

MIGHTY MUSCLES IN Y-12 are seen in the above three photographs. At the left, shapes are formed using this 7,500-ton triple-acting hydraulic press. This press can be adapted to press forging and rubber-pack forming as

well as the conventional die pressing operation. In the center, the country's largest isostatic press is shown, which has a cavity of 60 inches in diameter and 60 inches deep. It operates with mineral oil as the pressing

fluid. At right, argon is used as the pressing medium in this 30-inch vessel. Pressures of 20,000 psi and temperatures near 1,000° C have been used for gas-pressure bonding and gas compaction of specialty materials.

New Attack Warning Goes Into Effect In Y-12 Today

Effective today, March 1, a new air attack warning is in effect in Y-12. Upon the determination by appropriate national authorities of the North American Air Defense Command that an actual attack against our country has been detected, the warning message will be disseminated over the Nation Warning System.

Immediately upon receipt of this message at the Plant Shift Superintendent's Office the attack warning signal will be broadcast over the plant public address system which will be followed by the sound of the plant air raid sirens.

The attack warning signal shall be a three-minute wavering tone on the plant air raid sirens.

The attack warning signal shall mean that an actual attack against this country has been detected and that protective action should be taken immediately. As a matter of national civil defense policy the attack warning signal shall be used for no other purposes and have no other meanings.

Upon receipt of the attack warning all operations not designated to remain operating will be immediately shut down. Plant personnel will have two choices: one, go immediately to the plant portals where they will proceed to off-plant shelter sites according to the personal plans of each employee; or, take refuge in the fallout shelters provided in the plant.

Vehicles May Be Used

Government vehicles, other than emergency and security units, may be authorized for use to evacuate the plant if such is found necessary. However, the return or surrender of these units is mandatory as soon as conditions permit.

The number of fall-out shelters in the plant will be increased from the present 2,560-man capacity to 4,800. These will be stocked with

federal and local supplies to provide austere living for their population for as long as 14 days. Many of these shelters will be non-public, however. A list of non-public as well as public shelters will be published in a later edition of the Bulletin.

Union Carbide shelter managers will be responsible for their respective shelters. A new assignment list of shelters and managers is now being prepared.

Shelter Instructions

What to do in case of an imminent attack? Certain action by the employee who takes shelter in the plant immediately will make his shelter stay a little more pleasant. First, take what clothing and wraps that are available to you. Take with you what food, candy and personal items that you may have in your desk or locker. Also secure whatever electric lanterns and flashlights that are available, including extra batteries.

Remove the flashlights, gamma meters, radios and megaphones from the cabinets at the radiation assembly stations and take them with you to the shelter. Take with you all the portable radios that are available in the plant regardless of the net frequency. Some shelter areas are equipped with facilities where portable radios can be connected to outside antennas to provide for shelter-to-shelter communication.

Take with you all the gamma meters that are available in cars, offices, laboratories, etc. These meters will monitor the fallout intensity within the shelter.

Normal operations will be resumed as rapidly as possible following an all-clear signal.

New procedures, plant signs, and a list of shelter-area managers will be released shortly.

Safety Awards Distribution Set Beginning Tuesday

Y-12ers will collect their cumulative safety awards next week for all of 1966. The awards will be distributed at all of the portals.

Hours for distribution are 2 p.m. until 5 p.m. Tuesday, March 7. On Wednesday the awards will be passed out from 6:30 a.m. until 8 a.m. . . . and again on Wednesday from 2 p.m. until 5 p.m. On Thursday, March 9, final distribution will be made from 6:30 a.m. until 8.

The \$11 awards are for a cumulation of 8,854,536 man - hours worked (or earned) during 1966. The first safe period was from October 6, 1965 that extended through February 14 for a period of 3,640,209 man-hours. The others were as follows: March 4 through April 25, 1,524,662 man-hours; June 3 through August 14, 1,982,312 man-hours; and August 23 through October 18, 1,707,353 man-hours.

An employee's safety award will be at the portal indicated on his selection card.

The 24 selections include many fine items . . . picnic equipment, home appliances, and sporting goods.

