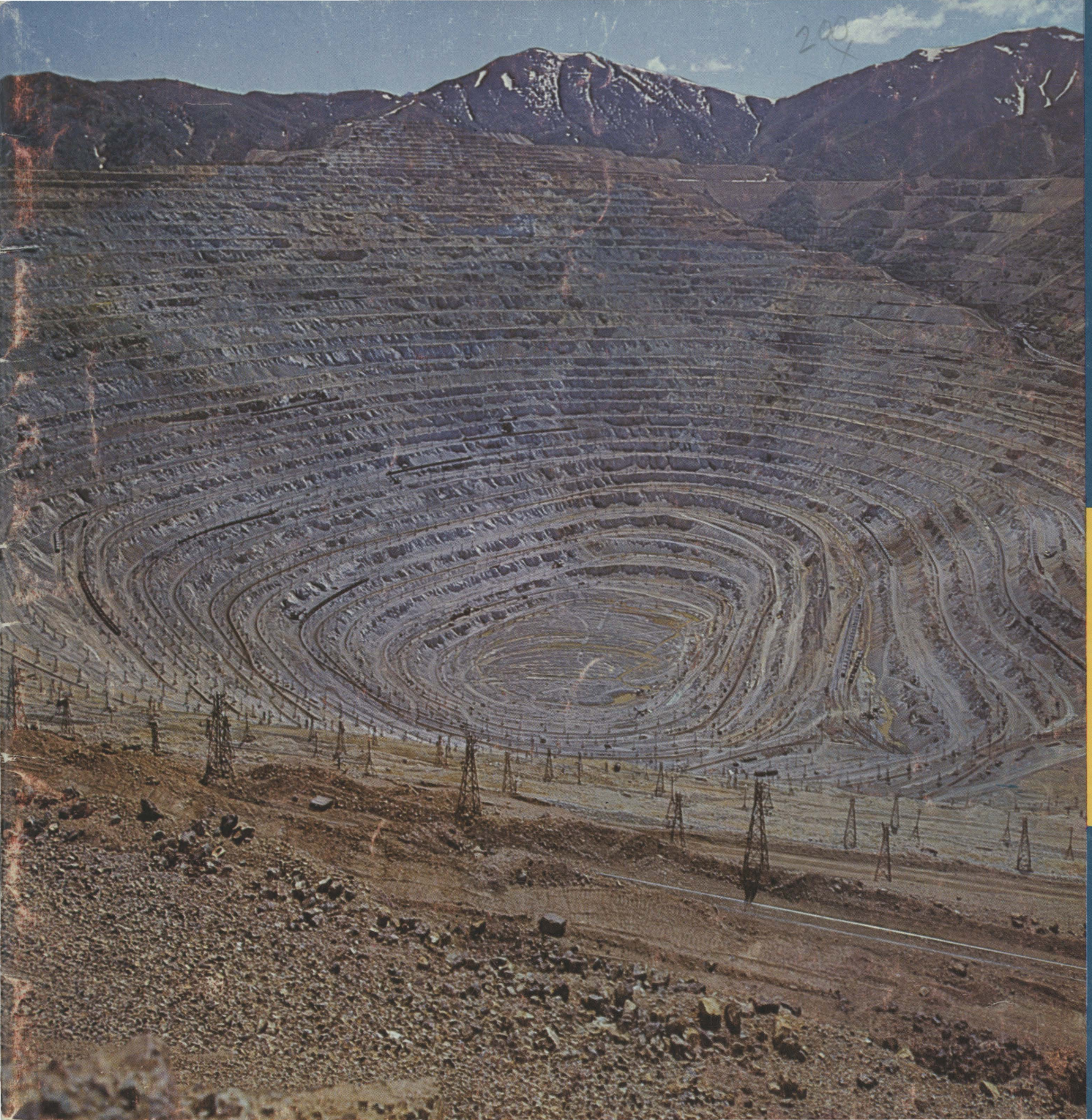


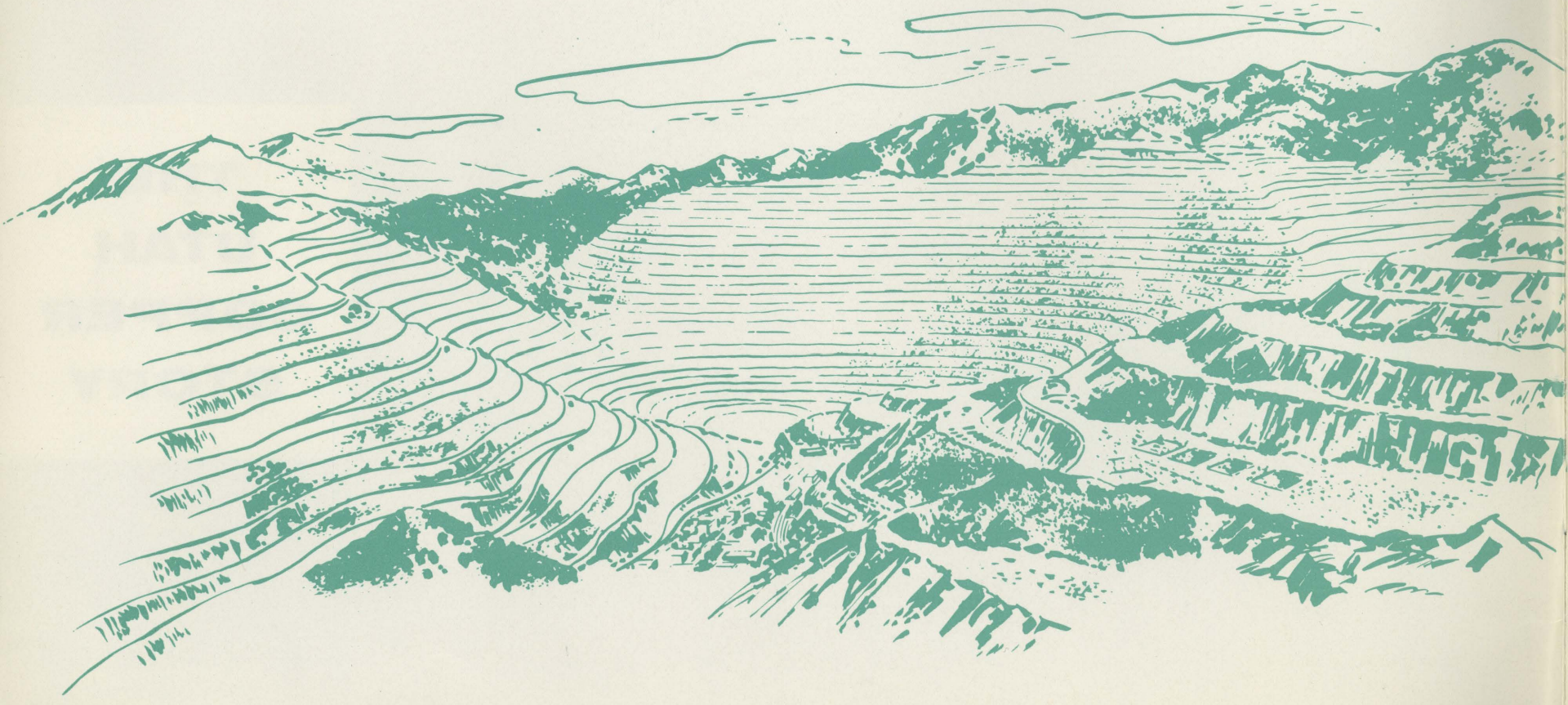
THE UTAH COPPER STORY

KENNECOTT COPPER
CORPORATION
UTAH COPPER DIVISION

KENNECOTT COPPER CORPORATION

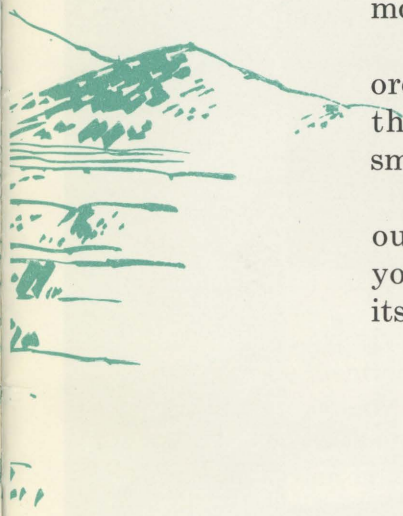
UTAH COPPER DIVISION *Kearns Building – Salt Lake City, Utah*

1960 - 1961 Edition



FOREWORD

The Utah Copper Division of Kennecott Copper Corporation is one of the world's largest copper producing operations. But it is more than that — it is an outstanding tribute to the vision and ingenuity of men, and a model of converting waste to economic gain.



The Utah Copper Division properties are a rare example of the whole ore processing operation — from ore to refined copper. Facilities include the giant open-pit mine at Bingham Canyon, two ore concentrators, a smelter, electrolytic refinery and related facilities.

These operations and the history of copper development in Utah are outlined in this booklet. It is our hope that it will supply information you may desire concerning our industry and how it helps Utah maintain its place in the nation's economy.

J. P. O'Keefe
General Manager

OUTSTANDING MINING ENTERPRISE

As statistics readily indicate, the Utah Copper Division of Kennecott Copper Corporation is one of the world's truly great mining enterprises.

From its beginning in 1904, marked by a new method of handling and processing huge tonnages of low-grade copper ore, the enterprise consistently has set world mining records.

Today, the Division's Bingham Canyon Mine is acknowledged as the world's largest man-made excavation, the result of removing a record-breaking two billion tons of material. What was once a large mountain has been transformed through mining activity to a huge pit, resembling an amphitheater.

From this tremendous tonnage of ore and overburden (waste material), there has been produced during the past 56 years nearly 15 billion pounds of the red metal, a record for any single, individual copper mine. Normally, the Division produces about 22 per cent of the nation's newly-mined copper each year.

To help illustrate the unique aspects of this mine, it should be mentioned that it is the second largest producer of gold in the Western Hemisphere and the nation's second largest producer of molybdenum, a metal important in making steel.

Other by-products of copper production are silver and such metals as platinum, nickel and selenium, which are present in the ore in minute quantities.

In 1943, during World War II, when copper was in great demand for defense purposes, the Division established these world records:

- Tons of ore milled in a 24-hour day 108,000
- Tons of ore and waste removed in a 24-hour day 235,000

(New record established June 9, 1960 ..... 275,103 tons)

- Tons of ore milled in one month 3,074,000
- Tons of ore milled in one year 35,375,000
- Tons of copper produced in one year 319,500

In order to handle such vast amounts of ore, the Division maintains its own ore haulage department, a 16-mile standard-gauge railroad between Bingham Canyon and the ore concentrating plants near Magna. When the mine is producing at full capacity, the Division sets another record – a record of haulage that establishes the highest traffic density of any railroad in the world.

Three other items may be of interest:

(A) The Division's smelter near Magna is the largest copper smelter in the world.

(B) The Division is the largest user of electric power in Utah. The power, generated at its own plant, is sufficient to supply the needs of a city with a population of 350,000.

(C) The Division is by far the largest taxpayer in the State of Utah.

Spectacular step in smelting – copper matte being loaded into converter furnace for further processing.

HISTORICAL HIGHLIGHTS

The Utah Copper Story began in 1863, when Bingham Canyon was first prospected actively by soldiers of the Third California Infantry who were stationed at Fort Douglas, immediately east of Salt Lake City. Many of them had prospected in the California gold fields before joining the army.

