

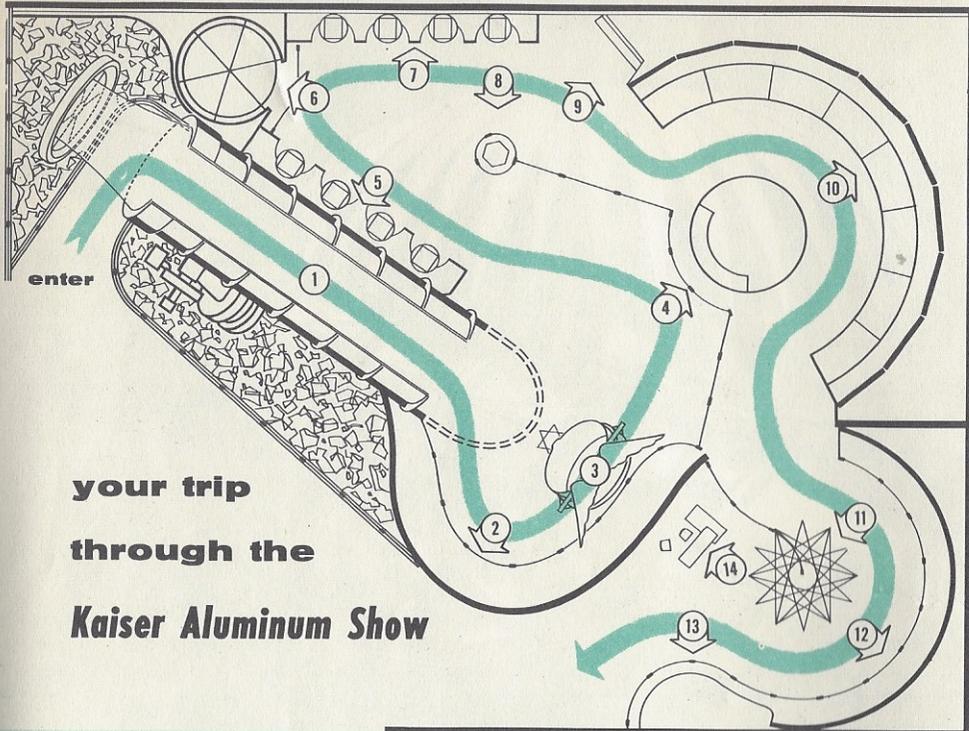
AT  Disney[®]land

the Story of Aluminum

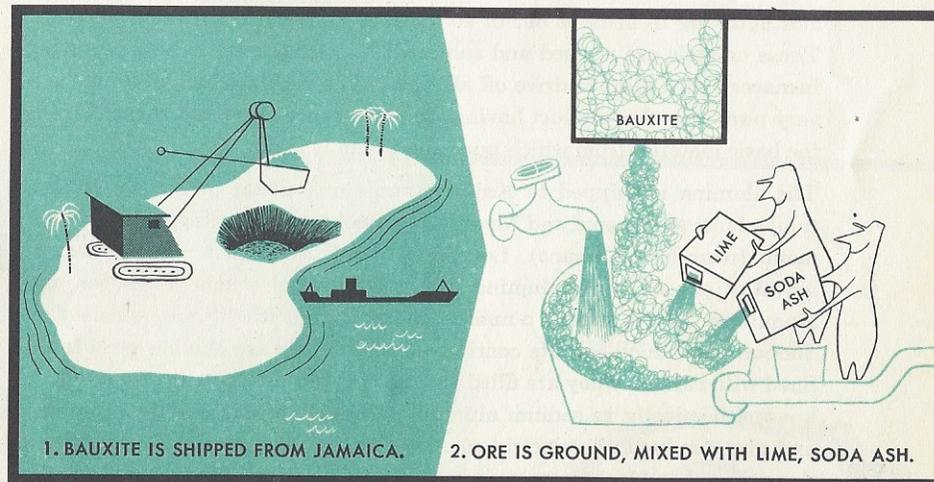
how
aluminum
is made

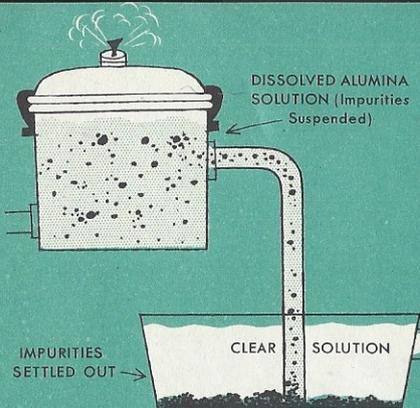
Aluminum is everywhere; it is the world's most abundant metal. A handful of practically any dirt will contain some aluminum, but separating it in pure form is not so simple. Just as with most metals, it is necessary to find an "ore" from which it can be extracted profitably; in this case, the only practical source has been the impure hydrated aluminum oxide known as bauxite. U.S. producers of aluminum use bauxite found in Arkansas, Dutch Guiana, and Jamaica. Kaiser Aluminum has large deposits on the island of Jamaica where the reddish ore is scooped up by mechanical shovels working in open pit mines.

your trip
through the
Kaiser Aluminum Show

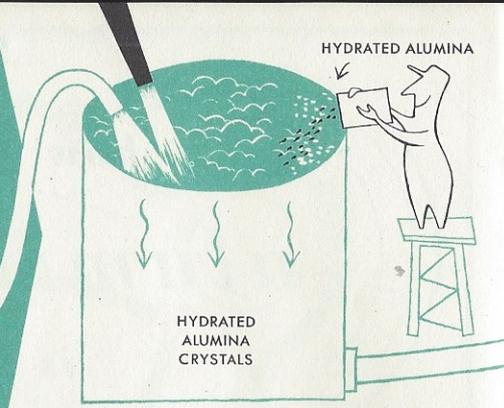


- 1** Forty-foot telescope of polished aluminum. The entrance to your trip through the world of aluminum — past, present and future.
- 2** Futuristic, free-form mural tells story of aluminum: bauxite mining, alumina conversion, electrolytic cells, pouring of pig aluminum.
- 3** Fanciful replica of crucible pouring molten metal into star which represents "Aluminum—the Brightest Star in the World of Metals."
- 4** Huge aluminum time sphere with ancient knight, today's firefighter and spaceman of the future telling of advantages of aluminum.
- 5** Historical highlights of aluminum's discovery, development, early uses. Its value to mankind today is a credit to early scientists.
- 6** Revolving stage exhibits and demonstrates six basic aluminum forms — cast, rolled, extruded, drawn, forged and powdered.
- 7** Highly unique abstract statues present 16 examples of different methods of fabricating aluminum into products for better living.
- 8** Kap, Kaiser Aluminum Pig, is your host as you visit the panorama of properties of aluminum. Put him through his paces for aluminum-fun.
- 9** Versatile, useful aluminum also has advantage of offering more for your money. A 3-D chart compares its price with other materials.
- 10** You and Kap Pig put aluminum on its mettle in a series of tests and demonstrations of the advantageous properties of this wonder metal.
- 11** Eight-foot star surrounding Venus, classic symbol of beauty, reflects beauty of aluminum for utilitarian and decorative uses.
- 12** Typical uses of aluminum "at work, at play, at home and away" shown in modern mural. Magic blacklight reveals future applications.
- 13** "The Product of Tomorrow" shows items now under development that offer great promise of better living with aluminum in the future.
- 14** Information desk. The attendant will gladly answer questions about Kaiser Aluminum and "The Brightest Star in the World of Metals."

