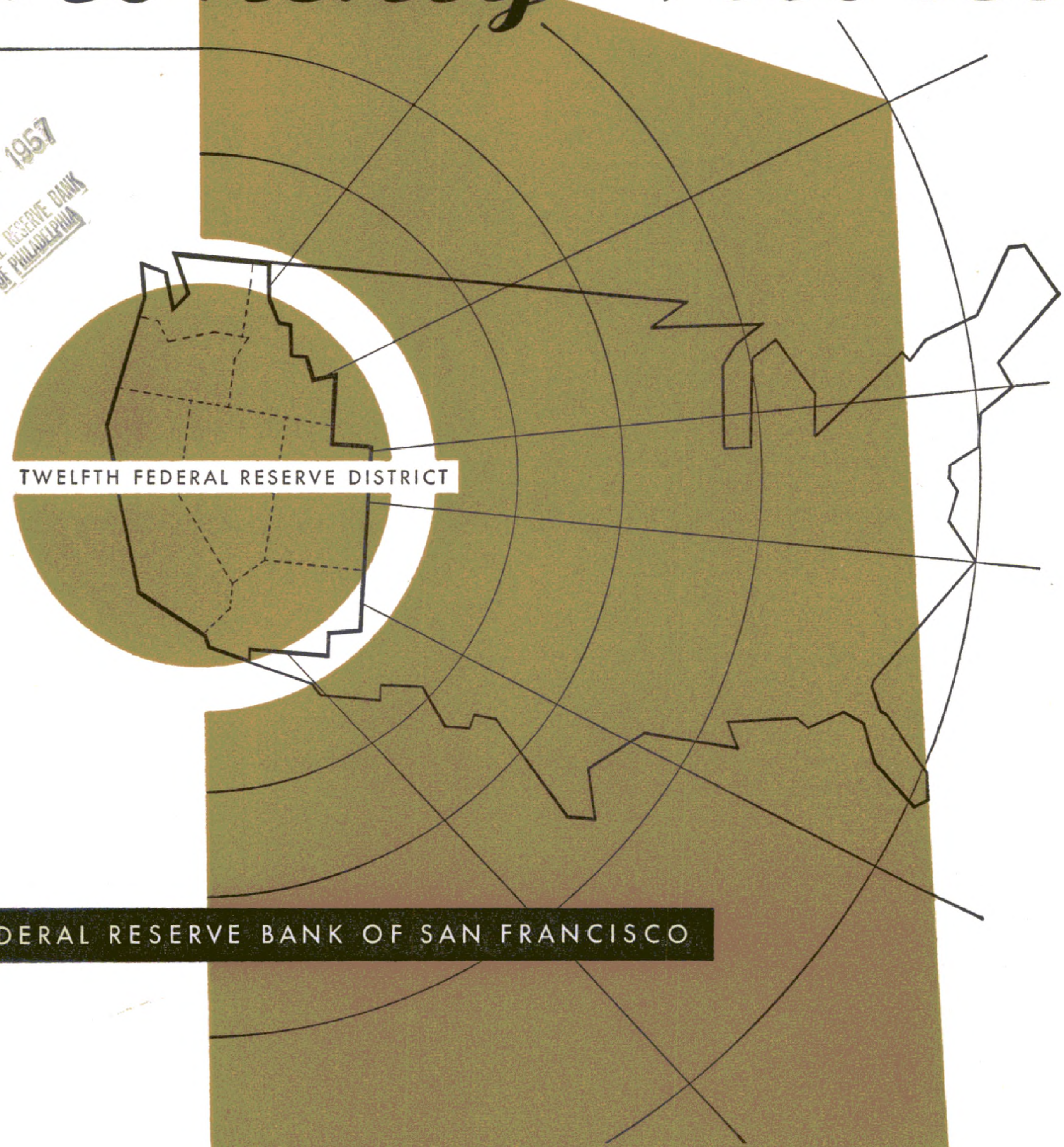
Monthly Review

1957
FEDERAL RESERVE BANK
OF PHILADELPHIA



FEDERAL RESERVE BANK OF SAN FRANCISCO

August 1957

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REVIEW OF BUSINESS CONDITIONS

THE most significant development in the economy in recent months is the resumption of inventory accumulation, as indicated by second quarter figures for Gross National Product. With the stimulus of a $2.5 billion jump in inventory investment, GNP rose at a seasonally adjusted annual rate of $5.2 billion from the first to the second quarter. This gain exceeds the rise of $3.1 billion from the final quarter of 1956 to the opening quarter of this year, even though prices have increased more slowly in recent months.

Consumer purchases increased at an annual rate of only $2.2 billion, compared with a gain of $4.4 billion between the final quarter of 1956 and the opening quarter of 1957. Spending for durables fell by nearly a billion dollars from the first quarter level as sales of automobiles and household appliances failed to register expected seasonal gains. The drop in purchases of durables was more than offset, however, by increases in expenditures for nondurables and services.

Private domestic investment rose in the second quarter. The entire increase stemmed from the jump in inventory investment; other components changed by minor amounts. A small increase in outlays for nonresidential building was offset by a further decline in residential construction expenditures, while business spending on durable equipment receded slightly.

Net foreign investment, which roughly measures the excess of exports over imports, also dropped from the first quarter level, though it remained positive. The increase recorded for total government purchases of goods and services amounted to $1.5 billion less than the previous quarter-to-quarter gain of $2.8 billion. The smaller gain resulted from smaller increases in state and local government as well as in Federal outlays.

The general picture provided by estimates of GNP for the second quarter is one of an economy operating at a high but relatively stable level of activity. GNP is actually a record of goods and services produced in a given period of time, as well as a tally showing how consumers, business firms, and government spend dollars. Each dollar spent on a final purchase represents a vote of approval for the production of some good or service. Consumers cast fewer votes for new housing and for durables, to the disappointment of the construction and manufacturing industries, but continued to cast a heavy ballot in favor of services. They also displayed an increased preference for nondurable goods.

TABLE 1

GROSS NATIONAL PRODUCT
Seasonally Adjusted Annual Rates
(in billions of dollars)

	1956 Fourth quarter	1957 First quarter	1957 Second quarter
Gross National Product	$426.0r	$429.1r	$434.3
Personal Consumption Expenditures	272.3r	276.7r	278.9
Durables	34.8	35.9	35.0
Nondurables	135.3r	137.3r	139.1
Services	102.2r	103.4r	104.9
Gross Private Domestic Investment	68.5	62.7r	65.0
Residential nonfarm construction	15.1r	14.4r	13.9
Other	18.4r	18.5r	18.9
Producers' durable equipment	29.9r	30.7r	30.5
Change in inventories	5.1r	—.8r	1.7
Government Purchases	82.8r	85.6r	86.9
Federal	49.0r	50.3r	51.1
State and local	33.9r	35.3r	35.8
Net Foreign Investment	2.4	4.1r	3.5

r=Revised.
Source: United States Department of Commerce, *Survey of Current Business.*

Business firms constantly attempt to gauge how their customers—consumers, governments, or, perhaps, other business firms—will vote. Accordingly, they plan production schedules, hire workers, purchase materials, and, if necessary, expand capacity. Forecasting errors may cause stocks to pile up on shelves and in warehouses or, if consumer intentions have been underestimated, lead to a depletion of such stocks. During short periods of time inventories of finished goods serve as an indicator to business firms as to how well they had forecast the balloting of their customers. Large errors can lead to undesired excess capacity and perhaps to cancellation of expansion plans.

The failure of consumer purchases to expand as expected has played a significant role in restraining the expansion of business activity over

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the first six months of the year. Retailers have trimmed orders, manufacturers have cut production, and manufacturing employment has receded. However, the economy has been able to absorb with relative ease the adjustments that have occurred. Unused capacity currently in evidence in most industries is moderate; the GNP accounts show that business spending for nonresidential construction and for equipment remains strong.

District nonfarm employment rises in June

In the Twelfth District, the second quarter closed with a gain in nonagricultural employment from May to June of nearly 0.5 percent after seasonal adjustment. The advance was the largest for any month so far in 1957 and is only slightly less than the average monthly gain during 1956. All major industry groups participated in the rise. Finance and service industries continued to expand more rapidly than total nonfarm employment, and the number of workers in government and mining jobs showed sizable gains also. Despite the rise in mining employment, which resulted from the expansion of activity in petroleum extraction in California, the number of workers in the industry was down about 1 percent from the June 1956 level. Employment in construction showed a slight rise for the first time in several months, but nevertheless was down 6 percent from a year ago.