Their commanding officer, Colonel (later General) Patrick E. Connor, who is credited with being the "father of Utah mining," encouraged his men to spend their leisure searching for metals.

Fragments of lead ore were found, and the first mining district in Utah was organized late in 1863 under the name of West Mountain. Gold was discovered the following year. Some promising mineral deposits were located, but because of difficulties, including the lack of a railroad, development was slow.

Ironically, the first copper deposits were largely neglected because they were low grade and not as easily smelted as lead ores. Bingham Canyon, until after the turn of the century, was essentially a lead-silver-gold mining camp.

Meantime, Colonel Enos A. Wall, a noted figure in Utah mining circles, had seen the possibilities of the copper deposits, and in the 13-year period beginning in 1877 he acquired all or part of 19 claims covering 200 acres. He had driven more than 3,000 feet of tunnels and drifts, enough to satisfy him that the copper bearing deposits, although low grade, were of great size.

He interested Captain Joseph R. De Lamar, a pioneer in Utah mining, in the Bingham property. From

1895 through 1899, the captain made several examinations of the property, his enthusiasm fluctuating in direct proportion to the fluctuations in the market price of copper. However, in 1899 he purchased a one-fourth interest in the property. He later obtained options on other claims.

Two young mining engineers, Daniel C. Jackling and Robert C. Gemmell, who were working for the captain, made an examination of the Bingham property. They later wrote one of the most significant reports ever prepared about a potential mining property.

These two imaginative explorers visualized a substantial profit from developing ore containing only two per cent copper, which they proposed mining by steam shovels in open-pit operation. They also proposed a concentrating plant be built 15 miles away near Garfield Beach on Great Salt Lake, nearest source of adequate water. The ore would be hauled on a standard-gauge railroad.

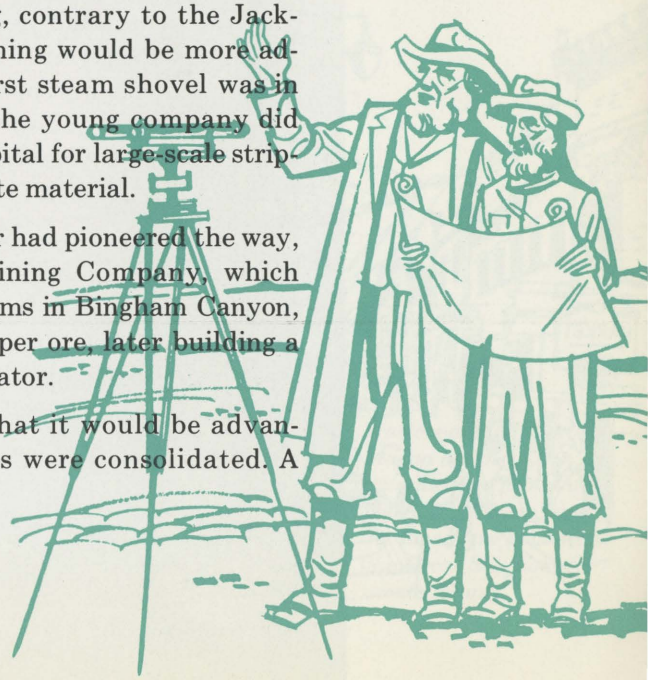
Their proposal, which embodied radical departures from accepted copper mining procedures, included the application of mass mining and milling methods. The brilliant report was ridiculed by successful mining men of that era. One man, approached for financing, remarked scornfully that the Bingham property contained a smaller percentage of copper than was being dumped as waste material at the copper mills in Butte, Montana. Captain De Lamar accepted the skepticism of the profession and gave up his option on Colonel Wall's property.

Four years later Jackling put the proposal before Charles McNeill and Spencer Penrose of Colorado Springs, Colorado. The two inspected the property with K. R. Babbitt and R. A. F. Penrose, and offered to provide the initial financing for the enterprise.

On June 4, 1903, the Utah Copper Company (now the Utah Copper Division) was organized under the laws of Colorado. The first ore was milled in August, 1904, in a 300-ton per day capacity mill at Copperton, located a few miles below Bingham.

The following year the Guggenheim Exploration Company, after 17 engineers spent seven months examining the property, underwrote a $3,000,000 bond issue. The American Smelting and Refining Company began construction of a smelter at Garfield to treat the concentrates from a new 6,000-ton plant near Magna. The smelter started operation in 1907.

Operations at the mine, however, had been confined to underground mining, contrary to the Jackling report that open-cut mining would be more advantageous. Although the first steam shovel was in use in the summer of 1906, the young company did not yet have the necessary capital for large-scale stripping of the overburden, or waste material.



In 1908, after Utah Copper had pioneered the way, the Boston Consolidated Mining Company, which owned the upper group of claims in Bingham Canyon, started mining low-grade copper ore, later building a mill near the Magna concentrator.

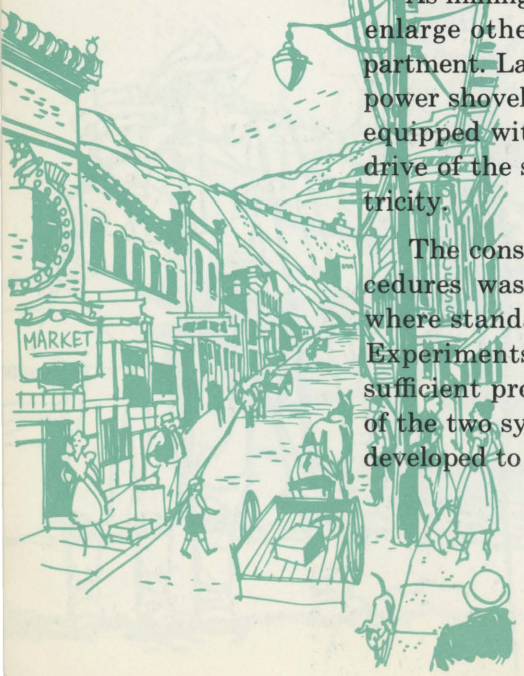
It was soon recognized that it would be advantageous if the two properties were consolidated. A

merger was effected in 1910, with Jackling in charge of the enterprise. The Boston company mill was remodeled and renamed Arthur Mill; the Utah mill was renamed Magna Mill. The two mills concentrated nearly 5,000,000 tons of ore in 1911. It soon became evident that more ore would be needed to keep the two plants operating.

Tonnage from the Boston underground working was increased and remained at a high level until 1914, when underground mining was discontinued and the entire property was converted to open-cut methods.

During 1910 and 1911 Utah Copper constructed its own 20-mile railroad, the Bingham and Garfield Railroad, to connect the mine with the mills and smelter. The road was abandoned in 1948 and replaced by a shorter industrial track system utilizing electric locomotives.

As mining operations expanded it was necessary to enlarge other facilities, such as the mechanical department. Larger ore and waste cars were introduced; power shovels, first operated on railroad tracks, were equipped with tractor-type treads. Later the power drive of the shovels was changed from steam to electricity.



The constant search for better methods and procedures was extended to concentrator operations, where standard practice involved gravity processes. Experiments with froth flotation processes showed sufficient promise in 1914 to warrant a combination of the two systems. The flotation system was steadily developed to a high degree of efficiency. As a result of constant research and improvement, about 90 per cent of the metal is now recovered, compared to about 60 per cent in 1920.

Through the years the Division continued to improve methods and procedures, and to this end has invested millions of dollars of profits to assure flexibility and sustain quality production – a major factor in the numerous world records being set. Such capital expenditures have extended the life of the mine and the property and permit it to be one of the greatest mining enterprises in the world.

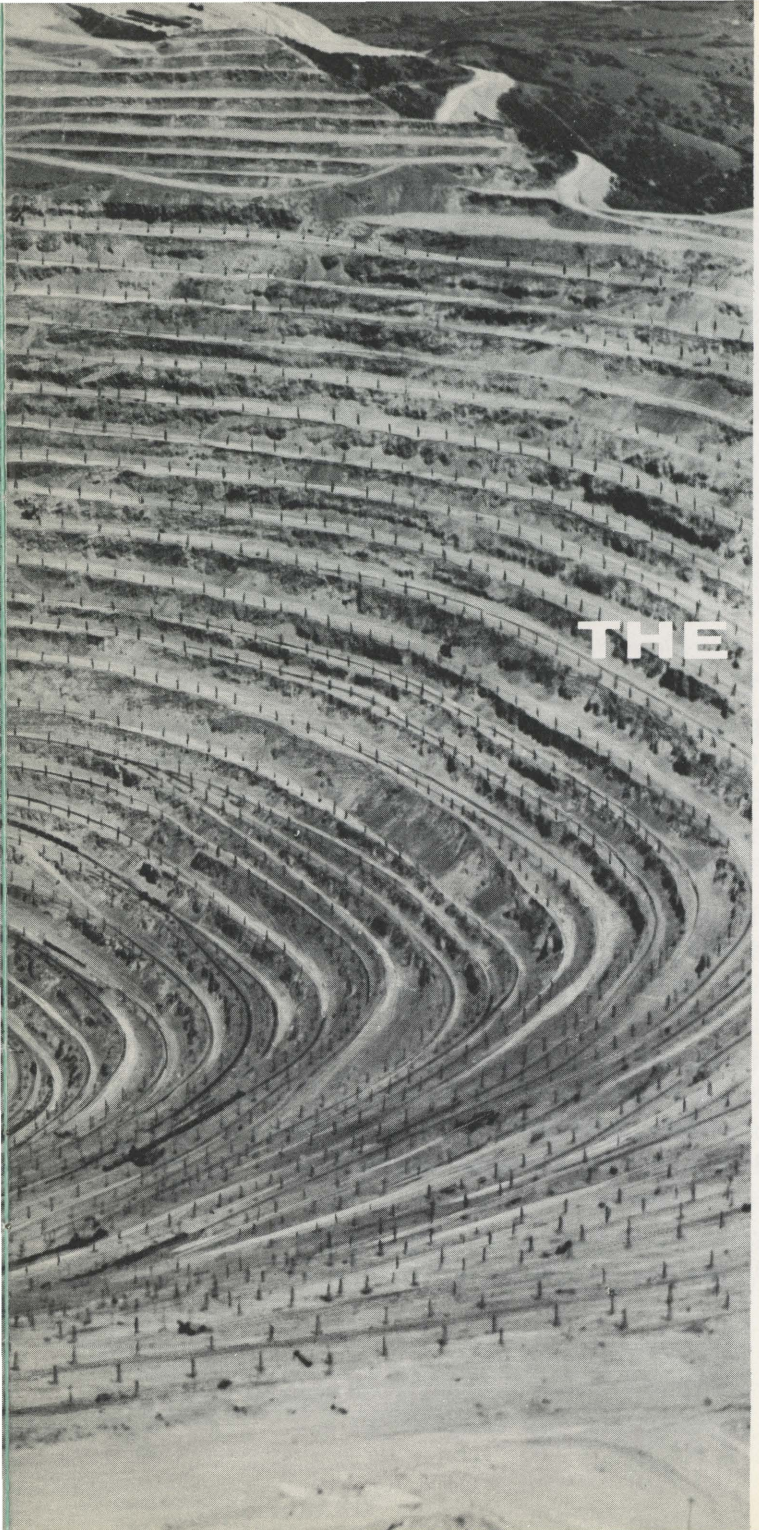
Major, long-range improvement projects recently completed, underway, or now in the planning stage represent an investment of approximately $50,000,000.

