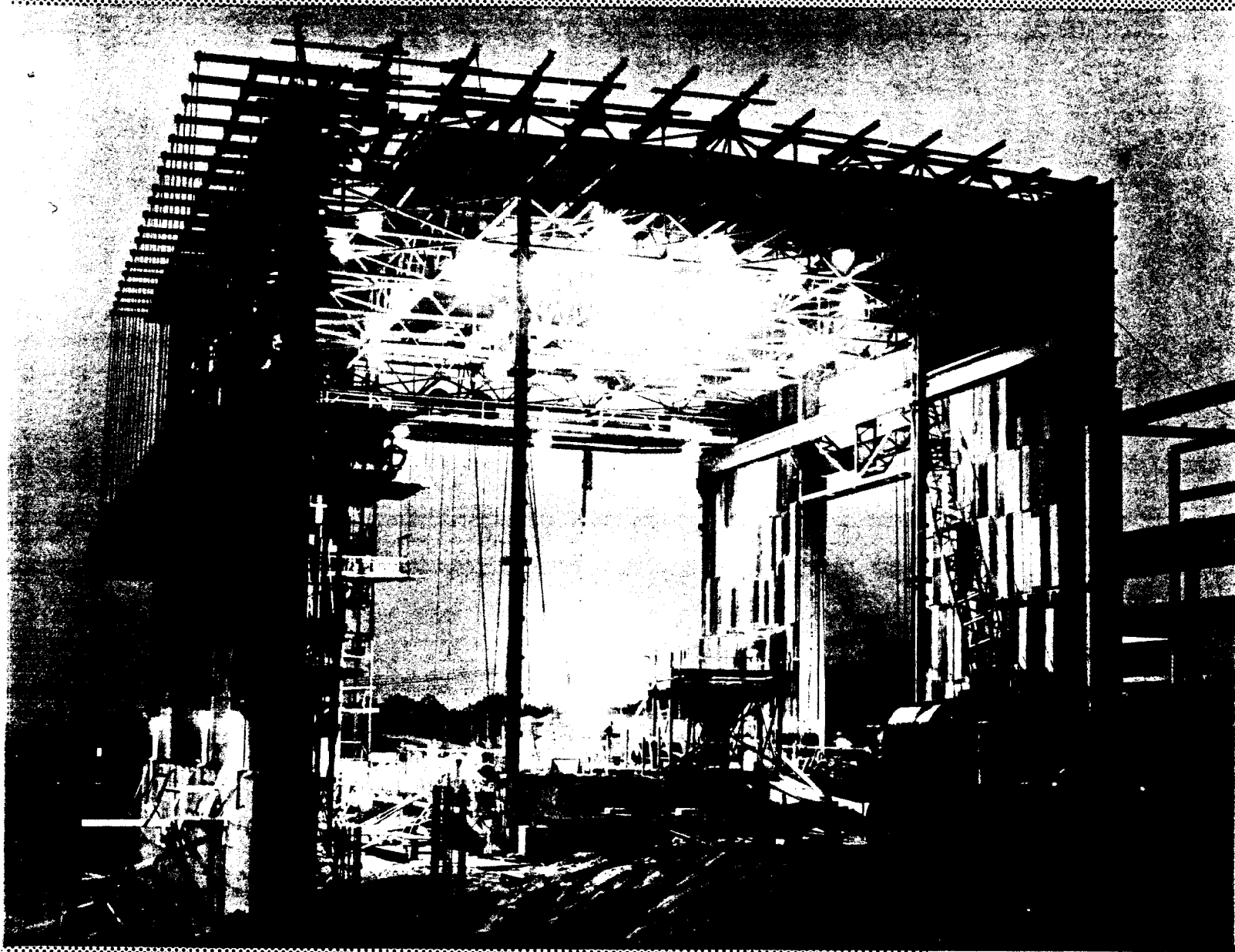
ISOTOPICS



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COVER: PILE PROGRESS

Night on Rutherford Hill

The Cosmotron

This is the second of a series of articles written for the layman, explaining some of the technical programs of the Laboratory and the meaning of the various terms used.

What is the mysterious binding force that holds the nucleus of the atom together? What is a meson? Are mesons part of the binding force? Can the particles of the atom be broken down into still smaller particles? Can matter be created from energy? These are a few of the questions that are still puzzling the scientists. Some of the answers may be obtained when Brookhaven National Laboratory's big new atom-smashing machine is in operation.

The construction of this revolutionary electronuclear machine, which was designed by a group of our scientists under the direction of Dr. M. Stanley Livingston, chairman of the Accelerator Project, has been approved by the U. S. Atomic Energy Commission and it is planned to complete it in three years. It will cost in the neighborhood of three million dollars and will be the highest energy accelerator planned for the eastern United States.

