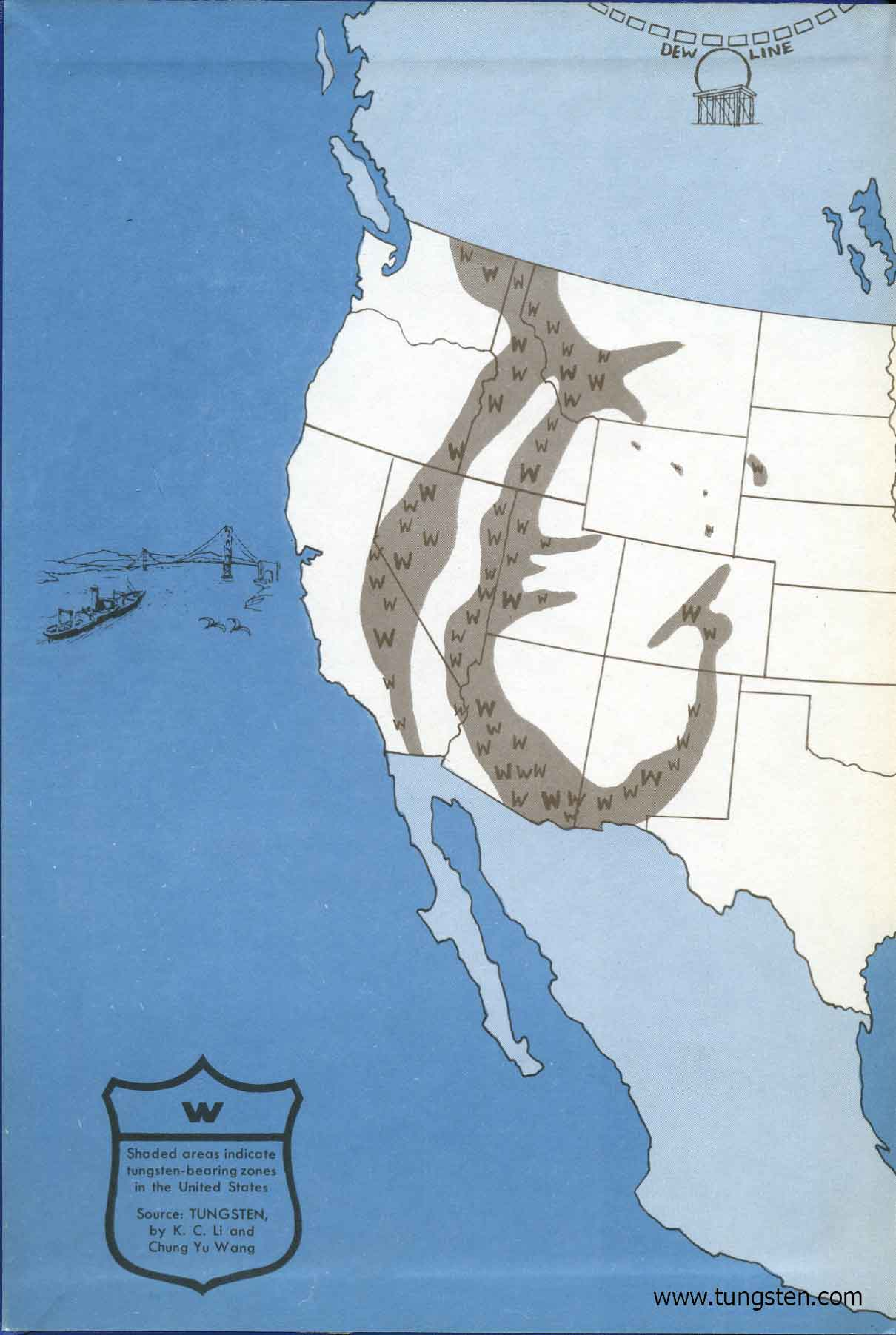
Tungsten

The Story of an Indispensable Metal


DEW LINE
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Shaded areas indicate tungsten-bearing zones in the United States
Source: TUNGSTEN, by K. C. Li and Chung Yu Wang


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Tungsten

The Story of an Indispensable Metal

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Above: Wolframite Crystal

TUNGSTEN

This is the story of Tungsten.

It is a metal few people know about — except in a vague, indeterminate way. If you ask, the answer is almost sure to be, "It's used for light globes or something, isn't it?" Yet never a day or a night goes by that you are not indebted to tungsten for a number of reasons.

It is invaluable in war, important in peace, and extremely difficult to wrest from nature. It is a metal that is not found as a metal at all as we ordinarily visualize metal. It is a rare element, a fascinating and curious substance. It never occurs in nature by itself, but always is tied in with oxygen. Even when it is laboriously concentrated by complicated processes from reluctant ores, this trioxide must be further refined for commercial use in alloys or as pure metal.

The story of tungsten involves bold and brave personalities; fabulous discoveries; invisible light, and sounds beyond the range of the human ear; wars won and the course of history altered; modern mass production and destruction; and comforts for our daily lives far beyond the dreams of our forebears.

So this is tungsten. The name is derived from the Swedish words meaning heavy stone. Heavy it is and, as a carbide, hard, too. For a metal spoken of in units of pounds rather than tons, tungsten is extraordinarily heavy, with a density two and a half times that of iron, and equal to that of gold. And in hardness tungsten carbide is second only to the diamond. Tungsten carbide is the hardest metallic substance yet made use of by man.

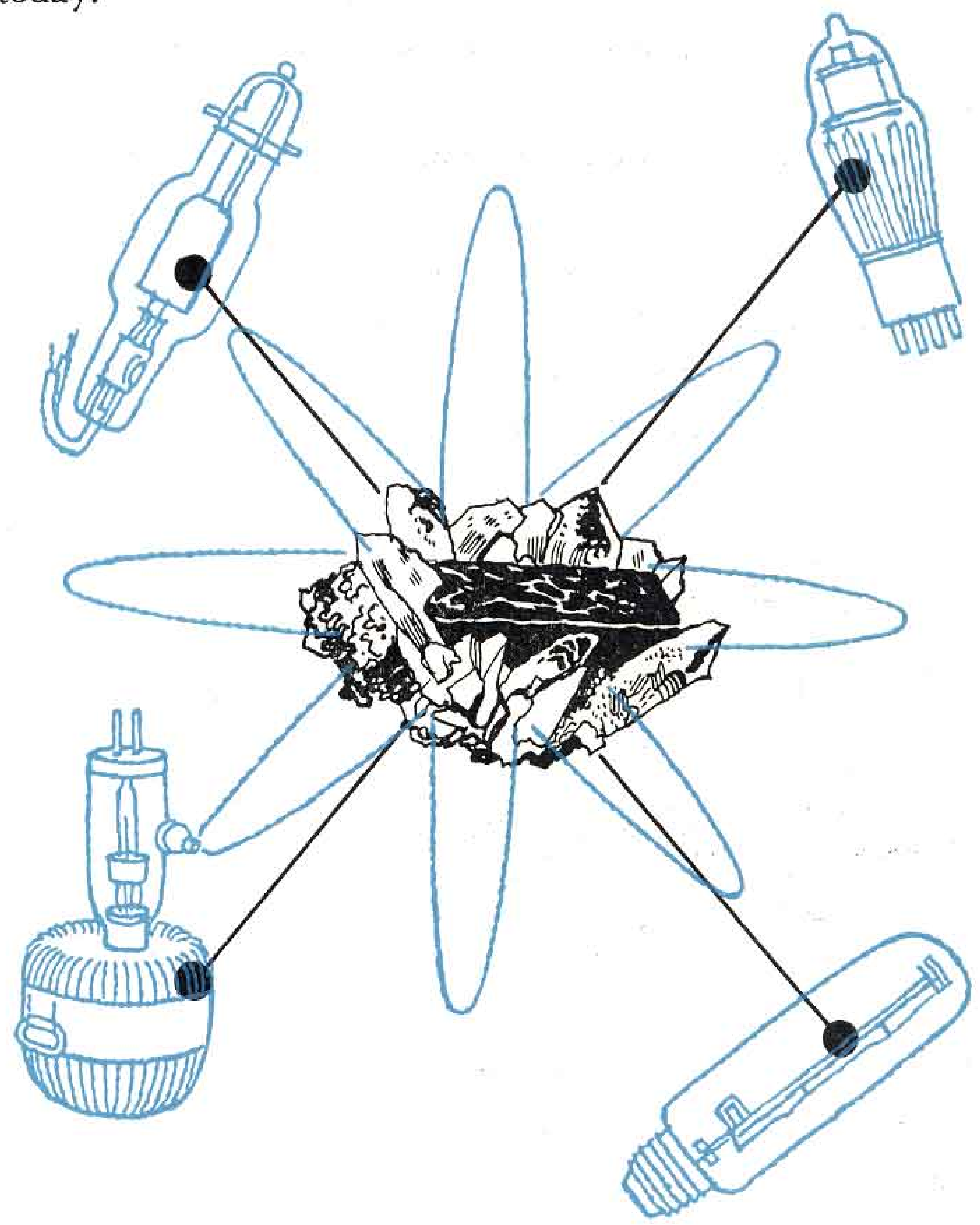
Tungsten's quality characteristics are not equalled by those of any other metal. Its greatest virtue, the quality that makes it indispensable in today's world, is that it retains its strength at high temperatures. Tungsten has the highest melting point of any metal known to man — 6152° Fahrenheit.