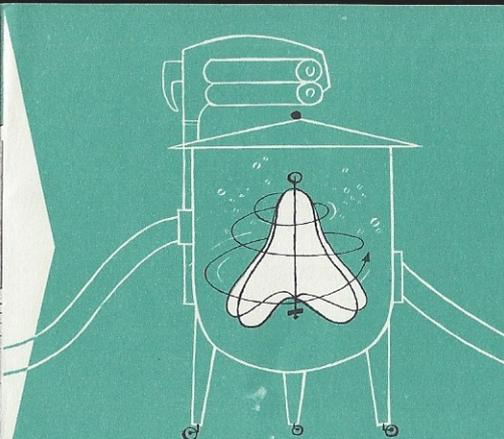




3. DIGESTERS DISSOLVE ALUMINA UNDER PRESSURE.



4. CRYSTALS FORM IN HUGE PRECIPITATION TANKS.



5. WASHING REMOVES IMPURITIES FROM CRYSTALS.



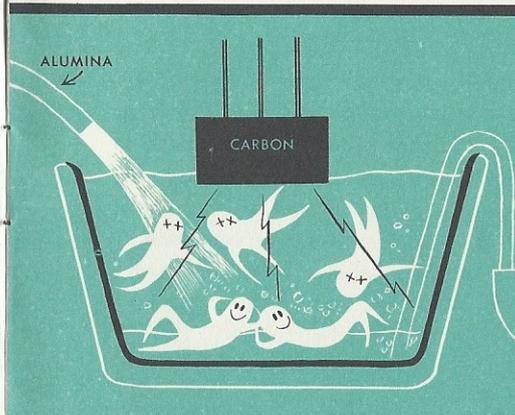
6. ROTARY KILNS DRIVE OFF WATER CONTENT.

But mining bauxite is only the first step in producing aluminum. The impure ore must first be converted into pure aluminum oxide, alumina. Kaiser Aluminum's chemical plant at Baton Rouge, Louisiana, does just that by treatment in a series of chemical processes. The bauxite, shipped in 10,000-ton ships from Jamaica, is unloaded at Baton Rouge. It is crushed, added to a caustic soda (lye) solution, and heated under steam pressure to dissolve the alumina. The impurities, which do not dissolve, are separated from the alumina solution by settling and filtration and the alumina recovered by cooling and agitating to bring it out of solution as crystals of hydrated alumina. These crystals are washed and subjected to intense heat in long revolving furnaces called kilns to drive off all water. The final product, alumina, is a very pure granular product having the appearance of refined sugar. This is the basic material from which pure aluminum is made.

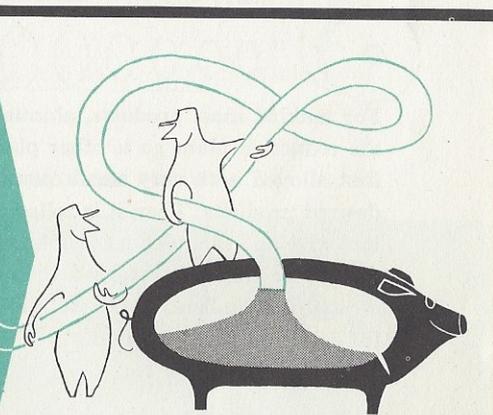
The alumina is shipped to Kaiser Aluminum's metal producing (reduction) plants at Tacoma and Mead (near Spokane), Washington, and Chalmette (near New Orleans), Louisiana. Metal production requires the removal of oxygen, since alumina contains an equal weight of oxygen and aluminum. This is done in a number of electric smelting furnaces called reduction pots which operate continuously. The pots are shallow steel tanks lined with carbon. They are filled with molten cryolite, a salt-like substance known chemically as sodium aluminum fluoride, which dissolves alumina and also conducts the electric current. The electric current is introduced through carbon blocks immersed in the molten cryolite. Under the influence

of electric energy, the oxygen combines with the carbon, leaving pure aluminum. The molten aluminum is deposited at the bottom of the pot from which it is periodically siphoned off and poured into molds to solidify and form "pigs".

