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John Hastings, Director

FOR USE IN PM PAPERS OF WEDNESDAY, DECEMBER 15, AND AM PAPERS, DECEMBER 16

(News conference on cyclotron gift to Smithsonian will be held Wednesday, December 15, 2:30 P.M. in basement of Pupin Physics Laboratories, Broadway & 120th St.)

The history-making cyclotron at Columbia University that was used in the first atomic energy experiments in America 26 years ago has smashed its final atom.

The machine on Morningside Heights in Manhattan, which may be the oldest operating cyclotron in the world, is being dismantled and given to the Smithsonian Institution, the University announced today (Wednesday). It will be shipped to Washington, D.C., to become a prized youngster among objects in American history hundreds of years old.

The "atom-smasher" is just 27 years old -- about the same age as the fast-moving Atomic Era itself, where old age comes early.

The Columbia cyclotron was used in January, 1939, in the experiments that split the uranium atom and recorded the release of its tremendous energy for the first time in America.

Later the same cyclotron was used to establish the first proof that the rare Uranium 235 isotope, not the other more common uranium isotope, was the fissionable material. That proof opened the way to the United States' intense research effort during World War II that led to the creation of the atomic bomb and the development of atomic energy.

And in the 1940s the cyclotron was used in neutron spectroscopy -- work that revealed to scientists the internal structure of the nuclei in various materials and provided basic knowledge for future nuclear research.

"Those experiments gave some of the first data on which our nuclear science has been based ever since," Dr. John R. Dunning of Columbia said today.

Dr. Dunning, who designed and built the cyclotron when he was an associate professor of Physics at Columbia, now is dean of Columbia's School of Engineering and Applied Science.

Much of the cyclotron's early work was done under rigid secrecy that covered the Manhattan Project -- the United States' urgent scientific effort to develop the atom bomb during World War II. Later the cyclotron produced radioactive isotopes for medical research.

Most recently, it was the instrument many Columbia students used to perform original research to earn their Ph.D.'s. Since 1950 many of Columbia's principal high-energy studies have been carried out on the University's giant synchro-cyclotron in Irvington, N.Y.

The smaller, Smithsonian-bound cyclotron has now been over-powered by enormous particle accelerators hundreds of times stronger. But it was called a "leviathan" and the "Big Bertha of atomic artillery" when it first went into operation near the end of 1938. Housed in the basement of Columbia's Pupin Physics Laboratories on upper Broadway, the cyclotron began then to whirl atomic particles at speeds as high as 25,000 miles per second to break the secrets of the atom's nucleus. Within months the atom smasher began its pioneering work in atomic energy.

In the intense research program by the United States government that followed, much of the effort was devoted to the technique of separating U-235 in a form pure enough to create an explosion -- the explosion many scientists had dared only hypothesize. Dunning, Nier, Booth and Grosse then invented and perfected the gaseous diffusion method of separating the pure isotope (the technique that has since been adopted for use in connection with the world's major nuclear power plants).

Before long, the Manhattan Project's lid of secrecy closed on the entire Pupin Laboratories building. Basic research, some related to national defense, continued to be done on the cyclotron and everyone using it had to abide by strict security rules.

During that time William W. Havens and James Rainwater, now professors of Physics at Columbia, performed neutron spectroscopy work that has added considerably to science's knowledge of the structure within nuclei of various kinds. Research went on in the building in a charged and urgent atmosphere and, although few employees knew the ultimate objective of their work, they believed it was important. In this pressing mood, the two scientists manned the cyclotron for weeks at a time without stopping, Dr. Havens working during the day and Dr. Rainwater at night. They kept the cyclotron in operation nearly 24 hours a day.

Early in the 1940s sections of the Columbia cyclotron were rebuilt and some of its discarded parts found their way into scrap metal drives for the war effort.

