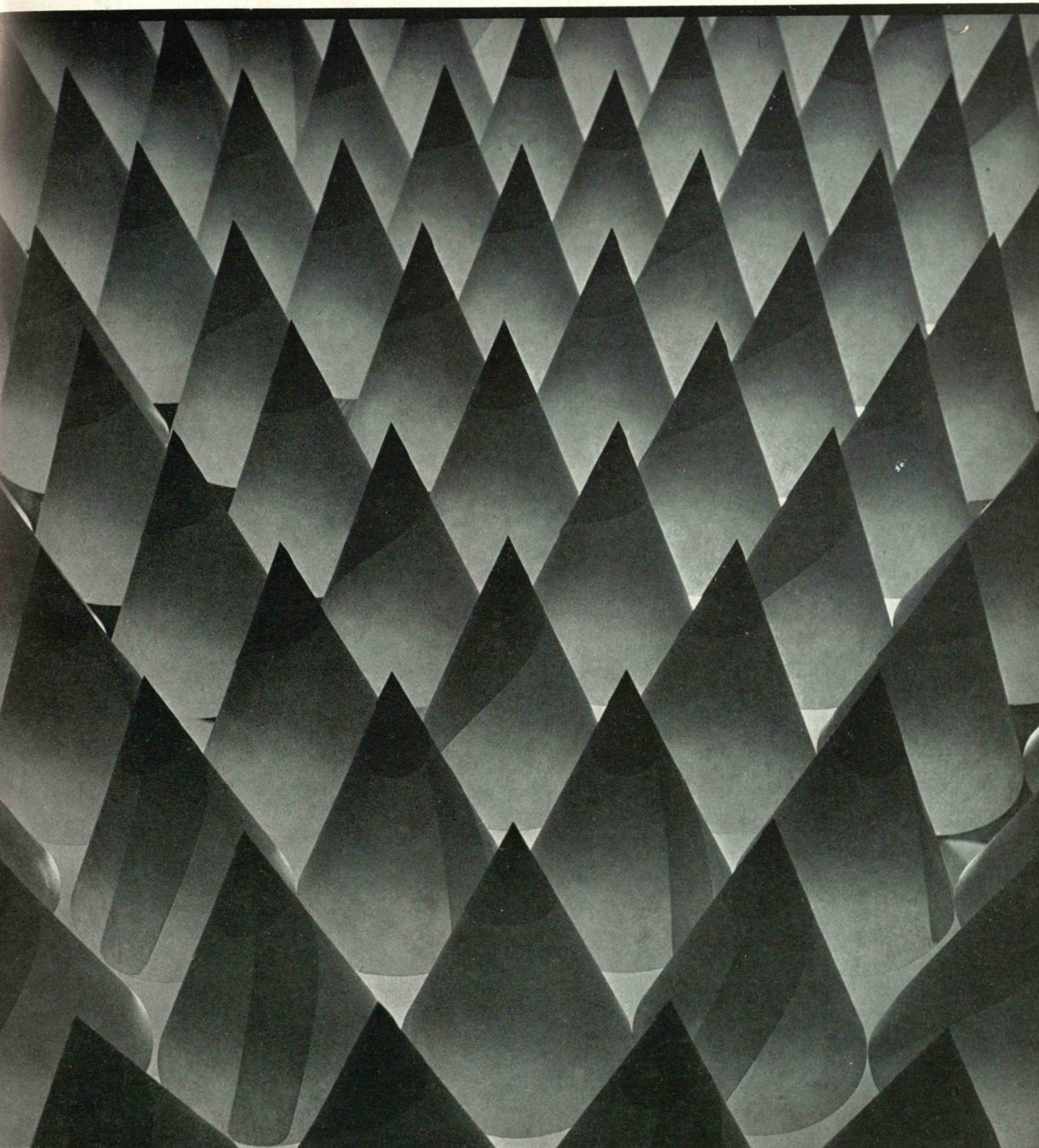
April 1939

TECHNOLOGY REVIEW



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THE TECHNOLOGY REVIEW, April, 1939. Vol. XLI, No. 6. Published monthly from November to July inclusive at 10 Ferry Street, Concord, N. H. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $3.50; Canadian and Foreign subscription $4.00. Entered as second-class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.