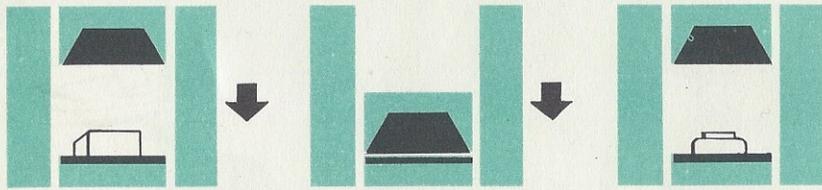
To make one pound of aluminum requires two pounds of alumina (obtained from four pounds of bauxite), 0.6 pounds of carbon, small amounts of cryolite and other materials, and approximately 9 kilowatt hours of electricity. At full capacity, the Kaiser Aluminum reduction plants produce 816,000,000 pounds of aluminum per year.



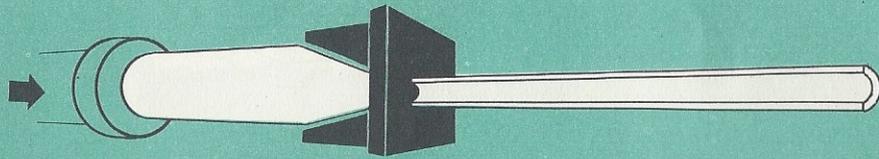
7. ELECTRICITY FREES ALUMINUM ATOMS.



8. METALLIC ALUMINUM IS Poured INTO PIGS.



FOR EXTRA STRENGTH, ALUMINUM IS FORGED.

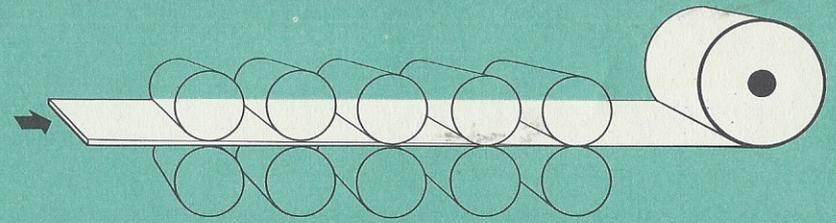


TREMENDOUS PRESSURE IS USED IN EXTRUDING SHAPES.

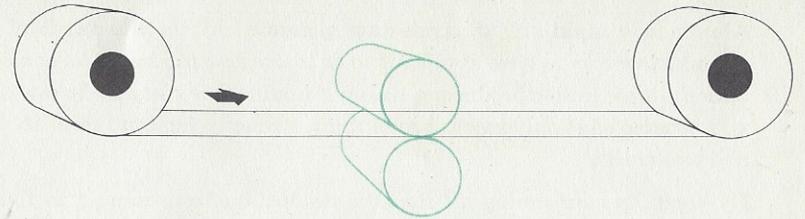
aluminum mill products

for nation's fabricators

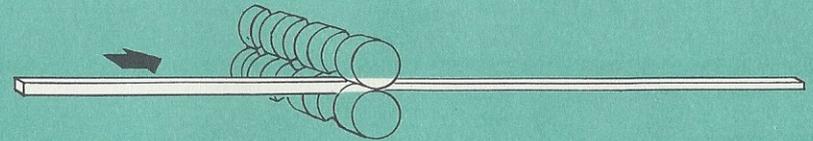
For making most products, aluminum is not used in pig form. Pig from the reduction plant goes to other plants for further processing. The metal is first alloyed with very small quantities of other metals to obtain specific, desired products. Then it is rolled into sheet, plate, foil, rod or bar; drawn into wire and stranded into cable, made into castings, extruded into various shapes or tubing, or forged into light, strong pieces of equipment and structural members. These mill products in turn are manufactured into useful articles, large and small, by a host of fabricating companies.