SAFETY SCOREBOARD

The Y-12 Plant Has Operated 87 Days Or 2,371,000 Man-Hours (Unofficial Estimate) Through February 26 Without A Disabling Injury A Job Well Done Is Also Safely Done

Y-12 Story — Part II

Major Fabrication Methods In Y-12 Utilize Large Variety Of Machines

(Editor's Note: This is the second in a series of articles on the functions of Y-12. This talk was presented by R. F. Hibbs, Plant Superintendent, for the U.S. Army Nuclear Science Seminar held in Oak Ridge during last summer.)

Most of the fabrication work done at Y-12 is accomplished through the use of portions of one or more of three basic systems: a wrought products cycle, a cast products cycle, and a powder products cycle.

The wrought cycle in Y-12 is generally characterized first by the formation of compacts by such unit operations as vacuum casting, arc melting, electron-beam melting, or powder compaction. These compacts are worked into mill products such as sheet and plate, extrusions, or forgings which are then formed to shape and approximate dimensions. The shapes are machined to final dimensions, certified, and possibly consolidated into subassemblies.

Typical examples of the types of equipment used include the 6-inch, four-high reversing mill. This machine is a very stiff mill having 4.5 million pounds of separating force, but it can be operated with a mill crew of only three people because a closed-circuit television is utilized for control purposes. A uranium billet weighing over two tons can be handled by this facility. This primary mill is complemented by a 42-inch, four-high finishing mill and a 42-inch Sendzimir cluster mill for foil rolling.

Several Large Presses

Shapes are formed using a 7,500-ton triple-acting hydraulic press. This press can be adapted to press forging and rubber-pack forming as well as the conventional die pressing operation. In addition to

this press, Y-12 is equipped with several Hydrofoam presses ranging in size from eight to 32 inches. Other die presses, extrusion presses, water die, and explosive forming equipment are also available.

Machining wrought shapes utilizes some of the large variety of over 1,500 machine tools that are located in over 50 well-lighted, environmentally controlled shops. A continuing program of tool upgrading and replacement provides the Plant with one of the most modern up-to-date machining facilities in the Atomic Energy Commission Complex. Typical of this equipment is the 120-inch vertical turret lathe. This machine is tracer controlled by a precision-hardened steel template, while the three-axis milling machine is numerically controlled through the use of computer - produced instructions contained on plastic tape. The large boring or turning machine is also numerically controlled. Following machining, dimensional inspection is required.

Nine Inspection Areas

The physical facilities at Y-12 for dimensional measurement comprise nine inspection areas totaling approximately 28,000 square feet of floor space. A typical area is specially designed and constructed to maintain temperature and humidity levels consistent with accuracy requirements. Airlocks at entrances form thermal and dust barriers.

Precision measuring equipment ranges from small hand tools for routine bench work to manual, semiautomatic, or tape-controlled measuring machines. Manually controlled measuring machines are used routinely for the dimensional



Technical Goes A-Valentining

Ray Galford Sweeps Y-12 Bowling Tournament With 1814!

Y-12 Beavers Cop Volleyball First Half Championship

The Volleyball League wound up its first half last week . . . with Y-12's Beavers taking top standings with 43 games won, only one lost.

Action on Court A last week began as the ORNL Set-Ups battled four games from the hides of Y-12's Eagles, 15-5, 15-10, 15-5, and 15-3. The K-25 Sports kayoed the Tigercats 15-3, 15-7, 15-5 and 17-15. ORNL's Ecobums won four from the Charley Browns, 15-7, 15-5, 15-1, and 15-4.

On Court B, the Old Men ousted the Beagles from the first two games, 15-10, 15-12 and returned to take game four, 15-10. The Beagles won number three 15-12. Y-12's Beavers belted the Neophytes 15-5, 15-4, and 15-1. The ORNL Scrubs shellacked the Mix-Ups 15-3, 15-6, 15-0 and 15-10.