THE TABULAR VIEW

IN a world filled with wars and rumors of wars, the subject of defense and the means thereof is one which few thoughtful men can ignore. As far as the United States are concerned, discussion of the implementation of warfare focuses now, as it must in the future, on insurance against aggression and on nothing else. Commander Henry E. Rossell's article on naval armament in the January Review (page 120) considered one aspect of this problem; another is reviewed currently (page 251) by FREDERIC E. GLANTZBERG, '27, who, as captain in the Army Air Corps, brings like expert judgment to bear on the importance of aviation in the general defense program of the country. Writing of course unofficially, Captain Glantzberg offers an analysis of the preludes to Munich, which takes on added interest in the light of recent developments in Central Europe. ¶ Associate professor of physical metallurgy at the Institute, JOHN WULFF is pleasantly known to readers of The Review as author of a pioneering presentation, in our December issue (page 74), of the important technique of powder metallurgy. Another activity with which he has been identified is the concerted study of the production of corrosion-resistant alloys which, in characteristic Technology fashion, is being made by a committee of coöperators drawn from several Institute Departments. Surveying in this issue (page 254) the background out of which the problem grows, Dr. Wulff canvasses alloys as a means of decreasing enormous annual losses due to corrosion and presents in conspectus salient findings of the research program continuing at the Institute. ¶ It is the task of such a section as the Trend of Affairs to report, to comment, to explain. These functions it should perform with respect to the interesting, the important, the unusual in its field as the news of the month discloses them. As reporter, the Trend of Affairs occasionally will offer the factual statement of some new thing which later deserves more critical treatment; thus it is with the development of frequency modulation as a new factor in the radio equation. Noted in March (page 200), this center of fascinating speculative possibilities is expertly explored in this issue (page 257) by DONALD G. FINK, '33, who writes with the authority to be expected of the managing editor of *Electronics* and with the gusto of one who has been and gone and seen and heard. His article, in addition to its value as exposition of a puzzling subject and as stimulating foreglimpse into a possible future, affords interesting commentary on the interrelationships of ingenuity and industry. ¶ The pronouncements of public men command a passing attention automatically because of the official positions of their authors. But they command a lasting respect and remain in memory when they result from the vigor of mind and integrity of spirit which are independent of private or public status. The Review directs your attention to a farseeing discussion of intellectual freedom by KARL T. COMPTON, President, which appears in the Institute Gazette (page 261).

MAIL RETURNS

Approximations and Taxonomy

FROM CHARLES H. BLAKE, '25:

The following may have some interest as technical footnotes to my paper on wood destroyers in the January Review.

Those who do not concern themselves with that branch of biology called taxonomy (the classification of organisms) berate the taxonomists for not knowing their own minds and, hence, not achieving a stable classification. Actually a stable, and *correct*, classification is the aim of taxonomists, but since any classification is better than none, we must, in view of the incompleteness of our knowledge, approach the goal by a series of approximations after the fashion of a pendulum coming to rest. In the first draft of my paper I spoke of false deathwatch beetles (*Bostrychidae*) and powder-post beetles (*Lyctidae*). I had overlooked the fact that Böving and Craighead had divided the first family into two (*Bostrychidae* and *Psoidae*) on the basis of characters of the grubs. Recently a definitive catalogue of this group of beetles by P. Lesne has come to hand, and we find that all three families are thrown together as one (*Bostrychidae*)!

The mention of Hopkins' equivalent isophane (line of simultaneous appearance) referred to his work on bioclimatics (United States Department of Agriculture, Miscellaneous Publication No. 280). In effect, an isophane enables us to define the temperature characteristics of a point on the land by a single figure. Perhaps this may prove to be an oversimplification, but at least it is an attempt to define numerically the ranges of organisms and of certain biological phenomena in usable terms. It is one of the simpler applications of mathematics to biology. At the other extreme stands Woodger's "Axiomatic Method in Biology," in which the essentially nonnumerical apparatus of symbolic logic is brought to bear on biology. So far as I am concerned this latter method has no practical value, since I am not convinced that it leads to increased clarity of either thought or expression.

Lincoln, Mass.