While the technical name of the machine is Proton-Synchroton, our scientists prefer to call it a Cosmotron -- "cosmo" for "cosmic ray" and "tron", a Greek ending that means "the agency for" -- as they expect to be able to artificially create cosmic rays. These are the rays of extremely high velocity and penetrating power that continuously bombard the earth. It is thought that these rays have their origin beyond the earth's atmosphere and may be produced by changes in form of atoms that are continuously taking place in interstellar space.

Existing cyclotrons, even the 184-inch diameter machine at Berkeley, will produce protons to only a few hundred million volts energy. This is far smaller than the energies of the cosmic rays. Higher energy cyclotrons could be built only at prohibitive costs. Electron accelerators, such as synchrotrons, have a physical limit (due to radiation loss) which will restrict energies to about 500 million volts. The Cosmotron will accelerate protons to three billion volts energy, which will overlap into the energy range of the primary cosmic rays.

About a year of design study and program planning by Dr. Livingston, Dr. Leland J. Haworth, Dr. George K. Green, Dr. John P. Blewett and all members of the Accelerator Project, was necessary before the plans were completed.

When the Cosmotron is in action protons produced in a Van de Graaff generator will be injected into a vacuum "donut" which will be enclosed in a huge magnet 75 feet in diameter. The protons, zooming around this almost circular "race track" will be accelerated each time around until they reach speeds of nearly 180,000 miles per sec-

ond, 96 percent of the speed of light. At this energy the mass will have increased to four times the normal proton mass, in effect creating matter from energy.

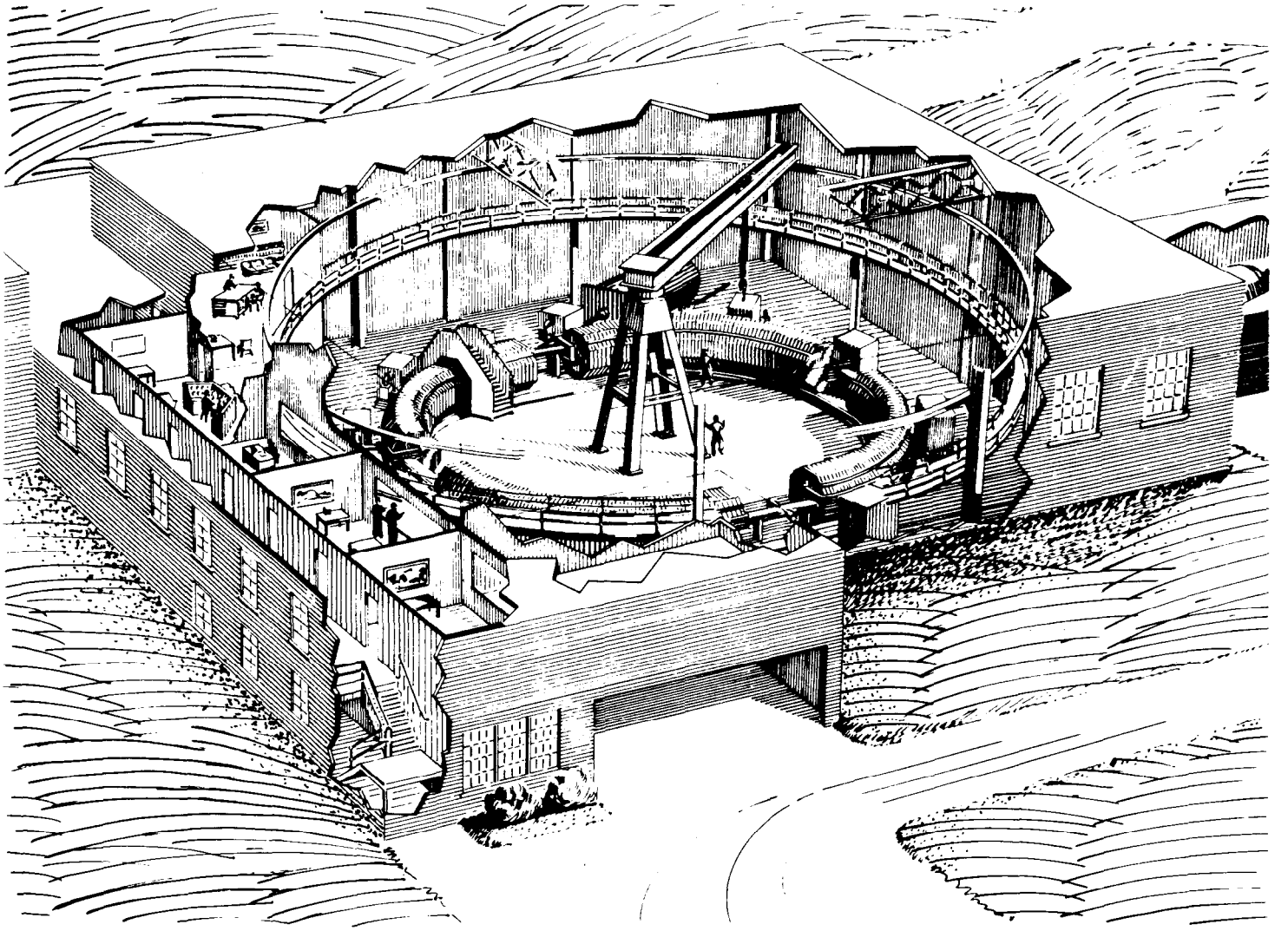
The magnetic field that will guide the protons on a circular course will be created by power derived from four huge generators with a peak capacity great enough to propel a battleship.