Final 1st Half Standings:

Team	W	L
Beavers, Y-12	43	1
Set-Ups, ORNL	36	8
Scrubs, ORNL	33	11
K-25 Sports	30	14
Ecobums, ORNL	30	14
Old Men, ORNL	25	19
Tigercats, ORNL	18	26
Beagles, ORNL	16	28
Eagles, Y-12	13	31
Mix-Ups, K-25	11	33
Charley Browns, ORNL	7	37
Neophytes, Y-12	2	42

Mixed League Hits Final Home Stretch

Two teams moved up in the Mixed Bowling League last week to tie with another for second standings. The Twisters and Mustangs both took three points from opponents . . . the Novices and Alley Cats respectively. The Hits & Misses shared two points with the Rollers, as did the Goofers with the Roses 'N Thorns.

Spence Ferguson, Twisters, swept male honors all the way, rolling singles of 203 scratch, 235 handicap . . . series of 561 and 657. Irene Carmack, Mustangs, accounted for two scratch games of 189 . . . two handicap games of 231 . . . series of 512 scratch, 638 handicap.

The Mustangs were best on singles . . . 686 scratch, 811 handicap . . . and scratch series of 1883. The Twisters rolled high handicap series of 2281.

League standings follow.

Team	W	L
Hits & Misses	20	12
Goofers	18	14
Twisters	18	14
Mustangs	18	14
Rollers	17	15
Roses 'N Thorns	16	16
Alley Cats	13	19
Novices	8	24

The Bulletin

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OAK RIDGE POWER SQUADRON receives its charter . . . 20 years ago. From left are G. J. Angele, Admiral Hymen G. Rickover (then a Naval captain), W. C. Tunnell, Fred Franklin, first commander of the squadron, and A. H. Patterson. The squadron is planning a 20th-anniversary celebration in Oak Ridge Saturday, March 4.

Oak Ridge Power Squadron Readies For Big 20th-Anniversary Celebration

Twenty years of water under the dam . . . so to speak. That's the way the Oak Ridge Power Squadron is looking at their big anniversary celebration slated Saturday, March 4, at the Elk's Club.

Gus Angele, Engineering Mechanics, recently shared some exciting memories of the past 20 years with the ORPS. Twenty years later . . . with approximately 2,500 residents of the area properly educated in the safe way of handling boats and being around the water (these piloting instructions have all been free, too!), and much more.

The local Power Squadron has helped organize squadrons in

Kingsport, Johnson City, Knoxville, Asheville, North Carolina, and Huntsville, Alabama.

In 1954 the local squadron was awarded the "Bell" at the annual meeting for the best training program in the country . . . having taken three awards for training aides on previous occasions.

The Oak Ridge units has had the highest percentage of members holding advanced grades in both districts to which they have been assigned for the past 20 years.

Under the courses offered free to the public are such things as equipment, rules of the road, seamanship, safety at sea, the compass and other aids to navigation, charts and manners and customs on the waterways.

Engineering's Angele was present back in March, 1947, when Admiral Hyman G. Rickover (then a Navy captain) was in town for the formal presentation of the Power Squadron's charter. Fred Franklin was named the first commander of the squadron, A. H. Patterson, a former Y-12er, was the second commander; and Gus assumed the helm in the squadron's third year.

Now, the squadron is paging its former members, graduates, and students for the gala 20-year celebration.

Details on Saturday's clambake may be obtained from Angele, on extension 3-5033, or at his Oak Ridge home telephone 482-2656.

Playboy-Has Beens Still Classic Tops

The Playboys and Has Beens still fight it out for top standings in the Classic Bowling League. Both took three-point wins last week, the 'Boys from the Swingsters, the Has Beens from the Eightballs.

Four points went to the Rebels around the Rippers, the Cubs over the Smelters and the All Stars past the Screwballs. Other three-point wins were gleaned by the Tigers over the Eagles, the Splinters over the Bumpers and the Markers over the Wasps.

Jack McLendon, Has Beens, rolled a 235 scratch game, 258 handicap single. Don Troutman, Markers, marked a 571 scratch, 652 handicap series.

The Has Beens rolled high singles . . . 919 scratch, 1066 handicap . . . while the Rebels captured high series scores of 2614 scratch, 2941 handicap.

