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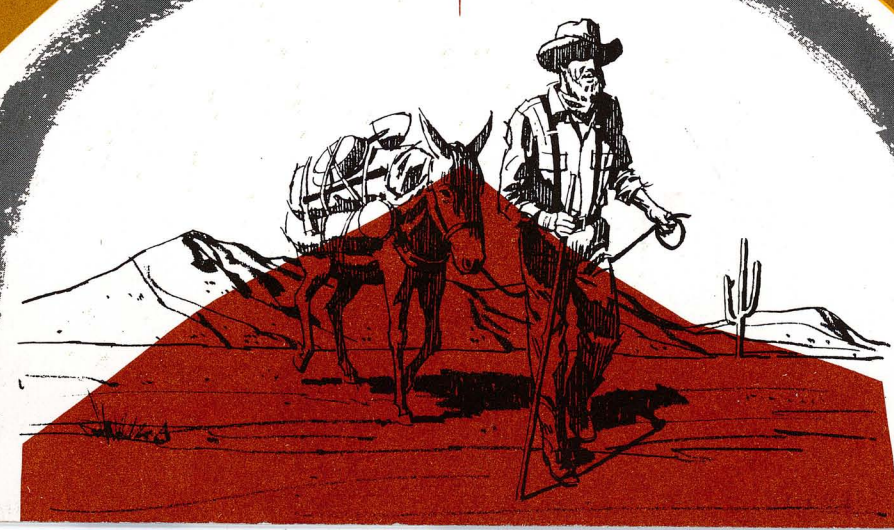
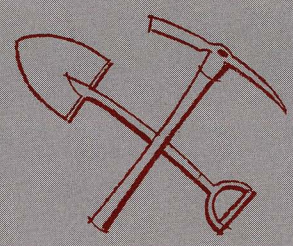
Kennecott Copper Corporation

Ray Mines Division

Copper Mining in Ray and Hayden, Arizona

Yesterday and Today



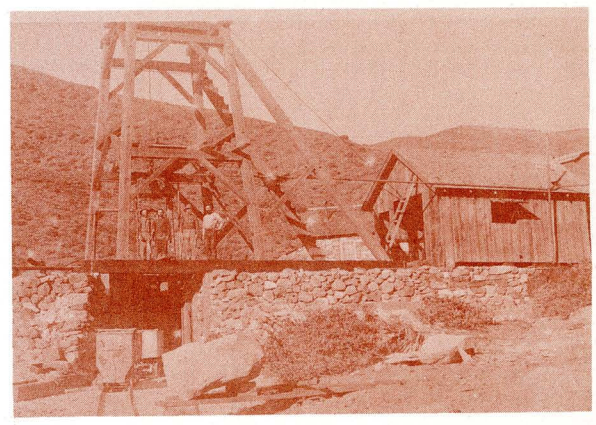


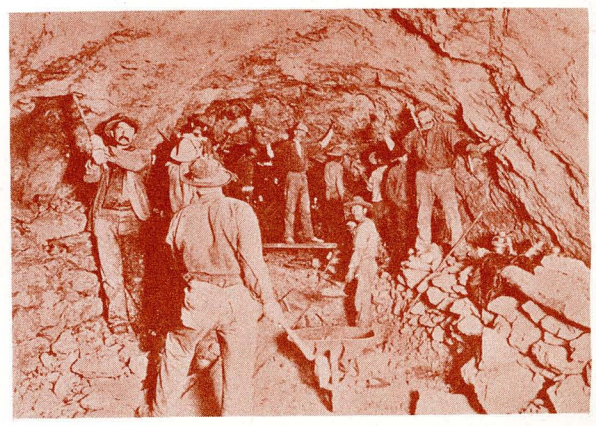
Foreword

Over a century ago a stout-hearted breed of men risked death — from Indians, thirst and starvation — to search the rugged mountains and harsh deserts of the Southwest for mineral wealth. ■ One of these, Tom Haley, was one of the first to stake claims in the Mineral Creek Mining District, site of what is now the Ray Mine. ■ Haley was joined in 1878 by William Souffrien, and together they began to explore and develop the District. ■ In the 1880's the Ray Copper Company (also known as the Mineral Creek Mining Company) was formed, a small smelter was built in a nearby gulch and production begun. ■ Various other small companies were formed during the period from 1880 to 1900, but, in the words of an early-day newspaper — "The great ore deposits lay practically untouched up to the year 1907, when the Ray Consolidated Copper Company was formed. Col. D. C. Jackling, known as the "Father of the Porphyries," was the guiding spirit behind the Ray Consolidated Company. ■ Col. Jackling's contribution to the building of America was to make the United States a copper nation in fact, not merely in token. Using Col. Jackling's techniques, the Ray Mine was the first underground operation to produce 8,000 tons of copper ore by the block caving method. ■ In 1926 the Nevada Consolidated Copper Company absorbed the Ray Consolidated holdings; these were later absorbed by Kennecott. ■ In the past half-century of progress, the underground mine has been replaced by the huge open pit mine — the horse and buggy era has been replaced by the jet age, and man is now probing space and looking forward for new worlds to explore.

A. P. Morris
General Manager
Ray Mines Division

Kennecott's trademark is derived from the ancient Egyptian "Ankh" — a symbol of everlasting life. Medieval alchemists used a similar sign to designate the "everlasting metal," copper.



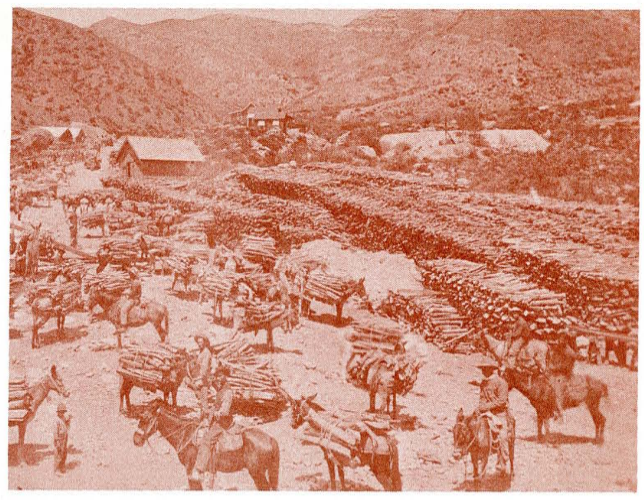


Typical old-time mine, left, had a head-frame of heavy timbers atop its vertical shaft. Winch and cable hoisted ore buckets to surface.

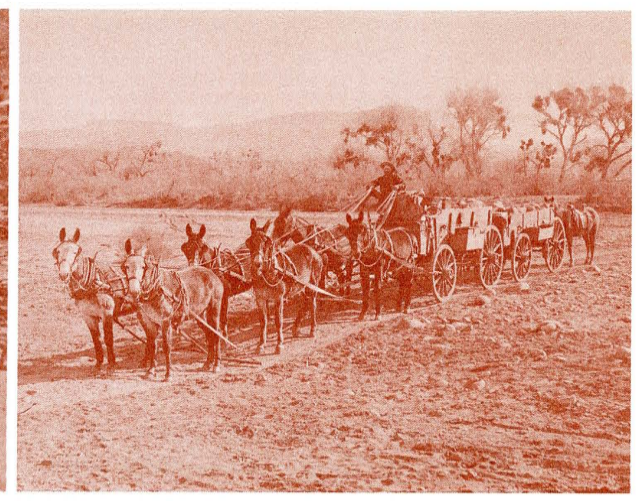
Blast-holes for explosives were hand-drilled in the rock. Ore was hauled in wheelbarrows or small mine cars.

Arizona's early-day copper miners toiled long hours with pick and shovel for small wages. When "pay dirt" petered out, as it often did, they had to seek jobs elsewhere. When a miner got hurt, his friends fed him until he could return to work. If he was killed in an accident, they passed the hat to bury him — or to buy his widow and children transportation to their nearest kinfolk.

The large mines hauled ore out in tandem-hitched wagons drawn by many teams of horses or mules — over dangerous mountain roads. Some mines used pack-burros to transport ore.



Above photo shows the wood supply which was needed by an early-day smelter. Obtaining coal was too costly.



Freighters risked their lives to haul equipment, food, and medical supplies to mines through Indian country.

Few early-day miners were fortunate enough to have wives to boil their laundry. A great many were forced to "batch it" — or take up residence in a boarding house.

Once a prosperous community, this mining town was abandoned long ago to the coyotes, lizards and bats.

The "worthless" mountain that has contributed over 435 million dollars to Arizona's Economy

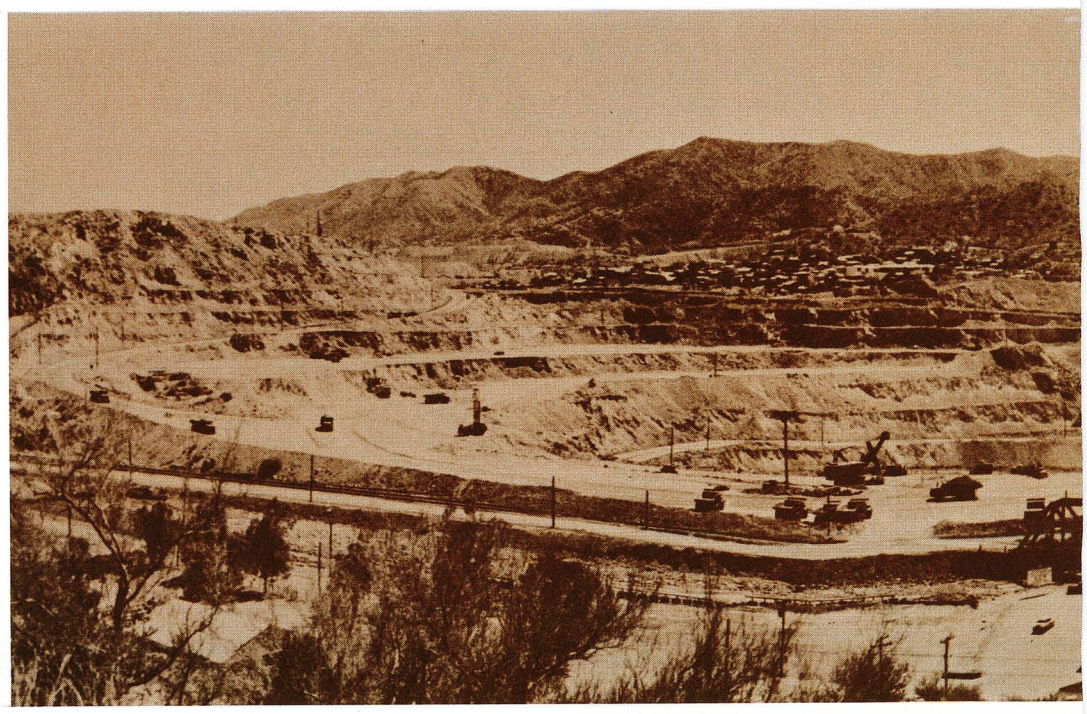
—through wages and salaries, taxes, plants and equipment, and purchases in the state.

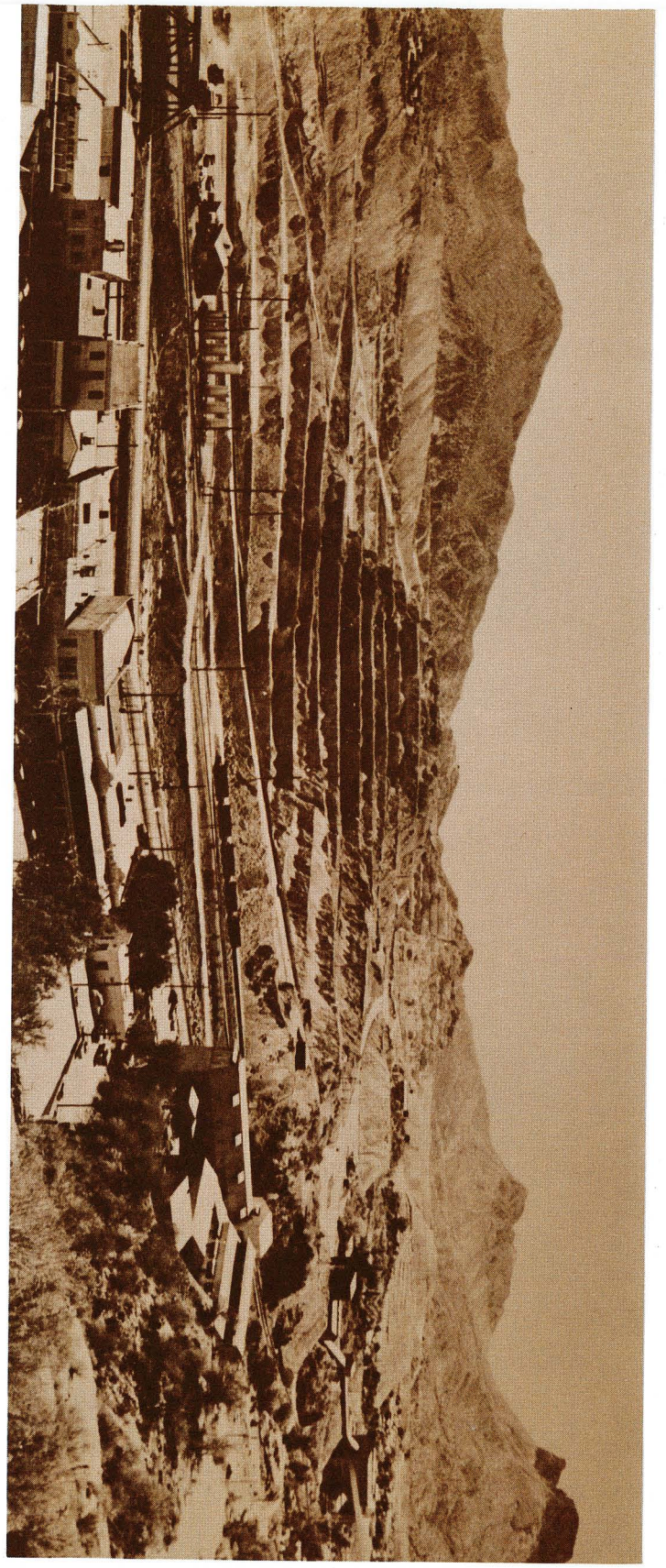
These before and after photos of Kennecott's mining operation at Ray, Arizona, taken almost fifty years apart, tell a dramatic story – and one of significance to Arizona's economy.

The top picture shows the mountain as it looked in 1912, when it still contained enough fairly high-grade ores to be profitably operated as a "shaft, drift, and tunnel" mine. But with each passing year the ore became progressively lower in copper content – until, in 1948, the mountain was judged by experts to be worthless for further underground mining.

Kennecott engineers dedicated themselves to the task of finding a lower-cost method of extracting the vast quantities of low-grade copper ore still remaining in the mountain. The answer—open pit mining—required the investment by Kennecott of millions of dollars in new equipment and machinery.

The lower photograph, taken in 1961, shows the result – an open pit mine 126 times larger than a college football stadium.





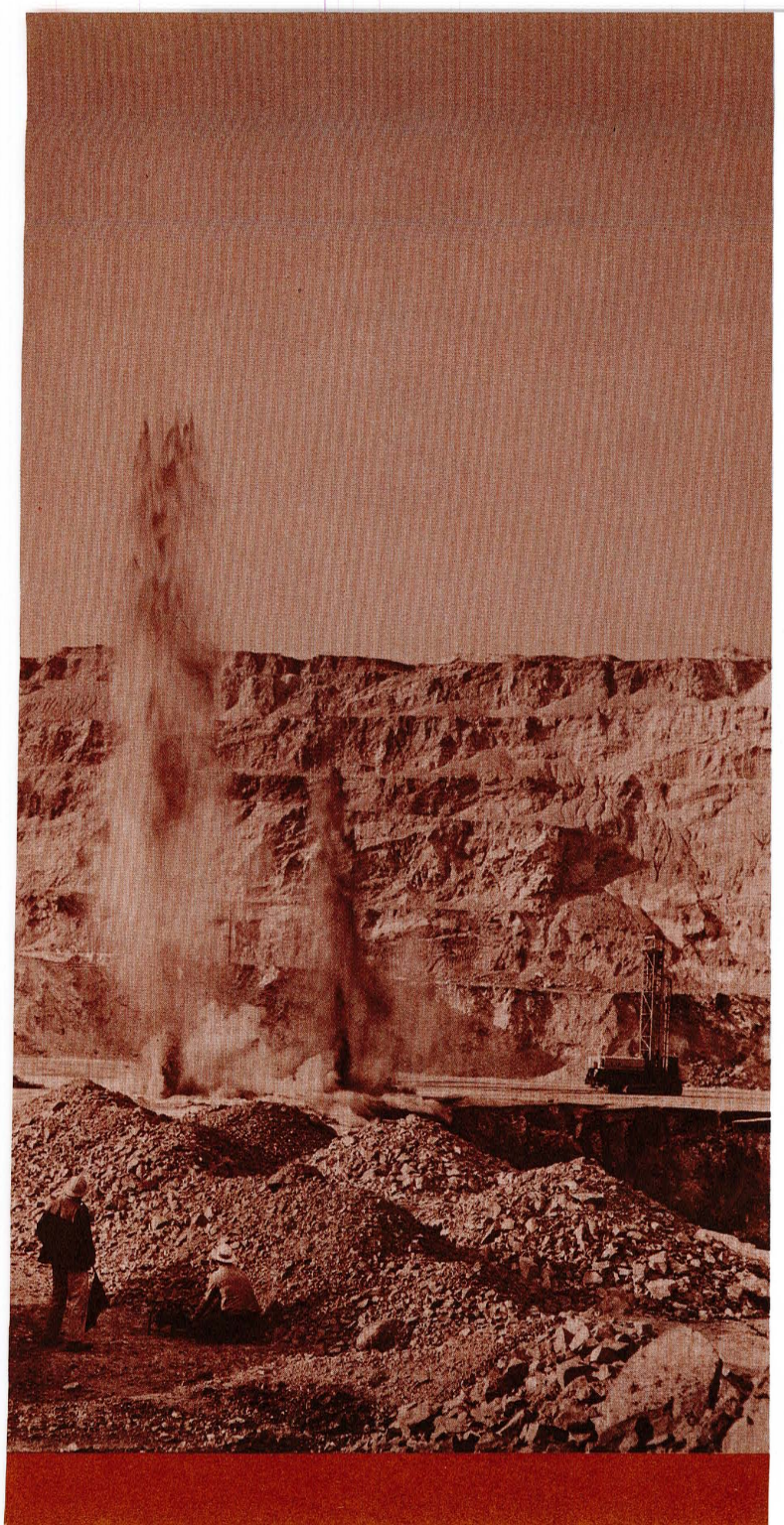
Open pit mining:

Excavating low-grade ores on a vast scale

Years before actual excavation begins, an exploration crew drills hundreds of test-holes to locate and take samples of copper ore deposits that lie buried in the mountain. At that time, maps and other records are made — from which mining engineers develop a long-range Master Plan for excavating the ore.

Left: Survey crews at Kennecott's Ray Mines Division, using Master Plan maps which have been frequently up-dated to keep them current, mark spots where blast-holes are to be drilled. Tractor-mounted rotary drills move in to sink 55-foot holes.

Below: Under supervision of the Blasting Foreman, each hole is loaded with the precise amount of explosives needed. The most rigid safety precautions are observed in the blast area.



Left: While safety-conscious members of the Drilling and Blasting crew crouch behind an embankment hundreds of feet away, explosives shatter an average of 40,000 tons of material in each blast.

Continuous blasting and hauling turned former mountain into huge man-made crater at Kennecott's Ray Mine. Each stair-like "bench" is 45-feet high.

Samples of the rock broken by the blast are taken by Quality Control workmen to be assayed and classified as ore — to be milled or leached — or waste matter.

Hauling and dumping 3¼ tons of ore and waste to get 16 pounds of copper

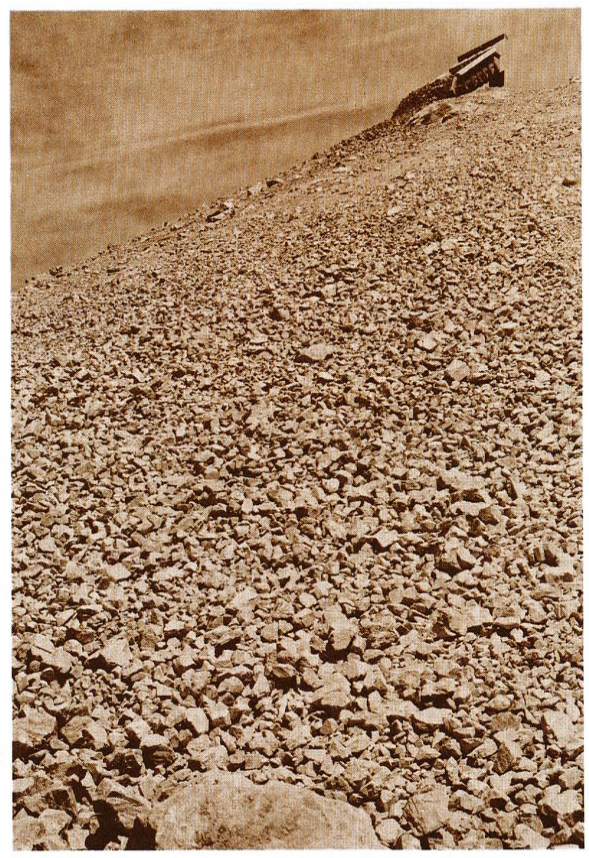
The ore at Kennecott's Ray Mines Division averages only 8/10ths of 1% recoverable copper — just 16 pounds of copper per ton of ore. And for every ton of ore recovered from the pit there are 2¼ tons of additional rock which must be removed. Some of it, containing small amounts of copper, is sent to "leach" dumps to extract some of the copper by leaching with water. But the major portion, being worthless, is hauled to the "waste" dump.

Scooping up 11 tons of blast-broken material at a single "bite," huge electric-powered shovels work night and day loading a fleet of haulage trucks.

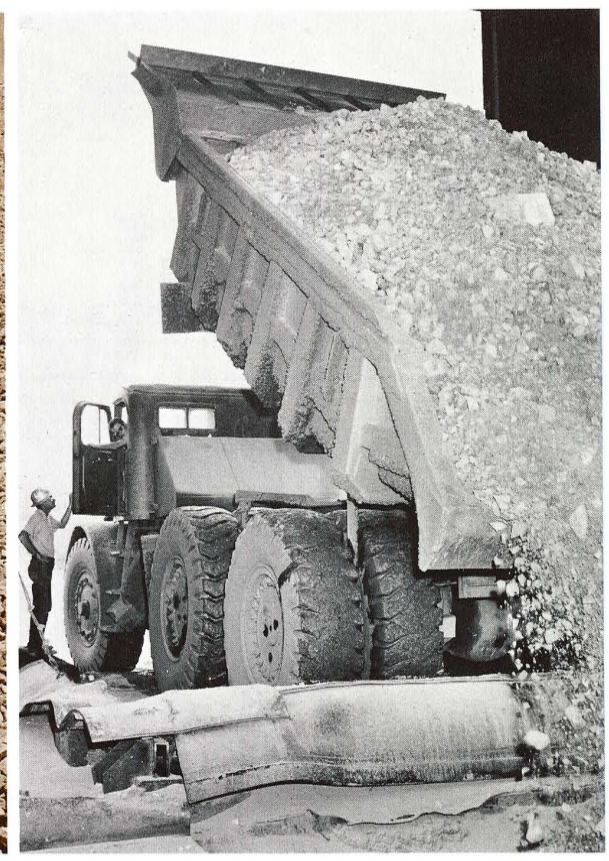
Diesel-powered haulage trucks have 55-ton capacity and two engines, which develop a total of more than 600 horsepower. The truck driver has to climb up to cab on ladder.

To provide better working conditions for Kennecott's workmen — and to minimize abrasive wear on equipment — dust is controlled by frequently sprinkling truck haulage roads with a chemical-water mixture.

Three of Kennecott's large fleet of haulage trucks — which are maintained in top mechanical condition for around-the-clock use by crews of three 8-hour shifts.



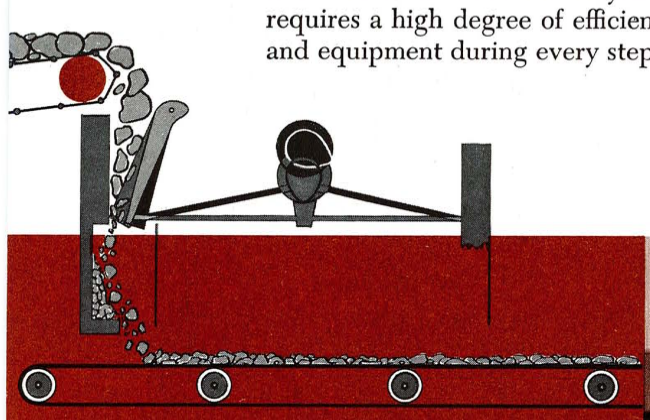
Even a giant haulage truck — upper right corner of photo — looks small compared to the mountain of waste rock onto which it is dumping a 55-ton load. Such dumps cover many hundreds of acres.



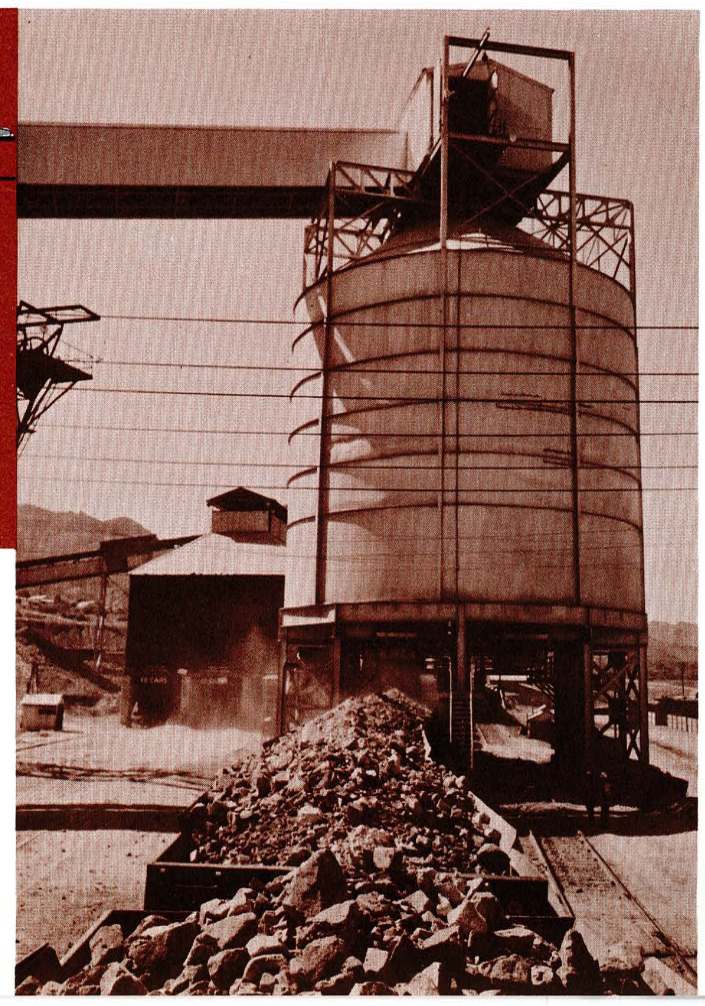
Material classified as "ore" is hauled by trucks and dumped — one truckload approximately every 3 minutes — into Primary Crusher, which prepares it for shipment to Reduction Plant.

Starting the trip from mine to smelter

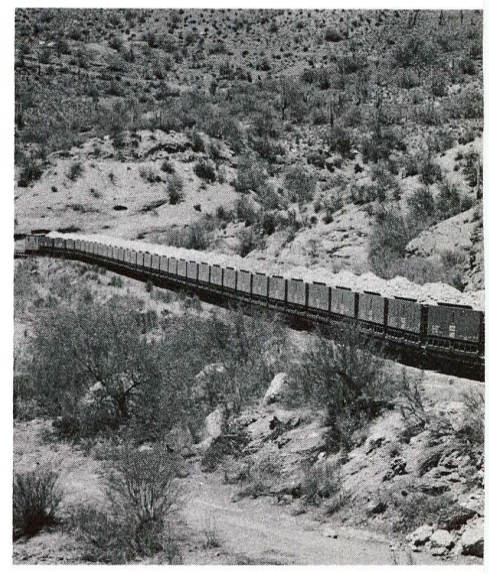
It takes excellent long-range and day-to-day planning to maintain a smooth, uninterrupted flow of copper ore from Kennecott's open pit mines at Ray, Arizona, to the Reduction Plant in Hayden — a distance of twenty-three miles. It also requires a high degree of efficiency in the utilization of both manpower and equipment during every step of the journey from mine to smelter.