Tungsten's vital role in the past is perhaps only prologue to that it may assume in the years to come.

Because it is important in your life today, and may be more so tomorrow, this story of tungsten is written for you.

ELECTRONICS

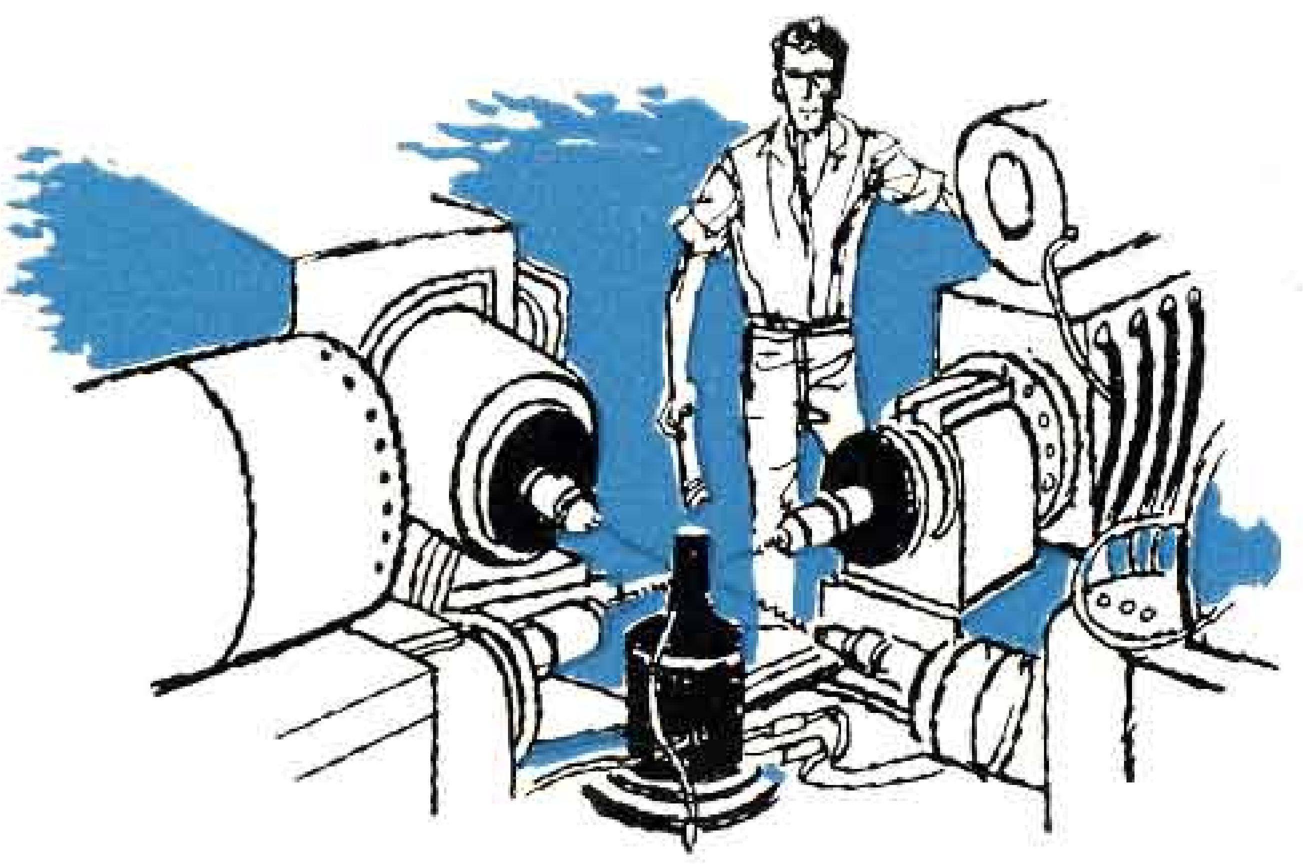
In this electronic age, the vacuum tube is the heart of virtually all electrical devices. The filaments in these tubes must have extreme heat resistance. Tungsten in the pure metal form fills the bill as no other substance does and at a cost within reach of anyone. Without such efficient filaments, we would have no electric lamps, no electronic tubes. Without these vital tubes — no electronic wonders such as we have today.



HIGH-SPEED STEEL

Without tungsten, industry and manufacture, transportation and communication as we know them today in the United States could not exist. Without tungsten, freedom as we enjoy it today might not be ours. We would be without most of the comforts we consider necessities, for we could not have the mass production that makes possible an endless stream of products at prices within the reach of all. Efficient mass production depends on hot work steels, and tools made of high-speed steels. The best high-speed steel tools and precision instruments that make possible most minute tolerances in manufacture are made of tungsten alloy steels and tungsten carbides.

The addition of tungsten materially increases the hardness and heat resistance of steel at high temperatures. This quality is called hot hardness or red hardness, and makes possible tool speeds once believed to be unattainable.



Tungsten is invaluable when used directly as a metal, and unequalled when used in the form of alloys as in machine tools.

Tungsten may be thought of in terms of the comforts and luxuries of peace and in terms of military might and national security. No matter — this story is yours really, because tungsten and you live together every day in times of peace or war.

A NEW METAL

Tungsten in its different forms is suitable for many uses. Tungsten is used in alloy steels for high temperature purposes, in tungsten carbide for cutting or drilling tools and in armor piercing projectiles. As a pure metal tungsten is used in electronics and electric lighting. Chemicals are employed to obtain tungsten pigment important in dyestuffs, inks, and ceramic frits. An important use of the tungstates is in fluorescent lamps.

As the history of metals goes, tungsten is a new metal and its versatility is a relatively recent discovery. Only in the last four decades has it become established as a strategic metal. In that role it has swayed the destiny of nations. It continues to dominate industrial empires, economic forces, and military strategists.

WO_3

Tungsten, as a mineral, was first mentioned in scientific literature in 1574 — as wolferam. The tin miners of Cornwall, England, called the mineral cal, or call, or mock lead, and regarded it as harmful, saying it "eats up tin as a wolf eats sheep."

The name wolfram — the accepted spelling today — is derived from the German word wolf, a beast of prey, and ram, froth. From the old miners' description of the metal, the world's scientists adopted the name wolfram and used the first letter of the word as the symbol for tungsten. Because tungsten is recovered from nature as a trioxide, scientists and industrialists and metallurgists today talk in terms of WO_3.

Tungsten was first isolated as a new element by K. W. Scheele in 1771. He had found a hitherto unknown acid, which he named tungstic acid. Subsequently, the mineral he had worked with was named scheelite, the name it bears today.

The Spanish brothers D'Elhuyar, who had worked with Scheele, published the first account of the isolation of this new element tungsten. By 1786 the Spaniards had discovered that tungsten, combined with pig iron, formed "a hard, brittle combination," but there the research ended.

When Robert Oxland took out a British patent in 1847 for a process of making sodium tungstate and tungstic acid, the metallurgy of tungsten began.

The first practical application of tungsten alloy steel in the form of rails was made in Terre Noire, France, in 1868. A generation later, in 1900, tungsten high-speed steel was first brought to the attention of the general public. That, too, was in France, at the Paris Exposition. There the exhibitor, Bethlehem Steel Company, demonstrated tungsten-steel alloy as a tool steel. General adoption of this product led to redesigning of machine tools and to great savings in production costs for countless items.

65%–75% concentrates are obtained from Tungsten ore

Today virtually all types of high-speed tools are made of steel containing tungsten. The basic type has 18 per cent tungsten, 4 per cent chromium, 1 per cent vanadium, and from .50 to .80 of 1 per cent carbon.

The use of tungsten-steel high-speed tools has meant savings of billions of dollars to industry — and consequently lowering of prices to consumers.

TUNGSTEN BECOMES A STRATEGIC METAL

The importance of tungsten in international conflicts first was illustrated in World War I. The story demonstrates how thin can be the line between triumph and disaster, how blind scientists sometimes can be, how the fate of the world might have been altered.

