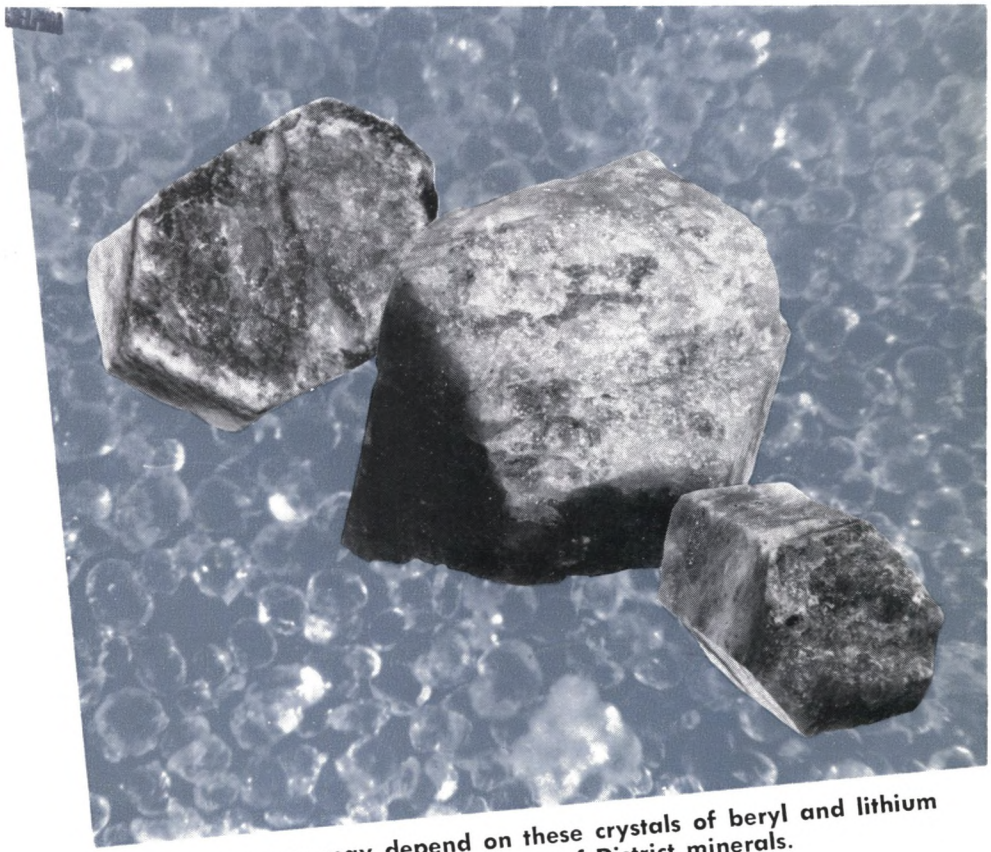
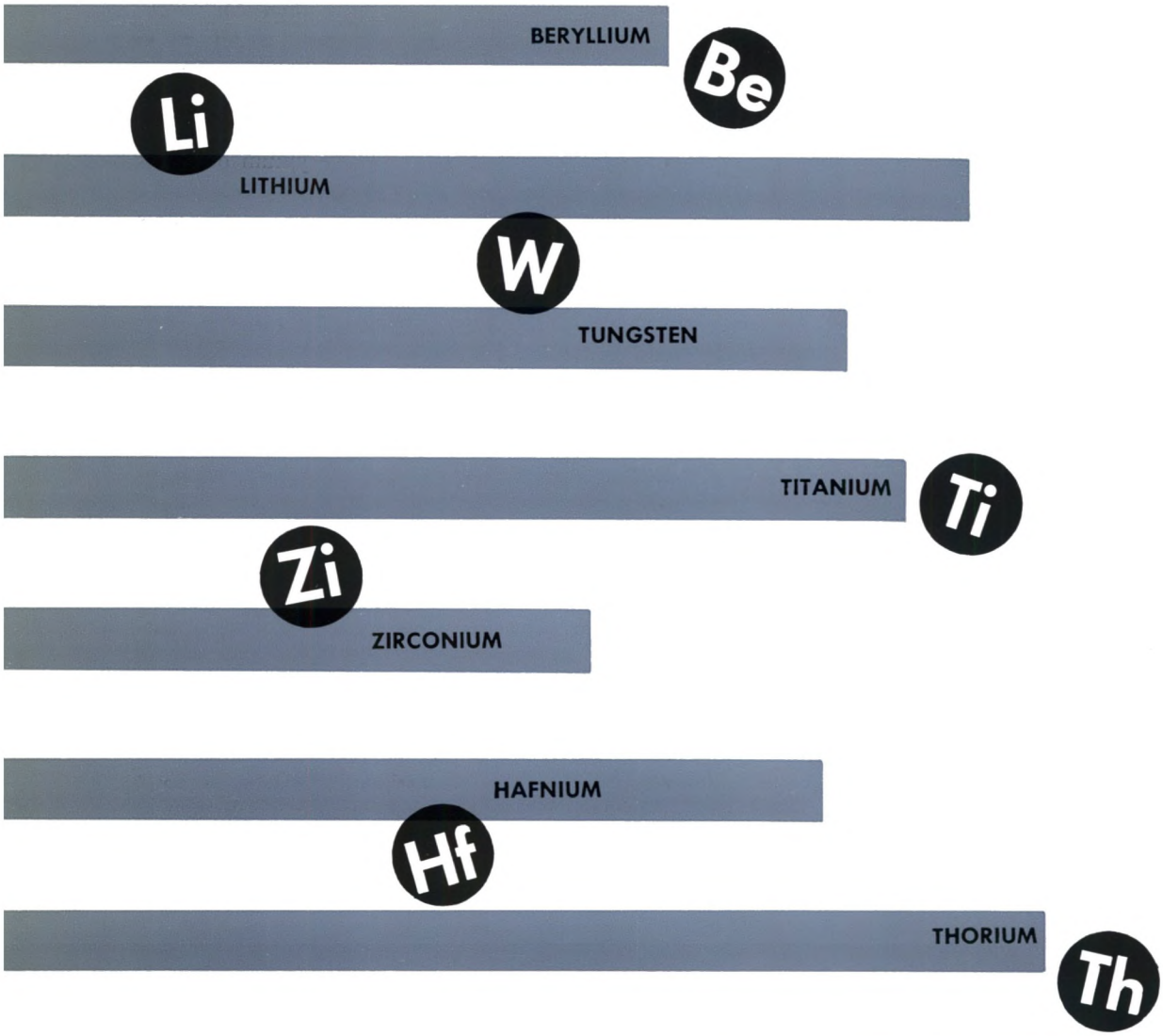
MONTHLY REVIEW