Primary Crusher's powerful mechanical "jaws" reduce the freshly-mined ore to chunks no larger than 10 inches. A conveyor belt takes them to top of nearby Ore Storage Bin.

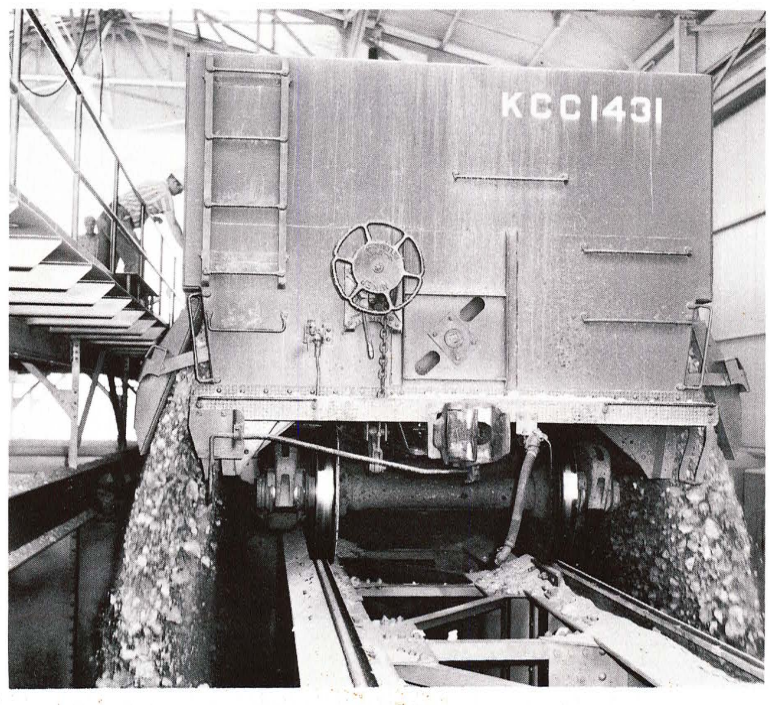


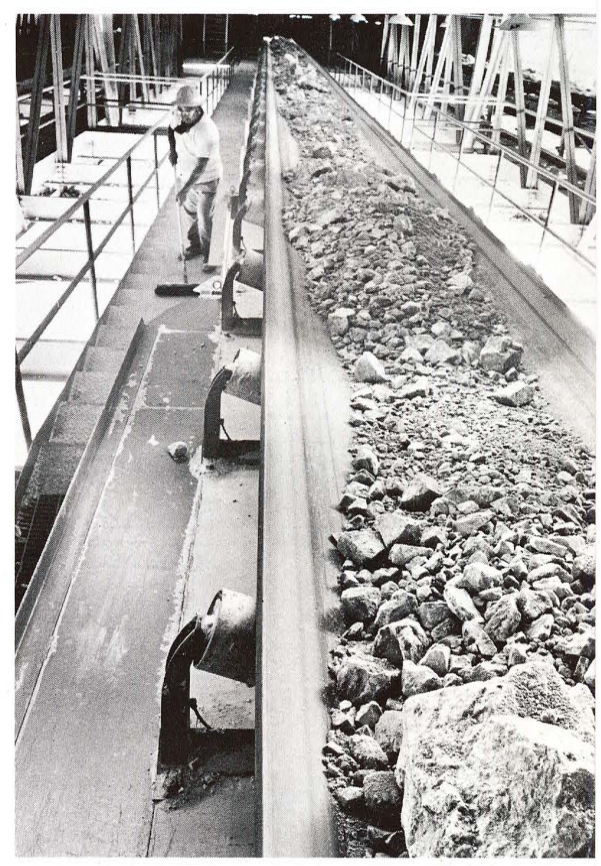
Standing astride the railroad tracks at Ray, the Ore Storage Bin has a capacity of 7500 tons. As empty ore cars pass beneath it, the ore flows by gravity, tumbling down chutes which fill each car to capacity. Kennecott's Ray Mines Division has 124 of these 100-ton ore cars in 24-hour service.



To maintain daily production of 22,500 tons of ore, six 38-car trains make the trip every 24 hours from Ray to Hayden. On their 23-mile journey, these trains traverse picturesque, sparsely-settled country that is little changed from the days of "Boom and Bust" mining.

Upon arrival at Hayden, a whole trainload of ore can be unloaded in minutes. The ore cars, of "bottom-dump" design, unload their cargo in Kennecott's big underground Track Hopper. Over 50 feet deep, the Hopper has a capacity of 6,000 tons — over 1½ trainloads of ore.

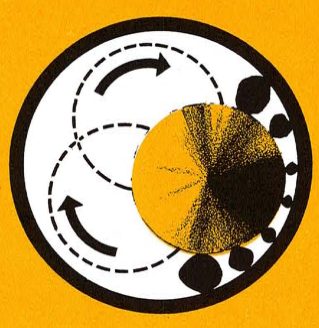




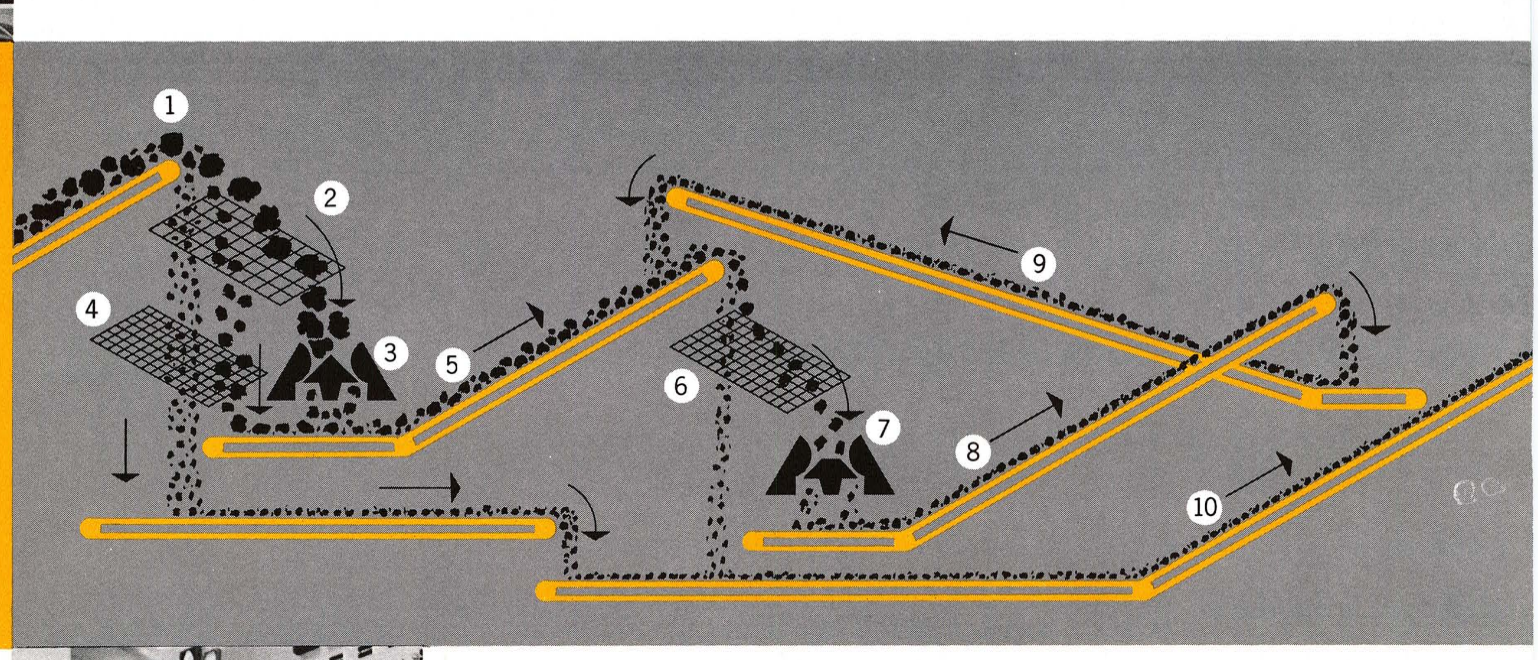
At the bottom of the Track Hopper there are six hydraulically-operated "feeders" that supply ore to three 48-inch wide conveyor belts. They take the ore up an incline for a distance of 535 feet to a point high inside the huge Crushing Plant.

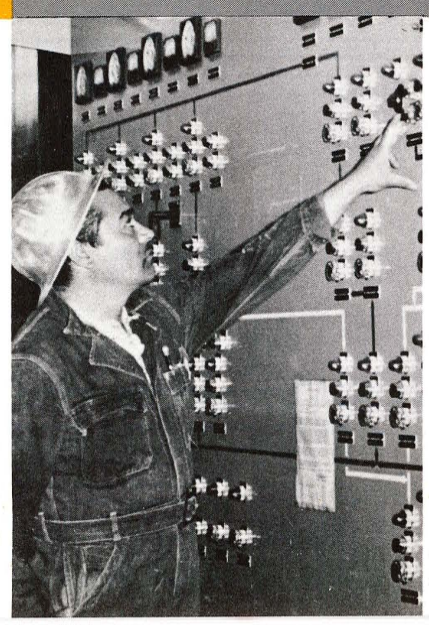
Above: Three conveyors feed ore into the cone-crushers.

Crushing and transporting ore on conveyor belts to the mill



Sketch above is an overhead view of a cone-crusher. The two dotted circles show how cone-shaped "head" revolves and crushes ore against the outside walls of a crusher.



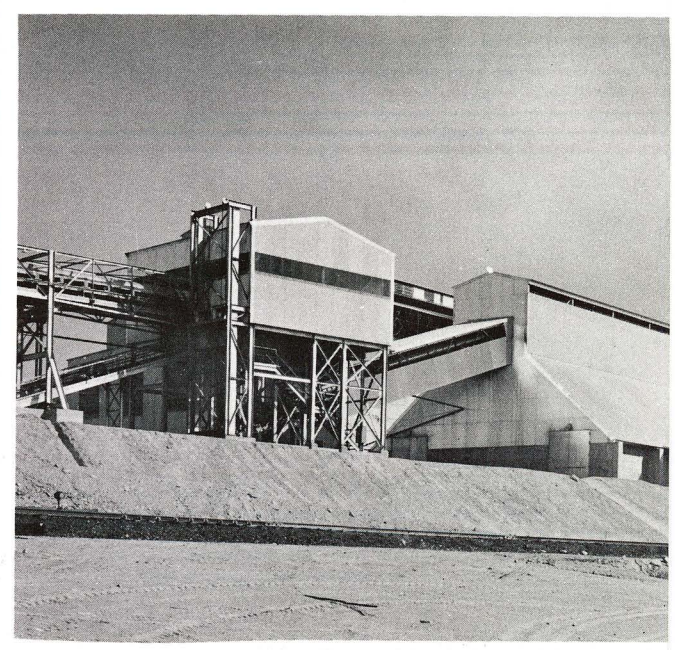


This Control Panel operates the entire crushing process.

The function of the Crusher Plant is to reduce the incoming random-sized ore from the Mine into sizes ½-inch or smaller. The ore passes through three Second Stage and four Third Stage cone-crushers. The above diagram shows, in simplified form, how the ore is processed in the Crusher Plant.

Ore from Track Hopper enters on a conveyor belt (1). Bits of ore which are smaller than ½-inch fall through a double-deck screen directly onto belt that by-passes crushers. Large chunks of ore are diverted by top screen (2) into Second Stage Crusher (3). Lower screen (4) diverts intermediate-sized ore larger than ½-inch onto conveyor belt (5) that also carries ore crushed by Second Stage Crusher up incline to ½-inch mesh screen (6) which diverts ore larger than that measurement into Third Stage Crusher (7). Conveyor (8) receiving ore from Third Stage Crusher transfers it to belt (9) that empties onto conveyor "feeding" ½-inch mesh screen over Third Stage Crusher. This "closed circuit" system re-circulates all of the ore which enters the Crushing Plant until it is small enough to fall through ½-inch screen onto the bottom conveyor (10) which carries ore toward the Fine Ore Storage buildings.

"Weighing a mountain in motion." A record of the ore tonnage produced by each shift is maintained by a "weightometer"—being read by a Kennecott employee.



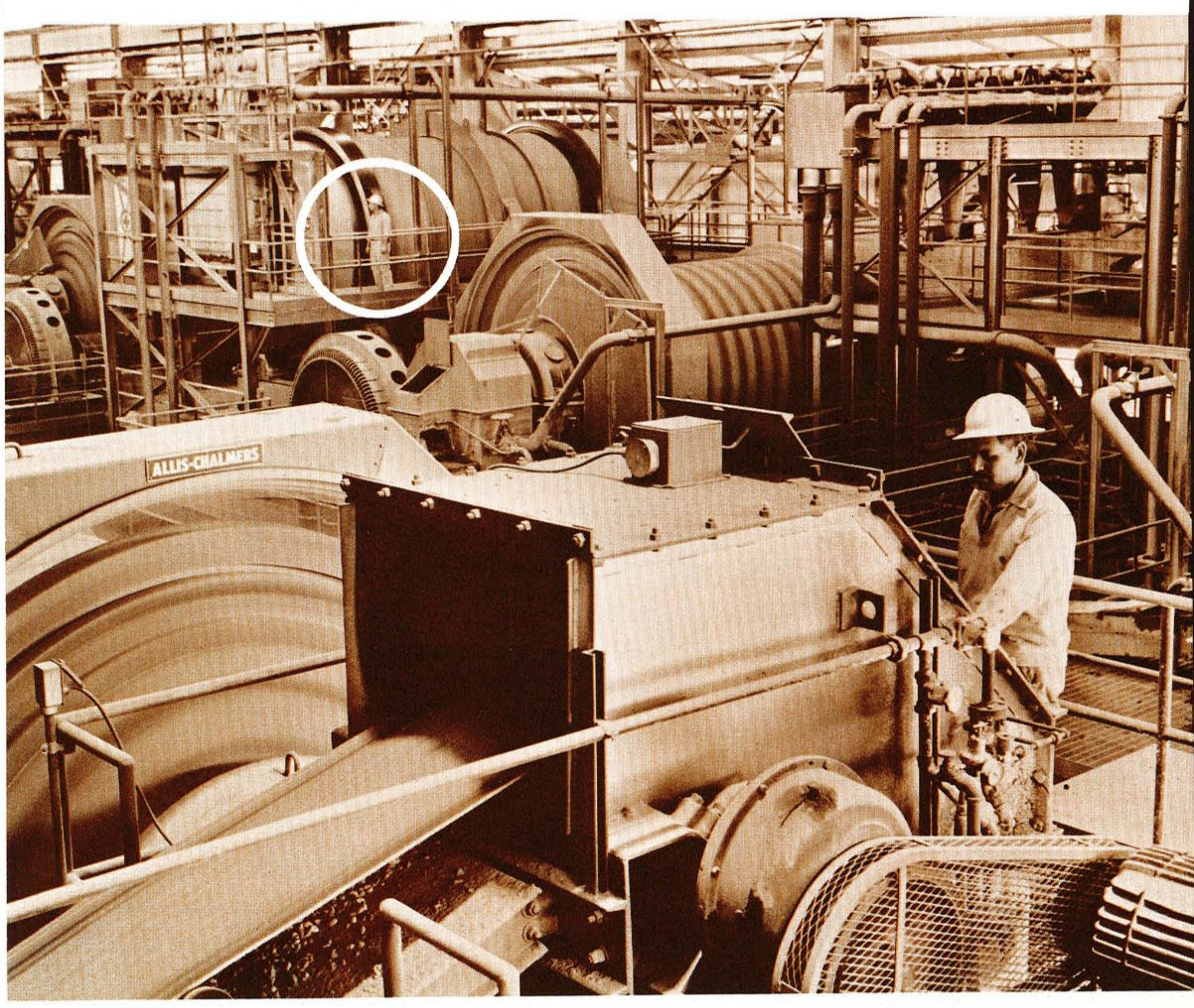
The smaller of the two buildings above is the "Transfer House" that receives up to 1600 tons of ore each hour from Crusher, and deposits it in the larger building which is Fine Ore Storage Bin. This tent-like steel and concrete building is longer than a football field and has ore storage capacity of 28,000 tons.

Below: This conveyor is the longest, 2067 feet, in the network of conveyors connecting Kennecott's vast facilities in Hayden. Ore is transported by it from Crusher to the big Fine Ore Storage Building.

The "dry grinding" cycle — which began at the mine's Primary Crusher in Ray — is completed by the storage of finely crushed ore in Fine Ore Bin at Hayden.

Milling and Grinding

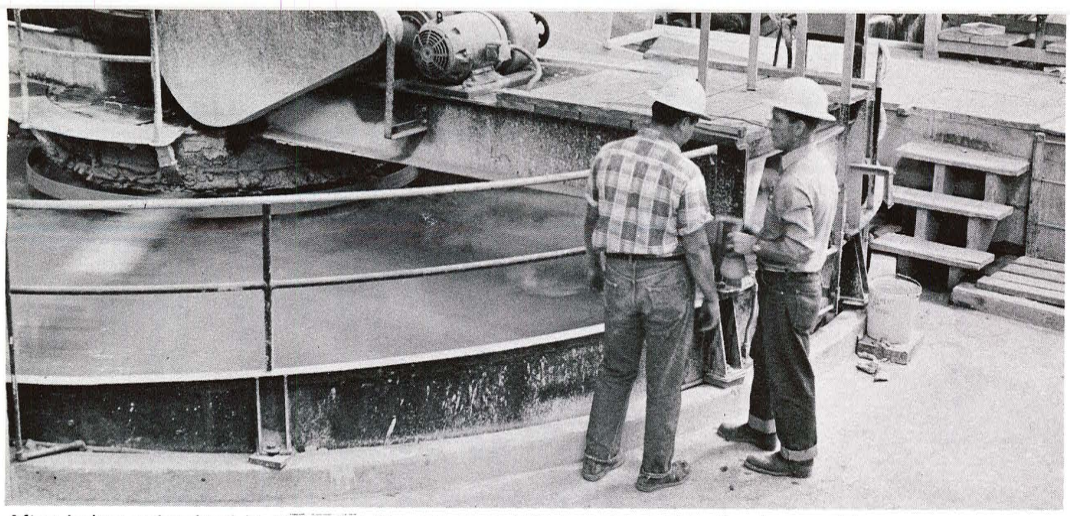
Reducing copper ores to powder fineness



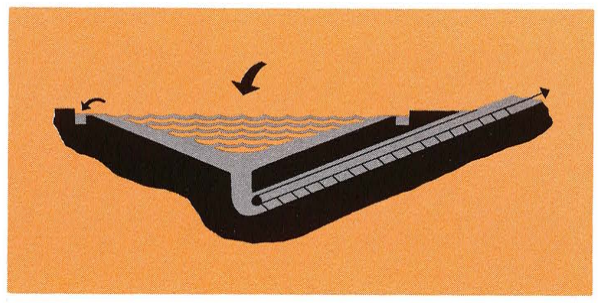
The "wet grinding" cycle begins when the ore is fed into the six Grinding Sections at Kennecott's Concentrator in Hayden. Each of these Sections has one rod mill, a leaching circuit in which acids dissolve the oxide minerals, two ball mills, and "cyclones" or "classifiers" that separate slimes from sands. In addition, four sections each have four smaller ball mills and classifiers.

Left: A Kennecott grinding operator checks flow of finely crushed ore into one of the rod mills. Man at upper left of photo stands beside leaching drum.

The end-plate of a rod mill, below, was removed to permit taking this photograph. The round objects are the ends of heavy steel rods that tumble over and over as the mill revolves. Copper ore, mixed with lime and water, is pulverized by this action.

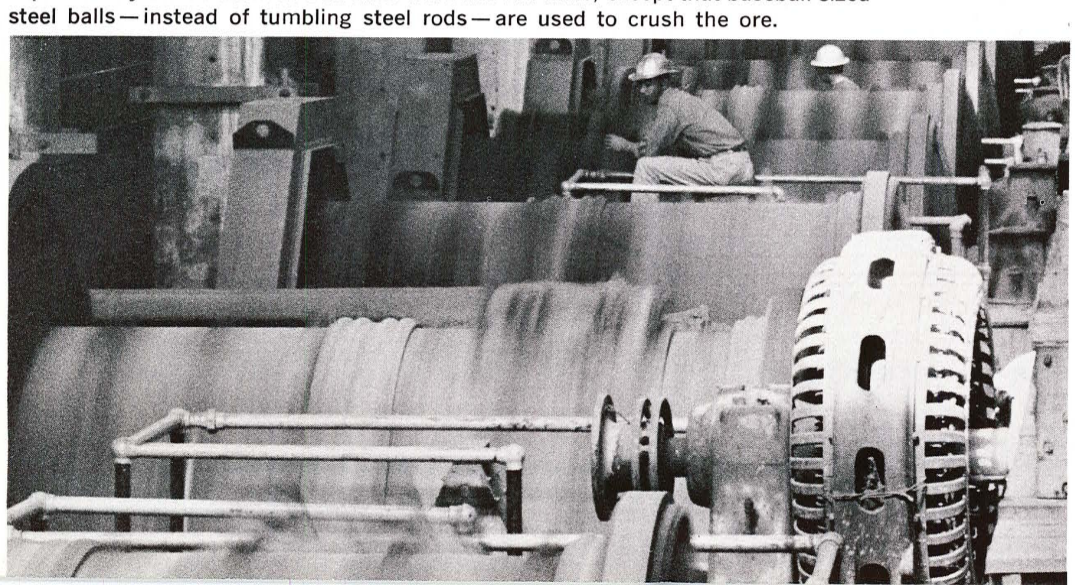


After being pulverized in rod mills the ore goes into Leaching Circuit, where acids dissolve out the copper from the tiny ore particles in which it is imprisoned. Leached ore goes into various classifiers. A Bowl Classifier is shown above.

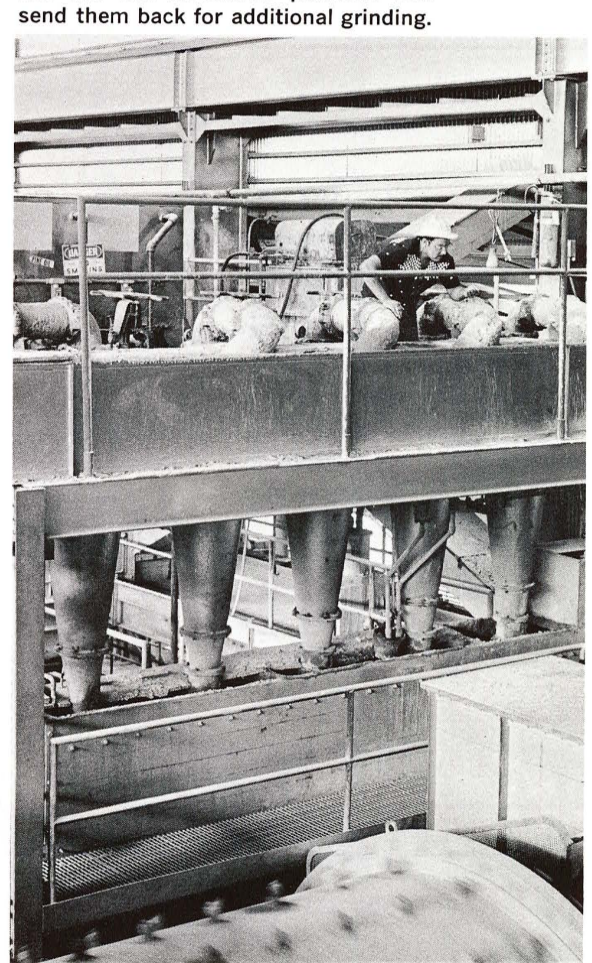


Cross section view of a Bowl Classifier shows how revolving "rakes" agitate the fine ore "slimes," causing them to flow to outer edge and over rim into trough. Larger, heavier "sands" sink to bottom.

Battery of 16 ball mills pulverizes "sands" to further fineness after they have been separated by bowl classifier. Ball mills work like rod mills, except that baseball-sized steel balls — instead of tumbling steel rods — are used to crush the ore.



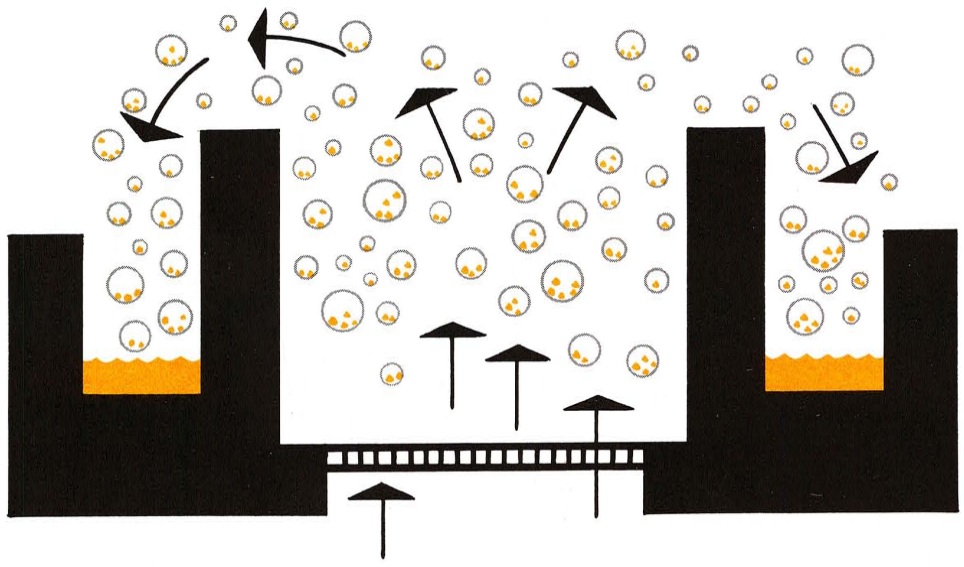
From the ball mills, the finely ground ore goes to "cyclones," which separate out the still-too-coarse particles and send them back for additional grinding.



Flotation:

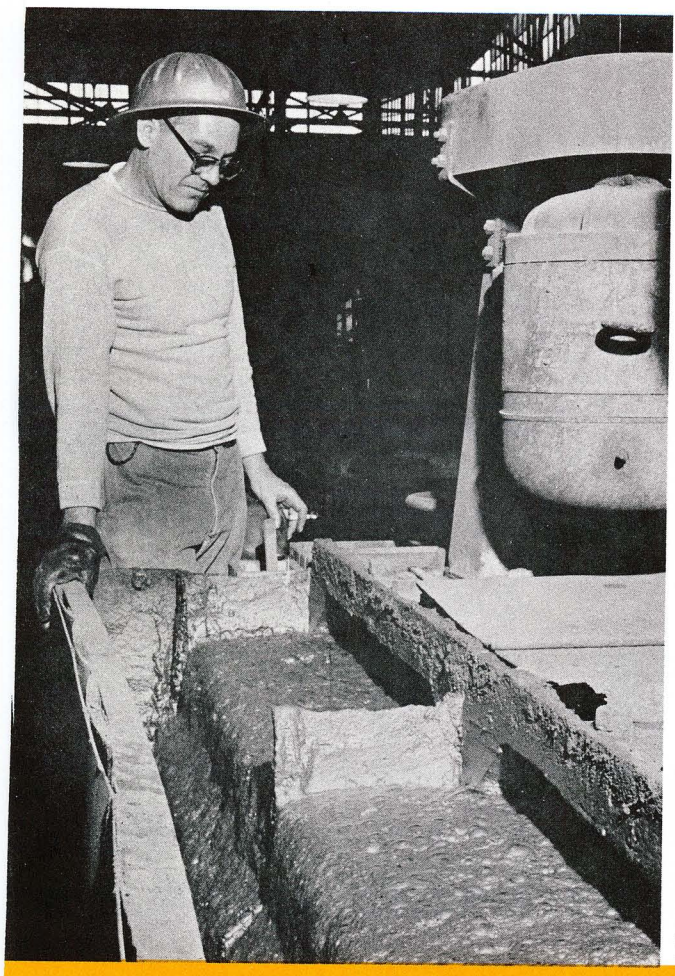
Tiny ore particles "hitch-hike" a ride on rising bubbles

Flotation is the third phase of the L-P-F (Leach-Precipitation-Flotation) system used by the Ray Mines Division to recover a higher percentage of copper from low-grade ores. This is accomplished by: *Leaching* non-sulphide copper minerals with sulphuric acid; *Precipitating* the acid-dissolved copper with sponge iron (which changes places with it); and recovering the elemental copper by *Flotation.*



In the Flotation process the ore — mixed with a reagent and a "frothing" substance — flows through long troughs. The sketch above shows end-view of one. Air is blown through porous bottom of trough, causing millions of oily, sticky bubbles to form and rise — carrying ore particles up and over the top of trough's center section.