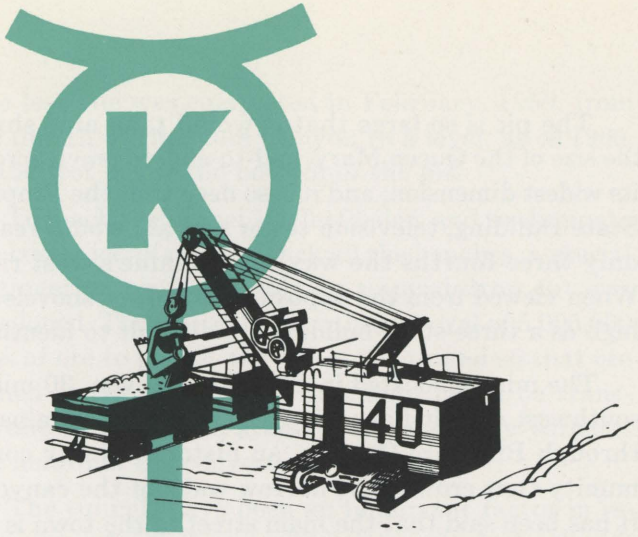
Among these are:

- An 18-thousand foot tunnel, driven from the Copperton Assembly Yard to the Mine. Costing $12,000,000, the tunnel will eliminate expensive uphill ore haulage caused by the mine's increasing depth.
- Construction of an $18,000,000 addition to the Central Power Station to increase electrical output from 100,000 kilowatts to 175,000 kilowatts.
- A $10,000,000 program designed to modernize the Utah Smelter.

Waste material from Magna and Arthur concentrators flows into 5300-acre tailings pond. At sunset, the pond rivals the Great Salt Lake for scenic beauty.


THE





THE "INCREDIBLE" MINE

The Bingham Canyon Mine of the Utah Copper Division is unique in many ways. Among the distinctive features for which it is noted are:

It is the first open pit mine in the copper industry.

It is the largest single mining project man has ever undertaken.

It has produced more copper than any individual mine in history, and its by-products of gold and molybdenum make it the second largest producer of these metals in the country.

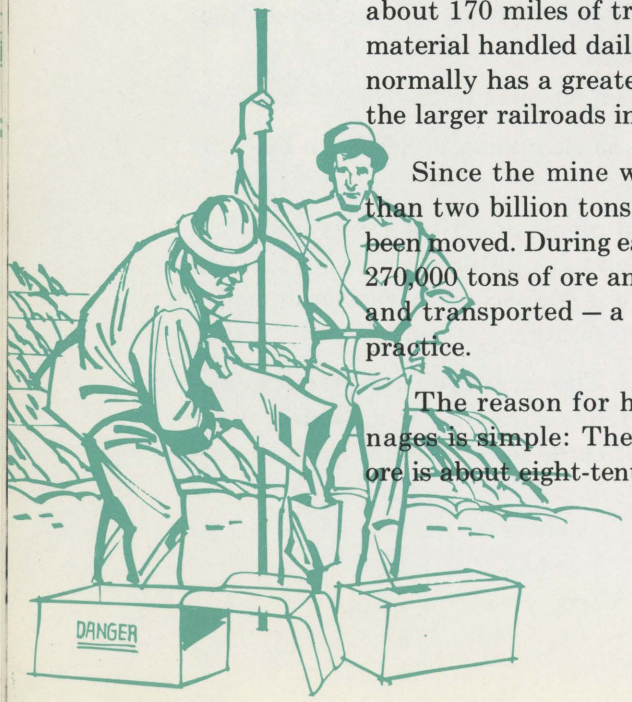
The mine is vast. The excavation area, for example, covers more than 1,000 acres, and at its widest point it is about one and three-fourths miles from east to west.

Aerial view of mine highlights vast area of North America's largest open pit copper mine.

The pit is so large that it would take nine ships the size of the Queen Mary, end-to-end, to reach across its widest dimension; and it is so deep that the Empire State Building, television tower and all, would reach only three-fourths the way up the mine's west rim. When viewed from the opposite rim, power shovels as high as a three-story building are difficult to identify.

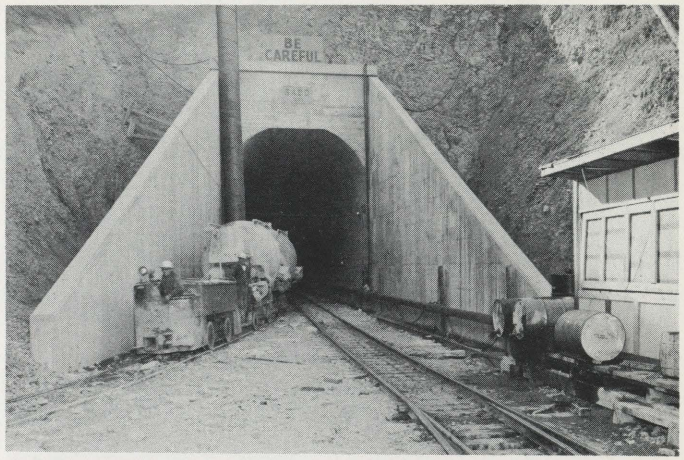
The mine is located in Bingham Canyon, 30 miles southwest of Salt Lake City. Entrance to the mine is through Bingham Canyon, an historic mining community that crowds the narrow walls of the canyon. It has been said that the main street of the town is so narrow that dogs wag their tails up and down rather than sideways.

Standard-gauge railroad tracks used for transporting ore and waste material line both sides of the canyon above the homes. The mining area itself requires about 170 miles of trackage. Because the amount of material handled daily is so huge, the haulage system normally has a greater volume of traffic than most of the larger railroads in the world.



Since the mine was started 56 years ago, more than two billion tons of ore and waste material have been moved. During each operating day approximately 270,000 tons of ore and waste must be blasted, loaded and transported – a classic example of mass mining practice.

The reason for handling such tremendous tonnages is simple: The average copper content of the ore is about eight-tenths of one per cent, or 16 pounds



Recently completed 18,000 foot tunnel helps eliminate costly uphill haulage of ore from lower levels of mine.

of copper for each ton of ore. However, in order to mine one ton of ore it is first necessary to remove two tons of overburden or waste material. In other words, 6,000 pounds of material must be handled to obtain a mere 16 pounds of copper.

Present operating schedules call for 90,000 tons of ore per day. This, plus the two-to-one ratio of waste material, means 270,000 tons must be handled to meet the schedule.

The Division has a productive capacity of more than one-half billion pounds of copper every year. This represents about 22 per cent of the new copper produced annually in the United States, or 8 per cent of the free world's reported primary production. Before new copper mines were brought into production in the United States during the past decade, the Divi-

sion accounted for one-third of the nation's red metal supply.

From its very beginning, when new and radical departures from accepted mining practices were inaugurated, this "incredible" mine consistently has been an attraction. Its history, its amazing production records and its sheer physical magnitude have set it apart from other large mines of the world.

The mine is big, is breathtaking; it is one of the finest examples of the free enterprise system at work.

The bottom level of the mine is at an elevation of 5,640 feet above sea level and the top level on the west side is at 7,800 feet, or almost one-half mile higher.

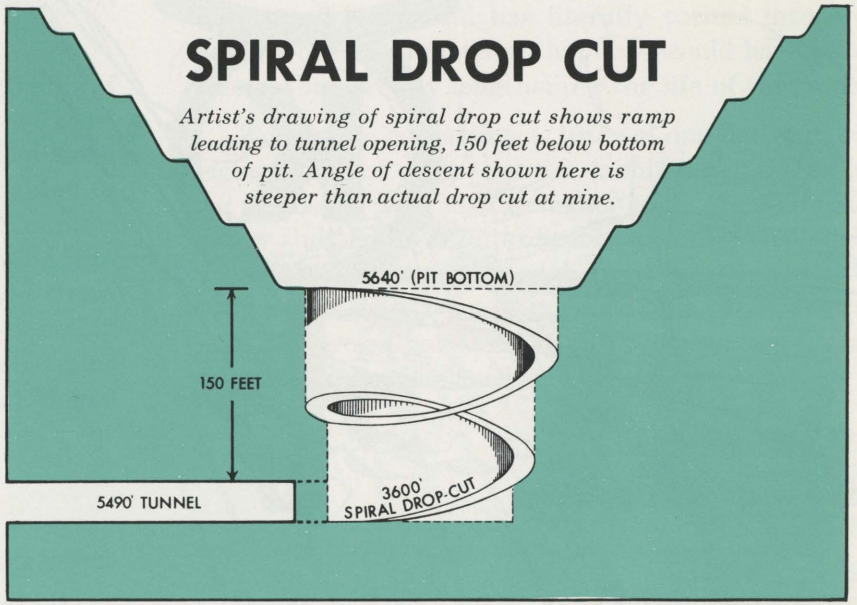
From the bottom of the pit to the mountain tops there are numerous levels or benches. They vary from 50 to 75 feet high, with a maximum width of 65 feet. Without these benches, it would be impossible to mine under the open-pit method, the feasible and economical method to handle the low grade ore in great quantity.

The ore body is in the shape of a plug, or an inverted cone. To utilize the huge shovels and to transport the ore over a practical railroad grade from the mine, it is necessary to have ample working space. Therefore, as the mine develops in depth to reach the ore body, all benches, particularly those composed of waste material, must be pushed farther and farther back to gain the needed operating space and maintain a proper slope.

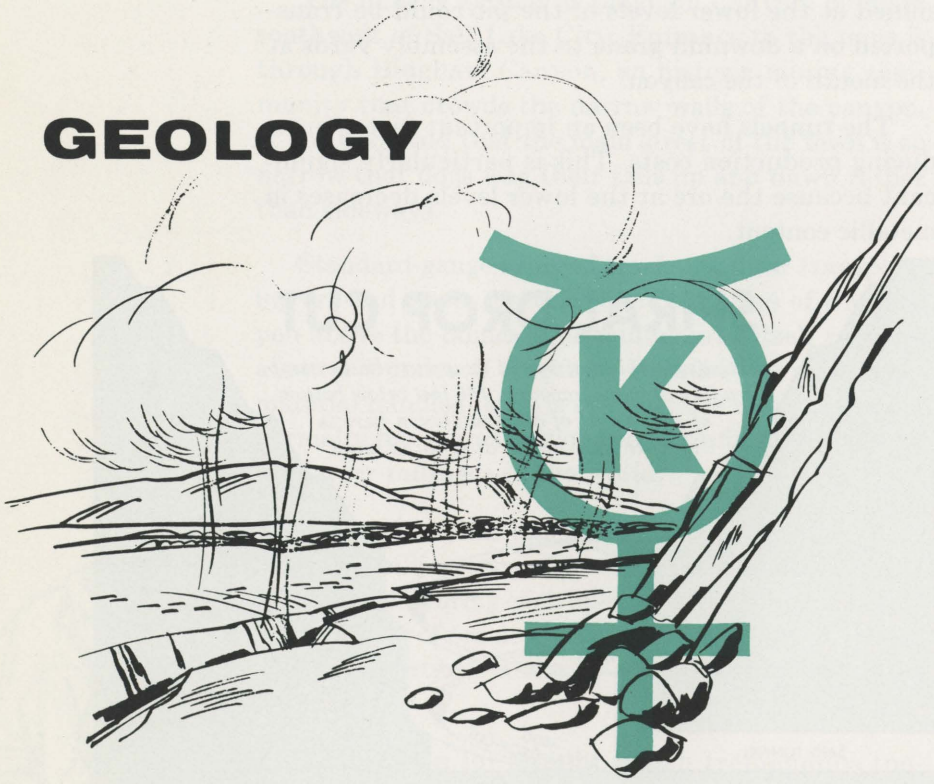
To avoid slow and expensive uphill haulage of ore to the top of the mine, three tunnels have been driven. The last one was completed in February, 1959, from the mouth of Bingham Canyon to a level, as of 1960, of 150 feet below the bottom of the pit.