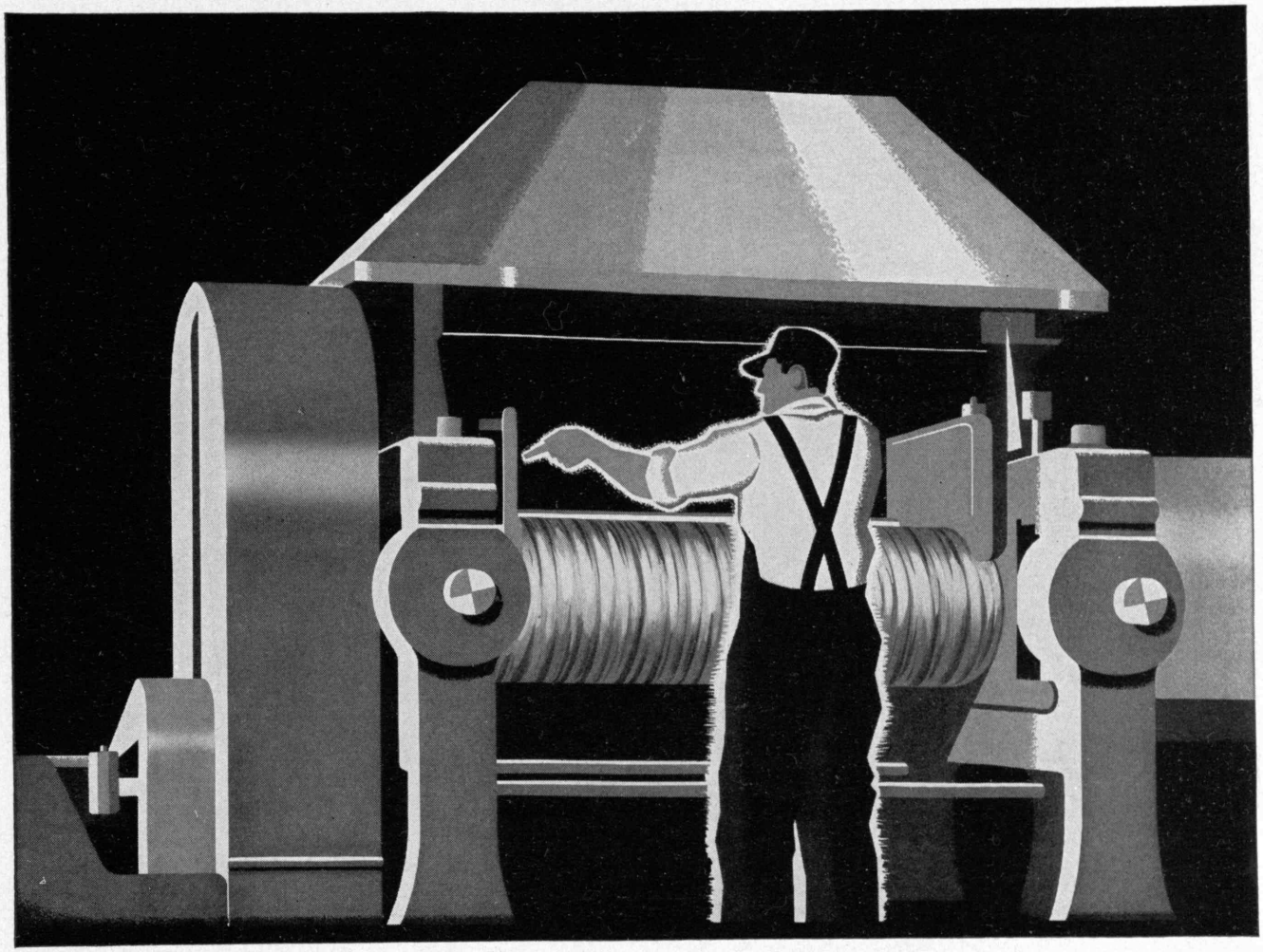
Domiciliar Conversation

FROM EVE WITHERS:

Sulphurous comment about planned economy, as respondents to your questionnaire about housing present it (see The Review for March), seems to put most of its emphasis upon the assumed hatred of being coördinated. Thus planned communities are attacked as lacking "individual opportunities for the home lover," being "too regimented," and being populated by people who "are too much like my own social set." All of these statements seem to me to contain much truth, and no doubt they serve as full reason, in the minds of their writers, for the choice of domestic environment which the writers have made. Thus both as outward argument and as inward rationalization for a given decision, they are effective.