This Kennecott workman in the L-P-F Building at Hayden is installing a new canvas "matt" in the bottom of one of a battery of trough-like Flotation Cells. The air is pumped through strong metal screen beneath canvas.



The frothy mass of bubbles that rise continuously from the bottom of Flotation Cells overflow from both sides into concrete "launders." Non-copper waste materials, called "tailings," remain at bottom of center section.

The "hitch hiking" copper ore particles are deposited by bubbles into the "launders" on both sides of Flotation Cells. Now separated from most waste matter, this copper "concentrate" is then pumped to Smelter.

L. P. F. CIRCUIT (Slimes)

All concentrates which are sent to the smelter are derived from three sources: The L.P.F. Circuit, (diagramed across the top of this page) which handles the "slimes" or very fine material which does not need to be re-ground after passing through the rod mills; The Sulphide Circuit (diagramed across the bottom of the page) which handles the coarser "sands" after they have passed through the ball mills; and the Precipitation Plant (diagramed in the center) which recovers copper from ores considered in the past to be waste.

ACID ADDED

40 FOOT LEACHING TANK

Overflow material from sands-washing classifiers is fed into the 40 foot leaching tank where sulphuric acid is added to leach out the copper mineral and form a copper sulphate solution.

SPONGE-IRON ADDED

PRECIPITATORS

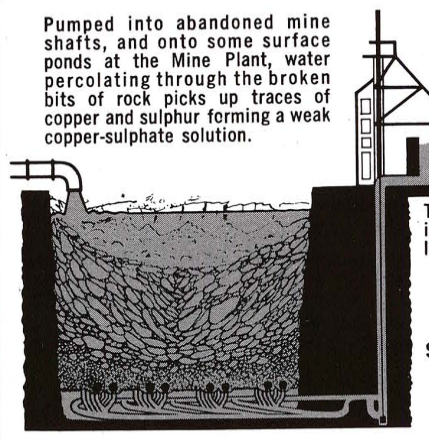
The solution is pumped into precipitators where sponge iron — a powdery metallic iron — is added. This serves to drop, or precipitate, the copper out of the solution.

REAGENT ADDED

COPPER FLOTATION (Acid)

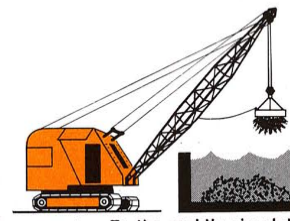
Reagents, consisting of a frother and a collector, are added to this watery pulp. The collector coats the mineral particles allowing them to adhere to the bubbles formed by the frother when compressed air is blown through the bottom of the flotation cells.

Pumped into abandoned mine shafts, and onto some surface ponds at the Mine Plant, water percolating through the broken bits of rock picks up traces of copper and sulphur forming a weak copper-sulphate solution.

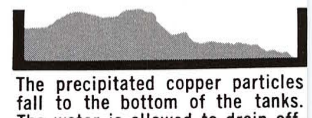


SUMP PUMP

This solution is collected, pumped into large vats or tanks and allowed to circulate freely.



To the rapidly circulating solution, tons of old tin cans are added. The chemical action of the copper-sulphate on the iron in the cans causes the copper to precipitate out of the solution.



The precipitated copper particles fall to the bottom of the tanks. The water is allowed to drain off, the material, known as "cement copper" is air dried . . .

SULPHIDE CIRCUIT (Sands)

ACID ADDED

ROD MILLING

LEACH DRUMS

In the sulphide circuit, "sands," the coarse-ground product from the rod mills is fed into the leach drum and mixed with sulphuric acid in amounts sufficient to leach oxide copper.

SANDS WASHING CLASSIFIERS

The leach drum discharges into a series of counter-current washing classifiers where the solutioned copper is washed free of the sand and fed up to the L.P.F. circuit.

LIME ADDED

GRINDING CIRCUIT

Sands from the classifier are fed into ball mills, lime is added, and 70 tons of 3-inch steel balls grind the sands to powdery fineness.

REAGENT ADDED

COPPER FLOTATION (Alkaline)

Materials sent from the ball mills are conditioned with reagents. (lime, a collector and a frother) and the copper mineral is floated out. (Pg. 14). Pine oil is employed as the frother and Xanthate as a collector.

The process by which Kennecott utilizes waste materials to recover every possible ounce of copper from low grade ores

L. P. F. TAILINGS

L.P.F. tailings are fed directly to the tailings disposal area while the concentrate is fed to the smelter area for disc and air drying.

The underflow from the thickener and the L.P.F. tails flow into the tailings disposal area where the dry tailings look like desert sands.

GEN. TAILINGS

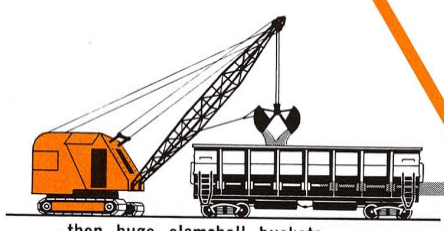
WATER RECLAMATION

All tailings with the exception of those from the L.P.F. plant are pumped to the 325 foot thickener from which Ray Mines Division recovers 4,500,000 gallons of water daily.

L. P. F. CONCENTRATES

SMELTER

(Sponge Iron-Acid plant in foreground.)



DEWATERING

. . . then huge clamshell buckets scoop up the precipitate copper, load it into railroad cars and it joins the other concentrates at the smelter.

GEN. COPPER CONCENTRATES

The sulphide copper concentrate is fed to the smelter for de-watering and air-drying, and then fed into the Reverberatory Furnace for smelting.

SULPHIDE COPPER CONCENTRATE

Tailings from the flotation cells are rejected as waste material and sent to the tailings dump.

PYRITE TAILINGS

REAGENT ADDED

SULPHIDE TAILINGS

The sulphide tailings contain pyrite (iron sulphide) mineral which is a valuable by-product. From pyrite, sulphur and iron can be recovered.

CYCLONE SCRUBBER

The tails from the sulphide circuit are pumped into cyclones which condition the pulp by a scouring action, resulting in the removal of lime film.

PYRITE (Iron Sulphide) FLOTATION

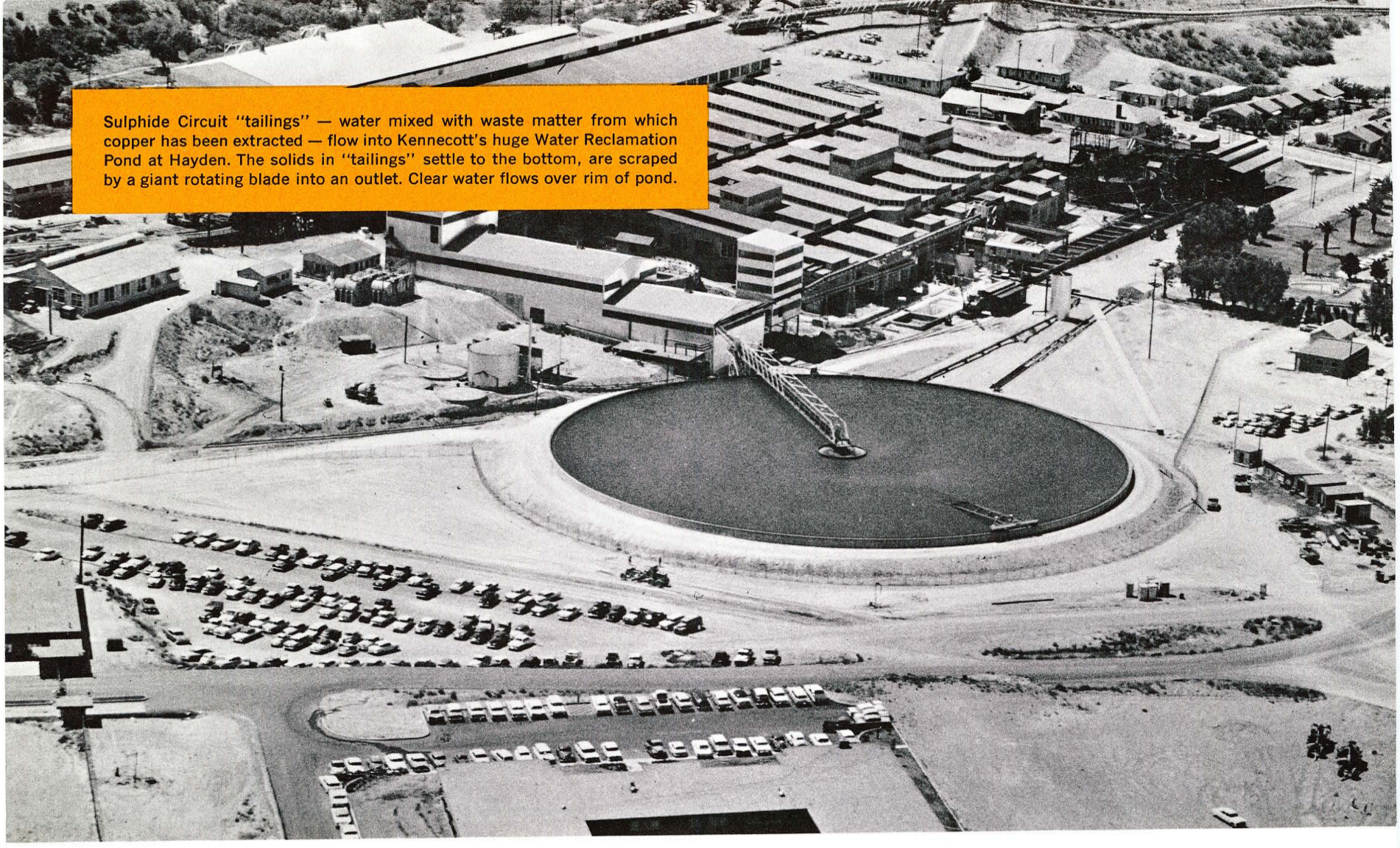
Again reagent (Xanthate) is added to float the pyrite mineral in flotation cells. The resulting pyrite concentrate is cleaned three times by machines which resemble giant eggbeaters.

PYRITE CONCENTRATE

The pyrite concentrate is pumped to the Sponge Iron and Acid Plant, where, through a roasting and reduction process, the sulphur and iron are recovered.

SPONGE IRON & ACID PLANT

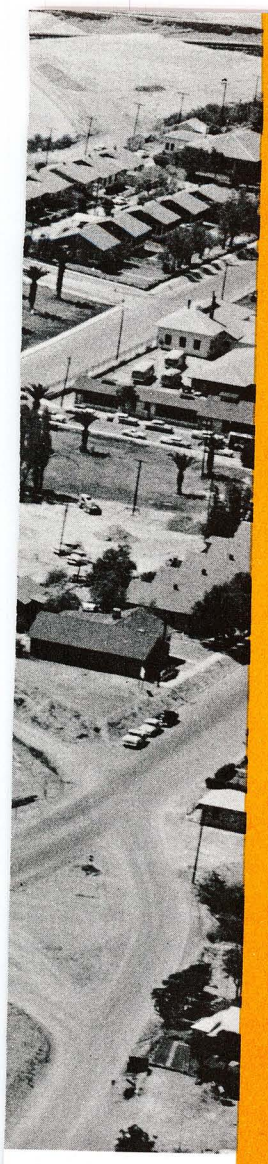
The metallic iron is recovered as a powder-fine sponge iron, the sulphur is made into sulphuric acid. Both are used in recovery of the copper mineral.

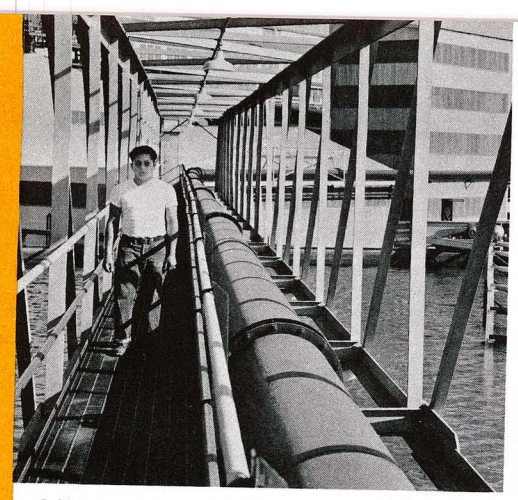


Sulphide Circuit "tailings" — water mixed with waste matter from which copper has been extracted — flow into Kennecott's huge Water Reclamation Pond at Hayden. The solids in "tailings" settle to the bottom, are scraped by a giant rotating blade into an outlet. Clear water flows over rim of pond.

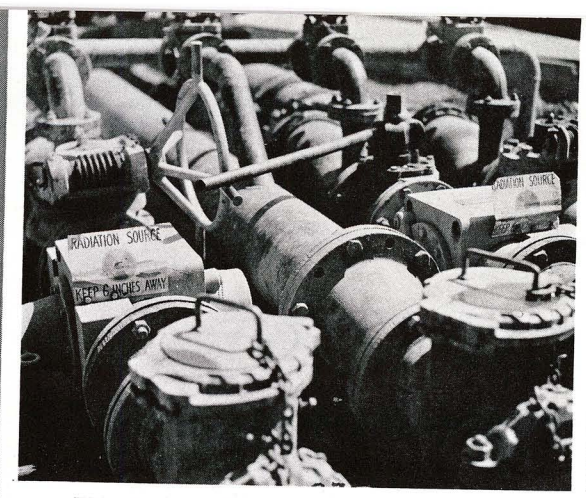
Water Conservation: 4,500,000 gallons per day...

The amount of water available to Kennecott's Ray Mines Division for processing copper ores is limited by Government decree, which apportioned water in the Gila and San Pedro rivers to the legal users. It was therefore necessary, in order to expand copper production to its present-day capacity, to devise methods for reclaiming and re-using large quantities of water. This was accomplished by building the above Water Reclamation Pond.

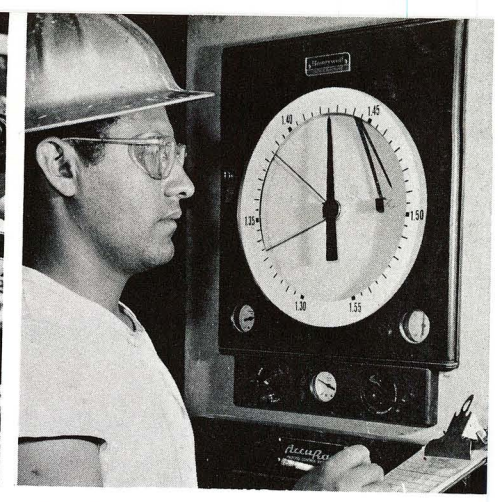




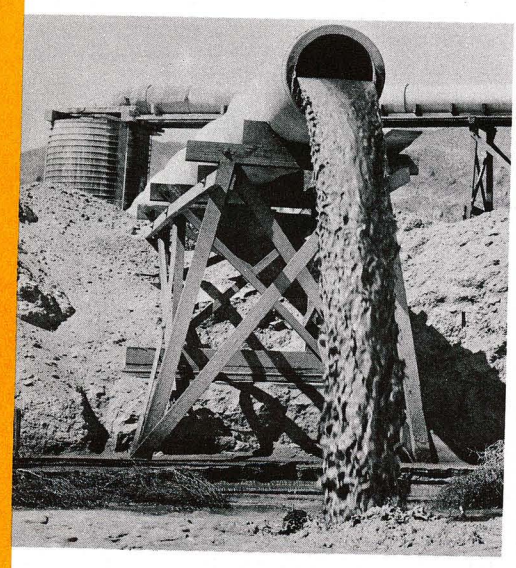
A Kennecott workman walks over bridge-like structure alongside big pipe through which "tailings" flow to center of the 325-foot diameter Water Reclamation Pond at Hayden.



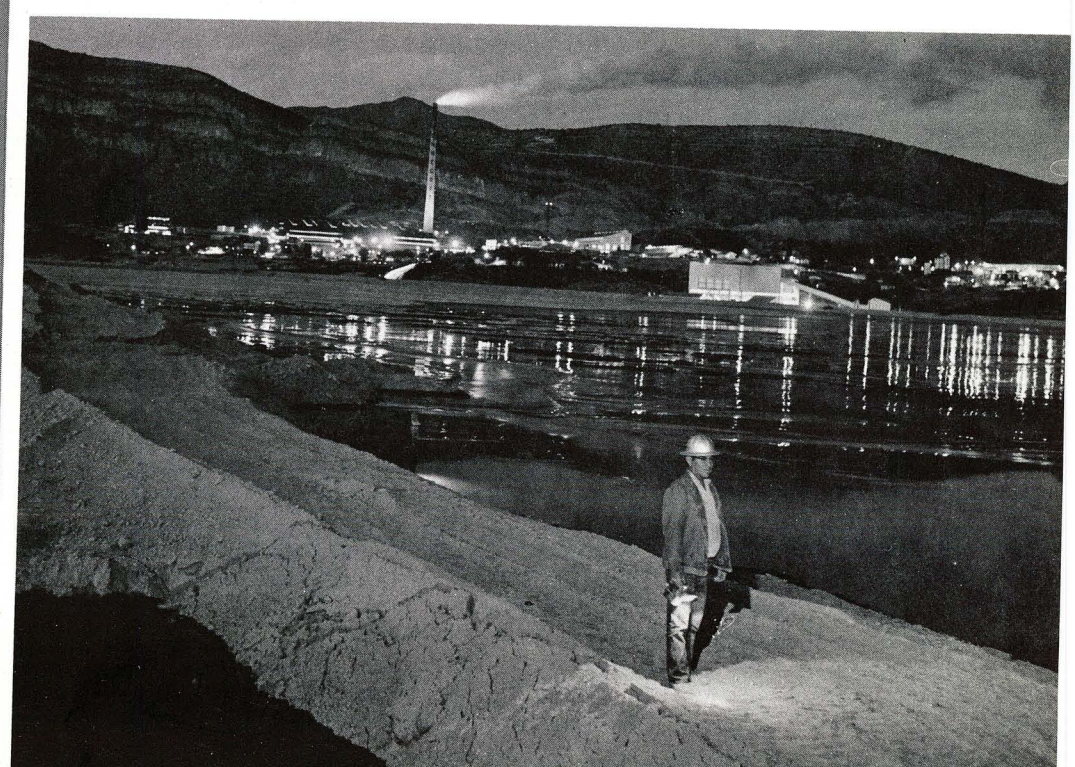
This device utilizes radioactive isotopes to measure density of "tailings" — and to activate valves which maintain most efficient ratio of water to the waste materials.



This dial records the amount of "tailings" handled by Water Reclamation Pond, and other information about system's operation. Saving: 4½-million gallons per day.



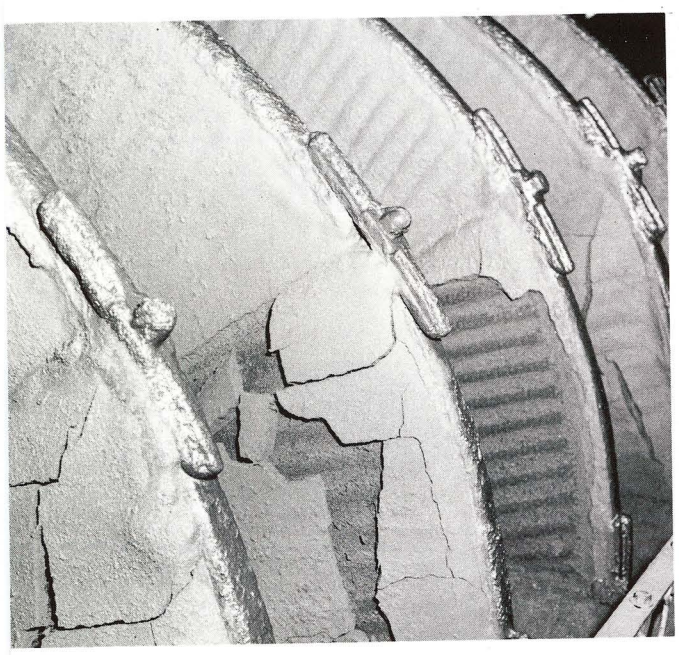
"Tailings" pour into disposal area, which covers 1100 acres of desert. A crew of 12 men and six tractors are required to build dikes, maintain and patrol them around the clock. Photo at right: night dike-walker.



Smelting:

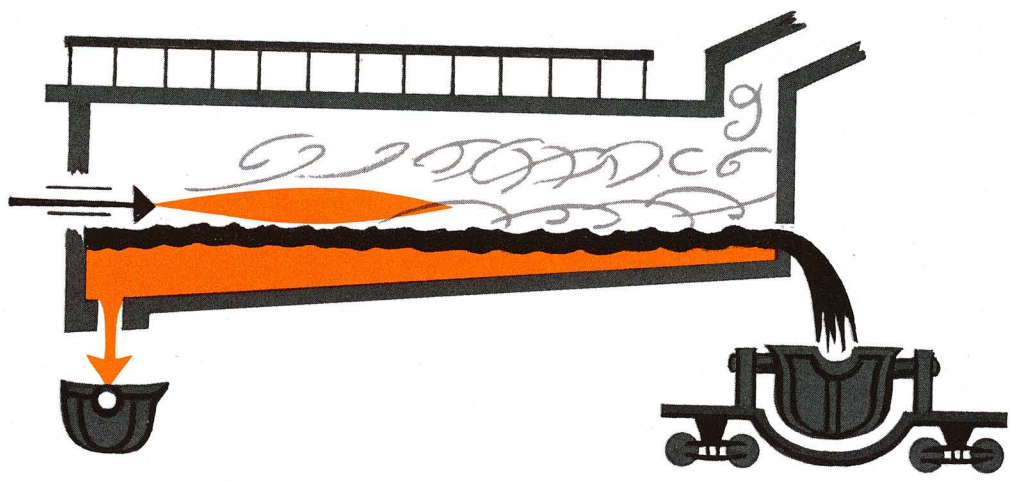
2800°F heat

that liquefies metals

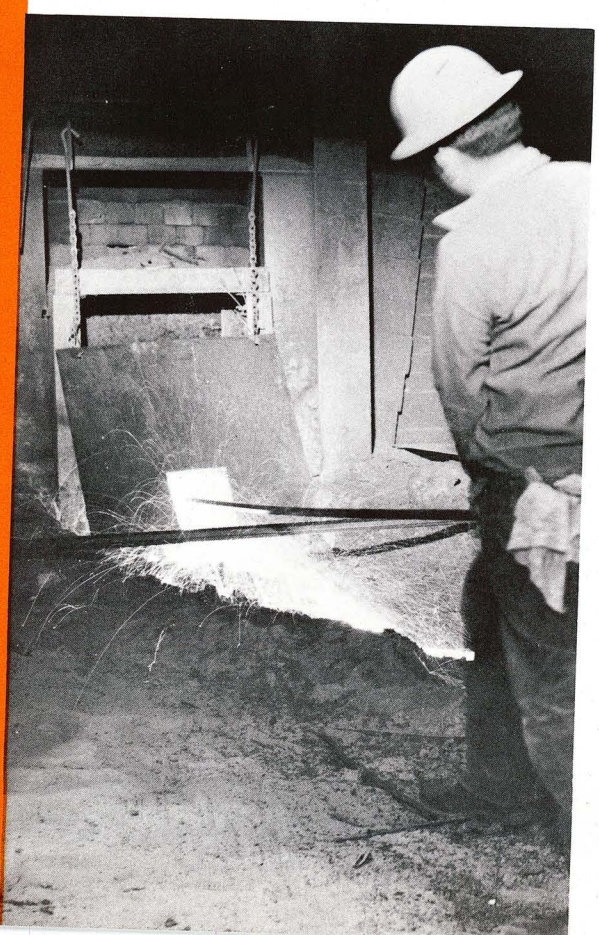


Above: The wet copper "concentrate," which at this stage contains 18% copper, is dried on these disc-type vacuum filters. After being dried, it goes to storage bins — and from there to Smelter Building.

Kennecott workmen, in lower left corner of photo at right, are dwarfed by immense size of the equipment in Converter Aisle of Smelter Building. High above them another Kennecott workman operates huge crane that travels full length of the Converter Aisle.

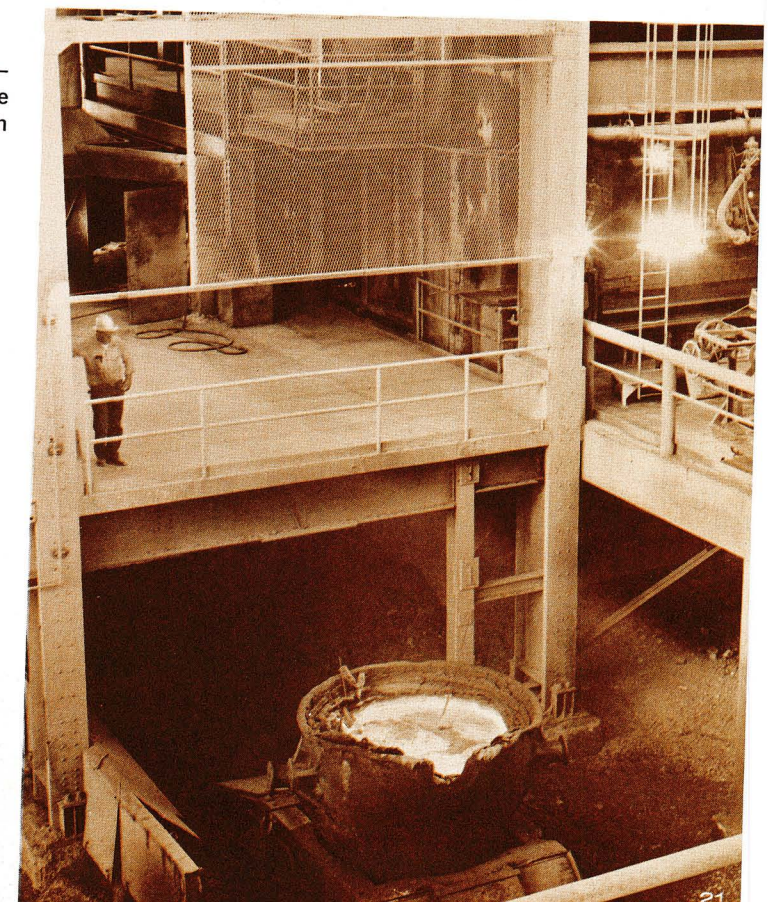


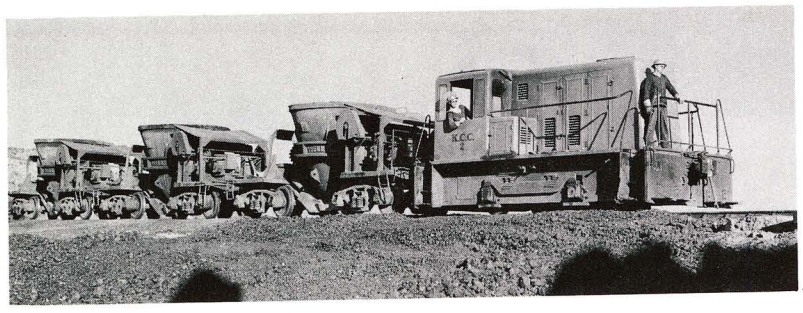
This sketch shows how copper "concentrate" is liquefied by 2800-degrees Fahrenheit heat in 35-by-120-foot Reverberatory Furnace. Molten material, called the "bath," is maintained at a depth of four feet. It consists of "slag," which contains valueless impurities — and of "matte," which is a mixture of iron, sulphur, and copper. "Slag" floats to the top and is skimmed off into steel pots of 15-tons capacity which are mounted on rail-cars that haul it to disposal area. The "matte" flows into 20-ton capacity steel ladles, for transportation by overhead crane to a Converter Furnace.



Kennecott workman draws matte — containing 30% copper — from tap-hole in Reverberatory Furnace. Glowing with intense heat, it flows into steel ladle.

Right: 20 tons of matte copper is moved into the converter aisle by the workman pictured, who is operating the control of the matte car. The ladle will be lifted from the car and taken to one of the three huge converter furnaces.