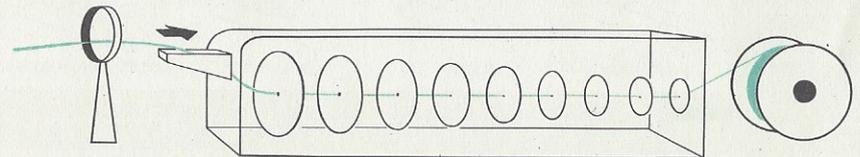
POWERFUL ROLLING MILL PRODUCES SHEET AND PLATE.



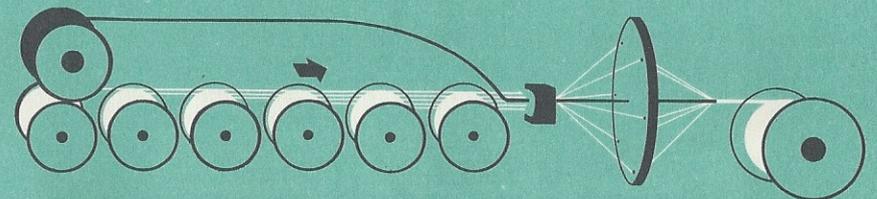
PRECISION MILLS ROLL SHEET INTO ULTRA-THIN FOIL.



BLOOM IS ROLLED INTO ROD AND BAR.



ROD IS DRAWN THROUGH SERIES OF DIES INTO WIRE.

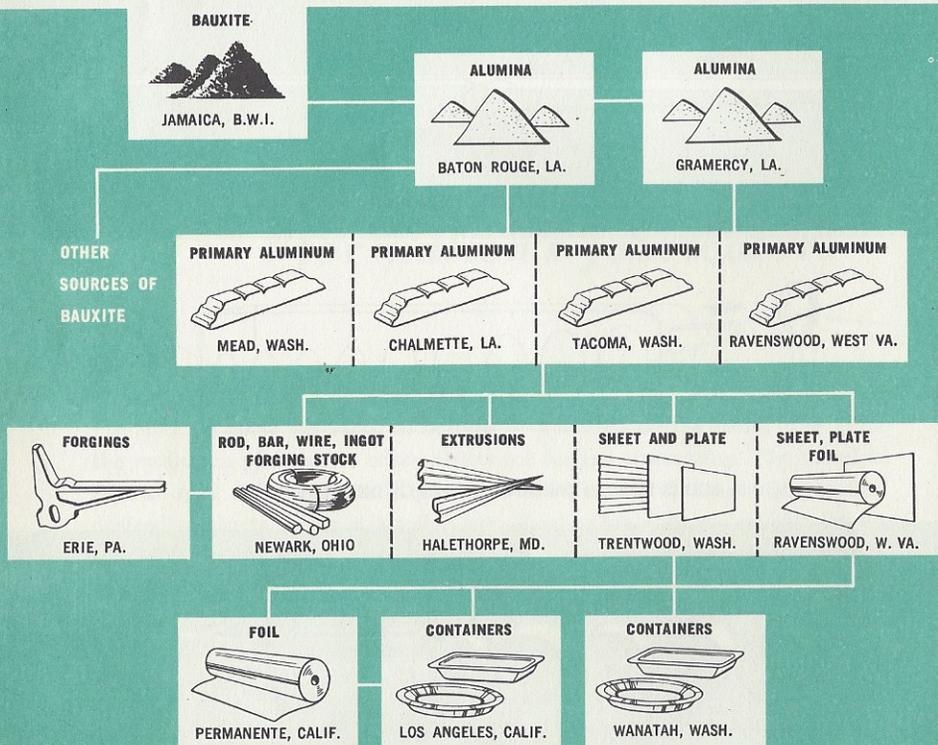


STRANDING MACHINE FORMS ELECTRICAL CONDUCTOR.

an integrated industry meets growing demand

Aluminum's rapid growth strides are generated by the thousands of U.S. manufacturers who have applied it to as many new products. As one of the nation's three major producers, Kaiser Aluminum is completely integrated and capable of supplying the metal in all its many forms to meet their individual needs.

