December 1940

TECHNOLOGY REVIEW

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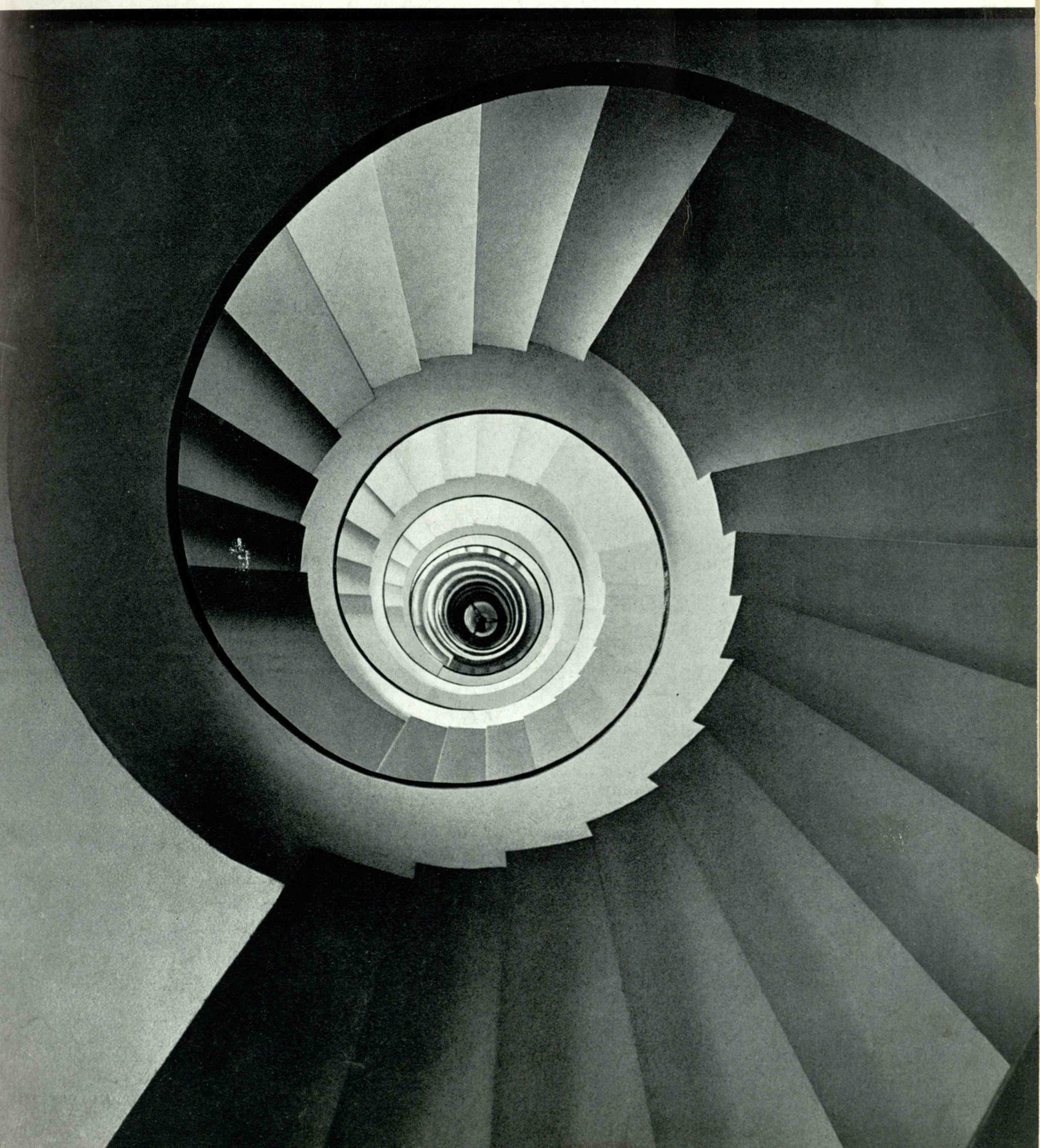