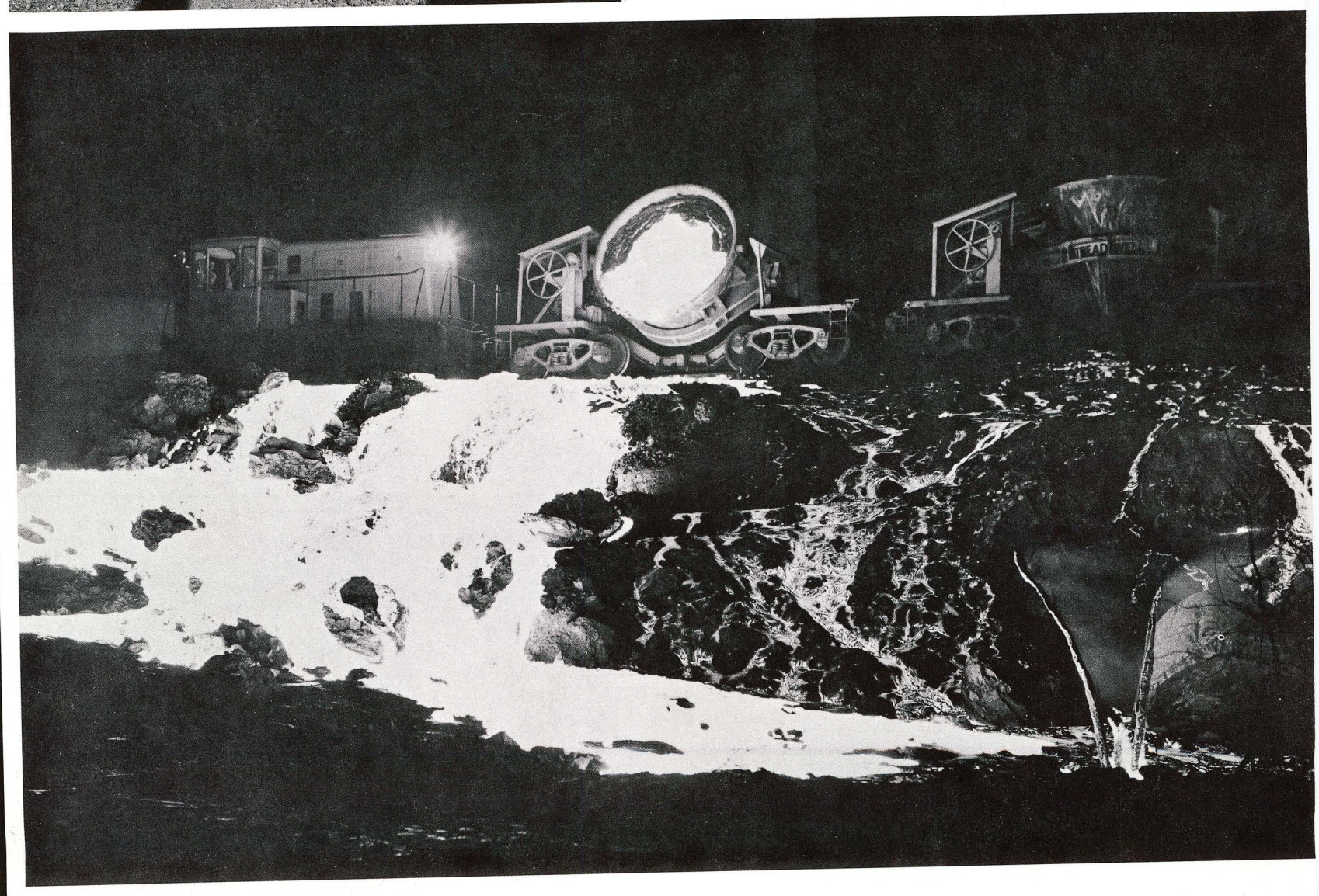




SLAG

Left: A "slag train" of steel pots, each filled with 15 tons of molten waste matter, makes a trip from Reverberatory Furnace to disposal area.

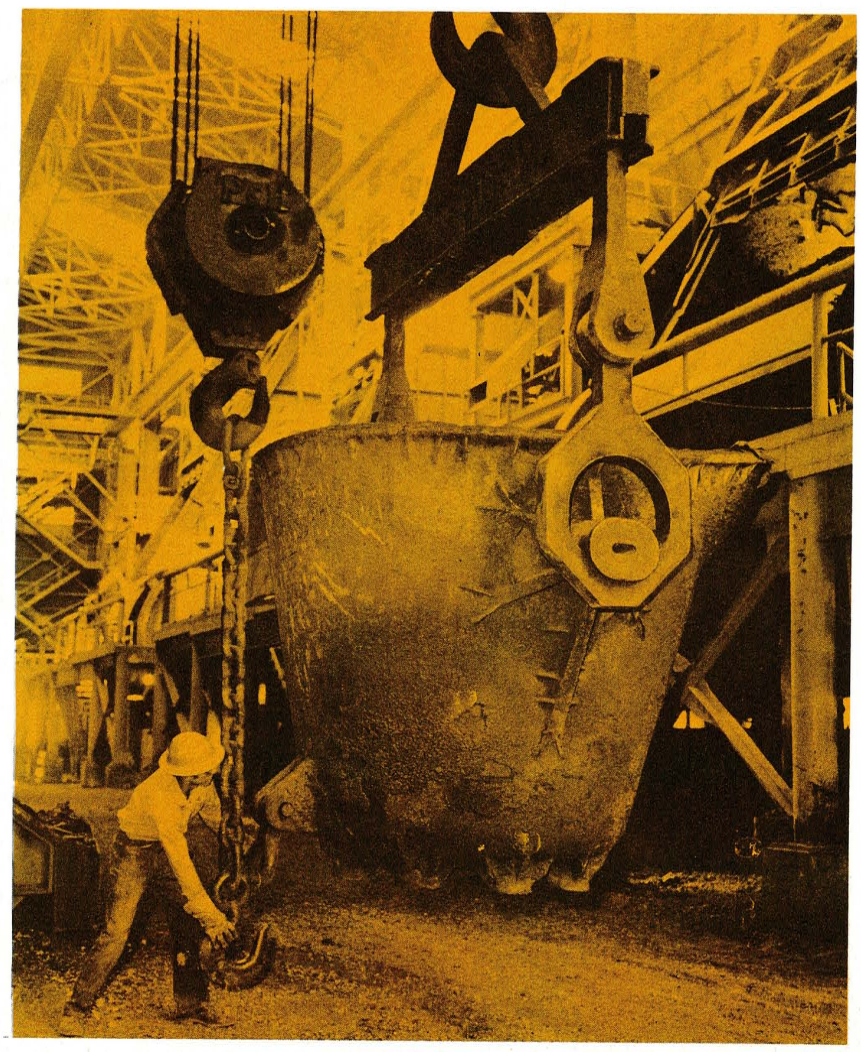
Pouring of "slag" at night creates a spectacular sight. It flows downhill like lava from a small volcano crater, and solidifies as it cools into rock-hardness. Result: man-made mountains that never stop growing.

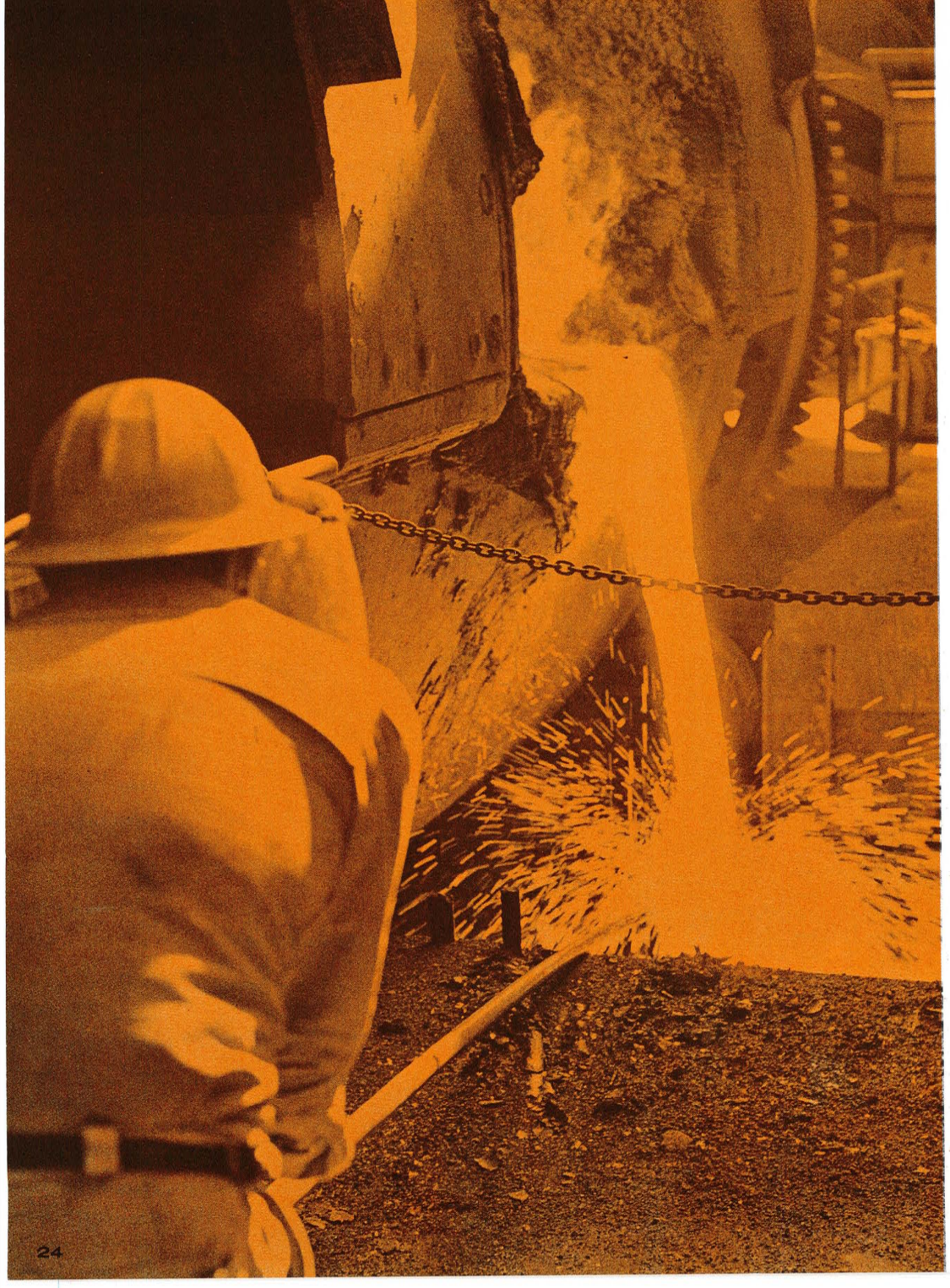


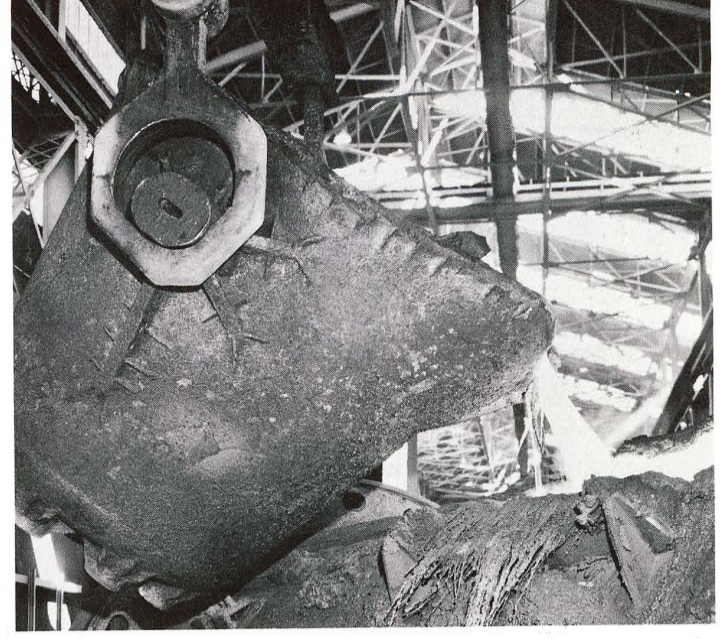
MATTE

Below: A Kennecott workman attaches crane-hook to steel ladle which contains 20 tons of molten matte drawn from tap-hole in Reverberatory Furnace. Crane Operator, high overhead, acts on hand-signals given by the man attaching hook. Crane hoists ladle aloft to a "converter" opposite the Reverberatory Furnace.

Matte is poured into cylindrical Converter Furnace. Then compressed-air is blown into it, causing sulphur in the matte to go up the flue in form of sulphur dioxide. Iron impurities become iron oxide, are removed by adding silica rock "flux" to form "slag" that is skimmed off for reprocessing.





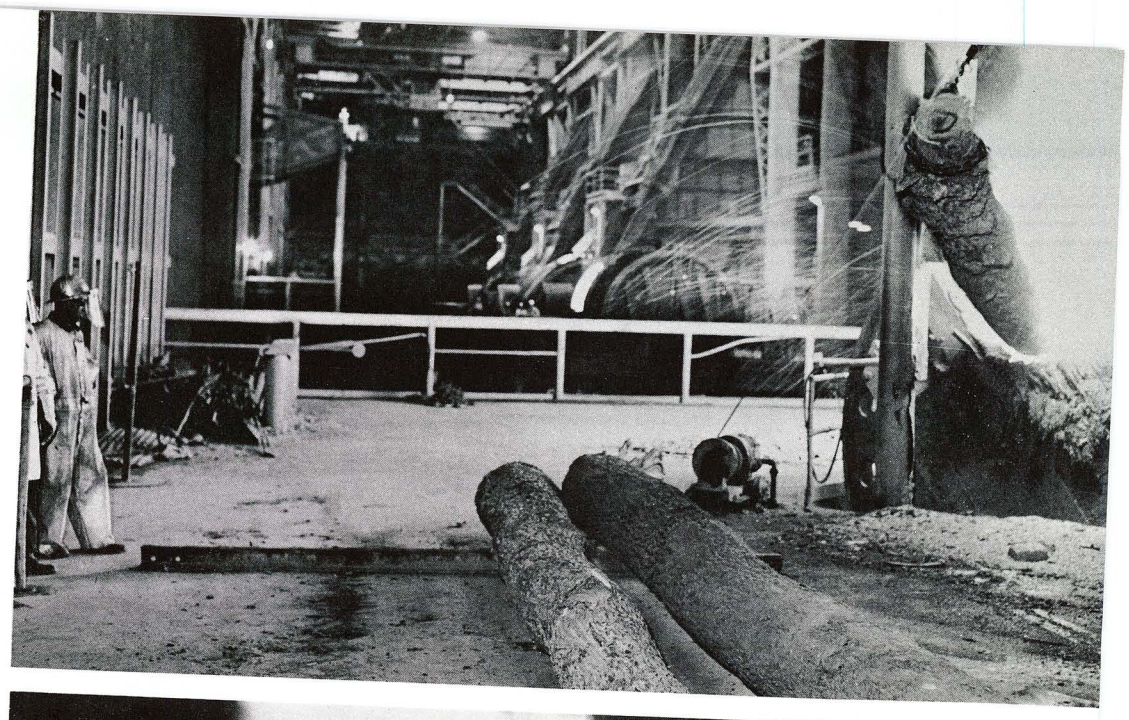


Sampling . . .

The Quality Control department plays a vital role in mining, milling, and smelting of low-grade copper ores by Kennecott's Ray Mines Division. Analysis of rock samples taken in the pit enable the production planners to schedule the most efficient handling of *ore, leach,* and *waste* material — and to supply the Reduction Plant and Smelter with an uninterrupted flow of the required quantity and quality of ores. Around-the-clock sampling also provides a constant check on the operating efficiency of each process and piece of equipment.

As molten copper is poured from Converter Furnace into giant ladle, a Kennecott workman on a platform uses long-handled "spoon" to collect a sample for analysis by Quality Control.

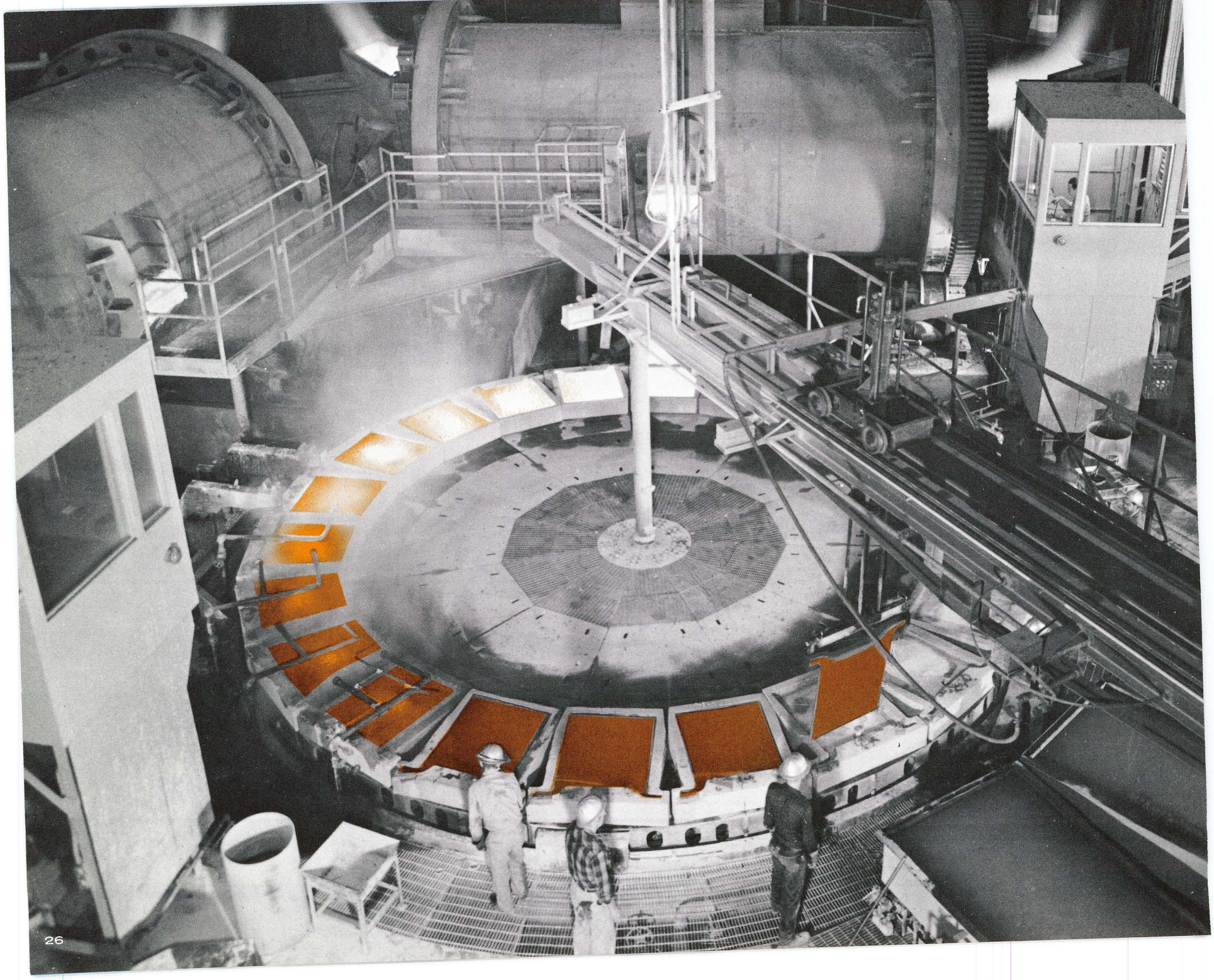
Left: Twenty tons of molten "blister" copper — more than 99% pure, but still not yet pure enough to be used commercially — is transported by overhead crane and poured into Anode Furnace.



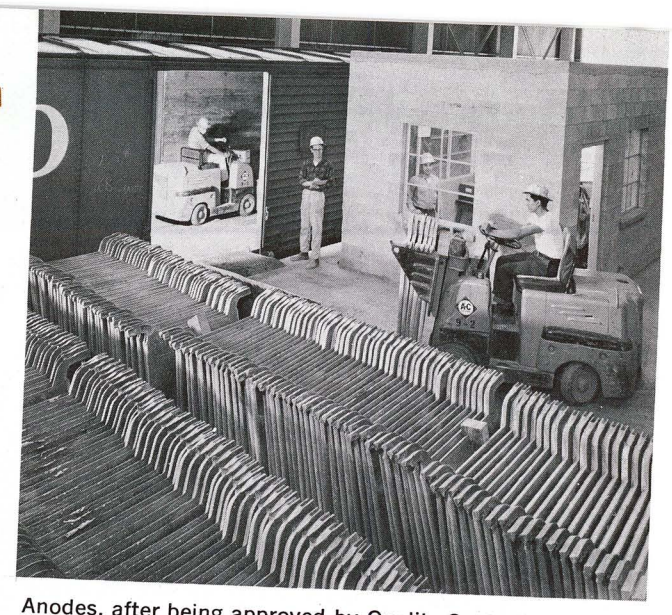
and Poling

The "poling" process — so called because big oak logs or poles are literally thrust into an Anode Furnace — produces an always-exciting spectacle.
Instantly, upon being thrust into the molten metal, the poles are incinerated — which releases the copper from the copper oxides formed in the Converter Furnace during the oxidizing process. After the copper oxides have been de-oxidized in this manner, the remaining molten metal in Anode Furnace is known as "fire refined" or anode copper.

Top photo shows poles being thrust into Anode Furnace. Process is controlled by Kennecott workman, below, who is shielded from intense heat by glass wall, face protector and special clothing.



99.6% pure copper anodes start a journey



Anodes, after being approved by Quality Control, are picked up, several at a time, by fork-lift trucks and loaded in box-cars for shipment to Kennecott Refining Corporation in Anne Arundel County, Maryland, for electrolytic refining.

Aerial photo shows Smelter Building and supporting facilities of Kennecott Copper Corporation's Ray Mines Division in Hayden, Arizona. For each 700-pound anode produced here, 90,000 pounds of copper ore must be processed.

After "poling" is completed, fire-refined copper is poured from Anode Furnace into tilting ladle which, in turn, pours into molds on the outer rim of Anode Casting Wheel as it slowly revolves. The shape of the molds forms the metal, as it cools and solidifies, into wedge-shape slabs with ear-like projections that simplify handling by crane and fork-lift trucks. After partial cooling, anodes are lifted from molds by small crane and immersed in water for further cooling. Entire process is controlled by Kennecott workman in glass-shielded booth in the upper right hand corner of large photo at left. Kennecott Quality Control workmen inspect anodes after they have cooled and send those with flaws back for remelting in Converter Furnace. Thickness and weight are carefully checked.

Lime Quarry:

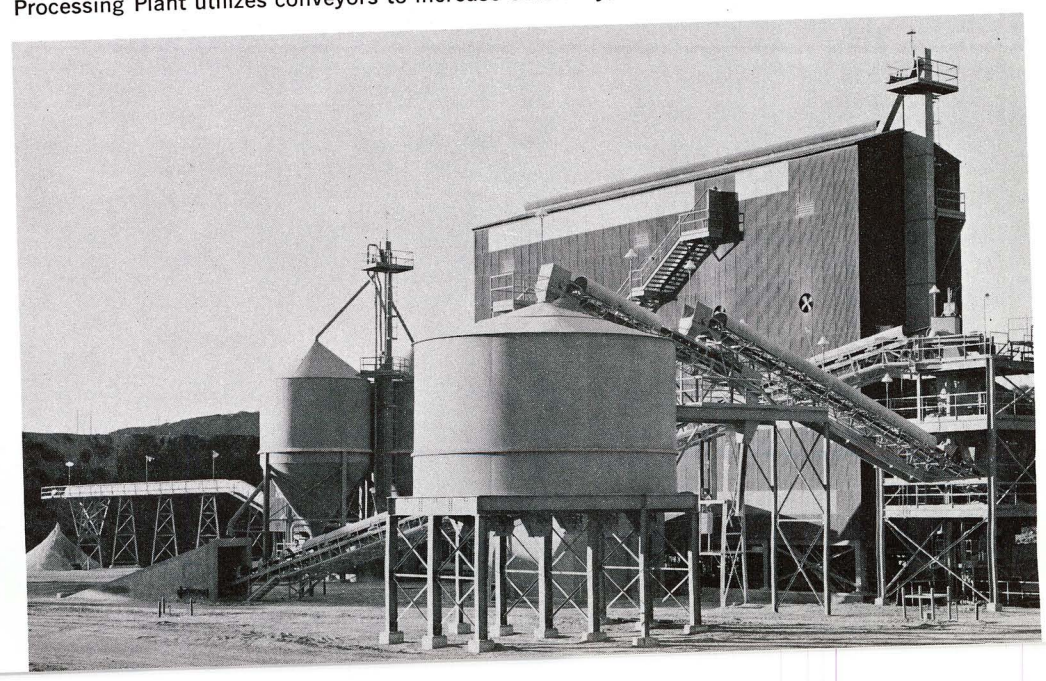
MINE-WITHIN-A-MINE

The Ray Mines Division of Kennecott Copper Corporation is producing "milk of lime" for the Hayden concentrator — which is required for "pH" control in the flotation process. (The "milk of lime" neutralizes acids in ore and acids used in the leaching circuit.) Impure limestone comes from quarry one mile east of Hayden. Some 6,000 tons per month are treated in Kennecott's new Lime Processing Plant, which was recently completed at a cost of $700,000.

Lime processing plant consists of four sections: crushing, screening, calcining, and slaking. It takes only three men to operate plant, which can process 200 tons of lime rock per day to produce 100 tons of burned lime.

Lime quarry's operation is similar to the Ray copper mine. Blast-holes are drilled in the lime rock; an explosive charge is detonated; the broken rock loaded by shovels into trucks and transported to the Lime Processing Plant.

Like all Kennecott's facilities at the Ray Mines Division in Hayden, the Lime Processing Plant utilizes conveyors to increase efficiency, cut costs.



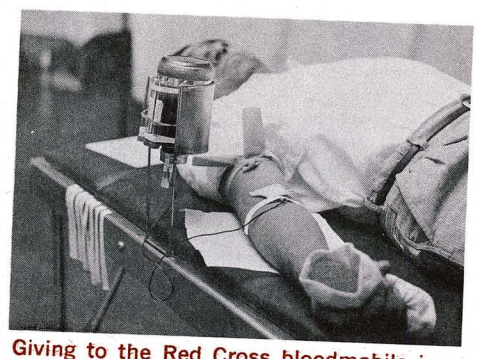
On-the-job Safety

The National Safety Council rates mining as one of our nation's most hazardous industries. Yet, because of the outstanding Safety Programs at Kennecott's Ray Mines Division, its employees are even safer on the job than is the average industrial worker in the United States. And the average industrial worker is 7 times as safe **on** the job as **off.**

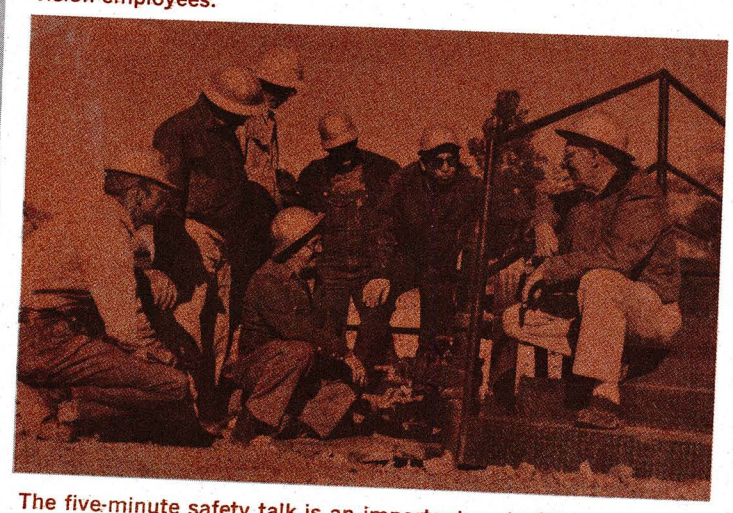
Off-the-job Citizenship

Kennecott is proud of the excellent citizenship record of its employees at Ray Mines Division. They play a vital role in civic affairs, Parent-Teacher and Scouting work, and the encouragement of character-building sports and activities for boys and girls. Their record of donations to the Red Cross Blood Bank and purchases of United States Savings Bonds is also outstanding.

A Kennecott Industrial Relations representative receives the Silver Beaver Award, highest in scouting.



Giving to the Red Cross bloodmobile is a routine thing for many of the Ray Mines Division employees.



The five-minute safety talk is an important part of the safety program at Kennecott.

A Reduction Plant employee serves as scoutmaster for a group of Hayden youngsters.

A new member is welcomed into the Wise Owl Club. His eyesight was saved by his safety glasses.

Quick facts about man's oldest metal:

COPPER

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.

