November 1940

TECHNOLOGY REVIEW

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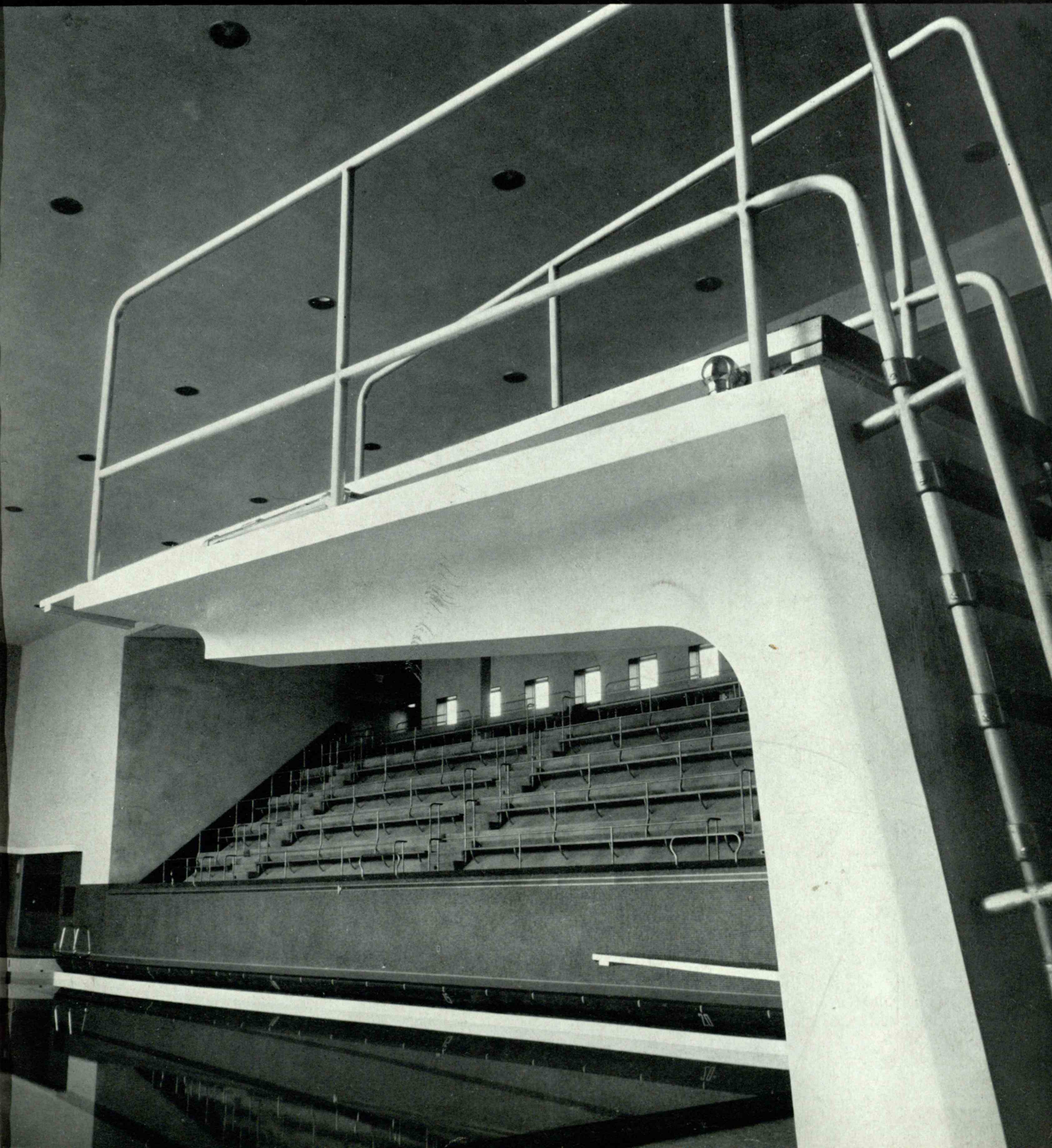