Man-in-space may depend on these crystals of beryl and lithium perchlorate—products of District minerals.

FEDERAL RESERVE BANK OF RICHMOND SEPTEMBER 1959



District Minerals = Space Age Metals

The pressure for new materials and products to meet space age needs spotlights the District's mineral reserves of beryl, spodumene, ilmenite, rutile, hubnerite, zircon, and monazite. These strange-sounding minerals are the sources of the elemental metals of beryllium, lithium, titanium, tungsten, zirconium, hafnium, thorium, and the "rare earths." These names, too, are unfamiliar to most persons outside of the metallurgical field; yet from these basic elements stem some of today's most unusual materials and products.

In terms of tonnage and dollar value of production, however, these District mineral ores cannot be classed among those of major commercial significance. In fact, in the over-all economy of the District, these mineral ores play a minor role, and, of course, cannot be compared with the economic value of fuel minerals But most of these little-known metals, either in a pure state or in combination, are vital to the defense of this country.

The District's role in the fascinating area of these so-called "space age" metals is comparatively new. Although District mining goes back to the discovery of gold in the 18th century, the monazite sands of South Carolina were not dredged until 1955, and zircon did not enter the District picture

until two years later. The titanium ore—rutile—was mined in small quantities as early as 1903 in Virginia, but demand for the District's material did not really develop until the post-World-War-II period when the first pure titanium was produced commercially. As recently as 1957, a large facility was opened in Virginia to recover both rutile and ilmenite—the other titanium ore.

The tungsten story is similar—until 1942 nearly all domestic mining was confined to the western states, the first United States ore having been discovered in 1904 in California. But the soaring demand for this metal plus the cutoff of imports during World War II caused a nationwide search for this ore. The discovery of the rich mineral deposit in North Carolina—the largest known vein in the United States—was of great strategic value. The importance of lithium in the history of District metals is also a recent development. The Kings Mountain, N. C., spodumene mine was not opened until 1943; District production of lithium ores prior to this time was insignificant.

This recent awakening of interest in the District's mineral deposits is a direct result of the new discoveries in mining and processing techniques and in the versatility of these wondrous metals. Almost overnight these little-known metals have come of age, for this new age calls for new materials to meet its needs.

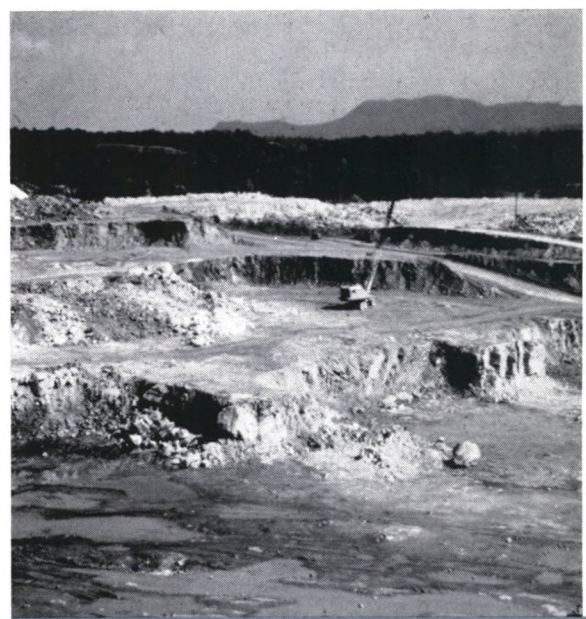
LIGHTWEIGHT AND STRONG Jets, missiles, and rockets require structural materials that are lightweight, yet tough enough to withstand the stress and pressure of space travel. Three District metals—titanium, beryllium, and lithium—are particularly adaptable to meet these requirements.