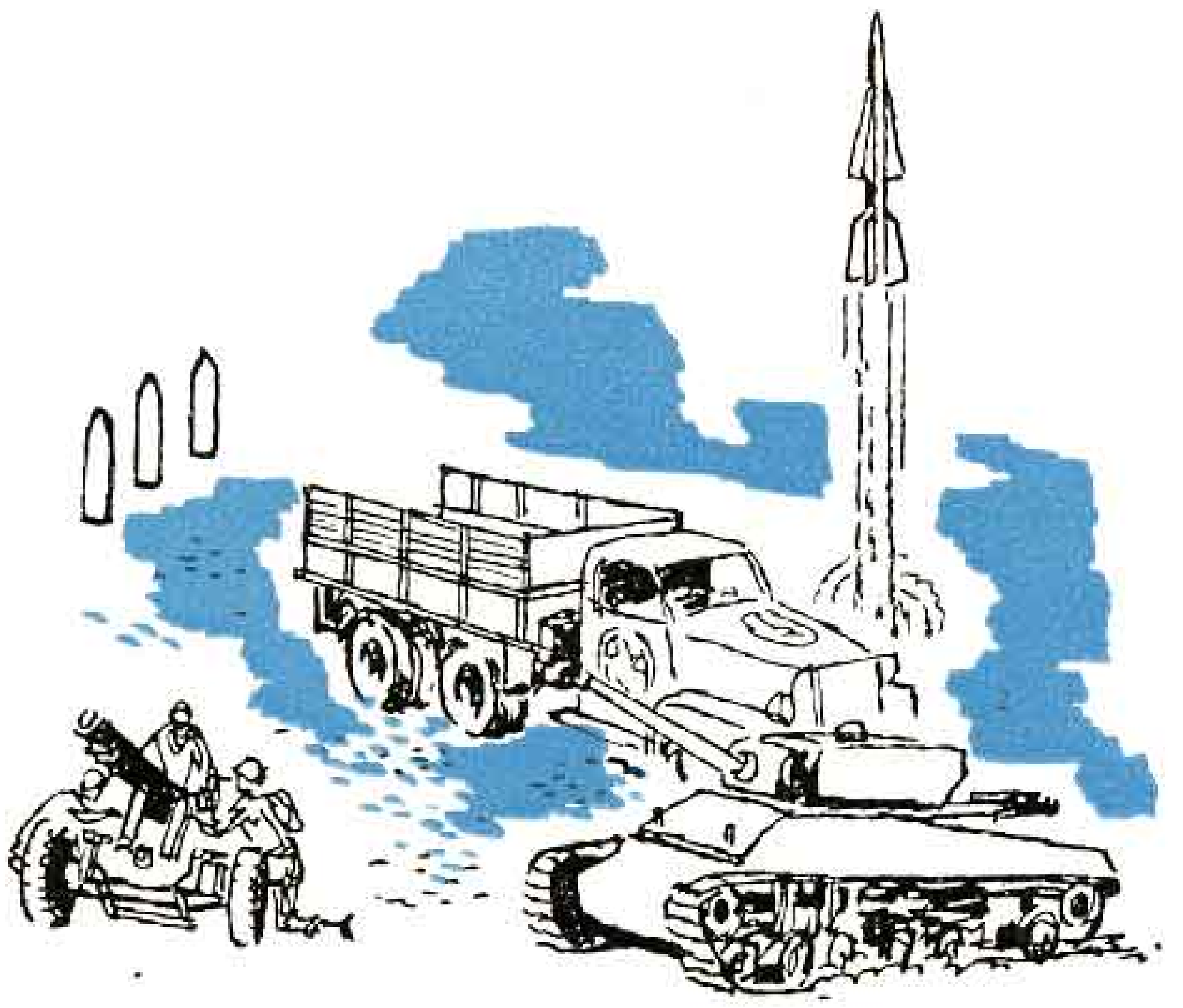
In 1913, the year before the Kaiser's armies marched into Belgium, the British mining interests had no use for tungsten — considered it a nuisance because it made tin extraction more difficult.

But the Germans were more alert, for they gladly took all this "useless" wolframite from the Cornish mines. As one British scientist put it, "the Germans somehow know how to make use of this blooming stuff." Considered "waste," the British were glad to sell it to German industrialists for 8 to 10 shillings a unit.

As World War I began, military and economic experts assured each other and the world that Germany could not keep up its industrial pace, and that its ammunition supply would be exhausted in six months. But it was soon discovered that Germany was increasing its munitions output, even exceeding that of the Allies. Germany's top-secret then was the use of tungsten high-speed steel in cutting tools. And the ore, the British found out later, had been coming from their own Cornwall mines!

With this impetus, due to demands of military might, world production of tungsten had leaped by 1916 to 23,104 short tons of concentrates. Only nine years before it had been 6,135 short tons — an amount in those days considered surplus.

Almost immediately an international scramble for tungsten was on, and the price shot up to almost $100 a short ton unit (20 pounds WO_3) in the United States.



Tungsten was established as a strategic military item in the munitions race of World War I, but the military requirements for this metal became astronomical during World War II with the introduction by the Germans of a tungsten carbide armor-piercing shell.

During the 1930's, as Hitler's shadow darkened over Europe, Italy, France, Russia, and Germany began placing extraordinary orders for tungsten concentrates. Before World War II was started, Germany had bought up virtually the entire world supply of off-grade tungsten ore. In a barter agreement with China in 1936 Germany obtained directly about 45% of China's rich tungsten ore. And from every other source huge tonnages of Chinese ore were imported, as well as ore from Bolivia, Argentina, Peru, Mexico, and even the United States — all bought through her Axis partner, Japan, then considered "neutral" by the Americas.

It was Germany's use of high-velocity armor-piercing projectiles with the tungsten carbide core that almost made the North African campaign a successful one. These projectiles virtually melted the famous British tanks and made the German Panther and Tiger Tank Corpsmen famous. It was the most awesome, most destructive armor-piercing missile yet invented by man.

TUNGSTEN VITAL TO DEFENSE

It was two years — a period to be measured by death and destruction, fearful costs in human lives, not just a period of calendar days — before the United States perfected similar projectiles and produced them in quantity sufficient to give the Allies victory in the Battle of the Bulge.

The tungsten carbide core of the projectile pierces the walls of armored tanks virtually as if they were paper and, having penetrated, scatters lethal pieces of most intense heat and destruction. U. S. military requirement of tungsten during the peak munitions production year of World War II was approximately 30 million pounds of tungsten metal, more than twice again the production of this country.

Tanks, trucks, guns, shells, armor-piercing projectiles — all the paraphernalia of war — depend on high-speed steel tools. The best high-speed steels are made of tungsten alloy. Altogether, tungsten was used in 15,000 different types of war items in World War II.

Tungsten in the form of a high-velocity projectile's inner core, and in the form of tool steels helped vastly to bring victory and an end to World War II.

It played its part in the Korean conflict in projectiles and machines and in atomic threat.

Tungsten itself is a component of precision instruments or is used in making these instruments, including range finders controlled by radar, and the geiger counters used to find radioactive materials for nuclear fission.

The nation possessor of a tungsten stockpile possesses, also, political as well as military power.

LONG SEA HAULS UNNECESSARY

China's tungsten deposits are the largest known resources. But in the days of the Sino-Japanese War, forerunner of World War II, the flow of tungsten was disrupted. Stockpiles, however, accumulated in Indo-China. Japan coveted that supply.

During World War II when the Vichy regime came to power in France, Japan had Germany order Vichy to remove the Governor-General of Indo-China in favor of another who would cooperate better in the matter of huge tungsten shipments stored in Indo-China and destined for Japan. But before the shift of Governors could be made, the United States quietly and quickly arranged for purchase of the entire stock, and off went this strategic metal to the United States with Japanese war vessels in pursuit. The shipments got to America safely just prior to Pearl Harbor.

In the race for tungsten hung the balance between victory and defeat. Germany was paying Portugal and Spain $50,000 a ton for the vital, critical metal. Both Britain and the United States entered into this "preclusive" buying at the same high price on the sound theory that every pound of tungsten ore they bought was one pound less for Hitler.