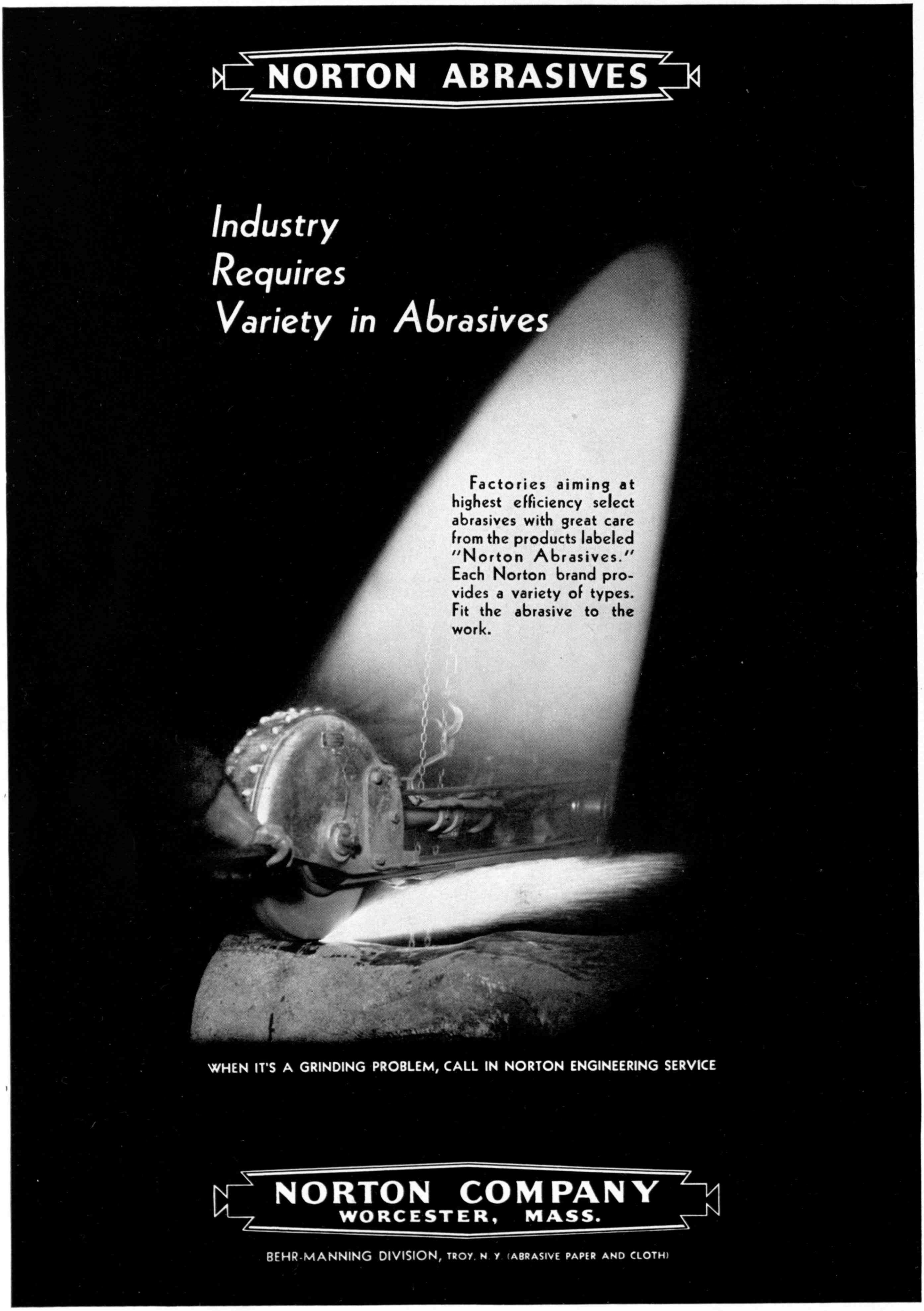

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THE TABULAR VIEW

Plunge. — Entering upon a new year and a new volume, The Review this month appropriately wears on its cover a photograph of the cantilevered diving tower which is one of the many admired features of the Alumni Pool, available to students this fall through the co-operation of Alumni with Technology.

Pointer. — The contents of The Review, beginning with this issue, are to be indexed each month in the "Industrial Arts Index," familiar to users of libraries. The Review's own annual index will appear as usual at the close of Volume 43 next summer. Copies of the index to Volume 42 may be had on request.