Really, what these writers are talking about is the great difficulty, if not the downright impossibility, of escaping from the house itself anyway. From my own experience I am convinced that the younger home-owning class — that is, the group who have accumulated enough of the world's goods, or enough credit, or enough speculative ability in combination with energy, to buy and own, or to build — very easily become so engrossed with the house, or so fatigued by the outlay of work necessary to buy it, that they can talk about little else. It is always a case of comparing cellars, and arguing about kinds of insulation, and agreeing secretly, after the guests have gone home, that one's own decision about roofing materials was the right one and Simpkins after all didn't know what he was talking about. Here is the difficulty with the planned community: It enhances the sameness of people because it imposes on them the task not merely of justifying in conversation the purchase of a house which was more or less free choice but the purchase of a house which, because it is the product of a deliberate effort at efficient perfection, can't escape being a standardized thing — neat, clean, smooth, slick, and hence unoriginal, unindividual. The only way in which to justify the wisdom of buying House A rather than House B then becomes a pseudoscientific totting up of material attributes, and conversation degenerates into statistics of heat loss, and the highballs wilt as the long evening wanes.

Winston-Salem, N. C.



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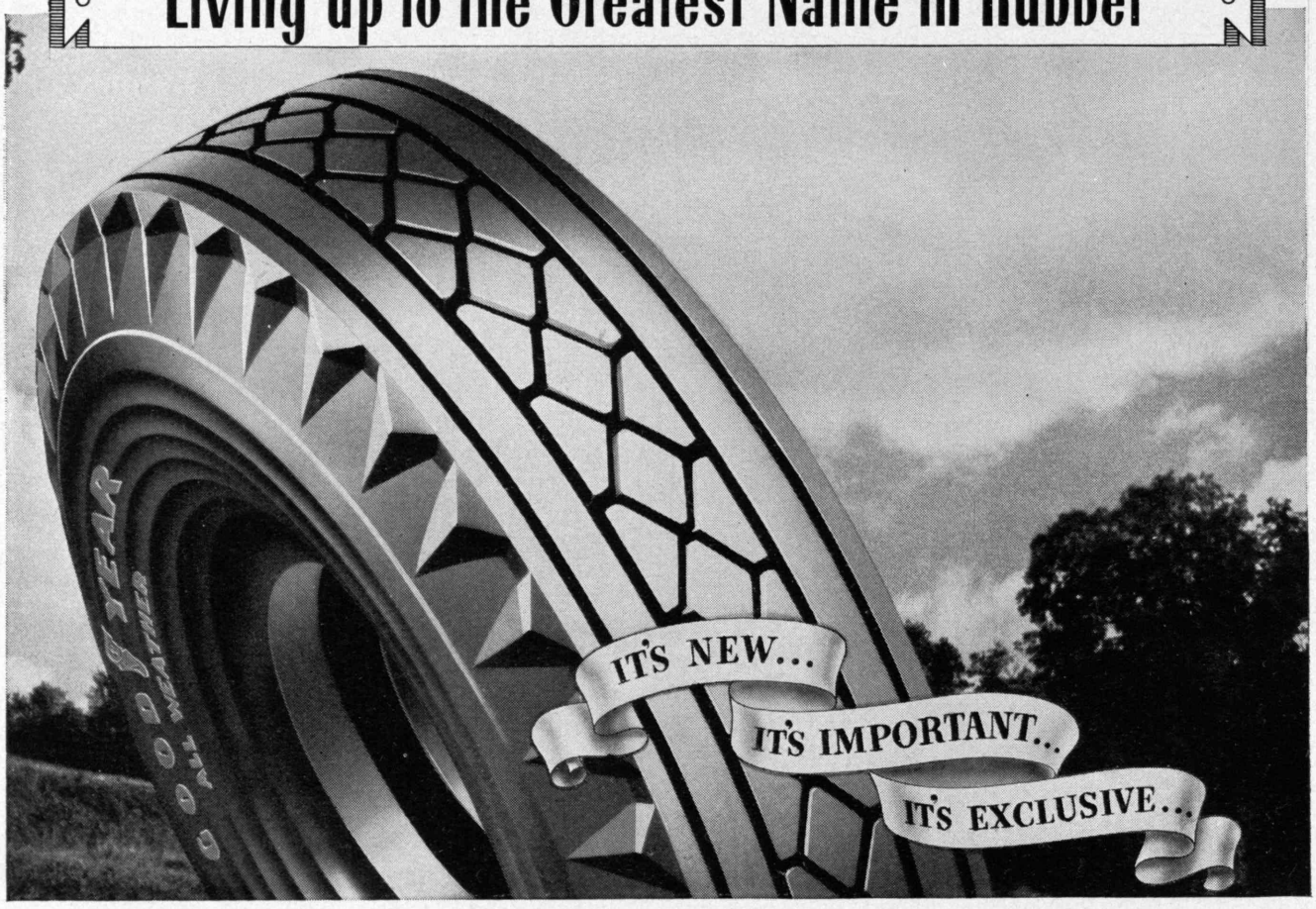