Team	W	L
Playboys	25	11
Has Beens	25	11
Rebels	22½	13½
Swingsters	22	14
Tigers	21½	14½
Eagles	20	16
Splinters	20	16
Cubs	20	16
Markers	19½	16½
Wasps	17	19
Bumpers	17	19
All Stars	16	20
Screwballs	11	25
Eightballs	11	25
Rippers	10½	25½
Smelters	10	26

Rifle Club Sponsors Course For Youngsters

The Anderson County Junior Rifle Club will hold its Spring class in rifle marksmanship beginning tomorrow, Thursday, March 2. The classes will be held from 6:30 until 8:30 p.m., at the Club House located in Clinton City Park and will continue through the month of March.

Rifles, ammo and targets are all furnished. The age limit is 10-18 years . . . and the total cost is only \$3.50. Both boys and girls are welcome.

Further information, or reserva-

Recreation



calendar

Sunday, March 5

SKEET TOURNAMENT: 1 p.m., Oak Ridge Sportsman's Association Range.

Monday, March 6

BOWLING: 5:45 p.m., C League, Ark Lanes.

TABLE TENNIS: 7 p.m. Wildcat's Den.

PHYSICAL FITNESS: (For Women) 7 p.m., Oak Ridge High School Girls' Gym.

BASKETBALL: Beginning 6:30 p.m., Oak Ridge High School Gymnasium. Radioisotopes vs. Collegians; Celtics vs. Has Beens; Bombers vs. B bar R's.

Tuesday, March 7

PHYSICAL FITNESS: (For Men), 7:30 p.m., Oak Ridge High School Gym.

Wednesday, March 8

BASKETBALL: Beginning 6:30 p.m., Jefferson Junior High School Gym. Bat Boys vs. Braves; Ecobums vs. Collegians; VIP's vs. Has Beens.

BADMINTON: 7:30 p.m., Jefferson Junior High School Gym.

BOWLING: Mixed League, 8 p.m., Ark Lanes.

Thursday, March 9

BOWLING: 5:45 p.m., Classic League, Ark Lanes.

VOLLEYBALL: Beginning 6:30 p.m., Robertsville Junior High Gym. Court A: Old Men vs. K-25 Sports; Charley Brown's vs. Eagles; Mix-Ups vs. Set-Ups. Court B: Beavers vs. Tigercats; Scrubs vs. Beagles; Neophytes vs. Ecobums.

Basketball Gets In Only 3 Licks

Only three games made the history books last week as men on the hardwood in the Basketball League observed the holiday.

Two Y-12 Braves collided in the first action, as the Collegians tore into the Braves, 40 to 38. Both teams started cold. It was almost four minutes into the game before Jim Batch hit a foul shot . . . as the deliberate slow-down type ball game got underway. Action picked up, however, and it wasn't until the closing minutes before the Collegians' Eddie McFadden helped settle the issue.

The ORNL Bombers lowered the boom on the Ecobums 53 to 44 in Wednesday's second game. This was a very good and close game until the last minute and half of action, when three or four steals took the Ecobums out of the action. Jim Shoemaker and Ray Nabors accounted for 11 each of the Bombers winning tally.

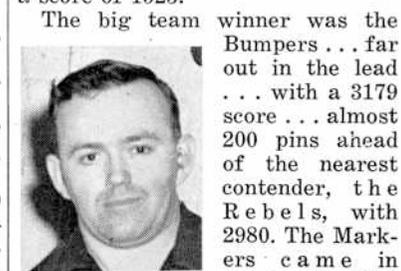
The VIP's again showed their strength last week, this time against the Bat Boys . . . 77 to 34. The VIP's in the sizzling hands of Jim Carter and Bob Compton (who both scored 21 points) burned up the courts as all five players on the winning squad got in the double figure scoring column. Romeo Greene led the charge of the "light" brigade with 18 points.

Team	W	L
VIP's, ORNL	6	0
Bombers, ORNL	5	1
Radioisotopes, ORNL	4	1
B bar R's, ORNL	3	2
Ecobums, ORNL	3	3
Collegians, Y-12	2	3
Braves, Y-12	1	4
Celtics, K-25	1	4
Has Beens, ORNL	1	4
Bat Boys, Y-12	1	5

tions, may be had through R. L. Lines, extension 3-6924, or Oak Ridge 483-0288.