To reach the tunnel 150 feet below and to eliminate the costly job of moving back all the benches, a special engineering project involving a spiral drop cut was developed. The plan called for the removal of 5,000,000 tons of ore to permit the use of the tunnel so that ore mined at the lower levels of the pit could be transported on a downhill grade to the assembly yards at the mouth of the canyon.

The tunnels have been an important factor in reducing production costs. This is particularly significant because the ore at the lower levels decreases in metallic content.



GEOLOGY



Geologists estimate that the Bingham Canyon Mine had its origin some 60,000,000 years ago when mountains were formed by the folding and uplifting of sedimentary rocks, already old, which had been laid down as sands, silts and limestones in the shallow seas of the Pennsylvanian period.

Within these mountains an area of weakness developed in the earth's crust creating zones of fissures and fractures. Into one of these zones was forced a massive plug of molten porphyry rock from deep within the earth.

While still hot, much of the porphyry plug and some of the surrounding sedimentary rock were fractured and shattered. The shattered porphyry provided a ready path of escape for hot, mineral-charged waters and gases, which probably were driven off during the cooling of the molten rock at great depths.

As these hot, metal-bearing solutions passed upward through the fractured rock they were deposited in tiny cracks and cavities in the porphyry. Today, this mineralized plug constitutes the disseminated porphyry ore of the mine.

Copper is present chiefly in the minerals chalcocite and chalcopyrite, composed, respectively, of copper-sulfur and copper-iron sulfur. The ore today contains less than one per cent copper, plus small amounts of molybdenum and minute quantities of silver and gold.

Only the large size and uniform mineralization of the ore body, which permits large-scale mechanized operation, make it economically possible to recover the metals from the low-grade material.

MINING METHOD

Several years ago Kennecott published an advertisement entitled: "Every Day Is Fourth of July at Bingham Canyon." The advertisement pointed up the fact the Division daily blasted thousands of tons of ore and waste material as one of the steps in producing copper.

While this is the spectacular part of the operation, it is by no means the complete picture of mining methods used. To break up the ore and waste, mobile drilling units drive holes up to 30 feet deep at intervals of 20 feet to 50 feet into the toe of a level, or bank. Each hole, charged with blasting powder or ammonium nitrate, breaks up approximately 2,200 tons of material.

Full revolving shovels with dippers capable of scooping up to 10 to 16 tons of material at a "bite" are used for loading ore and waste material. The waste is loaded into 80-ton side-dump cars and hauled to disposal areas by electric locomotives hauling trains of seven cars. In similar manner, ore is loaded into railroad cars of 90-ton capacity and hauled in trains of 13 to 21 cars seven miles to the Copperton assembly yard at the mouth of Bingham Canyon. Here, trains are made up for movement to the Arthur and Magna concentrating mills 14 miles northward.

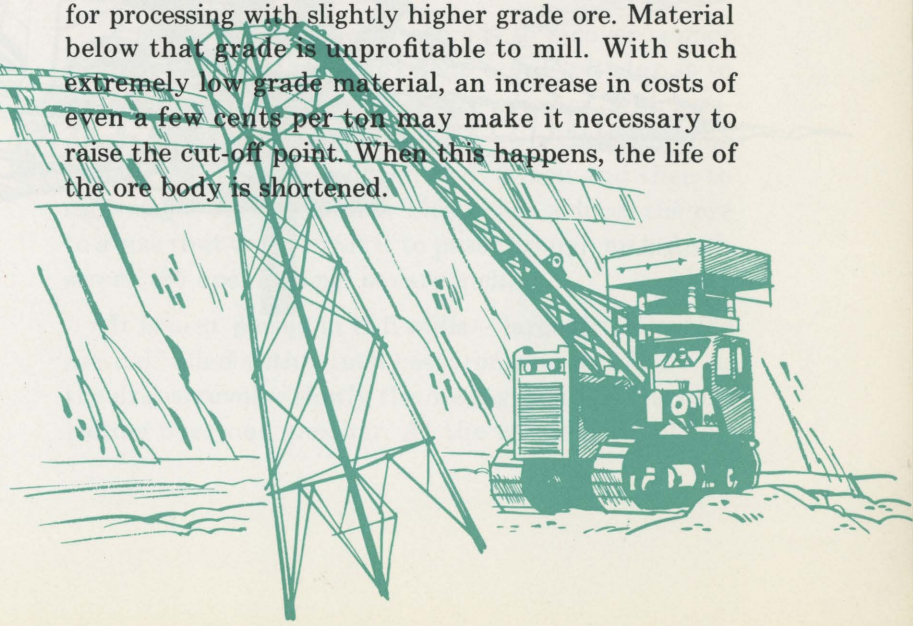
The "Cut-Off" Point

Although operating under sound engineering principles, with good equipment and highly competent employees, there is a point below which it is not economically possible to mine even large tonnages of waste and low-content copper ore at a profit. This point is the "cut-off" point.

Years ago the cut-off point was 8/10ths of one per cent, or 16 pounds of copper per ton of ore. Material containing 16 pounds or more was sent to the mills as ore, and material containing less copper had to go to the waste dumps. Constant and forward-looking planning, research and plowing back into the property of millions and millions of dollars for new facilities, equipment and processes have progressively changed the picture.

Increased efficiency has permitted a reduction of the cut-off point and has literally turned into ore millions of tons of material that once would have been waste, thus greatly lengthening the life of the mine.

Today, ore containing 4/10ths of one per cent, or eight pounds of copper per ton, is shipped to the mills for processing with slightly higher grade ore. Material below that grade is unprofitable to mill. With such extremely low grade material, an increase in costs of even a few cents per ton may make it necessary to raise the cut-off point. When this happens, the life of the ore body is shortened.



ORE HAULAGE SYSTEM

The Ore Haulage Department of the Division is another example of the tremendous size of operations. In 1910 and 1911 the Company built a 20-mile railroad between the mine and the concentrators at a cost of $4,500,000. As the mine grew deeper and as production costs mounted steadily, the Division was faced with the necessity of shortening the route over a lower elevation to eliminate the steeper grades and sharper curves.

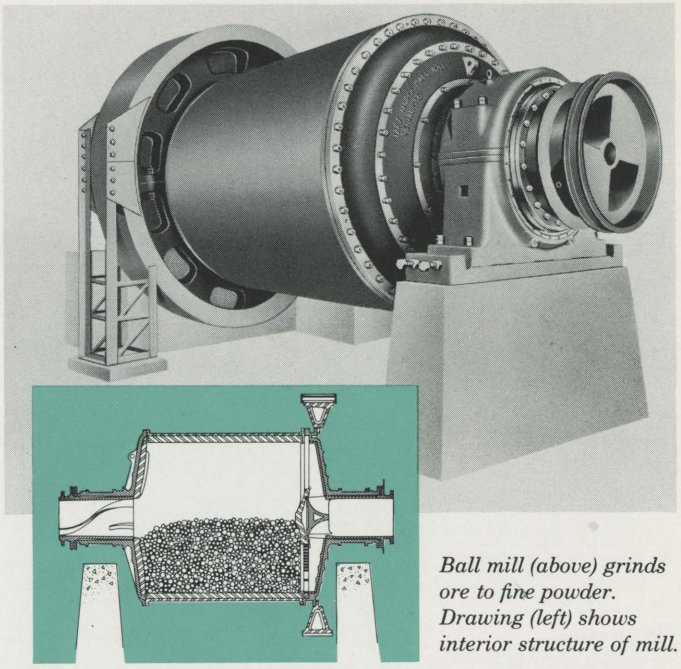
So the $4,500,000 line was scrapped. The new lower-level route, only 14 miles long, with far better grades and curves, was built in 1946 at a cost of $5,500,000. The line is equipped with centralized traffic control. Three tunnels reduce costs by eliminating many of the difficult grades for trains moving out of the mine.

On a normal basis, the Department must handle some 30,000,000 tons of ore annually, which means that a cost saving of even a fraction of a cent per ton is a substantial gain.

As many as 92 cars can be handled on the new route in a single train powered by two 125-ton electric locomotives operating as a single unit. The department also handles the movement of copper concentrate from the two concentrators to the nearby smelter, as well as rail traffic to and from the refinery, concentrators and connecting railroads.

The electrified track system in the mine alone totals 166 miles of standard gauge track using 90 to 132-pound rails. To support the transmission and trolley lines, there are more than 4,000 portable steel transmission towers, which are being moved continually to meet new track alignments required as the mine levels are changed.

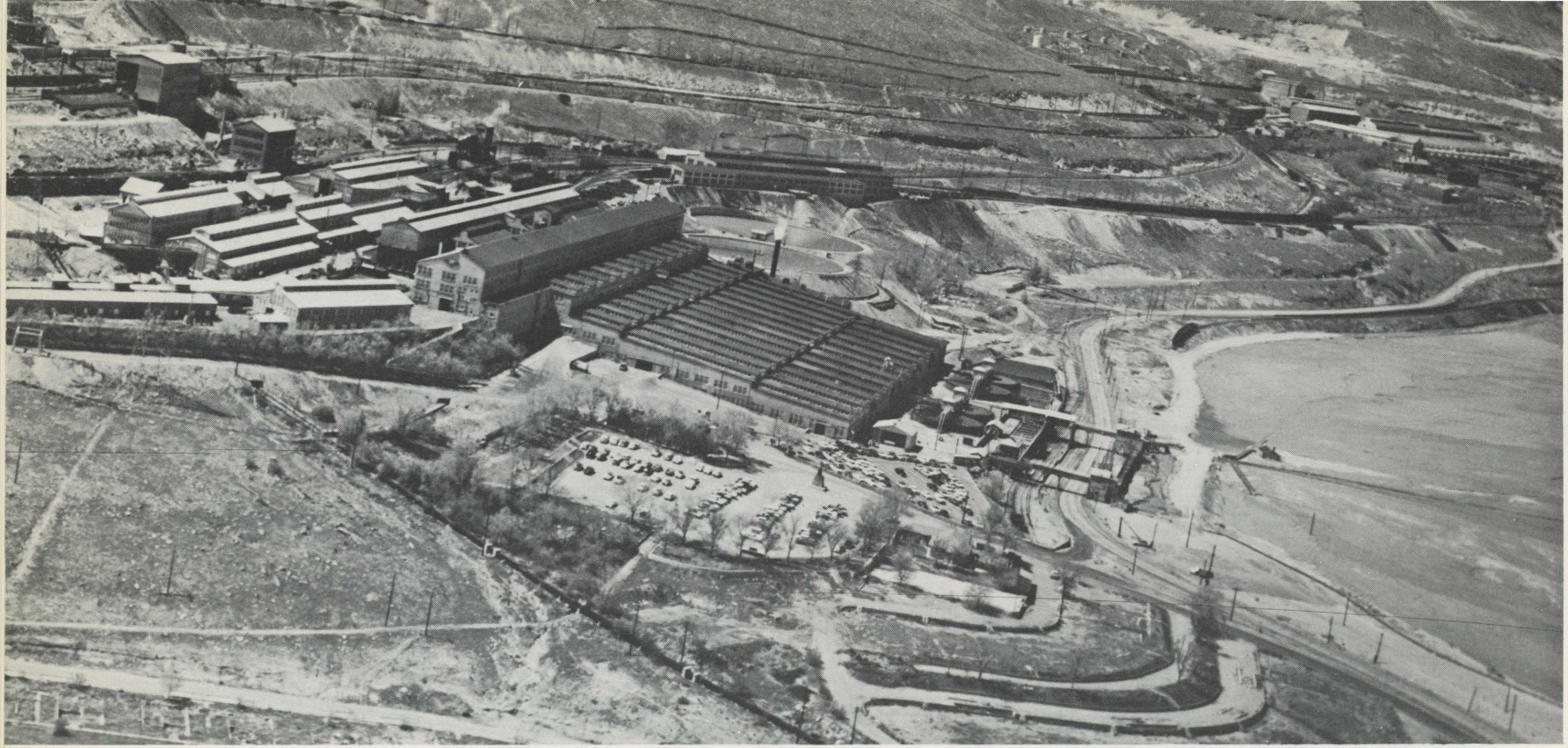
CONCENTRATOR OPERATIONS



Ball mill (above) grinds ore to fine powder. Drawing (left) shows interior structure of mill.