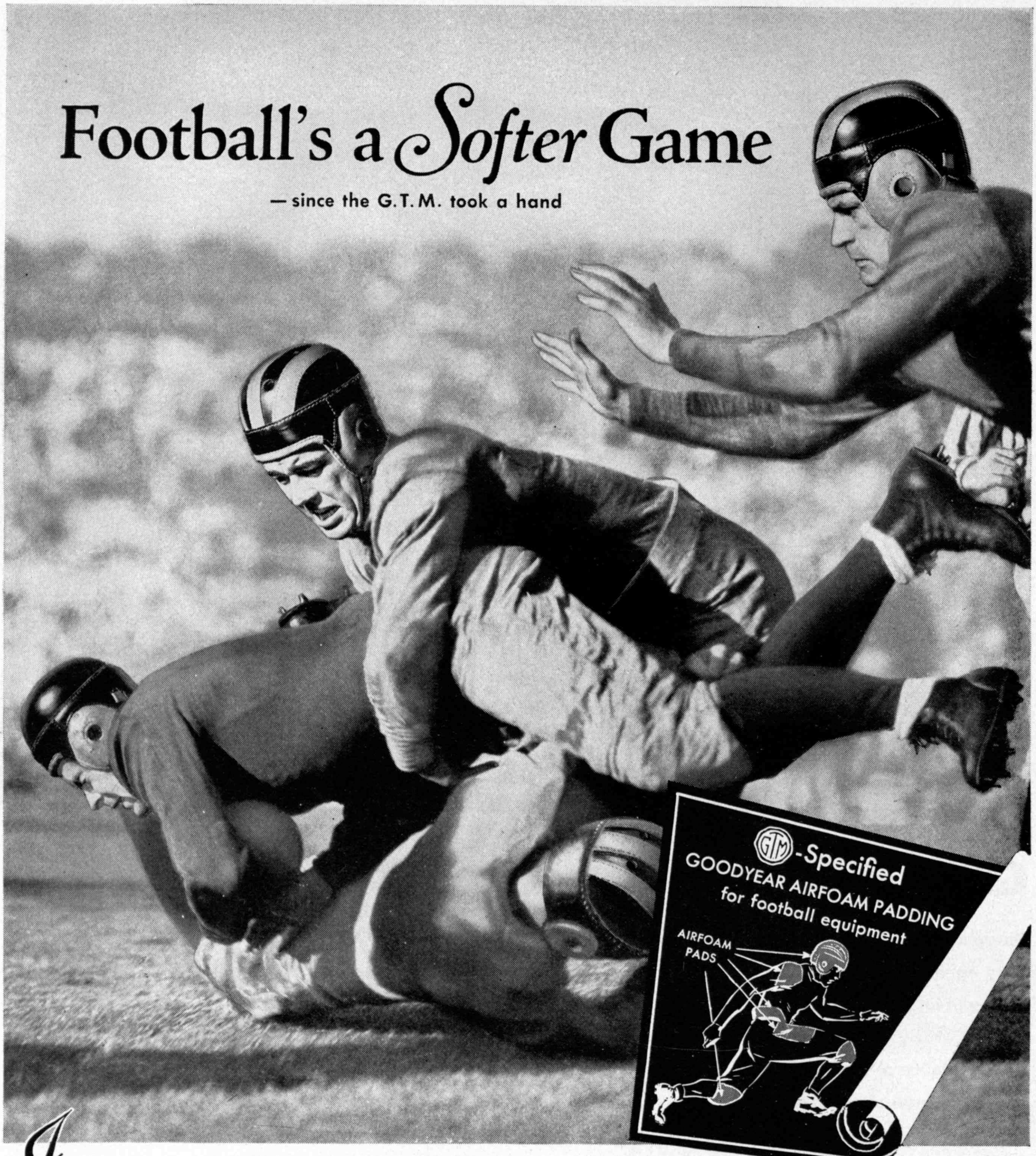
Horizontal Man. — What is the real task which an architect undertakes when he traps a chunk of infinity for other men to use? Answers to this question are as diverse, naturally, as men's minds; few would be recognized, however, as possessing greater authority than that made on page 14 by ALVAR AALTO, the distinguished Finnish architect who this fall joined the Institute staff as research professor in architecture. Professor Aalto has earlier expressed in noted buildings the humanistic ideas of construction which he discusses in this issue of The Review.

Height-to-Paper. — That invention is usually the result of a cumulative process requires little argument. It is supported by consideration of the technological background of Johannes Gutenberg's invention, five centuries ago, of printing with movable types, described for The Review (page 17) by DOUGLAS C. MCMURTRIE, '10. Typophile and author, Mr. McMurtrie is director of typography for the Ludlow Typograph Company and chairman of the invention of printing anniversary committee of the International Association of Printing House Craftsmen.

Fortified Flour. — In war, food for soldier and civilian alike offers special problems, to the discussion of which (page 20) JAMES A. TOBEY, '15, brings specialized knowledge. He is director of nutrition of the American Institute of Baking and lieutenant colonel in the Sanitary Corps Reserve, United States Army. Lecturer in public health law at the Institute, from which he received the doctorate of public health in 1927, and at the Harvard University School of Public Health, Dr. Tobey is author of a number of books and is a frequent contributor to magazines.

Louder. — Acoustically speaking, some auditoriums were never meant for speaking. Why, is a matter of reverberation time, absorption, and other physical questions, ably explained (page 22) by PHILIP M. MORSE, Professor of Physics at Technology, student of acoustics, Editorial Associate of, and among the most stimulating contributors to, The Review.

Write Right. — A reasonably frequent diversion of all who have to do with writing for print is arguing about how to do so. The Review Editors are no exception; out of a fairly harmonious symposium they settled lately on a few conclusions (page 24).



In this fall's gridiron wars many players will be safeguarded from bruising, bone-breaking impacts by a new kind of football armor devised by the G. T. M.—Goodyear Technical Man. It is padded with Airfoam, Goodyear's amazing new latex cushioning that makes modern furniture and automobile seats so gloriously comfortable. Molded into helmet, hip and shoulder pads, Airfoam softens the hardest block with a resiliency unknown in stiff conventional harness. And its porous, self-ventilating, featherweight structure makes Airfoam-padded gear cooler, lighter, less wearing on the boys. First adopted by a leading midwest university last year, Airfoam quickly proved its superior advantages in protecting tackler as well as tacklee. Elsewhere, too, Airfoam is being specified by the G. T. M. with great success — in invalid equipment, seed-sorting machines and other novel uses demanding exceptional cushion.