Louie Anfinson Takes Women Hi's With A 1523 Total

Ray Galford bounced into the magic circle this past weekend to take the Y-12 Bowling Tournament, totaling a rollicking 1814 All Events scratch score. Louie Anfinson took women's all events with a score of 1523.



Galford

The big team winner was the Bumpers . . . far out in the lead . . . with a 3179 score . . . almost 200 pins ahead of the nearest contender, the Rebels, with 2980. The Markers came in third with 2920 and the HiLifers fourth with 2873. (The Bumpers team consists of Ray Galford, Red Halsey, J. W. Markland, C. W. Craven and Elmer Green.)

Men's Doubles went to J. D. Davis and P. W. Bullard with a 1273 handicap total. J. W., Red Halsey and Galford rolled a 1179 scratch double combination!

Louie Anfinson and Bobbie Hill rolled scratch highs in women's doubles with 962 . . . Irene Carmack and Mildred Morris posted handicap highs of 1191.

Galford, as expected, took the men's singles with a 618 scratch. Fred Fox rolled high handicap singles of 680.

Women's singles went to Anfinson, 529 scratch; and Libby Scates, 659 handicap.

Elmer Johnson and Edith Duckworth rolled high in Mixed Doubles, 1012 scratch. Handicap highs were rolled by Barbara and Bill Hackett, who posted an 1186.

Elmer Green racked up All Events handicap honors with a 1904.

The Rebels were handicap winners in team rolling with a 2980 (although the Bumpers took this honor . . . they can take only one trophy).

Female bowlers in handicap scoring saw Libby Scates fire an 1824 handicap score; Irene Carmack a 1787; and Edith Duckworth a 1750.

Handicap Winners

Men, taking the "scratch" in handicap rolling, after Fred Fox, were Tom Watts, 670; Jack McLendon, 669; R. B. Ellison, 663; L. E. Sikes, 657; Ray Galford, 645; C. W. Craven, 639; H. D. Whitehead, 637; Elmer Green, 636; Jay Holzknecht, 632; Jack Spears, 625; R. G. Marlar, 623; W. F. May, 621; Otto Briscoe, 620; Walt Sherrod, 620; C. C. Roberts, 620; Bill Grubb, 615; Frank Adams, 612; and Dick Huber, 612.

Winning Men's Doubles in the money count, also, (following the Davis-Bullard pair) were Pappas-Briscoe, 1257; Red Halsey-Galford, 1254; Grubb - Householder, 1242; Forrester - Pryor, 1237; Groppe-Groppe, 1222; Tibbatts-Holtzknecht, 1221; Scates - McGinnis, 1213; Ferguson - Johnson, 1208; Boyd-Bartholomew, 1206; Cooper-Hatmaker, 1206.

Softball Teams Urged To Enter Names Now!

Softball teams are being urged to enter plant competition not later than April 1. Teams are needed to determine the number of fields that will be needed this summer.

Enter your team with the Recreation Department now. Roster is not needed at present. That number is 3-7109.

Dark spots are danger spots.



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Automobile Injuries Claim Lives Of Two Well-Known, Young Y-12ers

Mr. Leon Presley Baird, Material Procurement Department, died Tuesday, February 21, in Nashville, from injuries received in an accident Friday, February 17.

A native of LaFollette, Mr. Baird came to Y-12 July 25, 1960, after serving in the U.S. Navy. He was a graduate of Oak Ridge High School, and had done undergraduate work at the University of Tennessee extension.



Mr. Baird

Survivors include his wife, Mrs. Mary Holloway Baird, 506 Michigan Avenue, Oak Ridge; parents, Mr. and Mrs. Sherman L. Baird, Oak Ridge; sister, Carolyn, Nashville; grandmother, Mrs. Sampson McGhee, LaFollette; grandfather, J. Frank Baird, Jacksboro, and several aunts and uncles in Campbell County.

Funeral services were held Thursday, 2 p.m., at the Robertsville Baptist Church, with the Reverend W. C. Summar officiating. Interment followed in the Oak Ridge Memorial Park.