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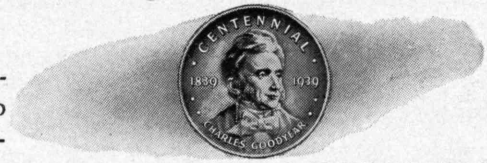

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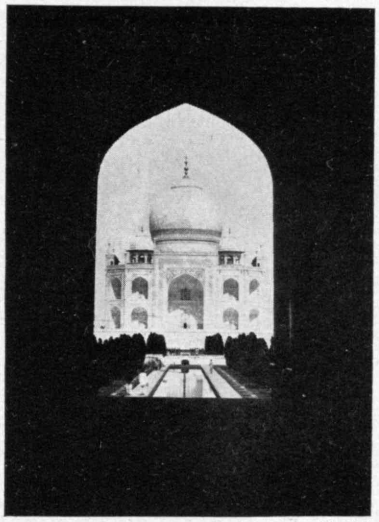
GOODYEAR



Crispness of contrast in an Indian version of the Taj Mahal

K. Lall

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THE COVER

"CONES" — PAPER DRINKING CUPS

From a photograph by Kirby Kean

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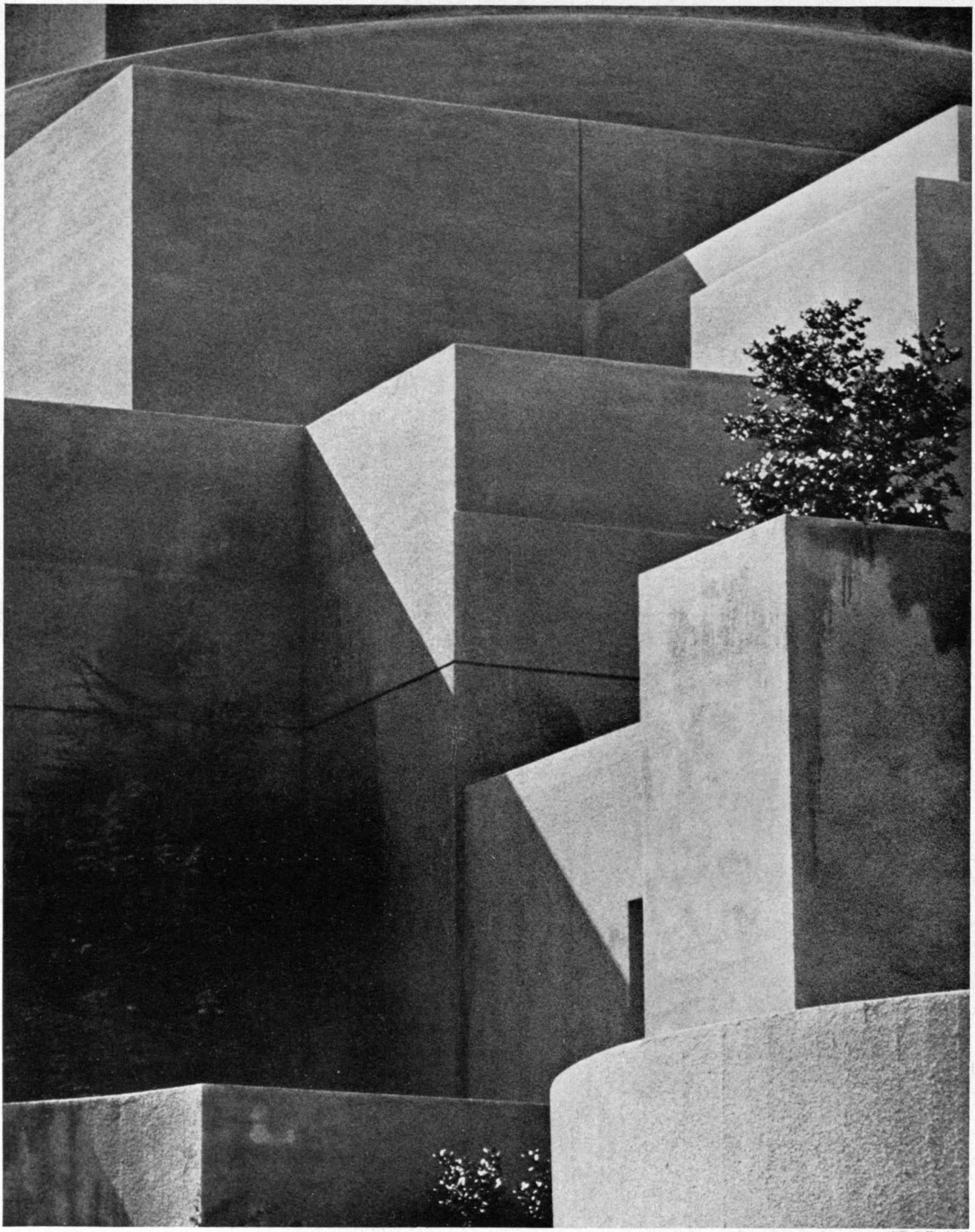