By carefully performing all steps of production from mining to finished mill product, Kaiser Aluminum assures the fabricator and millions of consumers a better, more economical product. Through private financing it has built up an extensive integrated chain of operations, as shown below:



development of a plentiful, economical metal

Though it is the most plentiful metallic element in the crust of the earth, aluminum defied discovery until the 19th century. The reason is that it is found only in combination with other elements, and not as a metal.

First to obtain tiny quantities of aluminum was Hans Christian Oersted, Danish scientist, who in 1825 treated alumina (aluminum oxide) chemically. Later Frederick Wohler, a German, produced some pellets of aluminum. But as late as 1852 aluminum was as rare as a jewel and commanded a jewel's price, \$545 a pound.

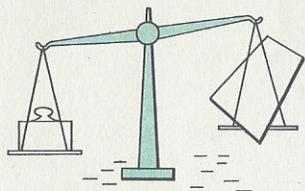
Then Henri St. Claire Deville, French chemist, developed an improved process that won the interest of Emperor Napoleon III, who sensed the military advantages of this light metal. By 1859 the price dropped to \$17 a pound and production rose to two tons, but aluminum was still too scarce and costly to be used in anything but novelties and jewelry. One of the first aluminum articles made was a baby's rattle.

Scientists kept trying to find a cheap, easy way to produce aluminum but without success. Then in 1886 an amazing thing happened. Almost simultaneously Charles Martin Hall, an American, and Paul Héroult, a Frenchman, discovered the electrolytic process for producing aluminum—the same basic method used in modern aluminum plants. Each was only 22 years old. Almost overnight it became possible to produce aluminum cheaply. In 1890 the cost was \$5 a pound; by 1900 it was 33 cents. Today aluminum is one of the most economical of metals, produced in rapidly mounting quantities to fill thousands of uses.

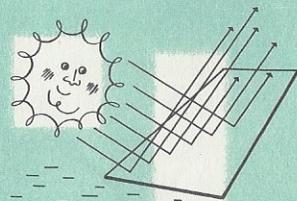
advantages

and characteristics

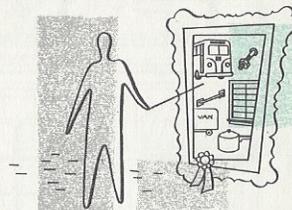
Whether it is used singly or in various combinations, aluminum possesses advantages and characteristics which benefit both consumers and manufacturers by making it possible to produce better products at economical cost.



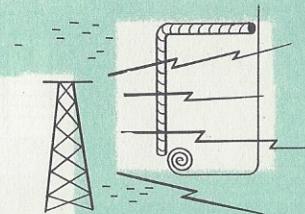
LIGHTNESS



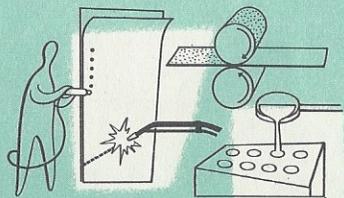
REFLECTIVITY



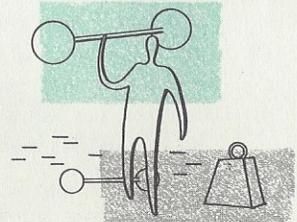
APPEARANCE



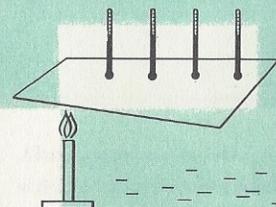
ELECTRICAL CONDUCTIVITY



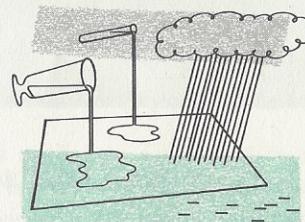
WORKABILITY



STRENGTH



HEAT CONDUCTIVITY



CORROSION RESISTANCE

LIGHTNESS. One third the weight of steel or copper . . . Aluminum articles more easily handled, transported.

