

were developed to carry scientific apparatus weighing as much as two men to new heights above the earth.

A new magnetic iron-nickel alloy, Orthonol, proved superior for use in magnetic amplifiers instead of the delicate electronic tube.

A method for making shadow photographs under the electron microscope of the direction and strength of the fields of minute "atomic magnets" within magnetic materials provided a new tool for fundamental research in physics.

The idea was proposed that space between the stars may be filled with tiny, magnetic needles of iron in giant magnetic fields.

Radio microwaves were used to find the dimensions and spin-rate of certain molecules in gases by the absorption of the rays passed through the gas.

Zirconium was found to be suitable as a structural material for building atomic energy piles.

Small-lot production of titanium metal was applied commercially.

A ten-minute warning that an atomic bomb will drop can reduce the casualties of a normal city ready for atomic attack from 100,000 to 10,000, it was estimated.

A new atomic particle, the negative proton, was predicted.

The Nobel Prize in physics was awarded to Dr. Hideki Yukawa who predicted the existence of the meson three years before it was found in experiments with cosmic rays.

Platinum with mass 190 was discovered and two other stable isotopes were predicted: tellurium 118, gadolinium 150.

A polarizer for infra-red rays in sheet form was invented.

A supermicroscope that "sees" with mirrors made possible use of infra-red rays for spectral analysis and identification of chemicals; plans were made for the manufacture of this instrument in the United States.

A radiation detector for disaster use in bombed areas where amount of radiation would swamp a Geiger counter was put into commercial production.

An atomic clock which tells time by the movements of atoms in molecules of ammonia was put in action.

A new theoretical approach was proposed for reconciling the relativity theory of Einstein with quantum mechanics, emphasizing position in the case of macroscopic worlds and velocity inside the atom.

The "scintillation counter" is a new device developed for detecting radioactive radiations.

Soft X-rays were found in the upper atmosphere by V-2 rocket exploration and believed responsible for the ionosphere.

Radioactive elements do not speed plant growth, it was established.

Methods of disposing of dangerous atomic wastes by having bacteria absorb them and by incorporating them in concrete were developed.

New use was found for the atomic furnace, or chain-reacting neutron pile, in measuring the amount of chemical element in an unknown material through the activity induced.

New semiconductors were produced by irradiation of germanium in the atomic pile with slow neutrons, thus creating a predictable number of impurity centers in the material itself.

An ultraviolet microscope was developed which makes photographs in color, making possible contrast effects without the use of chemical stains.

A new technique was developed for thin slicing for preparations for the electron microscope which makes slices so thin that 4,000 would be only the thickness of a human hair.

Several theories were advanced to account for

the birth of cosmic rays: one that great clouds of dust in interstellar space create magnetic fields in which a particle may gain energy; another that the energy comes from tremendous explosions of supernovae.

Molten zirconium at a temperature near 6,500 degrees Fahrenheit provides the light in a new lamp developed for use in photography, projection and television.

The Neg'ator, a mechanical spring that resists less the more it is deformed, was developed.

A new method of taking photographs by use of a screen coated with specially prepared phosphors, and called thermo-radiography, was developed.

Better synthetic rubbers were produced which are resistant to extreme heat and Arctic cold and which will not deform materially under the weight of vibrating machines.

By international agreement, the name of the element tungsten was changed to wolfram, columbium to niobium, and agreement was reached on what to call other elements going by different names in different countries.

An unexpected source of chemical energy was found present in the atomic piles when potassium chloride was changed to potassium sulfate, a highly oxidized material capable of reducing other substances.

New facilities for the production of plutonium were put into operation at Hanford, Wash.

A new method of making acetylene from methane, making use of electric current, was announced.

Quartz crystals produced synthetically were found to be better than the natural ones.

The all-synthetic fiber, dynel, the short staple form of vinyon, was announced.

Orlon, a new synthetic yarn from natural gas, oxygen and nitrogen from the atmosphere was developed and found to be resistant to sunlight, moisture, fungus and insects.

A new process was developed for making metal films, so thin that they can be used as supporting membranes for electron microscopic studies.

Crystals of calcium tungstate were made synthetically in water-white pure form.

The Nobel Prize in chemistry was awarded to Dr. William F. Giauque, world pioneer in low temperature research.

New detergents called morpholinium alkyl sulfates which not only cleanse but kill germs were produced.

Higher gasoline yields, lower butane and gas yields, and somewhat lower gasoline octane numbers were obtained with silica-magnesia cracking catalyst.

A wool-like synthetic fiber was made from cottonseed protein.

Thermoluminescence was found to be a sensitive test for radioactivity in rocks of the earth.

It was made possible to re-use photographic wash water over and over by a water purification method using ion exchange.

Starch was converted into sugar by polarized infra-red light.

A new lubricant of unprecedented stability and a chemically inert plastic were applications made of a new family of organic chemical compounds, the fluorocarbons.

Synthetic seaweed fibers were used to weave light delicate fabrics from which the seaweed-like fibers are removed by washing out.

An isotope of nitrogen with mass 12 was discovered by bombarding carbon with high energy protons from a linear accelerator.

Spectrographic study revealed in the upper atmosphere two kinds of carbon dioxide; one composed of two atoms of oxygen to one of heavy carbon; the other composed of one atom

of ordinary carbon to one of ordinary oxygen and one of heavy oxygen.

Infra-red studies revealed that long heat waves can pass blocks of purest germanium of considerable thickness.

## EARTH SCIENCES

### Fuel Was Obtained from Unmined Coal

A process was developed for obtaining fuel gases from unmined coal by sending an electric current through it.

A one-step method for getting high-grade gasoline from low-grade crude oil without use of high pressure was devised.

The theory that the earth's magnetic field may be due to the gravity pull of the earth as it spins on its axis was advanced.

A one-pound Geiger counter was developed in Canada for uranium prospecting.

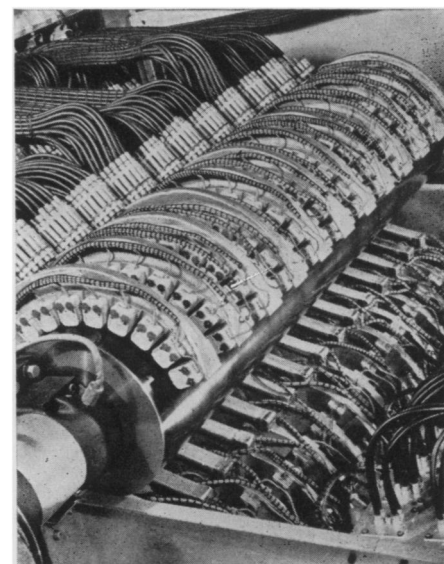
An industrial seismograph was devised; it is about the size of a box camera and used to measure vibration in machinery.

In carefully controlled experiments to produce precipitation by seeding cumulus type clouds with dry ice, the most obvious result was dissipation rather than rain-producing development.

A new cloud analyzer which measures the height of a cloud at its summit as well as at its base and indicates the density, was developed.

Fossils of three different races of ape-men were found in South Africa; one of giants two and one-half times as big as today's average human being; another a race of small, gracefully built ape-men weighing about 100 pounds each; and a third type more nearly human than some of those previously found.

Measurement of the heavy oxygen present in fossils from upper Cretaceous chalk deposits of England and comparison with that in the sea water showed that a hundred million years



**HARVARD MARK III**—The magnetic drum memory organ of this computer has many pick-up heads and wires that are the electric nerves leading in to the rest of the computer.