PHYSICS

Atomic Age Alarm

Clicks of the Geiger counter sound warning of radioactivity. A metallic tube is the heart of this defense against atomic radiations.

By RON ROSS

➤ CLICK . . . click . . . click, click, click, click—faster and faster, an ominous signal is heard.

The atomic alarm has sounded. It can be a warning, in time, against atomic bombs. Or the death rattle of our civilization.

Harsh, staccato noise emitted from an electronic device that scientists call a Geiger counter. It clicks out its warning of radiation, such as that emitted from radium, or more pertinently from the mother stuff of atomic bombs, uranium. Whenever dangerous radioactivity is sprayed out in radiations—X-ray-like gamma rays, alpha particles which are helium hearts, beta rays which are fleet electrons—the Geiger counter clicks.

Mechanical Policemen

Tomorrow, in a world deadly fearful of illicit atomic bombs or atomic materials, Geiger counters will be the unsleeping mechanical policemen of the atomic age.

You may not read about it, but the chances are that every passenger who steps off an international airplane or debarks from a transoceanic steamer will be given the once-over with a Geiger counter.

At the gateways to our public institutions, at the freight and package entrances to our critical and important offices, these warning devices will be on guard.

Patrolling airplanes will carry them routinely to chart any unusual activity in the upper air. The alarm could be sounded if a radioactive gas attack seemed approaching. At critical and important places, such as 42nd and Broadway and atop Golden Gate Bridge, the counters will be on watch.

Just as radar will constantly scan our frontiers for incoming ships by air and sea, so the detectors of radioactivity will be a part of the nation's defense.

The difference between life and death in the future may be a metallic tube. This tube is the heart of the Geiger counter. Tell-tale radiations from uranium, plutonium or other radioactive materials sound the atomic alarm when they strike the remarkable tube of the Geiger counter.

These rays cannot be seen with our eyes and are not felt by our bodies. Most powerful ray from atomic bomb material is the gamma ray. This is a sort of short-wave X-ray. It is only one tenth as long as the shortest X-ray but usually many times as powerful.

Beta rays are high speed electrons, the negatively charged particles which are a part of all atoms. They are not so penetrating as gamma rays but are more powerful than alpha rays, which are composed of "stripped" helium atoms.

Hiding, or shielding, the rays of uranium from the tube of the Geiger counter would require huge amounts of lead for even a small bit of material. Sneaking an atomic bomb or its materials into an area guarded by the counter will be difficult, if not impossible.

The Geiger counter was first developed nearly 40 years ago by a German professor, Hans Geiger, and the famous English physicist, Lord Rutherford. Later, Geiger and a German colleague, W. Mueller, improved the counter so that it could count large numbers of particles in a short time. The instrument is formally known as the Geiger-Mueller counter.

COUNTER TUBES—Each of these, used in Geiger counters, has a different ray-detecting job.

The counter is a million times more sensitive than most of the devices in scientific laboratories. It measures the ultimate particles of matter. A single particle of an atom triggers a click from the counter. Yet, this senstive instrument is amazingly simple.

Balance in Tube

A delicate electrical balance is set up inside a tube. When a bit of an atom, a ray given off from uranium or other radioactive material, penetrates the thin wall of the tube, it upsets this balance. An electrical charge is given off. This charge becomes a click for each ray entering the tube.

The metallic tube may be of many different sizes. Scientists at the National Bureau of Standards have developed a hypodermic needle type of counter tube. This is hardly bigger than a small needle and is used for radioactive tracer work. A novel counter was built from an empty tooth paste tube. More common types of counter use metal tubes an inch or more in diameter. The tube may be enclosed in glass or have a glass window.

The thickness of the wall of the tube is important. This determines which rays will be detected by the counter. For spotting radioactive material, a metal tube which may block alpha and beta rays can be used. To detect uranium, a gamma ray counter is sufficient. These powerful rays can warn of radioactivity without help from beta and alpha radiations.

Inside the tube of the Geiger counter is a wire running the length of the tube. The wire connects insulting disks which seal the ends of the tube. The tube contains a gas at low pressure.

High voltage is applied to establish a strong electrical field between the wire and the tube. The voltage is high enough so that the gas is just ready to "break down." This establishes a delicate electrical balance.

The balance is broken by a ray pene-

trating the tube. The penetrating ray rips the gas molecules and frees charged particles, called ions. This produces an electrical discharge.

When the discharge is amplified by the Geiger counter, you hear a click. Each time a ray penetrates the tube, it sets off the electrical discharge and you hear a click.

Even away from uranium and other well-known radioactive materials, there is some clicking. Powerful cosmic rays from outer space penetrate the tube and cause clicks. Some materials which are not thought of as radioactive may send out some radiation which can produce some clicking.

But normally, the clicking of the counter is irregular. You can count the clicks in a minute. When radioactive material is brought into the room near a counter, the clicks increase. They become a steady clicking, faster and faster as the material is brought closer. This is the atomic alarm system.