Commercially pure titanium and its alloys, because of their strength and weight saving, are used extensively by the aircraft industry. The new commercial jet transports—the Boeing 707, the Convair 880, the Douglas DC-8, and the Lockheed Electra—contain much titanium in their engines, structural members, and auxiliary equipment. The Martin SeaMaster, the Navy's jet attack seaplane, contains more than 500 titanium parts; its pure titanium center beam is probably one of the largest pieces ever fabricated. The high strength-to-weight ratio of this metal is also illustrated by the use of titanium missile bottles which must withstand internal pressure of 5,000 pounds. A titanium bottle actually weighs 40% less than a satisfactory bottle made of aluminum; yet titanium is 60% heavier than aluminum.

Beryllium is about one-fifth the weight of steel and almost as tough; yet its commercial applications have been limited because it is difficult to process and to fabricate. Consequently, this metal has been the target for concentrated research which has paid off handsomely. Two months ago it was announced that a huge beryllium dish—80 inches in diameter—had been made for use in the capsule that may carry man into space. This successful fabrication of beryllium will undoubtedly be a tremendous stimulus to increased use of this structural metal. Lithium, the lightest of all metals, is also challenging the serious attention of researchers in metallurgical circles. It is now being used primarily as an alloying agent for aluminum and magnesium.

DEFIES 5,000°F In addition to being lightweight and tough, these three metals retain their strength at high temperatures—another condition necessary for space travel materials. For example, beryllium stays strong at temperatures above 1,000°F. In fact, this metal's property to resist heat combined with the property of lightness was the reason beryllium was chosen as the metal most suitable for the re-entry shield of the man-in-space capsule.

Other District metals with high-temperature resistance, yet not coupled with the characteristic of lightness, are equally important in the structural material field. Thorium, almost twice as heavy as iron, is an ideal complement to magnesium—the latter provides the light weight and thorium, the property to resist heat. Magnesium-



The open-pit mine at Kings Mountain, North Carolina, is the country's largest source of spodumene—the primary lithium ore.

Earth laden with the minerals of monazite, zircon, ilmenite, and rutile is scooped up by dredging machines in South Carolina.

Exploration for minerals is an important part of mining. Shown are earth samples being separated to determine mineral content.

thorium alloys were used in the construction of the Bomarc interceptor missile and in the Vanguard launching satellite rocket.

Tungsten is also an important alloying agent. Because this metal adds hardness and heat resistance to steel at high temperatures, tungsten-steels have been used to make high-speed cutting tools and precision instruments since World War I. Tungsten has the highest melting point of any metal known to man and is today's only possibility for materials that must withstand temperatures above 5,000°F. Still in the testing stage is a spun-tungsten rocket nozzle. Developments not yet on a commercial scale point to the possible use of zirconium in the high-temperature field.

The rapidly growing electronics industry also requires heat-resistant materials. The pure metals of tungsten and titanium and, to a lesser extent, zirconium, hafnium, thorium, and the "rare earths"—a group of fifteen separate metals—are used in this capacity.

COMBAT CORROSION The corrosion resistant property of two of the metals—zirconium and titanium—strengthens their use as a material for equipment and parts that must withstand strong chemicals. This ability of titanium makes it suitable for equipment used in the chemical and process industries; it is resistant to most acids—the principal exceptions are high concentrations of sulfuric, phosphoric, and hydrochloric acids. Its special resistance to chlorides makes titanium a strong candidate for parts that must be immersed in sea water. Zirconium also has marine applications. Widespread use of this material was made in the construction of the recently launched atomic-powered ships.

NUCLEAR PROPERTIES Five metals needed for the utilization of atomic energy are found in the District. Because of their neutron-absorption properties, zirconium, beryllium, hafnium, and the "rare earths" are used as reflectors, moderators, or control rods in nuclear reactors. In its research program, the Atomic Energy Commission has been using lithium hydroxide. This fact was revealed in 1957, but the amount purchased remains secret. Contracts with industry, however, were discontinued in early 1959. Highly active lithium chemicals are being tested as an oxidizer in guided missile and rocket high-energy propellants. Thorium is being tested as a reactor fuel. At the 1958 Geneva Peace Conference, thorium fuel cycles were presented as being most promising. It has been said that thorium could contribute in the future more energy than the total of the world's coal and oil reserves.

MORE ABOUT DISTRICT ORES It is evident that the chemical and physical properties of these metals make them adaptable for varied uses. Because of their use in many strategic materials and products and because of the country's dependence on foreign sources of some raw materials, the District ore deposits are of tremendous importance.

District states are among the top domestic pro-

Improved techniques in metalworking—such as used in airtight welding of titanium—increase the use of District minerals.

Space-age uses of District metals include titanium pressure bottles which control the flow of propellant in the Atlas missile.

ducers of some of these unfamiliar ores and are the potential top producers of the others. In 1957, the latest year for which complete comparative state statistics are available, North Carolina ranked first in the nation in tungsten production; South Carolina ranked second in zirconium production and first for the monazite concentrates —the source for thorium and the "rare earths"; Virginia was third in the production of titanium.