Employment in the aircraft industry has tended to level in recent months as increases in Washington have nearly been offset by declines in California. It appears that aircraft employment may trend downward during the remainder of the year. Efforts of the Defense Department to reduce spending for military goods have recently led to elimination of over-time hours and the stretching-out of delivery schedules. In addition to this economy wave, rapid advances in technology have resulted in the decision that some types of missiles and aircraft have become obsolete. In the Los Angeles area cancellation of development work on the Navaho missile has resulted in the layoff of 6,000 employees. Ultimately, it is expected that 15,000 workers will be affected. Another District firm has announced that it will cut employment by from 9,000 to 12,000 workers in the next six months as existing military orders are filled and production of a large bomber is shifted to a Midwest plant.

In addition to the expected drop in aircraft employment, July employment figures were reduced because of labor disputes that were in progress during the employment survey week. Affected chiefly were the San Francisco Area metal trades industries and construction in the Los Angeles Area, where at least 20,000 workers were idled.

Construction slips further in June

The District construction picture darkened somewhat in June according to preliminary estimates of building permits granted. Total permit valuations decreased 14 percent from May. Slightly less than half of the decline resulted from a drop in the value of nonresidential permits. For the first half of 1957 total and residential valuations are each off 11 percent from the 1956 pace.

A slightly different picture is presented by contracts awards data. According to one estimate, nonresidential contracts were about 2 percent above those of 1956 in the first half of 1957, while residential awards slipped 4 percent. Total awards, however, are reported to have risen 12 percent as contracts for utilities and public works construction are running about one-third higher than in 1956. A large fraction of the latter activity involves construction in non-metropolitan areas which does not require building permits. The movement of construction employment in the District (down 6 percent from the year-ago level in June) suggests that District construction activity lies somewhere between the depressed level pictured by the building permit series and the more optimistic one suggested by contracts awards figures.

Auto registrations decline in May

Complete data for new passenger car registrations in District states reveal a drop of 3 percent from April to May to a level slightly below that of May 1956. For the year, however, registrations are about 1 percent above the first five months of 1956. California registrations in June were 3 percent below those of May and 14 per-

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cent less than in June 1956. In another segment of retail trade, department store sales after seasonal adjustment jumped 4 percent from May to June and were up by about the same percentage amount from June last year. According to estimates available for the four-week period ending July 20, the year-to-year margin may have narrowed. Generally, sales at Pacific Northwest department stores show declines from a year ago, while little or no gain is reported for stores in San Diego, Downtown Los Angeles, and the San Francisco-Oakland area.

Steel production continues strong

Steel production in the Western Steel District in June was maintained at about the May rate of 99 percent of capacity although a drop in total tonnage occurred because of fewer working days. Weekly estimates of blast furnace operations for the first three weeks of July suggest that the high May-June rate continued. Nationally, production of primary aluminum in the first six months was approximately 4 percent less than during the comparable period in 1956. In the District the decline has probably been more sizable because of the shortage of electric power in February and early March. In the Twelfth District's forest products industry, output in July dropped sharply because of annual employee vacations.

Mining firms in the Twelfth District are reported to be offsetting price declines in copper, lead, and zinc by selectively mining higher-grade ores and by postponing mine development work. Nevertheless, mine production of copper during the first five months of this year dropped 2 percent from the same period in 1956. Lead production showed a gain of 7 percent. Since May, however, two major lead-zinc mines in Nevada have ceased operating and another in California plans to cut output sharply in the third quarter.

Loans outstanding decline at District reporting member banks

Loans outstanding at weekly reporting member banks in the District declined moderately during the four weeks ending July 24. The drop of $85 million in total loans contrasts with the $148 million rise in the previous four-week period when borrowings increased as the June corporate income tax instalment fell due. There was a small gain of $11 million in this category during the comparable July period a year earlier. During July of this year loans to commercial and industrial firms fell by a larger amount than total loans, as part of the loss was compensated for by small gains in agricultural and in security loans. Real estate and "other" loans declined slightly.

Among classified business borrowers, the largest reduction in indebtedness in July was registered by food, liquor, and tobacco manufacturers—a drop of $24 million. Declines of $7 million or more occurred for manufacturers of metals and metal products, for retailers, and for utilities and transportation firms. A considerable portion of the drop in business loans, $38 million, is not identifiable by industry.

Reporting member banks in the District added to their holdings of government securities during the first half of the four-week period ending July 24. In the following two weeks, however, $171 million in government obligations were sold, leaving a small net gain for the period. The increase of $11 million occurred as increased holdings of Treasury bills more than offset a reduction in notes and certificates held.

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The Aluminum Industry
Part I: Development of Production

Aluminum has developed from the status of a laboratory curiosity to a commonly used metal within less than 100 years. Although the use of aluminum is worldwide, Europe and North America are dominant in its production and consumption. The United States produces almost half of the world's output and consumes an even larger proportion. Copper, lead, and zinc, which were established metals long before aluminum was even produced, have been outdistanced by aluminum in terms of production and consumption in the United States. The aluminum industry now ranks second only to steel in size among the nation's metal industries.

This remarkable growth has all taken place since 1888 when the first aluminum was produced by the electrolytic process. Production and consumption of the metal increased year by year almost without interruption, although declines took place immediately after World War I, during the first years of the depression, and after World War II. The rate of growth, from each year to the next, averaged more than 12 percent over the period 1900-56. Although aluminum production and usage grew almost continuously, the metal and the industry did not become really familiar to the general public until Pearl Harbor and World War II, when the critical need for aircraft generated a demand for aluminum far beyond the capacity existent at the time. By 1943 annual primary[1] production was boosted to over 920,000 tons as compared with less than 164,000 tons in 1939. The war promoted aluminum not only by greatly expanding capacity but by improving technology and popularizing its uses.

One consequence of the aluminum expansion was a shift in the main center of aluminum production. Up until 1939 not a pound of aluminum was produced in the Pacific Northwest; by 1943, 28 percent of the United States production came from this area. The Government recognized the need for additional aluminum beyond the expanded capacity being created by the Aluminum Company of America and Reynolds Metals Company, a manufacturer of foil and other products which entered the primary aluminum industry in May of 1941. In June 1941, the Government began financing an additional expansion program, mainly designed and operated by Alcoa, which was vastly expanded again a year later. Since the Pacific Northwest was one of the few locations where surplus electric power was available to supply such a large expansion, many of the new plants were located there. These Government plants were purchased by private companies after the war and not only continued to operate but have expanded production to almost double the wartime peak in 1944 for the Pacific Northwest. Today aluminum is one of the most important manufacturing industries in Oregon and Washington. It is the largest single user of industrial power in that region and provides regular jobs for thousands of workers.

Expansion of reduction capacity, under construction or planned in 1957, will increase United States aluminum capacity by nearly 44 percent over that of 1956. This expansion is taking place in the face of an easing of supply. But since most of the new plants are scheduled for the Ohio Valley area, this additional production will be concentrated in a new center. These developments raise a number of interesting questions and problems that concern not only the Pacific Northwest but the industry as a whole. The factors governing the location of aluminum production activities and the ability of the market to absorb the greatly increased forthcoming production will be of interest to students of economic growth and regional planners alike.

This article on aluminum is the first in a series of three that will be published on the industry. The first instalment provides a brief history of

[1] Primary aluminum refers to aluminum produced from bauxite; secondary aluminum is recovered from scrap. Historically, the producers and consumers of primary and secondary aluminum have been members of separate industries; secondary aluminum is not freely substitutable, in the eyes of the trade, for the primary product because of impurities. The primary producers account for approximately 80 percent of total production in the United States and represent the bulk of the capital invested in the aluminum industry. This article deals with the growth and development of the integrated primary aluminum industry.

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the aluminum industry together with a description of its current organization. A discussion of the demand for aluminum and possible changes in that demand will follow. The concluding article is concerned with the factors of economic location in the aluminum industry and the influence of technological and institutional changes on the current cost structure. The detailed consideration here of process, industrial organization, and structure, in addition to providing material of intrinsic interest, will be found indispensable for an understanding of later sections of the study.