Lights rather than the audible clicks may indicate the counts. When the count is high enough to indicate danger from radiations to persons close to the counter a bell or other sound alarm may go off. Automatic counting devices can be installed to make a record of the rays counted.

Secret "Counting"

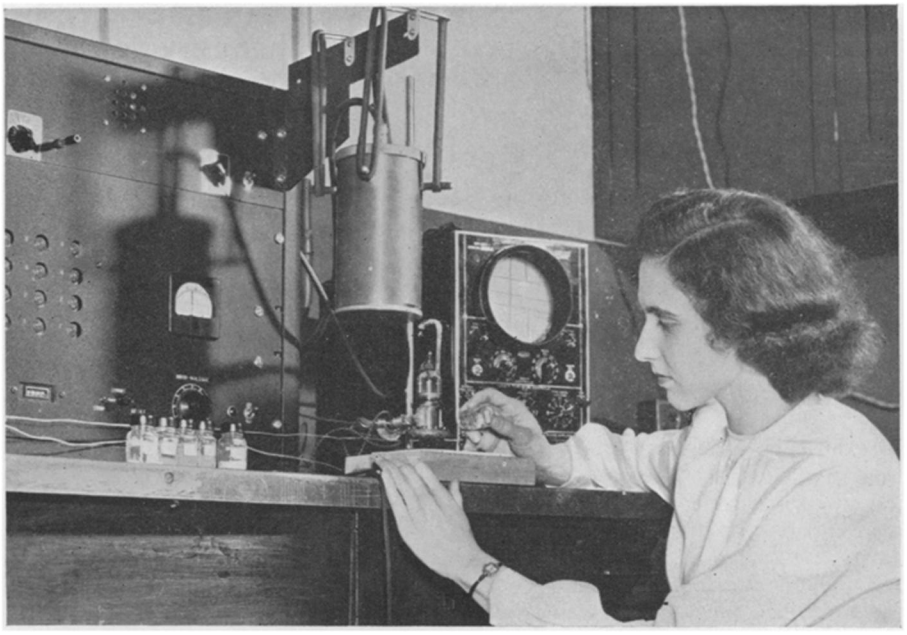
You may be "screened" for radioactivity without knowing it. Counters will probably be installed at some doors. The instrument could be camouflaged. If you walked through the door with a bit of uranium in a bag, the counter might set off a sound alarm system or a visual warning of radioactive material.

You will be "counted" many times for uranium in an age of atomic energy.

Geiger counters are used in nearly every stage of work with radioactive materials. Portable counters can be carried by prospectors searching for the stuff of the atomic bomb. A portable counter which weighs less than five pounds and has its own power from batteries is now on the market.

Science and industry use the counter in work with radioactive materials to help protect the health and lives of workers from the deadly rays.

The dangerous rays of radioactivity can be detected by equipment other than Geiger counters. But the Geiger counter is the most useful sleuth for tracking down the rays of uranium and other radioactive materials.



GEIGER COUNTER—This detector is being used to test for radioactivity in dust gathered after the Bikini aerial explosion last July.

A practical rival of the Geiger counter for some uses is the electroscope. It can indicate radioactivity and atomic bomb materials though it is rated less sensitive than the counter.

The simplest form of the electroscope has a gold leaf suspended from a vertical rod. When the rod is charged, the leaf stands out at an angle from the rod. As the charge of the leaf leaks away, the leaf swings down against the rod. The rate of swing indicates the conductivity of the air and can warn of the presence of radioactivity.

Electroscopes the shape and size of fountain pens were carried by workers on the atomic bomb project.

There are other detectors, which can warn of radioactivity, but they are chiefly useful to the scientist. He wants to know more than how many rays are counted. Science has other devices for research on how radioactive rays behave and other details from the life of an atom.

But for practical control of atomic energy—for locating uranium being transported illegally or warning of radioactivity attacks—the Geiger counter is our number one atomic sentry.

Science News Letter, June 14, 1947

METALLURGY

Oxygen, Man's Life-Breath, Speeds Steel Production

➤ OXYGEN, life-breath of man, can step up steel production, according to reports of the American Iron and Steel Institute.

The Institute reported that several plants for manufacturing oxygen are now under construction adjacent to steel plants. When the oxygen plants are in production, oxygen will find two important uses in steel production:

1. To increase the heat of the open hearth flame and save between 10% and 25% in fuel costs.

2. For stepping up the rate at which carbon is removed from the liquid metal.

Oxygen enriches the open hearth flame with increases in temperature of up to 500 degrees Fahrenheit. This can reduce the melt-down time as much as 30%.

Bubbling oxygen into the molten bath speeds the reaction which separates the carbon from the metal in liquid form. This can save from 17% to 30% of the time required for the process.

In addition to faster production of steel, better steel may result from the use of oxygen. Some metallurgists have reported better quality steel from the oxygen-enriched processes.

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