Purpose of the concentrators is to recover copper bearing minerals present in the ore. First step is to send the ore through a gyratory crusher, which reduces it to six-inch size. It next goes through cone crushers where it is reduced to 7/8 inch and then to rolls where water is added. This phase reduces the ore to a size that will permit it to pass through an 8-mesh screen (64 openings per square inch).

It is next placed in ball mills — large drums which are half filled with 2-inch cast iron grinding balls. As the drums revolve slowly the ore is ground by the balls rolling over one another. At the completion of this



Kennecott's Utah Magna Concentrator sprawls at the foot of the Oquirrh Mountains. Here, ore is processed into copper concentrate.

stage, more than 80 per cent of the ore will pass through a screen with 10,000 openings per square inch.

The material is then agitated in flotation cells, where chemical reagents are added, some of which help to create froth in the watery feed. Other reagents coat the desired mineral particles, giving them an affinity for the bubbles in the froth. These mineral particles attach themselves to the bubbles, ride them to the surface and float off the sides of the flotation cells.

The product is a copper mineral concentrate containing about 30 per cent copper, one and one-half per cent molybdenite and small quantities of gold and silver. The concentrate is then treated for the recovery of molybdenite. Through a combination of differential flotation and heat treatment, a high grade molybdenite concentrate is produced, containing more than 90 per cent of molybdenite, a small per cent of copper and practically no gold or silver. The molybdenite concentrate is sold in that form for further processing and ultimate use in the manufacture of alloy steels.

Almost all of the water is then removed from the copper concentrate which is shipped in carload lots to the nearby smelter for further processing.

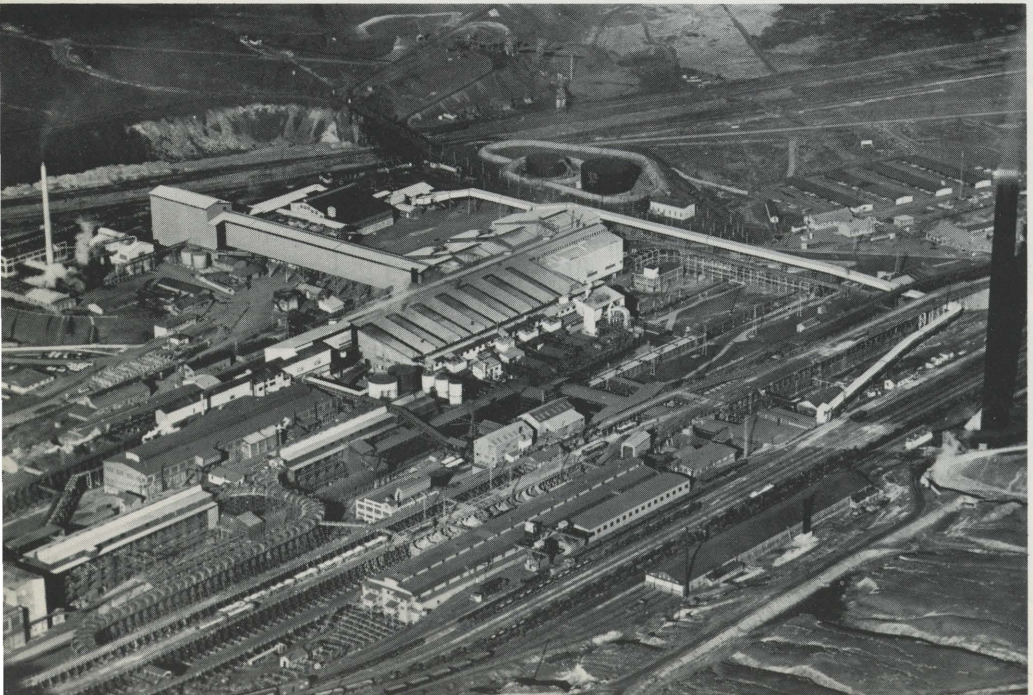
Close by the Magna Concentrator is the Arthur Concentrator. The two concentrators process an average of 90,000 tons of ore daily.

THE UTAH SMELTER

Located on the southern shoreline of Great Salt Lake, several miles west of the concentrators, is the Division's smelter, largest copper smelter in the world. It processes approximately 775,000 tons of concentrate a year.

The smelter was purchased from the American Smelting and Refining Company on January 2, 1959, at a cost of $20,000,000, as part of a program to integrate all of Kennecott's copper-producing facilities. Additional millions of dollars currently are being expended to modernize the smelter.

Part of the modernization of the smelter will be the elimination of the roasting furnaces, now the first step in handling the concentrates that come from the Arthur and Magna Mills. The concentrate is mixed with siliceous and lime fluxing materials and charged into the roasters for preheating and the elimination of some of the impurities.



When the charge, called calcine, comes out of the roasters, it is transported to the reverberatory furnaces and subjected to heat of 2700 degrees Fahrenheit. Under the heat, the molten mass separates, with the impurities, known as slag, floating to the top, where they are skimmed off. The slag, consisting of silica, iron, lime and alumina, is hauled to the dump. The remainder of the bath is copper matte, which is comprised of about 40 per cent copper and 60 per cent impurities.

The matte, being heavier, is tapped at a lower level than the slag and transported in huge ladles to the converter furnaces. Here, a combination of air (blown into the converters under pressure) and a silica flux removes additional impurities to produce copper about 98½ per cent pure.

The metal, now known as blister copper, is transferred from the converters to a holding furnace before it goes to the anode furnaces, where another step in removing impurities takes place.

At the anode furnaces, 20-foot pine poles are forced into the glowing metal to eliminate oxygen, an impurity. As the poles burn, the oxygen is consumed and removed as carbon dioxide. The copper, now 99½ per cent pure, is cast into shapes called anodes. These are shipped to the Division's refinery, where the remaining small percentage of impurities is removed.

Kennecott's Utah Smelter, world's largest copper smelter — processes copper concentrates produced by Magna and Arthur Concentrators.

THE UTAH REFINERY

The ~~Division~~ refinery, located near Magna, began operating in the fall of 1950 and produces electrolytically refined copper. It was built at a cost of more than $20,000,000, including $2,000,000 for expanding casting facilities.

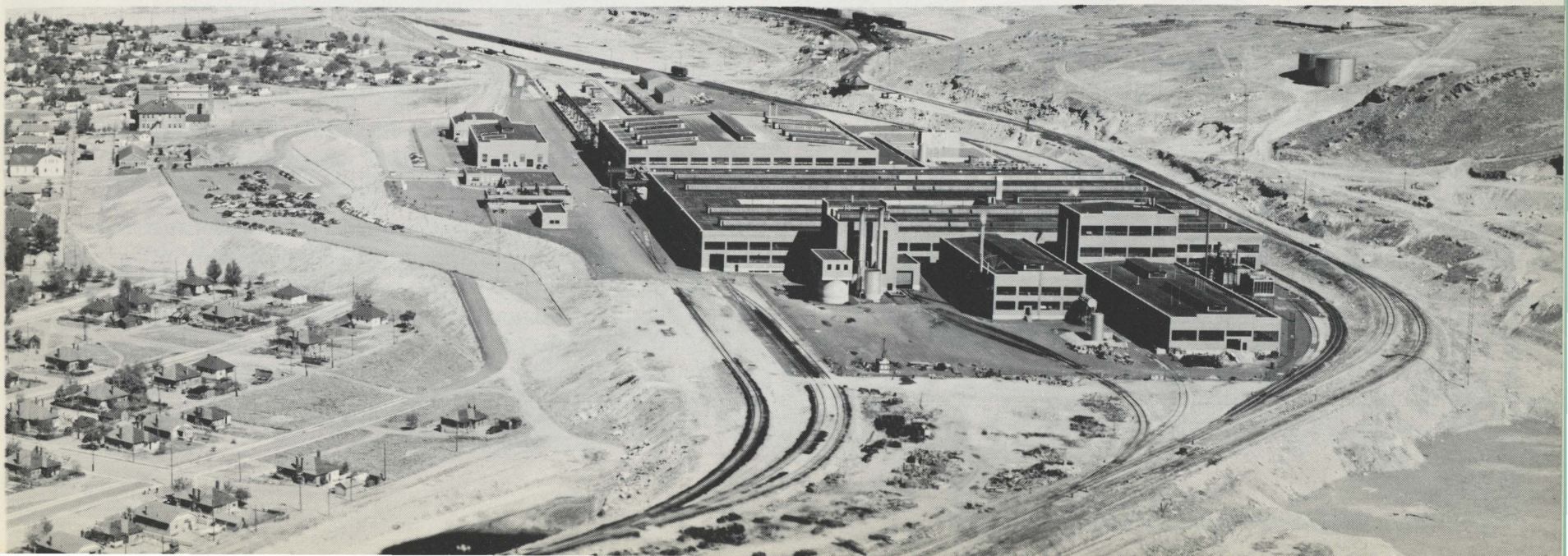
The refinery receives copper anode shapes from the nearby smelter in carload lots. These anodes, placed in lead-lined electrolytic tanks through which a solution of copper sulphate and dilute sulphuric acid is circulated, are alternated with cathode starting sheets made of refined copper.

An electrolytic action transfers copper from the anodes to the cathodes. The impurities, including small amounts of precious metals and other valuable elements, either remain behind as an anode mud or are dissolved in the solution.