When the protons reach full speed they will be deflected against a target. This target may be the gas in one of Dr. Johnson's high-pressure cloud chambers, or blocks of graphite in which mesons would be produced.

The machine will be housed in a large laboratory to be located on the top of the hill near the bowling alleys. One of the features of the building will be a crane with one end supported in the center of the building and the other end travelling on a circular track.

The primary purpose of the Cosmotron, according to Dr. Livingston, is to produce protons of sufficient energy to duplicate the process of meson formation by cosmic rays. (The meson is one of the newest of the nuclear particles to be identified. Little is known about them but they have actually been found in cosmic rays.)

"One significant experiment would be to bombard protons at rest -- hydrogen nuclei -- with high energy protons from our new accelerator when it is completed," Dr. Livingston states. "In this collision between two elementary nuclear particles, we would expect to see one or more meson fragments emerge. From this we will learn much about the actual properties of nuclear force and it is possible that the knowledge gained will be front page news."



BROOKHAVEN'S 3 BILLION VOLT COSMOTRON: This 75 foot diameter ring-magnet will accelerate protons to cosmic ray energies as they revolve in the donut shaped vacuum chamber. The machine will be housed in a building approximately 120 feet square, to be erected on the hill near the bowling alleys. On an upper level will be the control rooms, observation lounge and the recording equipment used by the research scientists. The beam of 3 billion volt protons produced in the Cosmotron should create mesons, the most recently discovered fundamental nuclear particles.

Mildred Hirst

STAFF PROFILE

Mrs. Mildred L. Hirst, R.N., is the attractive young lady on duty weekdays at the Infirmary who assists in attending to the ills that beset us during working hours. Mildred was born in Toledo, Ohio, and attended DeSales College. After leaving college she spent three years training in nursing at Mercy Hospital, and upon graduation was employed by DuPont as an industrial nurse. She left DuPont to take a similar position with Libbey-Owens-Ford Glass company.

When World War II started, Mildred asked for leave of absence and joined the Navy with a rank of Lieutenant (j.g.). While stationed in the USN Hospital in Asbury Park, Mildred met Fred Hirst, a member of the Marine Corps who had returned from duty overseas. In a few weeks Mildred's plans to return to Libbey-Owens-Ford collapsed and she and Fred were married.

When they were released from the service they came to Patchogue, which is Fred's home, and as Mildred was anxious to pursue her profession she secured a position as nurse with the Atomic Energy Commission at Camp Upton. She was transferred to the Laboratory payroll on March 21, 1947.

Mildred and Fred live in Bellport. They are both fond of swimming, golf, and photography. Although Mildred admits that she enjoys gardening, she doesn't make the statement with a great deal of enthusiasm. It is probable that most of the weeding is done by Fred.

Henry Wright

STAFF PROFILE

Henry "Hank" Wright, illustrator in the Photography and Graphic Arts Group, is also one of the illustrators for this magazine. The BNL seal was designed by Hank, as well as the Isotopics masthead.

When Hank was first married he spent his spare time playing the drums for Bill McCune's orchestra in New York City and various towns in Westchester. Mrs. Wright finally prevailed upon Hank to convert his bass drum into a coffee table, which would seem to be a sure method of keeping him from "playing around" nights. Hank has not decided whether to make a scrap basket or a salad bowl out of the snare drum but he says that the cymbals have been made into ash trays.

Hank was born in New York City and studied at the N. Y. School of Fine and Applied Arts. He has had experience in bank vault design with the S. H. Kress Company, general art work and greeting card design with the National Printing Company, and was technical illustrator and industrial designer in the Development and Research Department of the Mergenthaler Linotype Company.

During the war Hank was employed in the engineering department of the General Aircraft Corporation and with Professor Otto Koppen of M.I.T. School of Aeronautics, illustrating new designs for transport aircraft.

Hank and Mrs. Wright live in Riverhead. They have two daughters, Carol, 9, and Harriet, 11.

SIDEWALK SUPERINTENDENTS

It's human to be curious. Just let a carpenter start work on a building, a mason start mixing cement, or a steam shovel start operating — in no time an interested audience gathers, each member wanting to know what goes on.