The act Mr. Baird was performing at the time of the accident, warning traffic of another accident on an icy bridge, was the subject of the sermon at the Belmont Heights Baptist Church, Nashville, Sunday night. The Reverend Robert J. Norman entitled his sermon, "Are You Your Brother's Keeper."

Sincere sympathy is extended the Baird family.

Physics' Miller Leads This Week's Seminar

P. D. Miller, Oak Ridge National Laboratory Physics Division, will conduct this week's seminar. His subject will be "Search for the Electric Dipole Moment of the Neutron."

The seminar is set for Friday, March 3, at 3:15 p.m. in the East Auditorium, ORNL's 4500N building.

'Golden Coach' Is Last AAUW Film For Season

"The Golden Coach" will be the final offering in the AAUE Foreign Film Series for this season. The Italian drama, in color and with English dialogue, will be shown this coming Sunday, March 5, at 7 and 9 p.m. at Jefferson Junior High School. Set amid the magnificent scenery of a South American province in the days of the 18th century viceroys, the opulently-costumed film offers a dazzling star performance by the celebrated actress Anna Magnani. The screen play is based on a work by Proper Merimee and has excellent direction and photography, with background music by Vivaldi

An automobile crash has claimed the life of a Y-12er. Mr. Charles E. Murray, Buildings, Grounds and Maintenance Department, died Wednesday, February 15, near Oliver Springs.

Mr. Murray came to Y-12 July 3, 1951, after working on his family farm, with Stone and Neering Corporation, and the Hosiery Mills, Harri man. He was a veteran of the U.S. Army, serving from 1943 until 1945.



Mr. Murray

Survivors include his wife, Mrs. Ruth Campbell Murray, at home at Route 2, Oliver Springs; children, Brenda, Carolyn, Cindy, Charles Jr., V. J. and Weldie, at home; Mrs. Carolyn Coleman, Alexandria, Virginia; one grandchild; parents, Mr. and Mrs. Vander Murray, Harriman; sisters, Mrs. K. D. Collins, Mrs. Fred Campbell, Mrs. Clifford Nelson, all of Oliver Springs; Mrs. James Woods, Harriman; Mrs. Frank Bunch, Harbor City, California; brothers, Gene, Harriman; Billy and Robert, Hapeville, Georgia.

Funeral services were held at 2 p.m., Saturday, February 18, at Sharp's Funeral Chapel, Oliver Springs. Interment followed in the New Fairview Cemetery.

Sincere sympathy is extended the Murray family.

Noted Trio In Concert Saturday In Oak Ridge

The Balsam-Kroll-Heifetz Trio will play Saturday, March 4, in the Oak Ridge Playhouse, in the final concert of the Oak Ridge Civic Music Association's 1966-67 Chamber Series. Curtain time is 8:15 p.m.

The members of the trio, pianist Artur Balsam, violinist William Kroll, and cellist Benar Heifetz have been leaders in the field of chamber music for four decades. Their outstanding achievement is their unique balance of instruments: three voices blended into but one, yet each bearing an unmistakable stamp of its own. Educated in the United States and Europe, their careers have been in teaching as well as the concert stage, both here and abroad.

The program they have selected includes Brahms; Trio in C Major; Casella's Siciliana and Burlesca; and Schubert's E flat Major Trio. Single tickets will be available at the box office before the concert.

performed by the Rome Symphony Orchestra.

Single admission tickets at 75 cents will be available at the door before each performance Sunday.

A minute for safety is better than a month for repairs.

Y-12 Story (Part II)

Continued from Page 1
inspection of both large and small components.

In addition, semiautomatic sweep gauges and template tracing machines are available. Finally, numerically controlled inspection devices, such as the unusual six-coordinate measuring machine may be used.

Electronic Computers

Control of Y-12's dimensional-measurement operations and associated equipment is achieved by systematic production-control and data-analysis programs. Calibration of gauges and machines traceable to the National Bureau of Standards is a continuing program. Monitor parts, as anonymous dimensional standards, are introduced into inspection areas to ensure consistent quality inspection. Standards data, as well as data obtained from component inspections, are statistically analyzed on high-speed electronic computers, and reports of measurement quality are furnished to operations and quality control supervision.