PHYSICAL PROPERTIES OF COPPER

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

How copper contributes to the conveniences and pleasures of modern living

(Estimated percentages based on the 1958 census of manufacturers, U.S. Dept. of Commerce)

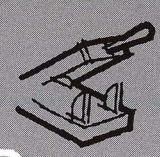
The following figures represent the approximate percentages of total copper consumption by each of the following:

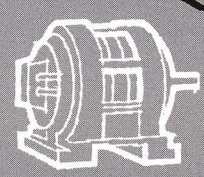
Light and Power Industry 16%

Electric generating plants
Transmission lines
Heat exchangers

Electrical Equipment 17%

Dynamos
Generators
Switches
Regulators
Transformers





Military 17%

Satellites
Missile guidance systems
Spacecraft
Ground-to-air missiles
Defense weapon systems
Manned aircraft
Radar detection systems

Building Construction 14%

Copper water pipes
Conduits
Electrical wiring
Heating-cooling systems
Roofing
Hardware
Curtain Walls
Gutters
Downspouts
Handrails

Railroad and Marine 1.7%

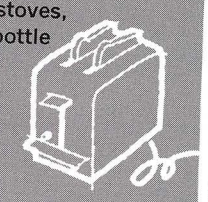
Copper water tubing
Air brakes
Air conditioners
Condensers
Heating systems
Ship propellers and shafts
Struts and rudders
Fuel lines
Torpedo tubes
Lubricating oil lines
Heat exchangers
Bilge pumps
Lavatories

Miscellaneous 4%

Fireplace andirons
Clocks
Lamps
Lipstick cases
Tableware
Utensils
Jewelry
Plaques
Curtain rods
Vases and ash trays

Household Appliances 1.7%

Washing machines
Electrical clothes dryers
Air-conditioning units
Vacuum cleaners
Refrigerators
Electric mixers, blankets, toasters, waffle irons, coffee makers, stoves, clocks, timers, bottle warmers



Industrial Equipment 9%

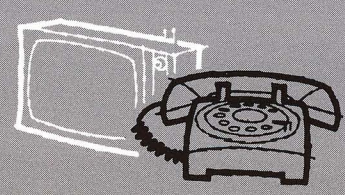
Automated machine tools
Lathes
Packaging machinery
Food cooking vats

Scientific Equipment 2.8%

X-Ray machines
Fluoroscopes
Heat-sensing instruments
Calibrators
Electronic gages
Electric furnaces
Laboratory equipment

Communications 5%

Telephone wire, cable
Coaxial TV cables
Television sets
Radio sets
Telegraph sending and receiving equipment



Motor Vehicles 9.8%

Electrical systems
Generators
Engine bearings
Radiators
Heaters

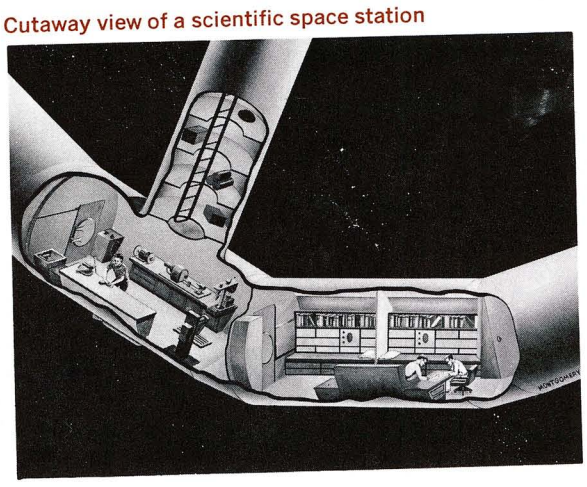
Electronics 2%

Radar antenna
Automatic direction finders
Airborne navigational systems
Electronic computers

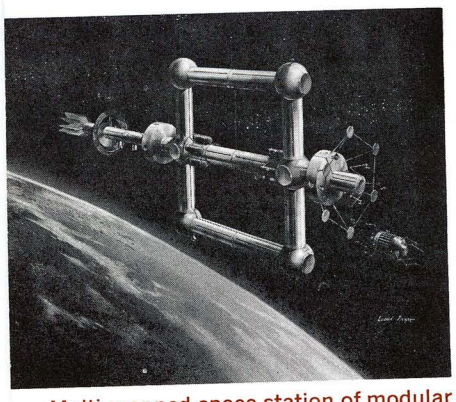
Copper's role in the World of the Future

Man's oldest metal, copper, is today contributing more to progress, the preservation of peace, and the betterment of mankind than at any time in history. Kennecott's role will continue to be an important one in World of the Future — for Kennecott is the world's largest mine producer of copper.

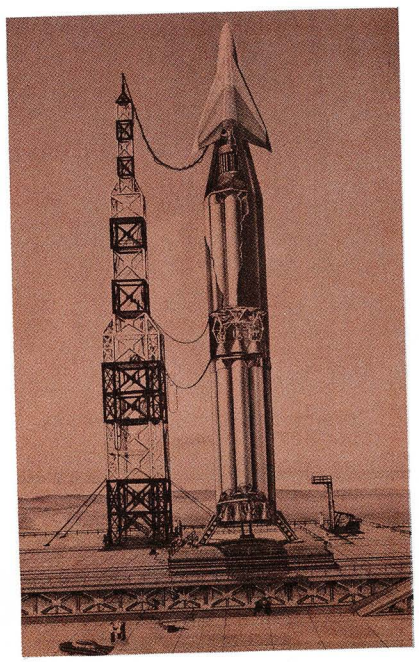
Cutaway view of a scientific space station



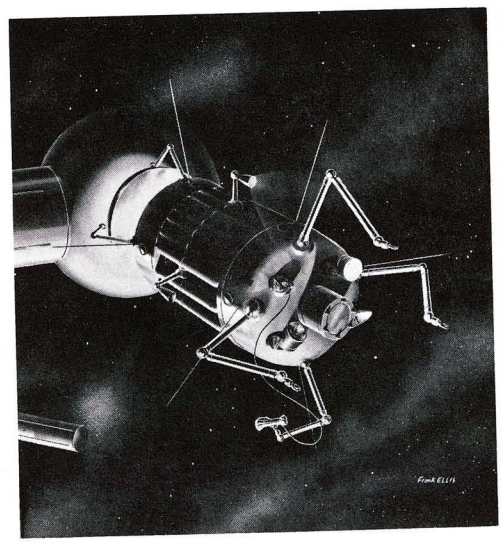
Drawings courtesy Lockheed Missiles and Space Company.



Multi-manned space station of modular design, to be assembled in space to orbit the earth, will create its own one-ton "G" force for occupants.

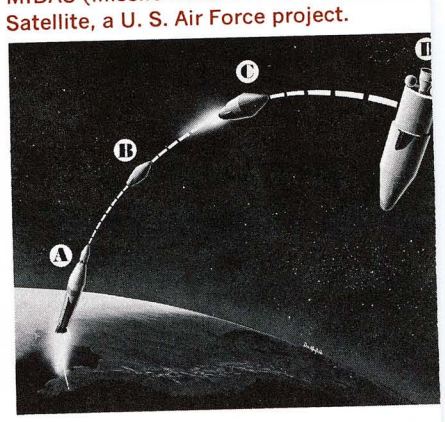


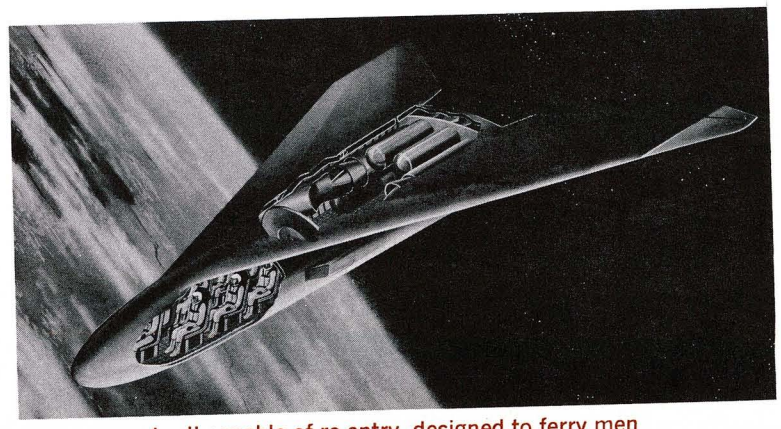
Saturn "booster," to which "Astrotug" and 7-man "Astrocommuter" space ship have been mated, ready for launching.



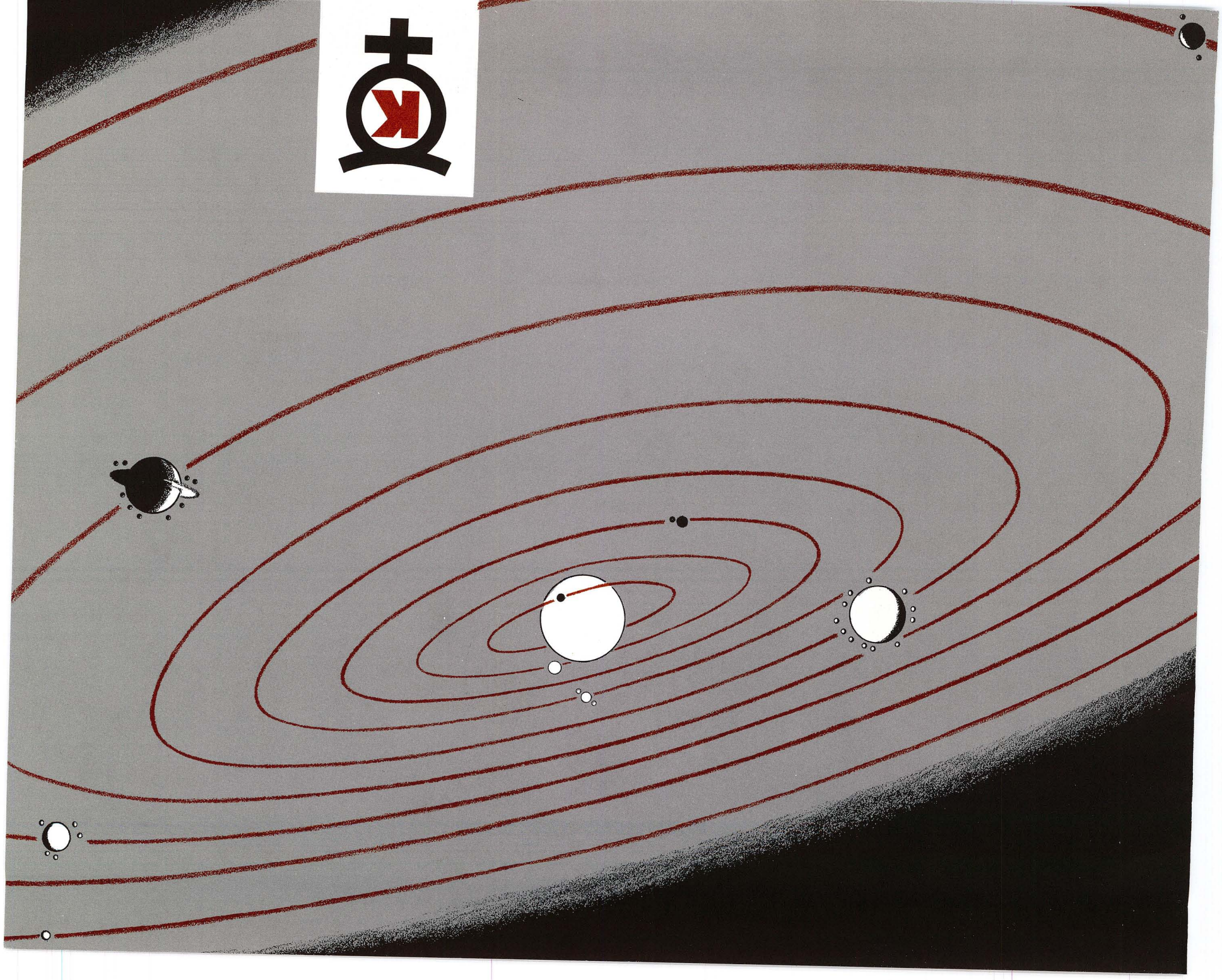
Artist's drawing shows "Astrotug" assembling a manned space station.

MIDAS (Missile Defense Alarm System) Satellite, a U. S. Air Force project.





"Astrocommuter," capable of re-entry, designed to ferry men and supplies between earth and manned space stations.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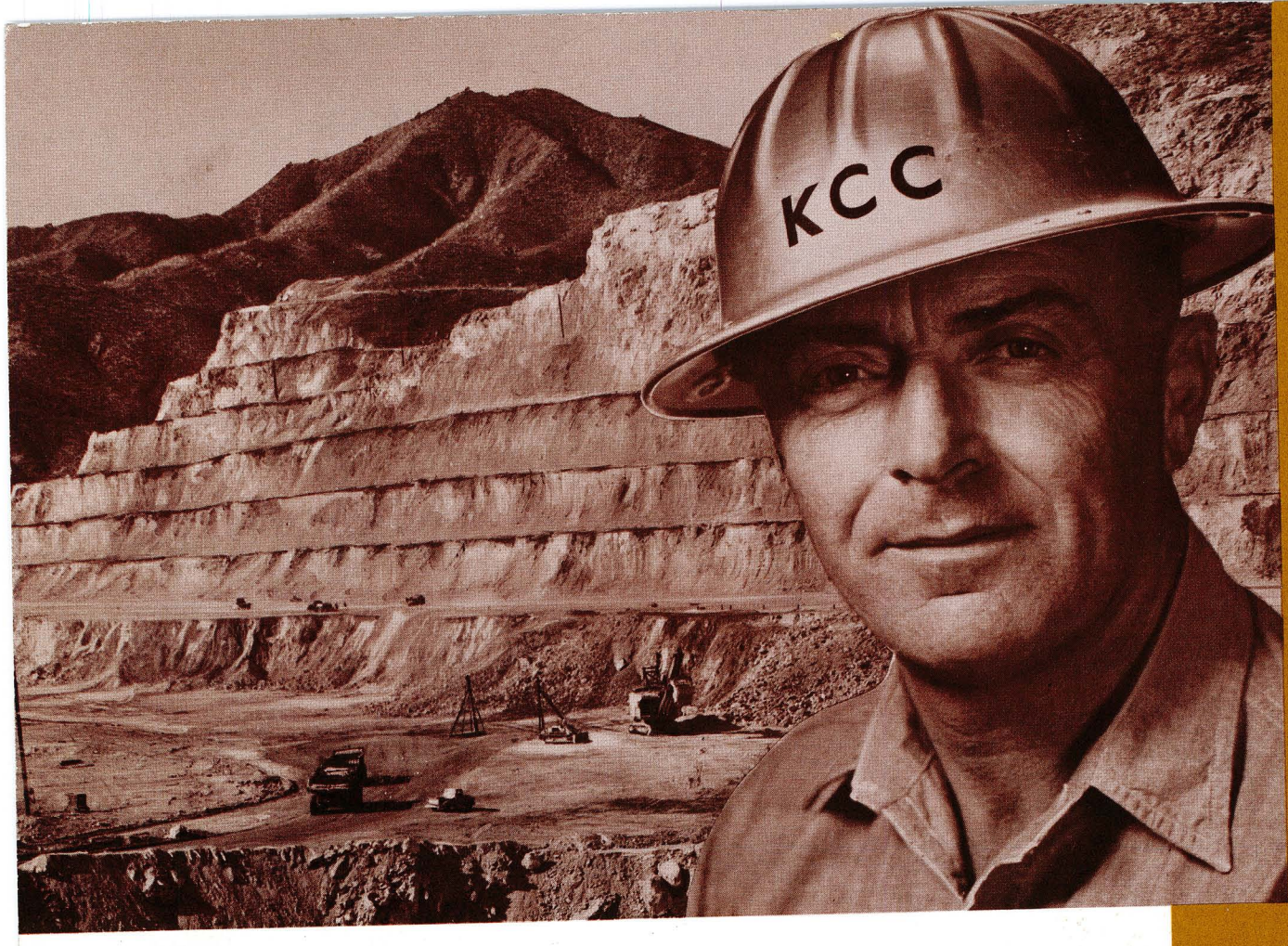

In the past half-century tremendous changes have taken place in Arizona's copper mining industry — brought about by improved mining technology and the investment of hundreds of millions of dollars in large-scale, high-efficiency facilities for the mining, milling, and smelting of low-grade ores.

Today's Arizona copper miners — and mill and smelter men — are highly skilled workers. They work shorter shifts, for wages that are among the highest of any U. S. industry.
At Kennecott's Ray Mines Division, employees receive many benefits over and above their regular pay: Premium pay for overtime and time worked on holidays, paid vacations or pay in lieu of vacations; payment for holidays not worked; paid sick leave; group health and life insurance. In addition, Kennecott contributes over $240 per year per employee into legally required state and federal funds. These extra benefits paid by Kennecott exceed $1500 per employee per year — an average of over $125 per month per employee in addition to paychecks.

Kennecott Copper Corporation
Ray Mines Division

Arizona produces as much copper as all of the other states in our nation, combined! And Kennecott is the world's largest mine producer of copper.

All About Kennecott

THE STORY
OF
KENNECOTT
COPPER
CORPORATION

All About Kennecott

The Story of Kennecott Copper Corporation

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ALL ABOUT KENNECOTT

The Story of Kennecott Copper Corporation

More copper is produced from the mines of Kennecott Copper Corporation than from those of any other company in the world. Kennecott can produce more than 600,000 tons of copper a year – 400,000 tons in the U. S. and 200,000 tons in Chile.

The company's operations include mines, concentrating mills, smelters, refineries and fabricating plants. Auxiliary facilities include railroads, electric power stations, lime plants, and sulphuric acid plants. The company has more than 27,000 employees, including those of subsidiaries, and 92,000 stockholders.

This booklet describes the various phases of Kennecott's operations, as well as those of its subsidiary companies. In addition, it tells how copper is produced and used. It has been prepared for stockholders, employees, and all others interested in the company.

FRANK R. MILLIKEN,
President

September 1961

The drama of molten copper –
pouring copper from a converter.

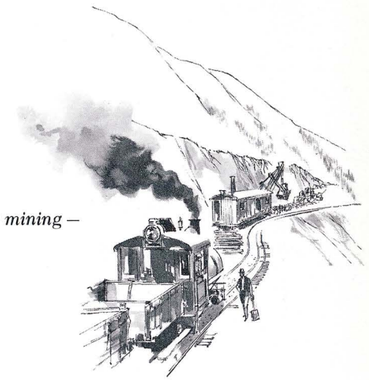
Kennecott's Background

The birth of the modern copper industry occurred at the turn of the century when a young engineer, Daniel C. Jackling, demonstrated at Bingham, Utah that production of the metal from low-grade ore was commercially feasible. Before that time copper came from small mines producing relatively high-grade ore containing from 5 to 35 per cent copper. By 1900 these high-grade ore deposits were dwindling and, with the dawn of the Electrical Age, the demand for copper was increasing rapidly.

Jackling conceived the idea of mining and processing by mass production methods the extensive deposits of low-grade ore containing about 2 per cent copper. He demonstrated that such deposits could be mined profitably from the surface by using steam shovels (later electric) to remove the surface rock and dig out the ore. He also took advantage of new methods of metallurgical extraction, and especially the improved flotation process, for concentrating this low-grade material. His procedure revolutionized copper mining and made available vast additional reserves to meet growing world requirements.

At about the same time that Jackling was experimenting with new mining methods in the West, another young engineer, Stephen Birch, was prospecting in Alaska. He learned of a newly discovered and exceedingly rich copper deposit near Kennicott Glacier, not far from Mount Blackburn, and acquired the claims to property which was destined to become the richest copper mine in the world. Some of the ore assayed nearly 80 per cent copper and, in addition, contained 20 ounces of silver to the ton.

In 1903 William Braden, a New York consulting mining



The beginning of modern copper mining — Kennecott's Utah mine in 1906.

engineer, went to Chile to investigate a large deposit of ore containing 2 per cent copper or better located in the Andes Mountains in the periphery of an extinct volcano at an elevation of 7400 – 9200 feet. The property was developed as an underground mine but as an "upside-down" one. Unlike most underground mines, from which ore is hoisted to the surface, at the Braden mine horizontal tunnels are driven into the side of the mountain and the broken ore is gravity fed through chutes into rail cars waiting below.

These three events were the forerunners of Kennecott Copper Corporation. The success of Jackling's process resulted in the development of large open pit mines, first in Utah, and later in Nevada, Arizona and New Mexico; this however required extensive capital. Birch's rich deposit was valueless until the building of a railroad to tidewater, 200 miles across glaciers and canyons, could be financed, and Braden's upside-down mine was not operable until ample funds for machinery and equipment had been provided.

Money for getting Jackling started in Utah was advanced by Charles M. MacNeill, Spencer Penrose and Charles L. Tutt. Subsequently, greatly increased amounts were needed for expansion to permit mining on the scale envisioned by Jackling, and the principal source of the additional funds was the firm of Guggenheim Brothers. This firm also advanced the money necessary to develop the Braden underground mine in Chile and, with J. P. Morgan & Co., the funds necessary for developing the Alaska mines. After the proving of Jackling's process in Utah, similar low-grade ore deposits were developed in Nevada, Arizona and New Mexico, and an important factor in their financing was the firm of Hayden, Stone

& Co. Others instrumental in the formation of Kennecott's predecessor companies were Mark Requa (Nevada) and H. O. Havemeyer II, (Alaska).

Operation of all four western mines was under the direction of Daniel C. Jackling. Thus, the management and/or ownership of the companies operating the four western mines, the mines in Alaska, and the mine in Chile were closely connected. In 1915 the associated interests decided to combine the companies into one corporate entity and, with the Alaska company as the nucleus, Kennecott Copper Corporation was formed on April 29th. The new company immediately began acquiring the stocks of the Braden and Utah companies. Subsequently, through acquisition and mergers, the Kennecott family grew to include Nevada Consolidated Copper Company, Ray Consolidated Copper Company (Arizona), and Chino Copper Company (New Mexico).

Kennecott derived its name from the location of the Alaska mine near Kennicott Glacier, which was named after Dr. Robert Kennicott, a well-loved explorer and naturalist, who did much work in Alaska and died there in 1866. The spelling became changed as a result of a clerical error.

It was early recognized that the Alaska mine, while fabulously rich, would have a limited life. This was an important reason why Kennecott's founders brought together the Alaska operation and those of the long-lived, low-grade mines in the West and Chile. The Alaska mine began producing in 1911 and was finally closed down in 1938, by which time all ore of commercial value had been taken out. But it was the earnings from this low-cost, high-profit operation that enabled Kennecott to come into being and to develop into the world's leading copper producer.

Today the four western mines are still flourishing and the Braden mine, the largest underground copper mine in the world, after 50 years of operation is producing more copper than ever.

In 1929 Kennecott entered the fabricating business by acquiring what is now the Chase Brass & Copper Company, a fabricator of copper and brass products, including rod,

tube, shapes, and flat rolled products. In 1935 Kennecott acquired a manufacturer of electric and communication wire and cable, and this business was expanded by the acquisition in 1958 of The Okonite Company, a manufacturer of power, communication and control cable.

The predecessor companies of Kennecott were pioneers in the development of low-grade copper deposits. Large amounts of capital were required for mine development, and railroad and mill construction. Custom smelters and refineries were already in operation, and it was unnecessary and generally uneconomical for Kennecott's predecessors to provide their own smelters and refineries. But with the passing of time this situation was altered by (1) the increase in Kennecott's smelting and refining requirements, (2) the benefit of eliminating smelting and refining fees, and (3) the advantage of operational control over the entire sequence of copper production. Consequently, in the period 1950-1960 Kennecott completed the construction or acquisition of necessary smelters and refineries, and today the company is doing all of its own smelting and most of its own refining. By the end of 1965 all refining will be done at Kennecott's own refineries.

Kennecott's venture in Alaska — 1909.

The colossus of American open pits — Kennecott's copper mine in Utah today. Kennecott has similar pits in New Mexico, Arizona and Nevada.

The heart of modern open pit mining — a power shovel which takes 14 tons of ore at a bite.

Kennecott Today

MINING

Kennecott's mines, in addition to producing more copper than those of any other company, move greater amounts of material. In 1960 at Kennecott's open pits and underground mine a total of 168,000,000 tons of ore and waste rock were moved. This is one-third of the tonnage excavated in digging the Panama Canal.

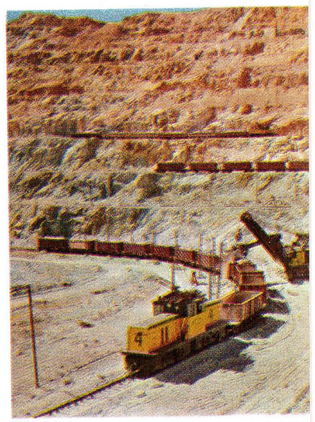
If the Empire State Building, the world's tallest structure, 1472 feet in height, were placed in Kennecott's biggest open pit, it would not top the highest level, which is 2200 feet above the lowest level of the mine; this vast bowl is more than 2 miles across and contains more than 150 miles of railroad track. All of Manhattan from the Battery to Wall Street could fit snugly into this man-made hole.

Open Pit Mining

Today Kennecott's copper mines include four large open pits in the western United States and one underground mine in Chile. The open pit mines are located near Salt Lake City, Utah; Santa Rita, New Mexico; Ray, Arizona; and Ely, Nevada.

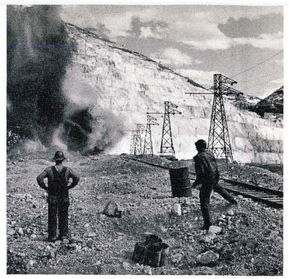
Essentially, mining methods are similar in all open pits. The mineable material usually consists of vast masses of low-grade ore containing about 0.8 per cent copper. Often the ore zones are overlain or flanked by waste rock with little or no metal content. Consequently, the mining of the economic material becomes a dual operation involving both the disposal of waste rock and recovery of the copper ore beneath or adjacent to it. The pits are dug in the form of amphitheaters with various levels, or steps, cut in the sides. The tops of these steps, or "benches," are the working places for

90 tons of ore are loaded into a railroad car in 4 minutes.



A 50-ton ore truck at the Ray division.

Power drills prepare the ground for blasting.



Explosives loosen the ore ready for loading.

the huge electric shovels that eat into the walls of the pit from which the ore and waste rock are first loosened by blasting. These same bench tops serve as haulageways for the transportation of both ore and waste. The ore is delivered to the crusher and mill by electric train or diesel truck, and the waste is transported to the waste dumps by the same means.

When pits reach depths that are excessive for ore haulage by rail or truck, skip or incline hoists are sometimes employed to bring material to the top of the pit.

Underground Mining

This method is more costly than open pit mining and a higher grade of ore is usually necessary in order to make it profitable. Kennecott's only underground operation is located 50 miles southeast of Santiago, Chile, where our subsidiary, the Braden Copper Company, operates the El Teniente (The Lieutenant) mine, one of the world's great copper deposits which, according to legend, was named after a fugitive Spanish army lieutenant who was supposed to have discovered it.

Here the ore, which has a copper content of approximately 2 per cent, is "caved" and drops downward through inter-connected ore passes within the mountain to control chutes and then into ore cars waiting below for hauling to the mill.

PROCESSING

All five of Kennecott's copper mines have concentrating plants (mills) located as close as practicable to the mines.

Most of Kennecott's ores are composed of copper sulphides, and the method of concentrating, described herein, is similar at the different plants, the exception being at the Ray division where the ore is specially treated to increase recovery.

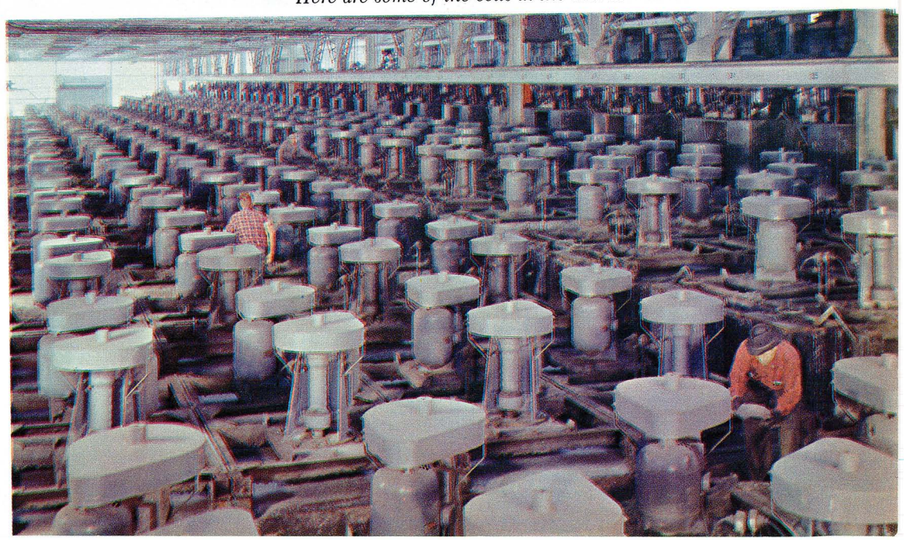
Irrespective of the method of concentrating, the purpose in all cases is the separation of the copper minerals from the waste material (concentrating), the extraction of the copper from these minerals (smelting), and finally the purification of the metal (refining).