There is no question about the construction on Rutherford Hill. Everyone knows it is the Pile building, and its progress can be watched from almost any location on the site. But what are the carpenters doing to the Health Physics building? What is the little building being erected next to the Accelerator Project Laboratory? What makes the Biology Laboratory roof shine so brightly?

We wandered about the site recently asking questions about these various activities, and if you are as curious as we are, the answers will interest you.

The new coating on the Biology Laboratory roof is a product called Luma-Shield. It is an asphalt roofing material containing aluminum particles. Many of the Laboratory buildings have tar-paper roofs which were put on seven or eight years ago. The new coating is expected to fill in the pores of the old roofing and extend its usefulness.

The shafts recently added to the outside of the Health Physics buildings on Herschel Place and Harvard Street are not escape hatches as somebody has suggested. They are for dumbwaiters to carry area monitoring and personnel monitoring equipment to the second floor.

The small building next to the Accelerator Project Laboratory will house a motor generator set that will produce power to energize the magnet for the model of the Cosmotron being constructed.

Up on Yale Road in the hospital area four buildings are being altered; three for use as hospital wards and one for physical examinations.

The building on Rochester Street near Bell Avenue will be used by the Radiochemistry Laboratory when major alterations are completed.

The Electronics Division Calibration Laboratory will occupy the building at 16 Pennsylvania Avenue when it has been remodelled.

In the field opposite the cabinet shop at the western end of Brookhaven Avenue two meteorological towers are being erected – one 160 feet high, and the other 420 feet high. They will carry the gadgets our meteorologists use.

The large ball field at the corner of Upton Road and Princeton Avenue has had its face lifted in preparation for the opening of the softball season. The white stripes that recently appeared on all of the open fields were not gridiron markings as you might suppose, but a mixture of bug juice to trap the Japanese beetle when he emerges from the ground after his winter rest.

STAFF PROFILE __ Mary Dargan

The young lady who greets you with a smile as you enter the library is Miss Mary A. Dargan, circulation librarian. She is responsible for the records of all the books loaned and handles requests for books that must be obtained from other libraries. In addition to these duties, Mary arranges for photostatic copies of articles or pages of books and attends to the general appearance of the book shelves.

Mary was born in Port Washington. She graduated from Port Washington High School and entered Adelphi College at Garden City. After graduating from Adelphi, Mary spent a short period in the Treasury Department of the American Telephone and Telegraph Company, but left there to enlist in the Coast Guard as a SPAR when the war started. During the war Mary was located at St. Augustine, Florida. When she was released from the service, Mary entered the Columbia College School of Library Service and upon finishing her course was employed by the Laboratory.

As manager of the Adelphi Archery Team, Mary has had plenty of experience with bows and arrows and expects to take an active part in the Laboratory Archery Club. She lives in Everamem, the house in Bellport inhabited by ten young ladies of the Laboratory. There is so much going on there, according to Mary, that she only gets home to see her family in Port Washington about once every two weeks.

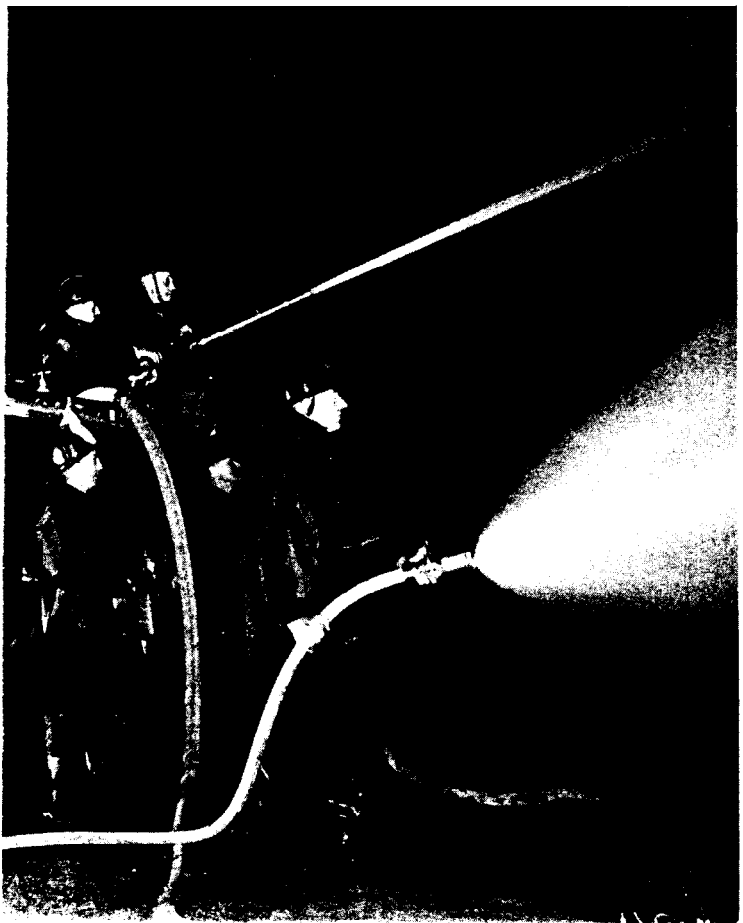
Mary is interested in all sports but she says she spends a good deal of her time sewing which is really more than a hobby since she makes all of her own clothes.