Description of Production Stages

Commercial development of the aluminum industry did not really start until the discovery in 1886 of the electrolytic process for reducing aluminum from aluminum oxide by first dissolving it in molten cryolite. Although changes have been made in detail, the entire process of producing aluminum has changed very little basically since that discovery. Today there are four basic stages: the mining of bauxite, the refining of bauxite to aluminum oxide (called alumina by the trade), the reduction of alumina to aluminum, and the fabrication of aluminum into desired forms.

Although aluminum comprises an estimated 8 percent of the earth's crust, it usually occurs in rocks and clays that cannot be utilized economically as a source for aluminum with present technology. The mining of bauxite, the chief ore for the aluminum industry, is comparatively simple, consisting usually of open pit operations with power shovels after the stripping off of whatever over-burden exists. Underground mining is necessary in some localities, however. After mining, the ore is loaded into trucks or dump cars and taken to an ore-treating plant where it is washed, crushed, and dried in preparation for the second stage, the production of alumina. In some cases, as in Arkansas, the crude ore is taken directly to the alumina plants.

At the alumina plant the finely powdered bauxite is stirred into a hot solution of caustic soda, and the alumina is extracted while the impurities remain in suspension. Passed through large filter presses where the residues are removed, the salt solution is then taken to great precipitation tanks which are as high as a five- or six-story building. As the liquid cools, aluminum hydroxide, which is aluminum oxide chemically combined with water, crystallizes out of the solution as a solid. It is then removed, washed free of caustic soda, and the chemically combined water is drawn off by heating the hydroxide white hot in huge oil-fired rotary kilns. The resulting white powder, alumina, becomes in turn the basic raw material for the reduction plant.

Electricity essential to smelting of aluminum

The reduction of aluminum from aluminum oxide is an electrolytic process which requires a large and continuous supply of electrical energy. A typical reduction plant consists of one or more lines of electrolytic cells or potlines. The pots are open steel boxes usually 12 by 15 feet in outside dimensions and about 3 to 4 feet high, lined with fire brick and thick carbon blocks or casings in which are embedded cathode connections. Above the pots and extending down into them are carbon anodes which receive current through huge copper or aluminum bus bars. Cryolite is heated to molten form in the pots and then alumina is dissolved in it. This solution is called the electrolytic bath. The passing of direct current from the anodes through the solution of cryolite and alumina and out through the cathodes electrolyzes the aluminum oxide by liberating the oxygen or recombining it with the carbon anodes to form carbon monoxide or dioxide, thus releasing the pure aluminum metal which collects in a molten state at the bottom of the pots. Each pot can produce about 500 pounds of aluminum every 24 hours. The molten metal is tapped periodically. As the pure aluminum is formed and removed, alumina is fed into the bath as needed. The process is continuous, operating on a 24-hour basis the year around. The pots are connected with one another but individual pots may be closed temporarily for repairs, since the linings have to be replaced about every two years.

Wrought products most important

The next stage consists of converting the blocks of aluminum into wrought products and

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castings. Wrought products develop from metal changed in shape by mechanical working of the ingot, while castings utilize the molten metal to fill forms of sand or metal. Castings, which range from sand and mold to die castings, account for approximately 15 to 20 percent of aluminum shipments, while wrought products make up the remainder.

The most important wrought product in terms of volume and utility is aluminum sheet. To make sheet, slabs, rectangular in shape and softened by pre-heating, are passed between large rollers until sufficiently flattened and elongated and then given further finishing treatment. Some mills now use slabs weighing up to two tons directly from the smelter. Sheets below the thickness of ⅛ inch are made by cold rolling and annealing the metal. This produces a better surface than hot rolling and adds strength and hardness.

Extruded shapes, another major wrought product, are formed by placing the metal, heated to a plastic condition, in a cylinder and forcing it through dies. Aluminum is very adaptable to this process, permitting a wide variety of forms which may be combined for exterior decoration or formations. Tubes are also made by extrusion. Ordinary structural shapes like I beams, angles, or channels are fashioned by forcing hot ingot between special rolls.

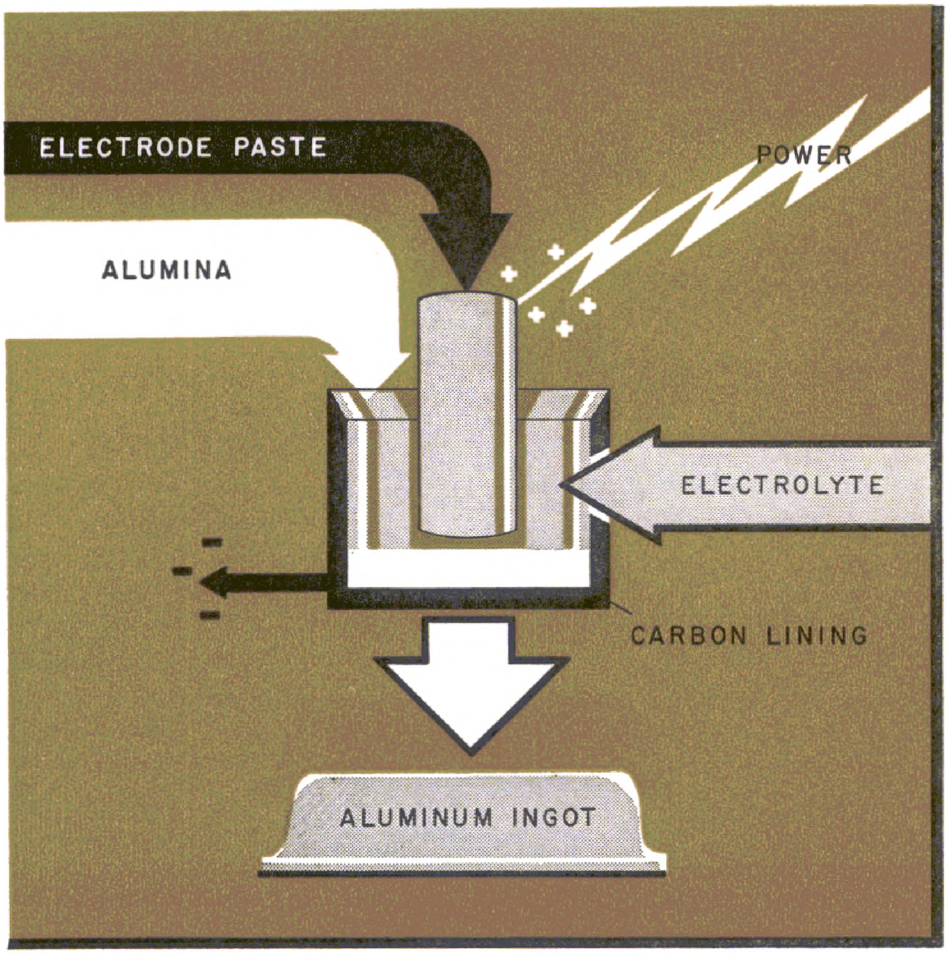
Forgings are made by hammering or pressing aluminum into predetermined shapes by the use of giant hammers or multi-ton mechanical and hydraulic presses. Such items as propellers and pistons are manufactured by this means. Miscellaneous wrought products include aluminum powder, flake, and paste, which are used in the paint, paper, photographic, and other industries. Rods, bars, and wire are other important wrought products fabricated either by forging or extrusion.

Castings, one of the largest individual outlets for aluminum, are made by four methods: plaster, sand, iron mold, and die casting. The last-mentioned process, which involves forcing molten metal under pressure into closed molds, permits very fine limits of dimensional accuracy and makes finish machining unnecessary. Castings become components of automotive equipment, cooking utensils, motors, household appliances,

CHART 1

DIAGRAMMATIC SKETCH OF

THE PROCESS OF ALUMINUM PRODUCTION



Source: Adapted from Earl B. Shaw, *World Economic Geography* (New York, J. Wiley and Sons, 1955).

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aircraft and machinery equipment, and numerous other products.

When one looks at the present-day aluminum industry with its complex production and fabrication operations and its many products, it is easy to forget the time-consuming and arduous background of experimentation that was necessary to make all of this possible. At first it was necessary to experiment in the laboratory merely to isolate the metal. Then the search continued for a process that was commercially feasible. And there were engineering and merchandising problems that had to be solved before the metal could become important commercially. The industry as seen today is the result of some 70 years of development.