The second major flow sheet is the cast products cycle. This system is characterized by casting the materials of interest to an approximate shape using vacuum, arc, or sand casting methods. The shapes thus produced are then machined, inspected and assembled. Typical is one of the several induction-heated vacuum casters used to cast shapes or billets of depleted uranium, uranium alloys, or one of the more common materials. Arc-casting facilities contain auxiliary equipment and furnaces for use with various metals. Y-12 also has the technology and equipment of melting metals by the levitation technique, in which metals are both supported and melted by a high-frequency electromagnetic field. This technique is ideally suited for such low-density metals as beryllium and aluminum where extreme purity is a requirement. A variety of special furnaces are also available for metal and ceramic sintering, brazing, and heat treating. Altogether, Y-12 has over 300 furnaces in operation.

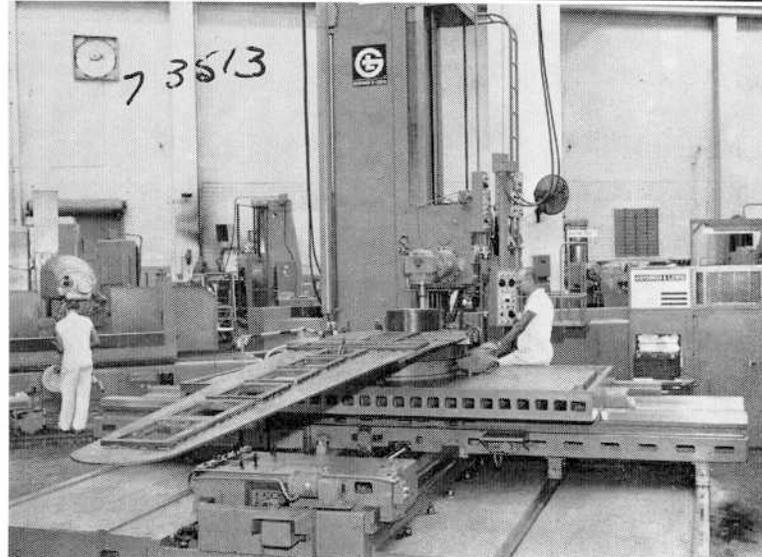
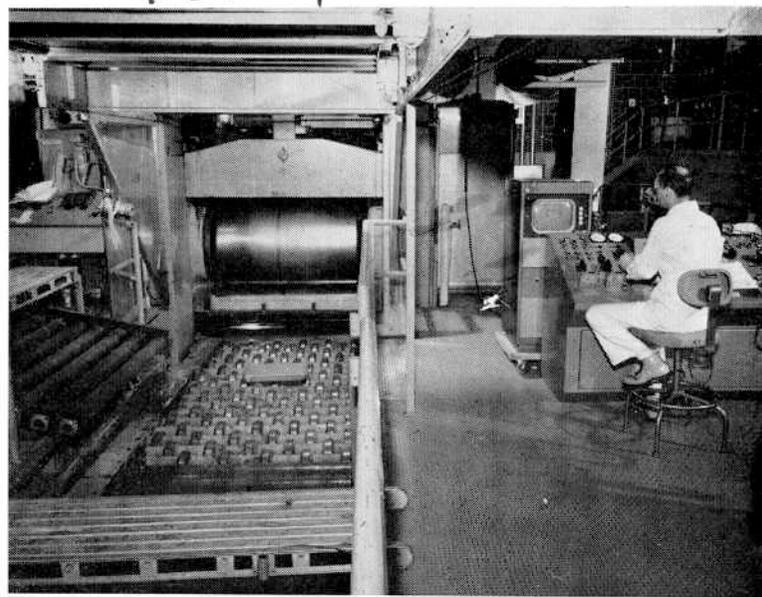
Additional Laboratories

During the review of the wrought product stream, examples of machining and dimensional measurement were mentioned. The chemical composition of the Plant products frequently is a specification. In addition to product analysis, Y-12 has laboratories for isotopic, special samples, and toxic materials analysis. Product analysis laboratories are provided with the environment, equipment and personnel to perform routine chemical, X-ray, and spectrochemical analyses for product certification, materials accountability, process control, and materials acceptance. The isotopic analysis laboratories utilize such equipment as the semi-automatic mass spectrometers.