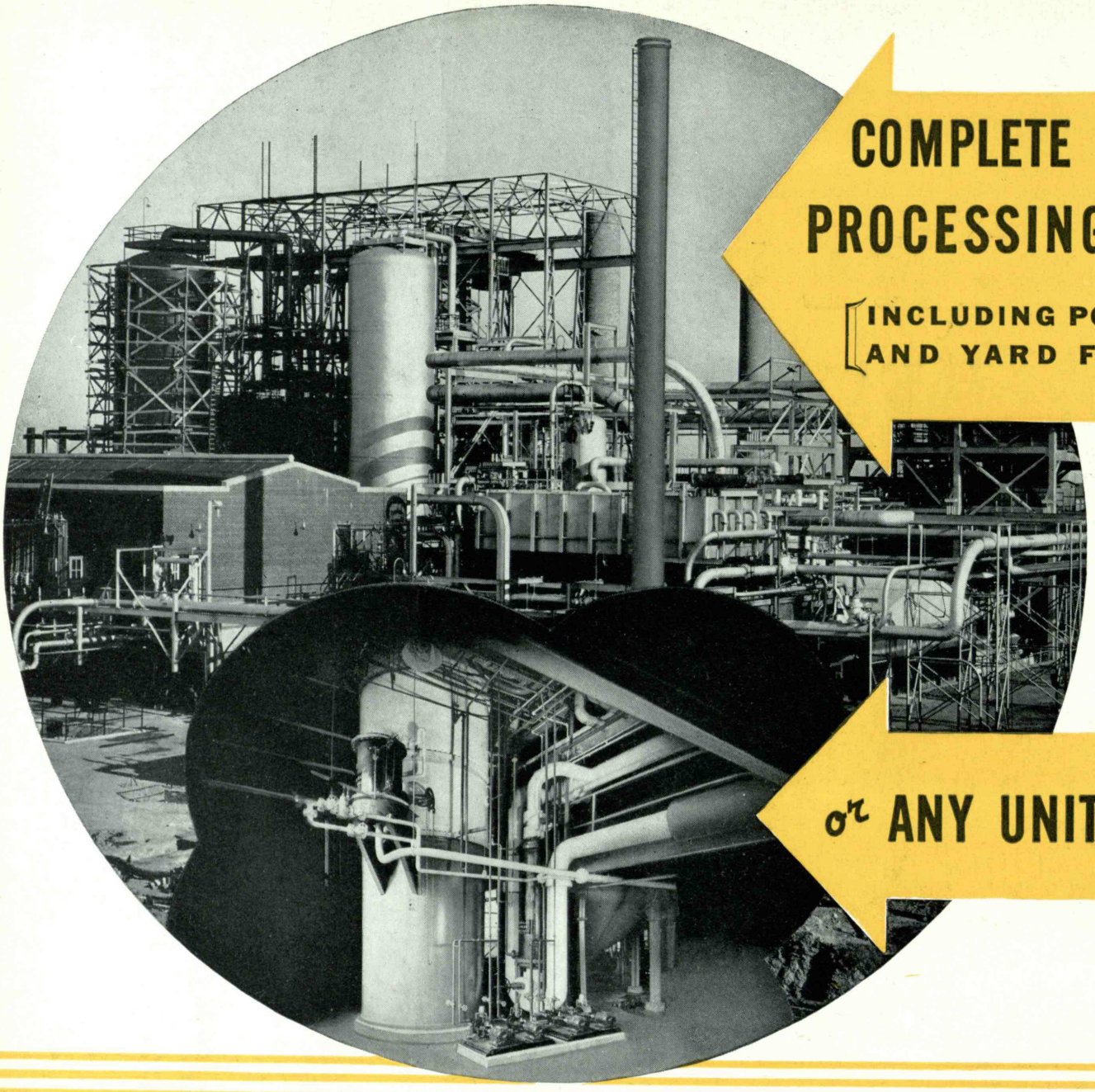

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THE TABULAR VIEW

Winchell Won't. — Best known means least known, as far as language is concerned, through the familiar though paradoxical fact that men generally don't analyze the things with which they are most familiar. Hence through his study of language in its psychological aspects — an undertaking of some ten years — BENJAMIN LEE WHORF, '18, is pioneering along frontiers to be found right in the back yard. How the patterns of English word formation may be given formal expression, and how the resultant formulas enable the linguist to predict much as does the physicist, are questions which he discusses in this issue of The Review (page 61) in explaining the right of linguistics to be regarded as an exact science. Mr. Whorf has investigated spoken Aztec in Mexico, has worked on the deciphering of Mayan hieroglyphs, has lectured on linguistics at Yale. He is a special agent for the Hartford Fire Insurance Company.