Brush fire fighting truck and equipment operated by crew from East House. (L. to R.) Charles Kollett, Salvatore Saulle, George Kramer, Owen Healey, Fred Peters and Walter Cerbek.

Firemen from East House extinguishing fire with mechani foam, one of the newest fire fighting methods. (L. to Ronald MacPhail, Donald Shepherd, Patrick Raimond, Orvi Meyer, Charles Corsi, William Pollack and Arthur Wiggi

Fire Departmer

West House fire fighters practicing with deck and fog nozzles under floodlights. On top of the truck, Harry Cox and Anthony Kreutz. Standing (L. to R.) Lewis Duffield, Wendel Marsh and John Tewes.



You won't find the Laboratory's firemen sitting around taking ticks off a Dalmatian coach dog, or playing pinochle in their shirtsleeves and suspenders. There isn't a Smokey Stover in the whole crew of 72. There can't be, because there's just too much to be done during the three shifts to permit any leisure save the standard half-hour recreation period.

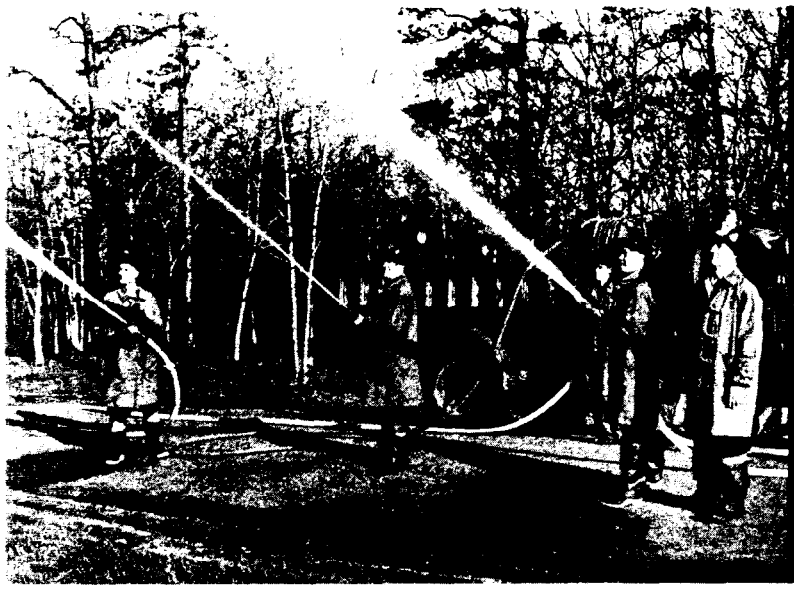
Ask any fireman and he'll tell you that Upton, New York could be a big headache. With 250 buildings, most of them of frame construction, spread over an area of more than 6,000 acres, the Laboratory has all the fire hazards present in a small city. In addition, the large stores of chemicals necessary for the type of research being done here increases the need for constant watchfulness and daily inspections.

Every hour of the day two inspectors are out visiting the Laboratory buildings checking nooks and crannys, seeing that fire extinguishers have been filled and tested, that fire buckets are in shape and that stand pipes and sprinkler systems are in operating condition.

Another patrol checks fire hydrants to see that they are not rusted, or, in the wintertime, frozen. When an inspector finds anything that might be serious, he reports at once to the Chief. In many cases the Chief calls in the Safety Engineer to make a special study.

Each fireman is required to pass a first aid test and spend many hours learning the various methods of handling hose. He studies all of the buildings, their exits and equipment, and attends lectures on fire fighting given by the Chief or by some visiting specialist.

In addition to the routine training, many books on fire fighting methods are available in the excellent library in the East House.



st House crew operating two, 1½ inch lines. Pumper to ich lines are hooked delivers 500 gallons of water per ute. (L. to R.) Kenneth Meyer, Philip Peters, James vham, William Kirklewski and Bernard Weber.

First aid training using automatic resuscitaxor. In rear donning rescue breathers, Joseph Rhodes and Briton Connel. Foreground (L. to R.) Francis Painter, Joseph Beglin, Herbert Zenker, Joseph DeNardo, Salvatore Rosato and Fred Schramm.

Group Profile

And in their spare time the firemen keep all of the fire fighting equipment in first class condition, ready to roll on a moment's notice and, of course, keep the fire houses, the bunk house, and the Fire Department offices clean.