Cyclotrons, invented in the early 1930s by Ernest O. Lawrence of the University of California, are the simplest of the circular particle accelerators. At its center is a vacuum chamber gripped in

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the powerful field of a giant electromagnet. Within the chamber is a pair of "D's" -- two flat D-shaped shells of metal back-to-back, forming a circle. The original "D's" in the Columbia machine, about two inches thick and thirty inches in diameter, are perhaps the most valuable part of the Smithsonian gift. The "D's" are the heart of the cyclotron. Atomic particles such as protons or alpha particles, obtained from a filament in the center between the "D's," spin in the "D's" at ever-increasing speed and in ever-enlarging orbits. Each "D" is alternately charged with positive and negative electrical forces which change millions of times a second. The particles pick up speed when crossing from one "D" to the other. When the atomic bullets have attained a speed of about 25,000 miles per second and have reached the outside edge of the "D's," they are pulled tangentially from the chambei by a deflecting plate and sent straight to the target to be bombarded.

Other important parts of the cyclotron in the Smithsonian gift include original power tubes, the large 14-foot-long "torpedo" chamber through which the "D's" were controlled, and the oscillator and amplifier cages.

Asked today how he felt at the end of the operating career of the machine he designed, Dr. Dunning said, "I'm delighted that the country is recognizing, through the Smithsonian Institution, advances that science has made -- not just advances in research for warfare, but advances that point to progress in the constructive use of atomic energy.

"The cyclotron at Columbia was the stepping stone to our current preeminence in the field of nuclear energy. The building of nuclear power plants all over the country is a booming industry. We

(can take pride in that."

It was January 25, 1939, when scientists at Columbia demonstrated for the first time in the New World that when the uranium atom split it released enormous energy -- millions of times greater than man had ever seen before.

That historic night was windy and cold when, at 7 P.M., Dr. Dunning descended to the cyclotron laboratory in the basement of Pupin. Waiting for him were Eugene T. Booth, a Columbia physics instructor then and now scientific director of Laser, Inc., Briarcliff Manor, N.Y., and Francis G. Slack, then visiting professor from Vanderbilt University and now retired.

Earlier that day Dr. Dunning and other Columbia scientists had discussed electrifying news from Germany. Otto Hahn and Fritz Strassmann, working in the Kaiser Wilhelm Institute in Berlin, had discovered barium and other elements of medium atomic weight in the debris of uranium that had been disintegrated by neutrons. It appeared that a certain amount of mass had disappeared in the experiment.

The Columbia scientists theorized that the fission (splitting) of the uranium atom might have caused the release of a considerable amount of energy. But they needed proof. Dunning spent the afternoon planning an experiment to demonstrate the atomic energy idea, and now, that night, everything was ready.

With mounting excitement, Booth and Slack helped Dunning set up the equipment: a holder for neutron-producing radioactive bombarding material, an ion chamber amplifier system for the uranium, and an oscilloscope with screen to show with lines and dots the amount of energy given off by the uranium under fire.

Dunning covered a thin plate with black, powdery uranium oxide and placed it as a target in the ion chamber. Then he put a radioactive beryllium-radon mixture in the holder. Carefully, he moved the holder into position for bombardment.

Suddenly, huge green lines shot up in the circle of the oscilloscope screen. They leaped high and seemed to jump from the screen and they stunned the scientists. Dunning had never before seen anything like these "enormous kicks," as he called them. He quickly calculated that up to 200,000,000 electron volts were being generated. At that rate one pound of fissionable uranium could yield as much energy as 5,000,000 pounds of coal.

Dunning repeated the experiment many times, using two different sources for the bombarding neutrons to be sure his findings were accurate. One was the natural beryllium-radon source; the other was the cyclotron.

The neutrons fired at the uranium target from the cyclotron produced the same astonishing "kicks" on the screen. On January 26, with fear and hope, Dunning wrote these words in his laboratory notebook:

"Believe we have observed a new phenomenon of far reaching consequence."

The fact of atomic energy had been established. The next job was to find a way to harness it.