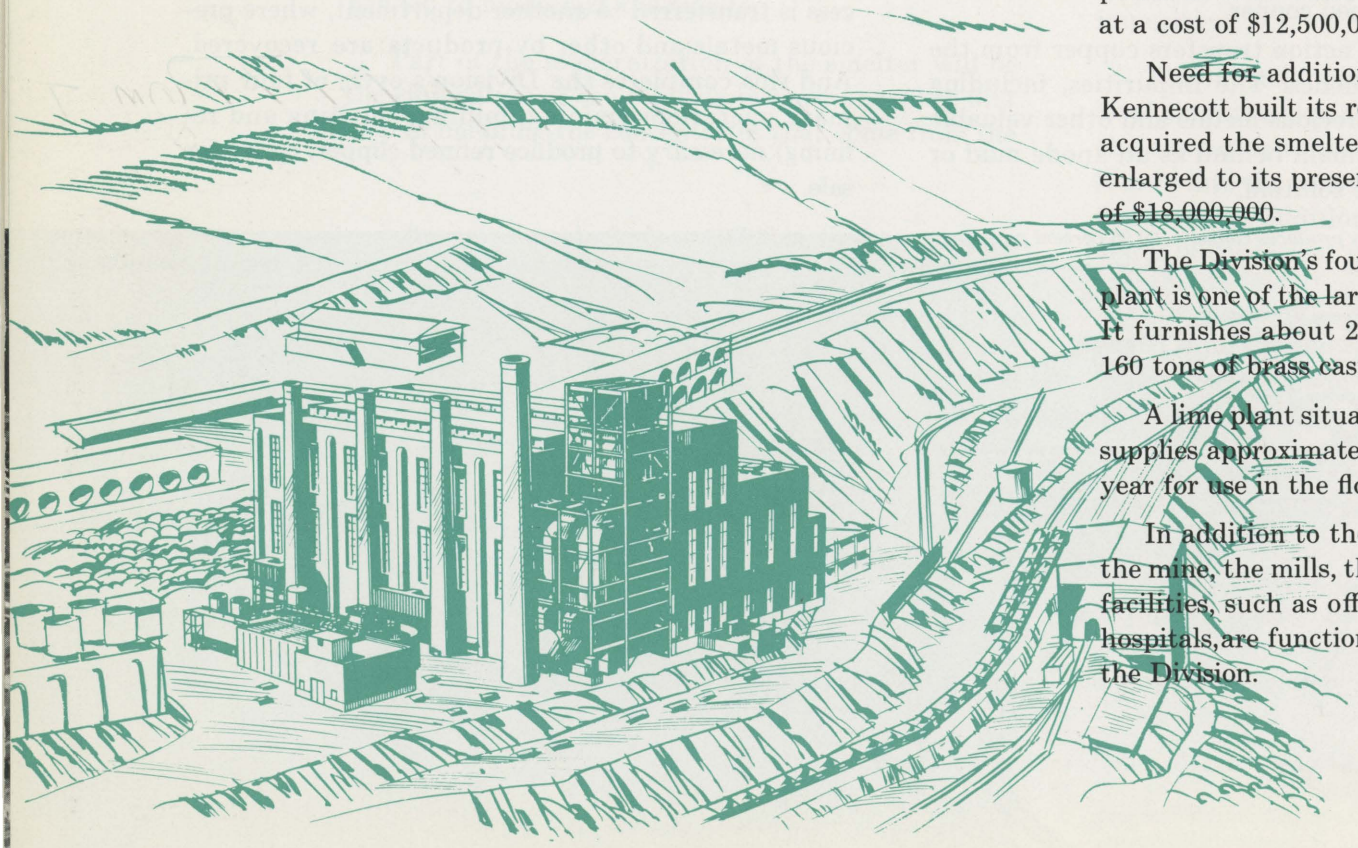
Approximately 28 days are required to consume an anode and about 14 days to produce a cathode. During the process, the cathodes become progressively thicker and heavier and the anodes progressively thinner until about 15 per cent of the original anode remains. Cathodes then are removed, washed, and taken to the adjacent casting building, where they are melted in electric furnaces. The copper, 99.96 per cent pure, is then cast into marketable shapes and shipped to a wide range of customers. The plant has a capacity of 16,000 tons of refined copper per month.

The anode mud recovered from the refining process is transferred to another department, where precious metals and other by-products are recovered. And this completes the Division's cycle of four primary operations (mining, milling, smelting and refining) necessary to produce refined copper, ready for sale.

Kennecott's Utah Refinery produces copper — 99.96 percent pure. It has a capacity of 16,000 tons of refined copper per month.



AUXILIARY DEPARTMENTS



Because of the magnitude of the operations and the unique problems encountered in the mining and treatment of large quantities of low grade ore, many auxiliary departments are vital to efficient operations.

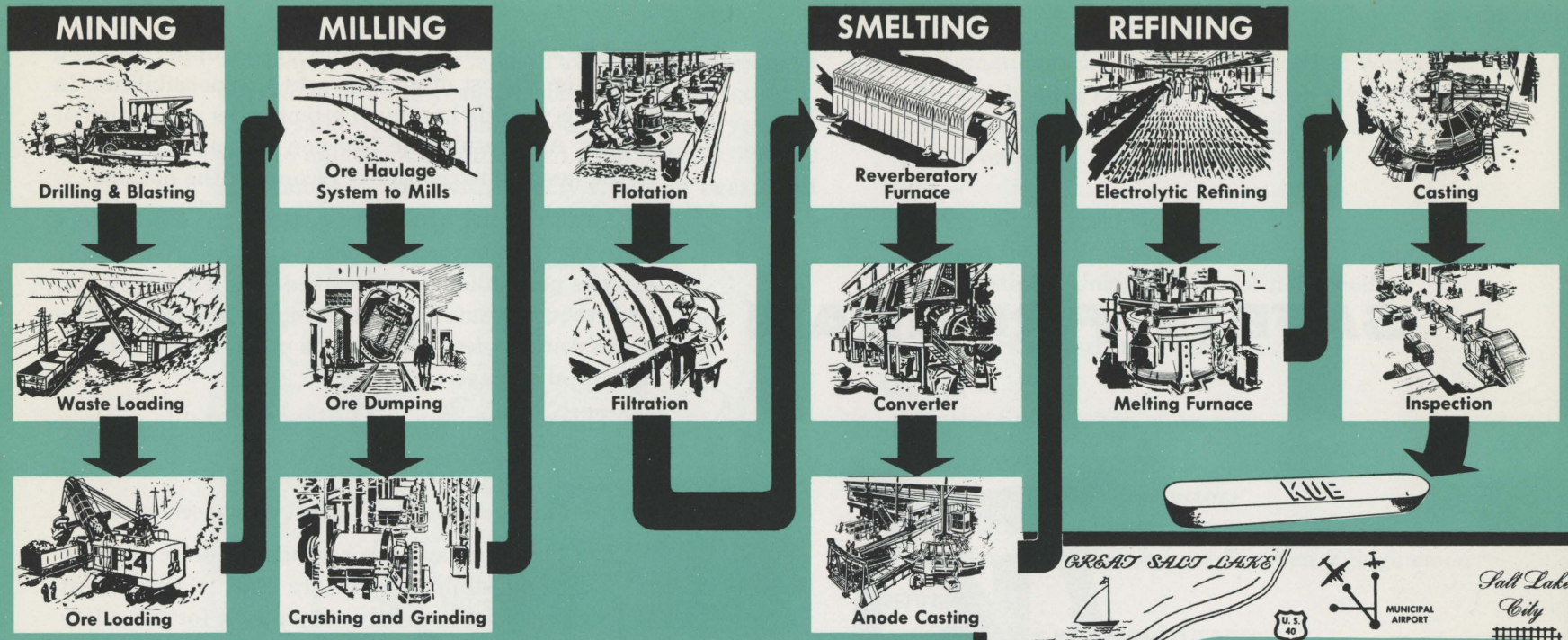
One of the most important of these is the power plant, which was enlarged in 1960 to a rated output of 175,000 kilowatts, sufficient to serve a city of 350,000 people. The Division began producing its own power in 1944 when it built a 100,000 kilowatt plant at a cost of $12,500,000.

Need for additional power became evident when Kennecott built its refinery in 1950 and subsequently acquired the smelter in 1959. The power plant was enlarged to its present capacity at an additional cost of $18,000,000.

The Division's foundry at the Arthur concentrating plant is one of the largest in the Intermountain States. It furnishes about 21,000 tons of grinding balls and 160 tons of brass castings per year.

A lime plant situated near the Magna concentrator supplies approximately 29,000 tons of burned lime per year for use in the flotation process.

In addition to the large machine shops located at the mine, the mills, the smelter and the refinery, other facilities, such as offices, warehouses and emergency hospitals, are functioning for the efficient operation of the Division.



THE FOUR PHASES OF THE COPPER CYCLE IN UTAH

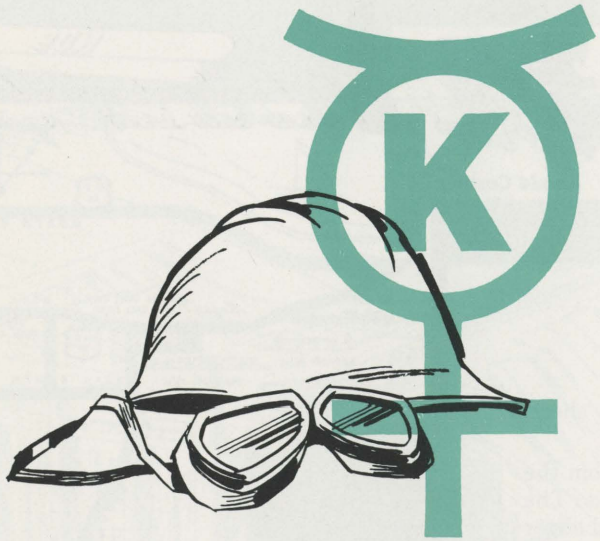
The four phases of the copper cycle in Utah are described graphically on this flow sheet. Phase number one is mining – the removal of waste (overburden) and ore.

Phase number two is milling. The Ore Haulage Department transports the ore from the mine to the mills, where copper concentrate is produced by the flotation process. The concentrate contains about 30% copper, small amounts of molybdenum, gold and silver and still smaller amounts of some other metals. Molybdenum is separated by a second flotation process and recovered as molybdenite concentrate.

Phase number three is smelting. Smelting processes concentrates from the mills and produces copper anodes, 99.5% pure.

Phase number four is refining. Anodes produced by the smelter are processed at the refinery, emerging as 99.96% pure copper. In the form of ingots, ingot bars, wirebars, slabs, cakes, cut cathodes and billets the metal is shipped to fabricating plants and other customers. It is at the refinery that gold, silver and other by-products are recovered from the copper.

SAFETY PROGRAM



The safety program at the Utah Copper Division is high on the list of management's responsibilities. In fact, it is accorded as much attention as production or profits. As a result, the Division has maintained one of the best industrial safety records in the nation.

Utah Copper accident statistics have been kept since 1917, when the frequency rate was 110 disabling injuries per million hours worked. The Division's current frequency rate is about three accidents per million hours worked—less than half as many as the national industrial average.

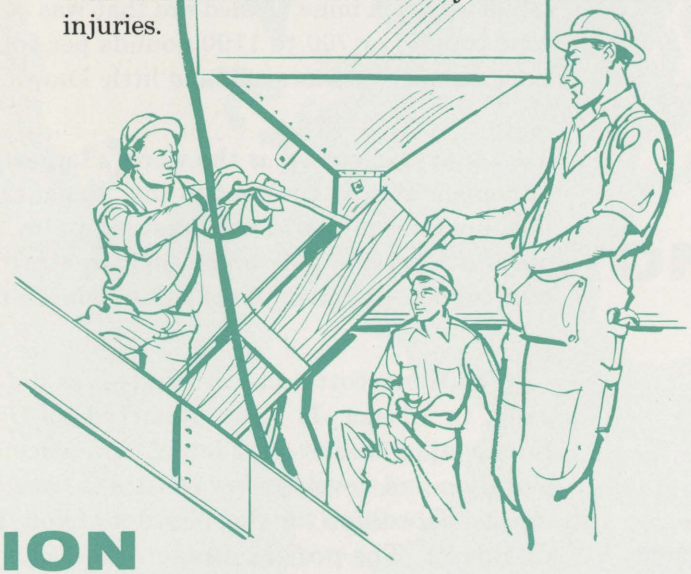
This outstanding record is attributable to these factors:

1. — Management places great emphasis on safety.
2. — The Company has established direct lines of responsibility to insure that management personnel is strictly accountable for the safety record of every department and every individual employee.
3. — The wholehearted cooperation of all employees, who give vigorous support to the safety program.