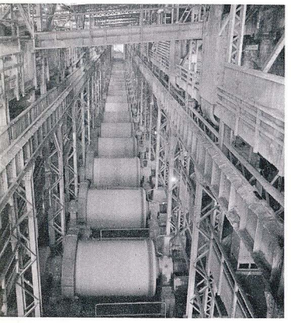
Concentrating

The large chunks of ore from the mine are first crushed into small pieces of less than 1 inch in diameter. These are then ground in the concentrating mill to pieces small enough to pass through a screen with 64 openings per square inch. Further grinding is necessary to reduce the ore to the tiny size of the copper-bearing particles. To do this, water is added and the particles in the resulting "slurry" are ground so fine that they would pass through a screen with 10,000 openings per square inch.

This pulverized ore now goes through the flotation section of the mill where chemical reagents are first added to the slurry. One chemical creates bubbles in the mixture, another coats the mineral particles and causes them to adhere to the bubbles. The bubbles, carrying particles of mineral with

The recovery of the desired mineral particles from thousands of tons of ore a day requires hundreds of flotation cells. Here are some of the cells in the mill at Utah.





Copper ore is ground in ball mills prior to flotation.

some waste still attached, rise to the top of the flotation cells and overflow as copper concentrate containing from 15 to 35 per cent copper. The material not floating to the top of the cells is called "tailings" and is usually disposed of as a waste product. To prepare the concentrate for smelting, most of the water must be removed, and this is done in thickening tanks and by filtration.

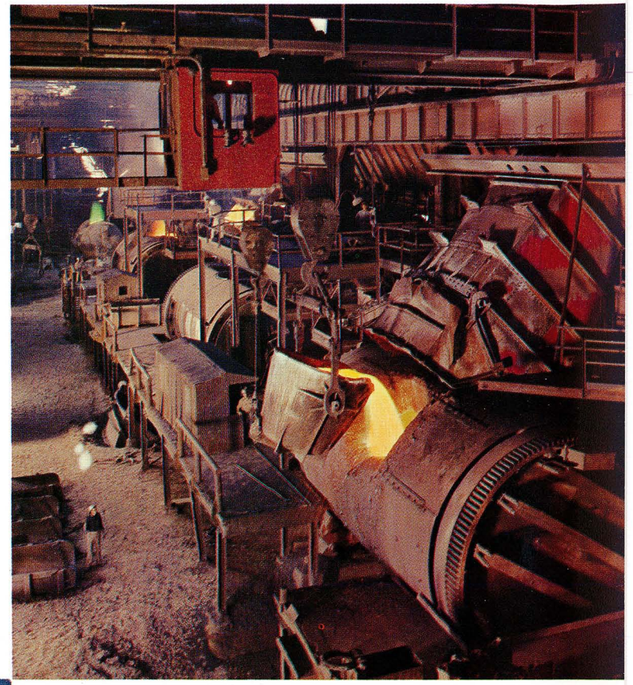
The ore at the Ray division is more complex and less susceptible to flotation. Here, after the ore is pulverized, it is concentrated by the "leach-precipitate-float" process, in which copper present in the form of oxides as well as sulphides is recovered.

In addition to the ore that is put through the mill, there are millions of tons of waste rock sent to the dumps which contain copper, but in too small amounts to justify milling. A portion of this copper is recovered by pumping a water solution to the top of the dumps and allowing it to percolate downward through the mass. In this process the copper contained in the material in the form of soluble oxides is dissolved and, subsequently, separated from the solution by precipitation.

Smelting

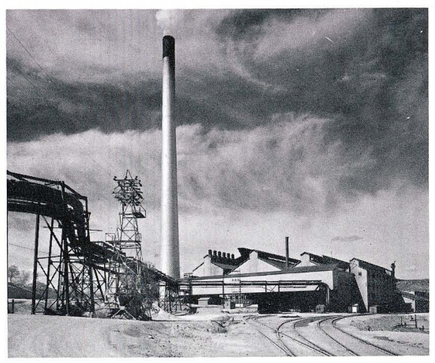
At all five of Kennecott's smelters, fluxing materials (lime and silica) are added to the concentrate and the resulting mixture is charged into reverberatory furnaces. Here at a temperature of 2700°F. chemical reactions induced by the fluxes occur in the melted mass and a fluid waste material, termed "slag," forms and rises to the top. This is periodically drawn off and discarded. The heavier iron and copper sulphides settle to the bottom in an impure mixture called "matte."

The molten matte is taken in huge ladles and charged into the converter, where silica is again added and air is blown through the hot liquid mass. The air burns off the remaining sulphur in the form of sulphur dioxide and oxidizes the iron. Silica is added to make the iron fluid so that it can be removed as a slag. Ultimately nothing remains but molten copper, about 98 per cent pure (plus other recoverable metals); the copper is then either conveyed to the refining furnace



Impurities in the molten copper are removed in the converters.

The copper contained in the waste material in the mine dumps is recovered by precipitation.



The 500-foot high smelter stacks are landmarks in the western copper states.

or cast into cakes called "blister copper," for subsequent refining.

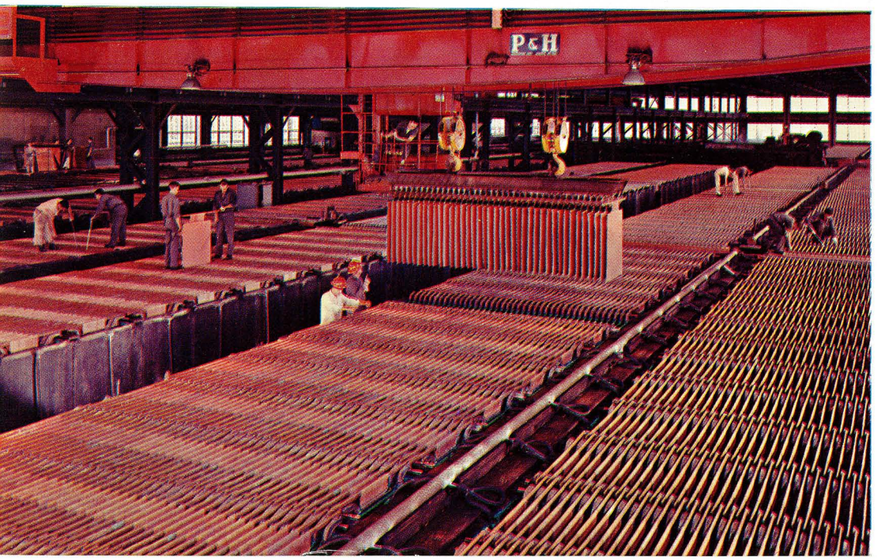
Refining

Blister copper usually contains some harmful impurities and refining is necessary in order to eliminate such impurities and to improve the physical properties and recover associated valuable metals when present in economic quantities. The process starts in the fire refining furnace, where compressed air is forced through the molten blister. This oxidizes the impurities and they are eliminated either as gases or as slag. In the process a certain amount of copper is oxidized, and this must be de-oxidized before the metal is ready to use.

Fire refined copper is quite pure and meets the requirements for many fabricating operations. However, when the copper is to be used for electric conductors and/or when precious metals are present in sufficient quantities to make their recovery desirable, it is necessary to refine it further by electrolysis.

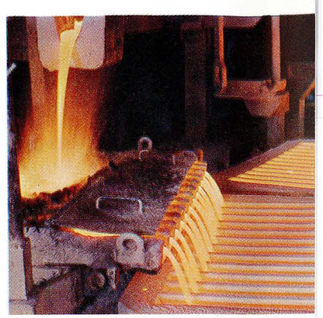
At the electrolytic refinery copper enters in the form of cast shapes, called "anodes," which are about 2 inches thick, and 36 by 40 inches in area. These are hung in lead-lined tanks, through which a solution of copper sulphate and sulphuric acid is circulated. Alternating with the anodes are

Refined copper plates being taken from tank at one of Kennecott's refineries.



cathode "starting sheets" of pure copper. Under the action of an electric current passed through the solution, the anode is decomposed and the copper therefrom is deposited on the starting sheets, i.e., "cathodes," the impurities either going into the solution or dropping to the bottom of the tank in the form of mud. Such impurities may consist of gold, silver, platinum and selenium. These are separated one from the other and recovered. The cathodes gradually increase in size as the anodes dissolve. About 14 days are required to produce a cathode of commercial size. The cathodes are removed from the tanks and sent to an electric furnace where they are melted and cast into shapes for shipment. The copper thus produced contains less than 0.1 per cent of impurities and is ideal for use by the electrical and communications industries.

Kennecott has electrolytic refineries in Utah and Maryland which produce all but a small part of the company's requirements of electrolytic copper.



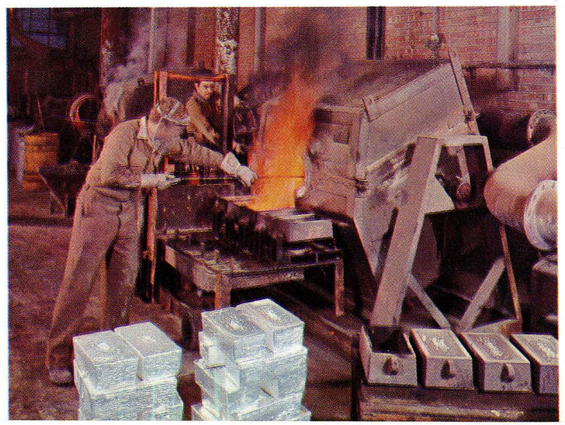
Refined copper being cast into shapes suitable for use in the fabricating plants.

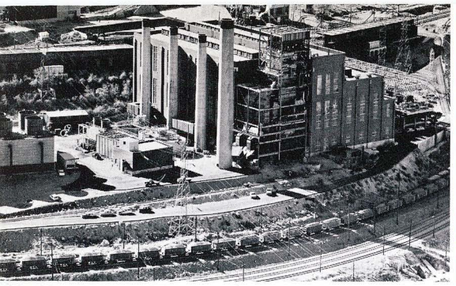
By-Products

Valuable by-products are produced in the course of Kennecott's processing operations. Molybdenum, an important ingredient in making ferroalloys, is contained in our ores and is recovered as the mineral molybdenite in our concentrating mills. The sulphur dioxide generated in the smelting process is converted to sulphuric acid and either used in our operations or sold.

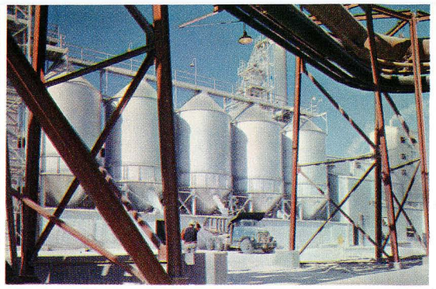
Gold, silver, platinum and palladium, along with selenium and tellurium, are recovered from the mud of the refining

Casting silver bars for shipment to the market. Silver is an important by-product of the Utah refinery.





Electric power plant at one of Kennecott's mines. Power is a major item in copper production.



Lime plant at New Mexico division. Lime is required in the flotation process.

tanks. While present in Kennecott's ores only in small quantities, the huge tonnages of ore handled mean that significant amounts of these elements are recovered. For example, Kennecott's by-product production of gold makes the company the second largest U. S. gold producer, and its recovery of silver makes it one of the leading producers of that metal.

Auxiliary Facilities

Because of the size of Kennecott's operations, large auxiliary facilities are required. Railroads and rolling stock are used for ore haulage. Water plants must be available to satisfy mill, smelter and refinery requirements. Lime plants are needed to provide lime for flotation. Large electric power plants are needed – the plant at our Utah division has a capacity of 175,000 kilowatts, enough power to meet the residential requirements of a city of 87,500 typical homes. Each division requires machine shops capable of repairing almost every type of equipment from the smallest motor to the biggest electric locomotive.

FABRICATING

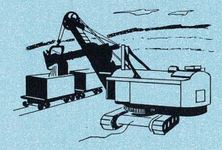
The principal forms in which copper and its alloys are used are sheet and strip, shapes, tube, rod and wire. The chief alloys of copper are brass, composed of copper and zinc, and bronze, a combination of copper and tin.

Copper, brass and bronze products, except wire and cable, are made in brass mills. Wire and cable is manufactured in wire and cable plants. About 75 per cent of Kennecott's copper is sold to independent brass and wire companies, and about 25 per cent is used by Kennecott's fabricating subsidiaries, Chase Brass & Copper Co. and The Okonite Company.

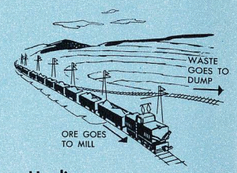
BASIC STEPS—COPPER ORE TO FINISHED PRODUCT

MINING

Blasting
The ore, containing approximately 0.8 per cent copper, is broken by blasting.

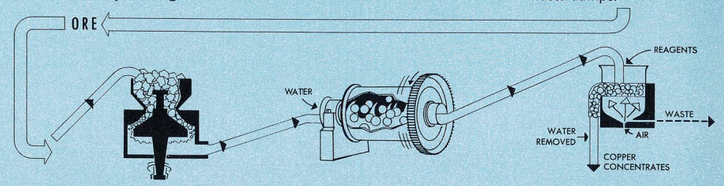


Loading
It is loaded into ore cars or trucks by electric shovels.



Hauling
The ore is hauled to the mill, and the waste material to the waste dumps.

MILLING

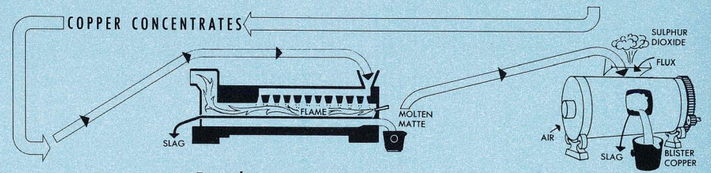


Crushing
The ore is crushed to pieces the size of walnuts.

Grinding
It is then ground to a powder.

Concentrating
The mineral-bearing particles in the powdered ore are concentrated.

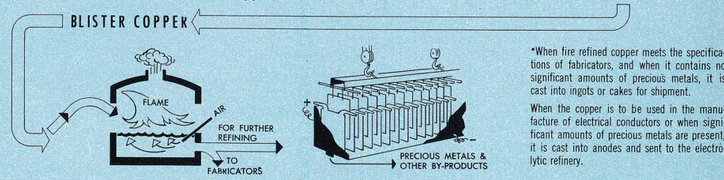
SMELTING



Reverberatory Furnace
The concentrate (15-30 per cent copper) is smelted, forming "copper matte" (25-45 per cent copper).

Converter
The matte is converted into blister copper with a purity of about 98 per cent.

REFINING



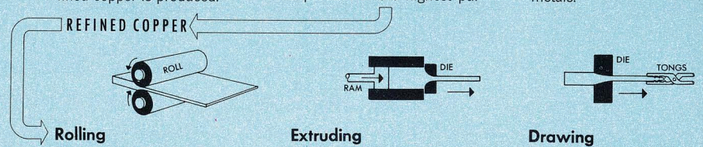
Refining Furnace
Blister copper is treated in a refining furnace and fire refined copper is produced.*

Electrolytic Refining
Fire refined copper is further refined electrolytically when a product of the highest purity is required, or when it is desired to recover precious metals.

*When fire refined copper meets the specifications of fabricators, and when it contains no significant amounts of precious metals, it is cast into ingots or cakes for shipment.

When the copper is to be used in the manufacture of electrical conductors or when significant amounts of precious metals are present, it is cast into anodes and sent to the electrolytic refinery.

FABRICATING



Rolling

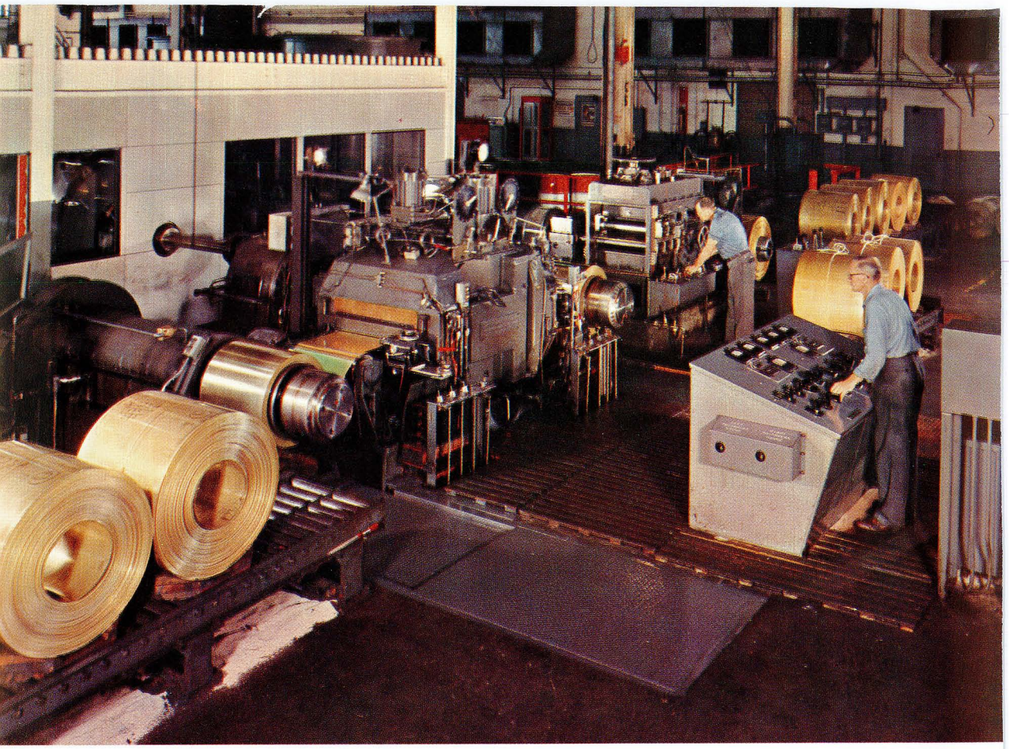
Extruding

Drawing

Copper and its alloys, brass and bronze, are fabricated into sheet and strip, shapes, tube, rod and wire.

Sheet and strip, shapes, tube, rod and wire, are further fabricated into the articles seen in everyday use.

Kennecott Copper Corporation



The glow of finished products — fabricated copper and brass ready for shipment.

Brass Mill Products

Chase has three main plants, including (1) the mile-long Metal Works plant at Waterbury, Connecticut, where sheet, rod, shapes and tube are fabricated, (2) the Babbitt Road plant at Cleveland, where rod and tube are produced, and (3) the Upson Road plant, also at Cleveland, which produces the flat rolled products, sheet and strip.

Copper is received from refineries in forms suitable for immediate fabrication. Copper alloys, however, must be compounded by melting their respective components in the desired proportions in electric furnaces, and casting into shapes before fabrication can take place.

Copper and brass sheet and strip are rolled from cakes. The cakes are cast in molds and are from 5 to 9 inches thick, 25 inches wide and up to 72 inches long. They are rolled on a

hot mill to a thickness of approximately ½ inch. This strip is then rolled on other mills to the desired thickness and sheared to the required dimensions.

Copper and copper alloy tube and pipe are produced, either by piercing or extrusion, from billets which vary in length to 52 inches and in diameter from 3 to 11 inches, depending upon the final tube size desired. Under the former process, the heated billet is pierced by rotating between rolls and over a piercing mandrel with sufficient force to induce the plastic metal to flow over the mandrel and form a shell; after cooling the shell is pulled through successive dies and over mandrels to reduce it in diameter and wall thickness to the required size. Under the extrusion process, by which shapes also are produced, the heated billet is forced under great pressure to flow through a hole in a die of the required size and contour.

In order to make quick deliveries to Chase's more than 40,000 customers, the company maintains a nationwide system of 26 strategically located warehouses, each of which carries a full line of brass mill products. In addition, the warehouses stock stainless steel and aluminum, thus rounding out a multi-metal Chase sales and service program.

Wire and Cable Products

Because copper is the best commercial conductor of electricity, the electrical and communication industries account for about one-half of the U. S. consumption, chiefly in the form of wire and cable.

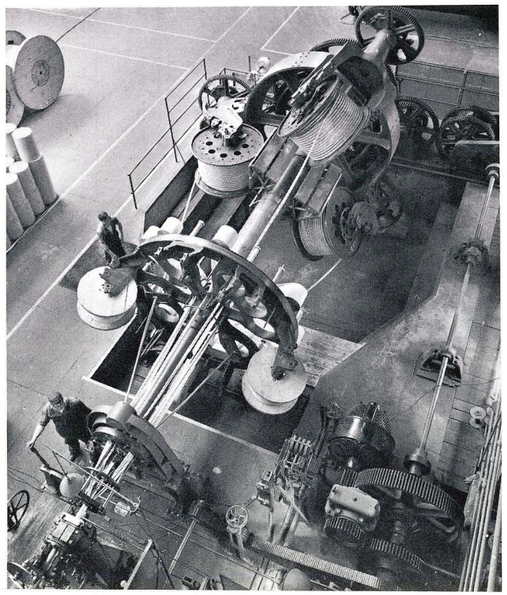
Kennecott's subsidiary wire and cable company, The Okonite Company, operates plants at Passaic, Paterson and North Brunswick, New Jersey and Phillipsdale, Rhode Island. It manufactures wire and cable for electric power transmission, control and signal systems, and electronic and communication circuits.

Copper wire is produced from wire bars approximately 4 inches square, 54 inches long and weighing from 250 to 275 pounds. The bar is heated and rolled on a rod mill into rods from ¼ to ½ inch thick. The rods are then drawn through dies to the required sizes, sometimes to filaments no thicker

than a human hair. More often, a number of wires are twisted together to form a large flexible conductor (cable). The size of the conductor varies according to the amount of current it must carry. One cable circuit recently built by Okonite is capable of carrying the full electric power needs of a city the size of Washington, D. C.

An important activity of Okonite is the development and application of various electrical insulations and protective coverings that enclose the copper conductors. These insulations may be rubber, plastic, paper, glass or other materials that will withstand electrical pressures, in some cases as high as 345,000 volts. Coverings such as lead, steel wire or tape, fibrous materials, or tough rubber or plastic jackets are designed to protect the basic insulation from exposure to the elements and other environmental hazards such as oils, chemicals, moisture, heat and mechanical damage.

From threadlike magnet wire for tiny coils to underground power cables nearly 6 inches in diameter, Okonite products have been used by power and telephone utilities, railroads, and in mining and industry since 1878, a year before the birth of the electric light. Okonite wire and cable is distributed from warehousing facilities in the principal industrial centers of the United States.



Cables like this make it possible to transmit large blocks of high voltage electric power under ground or under water.

A helicopter brings supplies and equipment to an exploration party in the Cascade Mountains.

EXPLORATION

For every ton of ore mined from a Kennecott deposit, another ton must be found if the company is to maintain its position in the mining industry. For this reason exploration for mineral deposits is an integral part of Kennecott's operations. The function embraces two tasks — first the search for new deposits and, second, the search for extensions of ore zones at existing properties.

Trained geologists, aided by the latest equipment and exploration techniques are working in Canada, Latin America and various parts of the United States. Each of the company's mines has attached to it one or two men specially trained in mineral deposit work.

Today the use of airborne equipment is routine in exploration operations, especially in regions of rough topography, marsh, or forest where roads are lacking. Helicopters are especially effective because they require little landing space and can enter narrow valleys that are difficult for fixed-wing aircraft. Thus, the helicopter today has replaced the horse or mule for hauling supplies and men. Also, airborne equipment is used in geophysical surveys; special electronic devices, incorporated in the aircraft, may record valuable clues to a hidden mineralized area.

Despite the assistance of the newest electronic devices, however, the ultimate proof of the existence of an ore body still rests upon exploration from the ground through diamond

drilling, tunneling or shaft sinking. Thus, Kennecott's geologic investigations to detect hidden ore deposits are made both from the air and from the ground.

RESEARCH

Kennecott maintains a continuous program of research for the purpose of (1) increasing the recovery of copper and by-product metals, (2) reducing production costs, (3) developing new products, and (4) improving the quality of existing ones. The company's research activities are carried on at the Western Research Center in Salt Lake City, the laboratories of Chase Brass & Copper Co. in Waterbury, and the laboratories of The Okonite Company in Passaic and Paterson, New Jersey.

The Western Research Center, located adjacent to the campus of the University of Utah, is staffed by scientists, engineers and technicians, whose efforts are primarily directed toward the improvement of the company's mining, milling, smelting and refining operations. Its laboratories contain the most modern research facilities, as well as pilot plants.

Some of the Center's more important achievements include the successful application of the leach-precipitate-float process to the refractory ores of the Ray division, the recovery of the rare and precious metal rhenium as a by-product of copper production, the development of an electrolyte purification system for the Utah Refinery, and the successful application of new reclamation techniques for the re-use of water at the various concentrating mills.

The laboratories at Chase and Okonite are concerned with the improvement in quality of fabricated products, the development of new ones, and new uses for existing products. Research accomplishments at Chase include several new alloys, improved protective coatings for copper and brass, the continuous casting of copper, improved methods of joining copper, and methods of processing the newer metals columbium and titanium.

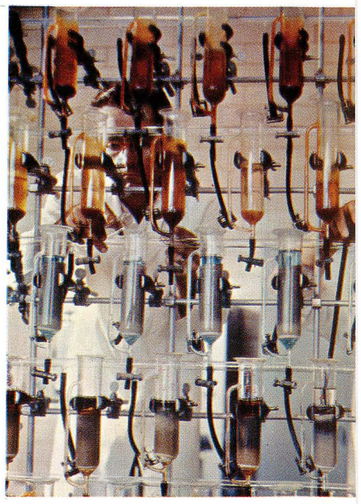
Product research at The Okonite Company has resulted

in an improved high voltage underground cable. Extensive research has been conducted on cross-linked polyethylene which should result in a major improvement in electric cable insulation. It is expected that current research on a non-destructive method of testing cable will make it possible to insure the quality of all cable shipped.

The purpose of the above described research in the development of processes and products, is to find commercially profitable applications which will result in financial benefits to the company in the near future. This is known as APPLIED RESEARCH. In addition to this type, Kennecott is entering the field of BASIC RESEARCH, with primary emphasis on the solid state physics of metals. This kind of research has for its objectives the acquisition of fundamental knowledge and the discovery of new scientific facts. It is essentially long range in nature but has tremendous potential rewards.

Kennecott's Western Research Center houses the latest and most modern scientific equipment.

Scientists engaged in the never-ending task of improving copper recovery.



OTHER INTERESTS

Quebec Iron and Titanium Corporation

This two-thirds owned Kennecott subsidiary operates an open pit iron-titanium mine near Allard Lake in northeastern Quebec, and an eight-furnace electric ore-treatment plant at Sorel, near Montreal. The ore deposit is the largest known of its kind in the world and the ore is rich in metal content, consisting of 40 per cent iron and 36 per cent titanium dioxide.

The products of the treatment plant at Sorel are iron and titanium slag. The iron, known in the trade as "Sorelmetal," contains very small amounts of phosphorus and silicon, and virtually no manganese. This fact makes it particularly suitable for use by foundries and in the manufacture of ductile iron.

The titanium slag is sold mainly to the pigment industry for use in the manufacture of titanium dioxide for the paint, textile, white rubber, paper, ceramic and other industries. It can also be used in the manufacture of titanium metal.

In 1960 approximately 345,000 tons of slag and 222,000 tons of iron were produced.

Tin and Associated Minerals Ltd.

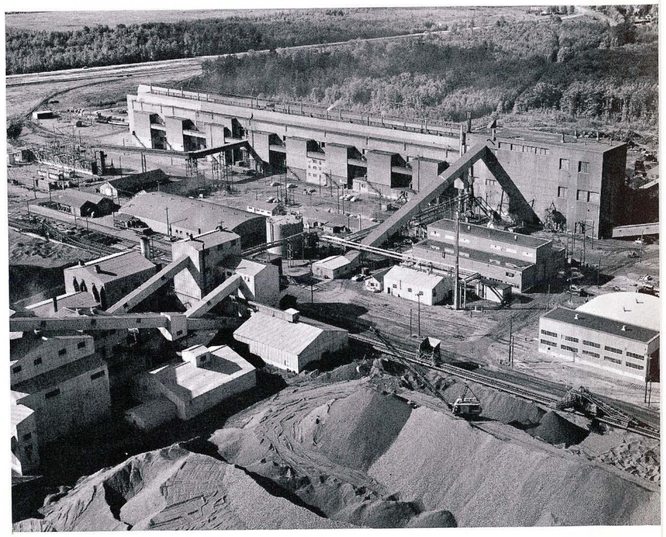
This three-fourths owned subsidiary of Kennecott operates a columbium mine and concentrating plant at Odegi on the Northern Plateau of Nigeria. The deposit consists of a combination of minerals containing columbium, tin, zirconium and hafnium.