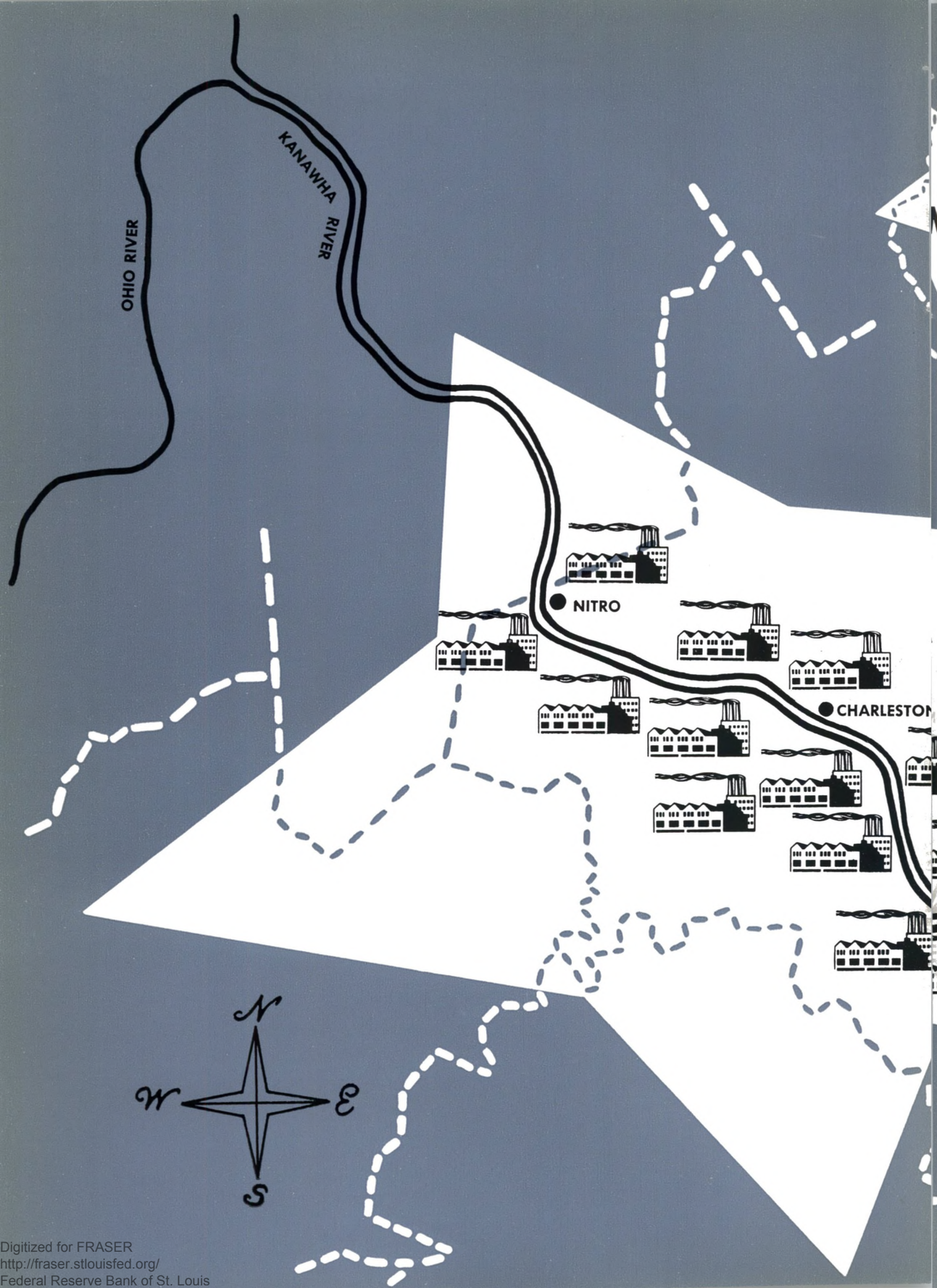
Comparative state ranks of mineral production are not available for lithium. It is reasonable to assume, however, that the District was the nation's top producer since over 90% of the known reserves in the United States are found in the tin-spodumene belt—an area 2 miles wide and 25 miles long between Gaffney, S. C., and Lincolnton, N. C.

Beryl is included in the list of the District's space age minerals, not because of the District's present rank as a producer, but because of its tremendous potential as a major producer. The tin-spodumene belt of the Carolinas contains 92% of the known domestic beryl reserves. This source, however, is untapped because of the lack of an economical method of separating beryl from the ore in this area. Research in recovery methods is being stepped up since 90% of U. S. requirements must be imported and since the 1958 consumption of beryl topped any previous year.

The year 1958 was a tough one, however, for some of these space age minerals. The Hamme mine in North Carolina was closed in mid-1958, causing a 30% reduction from 1957 in North Carolina tungsten production. This was a result of a continuing industry decline started in late 1956 by the suspension of Government stockpile purchasing. Mining operations in the Horse Creek area of South Carolina were also discontinued in 1958, hitting hard at this state's production of monazite and zircon concentrates. Virginia's production of the titanium ores remained steady in 1958 in contrast to a national decline. The company now mining lithium-producing ores in North Carolina reported no slowdown in 1958 and plans for increased expenditures for research. Another corporation now processing Canadian ore at its North Carolina plant announced in late-August that it will start large-scale mining of its North Carolina spodumene deposits early next year.