The rate of accidents, in view of the millions of man hours worked each year, has been reduced theoretically to the point that one man working 40 hours per week would have only one accident in 110 years.

It also has been determined that the average Division employee is three times safer working on the job than the average person is at home.

Nearly 1200 Utah Copper Division employees have worked 20 or more years without a lost-time accident. These safety-minded employees average 26 years of service and have accumulated a total of 49,628,800 man-hours of work without any time lost because of injuries.



UNION REPRESENTATION

The Utah Copper Division is one of the largest employers in the state. To represent employees on labor contracts, there are 20 individual bargaining units from the following union organizations:

MINE —

Office Employees International Union
International Association of Machinists
International Union of Operating Engineers
International Brotherhood of Electrical Workers
Brotherhood of Locomotive Firemen & Enginemen
International Union of Mine, Mill & Smelter Workers

MILLS —

System Federation No. 155
International Brotherhood of Electrical Workers
International Union of Mine, Mill & Smelter Workers
United Steelworkers of America

SMELTER —

United Steelworkers of America

ORE-HAULAGE DEPARTMENT —

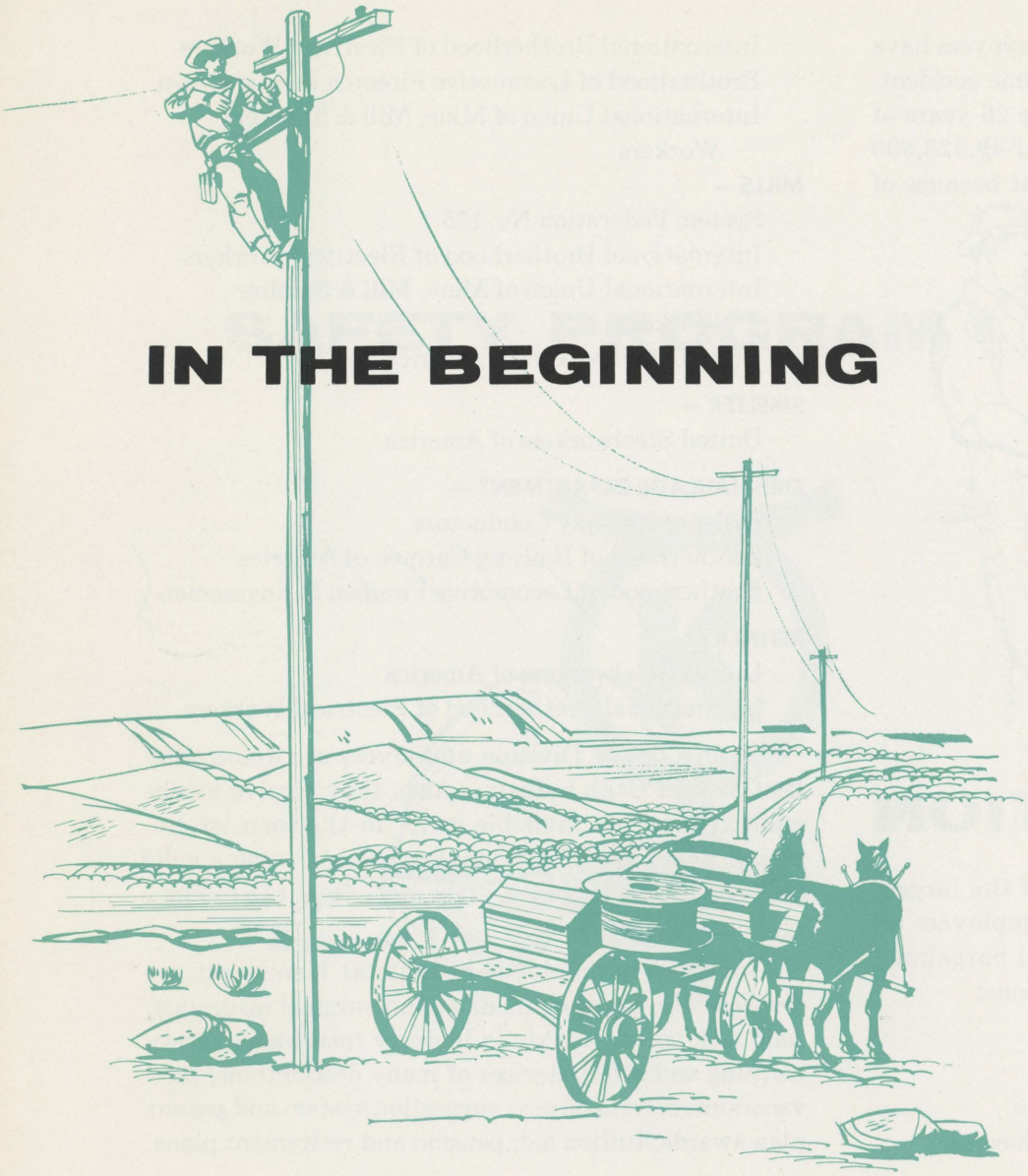
Order of Railway Conductors
Brotherhood of Railway Carmen of America
Brotherhood of Locomotive Firemen & Enginemen

REFINERY —

United Steelworkers of America
International Brotherhood of Electrical Workers

Utah Copper Division employees are among the best paid in Utah industry. Also, they receive a substantial sum of "invisible pay," in the form of employee benefits. These benefits have become a solid part of employee compensation and amount to millions of dollars annually.

Included in employee benefits at Kennecott are low-cost life, hospital, medical and surgical insurance; paid sick leave; weekly indemnity insurance; safety clothing and safety devices of many descriptions; paid vacations; severance pay; suggestion system and patent plan awards; tuition aid; pension and retirement plans.



IN THE BEGINNING

Kennecott's history as a copper producer records an amazing contrast respecting the metal content of the ores it has processed. During the formative years in Alaska, nearly a half century ago, the company's fabulously rich mine yielded ore that was 35 to 55 per cent copper, or 700 to 1100 pounds per ton. At that time, Kennecott was small and little known.

Today, Kennecott is the world's largest producer of copper. But, in contrast to the "bonanza" days, it now operates mines in four western states that yield ore that averages only about eight-tenths of one per cent copper — or an infinitesimal 16 pounds to the ton.

The Kennecott name originated, as did the company, in Alaska. It came about when Dr. Robert Kennicott, who had considerable influence in the exploration and development of Alaska, was named to lead an expedition for the Western Union Telegraph Company. The project was to run a telegraph line across Alaska.

Dr. Kennicott died in Alaska in the summer of 1866. In his honor, a mining district, Kennicott, was named for him. It was in this district that the "bonanza" mine was discovered and put into production.

However, a clerical error changed the spelling from Kennicott to the now accepted Kennecott, thus changing the spelling of the original Kennicott Mines Company and the district in which the mine was located.

COMPANY OPERATIONS TODAY

In addition to the Utah Copper Division, Kennecott operates the following other copper producing properties: Chino Mines Division in New Mexico; Nevada Mines Division in Nevada; Ray Mines Division in Arizona, and the Braden Copper Company in Chile, South America.

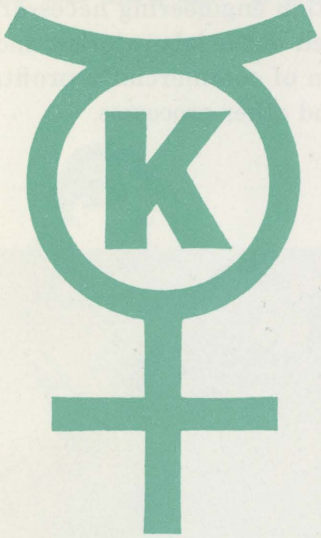
Its subsidiary companies include: Chase Brass and Copper Company, Inc., with fabricating plants at Cleveland, Ohio, and Waterbury, Connecticut; Kennecott Refining Corporation near Baltimore, Maryland; the Okonite Company, with three wire and cable fabricating plants in New Jersey and one in Rhode Island, and the Kennecott Sales Corporation of New York, which sells the metals Kennecott produces.

Also part of the Kennecott family are the following companies in which the company owns either controlling or substantial stock: Quebec Iron and Titanium Corporation, and Quebec Columbium Ltd., both in Quebec, Canada; Tin & Associated Minerals Ltd., Nigeria, Africa; Merriespruit (Orange Free State) Gold Mining Company, Ltd., and Virginia Orange Free State Gold Mining Company, Ltd., both in the Union of South Africa, and the Garfield Chemical and Manufacturing Company in Utah.

Besides the foregoing ownership in affiliates, Kennecott holds for investment about 13 per cent of the common stock of Kaiser Aluminum and Chemical Corporation, about 7 per cent of the common stock of Molybdenum Corporation of America, and 25 per cent of the common stock of Western Phosphates, Inc.

Casting copper into cakes makes a brilliantly colorful display at Kennecott's Utah Refinery.

STATISTICAL DATA



Totals from Beginning of Operations to June 30, 1960

Taxes	$ 751,489,988
Payrolls	543,774,096
Purchase of supplies and services	660,842,391
*Freight and other payments	483,691,117
Total	$2,439,797,592

*Includes smelting charges prior to January, 1959 when Kennecott purchased smelter.

Based on current operations, Utah Copper Division's annual expenses for payrolls, taxes, supplies, freight and other sundry items total approximately 120 million dollars a year.