WORKABILITY. Easily formed, fabricated and joined by all commonly-used methods . . . And the cost is frequently lower, too.

REFLECTIVITY. Good reflector of light and radiant energy . . . Useful for insulation, light fixtures.

STRENGTH. Some alloys stronger than structural steel . . . A big advantage when combined with aluminum's natural lightness.

HEAT CONDUCTIVITY. Conducts heat rapidly and evenly . . . Superior to other metals . . . A natural for cooking utensils, heat exchangers or where heat dispersal is an important factor.

OTHER QUALITIES. Aluminum is non-magnetic, non-sparking and non-toxic . . . properties which are valuable for a number of purposes.

ELECTRICAL CONDUCTIVITY. Aluminum first choice for power lines . . . Has superior conductivity on basis of weight when compared with copper.

APPEARANCE. Naturally pleasing . . . Left untreated, weathers to a soft gray . . . Readily takes finishes, including rich color, for almost any effect.

CORROSION RESISTANCE. No unsightly rust . . . Forms non-progressive protective coating, resisting corrosive attack . . . Especially durable for marine, chemical applications.

ROOFING
 TV ANTENNA
 ELECTRIC SERVICE LINES
 GUTTERS
 DOWNSPOUTS
 FLASHING
 DUCTWORK
 WINDOWS
 GARAGE DOOR
 SIDING
 SCREENS
 BUILDER'S HARDWARE
 NAILS



INSULATION
 PORCH RAILING
 FURNITURE
 TOYS
 POTS AND PANS
 APPLIANCES
 VENETIAN BLINDS
 AWNINGS
 HOUSEHOLD FOIL
 CABINETS
 LAMPS
 HEATER
 AND MANY OTHER ITEMS

you live with aluminum

We couldn't have this modern world of ours without aluminum. For one thing, this wouldn't be the air age. Though the airplane is perhaps the most spectacular use of aluminum, this light, strong, gleaming metal is essential to modern life in many other ways.

A list of aluminum's uses would more than fill the pages of this booklet and still be incomplete, because new uses are being discovered almost daily. Why? The reason is simple: aluminum is plentiful and inexpensive, and possesses the uniquely useful combination of advantages and characteristics which were discussed on the previous two pages.

Aluminum makes the idea that weight is needed in a material to get strength as outdated as the hoop skirt. That is one reason why aluminum is needed to build the big, fast modern airplanes; why it is used for the upper deck structures of great ocean liners, for containers, bridges, truck and trailer bodies and frames. And you don't have to strain your back to move the modern aluminum stepladder or wheel the aluminum wheelbarrow.

The corrosion resistance of aluminum, the fact that it is not subject to red rust, is extremely beneficial in home and other building applications. Roofing, siding, gutters and downspouts, windows, awnings, screen and nails made of aluminum never cause ugly brown streaks, cannot rot and do not have to be painted for protection.

In addition, the light metal's high reflectivity to radiant heat means that many aluminum products used in buildings provide cooler interiors in