OUTLOOK Companies engaged in mining and in metalworking continue to pour millions of dollars into research and development programs. Just last month a giant chemical firm announced plans for a metallurgical research center in Baltimore on high-temperature metals; specifically mentioned were titanium, zirconium, and tungsten. Government agencies are also intensifying their research on these ores and their metals.

Recent technological advances have opened the door to important new applications for these metals and their alloys. Future improvements in methods of mining, refining, machining, and welding, and the resulting lower costs should increase further the use of these space age minerals for commercial as well as military needs.



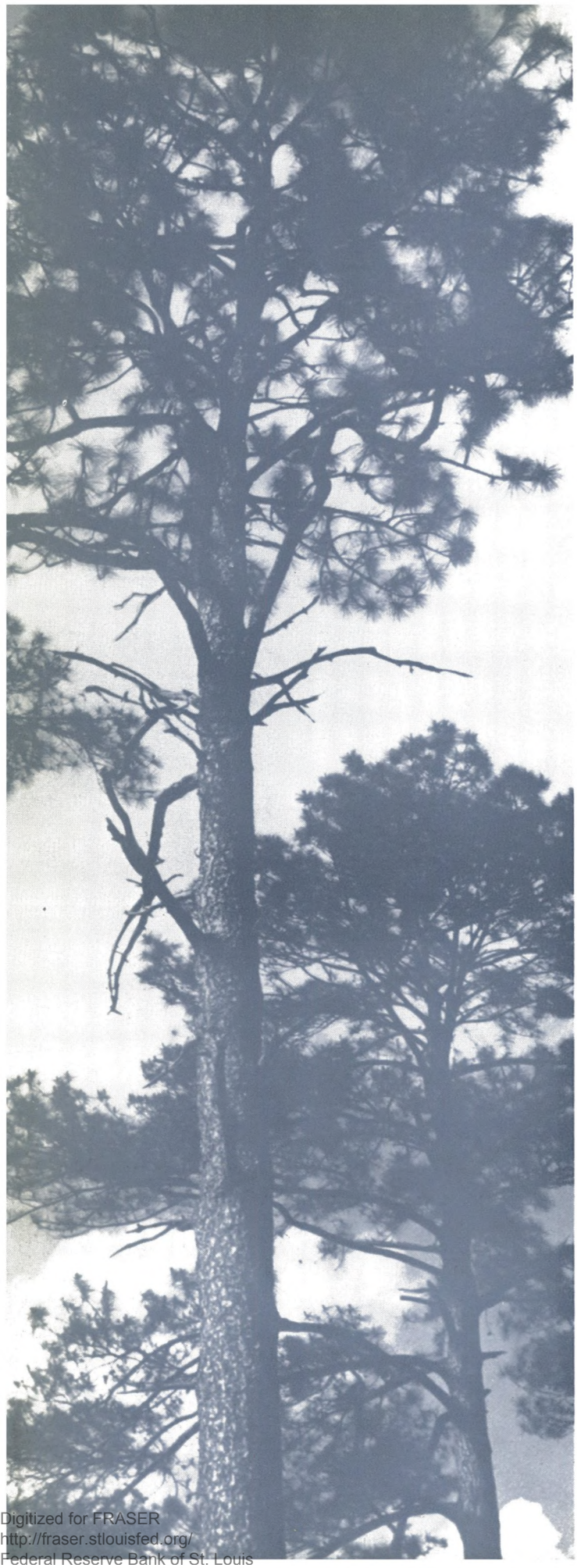
MONTHLY REVIEW looks at . . .

THE VALLEY OF THE GIANTS

Take plentiful supplies of coal, natural gas, salt, limestone, and water and you're bound to end up with a chemical industry.

The Kanawha Valley in West Virginia is bountifully endowed with these natural resources, and it has one of the nation's greatest concentrations of chemical plants. They are giant-size plants that stretch along the Kanawha River for 55 miles from Gauley Bridge at the head of the river to Nitro a few miles west of Charleston. Their importance to wage earners in the Valley area is obvious since they provide employment to some 15,000 persons, about 60% of total manufacturing employment in this area.

The Kanawha Valley is nationally important also as a coal mining center and as a producer of stone, clay, and glass and of metals and metal products. Four major railroads and modern highways serve the area, and low-cost bulk haulage is provided by the fast-increasing number of tow-boats on the Kanawha River.



Our Forested Acres

Tall, stately pines. . .moss-draped cypress. . . hemlock. . .spruce and balsam fir. . .giant oaks and yellow poplars. . .gum. . .hickory. . .maple. . . beech. . .ash and black walnut. These are but a few of the many kinds of trees that can be found in the District's 60-million-acre forest tract—an expanse that covers three-fifths of the entire land area and contains about 132 billion board feet of wood in lumber-size trees alone.

