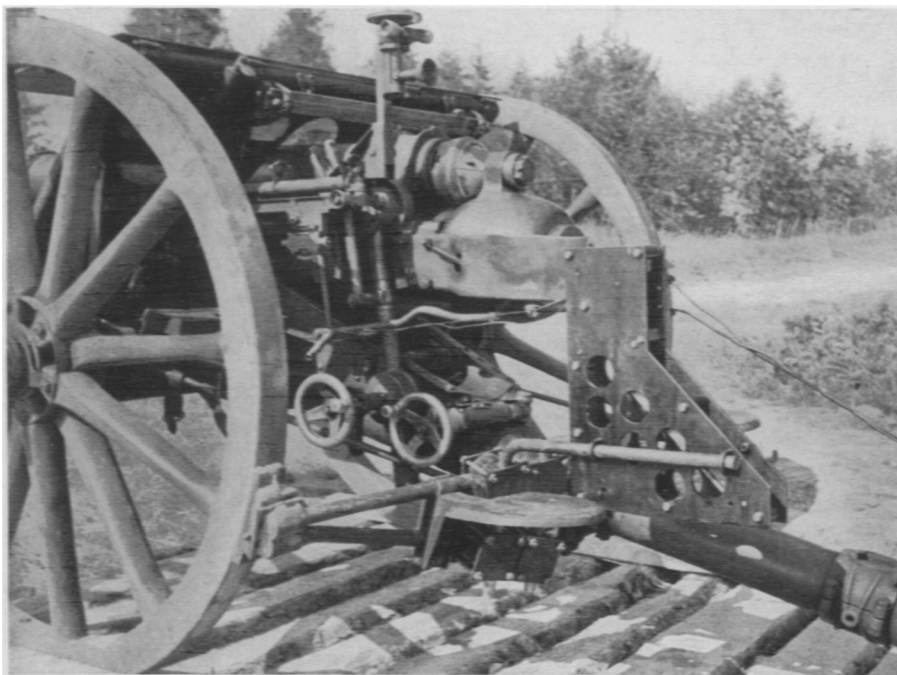
the new development of Dr. D. C. Rose, physicist in the division of physics and electrical engineering of the Canadian National Research Laboratories.

In effect the artillery shell passes down a narrow tunnel and every 50 feet intersects a beam of light falling on a photocell. Momentarily the shell blocks off the light beam and this decrease in light intensity cuts down the electrical output of the cell. By an amplifying system this electrical change produces a permanent record on photographic film.



**MEASURING SPEED OF SHELLS**

*Dr. D. C. Rose, National Research Laboratories of Canada, supervising the installation of his photoelectric device. A light beam from the small box at the bottom of the frame is reflected and falls on the photoelectric cell at top of frame.*



#### FIRING MECHANISM

*An electrically controlled mechanism is attached to an ordinary piece of field artillery for Dr. Rose's Tests.*

In field tests at the military camp at Petawawa, Dr. Rose set up metal frames whose upper and lower surfaces consisted of mirrors. A beam of light started from the bottom and was reflected back and forth across the space between the mirrors until its ray finally fell on a photoelectric cell concealed in a small box attached to the upper part of the frame. Thus the entire space within the frame was filled with a light beam which could be blocked out by the on-rushing shell.

#### Fires Shell

A series of four of these frames were carefully lined up before an artillery piece which at a known, and automatically registered, instant fired its shell through the frames.

Initial firing was merely through paper screens to test the alignment of the gun for its "jump" characteristics and to demonstrate that the automatic firing mechanism was working accurately. In subsequent tests the light beams and photocell frames were employed.

The timing of the speeding shells—which were found to be moving with a velocity of 1585 to 1600 feet a second—was accomplished by having the weakened photocell current swing a sensitive galvanometer. A beam of light striking a small mirror on this instrument was then reflected back to a moving motion

picture film. Simultaneously tiny markings created by a constant pitch tuning fork gave time signals on the film. Some 497.7 of these marks represented one second in actual time.

#### Old Problem

Ever since man fired his first gun determinations of the bullet or shell velocity have been a major problem for military officers. A rough average velocity from the time the shell left the gun until it struck its target could, of course, be obtained by a stop watch and a measurement of the range along the ground. From these facts it was easily possible to compute the length of the idealized parabolic path of the shell through its arc, and hence determine the average velocity. But the effect of air resistance during flight and other factors quickly showed that this was a theoretical answer which has only a fair resemblance to the real facts of speed.

Pioneers in the problem of projectile speed were Robins, 1742, Hutton in 1775-88 and Woolwich and Didion in 1839-40. All these men worked with the so-called ballistic pendulum invented by Robins. Hutton's method, for example, consisted in measuring the velocity of the cannon ball at the muzzle of the gun and at a known distance. The muzzle velocity was obtained by measurements on the recoil of the gun and the

velocity at a distance by having the cannon ball strike a heavy suspended pendulum and raise it a measurable height.

#### Shell Is Magnetized

American experiments late in the 1920's consisted of firing a magnetized shell through a series of solenoid coils thereby generating a slight electric current in the coils. The recording instrument was an oscillograph.

Another method, used widely to determine the air resistance of a shell, if not its speed, is that of wind tunnel tests. The shell, or a model of it, is placed in a wind tunnel and air is driven past it at high speeds approaching or equaling those attained in actual flight.

Object of all the tests is to obtain accurate data which can be correlated into the so-called ballistic tables used in wartime, where the distance of the target in yards or feet means setting the gun in a certain direction and pointed at a given elevation.

Dr. Rose's new method, because of its semi-portable character and its freedom from the need for an actual testing laboratory, can be carried into a combat zone if necessary and attain an accuracy comparable with more elaborate equipment operated in peacetime.

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#### RADIO

### Scientists Still Seeking Cause of Interstellar Static

SCIENCE is still on the search for the cause of strange radio disturbances that come from interstellar space.

Four years ago Dr. Karl G. Jansky of the Bell Telephone Laboratories found a sort of continuous static that came from somewhere about the center of the great system of stars in which we live. Its wavelength was 14.6 meters.

Drs. Fred L. Whipple and Jesse L. Greenstein of Harvard College Observatory have investigated the idea that the radiation comes from absorbing material at the center of our stellar galaxy which could act as what the scientists call "black bodies" and radiate at low temperatures. After elaborate computations, set forth in the current Proceedings of the National Academy of Sciences, they conclude that the amount of radio disturbance observed could not be accounted for in this way.

So the solution of this radio mystery is still being sought. The next clue being investigated is whether the disturbance occurs on other wavelengths.

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