Experimental aluminum

Although aluminum is the world's most abundant metal, it is so thoroughly and intricately concealed by nature that its very existence eluded scientists for centuries. It was not until 1807 that Sir Humphrey Davy established the existence of the metal, and the first pellet of the metal was produced in 1825 by the Danish scientist Oersted. By gently heating potassium amalgam with aluminum chloride and distilling the mercury from the resultant aluminum amalgam, he obtained a small lump of metal having the color and luster of tin. Frederick Woehler in Berlin repeated Oersted's experiment in 1827 but failed to observe production of aluminum. Using metallic potassium instead of potassium amalgam he obtained aluminum in the form of a gray powder. Nine years later, a third scientist, Henri Sainte-Claire Deville changed Woehler's method by substituting sodium for potassium. The metal was now made in lumps the size of marbles rather than pinheads. By 1854, Sainte-Claire Deville had succeeded in reducing the cost from $545 to $17 per pound. In June of the next year, Sainte-Claire Deville announced before the French Academy of Sciences that within four months he hoped to place the aluminum industry on a firm basis. Some years later, when his book *De l'Aluminum* was published, he concluded it with these words:

> I have tried to show that aluminum may become a useful metal by studying with care its physical and chemical properties. As to the place it may occupy in our daily life, that will depend on the public's estimation of it and its commercial price. The introduction of a new metal into the usages of man's life is an operation of extreme difficulty.

With Sainte-Claire Deville's method, the principal problem was the cost of sodium. About three pounds of sodium were needed for each pound of aluminum. Hamilton Y. Castner of New York was responsible for the next improvement by reducing the cost of sodium, but aluminum still remained relatively costly to produce.

Throughout this period of experimentation with the purely chemical production of aluminum there lingered the hope of somehow reducing aluminum by an electrolytic process. In fact, the discoverer of aluminum, Sir Humphrey Davy, tried to decompose aluminum electrolytically by first melting it with an extremely strong current. The result was a brittle white aluminum alloy. Henri Sainte-Claire Deville actually reduced aluminum electrolytically during the same year he refined the sodium process. However, the current needed had to be produced from batteries. This made the method so expensive that there was little inducement to develop it commercially in competition with the sodium reduction process. Another 25 years elapsed before dynamoelectric machinery was sufficiently common to be suggested for the current needed for electrolysis on a commercial scale.

New industry begins in a woodshed

It was in 1886 that Charles M. Hall, a young student at Oberlin College, Ohio, finally discovered an electrolytic process that was technically and commercially feasible. Hall knew that aluminum oxide could be cheaply obtained from bauxite, an ore bearing aluminum oxide. The bar to electrolysis, however, was its extremely high melting point of 2050° Centigrade. Hall reasoned that if he could find a solvent which would dissolve alumina in substantial quantities, he could electrolyze it in solution. He found the solvent in cryolite, a sodium aluminum fluoride compound, and in a woodshed behind his home in Oberlin, on February 23, 1886, succeeded in producing aluminum by electrolyzing a solution of alumina in molten cryolite.

Hall was sure that his process had commercial possibilities but he lacked the money to de-

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velop it. After many failures in trying to interest people with capital he finally succeeded in convincing the founders of the Pittsburgh Testing Laboratory, Alfred E. Hunt and George H. Clapp, who proceeded to raise $20,000 in cash and set up The Pittsburgh Reduction Company with Hall as a major stockholder.

Production was started on September 18, 1888, at the rate of 50 pounds per day, in a small, five-employee plant superintended by Hall. The price was set at $5 per pound, but the metal found such a limited market that the price was soon reduced to $4 and then $2. By 1890, however, production was expanded to 475 pounds per day, and a larger plant was opened in the following year.

Monopoly based on the Hall Patent

Hall secured a patent for his discovery even though Paul L. T. Heroult of France had independently discovered the same process. From 1888 to 1891 The Pittsburgh Reduction Company was protected by the Hall Patent, which did not expire until 1906. In 1891, however, the Cowles Company began to manufacture aluminum using the Hall process. After a bitter patent suit The Pittsburgh Reduction Company was awarded damages. New litigation later arose over the Bradley Patent on using the heat from the electric current used in electrolysis for melting the cryolite. The Hall process employed the same principle, but the original patent did not cover this aspect. In 1903 the validity of the Bradley Patent was upheld, which prevented The Pittsburgh Reduction Company from making aluminum without infringing on the Bradley Patent. A settlement was finally effected which gave The Pittsburgh Reduction Company the license to the Bradley process until it expired in 1909, three years after the Hall Patent was to expire. Thus from 1888 to 1909 The Pittsburgh Reduction Company was able effectively to bar competition by reason of patent rights.

Industrial and market structure

The Pittsburgh Reduction Company began consolidating its position and expanding its interests into the various stages of production almost from the outset. It was soon recognized that since there was no ready market for aluminum, it was necessary for the company to roll sheet and fabricate sundry articles to familiarize the metal trades and consumers with the various uses of the metal. As a result, The Pittsburgh Reduction Company expanded into fabrication facilities as its production of aluminum grew. Moves were also made to acquire facilities for all other phases of aluminum production.

As it happened, deposits of bauxite were discovered in Georgia and Alabama at just about the time Hall was producing his first aluminum. The Pittsburgh Reduction Company began to acquire these bauxite deposits in 1894, and by 1909 it had control as well of large deposits in Arkansas. Meanwhile, the company had built its own alumina plants, railroads, and generating plants. By the time its name was changed to Aluminum Company of America in January 1907, the company had become a completely integrated concern. The ore produced at its mines was run through crushing, grinding, and drying plants and then sent to East St. Louis, Illinois, where it was converted into aluminum oxide for the reduction plants at Niagara Falls and Massena, New York, and Shawinigan Falls, Quebec. Most of the electricity fed into the reduction cells was generated by the company, which also owned a substantial part of the rights to the water power which turned its dynamos. The company made its own carbon and had its own source of cryolite.

After establishing itself in all phases of aluminum production the Aluminum Company of America embarked on an ambitious expansion program. One consequence was that entry into the industry was rendered difficult for new firms. Alcoa's acquisition of a large part of the domestic deposits of bauxite suitable for aluminum reduction and the company's restrictive agreements with those firms which bought bauxite from it for purposes other than metal production were formidable obstacles to entry until 1912 when these agreements were cancelled. Furthermore, the company's rapid extension of operating capacity and acquisition of enormous undeveloped power reserves, along with its fund of merchandising and technical experience, seemed to leave

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little room for fresh capital and enterprise by other firms.

The only determined attempt to enter the aluminum industry in the United States before World War I was made by a group of experienced French aluminum producers who possessed their own bauxite in France. When the outbreak of the war prevented further financing in Europe to complete their partially constructed power plant and reduction works in North Carolina, the necessary capital could not be found in this country. The stockholders sold out to the Aluminum Company of America, which appeared to be the only potential buyer.

Industrial growing pains

The discoveries which made feasible the low-cost production of aluminum did not directly lead to its widespread use. Manufacturers, schooled in the tradition of metals such as iron, copper, and steel, were slow to utilize its potentialities. For many years after it became possible to make aluminum at a low price it was difficult to sell at any price. In each new field aluminum had numerous and sometimes great obstacles to overcome. Scientists had to establish accurately what it could and could not do; new techniques of machining, welding, and extrusion had to be worked out; new aluminum alloys and new ways of making alloys had to be found, and what is more, this knowledge had to be taught to the trade. Handbooks had to be prepared that fitted aluminum into the tables with which engineers are accustomed to work. There was no cozy niche all ready to receive a new metal. On the contrary, it had to fight its way into every market over the barriers of ignorance, tradition, lethargy, and competition.

The first few years of introductory selling were largely given to attempts to interest foundries, rolling mills, and wire drawing plants in the new metal. Results were slow because equipment and methods intended for high-melting point metals were not readily adapted to the lower fusion range of aluminum. Even when it became possible to produce aluminum in fairly large quantities, lack of familiarity with the metallurgical characteristics of the light metal led to blisters, slivers, and blowholes. Scrap losses and returned shipments were often greater than the metal that could be utilized.