A RENEWABLE RESOURCE Our forests helped build this five-state area, and today's forested acres continue to play a major role in its economic development. Consider some of the products that are made of wood—houses and furniture, fence posts, telephone poles, tool handles and railroad ties, baseball bats and tennis rackets, barrels and boxes. Consider, too, the many products that are made from wood. With the help of the scientist, wood is now transformed into such things as paper, rayon, cellophane, plastics, lacquers, glycerine, and a host of other items.

The importance of wood may be indicated in another way. The principal wood-using industries—lumber and wood products, furniture, pulp and paper—employ nearly 185,000 persons in the Fifth District, slightly more than one-eighth of the total manufacturing employment. Their combined annual payrolls total some $582 million, or one-tenth of the entire manufacturing payroll. Thousands of other District residents from whose timberlands wood and wood products are harvested also share in the economic return from the timber crop. Farmers in general, for example, receive 5 cents of each dollar of cash farm income from the sale of forest products. And there are still others who earn all or part of their incomes from businesses which are directly or indirectly dependent upon the forests.

To help meet the needs of wood-using industries, owners of District timberlands are cutting 6 billion board feet of sawtimber annually. Roughly three-fourths of this cut consists of sawlogs. Pulpwood comprises 10% of the total and veneer logs and bolts another 5%. The remainder goes into such products as poles and piling, cooperage logs and bolts, mine timbers, and the like. Even with this large cut, the District is growing 35% more sawtimber each year than it is cutting. However, the growth-cut relationship of softwoods, which are preferred for most products, is not nearly as favorable as that of hardwoods.

Above: Sawlogs—one-time forest giants—head for the mills to be processed into lumber and many other wood products.

Above: Fire destroys around 50 million board feet of Fifth District timber each year and future tree crops as well.

From the timber harvest in an average year, the District's sawmills produce around 4.4 billion board feet of lumber—enough to build some 440,000 five-room frame houses. The annual pulpwood production in Virginia and the Carolinas alone will yield enough wood pulp to produce around 2.9 million tons of paper.

TOMORROW'S DEMAND With the rapidly increasing population, it is obvious that the need for timber will be far greater in years to come than today. The question is: How much more? The United States Forest Service in its most recent appraisal of the timber situation and outlook has estimated that timber requirements will be so high by the end of the century that the nation's timber output will need to be from 70% to 120% larger than it is now.

What, then, will be the demand for timber produced in this five-state area? The District's forests are now growing more than one-fifth of the nation's annual growth of eastern softwoods and the same proportion of all eastern hardwoods. None of the western species—Douglas fir and ponderosa pine, for example—are grown here. If the District's share of the nation's yearly growth of both eastern species continues at its present level, then on the basis of the Forest Service's lower estimate, sawtimber growth of all species combined will need to be stepped up 50% by the year 2000. Greatest demand—a 90% increase over present day growth—will be in softwoods. Demand for District hardwoods will be only 16% greater.

On the other hand, if the Forest Service's upper estimate of future demand proves true, total de-

Below: Each year state and industry nurseries make millions of seedlings available to landowners for only a small fee.

mand for District timber will double in the next forty years. Growth of softwoods will need to be two and one-half times the present rate. Hardwood growth will need to be increased 50%.

FOREST OWNERSHIP Most of the District's commercial forest land is owned by individuals—farmers, businessmen, professional people, retired folk, and other private citizens. These persons hold title to 81 out of each 100 timbered acres. Another 10 of each 100 acres is owned by 4,250 forest industries. The remaining forest land—about 9% of the total—is in the hands of Federal, state, and local governments.

There are some 768,000 private forest owners in the District—four-fifths of them farmers. Most private owners—85% of the total, in fact—have small forests of less than 100 acres each. Most of these are farm and nonfarm woodlands. Owners of forest lands ranging in size from 100 to 500 acres account for another 14%. The remaining 1% of all private ownerships ranges from 500 to over 50,000 acres and for the most part is in the hands of the forest industries. It would seem that the key to our future timber supply is held by the District farmers and their fellow citizens who have small forest holdings.

OUR NATIONAL FORESTS Most of the government-owned forest lands are in national forests. These forests now cover some 3.7 million District acres and are under the supervision of the United States Forest Service. They were set aside for two purposes: to protect the watersheds of the larger streams and to demonstrate that depleted forest areas could be returned to production of timber. Legislation was later passed to permit the national forests to be used for hunting, fishing, camping, and other recreational activities. Though owned by the government, the timber in these forests is cut by private companies who bid for it competitively and do their logging under supervision of government foresters.

MEETING FUTURE NEEDS To meet the increasing demand for timber, a lot more forestry will have to be practiced on a lot more acres than at present. This simple formula has been advocated: (1) protect woodlands from fire and other destructive agents; (2) plant tree seedlings; and (3) harvest timber as a crop.

Fire, insects, and disease are our forests' worst enemies. Each year they destroy 210 million board feet of timber in this five-state area. These losses combined with those from other causes, such as weather and animals, kill a total of 360 million board feet of timber annually. The sawtimber killed is only a portion of the total loss, however. Tomorrow's crops—the young trees, seedlings, and seeds buried in the ground—are also destroyed. And scorched trees become easy prey for attack by insects and disease.