Further experiments in the winter and spring of 1939 conducted at Columbia outside the cyclotron laboratory suggested that a splitting atom could split other atoms and that a chain reaction was possible. Scientists b[illegible]ved that when the uranium atom [illegible] projectiles (neutrons) were released -- enough such bullets from each splitting atom to shatter at least two other atoms nearby.

At that rate, millions of atoms would be split by one another's neutron bombardment in the space of a millionth of a second and the result would be a cataclysmic explosion.

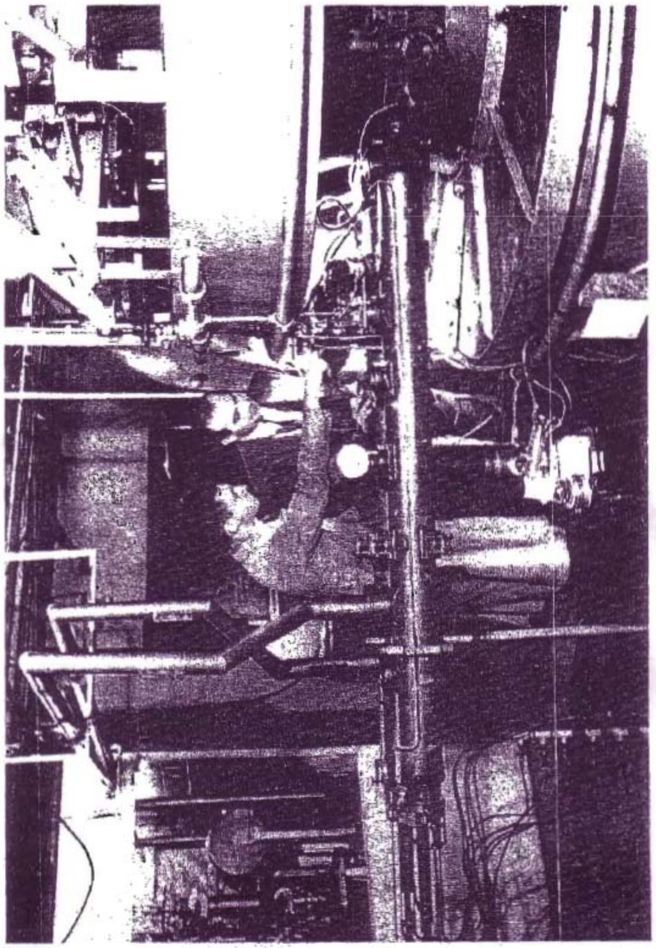
Why, then, didn't the uranium in Dr. Dunning's experiment January 25 blow up? Was only a small part of the uranium doing the splitting? These questions produced a theory that took a year to prove but in the end opened the door to the practical application of atomic energy.

Experiments in the Columbia cyclotron in March, 1940, proved for the first time that the material which was splitting was rare Uranium 235, an isotope which occurs in very small quantities in ordinary uranium. Only the pure U-235 had been fissioning in Dr. Dunning's uranium and the "impure" U-238 had absorbed the secondary neutrons, rendering them ineffective and preventing a chain reaction and explosion. The numbers refer to atomic weights.

Those 1940 experiments with U-235 and U-238 were performed by Dr. Dunning and Dr. Booth and Professors A.O. Nier and A.V. Grosse. When the U-238 deposit was placed on a plate in the cyclotron and the machine was started, the instruments recorded only a few spasmodic bursts of energy release per minute.

But when the light uranium, the U-235 isotope, was placed in the same bombardment chamber, the instruments recorded intense activity. Counters that click for every ten bursts kept up a barrage of sound and the oscilloscope line jumped high. The U-235 atoms were being split at a rate 10,000 times faster than U-238.