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Fall

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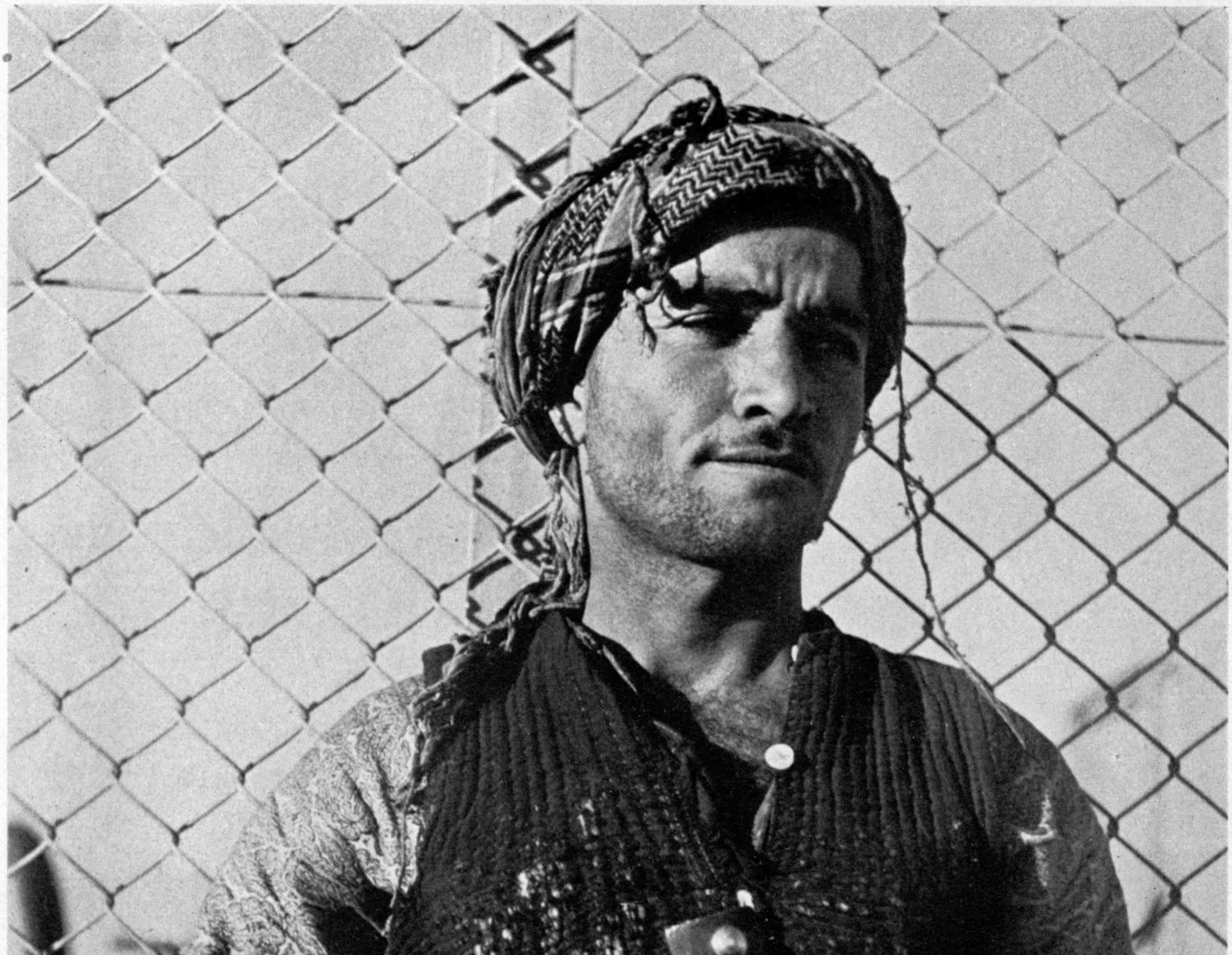


© Rene W. P. Leonhardt

As the war in Europe trends eastward, the contrasts enforced by industrial and economic needs of the Western civilization are highlighted. This Kurdish tribesman in traditional dress is on guard duty before a modern woven-wire fence at an oil well in Iraq.

THE TECHNOLOGY REVIEW

Vol. 43, No. 1 November, 1940

The Trend of Affairs

Pattern for Tomorrow

IF there is one continuous and tightly woven thread in the tapestry of history, it is that war brings fundamental changes — political, economic, technical — in everything its bloody finger touches. Modern warfare, with its emphasis on the destruction of industrial centers, the paralysis of a nation's nerve centers, the attempt to crush civilian morale through incessant bombing, holds implications which are revolutionary.

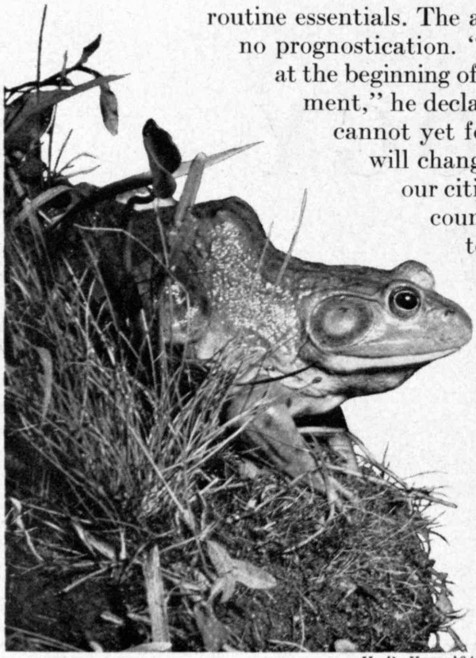
As The Review commented in an article in this section last January, one of the most compelling lessons which Europe's experience holds for us, or for any highly industrialized nation attacked by another power, is that the centralization which has been a keystone in building industrial efficiency must be replaced by decentralization, even though that may frequently entail considerable loss of efficiency. It is simply a case of a bird in the bush being worth two in the city. Efficiency must be sacrificed for safety, for continuity of production.