Raymond B. Collerd,'20

LINES, CURVES, AND ANGLES

The base of the Coit Memorial Tower on Telegraph Hill, San Francisco

THE
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REVIEW

Vol. 41, No. 6

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The Trend of Affairs

Subatomic Dynamite

PHYSICISTS have been poking at atomic nuclei for some time now, trying to find a trigger which would unleash the energy bottled up inside. Recently they found triggers for two of them — uranium and thorium. A uranium nucleus, when nudged by slow neutrons of energy less than a volt, sometimes blows up, shooting out fragments with energies of more than a hundred million volts. The exploding nucleus seems to break into two pieces of approximately equal mass, plus a spray of extra neutrons. Similar results have been observed with thorium, though the trigger here seems to be stiffer — neutrons of about a million volts' energy being needed to set off the explosion. Gold, silver, bismuth, lead, and several other heavy elements were also tried, with no results.

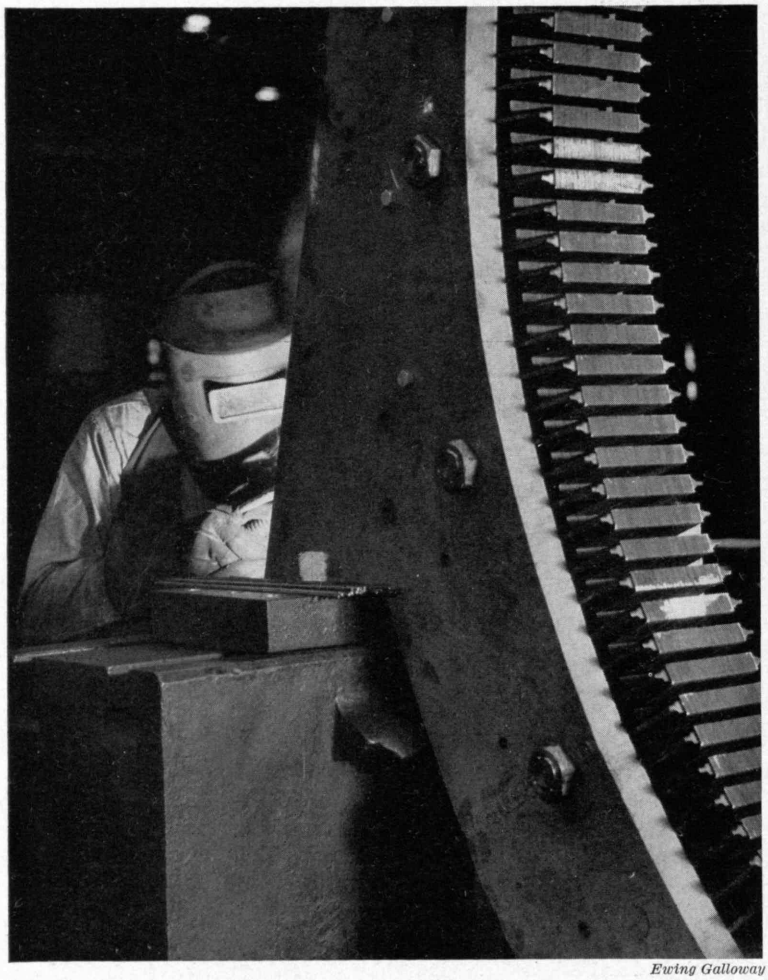
This does not mean that a way has been found for drawing energy from nuclei in unlimited amounts. The efficiency of the new process is as yet too low to make it possible to get more energy out than is put in to generate the neutrons. Nevertheless the new experiments show an energy output considerably greater than those previously known, and they indicate that nuclei can divide into halves. In all reactions hitherto discovered the nucleus loses only a small piece of itself in the explosion, acting more like a gun than a bomb. One can speculate at length on the possibilities suggested by the new discovery, but such speculations are premature as yet. The present results, however, show two interesting aspects.