To Andy Millis



To Andy Millis

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75 Tons

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75-TON COLUMBIA UNIVERSITY ATOM SMASHER

NEW YORK CITY — THIS 150,000-POUND CYCLOTRON AT COLUMBIA UNIVERSITY FIRES ATOMIC "BULLETS" AT 25,000 MILES A SECOND TO CHANGE CHEMICAL ELEMENTS. THE MACHINE'S 65-TON IRON YOKE, WITH TWO TAPERED CORES, FORM AN ELECTROMAGNET. PROF. JOHN R. DUNNING (RIGHT) AND HERBERT ANDERSON (LEFT) SRAND BESIDE HORIZONTAL PIPES FORMING OUTER CONDUCTOR OF LINES WHICH CARRY POWER INTO THE CYCLOTRON ACCELERATING CHAMBER AT RIGHT. ENERGY IS FED FROM OSCILLATOR (LEFT BACKGROUND) THROUGH SMALL CROSSED CONCENTRIC LINES (LEFT OF MEN) AT LOW VOLTAGES, INTO INTO LARGE CONCENTRIC LINES RUNNING ACROSS PHOTO LEFT TO RIGHT. LARGE CONCENTRIC LINES STEP UP VOLTAGES SO ELECTRODES ARE ALTERNATELY CHARGED POSITIVELY AND NEGATIVELY FROM ZERO TO 100,000 VOLTS. "BULLETS" ARE ACCELERATED IN THE VACUUM CHAMBER AT RIGHT END OF HORIZONTAL LINES. TANKS ABOVE AND BELOW THE CORES AND THE VACUUM CHAMBER HOLD OIL TO COOL THE SEVEN TONS OF COPPER COILS AROUND THE CORES.

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Strength and power were part of the Columbia University cyclotron from beginning to end: the Navy helped install it 30 years ago, and now football players are pulling it out.

In between -- besides making atomic energy history -- the cyclotron made marriages, earned degrees for students, submitted to a woman's rule for 10 years, and, once, was improved by a "hairpin."

It was December 14, 1935, when a caravan of thirteen trucks from Annapolis arrived on the Columbia campus with sections of the future atom-smasher's 65-ton electromagnet. The Navy had used it in a large radio transmitter but needed it no longer.

Each five-ton section was skidded down a special sloping trench into the cavernous basement of the Pupin Physics Laboratories at Broadway and 120th Street. And the basic magnetic yoke was assembled for the machine that was to help perform the first atomic energy experiments in America four years later.

Now, with its history-making career at an end and its most important parts destined for the Smithsonian Institution, some members of the Columbia football team are helping to get the cyclotron out again.

The biggest piece going to Washington is the "torpedo," a

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14-foot-long metal cyclinder the size of a small smokestack, which weighs 3,000 pounds. The torpedo, a vital control element of the cyclotron, is too long to turn any hallway corners in Pupin and too big for any of the high basement windows. Everyone is certain of that because a wooden mock-up of the torpedo was built exactly to size out of two-by-fours and was carried all around the cyclotron laboratory in search of a way out.

The captain of the football team, Ron Brookshire, and some of his Columbia teammates did the work, poking the heavy wooden frame into every likely exit, aiming it into possible openings at every angle. They found they'll have to tear out a section of concrete from a well window to get it out.

From 1946 to 1956 the chief cyclotron operator was a woman -- then Miriam Levin and now Mrs. Edward Melkonian. Her husband, now associate professor of nuclear science and engineering at Columbia, was doing research on the cyclotron when they met.

Mrs. Melkonian is responsible for the "hairpin" improvement. The cyclotron one day was ailing from low-intensity trouble, she recalls. In checking over the machine to repair it, she found that not enough electrons were "boiling" off the hot filament in the heart of the cyclotron where atomic particles are produced for acceleration. The coiled filament, she thought, seemed too wide across the hot area and she decided that a simpler filament, concentrating the heat in a smaller area, would be more efficient. She fashioned some tungsten into the shape of a hairpin and substituted it for the coiled filament. The tungsten hairpin more than tripled the cyclotron's intensity and the idea has been used in other cyclotrons since.

The cyclotron, she said recently, has a kind of personality because "everyone who worked with it became involved."

Over a period of 10 years she learned the cyclotron's quirks well and whenever trouble arose she was quick to recognize the source. She almost always made repairs in a conventional way, she said, but she admitted that once or twice she kicked it to get it going again.

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