Hummingbird. — Former editor of *Aviation*, now coordinator of research for the National Advisory Committee for Aeronautics, whose chairman is Vannevar Bush, '16, S. PAUL JOHNSTON, '21, tells (page 64) of efforts at vertical flight by means of the helicopter. To Da Vinci the idea of the airscrew was provocative; in our own immediate time, realization of its use seems nearing. Mr. Johnston's article constitutes a chapter of his book *Horizons Unlimited: A Graphic History of Aviation*, which Duell, Sloan and Pearce, Inc., have scheduled to appear on December 5.

Palms and Pumps. — Among prehistory's puzzles, how holes were "worried" through hard substances is one of the most interesting. It is not, of course, without fairly thorough answers. In this issue (page 66) a review of these engages LEROY L. THWING, '03, whose tales of other investigations into the records of applied technology are well remembered by Review readers. For some years connected with the New York Museum of Science and Industry, Mr. Thwing is a student of the history of technics.

Bumpers. — Ways of safeguarding drivers of automobiles against sudden death for themselves and for others are an important question to highway engineers, designers, safety engineers, and manufacturers. JOHN W. MEADER, '19, draws on a decade's experience and subsequent interest in the automotive industry in discussing (page 68) the need and two possible methods of securing better control. An economist and statistician, Mr. Meader is a member of the Society of Automotive Engineers.

Long John's Wooden Leg. — How Georges Bank can supply the Dust Bowl's frying pans is a question depending in part on cowskins, nickel, fathometers, hardy men, and the absence of cologne, as RICHARD HALLET reports in an account of voyaging to the fishing grounds aboard a modern otter trawler (page 70). Australia before the World War and the Maine Coast in the dead of winter have earlier been recounted for The Review by Mr. Hallet, who as novelist and fictioneer is well known.

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MAIL RETURNS

"*The Layman's Science*"

FROM VANNEVAR BUSH, '16:

"The Layman's Science" in the November Review is a scholarly treatment of a difficult subject. I beg to differ on a couple of points, or perhaps merely to shift emphasis, in the attempt to round out my own thinking on a subject which has always interested me.

The article argues that if the interpretation does not show how the scientific matter treated relates to the personal affairs of the reader, the interpretation will not take. If personal affairs are understood as including the building of an individual cultural pattern and philosophy, I might agree. If by everyday affairs we mean merely food, clothing, shelter, and so on, then there should be no appeal in astronomy; but there certainly is. True, some phases of astronomy advance physics, which in turn does very practical things for us; but the other, the philosophical phase of astronomy, which by no stretch affects our physical ways of living, has had enormous popular appeal.

This is important. Whole areas of scientific effort can be interpreted as of only general cultural interest, for their whole aim is to broaden and clarify matters which are impractical. Archaeology, paleontology, astronomy, much of geology, part of many sciences, have proved to be of intense interest to many and could undoubtedly be of interest to many more if interpreted with complete skill. Such interpretation cannot be done by a writer who thinks the public is interested only in matters that affect it personally.

"The usual reader lacks not only the special training necessary to a comprehension of the immediate event but also an understanding of the sequence of previous developments which made that event possible. . . ." This thought also runs through the essay. I think it has been much overemphasized and that American science writers in general write down unduly. If the object is to write so that all can understand, the case is hopeless. Science can be effectively interpreted only for those who have more than the usual intelligence and innate curiosity. These will work hard if given a chance and if they find they acquire something by so doing. (Witness Eddington's *The Nature of the Physical World.*) The trouble is that, in the hands of the usual science writer, they seldom get the chance.