During the early years from 1888 to 1895, a chemical laboratory for checking quality was the extent of technical control. Mechanical testing was farmed out to testing bureaus. If a salesman complained that an experimental lot of sheet was too hard or too soft to suit a customer's requirements, the mill production had to be slowed up for more samples. Because of these problems the Aluminum Company of America developed its own fabricating facilities and sales force as a means of expanding uses of the metal and overcoming the fears of potential users. There was always the hope that aluminum would replace some other material because of its inherent qualities and that every sample was the potential seed from which future tonnage would grow. That these policies and hopes were more than justified is fully apparent in the subsequent growth of the market and the ability of the company to maintain its monopolistic position until 1941.

Early uses

Despite the many technical and marketing problems, sales of aluminum by the Aluminum Company of America expanded from 99 tons in 1893 to over 3200 tons in 1903. Prior to 1890 the uses of aluminum were limited to two general classes. The first included parts of instruments or machines of various kinds, in which the labor per piece was so much greater than the cost of the material used that the latter cost was negligible. The second class might be termed "metal fancy goods" or novelties. A typical display of aluminum articles in 1894 included, besides cast and spun utensils, such an assortment as metal-backed brushes, collar buttons, tea balls, salt and pepper sets, bookmarks, trays, card counters, cardcases, paper cutters, looking glass and picture frames, hairpins, combs, penholders, candlesticks, match boxes, spoons, and house numbers.

Of all the fields of use developed during the decade following the introduction of the Hall process, no single one resulted in such a continuously increasing yearly consumption as aluminum electrical conductors. As early as 1895, The Pittsburgh Reduction Company had electrical resistance tests made at the laboratories of

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the Westinghouse Electric and Manufacturing Company and Lehigh University. In the following 10 to 15 years aluminum enjoyed some success in the field of electric transmission lines. But the potential market in the general engineering trades was not appreciably developed until much later.

It was the growth of large-scale production of automobiles which enabled the output of aluminum to expand so rapidly just before World War I. By 1914 about 80 percent of the cars made in this country contained aluminum crankcases and gear cases. In 1915 it was estimated that at least one-fourth of the annual production of aluminum was consumed in the form of light, stiff alloys, most of which went into motorcars. By the mid-1920's, however, improved technology in the drawing of steel made it possible for the automobile makers to substitute the cheaper metal.

The outbreak of World War I, on the other hand, gave a huge boost to the demand for aluminum. Production in the United States was raised from 40,000 tons in 1915 to nearly 60,000 tons in 1917 and 1918. Uses in such items as machine guns, time fuses for shrapnel, aluminum powder for explosives, and aircraft disappeared with the return of peace, but the uses which consumed great tonnages during the war stimulated new applications.

Impact of World War II on the Industry

Up to 1941, the production of primary aluminum was entirely in the hands of the Aluminum Company of America. This company operated an alumina plant at East St. Louis, Illinois, which was a relatively convenient point for assembling and treating bauxite ores produced in central Arkansas and ores imported from South America and also for shipping alumina to the company's four smelters. Two of these were located in the Southeast at Alcoa near Knoxville, Tennessee, and at Badin on the Yadkin River in central North Carolina, and two in New York State, at Niagara Falls and at Massena on the St. Lawrence River. All these plants made heavy use of hydro-electric power, partly company owned and partly secured from public utility sources.

Toward the end of 1940 the Reynolds Metals Company, a highly diversified enterprise with an established reputation in the production of aluminum foil, indicated a strong desire to enter the production of primary aluminum in anticipation of heavy defense needs. After lengthy negotiations, Reynolds was finally able to secure a loan from the Reconstruction Finance Corporation by pledging its plants as collateral, with special provisions designed to ensure the Government first claim on Reynolds Metals' earnings. Less than three months later, construction of an alumina and a reduction plant was begun near Sheffield, Alabama on a site now called Listerhill. They were in production by May, 1941.

Beginning in 1937 the Aluminum Company of America embarked on a large expansion program which in successive instalments extended over a five-year period and resulted in considerably more than doubling its physical plant capacity. In addition to substantial fabricating facilities, including a new foundry and forging plant at Los Angeles, this program provided for a new alumina plant at Mobile, Alabama, to operate on South American bauxite ores, and for the enlargement of the company's principal reduction works at Alcoa, using Tennessee Valley Authority power. Increased capacity was also planned at the company's three other smelters to the degree that power supply made possible.

Wartime expansion of aluminum capacity and output

In spite of the very large plans for expansion embarked upon in 1937, the size of the American aluminum industry was drastically revised upward by World War II. The enormous demands of the national defense and lend-lease programs not only for aircraft production but also for a wide variety of other military uses of aluminum far outstripped the resources of the existing units in the industry. When it became obvious early in 1941 that aluminum requirements for military purposes had been underestimated, Government agencies took steps to establish controls over existing supplies and to stimulate a greatly increased volume of output. A priority system was established in February 1941 which drastically restricted the use of aluminum for civilian pur-

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poses, and a Government-sponsored expansion of productive capacity was launched in June of the same year, followed by a second and enlarged program in February 1942. Together these two programs called for the guarantee of raw material supplies, for the construction at Government expense of two alumina plants and nine new smelters, and for hastening the installation of additional hydroelectric facilities.

With the exception of one smelter, built by Olin Industries, all the new Government plants were designed and constructed for the Defense Plant Corporation by the Aluminum Company of America and were operated by that company during the emergency period. Several of the new Government plants were completed by May 1942, and all of them were in operation by mid-1943. Their output had reached capacity before the end of that year except in two instances where labor shortages prevented full operation. In addition, Reynolds Metals constructed another plant at Longview, Oregon and added to their plants at Listerhill by securing an additional loan from the Reconstruction Finance Corporation. The Longview plant was completed by August 1941, and the expansion at Listerhill was finished by June 1942. Production of primary aluminum in 1943 exceeded 920,000 tons; and the total supply from all sources — primary, secondary, and imports — was nearly 1,400,000 tons, as against actual shipments to fabricators of about 1,085,000 tons. This compared with a production of about 164,000 tons in 1939.

Raw material and fabricating facilities enlarged

In addition to the new primary aluminum reduction plants, the Government's expansion program had included two large alumina plants, located in Arkansas and Louisiana, for the conversion of bauxite to alumina. These facilities, completed in successive stages in 1943 and 1944, more than doubled the capacity of the three alumina plants previously existing. Bauxite importation problems became acute in the summer of 1942 owing to the scarcity of shipping and intensified enemy submarine activity in the Caribbean. The consequent necessity of using more domestic ore of considerably lower grade than the Guiana bauxites led to the construction of special facilities at the four largest alumina plants to permit the maximum recovery of alumina from these lower grade ores.

The Government's plans for enlarging the capacity of the industry also extended to the construction of a considerable number of aluminum fabricating plants. These new plants were mostly Government-owned but were operated by concerns experienced in the metal working industries. A large expansion of privately-owned fabricating capacity also took place, some of which was financed by Government agencies. Emphasis was placed on rolling mills to produce strong alloy aluminum sheet and on plants to increase the output of extruded and tubular products, rods and bars, and special forgings and castings, all of which were vitally important in the tremendous expansion of aircraft production.

Emergence of the Northwest as an aluminum center

A striking shift in the geographic location of the American aluminum industry resulted from the large expansion caused by defense needs during the period 1939 to 1943. Until practically the eve of the war the industry's plant facilities through the primary metal stage, then represented only by the Aluminum Company of America, were all located east of the Mississippi River. The construction between 1939 and 1943 of two privately-owned and five Government-owned smelters in the Pacific Coast states, together with one plant in Arkansas, resulted in shifting nearly 50 percent of the industry's primary reduction capacity far to the west of the center of the country. Locating the Government's two large new alumina plants in Arkansas and Louisiana, while not so radical a move, also shifted the center of gravity of raw material supply somewhat to the westward.

The emergence of an aluminum industry in the Pacific Northwest was determined by two basic factors. The United States needed aluminum badly and immediately in the pursuit of its war effort. The Pacific Northwest was one of the few areas in the country that had the surplus of electric power needed. The Aluminum Company of America also built and operated two reduction

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plants in California at Riverbank and Torrance for the Defense Plant Corporation, but these plants did not continue operating after the war as the needed power could be obtained only by rationing.