Columbium, in the form of ferrocolumbium, is used to improve the physical properties and weldability of certain stainless steels, and of carbon and low-alloy steels. It is used in high temperature applications as a metal, in the form of columbium-base alloys, or as a minor ingredient in ferrous- or nonferrous-base metals.

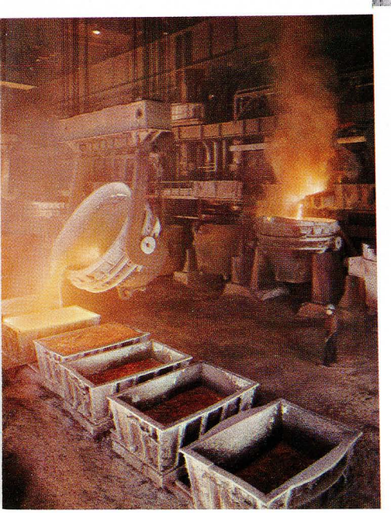
Columbium, zirconium and hafnium are used in the construction of nuclear reactors.

Garfield Chemical and Manufacturing Corporation

This 50 per cent owned subsidiary makes sulphuric acid from the waste sulphur dioxide gas of Kennecott's Utah smelter. The capacity of the plant is about 1000 tons of acid per day which is sold to industry, particularly for use in the manufacture of phosphate fertilizers. An important customer is Western Phosphates, Inc., in which Kennecott holds a one-fourth interest.



Plant of Quebec Iron and Titanium Corporation. Here ilmenite ore is converted into iron for the steel industry and titanium slag for use in the production of titanium pigments or titanium metal.

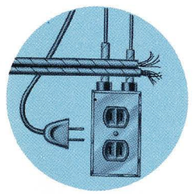


Pouring titanium slag — the furnace floor of Q. I. T.

Why and Where Copper Is Used

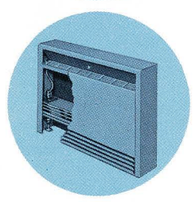
PROPERTIES

Copper pipe that carried water to the Egyptian pyramids 5400 years ago is still in good condition today, so little has time affected this enduring metal. Copper has a combination of properties which makes it indispensable in industry and in the home. Its principal properties are as follows:



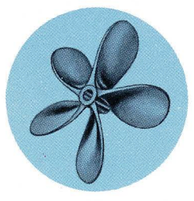
Electrical Conductivity

Since the discovery of electricity, copper has been the preferred conductor, and the international standards of electrical conductivity are based on the properties of the metal.



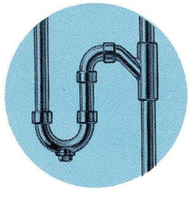
Thermal Conductivity

Copper conducts heat better than any other metal except silver, hence its use for automobile radiators, hot water heaters, and in other places where heat conductivity is important.



Durability

Copper and its alloys, brass and bronze, are resistant to corrosion and virtually indestructible under normal conditions. These qualities are another reason for copper's use in automobile radiators. The use of brass and bronze for ships' propellers and other applications indicates the metals' ability to withstand the corrosive action of salt water.

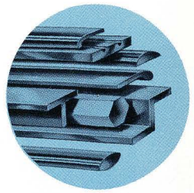


Workability

Copper lends itself to both cold and hot working, including stamping, swaging, spinning, shearing, forming, bending, drawing and forging. It is readily joined by soldering, brazing and welding.

Versatility

The most versatile of metals, copper has countless uses, from roofs and curtain walls of houses and buildings to electro-deposited micro-circuits for electronic applications. It has been used for the nose cones as well as the vital guidance relays of space rockets.



Beauty

Copper and its alloys are the only commercial metals that have natural, warm, glowing colors. The beauty of copper, together with its strength and durability, make it ideal for statues, doorknobs, lamps, pots and pans, fireplace accessories and jewelry.

USES

Copper and its alloys are unique in their desirable physical properties. Sometimes a single property makes the use preferable, at other times it is a combination of properties. The result is that copper is used in literally thousands of articles.

Because it is the best conductor of electricity other than silver, copper is used in electrical equipment, including generators, motors and transformers, and in communication equipment, including telephone instruments, wire and cable. Again because of its electrical conductivity, it is used in household appliances, including electric ranges, air conditioners, fans, toasters and irons. As previously mentioned, about half of all copper used is for electrical purposes.

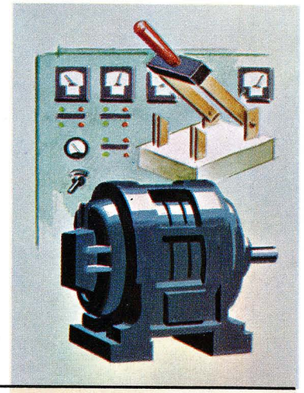
Copper is the favored metal for automobile radiators because of its thermal conductivity and corrosion resistance. Copper and its alloys are used in building construction for curtain walls, electric wiring, plumbing and roofing because of its combination of properties.

The beauty of copper and its alloys makes it in demand for decorative purposes, including lamps, clocks, fireplace ornaments and cosmetic accessories. It should be noted that "solid" 14 carat gold is an alloy of 58 per cent gold and 42 per cent copper.

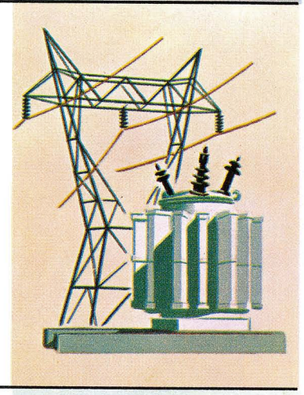
On the following pages some of the many uses of copper and its alloys are listed.

Where Copper is Used

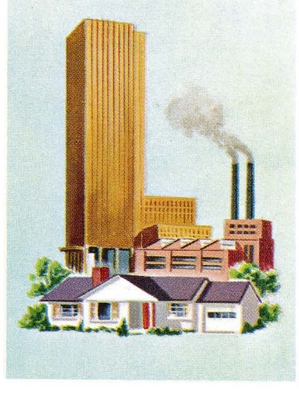
ELECTRICAL EQUIPMENT (19%)
BUS BARS
CIRCUIT BREAKERS
CONDUIT
CONNECTORS
ELECTROMAGNETS
GENERATORS, TURBINES
LAMP BASES, SOCKETS
MOTORS
RELAYS
SWITCHGEAR
WIRE



LIGHT AND POWER INDUSTRY (18%)
GENERATOR COMPONENTS
HEAT EXCHANGERS
TRANSFORMERS
TRANSMISSION LINES
WIRE AND CABLE

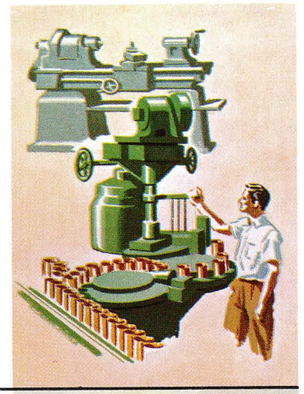


BUILDING CONSTRUCTION (16%)
ARCHITECTURAL TRIM
CURTAIN WALLS
DRAINAGE LINES
HARDWARE
HEAT PUMPS
HEATING LINES
PLUMBING LINES
RADIANT PANEL HEATING
ROOFS, FLASHING, GUTTERS AND DOWNSPOUTS
SCREENS
SNOW MELTING SYSTEMS
SOLAR HEATING
TERMITE SHIELDS
WEATHER STRIPPING
WIRING



INDUSTRIAL EQUIPMENT AND SUPPLIES (10%)

BOLTS, NUTS, SCREWS AND RIVETS
CONDENSER TUBES AND PLATES
CUTTING AND WELDING TORCHES
EXPANSION JOINTS
GAUGES
HEAT EXCHANGERS
METERS
NON-SPARKING TOOLS
PAINT
PAPER MAKING EQUIPMENT
PIPE, FITTINGS, VALVES
PUMPS
SALT WATER CONVERSION STILLS
WELDING ROD
WIRE CLOTH

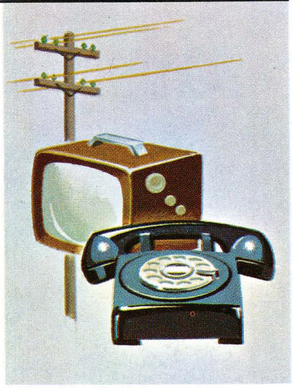


MOTOR VEHICLES (9%)

BODY PARTS AND TRIM
BRAKE COMPONENTS
ELECTRICAL SYSTEMS
ENGINE PARTS
GAS TANKS AND FEED LINES
HEATERS
IGNITION PARTS
KEYS AND LOCKS
PLATING ANODES
RADIATORS AND TANKS
RADIOS AND ANTENNAE
REAR AXLE COMPONENTS
STEERING GEAR COMPONENTS
TIRE VALVES
TRANSMISSION COMPONENTS

COMMUNICATION (6%)

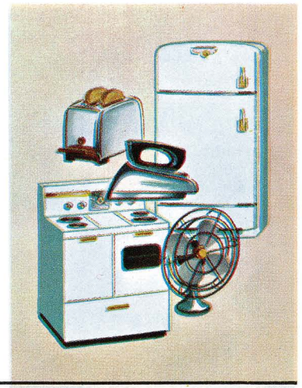
COPPER SHIELDING FOR RADIO FREQUENCY INTERFERENCE
OCEAN CABLE
PRINTED CIRCUITS
RADIO RECEIVERS AND TRANSMITTERS
TELEGRAPH INSTRUMENTS AND RELAYS
TELEPHONES AND CENTRAL STATION EQUIPMENT
TELEVISION RECEIVERS AND TRANSMITTERS
WIRE AND CABLE



Where Copper is Used (cont'd)

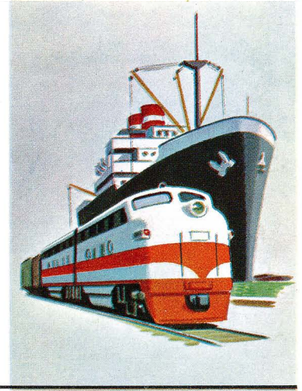
HOUSEHOLD APPLIANCES (3%)

AIR CONDITIONERS
CLOTHES WASHERS AND DRYERS
COFFEE MAKERS
DISHWASHERS
ELECTRIC BLANKETS
ELECTRIC CLOCKS
ELECTRIC RANGES
FANS AND HEATERS
HOT WATER HEATERS AND STORAGE TANKS
IRONS
LAMPS AND LIGHTING FIXTURES
MIXERS AND BROILERS
REFRIGERATORS AND FREEZERS
THERMOMETERS AND THERMOSTATS
TOASTERS AND WAFFLE IRONS
VACUUM CLEANERS



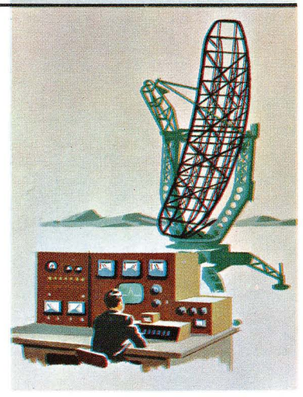
RAILROAD AND MARINE (3%)

BOAT HARDWARE
JOURNAL BEARINGS
LOCOMOTIVE PARTS
NAVIGATION INSTRUMENTS
PASSENGER CAR INTERIORS
PIPING
SHIP PROPELLERS AND SHAFTING
SIGNAL CONTROLS
WATER AND AIR LINES



ELECTRONICS (3%)

AUTOMATIC CONTROLS
COMPUTERS
(ELECTRIC BRAINS) ELECTRONIC COMPUTERS
ELECTRIC ORGANS
RADAR KLYSTRONS
RECORD PLAYERS
RECORDING EQUIPMENT

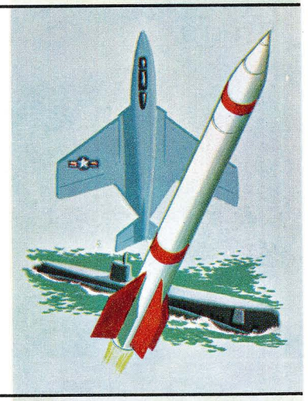


SCIENTIFIC EQUIPMENT (2%)

ATOMIC ENERGY ACCELERATORS
BAROMETERS AND THERMOMETERS
COPPER CHAFF
MICROSCOPES AND OPTICAL INSTRUMENTS
MONOCHROMATORS
RADIO TELESCOPES
REACTOR COMPONENTS
STELLARATORS
TELESCOPES

MILITARY (6%)

AIRCRAFT INSTRUMENTS
AUTOMATIC PILOTS
BOMB SIGHTS
ENGINE PARTS
FIRE CONTROL INSTRUMENTS
FUZES
INSIGNIA
MINIATURE GYROS
MISSILE NOSE CONES
MISSILE WIRING
ORDNANCE



MISCELLANEOUS (5%)

BREWING & DISTILLING EQUIPMENT
CAMERA COMPONENTS
CASKETS
CHIMES AND BELLS
CLOCKS AND WATCHES
COINS
ELECTROTYPES AND PHOTOENGRAVINGS
FIRE EXTINGUISHERS
FIREPLACE EQUIPMENT
FLAT AND HOLLOW PLATED WARE
FOOD PROCESSING EQUIPMENT
HARDENING GOLD
HOSPITAL AND DENTAL EQUIPMENT
JEWELRY
LINOTYPE MACHINES
MUSICAL INSTRUMENTS
SAFES AND VAULTS
SPORTING AMMUNITION
STATUES AND PLAQUES
VANITY CASES AND COSMETIC ACCESSORIES
ZIPPERS AND FASTENERS

KENNECOTT COPPER CORPORATION

Additional copies of this booklet may be obtained by writing to the Public Relations Department of Kennecott Copper Corporation, 161 East 42nd Street, New York 17, N. Y.

Kennecott

First Quarter Report

Report for the First Quarter Ending March 31, 1979

1979

Financial Analysts Tour Utah Copper Facility

Geologist A. Jaren Swensen briefs analysts at the Bingham Canyon mine site.

For four days in February, 70 security analysts toured Utah Copper Division's mine, concentrators, smelter and refinery and spent 13 hours being briefed by corporate and division executives, plant managers and others in what was probably the most comprehensive review of Kennecott ever put together in a single program. The analysts represented banks,

continued on page 4

Board Votes to Keep Carborundum

Meeting on April 20, Kennecott Directors unanimously voted to accept the recommendation of the Special Committee of the Board that The Carborundum Company be retained.

The decision was reached after considering a report by the Special Committee appointed on December 15, 1978, to give full study to the question of Carborundum divestiture.

The Special Committee, which had the assistance of independent financial experts, was unanimous in its view that Carborundum be retained. However, the Special Committee also identified certain alternatives which might accommodate the differing objectives of Kennecott shareholders, and recommended that they be given further study.

Said Chairman Thomas D. Barrow: "These alternatives involve the possible divestiture of operations which do not precisely fit into Kennecott's business strategy, and other suggestions such as the possible restructuring of both the Corporation's debt and equity. If any of these alternatives

continued on page 4

First Quarter Earnings Are $21.2 Million, Up 300% Over Same Quarter of Last Year

Financial Statement on Page 13

Kennecott Copper Corporation's net income for the first quarter of 1979 amounted to $21.2 million, or 64 cents a share—a 300 percent increase over the $5.3 million, or 16 cents per share, earned in the first quarter of 1978. Despite the increased earnings, Kennecott's return on shareholder's equity amounted to only 6.1 percent on an annualized basis.

Income before taxes and minority interests amounted to $31.2 million in the initial quarter of 1979, an increase of $19.7 million over the $11.5 million earned in 1978. Included in the pretax profits for this year's quarter was a total of $13.1 million; $7.3 million from the sale of an undeveloped coal property and liquidation of LIFO (last in, first out) copper inventories of $5.8 million. During the 1978 first quarter, pretax profit included $16.5 million of income from the liquidation of a portion of inventories of unrefined gold and silver.

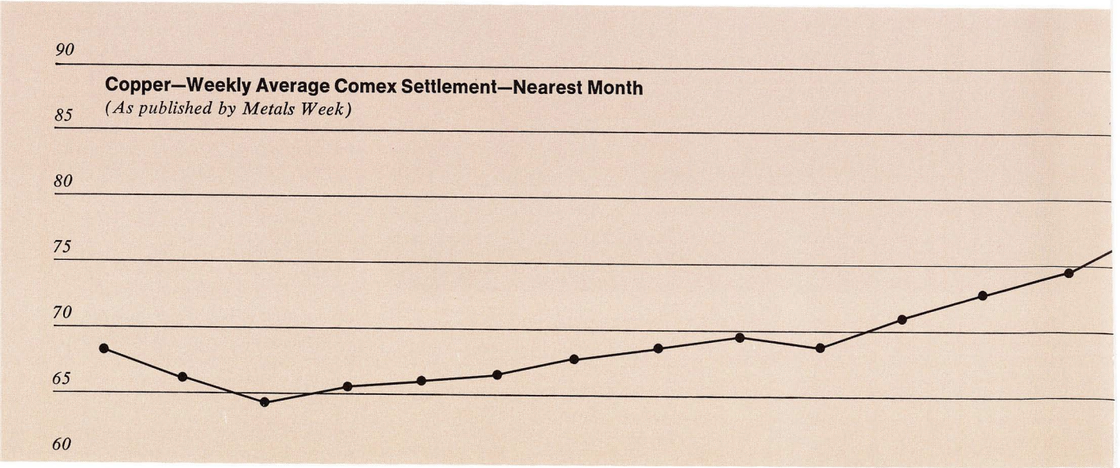
The effective tax rate for the 1979 quarter was 30.4 percent. In 1978, when certain operations incurred losses for which no tax credits could be recorded, the rate was 52.9 percent.

All divisions contributed to the increases in sales and income.

Kennecott Minerals Company, formerly the Metal Mining Division, reported significantly higher sales and income, despite lower sales of gold and silver than in the 1978 quarter. Copper production increased 13,220 tons to 98,647 tons, while sales were up by 17,817 tons to 110,211 tons. The average price received for copper was 28 percent higher than in the first quarter of 1978. Because of floods and unusually severe winter weather and less than full production at the new Utah smelter, production costs were higher than anticipated.

Molybdenum sales and prices increased importantly over last year, while sales of lead concentrates decreased because of a strike at Ozark Lead Company.

Both sales and operating income of The Carborundum Company subsidiary rose to record levels for any first quarter, with sales up 22 percent over the first quarter of

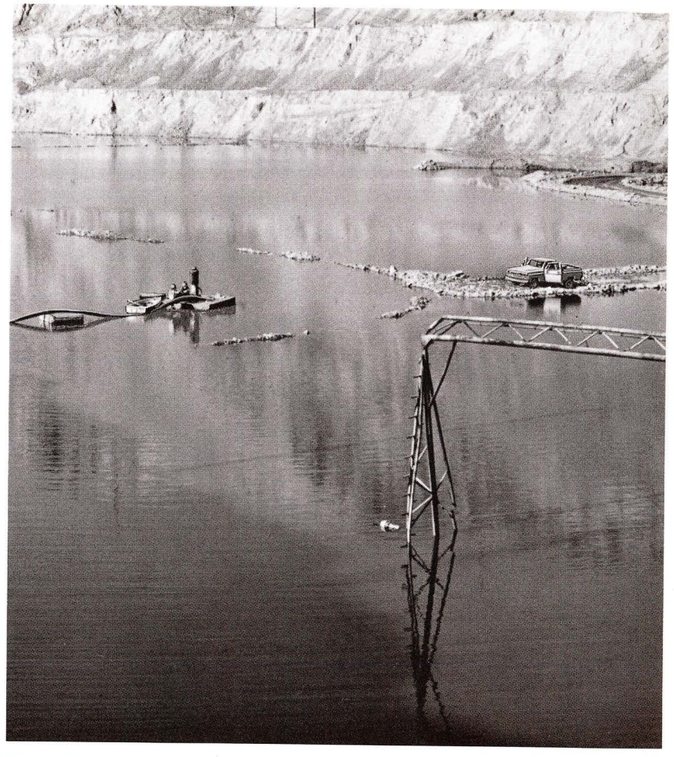


1978. The abrasives business was particularly strong in the U.S. and Canada, while all major product lines contributed to the sales increase. Carborundum's order rates continue to be high.

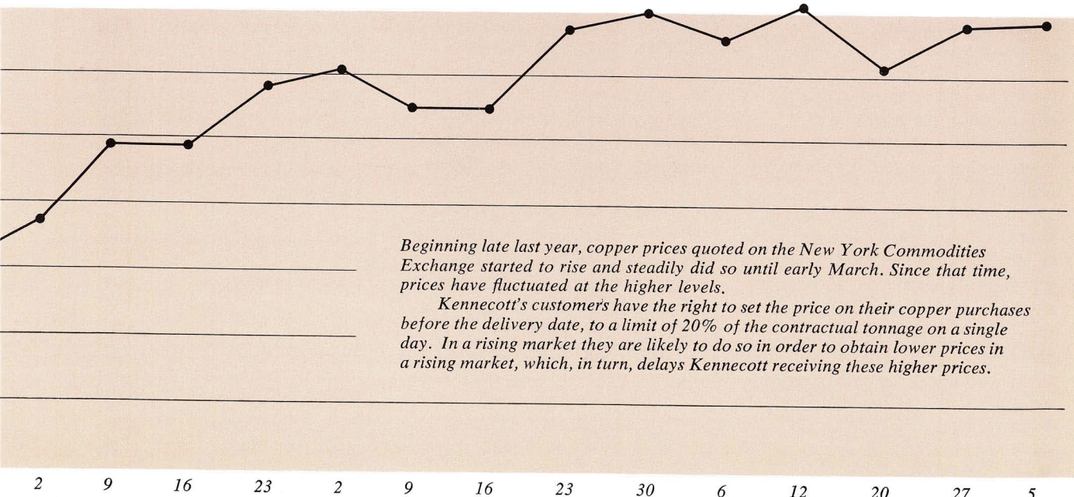
Chase Brass and Copper Co., Incorporated also reported substantial increases in sales and income for the first quarter, with Chase Metals Service Inc. recording particularly strong improvements of both sales volume and profits.

QIT-Fer et Titane Inc., a two-thirds owned Canadian subsidiary, had significant increases in both sales and operating income. An early opening of its shipping season on the St. Lawrence River allowed greatly increased sales above the normal first quarter, when a loss or break-even level is expected. Good demand for Sorelmetal, titanium slag, and iron powders is expected to continue.

Interest expense in the first quarter was $17 million compared to $13.8 million in the 1978 period, primarily because of higher interest rates. Dividend payments of $5 million or 15 cents a share were paid, the same as in 1978.



Winter floods in Arizona slowed production at Ray Mines Division, shown above.



Beginning late last year, copper prices quoted on the New York Commodities Exchange started to rise and steadily did so until early March. Since that time, prices have fluctuated at the higher levels.

Kennecott's customers have the right to set the price on their copper purchases before the delivery date, to a limit of 20% of the contractual tonnage on a single day. In a rising market they are likely to do so in order to obtain lower prices in a rising market, which, in turn, delays Kennecott receiving these higher prices.

Analysts inspect 150-ton ore truck, part of mining equipment display.

Analysts Visit Utah
continued from page 1

trusts, foundations, insurance companies, investment firms, pension funds, brokers and other institutions interested in Kennecott and its future.

Chairman Thomas D. Barrow told the group that a primary goal of Kennecott will be to achieve earnings of from $12 to $15 a share by the mid-80s and a 12 to 15 percent return on total assets. Barrow said he believes that one way Kennecott can achieve this goal is by making capital investments at its major western properties in order to become the lowest-cost copper producer in the U.S.

The greatest cost-reducing opportunity is at Chino, New Mexico, where a smelter, concentrator modernization, and transportation system changes could reduce the cost of copper produced by 20 to 30 cents a pound, making it the lowest cost mine in the country. Productivity could also be improved by modernizing Utah Copper's concentrators and initiating a program to recover copper from old tailings at the Nevada mine. All of these opportunities are being studied.

Barrow said the anticipated tight copper market over the next four to five years should permit Kennecott to generate sufficient cash flow to fund part of the improvements; the rest would be financed.

Reaction to the Utah visit was highly favorable. Among the comments were "one of the finest programs I have ever experienced," "an excellent learning experience... but, more important, an opportunity to explore the new Kennecott and its prospects," and "most helpful in assessing Kennecott's problems and opportunities."

Minerals Company Formed in Utah

The establishment of Kennecott Minerals Company, a new unit of Kennecott Copper Corporation, to engage in worldwide exploration, development, and marketing of mineral commodities, was announced April 20 by Thomas D. Barrow, Kennecott's chief executive officer.

The new unit is headquartered at Salt Lake City, Utah, and Glenn P. Bakken, an Executive Vice President of Kennecott, has been elected President of Kennecott Minerals.

Appointed to key positions in this newly-formed company are two Senior Vice Presidents of Kennecott Minerals. They are: G. Frank Joklik, formerly Vice President—Minerals Business Development of Kennecott; and Kenneth H. Matheson, formerly Vice President—Operations, of the Metal Mining Division. This Division has been superseded by Kennecott Minerals Company.

CBO Retained
continued from page 1

should, after further study, prove to be advisable, and be adopted by the Board, the result could be an enhancement of the value of Kennecott shares through increased yield or market appreciation."

Kennecott

Annual Meeting Report

1979

Remarks by Thomas D. Barrow Chairman of the Board

Fellow shareholders, I would like to welcome you to the 64th stockholder meeting of Kennecott Copper Corporation, and to my first meeting as Chairman of your company.

I have been chief executive of Kennecott for five months today—an eventful 151 days—during which I have been able to visit most of our major operations and facilities in the United States, to meet and talk with the many talented and dedicated people who work for Kennecott, and to appreciate the great resources, skills, and potential of your company.

I also am aware that many shareholders of Kennecott have some real concerns about the past, about recent events, about the earning and dividend-paying capacity of your company, and about the future—but principally about the future.

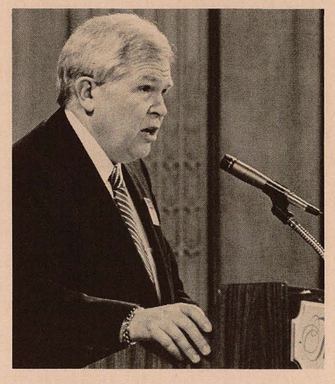
I have many of the same concerns—first, as your new chief executive officer, and second, as an individual stockholder with one of the largest investments in Kennecott shares.

Therefore, this morning I will concentrate on some of the concerns that Kennecott stockholders have expressed, and tell you what we have done, what we are doing, and what we plan to do.

Let's review, briefly, the recent earnings of Kennecott, the decision of the Board regarding Carborundum, our plans for the minerals business, the emerging emphasis for Kennecott's future, and expectations that we, as shareholders, may have.

Earnings, Sales Increase

Last week, Kennecott announced net income for the first quarter of $21.2 million, or 64 cents per share, a fourfold increase over the $5.3 million, or 16 cents a share, in the first quarter of last year. All divisions were profitable, and sales rose 34 percent to $574 million.



Chairman Thomas D. Barrow calls 64th Annual Meeting of Stockholders to order.

The average price received for copper was more than 25 percent higher than in the comparable 1978 quarter, and we sold 17,817 additional tons. Unfortunately, production costs increased more than anticipated, due principally to floods, heavy snow and cold weather, as well as less than full production at the new Utah smelter. Although published exchange prices have shown a larger increase, the purchasing techniques of copper users mean that actual prices received by Kennecott and other producers lag somewhat behind these published figures in a rising market.

Sales and prices for molybdenum increased, and production of lead was held down by a strike that continues at our Ozark mine. QIT-Fer et Titane Inc.—the new name for our Quebec company—reported significant increases in sales and operating income, Chase Brass & Copper had substantially higher sales and income, and Carborundum had record sales and operating income.

I am very pleased to report these positive results, and to say that we are confident that 1979 will be our best year since 1974. At the same

time, I must say that the earnings capacity of Kennecott can—and I assure you will—be improved. The sharp increase in the price of copper since I joined Kennecott—for which I refuse to take credit—is in large part responsible for these improved earnings. In turn, these increased earnings will help us to make the investments needed to greatly increase our profit-making capacity in the next decade.