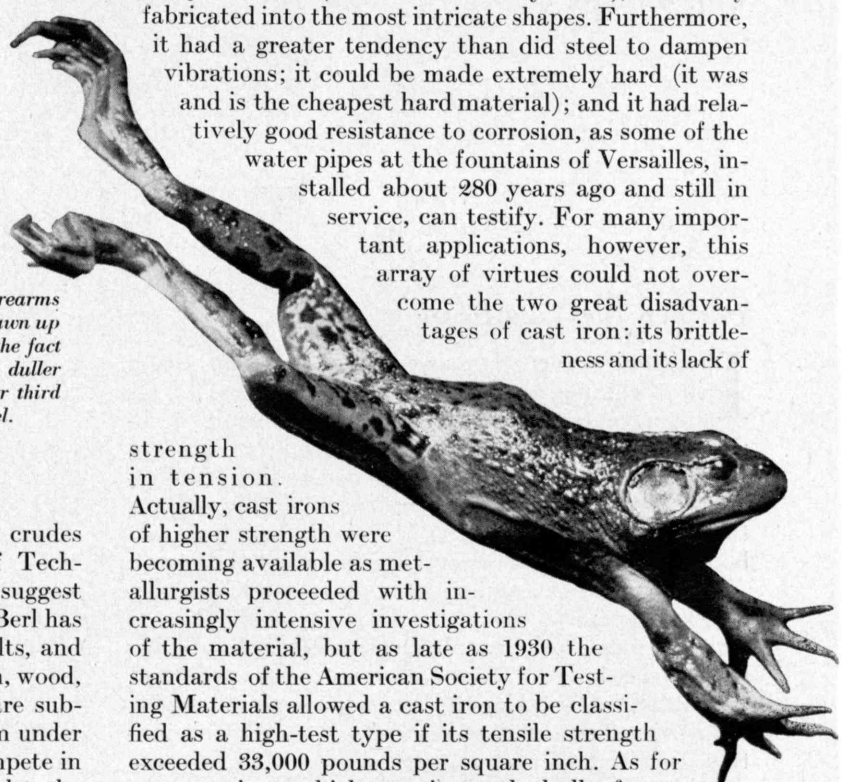
The problems to be considered in any mass dispersion of industry in this country — not only the removal of the physical plants themselves and their complete redesign but the problems of transport, employee migration, power, and a host of others — are obviously enormous. Bluntly, their solution calls for nothing short of a new epoch in city and regional planning, as well as new thinking on the part of architects. The latter must now consider not only form and beauty, efficiency and function, but also the legerdemain of camouflage and the strategy of concealment. The era of glass and light, of shining metal and geometrical precision and rich dark shadows, so young and so promising, must give way to that of drab daubs and leafy foliage. What figure industrial plants cut from the ground is not important; the important thing is what figure they do not cut from the air.

Just how vital this bird's-eye planning is in industrial design is the subject of a very practical article by Konrad F. Wittman in the *Architectural Record* for September. Widespread decentralization is imperative for reduction of risk. Planning for protection must, therefore, begin at the sites of plants. Railway junctions and highway crossings are important targets in war; hence they offer poor sites for factories despite the advantages of their proximity under normal conditions of operation. Plant security must be paramount. Powerhouses and water supplies must be far removed.

But there are definite postulates for the design of these scattered plants as well. There must be no narrow courts, no narrow streets, but ample open space between buildings. Considering the effects of explosions, the author shows that square buildings expose less wall surface in proportion to floor space; round buildings theoretically expose the least. Low buildings are preferable because they offer less resistance to air pressure than do buildings of many stories. In explosions, structural frames are less likely to collapse than are walls of solid brick. Windows must be angled to avoid reflecting light.

So much for design; what it cannot accomplish must be perfected by skillful camouflage. Buildings whose geometrical shapes throw straight shadows are easily spotted, and Mr. Wittman suggests that irregular curves be used to distort these shadows. Roofs must be hidden behind drab paint or even beneath turf, shrubs, and small trees, which disguise them as peaceful lawns and gardens. Strips of cloth and leaf-covered nets have their uses. Often the natural environment in which a plant is located helps with the deception if the buildings are skillfully blended with their surroundings. Even an artificial fog can conceal the contents of a valley. Underground shelters, extra power plants, even entire spare factories, and fire-fighting equipment are, of course, routine essentials. The author makes no prognostication. "We are now at the beginning of this development," he declares, "and we cannot yet foresee how it will change the face of our cities and of our country. The alterations may be manifold and radical."





H. B. Kane, '24

Rana catesbiana — *the common bullfrog — with the aid of the Edgerton high-speed lamp here demonstrates a sharp difference between human and batrachian diving as he flies through the air with his Popeye forearms crooked. As he enters his puddle, his legs are already drawn up for the first thrust. This fellow is a male, indicated by the fact that his ear disk is larger than his eye. His eye seems duller in the second picture because his nictitating membrane, or third eyelid, has closed to protect the eye during his travel.*

Not Dead Fish

CONFECTION and conversion of coals and crudes have been busying Carnegie Institute of Technology researchers, recent reports of whose work suggest interesting complementary relationships. Ernst Berl has been making crude oil, bituminous coals, asphalts, and coke in his laboratory from such materials as corn, wood, seaweed, leaves, and molasses — all of which are substances rich in carbohydrates — by heating them under pressure with limestone. The process cannot compete in price with crude oil from the ground but is said to be cheaper than making gasoline from coal by hydrogenation, and is of much scientific if not immediate technological interest.