By way of equipment the Laboratory Fire Department has some of the finest. Five 500-gallon trucks equipped with the latest innovations such as fog nozzles and mechanical foam. The Fire Department is also responsible for providing ambulance service. Two ambulances are in constant readiness. The newest one, painted white, is completely equipped and carries the finest resuscitator obtainable. A blue, converted Army Field ambulance is on call when the white one is out.

Despite the 35 miles of fire breaks that traverse and surround the site, any brush fire that breaks out in the vicinity is watched carefully to see that no spark jumps the gap. The Forest Ranger in the tower at Selden immediately notifies Chief Joseph C. Crawley or one of his deputies when a brush fire seems to be exposing the Laboratory site, and a quick trip is made to determine the possibility of a threat to our property. If it seems necessary, one of the two brush trucks equipped for fighting forest fires is sent out to assist the fire fighters from neighboring communities in extinguishing the blaze. The truck usually sent out is equipped with a two-way radio in order to be able to call the fire station for more water, as there are no hydrants in the woods and each truck must depend upon the water supply it can carry.

Chief Crawley, his two deputies, Walter F. Schmelz, and Arthur F. Rooney, and the 72 members of the Fire Department Group, provide 24-hour fire protection. The lack of fires within the area is ample testimony to their vigilance and to the efficiency of the system.

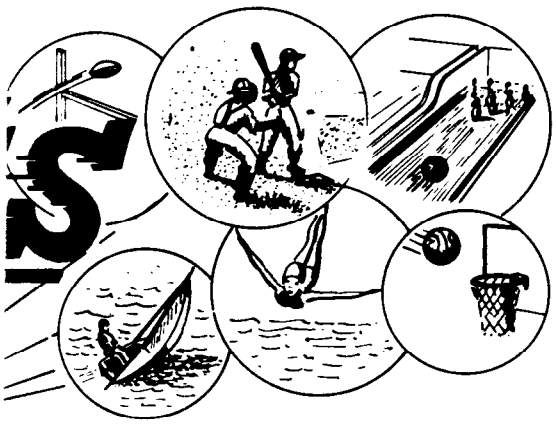
West House fire fighters drafting water from water hole using two 2½ inch lines hooked to 500 gallon pumper. (L. to R.) John Dietrich, Alfred Texeira, Myrton Kinney, Gilbert Anderson Anthony Kreutz and John Wulpern.

Spor

SOFT BALL: - Charles Watterson, Building and Grounds team, connects with ball catcher Saul Harris of Nuclear Reactor team was prepared to grab.

SOFT BALL: - Action in soft ball opener won by Building and Grounds team 4 to 2, Marvin Fox, Nuclear Reactor, gets set to lean on one. Catcher Wesley Keene, Building and Grounds team, hopes it's a strike.

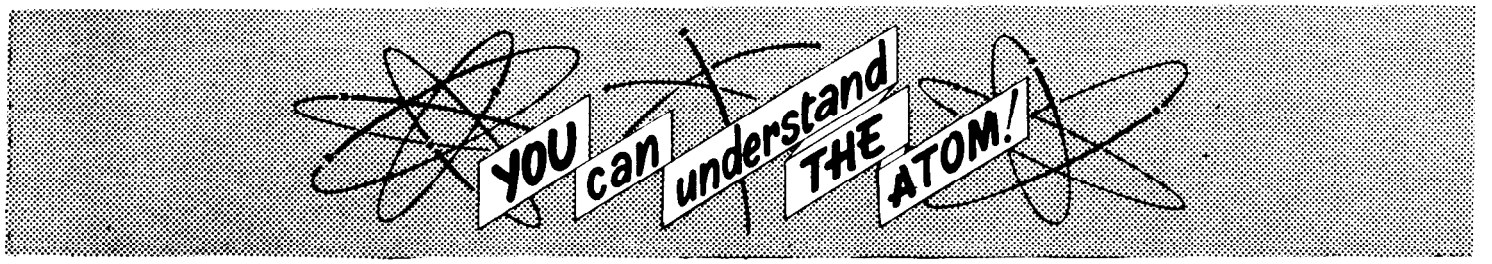
SOFT BALL: - Members of girl's soft ball teams at practice. Batter, Alice Gillman, catcher, Rose Ann Grattan. In background, kneeling, Barbara Carrol, Marjorie Morse and Julia Jacobs. Standing, Joan Simecek, Beatrice Wageli, Jennie Vivenzio, Viola Bowie and Florence Batvinis.



GOLF: - James G. Moore, Jr., runner-up congratulating Lewis Lento the winner of the first BNL Golf Tournament held at Island Hills Golf Club, Sayville, Saturday, May 22. Lento led his competitors with a low score of 83.

RIFLE AND PISTOL ASSOCIATION:- Instructor Macauley coaching members in use of rifle. (L. to R.) Marshall Shaw, Equen Meader, Macauley, Edward Nicholson and Jerry Tiller.