Mass spectrometry is one of the pioneer analytical tools of Y-12. Isotopic analyses of many elements are routinely performed. In addition to mass spectrometry, mass spectrography is used to determine impurities in the parts-per-billion range in various inorganic materials.

The need for chemical-purity certification and product-acceptance analysis has necessitated unusual capabilities in the field of emission spectrometry. In addition to an automatic 1.5-meter, direct-reading spectrograph, Y-12 has a specially designed 2-meter, 52-channel, direct-reading instrument for production control. Also, an automated 1.5-meter spectrograph is used for the analysis of microgram quantities of airborne particulates.

X-ray spectrometry has become



A FOUR-HIGH REVERSING ROLLING mill in Y-12, in the top photograph, is a very stiff mill having 4.5 million pounds of separating force, but it can be operated with a mill crew of only three people because of closed circuit television utilized for control purposes. In the lower photograph a large boring or turning machine is numerically controlled. It is one of the more than 1,500 machine tools utilized in Y-12.

one of the most versatile of the modern analytical techniques. Two 100-kv X-ray spectrometers are used to determine, by X-ray emission, more than 40 elements between atomic numbers 20 and 92. These elements are in a variety of matrices and at concentration levels from a few parts per million to several per cent. X-ray absorption analyses of aqueous or organic solutions are performed with modified X-ray diffraction equipment. Y-12's major analytical equipment includes over 60 spectrometers, spectrographs, X-ray diffraction units, analyzers and chromatographs.

The third major fabrication flow sheet is the powder products cycle. This system is characterized by the compaction of various metal and ceramic powders to billets or approximate shapes using isotatic or die pressing. The compacts thus formed are frequently sintered in vacuum, inert gas, or hydrogen at high temperatures, then subsequently machined, inspected, and assembled.

Country's Biggest Press

The country's largest isostatic press is in Y-12. The cavity is 60 inches in diameter and 60 inches deep and operates with mineral oil as the pressing fluid. In addition to this unit, three other isostats are available — one 16 inches in diameter and two 30 inches in diameter. These vessels operate at maximum conditions of 30,000 psi and 150°C. The 30-inch vessel has been modified to operate as a gas autoclave using argon as the pressing medium. Pressures of 20,000 psi and temperatures near 1000°C have been used for gas pressure bonding and gas compaction of specialty materials.

Y-12's high-temperature capabilities complement the high pressures of the isostatic presses to sinter compacted powders, a com-

bination that produces denser ceramic and refractory products. The high-temperature induction furnace is used to sinter compacts of refractory materials and utilizes a highly purified hydrogen atmosphere. The susceptor in this furnace was made at Y-12 and is probably the largest pure tungsten component ever fabricated.

Unusual Capability

Another unusual and significant pressing capability has been achieved by employing the Plant's ability to prepare large tungsten dies to extend the range of high-temperature presses. The high-temperature die press supplements the isostatic-pressing technique in the fabrication of powder metallurgy and refractory ceramic products.

Some of the machining equipment has been mentioned as well as some of the dimensional and analytical measurement facilities. At this point it might be well to comment on Y-12's physical testing capabilities for certifying the structural integrity of the Plant's products. Radiation testing provides a program of product certification comprising such major testing techniques as X-ray radiography, isotope radiography, mass-distribution measurement, scintilligraphy, and microradiography.

2,000,000 Volt X-Ray

A two-million-volt X-ray unit is used to detect internal voids and inclusions in materials up to 10 inches in thickness with a sensitivity of 1.5 per cent. Low-voltage X-ray generators with energies as low as 5 kv are used to radiograph extremely thin plastics and other low-density materials to determine internal voids and inclusions. Twenty-three other X-ray units ranging from 50 to 1,000 kv are in service.

(Next: Some Components and Services Provided by Y-12.)