Meanwhile, rather than make coal from farm produce, other investigators at Carnegie have patented a new way of making liquid organic chemicals from coal. In this process, details about which are not as yet sufficient to differentiate it sharply from the Bergius method of some twenty-five years ago, powdered coal reacts under pressure with hydrogen gas in the presence of a catalyst, such as copper oxide, giving sulphur-free oils which subsequently are treated again with hydrogen under pressure, with a nickel catalyst. Recovery of 80 per cent of the coal in the form of organic liquid hydrocarbons is reported accomplished by the method. The chemicals may be used in synthesis of dyes, explosives, and medicines.

This conversion process liberates hydrocarbons compacted into coal by the long labor of nature on vegetable matter that flourished in an earlier age. Dr. Berl's process — in its crude-oil aspect particularly — performs the conversion by a more direct route and is declared to demonstrate that lignin, the woody skeleton of trees, is not the main source of coal formed in nature. The plant carbohydrates, Dr. Berl asserts, were the raw material of coal thus formed; and asphalts, not dead fish, the raw material of crude oil.

Cast Iron Gets Tough

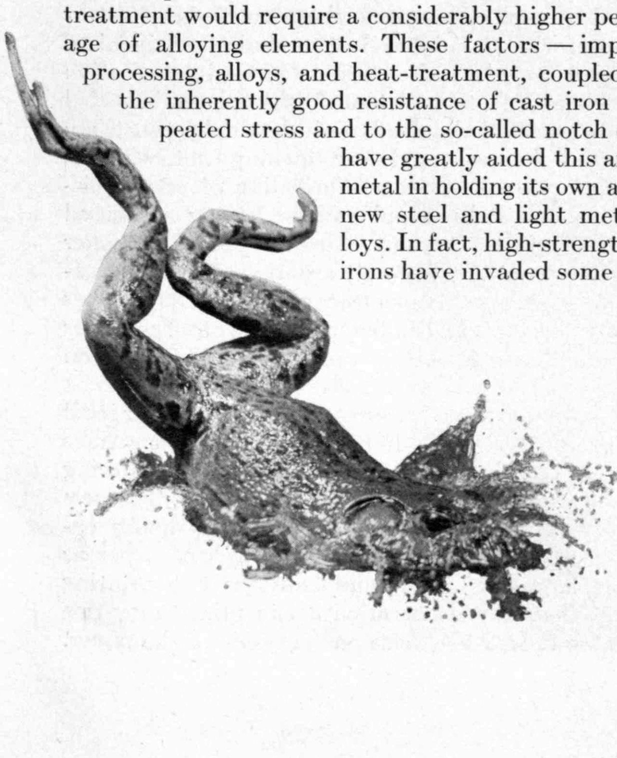
UP to the middle 1920's the cast iron of commerce was what it had always been, a material fit in general for the more plebeian tasks of industry, the jobs where severe shocks and heavy stresses — particularly tensile stresses — were not factors. Cast iron was cheap, readily available (foundries are everywhere), and easily fabricated into the most intricate shapes. Furthermore, it had a greater tendency than did steel to dampen vibrations; it could be made extremely hard (it was and is the cheapest hard material); and it had relatively good resistance to corrosion, as some of the water pipes at the fountains of Versailles, installed about 280 years ago and still in service, can testify. For many important applications, however, this array of virtues could not overcome the two great disadvantages of cast iron: its brittleness and its lack of strength in tension. Actually, cast irons of higher strength were becoming available as metallurgists proceeded with increasingly intensive investigations of the material, but as late as 1930 the standards of the American Society for Testing Materials allowed a cast iron to be classified as a high-test type if its tensile strength exceeded 33,000 pounds per square inch. As for gray cast iron, which constitutes the bulk of castings, strengths of 18,000 to 24,000 psi in tension were sufficient to meet the specification. In 1936, however, the standards blossomed out with classes of gray iron ranging in tensile strengths from 20,000 to 60,000 psi. Special alloy cast irons, called variously high-test, high-strength, and super cast irons, give tensile strengths up to 100,000 psi in the heat-treated condition; mild steels give from 50,000 to 70,000 psi.

The manner in which this rapid renaissance has occurred tends to confirm the view that cast iron is simply a steel matrix acting exactly like any other steel of similar composition, in which are imbedded a multitude of small graphite flakes that lower the strength of the iron by interrupting its continuity but also give it excellent bearing qualities and machinability. For a given hardness, cast iron usually machines faster than steel.

Foundrymen have learned that considerable improvements in the properties of cast iron can be had if they merely juggle their present variables — i.e., if they select raw materials with care, maintain temperatures at optimum levels, and, above all, adjust the silicon-carbon ratio. The presence of silicon in cast iron reduces the amount of carbon which the iron can hold in combined form. Thus more carbon is precipitated in the form of weakening graphite flakes and less is held as hard and brittle iron carbides. Foundrymen therefore lower the silicon content of their irons, but not to the point where the rise in the combined carbon content begins to produce excessively brittle and hard castings. They also find it desirable to introduce part of the silicon after the iron is melted and ready for pouring; such late silicon appears to produce graphite flakes that are relatively small and uniformly distributed.