Postwar Transition

With the closing of hostilities the Government faced the problem of disposing of plants built to satisfy war needs at any cost. Aluminum capacity had been expanded 7 times during the war while certain fabrication stages had been expanded over 45 times. Moreover, the geographical location and the very structure of the aluminum industry had been changed by the location of new plants. Its control, its geography, technology, economics of supply, cost, price, and its potential markets had all changed. This, combined with the Government's desire to promote competition, presented numerous problems of disposal that were to have a dramatic impact on the future of the aluminum industry in this country.

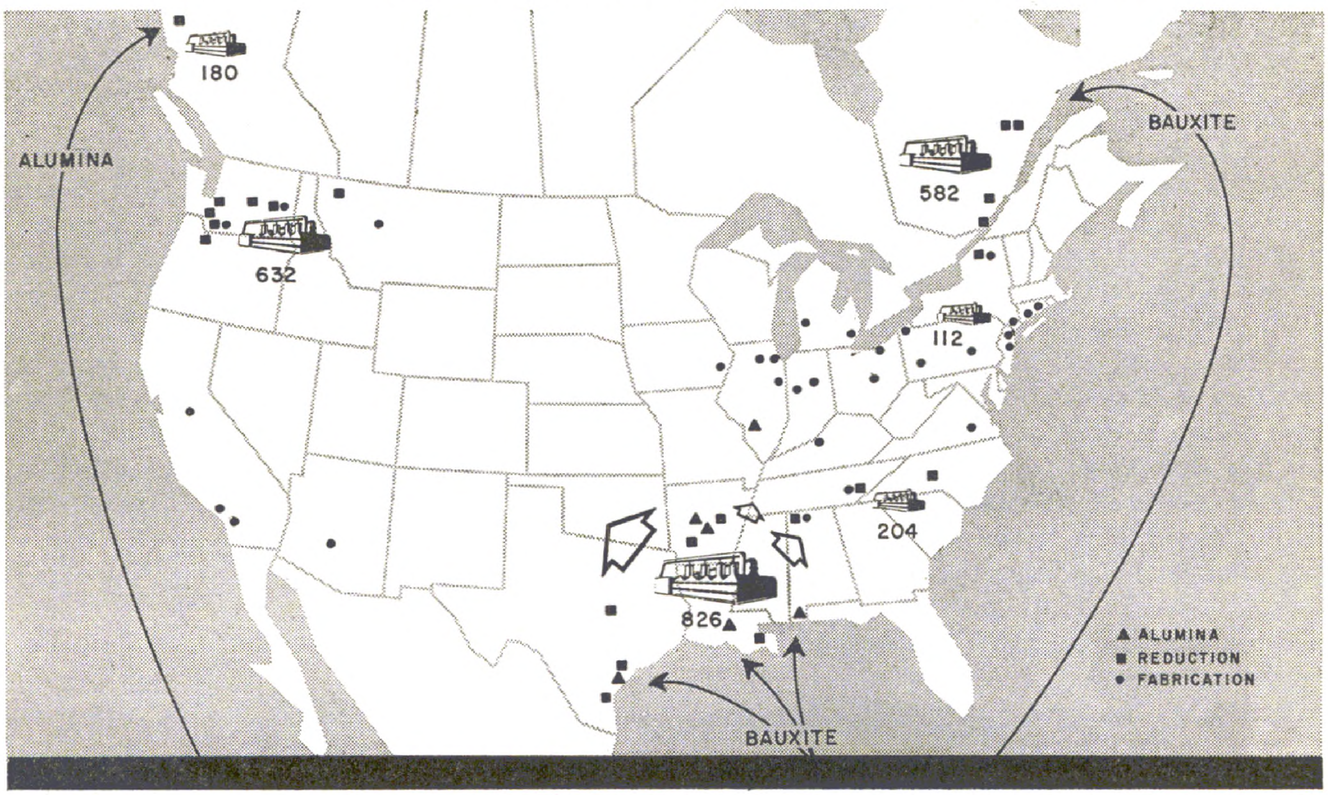
During the war the Aluminum Company of America nearly trebled its own facilities in a $300 million construction program. In addition, the company designed and operated Government plants worth nearly $500 million. Its assignment included eight of the nine Government smelting plants and nine of the largest Government fabricating plants. Thus, although Alcoa was operating more than 90 percent of the United States capacity for alumina and primary metal at the end of 1944, the United States Government owned 58 percent of the nation's smelting capacity; Alcoa, 35 percent; and Reynolds, 7 percent.

In the autumn of 1945, most of the Government aluminum plants were shut down. The

CHART 2

LOCATION IN THE UNITED STATES AND CANADA

BAUXITE REFINING, ALUMINUM REDUCTION [1], AND FABRICATING FACILITIES [2], 1956



[1] Figures under symbols refer to thousands of tons of aluminum produced in that region.
[2] Only fabricating facilities of fully integrated producers are included.
Sources: The figures and locations are compiled from United States Department of Commerce, *Materials Survey—Aluminum*, pp. III-1, III-2, III-5; American Bureau of Metal Statistics, *Year Book*, 1956, p. 90.

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prospects for disposal of the Government investment of $705 million in the aluminum industry were uncertain. The two primary aluminum producers had sharply curtailed production in their own plants. Their inventories of aluminum were piling up. Threatening the market were hundreds of millions of pounds of surplus aluminum from cancelled war contracts and from aircraft moving to the scrap heap. The primary industry was still largely controlled by the Aluminum Company of America, while its only competitor, the Reynolds Metals Company, was reducing its output to a small proportion of Alcoa's.

Disposal of Government aluminum plants in the postwar period

The question of disposal of the Government-owned plants, representing more than half the alumina capacity, well over half the smelter capacity, and a large fraction of the fabricating capacity of the industry, posed a major problem. In the Surplus Property Act of 1944, Congress affirmed its belief in free competition in American industry, stipulating that war plants be disposed of in a manner which would stimulate competition and break monopoly controls. A Government suit had been brought against the Aluminum Company of America for monopoly in 1937 in the United States District Court for the Southern District of New York. After five years of litigation the suit was decided in favor of Alcoa in 1942 and the Government appealed to the Supreme Court. Four of the Justices disqualified themselves, leaving the Court without a quorum. A bill was then enacted constituting the Court of Appeals for the Southern District a court of last resort to determine the appeal. The war had interrupted the prosecution of the suit so it was not until 1945 that this court of New York reversed the decision of the Southern District Court and ruled that the Aluminum Company of America had been monopolizing the ingot market. The District Court was ordered to await the disposition of the Government plants to determine what action, if any, would be necessary.

When the Government plants were offered for sale very few companies showed any interest. As one deterrent, much uncertainty surrounded the market prospects for aluminum. As another, new firms were hesitant to enter the field without an assured supply of alumina. The Government had a big alumina plant at Hurricane Creek, Arkansas that utilized low-grade bauxite ores, but the patents were held by the Aluminum Company of America. Without license to use these patents the plant was useless.

After lengthy negotiations Alcoa agreed to grant a nonexclusive royalty-free license to the Reconstruction Finance Corporation for the life of the patents relating to the extraction of alumina from low-grade bauxite. In return, the R.F.C. or any sublicensee had to grant Alcoa a license to use any improvements made on the patents. This agreement was followed shortly by arrangements to lease the alumina and reduction plants in Arkansas to Reynolds Metals Company. Reynolds then acquired additional reduction plants; and the Kaiser interests, through the Permanente Metals Corporation, leased three large reduction and fabricating plants. Later Permanente leased the alumina plant at Baton Rouge in order to be independent of others for alumina. Thus, during 1946, Reynolds and Kaiser together obtained 75 percent of aluminum plant disposals.

Disposal fostered competition

The control by Reynolds and Kaiser of almost 50 percent of the productive capacity of the industry now made effective competition a possibility. These two companies absorbed by lease or sale 12 basic plants with an original cost of $289 million. Reynolds obtained the larger share, eight plants (original cost, $194 million). Permanente obtained four plants (original cost, $96 million). Reynolds Metals Company was accorded priority in purchasing in that it had already entered the primary aluminum business in 1940. Kaiser's entry into aluminum was without previous experience in the industry.