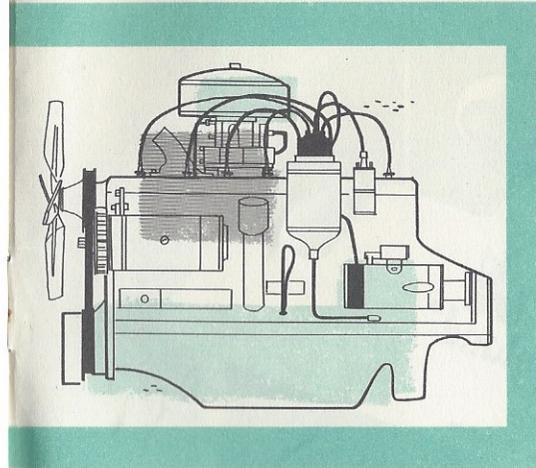
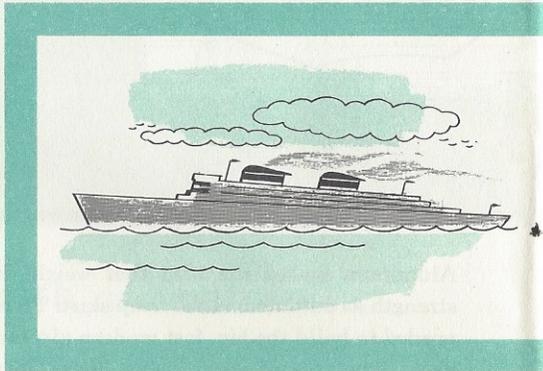
summer heat by turning back the sun's baking rays. In the same way this reflectivity contributes to living comfort inside the home in radiant heater reflectors, in air conditioning ductwork and in foil insulation.

One of the first common uses of aluminum—and still one of the best and most popular—was for pots and pans for cooking. The reason is that aluminum is a good conductor of heat; heat from the stove burner spreads quickly and evenly throughout the utensil. An aluminum pot is good-looking too, and easily cleaned; because of its purity aluminum does not transfer any off-tastes to food.

Various parts of your stove (like the griddle), washer (lid and agitator), electric iron (sole plate and housing), refrigerator or freezer (ice trays, evaporators, shelves) and other appliances are made of aluminum. In some cases the metal is chosen because it conducts heat; in others because of its ability to take a beautiful finish, as in trays, bowls and colored tumblers, in trim and hardware such as door knobs and locks, in furniture. In all because it is light and strong.

Aluminum household foil is a favorite with home-makers. It is handy for wrapping foods, for bowl covers, for baking potatoes, for many other convenient uses. In heavier gauges foil is ideal for use in your home freezer or locker, or in lining your broiler pan.

The electricity you use travels a good part of its way from the power plant through aluminum wire and cable. Aluminum wire, protected with weather-



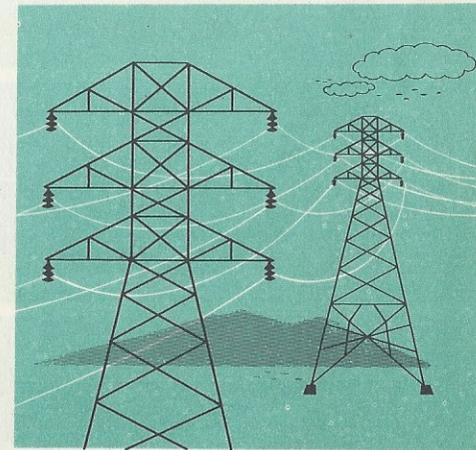
proof or insulated coverings, is used in distribution services and the lines that bring electricity from the pole to your home.

Farm uses of aluminum are growing more important—corrugated aluminum for better barns and other buildings, aluminum equipment for various uses and lightweight aluminum pipe for efficient portable irrigation. More and more aluminum is being used in automobiles in such items as pistons, cylinder heads,

automatic transmission parts, clutch housing, fuel pumps, battery trays, trim and moldings, wiring and brake components. Aluminum plays a part as well in equipment for recreation and sports, such as trailer coaches, boats, outboard motors, lamps, flashlights, stoves.

Besides all these every-day uses, there are many industrial applications such as processing and handling equipment. Aluminum is essential to our national defense, not only for building fighter planes and bombers but also for countless other items, from PT boats to guided missiles to the soldier's cooking and eating equipment.

Of prime importance in the growing demand for aluminum is the fact that it is easy to work with by almost every known method. What is most certain is that many new applications will be developed in the future: the story of aluminum's benefits to our civilization is really just beginning to unfold.



Kaiser Aluminum

Works its wonders in

Disneyland®

Kaiser Aluminum & Chemical Corporation, Oakland, California