Likewise an orthodox approach has been the use of alloying elements, the most important ones being nickel, chromium, molybdenum, and vanadium. Used singly or in combination, these alloys give sounder, tougher, stronger products which in machinability equal or excel straight cast irons of equal hardness. Alloyed cast iron is also less sensitive to changes in section, giving substantially the same strength in thick walls (which cool slowly) as in thin ones, a characteristic which ordinary cast iron most decidedly does not possess.

The latest trend in the production of iron castings, and the most surprising one to the foundryman of a generation, ago is heat-treatment. Not so long ago, cast iron was considered about as appropriate a metal for tempering and quenching as was copper or lead; yet service records are being set daily by parts which owe to proper quenching or tempering perhaps an additional 20,000 psi of tensile strength or a fine-grained, hard, and wear-resisting structure. Particularly noteworthy is the development of the interrupted hot quench, in which the hot casting is quenched not in a liquid at room temperature but in a salt bath at 500 to 700 degrees Fahrenheit. The treatment results in a hard, tough structure which tends to get harder as it is battered in service and which shows unusual resistance to sliding or rubbing wear. To obtain equivalent surface resistance without this heat-treatment would require a considerably higher percentage of alloying elements. These factors — improved processing, alloys, and heat-treatment, coupled with the inherently good resistance of cast iron to repeated stress and to the so-called notch effect, have greatly aided this ancient metal in holding its own against new steel and light metal alloys. In fact, high-strength cast irons have invaded some fields, such as crank- and camshafts for internal-combustion engines, which were formerly the province of forged steels. Higher alloyed cast irons have also lowered the cost of performing some of the most brutally severe tasks of industry, such as pulverizing ores in the mining trades; pumping sand, ashes, and concrete; and handling concentrated acids and alkalies in the heavy chemical industries. Like wood and the copper alloys, two other old materials of construction, cast iron is showing plenty of ability to keep up with the technical times.



Casein Casques

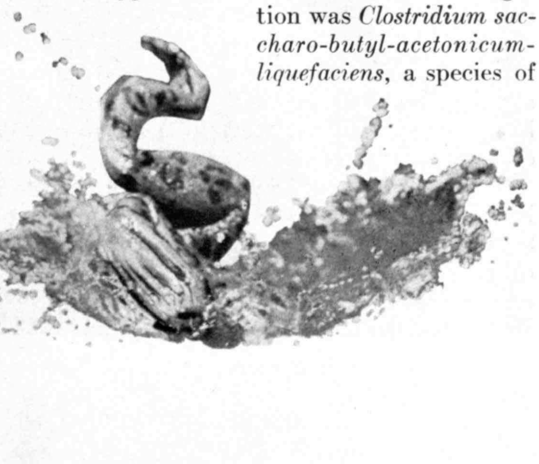
MILK may cover the heads of a million and a half Americans during the next year because Europe's rabbits are escaping export as Europe's hunters are mustered or mastered. Exports of rabbit and cony from Belgium, Czechoslovakia, and Poland vanishing, American hatters are reported looking with a kindly eye on the possibilities of felt made from casein wool. From a half million to a million pounds of casein fiber are expected to be used in hat manufacture during the next year.

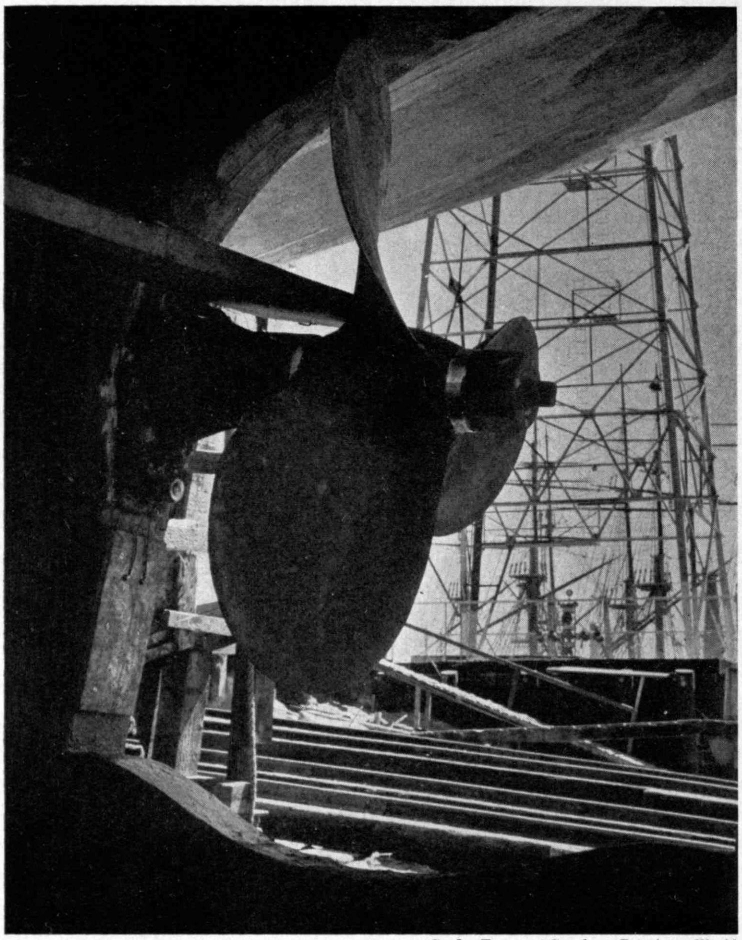
In the five years since processes were developed for the conversion of casein into a synthetic wool, American interest in the substance has been somewhat lackadaisical, in part because the fibers lacked resilience and did not felt readily, in part because the United States usually has no serious wool shortage, in part because experimentation with rayon and glass textiles engaged chief attention. The hatters' present resort to the synthetic is regarded as experiment purely; only about 3 per cent of total United States hat production is involved.