In February, I expressed my personal objective for Kennecott: That is, to achieve by the mid-1980's a return on assets of between 12 to 15 percent, which would yield earnings of about $12 to $15 per share, compared to the 15 cents per share reported for 1978. Let me emphasize, this is not a forecast, but a personal management objective. To achieve it will require heavy investment of capital, hard work, some luck, and faith in the future of the company. I can assure you, I have that faith.

A second matter of concern—and interest—to stockholders is the status of our agreement with Curtiss-Wright that terminated the proxy fight and permitted us to concentrate our attention, time, and money on the future earning power of the company.

The restructured Board of Directors is, I am pleased to report, concentrating on the future of your company, and is working very well together.

Carborundum Will Be Retained

On April 20, the Board voted unanimously—and I stress unanimously—to accept a recommendation from the Special Committee to retain The Carborundum Company as an integral part of Kennecott. The Committee, aided by outside consultants, studied this question at length, and concluded that Carborundum—a fine company whose business has not been affected, as has the copper business, by severe market cycles—should continue as a significant source of earnings, with an exciting promise for the future.

At the same time, the Board received from the Committee suggestions for alternative steps that might be taken to accommodate the differing objectives of Kennecott shareholders.

The Committee recognized that some shareholders are more interested in higher dividends or in shorter-term potentials; while others may have invested for the larger-term possibilities of capital appreciation. These are somewhat conflicting interests, but we believed that we should try to recognize both interests. The Board, therefore, voted unanimously to examine these recommendations and instructed management to conduct the necessary studies.

The suggested alternatives involve the possible divestiture of operations which do not fit precisely into Kennecott's business strategy, and other considerations such as the possible restructuring of both the Corporation's debt and equity.

If any of these alternatives should, after further study, prove to be advisable, and be adopted by the Board, the result could be an enhancement of the value of Kennecott shares through increased yield or market appreciation. Therefore, I assure you, we will give them careful study.

Although I would like to be in a position to speak more specifically now on the matters under study, I think it would be unwise to say more at this early stage.

Another element of the agreement was a proposal that Kennecott reimburse Curtiss-Wright for up to $1.8 million as compensation for proxy expenses incurred.

The sixty-fourth Annual Meeting of Stockholders of Kennecott Copper Corporation was held at the Plaza Hotel in New York City on Tuesday, May 1, 1979. The holders of 25,747,597 shares of the Corporation's common stock or 77.67 percent of the outstanding shares entitled to vote were represented at the meeting, either in person or by proxy.

Each of the management nominees for the Board of Directors listed in the Proxy Statement received at least 25,478,206 votes. The Directors elected at the Annual Meeting were: Thomas D. Barrow, T. Roland Berner, John S. Bull, Carter L. Burgess, Frank E. Case, Russell DeYoung, J. Peter Grace, Oliver R. Grace, Robert S. Hatfield, Peter O. Lawson-Johnston, T. Vincent Learson, James J. O'Leary, Walter H. Page, Ray W. Simmons, Wm. Thayer Tutt, William H. Wendel, Jesse Werner, and Fredrick A. Yonkman.

In addition, stockholders approved by a vote of 18,148,619 to 2,865,118 the reimbursement of Curtiss-Wright Corporation for up to $1.8 million in expenses incurred in the 1978 election contest and appointed Coopers & Lybrand as the Corporation's auditors for the ensuing year by a vote of 25,624,676 for to 154,580 against. The stockholder proposal submitted by Evelyn Y. Davis requesting disclosure of information concerning law firms retained by the Corporation was defeated by a vote of 1,178,227 for to 19,817,441 against; the proposal submitted by Lewis D. and John J. Gilbert requesting restoration of limited pre-emptive rights was defeated by a vote of 1,416,124 for to 19,558,057 against; and the second proposal submitted by Messrs. Gilbert requesting a ceiling on executive pensions was defeated by a vote of 2,038,906 for to 18,961,832 against.

A number of stockholders have written to me to question this part of the agreement. As we have reported, the effect of the agreement was to end a costly, time-consuming, and diversionary contest and to permit us to concentrate our full time and full effort to planning and operating our business.

The net effect of the agreement was to reduce the net expense to Kennecott. As we have reported, the 1978 proxy contest cost Kennecott $2.4 million. We were faced with direct costs of an estimated $1.5 million for a rerun of the proxy fight in January, and then with hidden costs of additional months of counting votes and of legal actions.

There was also the possibility of another major proxy confrontation to be decided at this meeting regardless of the outcome of the January election.

Thus, in December, I recognized that if we continued fighting, and won, we faced a minimum cost of about $4 million and a maximum cost in the range of $7 million. I also assumed that, if the opposition slate prevailed, it could reasonably be assumed that Curtiss-Wright would have asked for reimbursement of their total expenditures of perhaps $7 or $8 million, and this would bring the total financial exposure to the Corporation to perhaps as much as $14 million.

For these reasons and others, your company agreed that the reimbursement issue be put to a vote by the stockholders.

More than 300 stockholders attended the May 1 Annual Meeting in New York City.

Kennecott Looks Ahead

With the disruptive proxy contest behind us, during the last four to five months your management has been working a great deal more than full time to build an effective and spirited Kennecott team, and to explore, analyze, and plan for our future course. This process has not, of course, arrived at any final conclusions in such a short space of time. However, I want to share with you some of the directions that are emerging.

Kennecott's principal business is producing minerals. Its principal markets and operating areas are the United States and Canada. Its principal product is copper. Carborundum brings us two other basic businesses—abrasives and resistant materials, especially industrial ceramics, both of which are international businesses. In these basic technologies, Kennecott serves and will continue to serve the essential needs of the industrial world.

In addition, principally through Carborundum, but through Chase Brass and Copper as well, Kennecott has growing businesses in the environmental systems area and engineered systems and parts.

Key Markets Are Targeted

Therefore, as we make our plans, we see a company with five sectors, three of which provide essential commodities to industrial markets, and in which we have an important base in raw materials, production capacity, and technology. They are: minerals, abrasives, and resistant materials.

Environmental systems and engineered systems and parts, the two other major segments of our corporation, provide Kennecott with important positions in a number of expanding business areas where the risks are greater, but where profit margins are more attractive.

In the basic minerals business, the market for our principal product, copper, has been depressed for four years. However, because of increased prices and rapidly-declining inventories, it has once again become attractive and should remain so for a reasonable period because of a new supply-demand situation in the world. The average selling price for our copper was about 25 percent higher the first quarter of 1979 than in the same period a year ago.

Kennecott Leads in Copper

Kennecott has the best reserve position in copper of any American company, with the largest ore body in the United States, at Bingham, Utah, and two other excellent properties in New Mexico and Arizona.

The Chino concentrating facilities, for crushing, milling, and flotation, can be improved by new investments to reduce costs substantially and give us a significant cost advantage over competitors. At Bingham, as well, there are opportunities to upgrade our processing facilities, while at Ray more modest expenditures can keep that facility abreast of competition.

Kennecott has made known its commitment to conform to environmental laws. Since 1974, we have invested about $325 million in pollution control, or almost half of our total capital expenditures. Most of this was spent to significantly reduce sulphur dioxide emissions from our smelters in Utah and in Arizona. We are recovering about 90 percent of the sulphur dioxide from both these smelters, making them the cleanest in the United States. At Chino, and at Ely, Nevada, we've operated our smelters to meet the ambient air standards last year although we suffered production curtailments to accomplish this. I believe your company has gone further to meet the requirements of the Clean Air Act of 1970 than any other producer. This perhaps puts us in a short-term cost disadvantage compared to others, but should act to our advantage as others are required to meet emission standards.

Competitive Edge is Honed

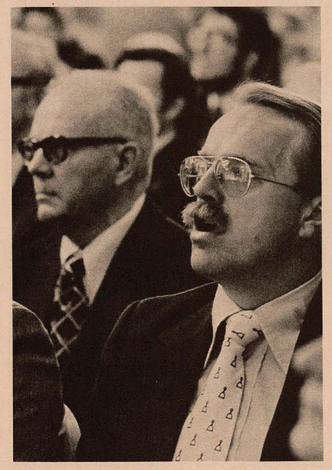
If the greatest strength of your company is in copper, which I believe it is, and if we can make selective investments to greatly improve our competitive strength, which we can, then that should be our first priority.

Therefore, we are developing plans to do so—to build a new plant at Chino for concentrating and for smelting, which should reduce operating costs for total production at Chino in the neighborhood of 20 to 30 cents a pound and further confirm our leadership in meeting environmental standards. It will cost a lot of money—in the range of $300 million—but, according to preliminary studies, could pay for itself in as little as three years. This is a real investment opportunity.

We have other opportunities.

At our Nevada facility, where the mining operation was shut down last year, an investment to extract copper from the tailings pond, which would require an investment of about $15 million, will pay for itself in less than a year, and would make the Nevada operation the lowest-cost copper producer in the United States.

As a second major step to reduce costs, the concentrator at Utah needs to be modernized to further reduce costs at this very important property.



Annual Meeting audience included financial analysts and press representatives.

One of my major concerns as manager on behalf of all the stockholders is to reduce the negative impact of the periods of low prices that affect all copper companies. The most attractive way to do this in my opinion is to reduce our costs so that Kennecott can be expected to make very good returns in bad times, but—on average—very satisfactory returns of 12 to 15 percent over the years.

Production Cost to Be Cut

Fortunately, I believe Kennecott has the opportunity to do so. Our goal, then, is to make ourselves the lowest-cost producer in the United States, and one of the lowest-cost producers in the world.

You probably have two questions—first, can we finance such plans, and second, how will they affect returns to stockholders.

We are putting a great deal of study into these questions. A financing plan for the Chino investment is being developed. A strong price will be needed to fund fully our cost reduction program. I believe that copper prices will continue at higher levels for at least the next three years because of a fundamental excess of demand over expected production.

Reviews of Kennecott business plans for various segments of the company have identified business units that might be divested because they do not fit into the strategic plan that is emerging for the company. Proceeds of such sales also might be applied to finance productive investments. Other sources for funds are also being considered.

Dividends Are Under Review

As for returns to investors, I am confident that the program I have outlined and others I will cover, will be rewarding to stockholders as we move into the next decade.

In the short-term, we have been reviewing dividend policy regularly at Board meetings, and will continue to do so, in light of current and expected earnings. We will meet later this month to consider our next dividend. In light of our improved profit performance in the first quarter, I am relatively certain

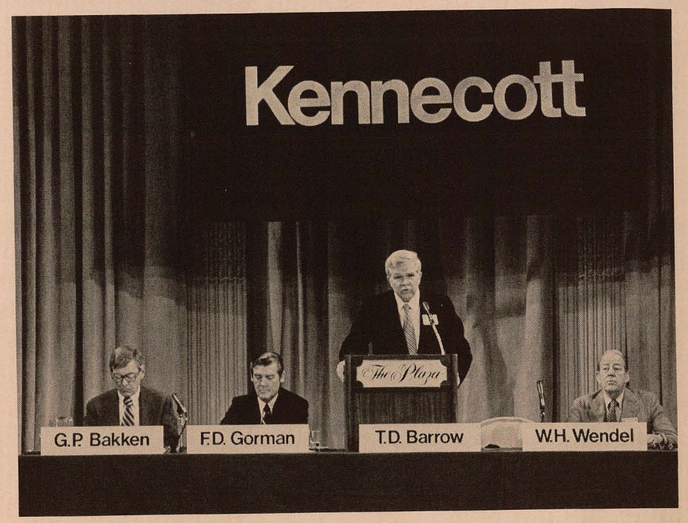
a change in dividend level will be discussed.

I should emphasize at this point that Kennecott's primary goal is to use its technical expertise and production abilities to expand selectively in the minerals business, not only in copper.

We now produce copper, gold, silver, molybdenum, lead, zinc, iron, and titanium oxides. Our exploration capability discovered one of the highest quality lead-zinc mines in the United States, in Missouri, with an extremely favorable reserve position nearby. This provides Kennecott with mineral products with different business cycles than copper alone. The Ozark Lead Company has been highly profitable, but unfortunately we are currently in the midst of a strike. We have made what we consider a generous wage offer to our employees; and although substantially above the 7 percent guideline, we believe it to be fully in accord with the tandem exemption in the guidelines. Kennecott is supporting the President's guidelines in both wages and manufactured goods prices. We hope to settle this dispute without breaching these guidelines.

Our exploration efforts also led to large, undeveloped reserves of phosphate rock in North Carolina jointly-owned with another company. Preliminary development work continues, while worldwide demand for phosphate fertilizers is increasing. Since world demand will rely increasingly on phosphate from Moroccan and U.S. reserves, and since the principal working sources in this country have been declining, I believe this project also has excellent potential for the future, if Kennecott decides to commit the necessary sizeable investments.

The search for minerals continues in many other areas, too, with the goal of diversifying our minerals base.



Chairman Barrow reports. Sharing dais are (left to right): Senior Vice President and Secretary Glenn P. Bakken; Vice President and General Counsel F. David Gorman, and President William H. Wendel.

But in order to present a completely balanced view, I should add that in each of these mineral areas there are current and potential problems. Substitute materials, such as aluminum, optical fibers, and plastics are important competitors in our major markets such as wire and automotive.

Although our lead business has prospered, we are aware of the possible elimination of tetraethyl lead from gasoline, we recognize that new types of vehicle batteries might not contain lead in the future, and we are aware of the high level of concern about lead toxicity in such products as paint. As we look at phosphate fertilizers, we must recognize the historical cyclic nature and wide price fluctuations that have been involved in this business.

As we evaluate mineral potential, management also will examine more sophisticated marketing techniques to help us in our decision-making, and to help support the products that we produce and sell.

CBO is Major Contributor

The prime objective of Kennecott in acquiring the Carborundum Company was to have a major source of earnings that would counter the sharp cycles of the copper market. Last year, its first as a Kennecott company, Carborundum contributed 60 percent of our operating profit, more than any other division. But I believe we acquired even more.

Carborundum has brought us fundamental positions in two additional areas—in abrasives and in resistant materials. These positions are based on technology and on important raw material production. Abrasives—from the basic silicon carbide and aluminum oxide grains to sophisticated grinding wheels and belts—are essential to almost all industrial processes.

Resistant materials, such as ceramics, offer properties, such as wear and heat resistance, that are much needed in the world today. Carborundum is marketing these in various product forms in such

diversified industries as oil drilling, nuclear power, refractories, automotive parts, mining, electrodes, fibers and other uses. It is a company that is well-grounded in a technology with obviously great growth potential.

Carborundum also makes Kennecott a much more international company, for much of its manufacturing and marketing are overseas.

It also has added depth in management and we are beginning to take advantage of several opportunities to give meaningful management development assignments in both Kennecott and Carborundum.

During the last 16 months when Carborundum has been a unit of Kennecott, most of the capital allocated to it has been directed to the fastest-growing business units in the most attractive industrial segments. This has proved rewarding to the company. As we develop our corporate plans, we must determine how the essential strengths in abrasives and resistant materials should be nourished and how much should be devoted to specific high growth opportunities.

Chase Brass and Copper, which continues its strong performance, provides precision-made materials to meet special customer needs. Its new continuous casting process, which is still in development, would greatly increase Chase's opportunities to penetrate important markets in the United States, and to offer us a vehicle for expanding into foreign markets. Last month, initial test samples from the new copper strip process—a very exciting technological breakthrough—were delivered to a major customer for evaluation and testing. So far, this important development project continues on schedule.

Hard Choices Are Coming

We have, then, a number of promising opportunities, and, therefore, some difficult choices to be made—very carefully. We are strong in some basic industries and technologies, where we have opportunities to bolster our positions. We can take important steps to dampen the effect of the copper cycle. And we must choose among those growth opportunities that we expect to have the most promise and long-range potentials to enhance the value of your investment in Kennecott, while we try to improve the current income to you in the form of dividends.

Remarks by William H. Wendel, President

Kennecott's net income for 1978 was $5 million or 15 cents per share, equal to the dividend for only one quarter. However, it was far better than income from continuing operations in 1977 of only 1 cent per share—in fact, 15 times better. This was accomplished even though the average copper price was 0.7 cents lower in 1978 than in 1977.

Kennecott total sales more than doubled to almost $1.9 billion, the largest increase in the Fortune 500 in sales for 1978. The increase came mostly from Carborundum, but Kennecott Minerals Company had a 29 percent increase, primarily because tonnage of copper sold was 22 percent higher. In spite of inflation and pollution control expenses, copper production costs were again kept in line. In fact, after by-product credits, costs of copper sold have been almost flat for four years. Ozark Lead had excellent performance.

Carborundum had a good year. Sales and operating income were up approximately 10 percent over 1977.

The circumstances were made difficult by the sale of Carborundum to Kennecott and last year's proxy fight. The experience of a tender offer, and a merger are traumatic, distracting the attention of managers at all levels and creating uncertainties and understandable concerns. Even worse is the hostile climate of a proxy fight.

The basic issue in that contest related to the fate of Carborundum. In fact, the fate of Carborundum was only settled ten days ago when the Board voted unanimously to accept the recommendations of the Special Committee to retain Carborundum.

Considering the conditions it faced in 1978, Carborundum had a very good year.

Chase sales increased 8 percent and operating income rose to $9.7 million, four times the 1977 results.

Kennecott's share of QIT's operating income was $20 million, an increase of almost 50 percent.

Cash Flow is Improved

Yes, the 1978 numbers were better. However, the primary objective of management was to improve Kennecott's cash flow. And this was done well. The net cash flow before financing and dividends was a positive $11.1 million compared to a negative cash flow of $167.2 million in 1977 before the Peabody sale and the Carborundum acquisition. This is a swing of over $178 million, truly remarkable. To be sure, much of what was done cannot be repeated in 1979, but it was done, and the same determination and management capabilities can now be applied to other corporate objectives.

Now let me turn to the first quarter of 1979, a far better picture. Net income was $21.2 million or 64 cents per share versus $5.3 million or 16 cents per share—four times as much. Sales rose by 34 percent.

The Minerals Company's copper volume increased 19 percent and prices advanced about 25 percent. Production costs were adversely affected by bad weather and less

than full production of the new smelter at Utah. Lead and zinc concentrates suffered from an ongoing strike, but molybdenum sales and prices increased significantly.

Carborundum had record sales, 22 percent over the same period in 1978, and net income was a record for any first quarter, 40 percent over last year. The abrasive business in the United States and Canada was particularly strong and is rapidly improving in Europe.

Chase and QIT also showed significant gains in sales and operating income. Incoming orders at

President William H. Wendel addresses stockholders.

Carborundum, Chase and QIT are high.

But I must add a sober note. Even though the earnings this quarter are four times last year's, this income, if annualized is a return on stockholders' equity of only 6.1 percent which is totally unsatisfactory. But that can, and I believe will, change.

Kennecott is Measured

Fortune's 500 Report for 1978 was published last week. Measured by sales Kennecott ranked 150, by assets 73, by stockholders' equity 64, but by net income a dismal 468. Income on every dollar of sales was only three-tenths of a cent and income on every dollar of equity was only four-tenths of a cent.

Now remember, I reported that costs of copper production had been held firm for four years. Therefore, it is proper to compare the Fortune 500 figures in 1978 with 1974. Income on every dollar of sales then was 12.7 cents, 16th in the nation, and income on every dollar of equity was 14.6 cents, 15 times greater than four years later. Since the costs were essentially the same, the big difference has to be price and once prices improve, as has been the case, the results can again be significant—the right way. It happened before, it can happen again.

I bragged to you about the good job Kennecott did in cash management last year. We did one other thing well. We went out and found, and enticed and recruited a man to be the new Chairman and Chief Executive Officer, as well qualified as anyone, and who is perhaps the best qualified of anybody. Tom Barrow meets all the specifications: his age, education, experience, interest, dedication, and conviction that this will be a great company. And he put his money where his heart is. He is, I think, the largest individual shareholder of Kennecott. He fully appreciates the value of Kennecott's most important asset, its copper properties.

But we had to pay to get him. So I am going to explain to you his employment contract. As you know from the Proxy Statement, the contract with Mr. Barrow is complex. However, the principles are simple and sound. In addition to his salary, which is competitive, Mr. Barrow may earn incentive compensation based on increases in profits and an annual bonus based on the price of Kennecott's stock. Beyond his salary, he cannot benefit unless you benefit. There is a penalty provision in incentive compensation if certain criteria regarding the relationship of dividends to profits are not met. A ceiling is also set on the amount of the incentive compensation. In other words, the arrangements offer a strong incentive to Mr. Barrow to perform in the three areas most beneficial to shareholders—profits, stock prices, and dividends. Again, he cannot benefit unless you, the owners, also benefit.

This is the eighteenth year that I have addressed an annual meeting as President of a publicly-owned corporation. The first 16 were, I must admit, more pleasant because the news was always more pleasant. There was always a sales gain each year and only a few dips in earnings. Yet the future may be brighter right now than ever before. All it takes is good management and good copper prices. On the former I am confident Kennecott knows where it wants to go and how to get there.

I am confident the copper organization is strong and able, and working well together. This management will solve the problems and take advantage of the opportunities. On the second ingredient, good copper prices, well—that is for you to decide. I think they are going to stay strong for several years.

Questions and Answers of Current Interest

Stockholder Valerie Dudarian, assisted by Kennecott employee Neal B. Cravens, poses question to Chairman Barrow.

Mr. W. Gable: What is the trouble at the Utah smelter?

Chairman Barrow: Basically we're trying to put in a new type of smelting system called a Noranda reactor. This is the first time this particular reactor has been used in this kind of a design. In any new piece of equipment, there is a certain period in which you find out what all the bugs are and then work them out of the system. We are making progress, but it is not operating up to its complete design capacity. It's running at about 70 percent.

In working with process equipment, these kinds of problems are, I believe from my experience in the process industry, relatively normal. The people in Utah feel that they will have it on line and operating close to capacity by mid-year.

Ms. Valerie Dudarian: In terms of divestitures, will there be any?

Chairman Barrow: We are looking at a number of small entities in the Company at all times for possible divestiture. As I tried to explain to you in my remarks, we have five major businesses; three of them are areas that we are in through the Carborundum acquisition, businesses in which we think we have an important position. These are continuing businesses, in the judgment of management. There are at least two other general areas that we're exploring—where some businesses are doing well and some, frankly, are not. We have to make decisions as to whether we should continue in some of these new and different businesses, or whether we should sell them and try something else. Our objective is to try to create growth and diversification for the Corporation so that we are not completely dependent on the ups and downs of the copper cycle alone.

The kinds of things we are looking at are relatively small businesses and they may be in a specialty product.

Mr. John Gilbert: What are our foreign obligations?

Chairman Barrow: We have no debt of significance, and we have none of the kinds of foreign exchange exposure that I think you're referring to, Mr. Gilbert.

Mr. Jacob Felder: Couldn't Kennecott distribute long-term Peabody Coal Company bonds to the shareholders as an asset?

Chairman Barrow: There is a restriction specifically on those bonds that prohibits that kind of an action. We are investigating other choices which might allow us to do something in the future. But there is a specific covenant against distribution.

Unidentified Shareholder: Over what period of time will the $300 million investment in Chino be expended, and how much of it will come from cash flow?

Vice-President–Finance Belanger: About one-third of the funds, we expect, could be generated internally. The rest of it would be done through a form of intermediate-term borrowing, so that we would expect to pay that borrowing back with the additional profits from the expanded and modernized mine within the next few years after the investment is on stream. The return on the project will be high, even though only one-third of the funds will be internally generated. I want to emphasize that the entire matter is still under study.

Kennecott Copper Corporation and Subsidiaries

Consolidated Statement of Income

(In thousands of dollars, except per share amounts)

	First Quarter	
	1979	1978
Sales	$574,466	$427,837
Interest and other income (Note 1)	13,501	9,418
	587,967	437,255
Cost of goods sold (excludes items shown separately below)	447,304	330,916
Depreciation, depletion and amortization	23,543	21,392
Selling and general administrative expenses	62,076	52,816
Shutdown expenses during strikes	534	—
Interest expense	16,972	13,773
Research, exploration and other expenses	6,336	6,826
	556,765	425,723
Income before taxes and minority interests (Note 2)	31,202	11,532
Provision for income taxes	9,500	6,100
	21,702	5,432
Income applicable to minority interests	524	164
Net income	$ 21,178	$ 5,268
Net income per share	$ 0.64	$ 0.16
Cash dividends per share	$ 0.15	$ 0.15

NOTES:

(1) The first quarter of 1979 includes a pretax profit of $7.3 million on the sale of an undeveloped coal property.

(2) In the first quarter of 1979 the liquidation of LIFO copper inventories produced a pretax profit of $5.8 million. In 1978, the Company liquidated a portion of its unrefined inventory of silver and gold. The effect of the liquidation was to increase income before taxes in 1978 by $16.5 million.

Interim statements are not audited by independent accountants.

Kennecott Copper Corporation and Subsidiaries

Consolidated Balance Sheet

(In thousands of dollars)

	March 31, 1979	December 31, 1978
Assets		
Current assets:		
Cash	$ 39,433	$ 38,802
Marketable securities, at cost which approximates market value	43,514	29,400
Accounts receivable, less allowance for doubtful accounts of $4.2 million in 1979 and $4.4 million in 1978	347,261	292,473
Inventories	452,668	464,239
Other	12,174	10,788
Total current assets	895,050	835,702
Investments and notes receivable	284,459	281,760
Intangible assets, including goodwill of $37.1 million in 1979 and $37.4 million in 1978	63,813	64,572
Deferred charges and other assets	56,803	53,265
Property, plant and equipment, less accumulated depreciation, depletion and amortization	1,377,945	1,381,565
	$2,678,070	$2,616,864
Liabilities		
Current liabilities:		
Notes payable	$ 62,291	$ 18,896
Current portion of long-term debt	4,071	4,822
Accounts payable and accrued expenses	271,968	260,539
Accrued taxes	127,483	146,177
Total current liabilities	465,813	430,434
Long-term debt	611,642	606,775
Deferred U.S. and foreign taxes	67,000	61,400
Sundry reserves and deferred credits	93,245	94,400
Minority interests in consolidated subsidiaries	52,087	51,778
Total liabilities	1,289,787	1,244,787
Shareholders' Equity		
Capital stock, $5 par value; authorized 50,000,000, outstanding 33,159,153 shares	165,796	165,796
Capital in excess of par value	102,443	102,443
Retained earnings	1,120,044	1,103,838
Total shareholders' equity	1,388,283	1,372,077
	$2,678,070	$2,616,864

Interim statements are not audited by independent accountants.

Kennecott Copper Corporation and Subsidiaries

Consolidated Statement of Changes in Financial Position

(In thousands of dollars)

	First Quarter 1979	First Quarter 1978
Funds provided by:		
Operations	$50,655	$ 28,528
Decrease (increase) in inventories	9,571	(36,128)
Total funds provided	60,226	(7,600)
Funds expended for:		
Property, plant and equipment	20,882	38,563
Increase in accounts receivable	54,788	13,293
Increase in investments and notes receivable	2,699	4,023
Decrease (increase) in accounts payable, accrued expenses and taxes	7,265	(7,223)
Net increase in other accounts	2,386	(399)
Total funds expended	88,020	48,257
Net funds (expended) before items below	(27,794)	(55,857)
Distributions to stockholders	(4,972)	(4,969)
Increase (decrease) in notes payable	43,395	(125,109)
Increase in long-term debt	4,116	130,012
Net increase (decrease) in cash and marketable securities	$14,745	($ 55,923)

Interim statements are not audited by independent accountants.

KCC/ASARCO Plan Montana Mining

Kennecott will receive a royalty of 25% of pre-tax profits from a copper-silver deposit near Troy in western Montana. The deposit contains an estimated 64 million tons of ore averaging 0.74% copper and 1.54 ounces of silver per ton, and there are possibilities for additional ore at several nearby prospects.

The Troy deposit was discovered by Kennecott in 1963 and will be developed by Asarco with no additional capital investment from Kennecott. Production is scheduled to begin in mid-1981.

QIT Controls Dust With CBO System

A fabric filter dust control system, scheduled to be in operation at QIT-Fer et Titane's smelter in Sorel, Canada, in the fourth quarter of 1979, will be the first of its kind on this continent. The system was designed and is being erected by Carborundum Environmental Systems Canada.

The field-erected, modular dust filter unit will clean 850,000 CFM of exhaust air contaminated with dust and fumes generated from 34 smelting sources. It is designed to use air-to-cloth ratios double that of conventional bag filter systems in this type of application, and to achieve residual dust loading of 0.005 grains per cubic foot of exhaust air. The system will result in the collection of some ten tons per day of fume from the smelter operation. At ground level, the fall-out of dust will be less than the amount of dust found in normal ambient air.

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