One more point: The urge to create, to do original thinking, or to make new things, is exceedingly strong in many individuals and much more widespread than is ordinarily appreciated. With this urge as an incentive, very large numbers of people will read carefully and often expositions of matters which to the scientist are commonplace — an example was the long series of articles on elementary physics when homemade radios were the vogue. This fact also has not been sufficiently realized by those who interpret. Of course this is not the only reason that people read articles on science; some, for example, read science as a "must" in the same way that they labor through the book of the month. I venture that if an analysis of reader demand could be made, the result would surprise us all. If writers think they are catering to an audience which wishes only to marvel at the spectacular or to have its everyday affairs enlarged upon, I believe they are reaching only a small fraction of their potential readers.

Washington, D. C.

Copia Verborum

FROM FRANK G. SMITH, '11:

Please bear in mind that I am not a literary critic, but I am so taken aback with reading "The Layman's Science" in the November Review that I must indulge in some good-humored raillery. I am always interested in reading The Review because it covers the news of the Institute very well. Altogether, it is a fine publication. "The Layman's Science," however, seems to me to fall far below the usual standard. The discussion is based on the difficulty of "translating" with reasonable accuracy the scientist's into the layman's language. The authors have used a style which is neither easy to read nor understand. Paragraphs are padded with long words which look important but almost need translating. They have fallen into the same pit with that scientist who cannot write his story in simple words. Their own story is difficult to read.

Did the editors make use of the reference to *Science* as quoted: "Science popularizers should write simply . . . . and clearly . . ."? Consider the first sentence of the third paragraph: "The question of adequate popularization becomes more difficult and more important as the material to be popularized increases in complexity or strangeness." Would it not be easier to read and (*Concluded on page 89*)

4140 GOES TO SEA

It is well for all concerned that builders of marine Diesels make performance capacity the primary basis for the selection of materials. Breakdowns at sea or anywhere else are no fun for anyone, including the engine builder.

But the demand for reliability can be met and production costs still kept where they should be. One prominent builder, for example, is doing both by specifying Chromium-Molybdenum (SAE 4140) steel for a number of parts including bolts, wrist-pins, cylinder head studs, gears, tappets and crankshafts.

The fact that this steel can be treated to develop the properties necessary for applications having such different requirements is of value to both builder and user. It simplifies heat treatment and stockroom procedures. And, since simplification makes for uniform quality in the finished parts, it gives added assurance of dependability.

You will find complete data on this and other molybdenum steels in our book "Molybdenum in Steel," which will be sent free on request to all technical students interested in modern materials for modern needs.

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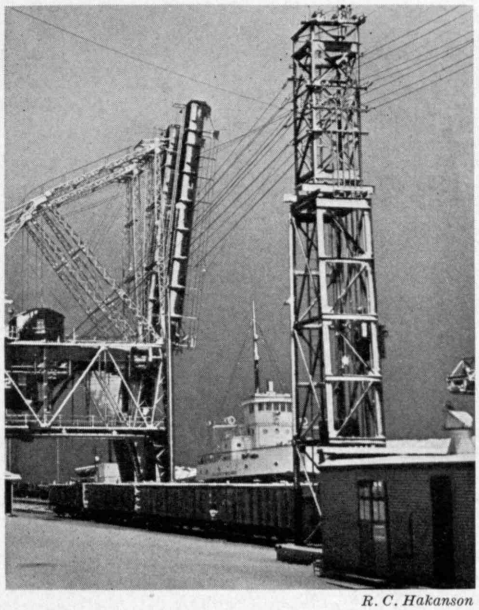