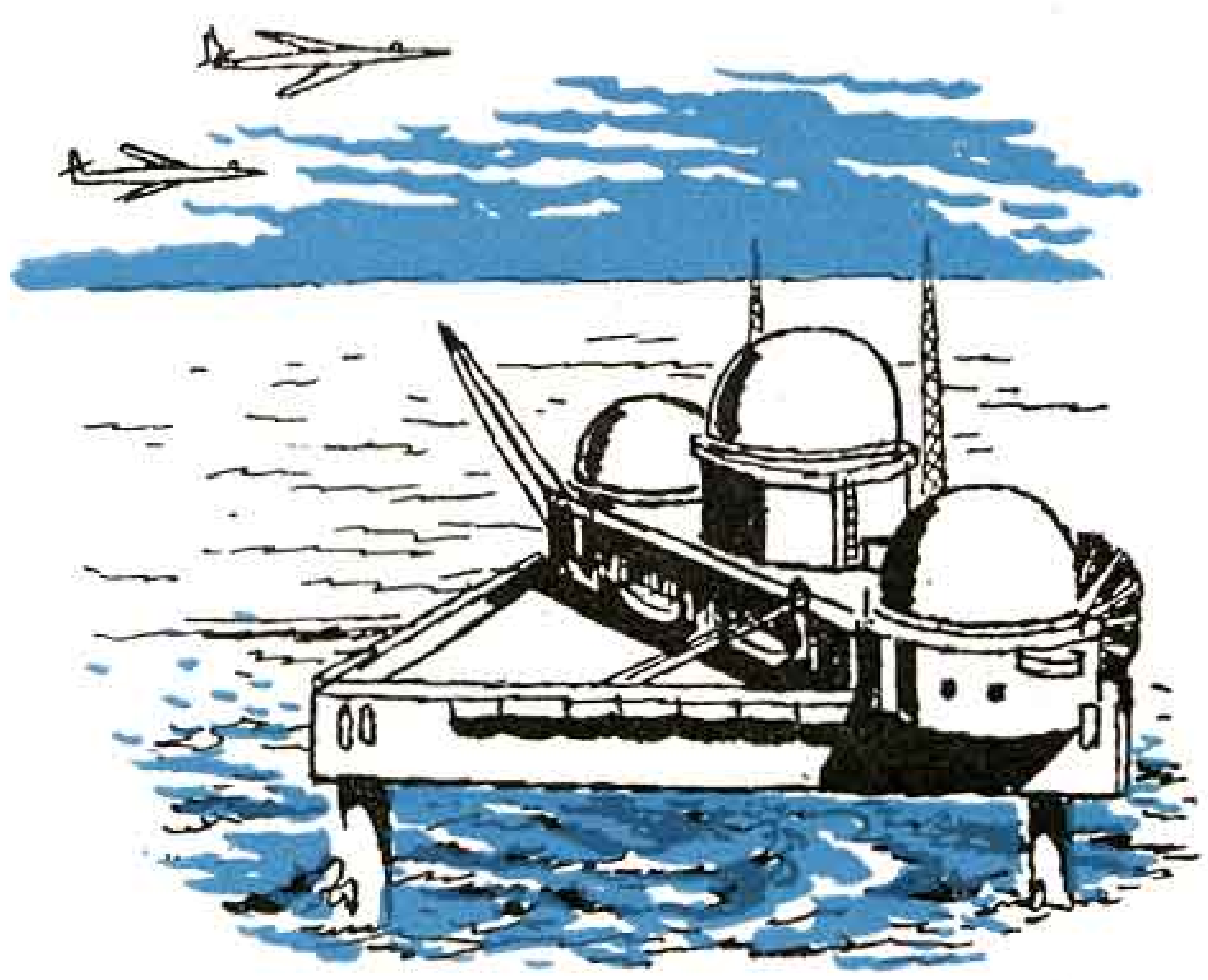
Tungsten, in times of crisis, serves a nation as well as gold. Before the era of lend-lease, the Chiang Kai-shek government used China's rich tungsten ore as security for large loans arranged by the United States.

RADAR, OUR FIRST LINE OF DEFENSE

China's tungsten ore reserves remain the world's largest by far. But today all this vast potential output is in the hands of the Communists. In the recent partition of Indo-China, its tungsten deposits, although small, fell into the hands of the Communists also.

The largest single known source of tungsten in the free world today is in South Korea, precariously located a few miles from the 38th parallel.

In the event of another war, the United States would have great difficulty in coping with long sea hauls and would be dependent upon the domestic tungsten mining industry for its supply of the strategic metal.



Our first line of defense is our radar warning system, which is an electronics system. Without tungsten, we could have no radar protection.

The world is barely in its second decade of the aircraft gas-turbine engine. More than a generation ago, the basic idea of the engine was known, but nothing could be done until modern "super-alloys" were developed, capable of maintaining their strength and resisting oxidization at the high temperatures encountered in the jet. Alloys for jet-engine use are now the subject of much research and cannot be considered to have reached a standard type that will remain fixed; however, important quantities of tungsten may be consumed in such alloys.

And the jet engines themselves could not be built without high-speed tools, for which tungsten again is necessary.

If the United States had no tungsten, our country would have no armor-piercing projectiles, no jet-planes, no communication system, no military position in this, the age of the A-bomb and its sinister relatives H and C.

But the United States does have tungsten. It has a healthy domestic tungsten mining industry. It has big mines and little mines. A stockpile is being accumulated at a rapid rate.

But, is it adequate? Will it be enough should war come again?

TUNGSTEN AND THE ELECTRONIC ERA

Tungsten is indispensable in the manufacture of our modern peacetime wonders. Not only is it a vital component as an alloy or as pure metal in the manufactured product, but also in making more efficient the machine tools of our great factories.

Its uses may be unlimited in this age of supersonic speed and intense heat. But it serves us most frequently, and we accept it most casually, in electronics.

The foundation of electronics was Edison's discovery in 1883 that when a metal is heated to a high enough temperature it gives off a stream of electrons. These electrons enable a vacuum tube to function as a rectifier, amplifier, modulator, or detector.

That Edison discovery was the beginning of the modern electronic tube. But, discovery of a principle is one thing, and its practical application is another. The problem was to find a metal that had two qualities: extremely high melting point, and extremely low rate of evaporation.

Tungsten filament alone meets both requirements, so its industrial history is closely identified with that of the incandescent lamp, the cheapest luxury one may have.

TUNGSTEN IN THE LIGHTING FILAMENT

The first patented process for drawing tungsten filaments came in 1904, and development of the tungsten filament for lighting began in 1909. Today filaments can be made so light, so fine, that enough for more than 20,000 electric lamps can be obtained from one pound of tungsten. The finest wires drawn from a tungsten bar have a tensile strength of more than 300 tons per square inch. A tungsten rod 5 feet long, the thickness of a pencil, can produce a strand of filament wire 450 miles long.

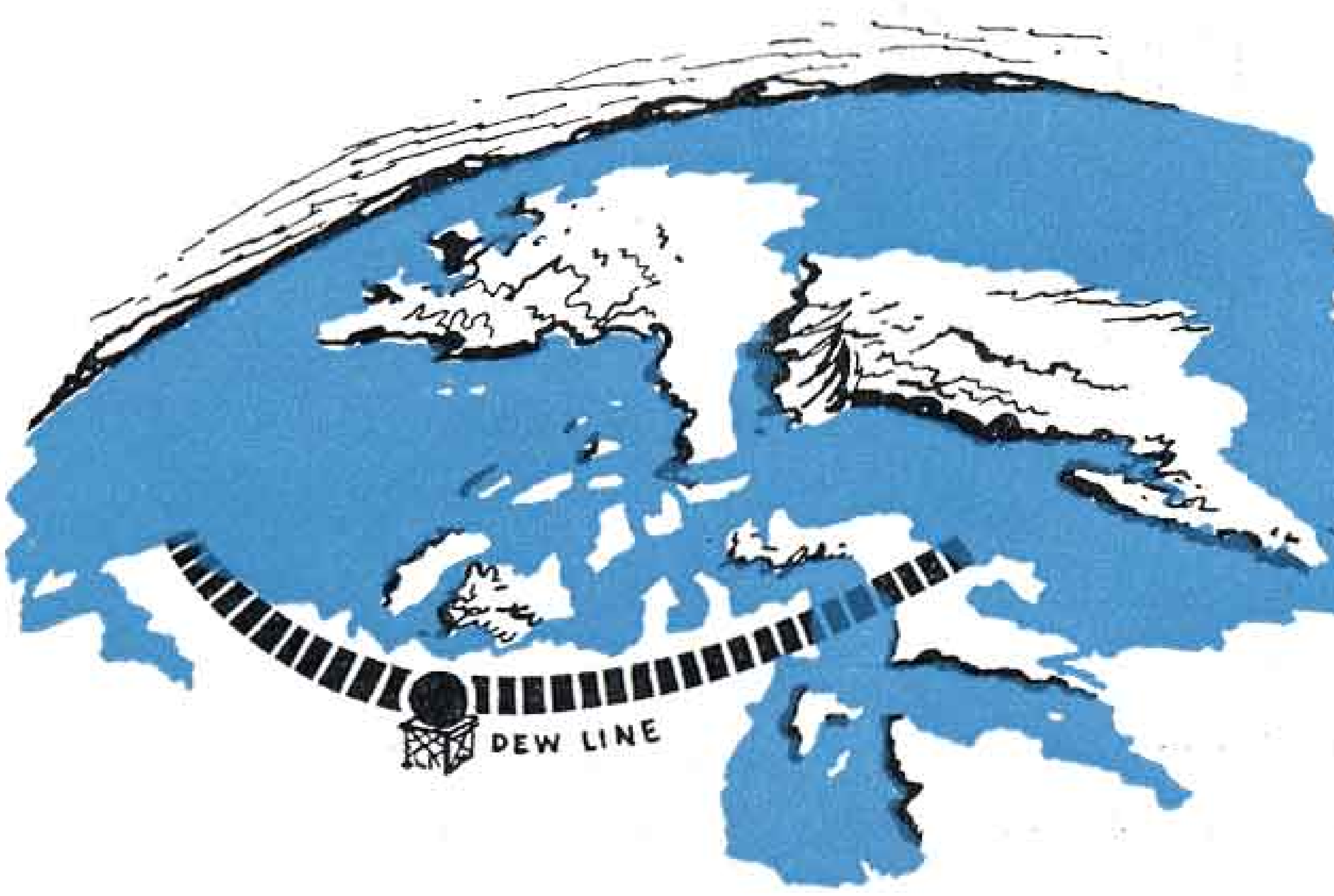
In 1927 it was estimated that had old-time carbon filament lamps been used to produce the same illumination as was furnished by the tungsten filament lamps in use that year, more than $2 billion additional actual expenditure for lighting would have been required!