ARCHERY: - Upton Archers line up for photographer. (L. to R.) Edna Knispel, Jennie Vivenzio, Frances Cammaroto, Rose Ann Grattan, Geraldine Bishop, George Davison, Stephen Palmero Raymond Cammaroto and Allen Morpeth. Members practice daily in the field west of the gymnasium.



This is the third of a series of articles on atomic energy, written by R.J. Blakely, which were printed on the editorial page of The Des Moines Sunday Register.

Radium gives off alpha particles. What happens to radium after it gives off these alpha particles? It was discovered that a gas accumulates around radium. This gas was called radium emanation at first, and later *radon* when it was discovered to be a new element.

The atomic weight of radium is nearly 226. The atomic weight of the alpha particle is 4. The atomic weight of radon is 222. It became clear that the radium atom has a complicated structure.

When alpha particles are directed against a gold leaf, most of them zip through, some are slightly deflected, and a few bounce back. Since gold is a solid, with its atoms packed close together, this behavior of alpha particles indicates that the gold atom must contain a lot of empty space inside it.

* * *

Scientists reasoned that the atom is made up of two parts - a tiny *nucleus* which make up most of the mass of the atom, and the remainder which makes up most of its size.

This remainder is about 10,000 times as large as the nucleus. It is mostly empty space, but also contains electrons. The atom as a whole is neutral electrically; the electron is negative; therefore the nucleus must be positive.

This reasoning explained why some electrons can be stripped off (some are near the surface of the atom). It also explained the behavior of the alpha particle. (The alpha particle, being a nucleus, is tiny and can go through the "empty space" of other atoms. It is positive and is repelled when it strikes the nuclei of other atoms, because they also are positive.)

* * *

Experiments with other elements when bombarded with alpha particles revealed two facts:

(1) **The heavier the element, the more violently the alpha particles are repelled; and** (2) **the increase in violence is regular as one goes up the atomic series.**

From this the following was reasoned:

The more violently the alpha particle is repelled, the more positive charges must be in the nucleus which it strikes. And the more positive charges are in the nucleus, the more negative charges (that is, electrons) must be in the atom to balance it electrically.

By means of X-rays scientists counted the numbers of electrons in the shells of the atoms of the elements from the lightest to the heaviest. They found that the hydrogen atom has one electron around its nucleus, the helium atom has two, and so on from element to element by increases of one until uranium is reached whose atom has 92 electrons around its nucleus.

The measurement of the regular increase in the repelling power of the nuclei from the lightest to the heaviest coincided with the regular increase in the numbers of electrons around the nuclei from the lightest to the heaviest.

It was therefore concluded that the atomic number of an element - that is, its place in the atomic series - gives also the number of positive charges in the nucleus of its atom and the number of electrons around the nucleus.

* * *

Further study produced the theory that electrons are arranged in neat and predictable patterns around the nucleus. The electrons revolve around the nucleus the way the planets revolve around our sun. They are arranged in successive "shells" or orbits. Hydrogen has one shell, with one electron revolving in it. Helium has one shell with two electrons in it. Neon has two shells, with two electrons in the inner shell and eight in the outer. Argon has three shells, with two electrons in the inner, eight in the middle, and eight in the outer. And so on.

Disturbances of electrons in the outer shells of atoms produce light rays, which have long waves. Disturbances of electrons in the inner shells produce rays of short wave length, such as X-rays.

Some of the atoms have outer shells which are "completed" - that is, they have all the electrons which they can take. But others have outer shells which are not completed. These are the atoms which combine easily with other "uncompleted" atoms, because two atoms with incomplete outer shells can share the same electrons.

This theory explains much about the chemical and electrical behavior of the elements - how they can combine with each other, how they can be ionized, why certain ones have similar properties, etc. Our main interest in atomic energy, however, is not with the satellites of electrons but with the nucleus of the atom.

Scientists bombarded many elements with the alpha particles which radium emits, From all of them, when their nuclei were hit, the same particle came out - a hydrogen atom minus its electron - in other words, the nucleus of the hydrogen atom.

This particle was named the *proton* (from the Greek word meaning "first", because hydrogen is Number 1 in the atomic series). Thus it was reasoned (1) that the proton, in addition to being the nucleus of the hydrogen atom, is also one of the "building blocks" of the nuclei of all the other atoms; (2) that the proton has the positive charge which neutralizes the negative charge of one electron; (3) that there is one proton in the nucleus of each atom for each electron around the nucleus; and (4) that, therefore, the atomic number of an atom is also the number of protons in its nucleus.

The weight of the hydrogen nucleus, alias the proton, is 1. If the nucleus of an atom were composed only of protons, then the atomic weight of an atom would be equal to its atomic number (plus slight additions to account for the almost negligible weight of the electrons). However, this is true only of the hydrogen atom. The atomic weights of all the other elements are greater than the number of protons presumed to be in the nuclei of their atoms.

Obviously, then, there must be something in addition to the protons in their nuclei.