Many years are required to grow sawtimber. On the average, it takes 45 to 50 years to grow a 12-inch pine tree. And eleven 12-inch pines are required to produce 1,000 board feet of lumber. For every 12-inch pine needed forty years hence, however, at least 9 pine seedlings must be planted now. This means that 100 pine seedlings need to be established now to produce 1,000 board feet of pine timber by the year 2000.

Much progress has been made in recent years in planting trees. Tree planting in the District, in fact, has more than tripled during the past five years and last year reached a total of some 203,000 acres. This means that around 203 million seedlings were planted. If most of these seedlings were pine—and they probably were—they can be expected to yield around 2 billion board feet of timber within the next 45 to 50 years. This is still far short of the number of seedlings that need to be established each year to produce the annual requirements anticipated by the year 2000.

Harvesting trees as a crop may be thought of as one of the A B C's of forest conservation or of good forest management. The woodland owner who makes repeated harvests instead of ruthlessly cutting all trees at one time finds that he increases the productivity of his timberland. Repeated harvesting of trees, in fact, is much like tobacco harvesting—tobacco has to be primed several times and there have to be several barnings because all the leaves don't mature at the same time.

The good tree farmer also harvests his trees by following a program of systematic improvement cuttings. The disease- and insect-infested trees and the storm-damaged, fire-scarred, and crooked trees are of little value. They yield few, if any, good sawlogs. Yet they choke off entirely, or compete with, the seedlings and young trees that would produce if given a chance.

The woodland owner who takes the steps necessary to bring his forested acres into full production will be helping to produce timber for tomorrow. For some owners, this would mean tapping a new source of income.

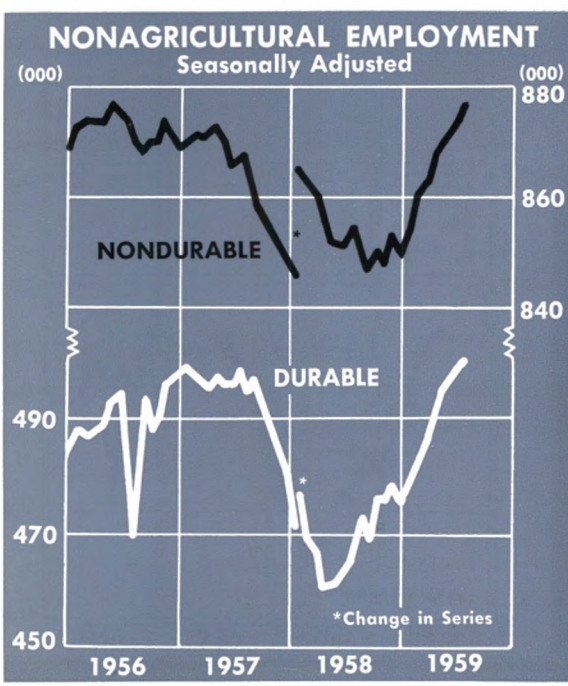
The Fifth District

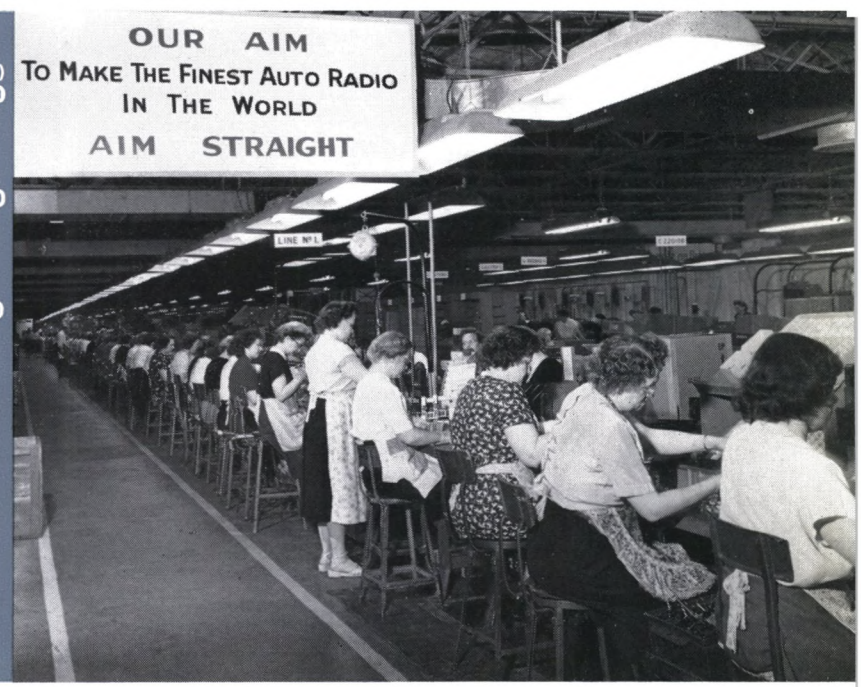
Discussion of business conditions during the past month has been dominated by consideration of the effects of the steel strike and conjecture about its settlement. As this is written, the meetings of union and management representatives have been suspended until September 2. By that date the strike will have run for 50 days. It will then be the second longest of the five major steel strikes held since World War II, and it will be only five days short of the record 55-day strike in 1952.