The year 1954 was the diamond jubilee of the first incandescent lamp. To celebrate Edison's great invention on this occasion, thirteen lamps of one billion candle power each were turned on at Atlantic City, their beams flashing like giant searchlights directed among the stars.

Because of tungsten filament and the vacuum tube, every American may enjoy the priceless luxury of light purchasable today for a few cents. And rarely does one find an American home that does not know the pleasure and convenience of communication through the use of radio, television, and telephone.

RADIO, TELEVISION, TELEPHONE, RADAR

In 1954 more than 2¼ billion electric lamps were produced in the United States for industry and home. That year more than 7,200,000 television sets and more than 13,000,000 radios were produced. These added to the millions already in use have helped to mould and to broaden the thoughts and the purposes of the people of this nation. The more than 50,000,000 telephones in use every day help unite us through sound and hearing. When one presses the light switch, or turns on the radio, or watches a television program, or uses the telephone for pleasure or business or emergency, each should be a reminder that we would not have these modern wonders of today without the fabulous heat-resistant qualities of that rare element, the pure metal tungsten. Wonders that we consider essential comforts!



Tungsten, of course, is necessary for all electric lights. But, it is also a vital component of X-ray machines, camera lenses, radio tubes, TV tubes, electrical contacts, automobile and airplane distributor points, and it is used as a catalyst.

Tungsten components are necessary in every area of communication — the telephone, AM and FM radio, radar. Tungsten components are used in products operating in infrared drying, radiant heat, short-wave communication, both visual and aural, electronic heating, sea and air navigational aids, and power transmission and distribution.

BRAIN MACHINES

Tungsten is indispensable to the newest of the modern wonders — the electronic "brain machines." These are machines that solve, in a twinkling, problems it would take the most highly skilled professional mathematician months or years to work out. These machines are being used increasingly not only by science, but by industry.

TUNGSTEN STEEL SAVES MAN HOURS

Before the electronics era, the major use of tungsten was as a constituent of tool steels, especially high-speed steels. One man operating a lathe with high-speed tungsten-steel tools can do the work of five men, with five lathes, using carbon-steel tools. The enormous savings are obvious.

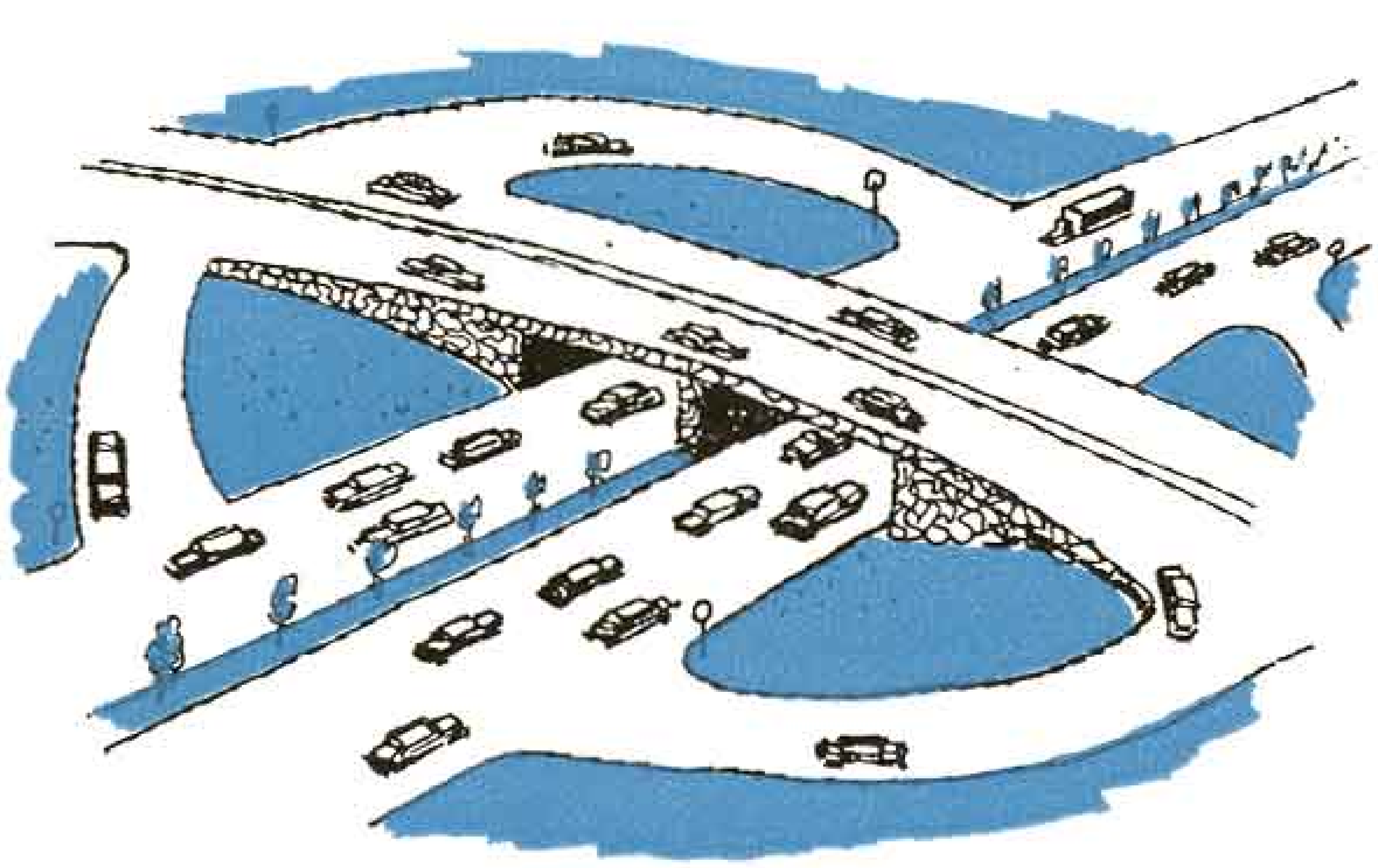
The extreme hardness of tungsten carbide has long been known, but its brittleness made its use not practical. But in 1927, the Krupp Laboratory discovered that if tungsten carbide is mixed with a bonding or cementing material, a very serviceable product is obtained.

In 1944, when the United States forces pressed into Germany at the close of the European conflict, records of the Krupp processes were among archivic material discovered hidden in salt mines and other places. But in the confusion of victory and occupation of the land by the Allies, the documents may have been lost. There is only speculation today as to the present possessor of the Krupp records and the sharing of the once closely guarded German method of using tungsten in high-speed steels.

Our talent for high-speed efficient mass production of high-quality goods has made the United States the world's greatest industrial nation.

KEY TO MASS PRODUCTION

Machine tools are the backbone of the United States industrial empire, and because of our modern-day steels and the machine tools that permit mass-production methods, millions of jobs and billions of dollars in payrolls are provided American workers. Because of these same machine tools and industrial methods, industries make profits and at the same time produce quality goods in lower costs. If the old-type carbon-steel tools were used, instead of high-speed tools made possible by tungsten alloys, every automobile would cost much more — be out of the buying range of the average person.



What is true of the automobile industry is true of all others where metal working is involved. The dollars saved and the dollars earned because of tungsten in industry amount to staggering sums every year.

It is only 25 years since General Electric shipped the first carbide-tipped tools on a trial basis. Today their use is common. To produce jet engines without carbide cutting tools, five times the factory and machine capacity and five times the labor force would be required. These tools outlast the toughest high-speed steels by as much as 100 to 1 and, because they cut at 5 to 6 times faster than old-type tools, save two-thirds of the man hours once expended. The design, weight, and construction and price of a present-day automobile or plane would be vastly different if limited to the steels and cutting tools of just a few decades ago.