WEST GATE OPEN

More and more staff members are using the West Gate at the end of Princeton Avenue, which is open morning and evening.

The road leading from this gate intersects Rocky Point Road about midway between Middle Island and Yaphank. Staff members travelling to points west can save time by using this gate during the hours when traffic in and out of the Laboratory site is the heaviest.

STAFF PROFILE -- William Ware

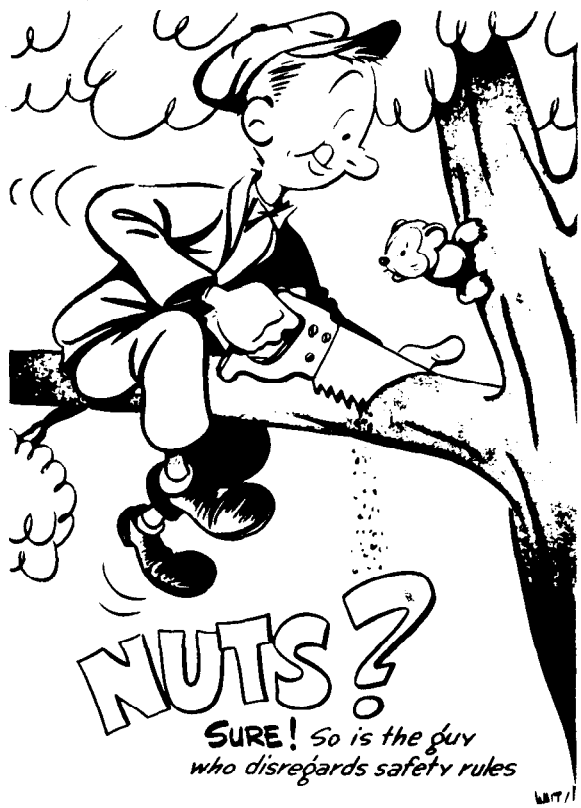
Twenty-seven months as an Aviation Cadet in the Royal Canadian Air Force in World War I, did not quench the patriotic fervor of William "Bill" Ware, supervisor of the Motor Vehicle Maintenance Section. When World War II started, Bill tried to enlist in the United States Air Corps but was rejected as over age. Not to be denied a part in the conflict, Bill enlisted in the Army as a private in November 1942.

After six months training in the U. S. Army Ordnance School in Nashville, Tennessee, Bill was stationed at Pine Camp, New York, as a Tank Training Instructor, and remained there for ten months. In May, 1943, he was detailed to Camp Upton as a Motor Sergeant and placed in charge of motor vehicle maintenance.

From 1943 until the present time, Bill has had the responsibility for the upkeep of all the motor vehicles at Upton, first as a sergeant in the Army, then as a civilian employee of the Army and after that as an employee of the Atomic Energy Commission. He was transferred to the Laboratory payroll when Associated Universities took over the site in 1947.

Born in Surrey, England, Bill was brought to America by his parents when he was four years old. He attended school in Philadelphia and between wars worked as a greens keeper and supervisor of maintenance and construction of golf courses.

Bill and Mrs. Ware live on Lakewood Street in Patchogue. Their son, William J. Ware, who is married and lives in Port Jefferson, is also employed here, as a typewriter repairman.



THEATRE GROUP ENTERTAINS LARGE AUDIENCES

with

'7 KEYS TO BALDPATE'

(The Cast)

Elijah Quimby.....Ed Nestor
Mrs. Quimby.....Wave Culver
William Hallowell Magee.....Ralph Kassner
John Bland.....Balfour Golden
Mary Norton.....Evelyn Jirak
Mrs. Rhodes.....Dorothy Lee
Peters, the Hermit.....Ed Nestor
Myra Thornhill.....Mina Kurz
Lou Max.....Martin Plotkin
Jim Cargan.....Tony Schaefer
Thomas Hayden.....Alf Christoffersen
Jiggs Kennedy.....Andy Underhill
A Policeman.....John Mikish
Owner of Baldpate.....Mike Lustgarten

* * *

More than 500 people attended the two evening performances of '7 Keys to Baldpate', presented by the Brookhaven Theatre Group on May 18 and 19. The play, a melodramatic farce by George M. Cohan which had a long run on Broadway, was a happy selection and the audiences seemed to enjoy the many amusing situations that occur during the course of the comedy. Watching one's friends or acquaintances perform added to the evening's enjoyment.

It was a good amateur performance and the members of the cast are to be congratulated on the results of their many weeks of rehearsal.

The play was directed by George Vaughan. Its presentation required the work of many people who did not appear in the spotlight — those who handled makeup, scenery, costumes, lighting, tickets, programs and other matters. All members of the Theatre Group are to be commended for their parts in the production.

Encouraged by the reception of their initial effort, the Theatre Group is planning to produce a musical comedy or operetta and all staff members who have histrionic leanings are invited to take part.