During this period of confusion regarding the disposal of the aluminum plants and the state of the market, production dropped sharply. In 1945 production of aluminum ingot fell 36 percent below the average 1944 level to only 495,000 tons. Throughout the first half of 1946 production was held back by strikes, shortages of soda

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ash for alumina production, and inadequate power supplies. Production in 1946 dropped to 410,000 tons, the lowest since before 1941 and less than in any subsequent year. Production and consumption started increasing again after 1946. By June 1950 when the outbreak of the Korean War necessitated another expansion of capacity, Reynolds Metals and Kaiser Aluminum and Chemical were well established. Various incentives in the form of accelerated amortization, government purchase guarantees, and the guaranteeing of private loans were offered to secure expansion in capacity. The three established firms provided the main response. Entry for completely new firms was inhibited by the high initial capital outlay required in comparison to the plants purchased at substantially less than cost after World War II.

Current Structure of the Industry

The aluminum industry of the United States is large whether employment, assets, or sales is used as an indicator. The Aluminum Company of America alone employs 55,000 workers with sales close to a billion dollars per year. The United States is now the world leader in aluminum production and consumption by a wide margin. As of 1955 over 40 percent of the world's reduction capacity was located in the United States while Canada had over 16 percent. Consequently, the United States and Canada have well over one-half of the world's productive capacity. Because of the geographical distribution of bauxite deposits in relation to industrialized nations, there is a heavy movement of bauxite and, more recently, aluminum in international trade. British Guiana, Dutch Guiana, and Jamaica have provided over 80 percent of the United States bauxite requirements and 100 percent of Canadian requirements. The United States has rapidly depleting deposits in Arkansas which are of a lower grade than the South American ores. Europe is quite well endowed with bauxite, particularly in France, Hungary, and Yugoslavia. France, Norway, Germany, and Italy are the principal producers of aluminum, although most of the other European countries also produce some aluminum. The United States is a major importer, along with Europe, despite its dominance in

TABLE 1

ALUMINUM REDUCTION CAPACITY AND CONSUMPTION FOR 1956 IN SELECTED AREAS

	Capacity[1] (tons)	Consumption (tons)
United States	1,775,500	1,778,000
Canada	762,000	91,900
South America	13,700	30,000
Europe	764,700	961,200
Asia	98,200	83,200
Russia and the Iron Curtain Countries	730,300	n. a.

n.a. Not available.
[1] Capacity dependent on availability of power.
Source: American Bureau of Metal Statistics, *Yearbook 1956*, (New York, 1957), pp. 88 and 92.

world production. Canada is the world's largest exporter, supplying both the United States and Europe.

Industrial organization

One peculiarity of the aluminum industry, particularly in the United States, has been the high degree of vertical and horizontal integration, which is to say, each firm has moved into the four basic stages of aluminum production as well as extending its control over an increasing number of plants at any one stage. Currently the drive for integration appears stronger than ever. As soon as Kaiser and Reynolds entered the field they made strenuous efforts to develop their own sources of bauxite, alumina plants, fabricating mills, etc. Although there are thousands of small independent fabricators, the bulk of the business is done by the three principal ingot producers.

At the moment three giants dominate the field —Aluminum Company of America, Reynolds Metals, and Kaiser Aluminum and Chemical Corporation, but there are others. Anaconda Copper Company entered the field toward the end of 1955 with a plant of 60,000 tons annual capacity of ingot at Columbia Falls, Montana. More recently, Harvey Machine Company announced the start of a 60,000-ton smelting plant at The Dalles in Oregon, which is expected to begin operation in 1958. In addition, Olin Mathieson has teamed up with Revere Copper and Brass to build a plant of 120,000 tons annual capacity in the Ohio Valley region. The projected combined capacity of these three new entrants amounts to about 15 percent of the current capacity of the three leading firms.

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Description of the leading companies

Of the three leading companies the Aluminum Company of America remains the largest and the most highly integrated. The sole producer of aluminum for years, Alcoa now accounts for 44.6 percent of United States capacity. It is the most completely integrated company in the industry, having large raw material reserves, supporting transportation and power facilities, alumina plants, reduction facilities, and fabricating units.

Alcoa, along with the other firms, has been engaged in a tremendous expansion program in all phases of its business. A new alumina plant with a capacity of 700,000 tons is to be built at Point Comfort, Texas, which will supply the adjacent smelter as well as the one at Rockdale, Texas. Plans have also been announced to build a 150,000-ton reduction plant at an Ohio River site in Indiana. It will include a 375,000-kilowatt steam power plant fired by coal in addition to ingot-casting equipment, a carbon plant for manufacturing anodes, machine shops, electrical shops, a rectifier station, and other service installations. Upon completion of its present plans, Alcoa's installed reduction capacity will be 962,500 tons.

Reynolds Metals Company possessed 27.5 percent of United States reduction capacity at the end of 1956. It is a producer of major aluminum products, including foil, in which it holds a dominant position. In addition to ingot and conventional mill products, the company fabricates parts for incorporation in the end products of other manufacturers and has a number of product divisions engaged in fabricating corrugated roofing, siding, gutters, downspouts, and aluminum windows. Reynolds Metals Company probably does more fabricating of finished goods than either of the other two leading companies. With the acquisition of bauxite reserves in Jamaica and Haiti, Reynolds has established itself in the four basic production phases in the aluminum industry.

Kaiser Aluminum and Chemical Corporation is the third giant in the field, accounting for 24.5 percent of United States reduction capacity at the end of 1956. Kaiser Aluminum and Chemical Corporation has moved very rapidly in the integration of its facilities to the point where its operations now extend from bauxite mines to consumer products.

Canadian firm is important supplier of aluminum

Aluminium Limited of Canada bears mention because of its huge size and its exports to the United States. The Aluminum Company of America began foreign operations by producing aluminum in Canada as early as 1901. By 1928, it organized Aluminium Limited, which acquired most of Alcoa's foreign holdings. The two companies were legally separate entities but tied together by the fact that Alcoa's stockholders now became holders of Aluminium Limited, the shares of which were distributed on a pro rata basis to the owners of Alcoa. In 1951 the New York Circuit Court ruled that stockholders in both firms would have to dispose of their stock in one of the companies. Aluminium Limited's total annual reduction capacity, held through its Canadian subsidiary, Aluminum Company of Canada, at the end of 1956 was 762,000 tons, as compared with Aluminum Company of America's 792,500 tons, Reynolds' 488,500 tons, and Kaiser's 434,500 tons. In addition, Aluminium Limited has interests in smelters in six other countries, with an aggregate capacity of 88,000 tons per year.

Aluminum Company of Canada, like United States firms, is embarked on ambitious expansion schemes. Its Kemano-Kitimat project, north of Vancouver in British Columbia, is believed to be the largest hydroelectric power development ever initiated by private capital. The reduction plant at Kitimat already has a capacity of 180,000 tons per year although the project is not yet completed. With further implementation of the over-all Kitimat plan at some future date, the generating capacity could be increased to approximately 1,592,000 kw., which would supply firm power capable of supporting an aluminum smelting capacity of 551,000 tons per year.

The principal activities of the Aluminium Limited enterprise embrace mining, shipping and transporting of the basic raw materials, generation of hydroelectric power, production of primary aluminum metal, and fabrication of some of the output into forms useful to the metal trade.

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Its international sales organization covers most areas of the world, and its research development program embraces nearly all aspects of the industry.

Because the company's primary producing capacity is almost five times its fabricating capacity, Aluminium Limited has become the largest supplier of aluminum ingot for independent fabricators in the western trading world. In recent years, 65 percent by weight of its aluminum sales have been made in ingot form. Most of the remaining 35 percent is fabricated within the company organization and sold as semifinished material, such as sheets, rods, extruded shapes, and castings, to manufacturers who perform the final operations in making end products available to consumers. A few subsidiary operations manufacture and sell such finished goods as transmission line cables, cooking utensils, and aluminum foil, but these account for little more than 5 percent of the gross volume of its metal sales.

Newly emerging structure of aluminum industry

The completion of plans already announced by the various companies will lead to slight changes of relative corporate positions within the industry. Nevertheless, important changes are taking place in the geographical concentrations of production and the level of capacity. Completion of expansion plans already under way or announced will culminate in United States capacity in 1958 45 percent greater than that of 1955. Canadian capacity will have increased even more by the end of 1958 with an expansion of 47 percent.