R. C. Hakanson

At Conneaut, Ohio, on Lake Erie, of a winter's day

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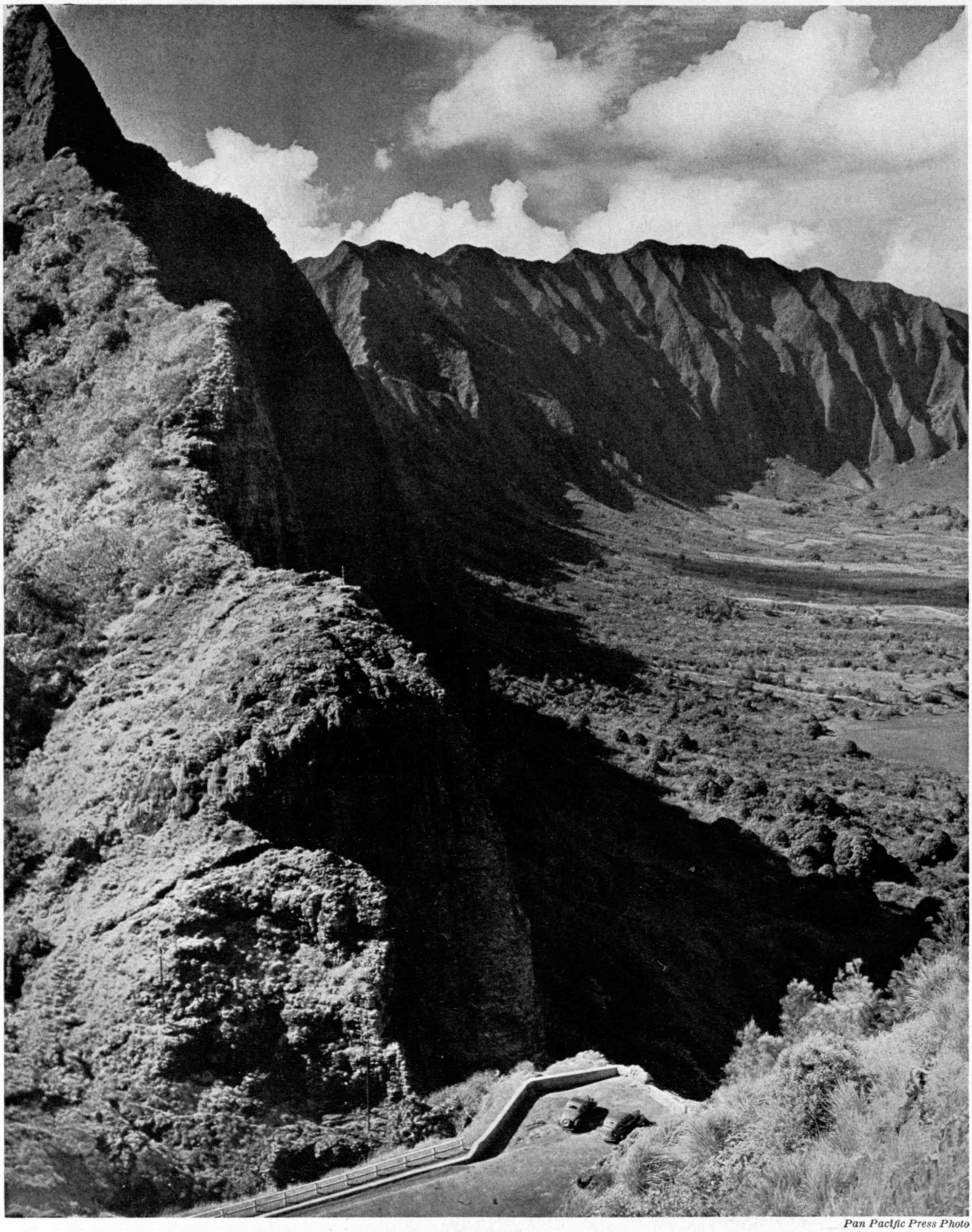


Pan Pacific Press Photo

AT HONOLULU

From this cliff, according to ancient Hawaiian legend, Kamehameha the Great, Hawaii's first monarch, had his enemies hurtled into the valley a thousand feet below.