Tungsten-carbide tools are used to cut and shape metals, plastics, wood, and all other materials that are either hard or abrasive. Virtually all metal products in the home, from door knobs to silverware, are made with dies of tungsten carbide.

ULTRASONIC MACHINING

Only diamonds are harder than tungsten carbide. And that presents a problem in the making of tungsten-carbide tools.

The solution is another miracle of modern industry. It is the use of ultrasonic sound waves, beyond the range of the human ear. Ultrasonic machining converts electrical energy into mechanical action. Particles of abrasive material, suspended in a liquid, flow between the tool tip and the metal to be worked on. The tool never touches the metal, but its vibrations of more than 20,000 cycles a second "hammer" the tiny abrasive particles against the metal with tremendous force.

This magic process drills and threads holes, makes accurate complex cavities and recesses in carbides, tungsten tool steel, and other materials once considered almost impossible to cut, such as glass, ceramics, and semi-precious stones.

TUNGSTEN CARBIDE

Tungsten-carbide drills are both elephant size and minuscule and have an unbelievably wide range of service. Smallest are those comparable in size to a human hair used to drill holes so small as to be invisible to the naked eye in tiny watch jewels.

Minute diamonds formerly not useful even in industry because they were too small to be soldered are now utilized through a bond of tungsten-copper-steel alloy. The effect is almost to double the working life of an industrial diamond used as a grinding tool. Second to the diamond in hardness and efficiency as a cutting tool is steel tipped with tungsten carbide. Although now used for only about 20% of all rotary tools, it works two to five times faster than an ordinary steel tool and retains its cutting edge up to 50 times longer.

A well-equipped dentist uses tungsten to tip his drill. Such a drill can rotate five times as fast as the former drill, needs less pressure, and is more comfortable for the patient.

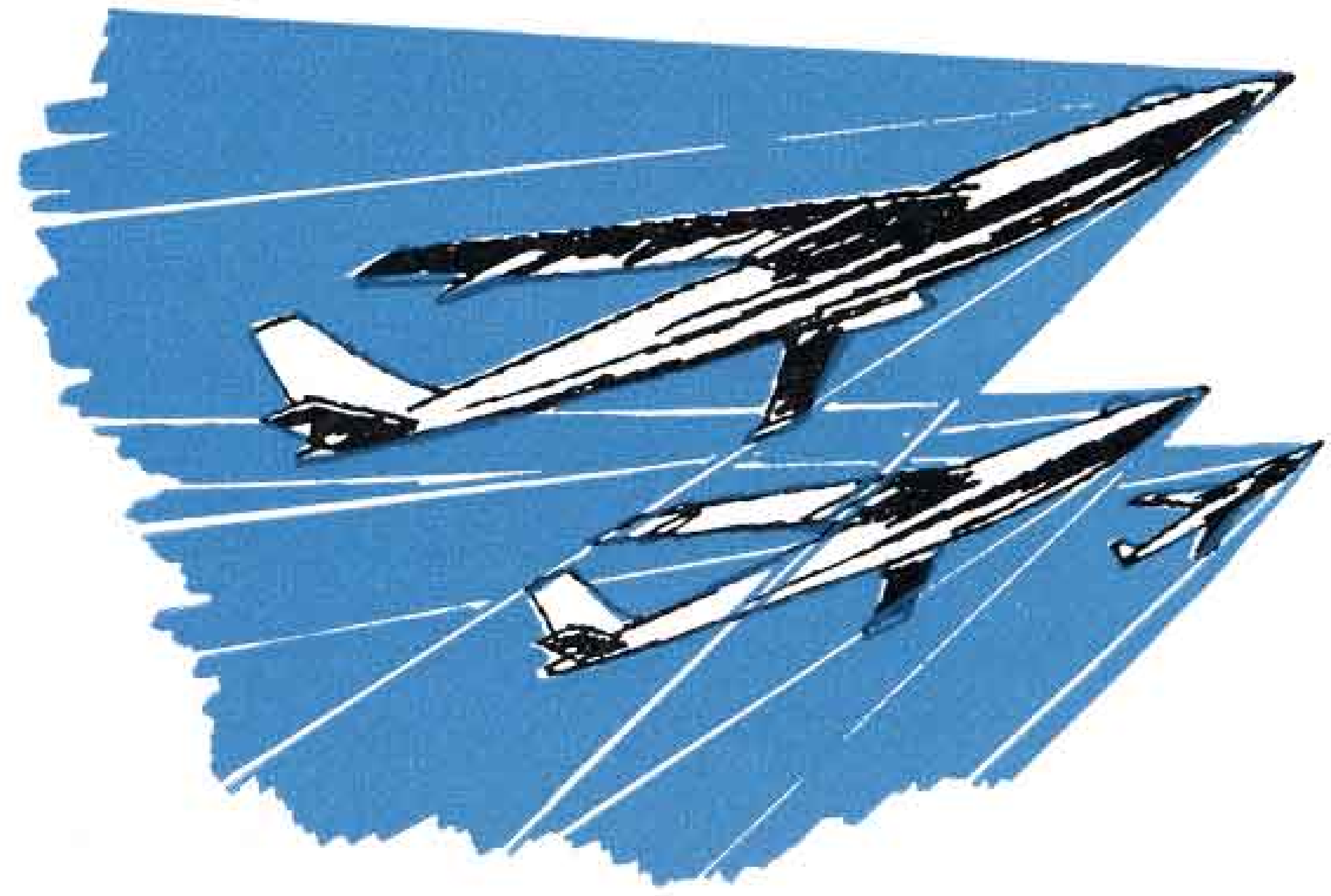
Tungsten-carbide drills have contributed greatly to our vast oil and gas industry, so important not only to our commerce, but to our national defense. The rich pools a mile or more beneath the earth's surface have been tapped largely because of the enormous savings and the elimination of the depth barrier by the use of drilling bits tipped with hard tungsten carbide. Tungsten is used for arc welding of stainless steel piping to produce an inside surface in the joint that can handle corrosive liquids, high-pressure and high-temperature steel, fluid metals, food, and pharmaceutical products.

Cemented tungsten carbide as a material for bearings is about five times more abrasion-resistant than ordinary drill-rod bearings.

The productive life of steel core rods has been increased 12 to 27 times by flame-plating, a method of applying tungsten carbide to metal parts. The deposit is from 0.0005 to 0.20 inches thick, and the process can be used for making wear-resistant parts of all types of steel, cast iron, aluminum, copper, brass, bronze, titanium and magnesium.

TUNGSTEN PUSHES BACK THE HEAT BARRIER

Without tungsten, aviation in the fullest commercial sense could not continue to set ever-faster speed records. For the problem today is not the sound barrier, which has been cracked time and again. The problem is the heat barrier. Scientists feverishly search for new alloy combinations with ever greater heat resistance. They are experimenting with ceramics, but tungsten continues to be the best material. A new ailment, "metal fatigue," causes many accidents in this age of supersonic flight. Research may prove that a greater proportion of tungsten in metal alloy or an expanded use of the hard and heat resistant element may be the preventive of this fatigue, the cause of many a sudden and shocking disaster.



In the fields of ground transportation heat-resistant metals become increasingly vital to progress.

Gas turbine engines with a throttle temperature of 1500° Fahrenheit, and in which the shaft rotates at 25,000 RPM, may revolutionize that field of industrial effort. Such engines would be impossible were it not for tungsten's unequalled heat-resistant qualities. Several leading automobile companies are experimenting in this field of motive power and fuel economy.

TUNGSTEN'S VERSATILITY

The end item you enjoy because of this versatile and fabulous metal may vary to unbelievable degrees. In all ranges of activity, from the fisherman's rod and reel equipped now with tungsten eyes instead of those formerly made with synthetic jewels, to the glamorous gowns of the couturière or the sturdy blue jeans of the working man, tungsten has a place. It is easy to think of tungsten in a fisherman's rod and reel, but who ever would associate tungsten with textiles? It is found both in manufacturing processes and in textile chemistry.

The use of tungsten alloy steel wire for high-speed automatic looms reduces the wear of certain machine parts to almost nothing, with a resultant saving in replacement and release of manpower. Tungsten chemicals are used in dyes; some of the most beautiful colors are derived from this fascinating, versatile metal.

The use of tungsten bobs up in thousands of different ways. No other metal produced in such comparatively small quantities has the industrial importance of tungsten; nor has any other metal had such influence upon the comfort of people at large.

Fabulous in its range of versatility and the scope of its international influence, tungsten is the source, too, of stories of bold adventure, business acumen and extraordinary strokes of good luck.

China's vast and rich tungsten deposits were discovered in 1911 by K. C. Li, a young man recently graduated from the Royal School of Mines in London, who was exploring for tin. His curiosity concerning a crudely constructed cook stove, homemade of hard black stone and seemingly impervious to heat, led him to the nearby rich outcropping of wolframite, not long before the Germans discovered its strategic value.