An interesting feature of the expansion plans in the United States is the move to a new location in the Ohio River Valley region. By the end of 1958 Pacific Northwest capacity will have dropped from 37 percent to 29 percent of the national capacity while the Ohio Valley region will have jumped from zero to 18 percent. The Harvey Aluminum plant at The Dalles in Oregon is the only new plant scheduled for construction in the Pacific Northwest.

Together with a shift in the location of new aluminum reduction facilities there has been a change in the energy source of electric power. By 1958 hydroelectric power will supply 65 percent of the aluminum industry's needs rather than 72 percent as at present. Gas will have declined from 24 percent to 18 percent, while coal and lignite will have jumped from 4 to 17 percent as sources of electrical energy. Some of the reasons for this shift will be discussed in the third instalment of this series.

The marked expansion scheduled for aluminum reduction capacity has raised some question as to the ability of the market to absorb all of the output that will be forthcoming within the next three years. In the next article a discussion of the factors that have influenced consumption in the past and that will affect the levels of consumption in the future will be presented.

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BUSINESS INDEXES — TWELFTH DISTRICT[1]

(1947-49 average = 100)

Year and month	Industrial production (physical volume)[2]							Total nonagricultural employment	Total mf'g employment	Car-loadings (number)[2]	Dep't store sales (value)[2]	Retail food prices[3, 4]	Waterborne foreign trade[3, 5]	
	Lumber	Petroleum[3] Crude	Petroleum[3] Refined	Cement	Lead[3]	Copper[3]	Electric power						Exports	Imports
1929	95	87	78	54	165	105	29	....	....	102	30	64	190	124
1933	40	52	50	27	72	17	26	....	....	52	18	42	110	72
1939	71	67	63	56	93	80	40	....	55	77	31	47	163	95
1948	104	101	100	104	105	101	101	102	102	100	104	103	86	98
1949	100	99	103	100	101	93	108	99	97	94	98	100	85	121
1950	113	98	103	112	109	113	119	103	105	97	105	100	91	137
1951	113	106	112	128	89	115	136	112	120	100	109	113	186	157
1952	116	107	116	124	87	112	144	118	130	101	114	115	171	200
1953	118	109	122	130	77	111	161	121	137	100	115	113	140	308
1954	111	106	119	133	71	101	172	120	134	96	114	113	131	260
1955	121	106	122	145	75	117	192	127	143	104	122	112	164	308
1956	116	105	129	156	77	118	210	134	152	104	129	114	195	443r
1956														
June	121	105	125	161	82	135	215	134	153	105	126	114	204	427
July	120	105	132	160	75	110	212	134	152	102	132	115	215	559
August	117	105	128	171	84	123	212	135	153	101	131	114	207	500
September	112	104	136	168	78	122	209	135	153	107	131	114	212	459
October	110	104	128	163	81	127	217	136	154	102	130	115	256	563
November	111	104	135	146	79	123	216	137	156	100	132	116	242	401
December	112	103	132	139	72	123	210	138	159	106	131	116	234	436
1957														
January	108	102	131	120	79	125	220	139	160	105	131	116	237	421
February	115	102	130	127	88	138	211	138	159	96	127	117	269r	417
March	115	101	132	140	88	133	221	138	159	100	133	116	267	489
April	111	101	132	154	78	135	228	138	159	103	127	117	298	534
May	111	101	138	157	82r	126	229	138	159	99	126	117	....	....
June	114	101	131	152	75	121	....	139	160	101	131	118	....	....

BANKING AND CREDIT STATISTICS — TWELFTH DISTRICT

(amounts in millions of dollars)

Year and month	Condition items of all member banks[6]				Bank rates on short-term business loans[8]	Member bank reserves and related items					Bank debits Index 31 cities[3, 12] (1947-49=100)[2]
						Factors affecting reserves:					
	Loans and discounts	U.S. Gov't securities	Demand deposits adjusted[7]	Total time deposits		Reserve bank credit[9]	Commercial[10]	Treasury[10]	Money in circulation[9]	Reserves[11]	
1929	2,239	495	1,234	1,790	......	− 34	0	+ 23	− 6	175	42
1933	1,486	720	951	1,609	......	− 2	− 110	+ 150	− 18	185	18
1939	1,967	1,450	1,983	2,267	......	+ 2	− 192	+ 245	+ 31	584	30
1949	5,925	7,016	8,536	6,255	3.20	+ 13	− 930	+ 378	− 65	1,924	102
1950	7,093	6,415	9,254	6,302	3.35	+ 39	−1,141	+1,198	− 14	2,026	115
1951	7,866	6,463	9,937	6,777	3.66	− 21	−1,582	+1,983	+ 189	2,269	132
1952	8,839	6,619	10,520	7,502	3.95	+ 7	−1,912	+2,265	+ 132	2,514	140
1953	9,220	6,639	10,515	7,997	4.14	− 14	−3,073	+3,158	+ 39	2,551	150
1954	9,418	7,942	11,196	8,699	4.09	+ 2	−2,448	+2,328	− 30	2,505	154
1955	11,124	7,239	11,864	9,120	4.10	+ 38	−2,685	+2,757	+ 100	2,530	172
1956	12,613	6,452	12,169	9,424	4.50	− 52	−3,259	+3,274	− 96	2,654	189
1956											
July	12,157	6,396	11,392	9,233	......	− 6	− 143	+ 240	− 8	2,519	195
August	12,173	6,439	11,356	9,286	......	+ 4	− 315	+ 247	− 103	2,565	198
September	12,423	6,491	11,581	9,305	4.57	+ 3	− 454	+ 466	− 59	2,640	182
October	12,384	6,468	11,747	9,326	......	− 5	− 417	+ 312	− 2	2,542	195
November	12,504	6,431	11,867	9,235	......	0	− 143	+ 209	+ 38	2,579	195
December	12,804	6,383	12,078	9,356	4.65	− 17	− 303	+ 451	+ 38	2,654	200
1957											
January	12,488	6,505	11,812	9,587	......	+ 33	− 558	+ 249	− 144	2,548	206
February	12,556	6,356	11,279	9,690	......	+ 41	− 816	+ 494	− 139	2,517	200
March	12,576	6,177	11,129	9,794	4.74	− 37	− 170	+ 170	− 9	2,495	199
April	12,649	6,520	11,622	9,839	......	− 35	− 445	+ 430	− 31	2,560	202
May	12,694	6,315	11,210	9,995	......	+ 56	− 261	+ 209	+ 54	2,526	200
June	12,911r	6,249r	11,310r	10,155r	4.81	− 29	− 374	+ 402	+ 20	2,483	203
July	12,912	6,319	11,407	10,188	......	− 49	− 426	+ 320	+ 6	2,457	205

[1] Adjusted for seasonal variation, except where indicated. Except for department store statistics, all indexes are based upon data from outside sources, as follows: lumber, California Redwood Association and U.S. Bureau of the Census; petroleum, cement, copper, and lead, U.S. Bureau of Mines; electric power, Federal Power Commission; nonagricultural and manufacturing employment, U.S. Bureau of Labor Statistics and cooperating state agencies; retail food prices, U.S. Bureau of Labor Statistics; carloadings, various railroads and railroad associations; and foreign trade, U.S. Bureau of the Census. [2] Daily average. [3] Not adjusted for seasonal variation. [4] Los Angeles, San Francisco, and Seattle indexes combined. [5] Commercial cargo only, in physical volume, for Los Angeles, San Francisco, San Diego, Oregon, and Washington customs districts; starting with July 1950, "special category" exports are excluded because of security reasons. [6] Annual figures are as of end of year, monthly figures as of last Wednesday in month. [7] Demand deposits, excluding interbank and U.S. Gov't deposits, less cash items in process of collection. Monthly data partly estimated. [8] Average rates on loans made in five major cities. [9] Changes from end of previous month or year. [10] Minus sign indicates flow of funds out of the District in the case of commercial operations, and excess of receipts over disbursements in the case of Treasury operations. [11] End of year and end of month figures. [12] Debits to total deposits except interbank prior to 1942. Debits to demand deposits except U.S. Government and interbank deposits from 1942. p—Preliminary. r—Revised.

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