THE
TECHNOLOGY REVIEW

Vol. 43, No. 2 December, 1940

The Trend of Affairs

Why Gertie Galloped

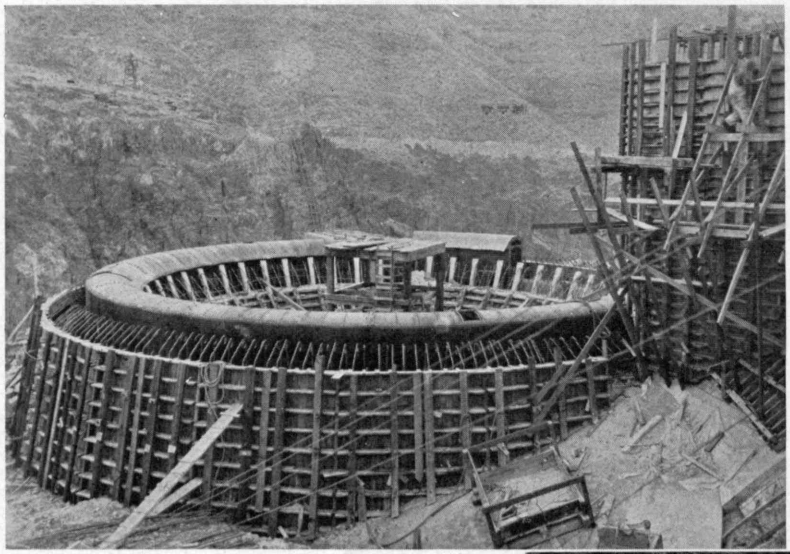
COLLAPSE of the Tacoma Narrows Bridge over Puget Sound at Tacoma, Wash., recently was starting point for various official inquiries from which engineering studies may be expected to result and to shed light eventually on the exact causes of failure. Nicknamed "Galloping Gertie" by residents of the region because of its tendency to sway exceedingly with the wind, the bridge had by its antics occasioned considerable speculation before it crashed 190 feet into the waters of the sound on November 7 in a 42-mile wind. Completed last July, it had the third longest center span in the world—2,800 feet—with two 1,100-foot side spans.

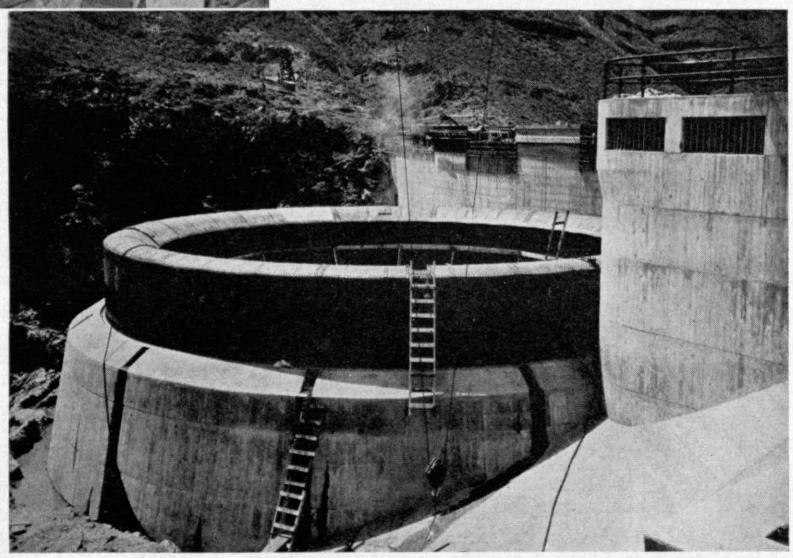
Careful study by vibration experts, correlated with observed behavior, motion pictures, and model tests, may be expected to clarify the question of why the bridge failed. The detailed considerations may well be underlaid by certain general conclusions. The vibration which led to the crash of the bridge seems generally agreed to have been caused by wind — an occurrence almost unprecedented for such bridges even though steady winds have long been known to produce destructive vibrations in other structures. Sleet-covered transmission lines, for example, have been observed to "gallop" through twenty-foot vertical distances under the influence of steady wind. Transmission-line strands have broken in fatigue from vibration caused by wind eddies on the leeward side of the wires. Airplane wings have broken off because of "flutter" occurring in power dives. All three of these causes of failure are well known in the special cases mentioned but seemed hardly to be expected in such massive structures as bridges. From tests of models and from observation and study of the bridge vibration itself, however, it appears evident that the vibration was actually a manifestation of one or more of these phenomena.

The Narrows Bridge differed from comparable suspension bridges principally in extremity of design, having a span-to-width ratio of seventy-two as compared to forty-eight for the Golden Gate Bridge. Instead of the more common stiffening trusses, large plate girders were used on the Narrows Bridge. Although in post-mortem these differences appear significant — hindsight always being easier than foresight — their possible importance in the Narrows Bridge could hardly have been anticipated in the light of previous experience.