DISCOVERY IN U.S.A.

California, where the discovery of gold once lured 100,000 prospectors in two short years, was also the state in which tungsten was first discovered in this country. And that was due to the scheelite problem in gold recovery. Since the original California discovery in 1904, the Atolia Mines, in San Bernardino County, have been as a group one of the largest, as well as the first, of the major domestic tungsten producers. Other early discoveries of tungsten were in Colorado.

Then, in 1917, major tungsten deposits were found near Mill City, Nevada. This was due to the long memory of a prospector who, upon learning that the government was much interested in a heavy white mineral, recalled such a specimen he had once collected along the "Old Emigrant Trail" on the slope of the Eugene Mountains. Identified as scheelite, a rush to the Nevada site followed, and many mining claims were filed.

Until 1942 nearly all domestic tungsten mining was confined to the Western states. In that year tungsten ore was discovered in Vance County, North Carolina, on the long ago homestead site of Jefferson Davis' grandfather. It was the richest mineral strike in the history of the state and one of the rare finds east of the Rockies. The depth of the deposit apparently has no ending. It is one of the world's great mines. And today this operation is working through two shafts, 1600 feet deep and 4000 feet apart.

TYPES OF TUNGSTEN ORE

Tungsten ore in North Carolina is mainly hubnerite. In California, as in Nevada, it is scheelite, a fascinating story in itself. The scheelite crystals mixed with quartz, garnet, epidote, calcite, and pyrite, sometimes are too fine to see with the naked eye. Something like detective work, occasionally, is needed to find the scheelite. The brown of the garnet and the green of the epidote supply clues. But to locate the scheelite, you must work in the dark, with "black light," the invisible light of ultra-violet rays. For even the smallest grains of scheelite present on a freshly broken ore face will glow like a feebly lighted filament when illuminated in darkness with "black light." Such an examination will indicate not only the limits of the ore body, but will enable an experienced man to judge the quality as well.

One of the fascinations of tungsten mining is that one can never tell the extent of the deposits. In the early days at Mill City, Nevada, an expert predicted that the ore would be exhausted at the most at a depth of 50 feet. Shafts are now down more than 1800 feet, and ore is still being recovered, with no signs of diminishing. Few areas in the free world contain as large showings of tungsten ore as this mining district.

DOMESTIC TUNGSTEN MINES

The United States is fortunate in having within its boundaries an efficient tungsten mining industry and courageous men willing to invest brave money to keep it so. Tungsten mines are operating in North Carolina, California, Nevada, Idaho, Utah, Colorado, Washington, Wyoming, Montana, Arizona, and other Western states.

But despite some large tungsten deposits, the domestic tungsten mining industry is faced with problems of economic instability. Unless these are solved, the future of our country may be at stake.

In the final analysis, mining of tungsten is just like mining any other metal. It is costly to close a mining operation, and a producer never does so voluntarily. Once a mine is closed down for lack of market, two years or more may be necessary to restore it to normal production levels. Workers drift away to other jobs, water seeps in and fills the workings, the wooden shoring that keeps deep-down tunnels open rots away, and tunnels and shafts cave in. It is costly to keep in repair a non-producing mine, and it is time-taking if not impossible to reopen one.

In case of national emergency, two years' delay in tungsten production may mean the difference between survival of the United States or abject defeat at the hands of an enemy.

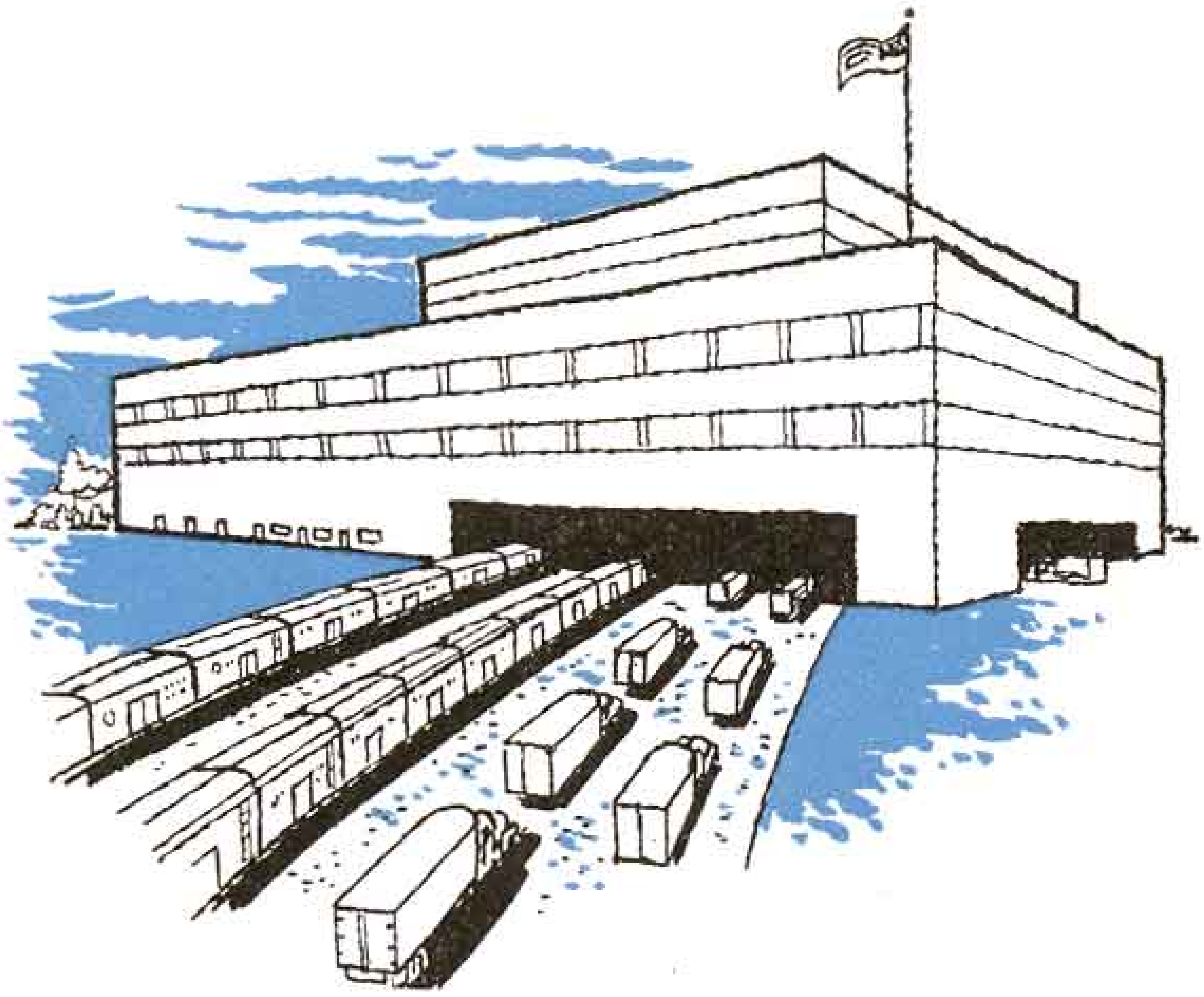
Tungsten, with indispensable qualities in the age of speed and heat, has always been a stepchild in the world market because it is produced by so many companies in so many countries. Yet in times of need, the United States could not depend on those foreign producers.

The amount of tungsten ore now produced in the United

States seems to meet current industrial consumption. But demand for the vital metal is on the increase, and the complex politics of our friends and enemies must be kept in mind.

STOCKPILING FOR NATIONAL SECURITY

So we must maintain our stockpile of this strategic metal. In stockpile form, it cannot deteriorate. It is indestructible. And above ground there is no guess-work about supply.



Today, all domestically produced tungsten is bought by the government for stockpiling. Without the government's purchase program extended by Public Law 206, passed by Congress in 1953, the domestic industry would have no market for its production, and the mines would close down.

And the tungsten mining industry of the United States needs other protection, tariff-wise. The domestic industry cannot compete, economically, with imported tungsten ore produced at much lower labor and other costs and brought into this country under a tariff that is too low.