The impact of the strike in the Fifth District has been most pronounced in Baltimore where the shutdowns of Bethlehem's gigantic Sparrows Point plant and other steel makers put over 28,000 employees out of work. In addition, over 3,700 workers in other industries in the Baltimore area were idle at the end of August as a consequence of the steel strike. Secondary unemployment has been severe also in areas of West Virginia where over 8,200 workers, including 6,700 miners, 600 workers in metal (other than steel) industries, and more than 200 transportation employees, were out of work at mid-August because of the strike. About 8,000 steelworkers, mainly in mills in the Wheeling area (Fourth District), have been on strike in the Mountain State. Roanoke is another area in the District in which strike-induced layoffs materialized quickly and to a serious extent. A U. S. Steel plant there has had between 500 and 600 workers idle, and the Norfolk & Western Railway shops have laid off almost 900 employees.

INTERRUPTED RISE The effects in the District of the steel strike were quickly registered in a decline in the number of man-hours worked in manufacturing industries in July. This was the first break in the continuity of the 1959 uptrend in this significant indicator of manufacturing activity. The drop of 1.5% in this seasonally adjusted statistical series stemmed largely from the shutdowns in the primary metals industry. Man-hours in this industry, after allowance for seasonal influences, were down almost 20% from the preceding month of June. Transportation equipment and lumber and wood products were the only other durable goods industries to record declines in man-hours worked in July. Fabricated metal products, machinery, furniture, and the stone, clay, and glass industry all showed fairly substantial gains. Reductions in man-hours worked in the food, apparel, and paper industries were sufficient to pull down slightly the total for the nondurable goods sector. On a state basis, declines in Mary-

Employment in District durable goods industries has shown a more rapid rise from the recession low than has nondurable employment.





land and the Carolinas more than offset gains made in Virginia and West Virginia.

CONTINUED EXPANSION In spite of slowdowns in some lines of economic activity arising from the steel strike, the economy of the District continues basically strong and in an expanding phase. Nonfarm employment, adjusted for seasonal variations, rose slightly in July. This, the seventh consecutive monthly increase, raised the July total 2.8% above the year-earlier figure. The gains from June to July this year, while small, were widespread, both industrywise and geographically. Employment increases occurred in manufacturing, mining, construction, government, finance, and in the transportation, communication, and public utility group. Only trade and service industries had declines in employment. All District states except Maryland continued to show employment gains in July, with the largest gain occurring in West Virginia.

VACATIONS+STRIKES=LOWER OUTPUT Daily production of bituminous coal in the District in July averaged about 326,000 tons. This was a decline of 42% from the average for the preceding month; the latter was the highest for any month so far this year. The reduction was a consequence mainly of the vacation shutdowns of union mines during the first 11 days of the month. However, curtailed demand for coal following the start of the steel strike on July 15 kept output from recovering to pre-strike levels. The daily average in the first four weeks of the steel strike was 445,000 tons, a decline of 21% from the June average. During the first five months of this year the steel industry consumed 27% of total bituminous output. It follows that coal production cannot show much improvement until settlement of the steel strike.

RECORD COTTON CONSUMPTION Expansion of the District's cotton textile industry continued apace in July with cotton consumption by mills rising to an all-time high. Although the volume of new orders has been quite light since mill vacation periods early in July, backlogs of unfilled orders have been unusually large. Mills continue to operate on a five-day week; such six-day schedules as have been reported have been mainly of a production-balancing nature. Should a sharp increase occur in retail markets for cotton apparel, it would back up quickly through apparel manufacturers and converters of unfinished cloth to the mills and greatly accentuate the condition of a tight supply of fabric available for immediate or nearby delivery. This would put prices and production schedules under considerable pressure.

Demand for cotton yarns is stronger than it has been in several years. Prices have been increased and buying has been active for fourth quarter. Mills in the southeast report that no carded yarn is available for immediate delivery and that backlogs of orders are at this year's best level.

Backlogs of orders at many knitting mills extend through the rest of this year. Many seamless hosiery mills in the District are sold out for this year. Seamless hosiery continues to make gains at the expense of full-fashioned. In the first six months of this year shipments of seamless were up 30% over the same period in 1958; shipments of full-fashioned hosiery, however, were down 6%.

STRONG RISE IN FURNITURE ORDERS Reports indicate that new orders received by furniture makers probably reached an all-time high in July. Shipments also rose substantially during the month to a point considerably above that of a year ago. These appear to be greater-than-seasonal gains. The very large backlog of unfilled orders—the best since early 1956—points to continuing high levels of production and shipments in the coming months.

BANKING Demands for bank credit by District business firms began their usual late summer upswing at the weekly reporting banks in the second and third weeks of August. The principal types of businesses increasing their loans at District banks in this period were construction firms, commodity dealers, retail and wholesale merchants, processors of food, liquor and tobacco products, and textiles, apparel and leather manufacturers. The weekly reporting bank figures indicate that consumer credit, which in previous months had been expanding fairly strongly, slacked off in August, the total outstanding declining over the three weeks.

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