Waste overburden removed at Mine	1,173,225,949 Tons
Milling ore mined	854,413,200 Tons
Copper produced	14,878,936,868 Pounds
Average grade of ore now being mined	0.8%
Investment per employee, approximately	$30,100
Annual consumption of blasting powder, approximately	8,800,000 Pounds

Number of employees June 30, 1960

Mine	Ore Haulage	Concentrators	Smelter	Power Station	Refinery	Quality Control	Other General-Plant	Total
2751	360	1466	1179	94	801	154	781	7586

		Percentages
Employees with 30 or more years service	495	6.8%
Employees with 20 or more years service	1568	21.4%
Employees with 10 or more years service	3684	50.4%
Fathers and Sons among employees	921	13.4%

RESEARCH CENTER

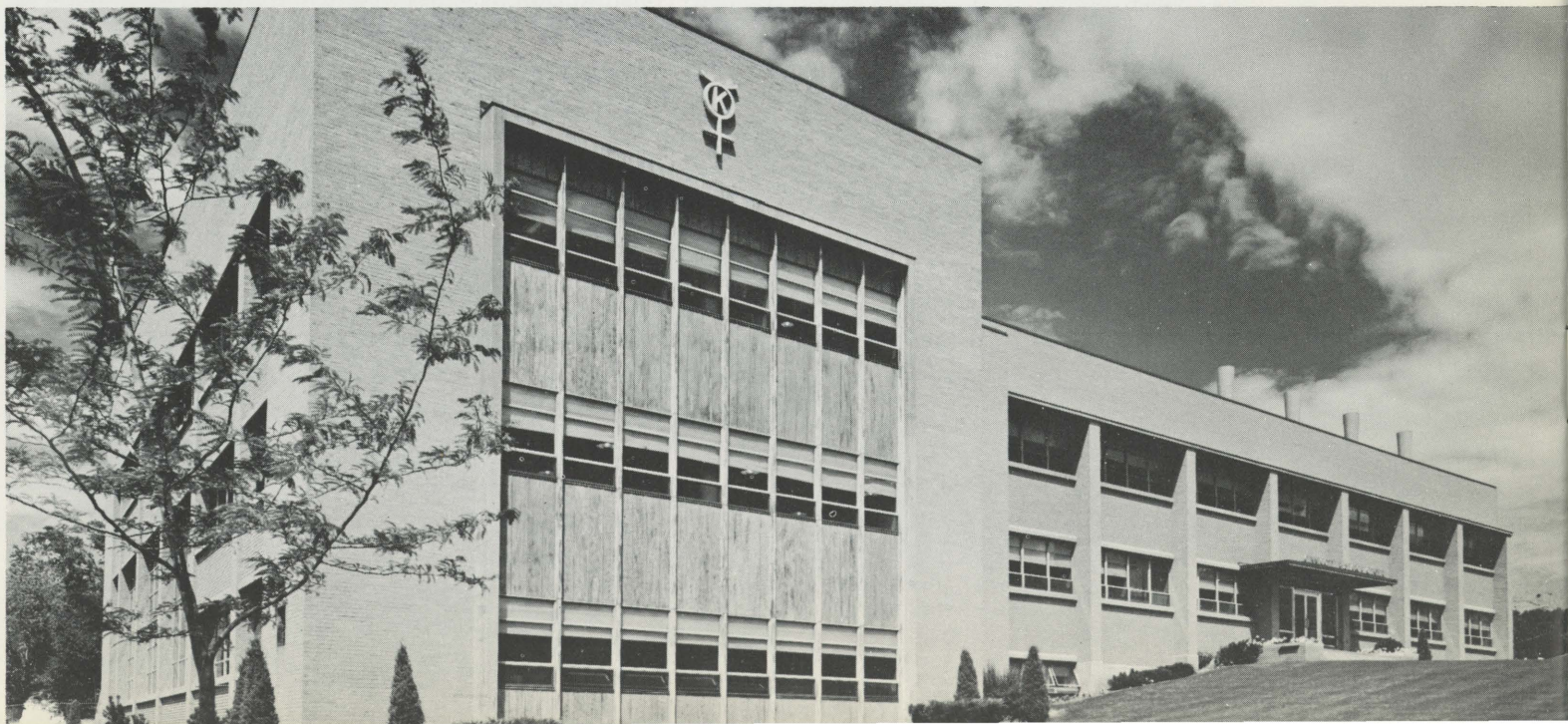
The Utah Copper Division of Kennecott is one of the units comprising the Western Mining Divisions of of the company. Included in the numerous functions of Western Mining Divisions is the Kennecott Research Center, adjacent to the University of Utah and the United States Bureau of Mines Metallurgical Research Center.

The Research Center, one of the largest of its type and scope in the industry, is concerned primarily with the improvement in practices of mining, milling, smelting and refining of copper. Both fundamental and applied research are conducted.

The center houses a pilot plant for studies in milling, smelting and refining. Also at the center is the Western Mining Divisions Engineering Department, which provides the various engineering, consulting, project development and design services needed by the several Divisions and by certain other domestic and foreign units of Kennecott.

This department makes special studies in a variety of fields and is active in developing improved and new mining and metallurgical methods and processes. The department provides project engineers for the development and application engineering necessary to prove processes developed in the laboratories, and for design and construction of commercially profitable plants based on these and other processes.

Kennecott's Research Center is located on the University of Utah campus in Salt Lake City.



PUBLIC AFFAIRS

Because the Utah Copper Division of Kennecott Copper Corporation represents one of the state's largest enterprises, its management feels keenly its duties and responsibilities as "a citizen" of Utah. Over the years the company consistently has supported community activities that have been reserved for private support, rather than governmental subsidy.

In addition to the United Fund and numerous other community and statewide appeals, the company is a substantial contributor to grants for institutions of higher education. Recipients have been the University of Utah at Salt Lake City, Utah State University at Logan, Brigham Young University at Provo and Westminster College in Salt Lake City. Many of the projects developed under these grants have been important to the general well-being of the state.

It has been noted elsewhere in this booklet that the Division is the state's largest taxpayer. As could be expected, a portion of the company's huge tax bill is allocated to the public education system of the state. During 1959, this portion totaled more than $8,675,000, or about $24,785 per day.

To illustrate:

The big shovels in the mine handle a combined average of 10,000 loads of ore per day. Therefore, every time one of these shovels scoops up a dipperful of ore the education fund gains $2.47, or sufficient money to pay for the education of one Utah child for one and one-half days.

COPPER

PHYSICAL PROPERTIES

Symbol — Cu — — Atomic Weight — 63.54
Specific Gravity — 8.96
Melting Point — 1981.4° F.
Boiling Point — 4700° F.
Electrical Resistivity — Microhm-cm — 1.673
Tensile Strength — H.D. — 60,000 pounds per square inch (annealed 30,000)
Crystal Structure — Face-centered cubic
Valence — one and two

Copper ranks next to iron as a metal of commercial importance. It has the best electrical conductivity of any base metal. Aluminum's conductivity is only 61 percent of copper, but three and one-half times that of iron. Copper is, therefore, the most important metal in the electrical field.

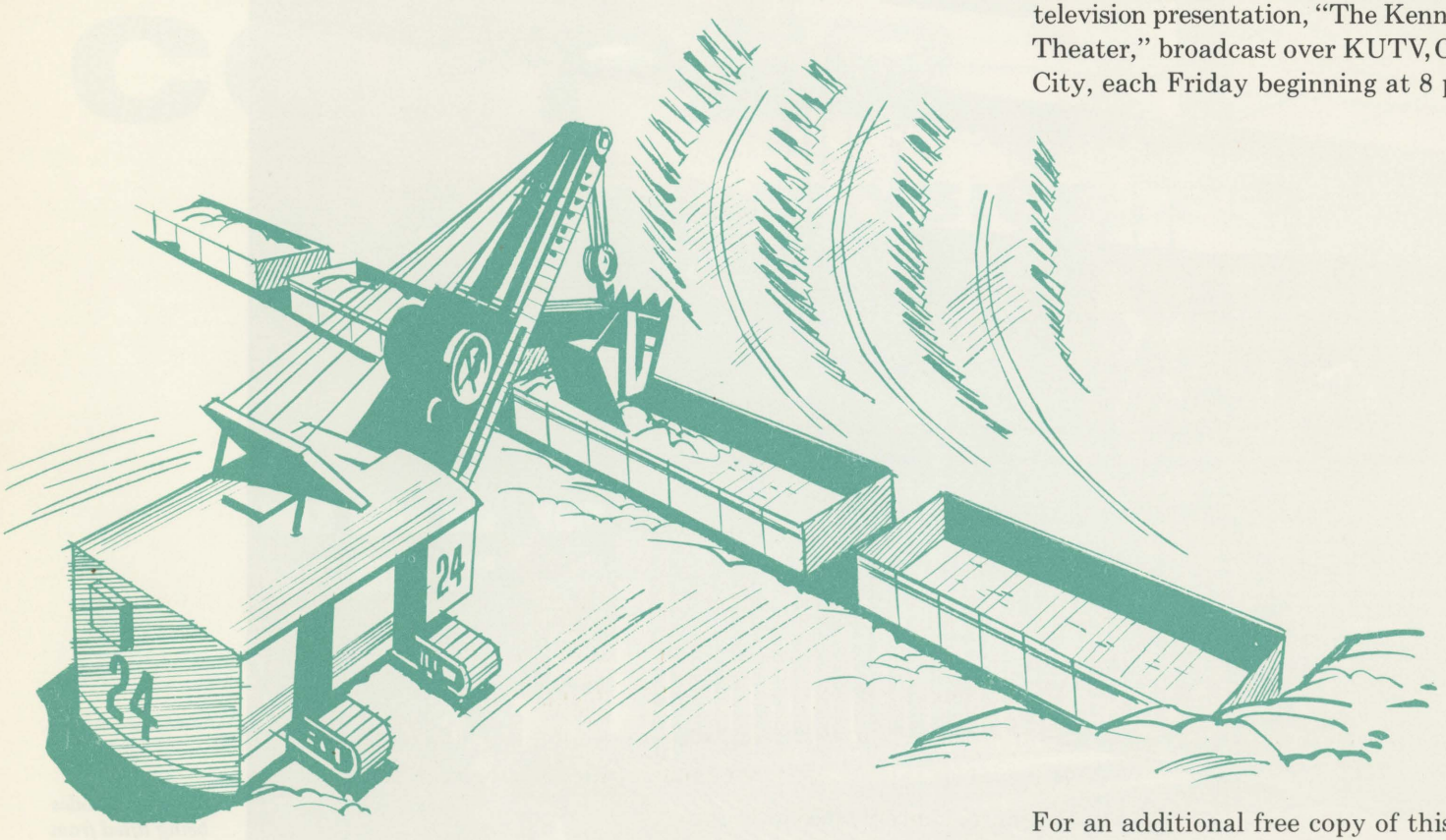
Copper has enough strength for minor structural purposes. It is easily rolled and drawn into wire. It has great resistance to weathering and is of moderate cost compared with competitive materials.

Copper is widely used alloyed with zinc to form brass, which is easily worked and offers good resistance to weathering. Brass is fairly strong and elastic, and because it has good thermal conductivity, has many uses in heat-transfer units such as fins and water heaters. Copper, alloyed with zinc and tin, forms bronze, noted for its resiliency, the ease with which it can be machined, and its resistance to corrosion.

A large percentage of copper is recovered as scrap after it has outlived its usefulness in its originally fabricated form. Of the total copper consumed in the United States, an estimated 60 percent returns to use as copper or copper alloys.

Copper cathodes being lifted from electrolytic cells at Kennecott's Utah Refinery. After cleaning, the cathodes are melted and cast into salable shapes.

Utah Copper Division invites you to hear its radio program, "This Business of Farming," broadcast Mondays, Wednesdays and Fridays, 12:15 to 12:30 p.m., and Tuesdays and Thursdays at 6:45 a.m. over radio station KSL in Salt Lake City; also to view its television presentation, "The Kennecott Neighborhood Theater," broadcast over KUTV, Channel 2, Salt Lake City, each Friday beginning at 8 p.m.



For an additional free copy of this booklet, write: Public Relations Department, Utah Copper Division, Kennecott Copper Corporation, Box 1650, Salt Lake City 10, Utah, or telephone DAvis 2-1533.

A circle with a curved line on top and a cross attached below has been used as a symbol for metals since ancient times. Kennecott has adapted this symbol as its trademark by adding the letter "K". Kennecott not only is the world's largest producer of copper, but the company, with its subsidiaries, is a leader in the production of brass, gold, silver, selenium, molybdenite and titanium concentrates.

Kennecott Copper Corporation
Utah Copper Division
Public Relations Department
Box 1650
Salt Lake City 10, Utah