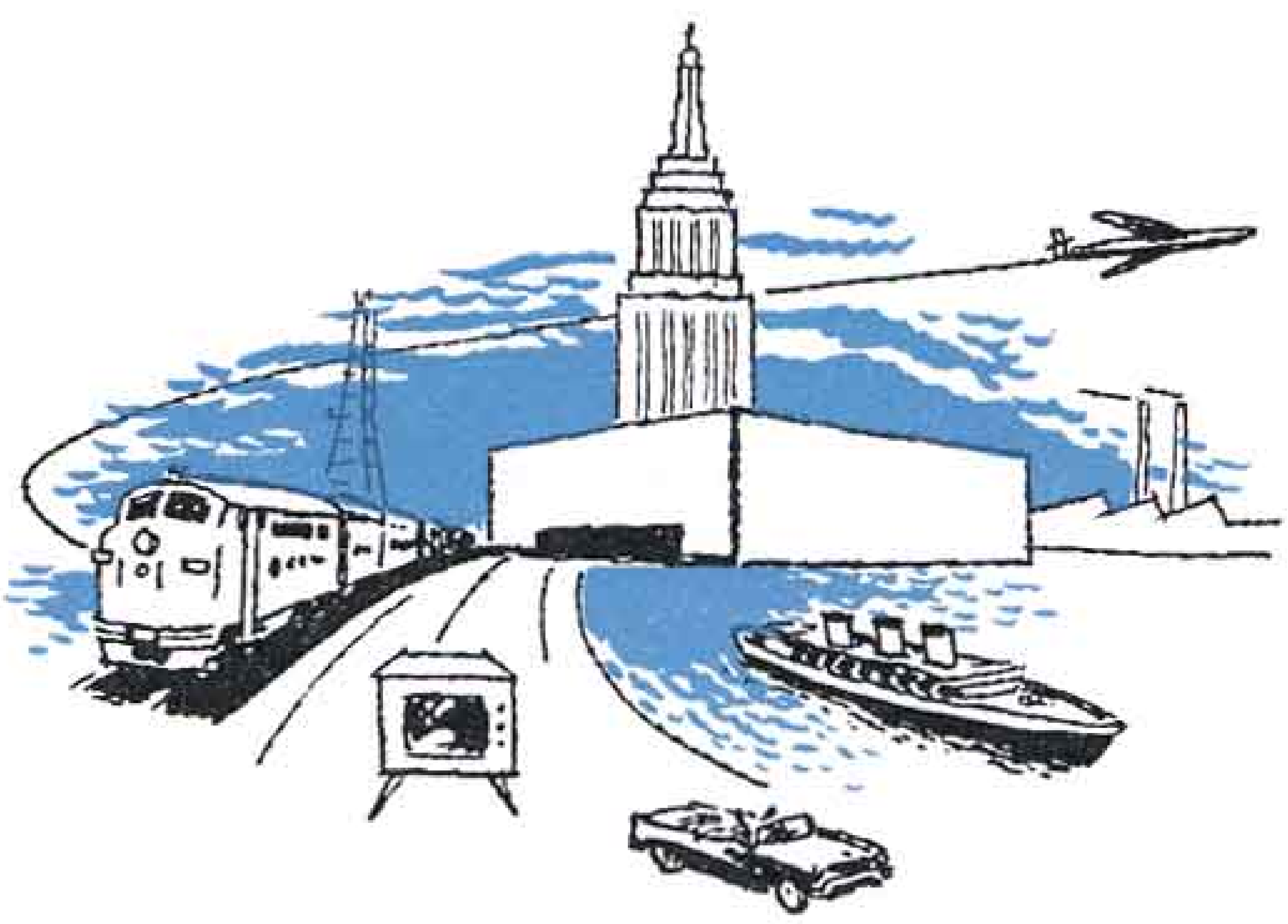
INDISPENSABLE IN AMERICAN INDUSTRY

This country's tungsten mining industry is a strategic necessity in military planning. But the comforts and luxuries that are part of the American pattern of everyday peacetime living are tungsten-born, too. It is a vital component that has made American industry the most efficient in the world, American working and living standards the best in the world.

Scientists, government, and businessmen unite today in efforts to give the free world peacetime benefits of atomic energy.

That, too, should be the goal for tungsten — for its peacetime everyday uses bring pleasures and comfort to millions of people in greater measure by far than fear of its wartime destructive power. Tungsten, if stripped of its military role, would still remain irreplaceable in our lives every day.

Tungsten metallurgy is still in its infancy; there is no way to estimate how great our needs for it may be.



Gold, the precious metal, throughout history has remained the symbol of financial security. But in the saga of the other indispensable metals, including silver, copper, manganese, platinum, and the new metals with lyrical names such as vanadium, titanium, germanium, molybdenum, aluminum, magnesium, and beryllium, there is none more important to America in terms of peacetime progress and national security than that strange and wonderfully versatile metal — TUNGSTEN.

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Information in this book has been gathered from a number of sources including:

Tungsten, by K. C. Li and Chung Yu Wang

Bureau of Mines, Bulletin 556 by Robert W. Geehan

Accessibility of Strategic and Critical Materials to the U. S. in Time of War and for our Expanding Economy, a Report of the Minerals, Materials, and Fuels Economic SubCommittee of the Committee on Interior and Insular Affairs — 83rd Congress

Tungsten publications of the American Tungsten Association

Saving Scarce Materials, Anglo-American Council on Productivity

Metals and Alloys of the Future, by Zay Jeffries and others.

First Printing 1955

Extra copies of this book and additional information on Tungsten may be had from
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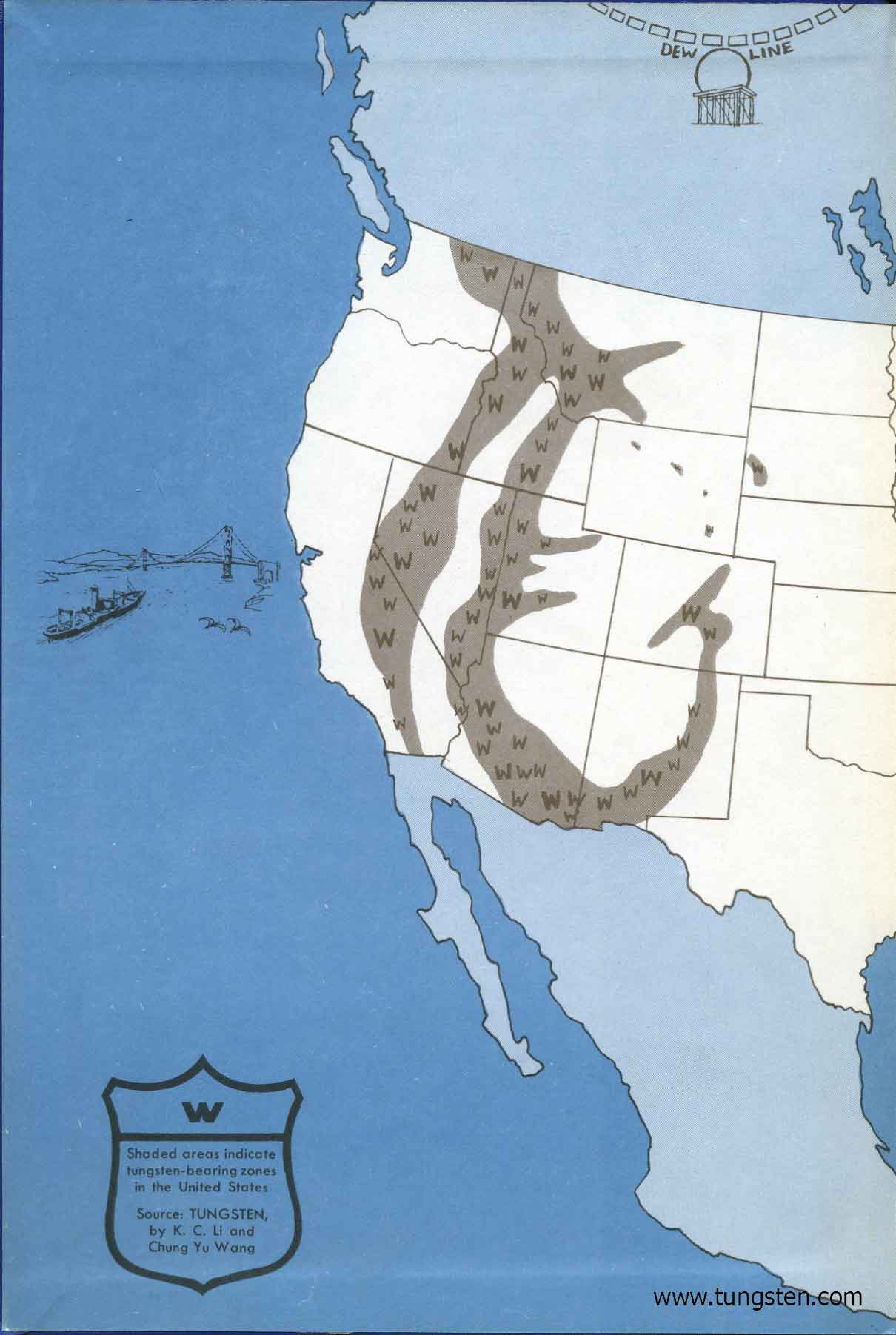
DEW LINE
W
Shaded areas indicate tungsten-bearing zones in the United States
Source: TUNGSTEN, by K. C. Li and Chung Yu Wang


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