Galloping and flutter have often been demonstrated on simple models. Having observed the Narrows Bridge at first hand during its months of annoying "bouncing," Blake Mills, '35, instructor in mechanical engineering at the Institute, has by means of a model illustrated a phenomenon something akin to transmission-line galloping as a possible cause of the vibration. In a small wooden model of a stiffening girder, supported on springs and placed in the air stream of a fan, a rather violent and continuous gallop is readily built up. This model is similar to one devised by Professor J. P. Den Hartog of Harvard to illustrate galloping of other types of member. A flat wooden slab, substituted for the girder model in the air stream, readily flutters violently with a combined bouncing and rolling motion somewhat similar to the photographed motion of the deck of the Narrows Bridge just before failure. No model has been built by Mr. Mills to show vibration caused by wind eddies, but a common example of this phenomenon is offered by telephone wires which "sing" in the wind.

Recognition in the Tacoma Narrows Bridge of any or all of these three types of wind-excited vibration by no means leads to a direct solution of the problem of failure. It may serve a purpose, however, in pointing out that on a structure designed for steady loads, dynamic load may in some cases be produced by steady wind. Violent vibrations hence can result from perfectly steady winds,





The glory-hole spillway at Owyhee Dam in Oregon is a vertical shaft of the record height of 309 feet, which diverts waste water to a tunnel passing far under the base of the dam and discharging into the river. At the crest the glory hole is 60 feet in diameter. The single ring gate controlling the full circle of the crest is the first of its kind. Above: *crest during construction.* Right: *ring gate in raised position during test.*

and there are evidently situations where structural designs must reckon with this fact.

Science in War

IN every independent nation of the world which indulges in higher education, scientists are today working against time — a few seeking impregnable means of defense, many more looking for invincible methods of attack. These men would be less than human if they did not in some measure enjoy their task, yet according to the writing of scientific pundits for more years than one can count, it is contrary to all that science stands for.

American men of science have come so recently to the mill that as yet they have done little more than help purposefully to turn the stones. In Britain, on the other hand, this affair has been going on for considerable time; some scientists have stopped to take stock, and have written about their stocktaking in a book, *Science in War*,* now available in America.

The discussion is entertaining and instructive. For the most part it deals with what science might have been able to do and might still be able to do for Britain in her current war. After an introduction, to which reference may more profitably be made later, the text begins with familiar illustrations from the past, such as Leblanc's invention, in 1787, of a new method for making soda. From today's events, authors choose the tale of the magnetic mine and its defeat through the process of degaussing ships. An extensive section on the airplane contains the suggestion that science might have quite as many useful things to say about air-combat tactics as it does about flight characteristics.

Some of the most vigorous pages are from the notes of an officer in the recent Spanish campaign and describe efforts to defeat the tank. These efforts were a sort of large-scale field study, employing the method of try and fail, though the ending is reported to have been happy. From this experience the authors conclude that research might have saved a great deal of time, in fact might have solved the problem in three months. They point out that empirical tests in battle may not give results until a war is lost. This section ends on a pessimistic note: "Indeed, those who despair of getting things done, might well wonder if the empirical research carried out by the Spaniards will not prove to have been far more rapid and effective than anything that will be possible with the war machine of our country — dominated as it is by an apparently unscientific war-office hierarchy."

For medical science the book has a better word to say, describing with enthusiasm several relatively new ideas — the use of Epicutan from the juice of half-incubated chicks to stimulate cell growth; the employment of vitamins in healing; the possibilities in chemotherapy in caring for wound infections, such as those of streptococcus, which are hard to treat by serum therapy; the plaster-sealed treatments of the Spanish campaign; and, for transfusions, typed bloods preserved in bottles. The principal recommendation in this section is for more research on shock.

It is a bit of a surprise, but only at first glance, to find so much of the book devoted to food. Much is said about Britain's failure to cultivate her own lands scientifically; a strong plea is entered for a serious study of insect pests, which even in ordinary times destroy one-tenth to one-fifth of all the vegetable crop from British farms; a delightful section deals with the modes of British stock

* Harmondsworth, Eng., and New York: Penguin Books, 1940. 140 pages, 25 cents. The authors are anonymous, but the ideas indicate that their names, if known, would command respect.