Nevertheless, milk producers, embarrassed by yearly accumulation of skim milk, less than 5 per cent of which now goes into casein for plastics, glue, and so on, will look on the hatters' experiment with hopefulness. Success might spur the utilization of casein as felt or yarn in other big markets. To make a synthetic wool dress, the casein from thirty quarts of milk is needed.

Not Patentable

YOU may patent a motor-driven fan to blow the foam off beer, and you may patent a woman's shoe with a jack in the heel to raise or lower it — people have done so. But you may not patent a bacterium, even under the terms of the Plant Patent Act of 1930; bacteria are not "plants" in the sense in which Congress used the term. Sustaining the Patent Office's rejection of an application for such a patent, the Court of Customs and Patent Appeals has so ruled. Basis of the litigation was *Clostridium saccharo-butyl-acetonicum-liquefaciens*, a species of





Cy La Tour and Son from Petroleum World

A Hollywood square-rigger and an oil well derrick are storytelling background for the propeller of a vessel in drydock at Long Beach, Calif.

sugar-fermenting bacteria useful for producing the neutral solvents butyl alcohol, acetone, and ethyl alcohol from suitable mashes. Cultured from Louisianian cane field soil, these bacteria are described as being superior to other previously known species in that the fermentation process utilizing them takes less time and gives greater yields of solvents. A patent covering the process has issued.

Recognizing that bacteria are regarded as plants scientifically, the court reasoned that the Plant Patent Act does not include them because in it the term plant is used in the popular sense. "A drop of water may contain thousands of bacteria," said the court, "but outside of scientific circles a drop of water would not be regarded as containing thousands of plants." The act provides, moreover, that plant patents may be issued to those who discover or invent a new variety of plant other than a tuber-propagated plant and asexually reproduce it by grafting, budding, cutting, layering, division, and the like. Bacteria did not seem to the examiner or to the court capable of being so treated.

The work done by the bacterium whose unpatentability has thus been determined is of historical importance. Some twenty years ago, Chaim Weizmann found a way of utilizing a species of bacteria to produce butyl alcohol and acetone from starch or cereal mashes. Both Great Britain and the United States employed that *Clostridium* in the production of war materials during the World War. During litigation over the Weizmann process, it was held in this country that a patent on the technique was valid despite the argument that it involved the life process of a living organism. "Were the patent for a bacteria per se," the court then held, "a different situation would be presented." That different situation found its answer in the refusal to consider the sugar-fermenting bacterium patentable.

Mixed Grill

RECALLING the legend of the lady who wanted to build her own house but could not drive nails successfully and hence fastened the structure together with hooks and eyes, comes announcement of beginning of production of small house "assemblies" on a new structural system which uses no nails, relying instead on bolts, angle braces, and wedge locks for the frame, on hooks and concealed clips for exterior enclosing units and interior surfaces. The system, in development for some ten years, is an improved beam-joist-and-stud type of construction. Emphasized is the fact that it permits the expansion or alteration of a building with minimum effort and time. Removal of a section of wall and attachment of a room completely finished and ready for use can be done in less than five hours, according to the designer. Plywood, light-gauge steel stampings, and precut kiln-dried lumber are utilized in the standardized structural units of the system; erection of the houses is an assembly operation only, for cutting and fitting are eliminated. A five-room house, fully equipped, is expected to cost about $3,000. ¶ Ethylene, the unsaturated gaseous hydrocarbon which, as an anesthetic, aids the surgeon and, as a constituent of coal gas, infuriates the householder, may harass the unwary florist if he places cut flowers in storage rooms where apples and other fruits are ripening. Investigators at the United States Horticultural Station in Beltsville, Md., find that cut flowers placed in sealed containers with ethylene suffer injuries duplicating those received by flowers stored near ripening fruit, which is known to give off ethylene. Shriveling of petals, discoloration, and early dropping of the flowers are caused by the presence of the gas and are speeded up at higher storage temperatures. For cut carnations, the investigators report storage temperatures of 34 to 36 degrees Fahrenheit as best. ¶ Rubber makes the printing plates of a new high-speed rotary press, built to print books on paper fed to it from a continuous roll rather than from a pile of individual sheets. Greater speed in the actual printing, greater speed and economy in preparations before printing, as well as saving in the cost of storing plates are cited as advantages of the process. The new press — first ever constructed for printing books entirely from rubber plates — carries a roll of paper as wide as forty-five inches and contains two printing units, so that at one operation it can print thirty-two pages of standard book size on each side of the paper.