The first aspect of interest is that the results seem to confirm the Bohr "waterdrop" theory of the nucleus. Professor Bohr has been insisting for several years that in their behavior atomic nuclei are very analogous to drops of water. This seems a bit farfetched at first, for nuclei are hardly dewdrops, being unbelievably small and being held together by forces which are neither electrical nor gravitational in origin. Nevertheless, Professor Bohr's opinions carry weight, for he is a Nobel Prize winner and one of the founders of the modern quantum theory.

He pictures the constituent protons and neutrons in a nucleus being held together by a sort of surface tension analogous to the surface tension which keeps a raindrop spherical. Ordinarily, in most nuclei, the surface tension is large enough so that none of the constituent particles can "evaporate." When an extra particle, a proton or neutron, is shot into a nucleus, however, the impact temporarily lowers the surface tension and "heats up" the nucleus, making it possible for one or more particles to evaporate away. This is the case with the artificially radioactive elements which are produced today in large variety and quantity in high-voltage laboratories all over the world. In these reactions, however, only a small portion of the nucleus is splashed out during the collision and the energy obtained is small compared to the output from the new experiments.

The natural radioactive elements are explained by saying that the nuclei of such elements are too large for the surface tension to hold the particles in. A few of the particles must evaporate from the surface before the nucleus becomes stable. In these cases, also, only a small part of the nucleus comes loose, and a relatively small amount of energy is released.

The waterdrop theory is obviously just an analogy which may be useful in suggesting further experiments. The new experiments show, however, that the analogy is closer than had been expected: They show that some heavy nuclei are unstable in the same manner that large waterdrops are unstable. A slight touch will start a large drop oscillating — elongating and flattening periodically — until the elongation is too much for the surface tension and the drop breaks in two. The analogy between this and the recent nuclear results is quite strik-



Ewing Galloway

The soleplate of a slow-speed synchronous electrical machine is being stitched in place by this welder

ing. There are differences, of course: For the drop of water the division is made without much fuss, but for the nuclear droplet the change involves a tremendous release of energy. Let us hope that a systematic exploration of the waterdrop analogy will suggest other fruitful experiments.

The other interesting aspect of the new discovery is the rapidity of check and countercheck of experiments in present-day physics. The discovery was made by Hahn and Strassman in Berlin in December. It was quickly checked and studied further by Meitner and Frisch, German refugees working in Stockholm and in Bohr's laboratory in Copenhagen. Bohr brought the news to this country, discussing the implications of the results at a conference in Washington on January 26. The February 15 issue of the *Physical Review*, journal of the American Physical Society, has announcements of confirmation and further details from four laboratories in this country: the Bureau of Terrestrial Magnetism, Carnegie Institution at Washington; Johns Hopkins; Columbia University; and the University of California. Anyone who has seen the mass of equipment used in a neutron generator and the tangle of sensitive electrical and photographic gadgetry needed to investigate nuclear reactions will be impressed at the speed of the laboratories in adapting equipment to the new experiment.

Government and Research

SO often cited as to make repetition egregious, the interdependence of science and democratic government is a social phenomenon unusually well publicized. Fresh reference to it is here made merely to suggest the fundamental justification for the recently issued set of monographs discussing the relation of the Federal government to research — the first volume of a series on the general subject of "Research — A National Resource," which is being carried on by the National Resources Committee under the chairmanship of Harold L. Ickes, Secretary of the Interior. This first volume, the work of the science committee, includes discussions of research carried on by the Federal government in the natural sciences and technology and in the social sciences, Federal expenditures for research, legislative provisions affecting research by Federal agencies, the legislative branch and research, the relation between problems of the Bureau of the Census and the social sciences, the relation of the Library of Congress to research, and research in American universities and colleges.

This last subject, the committee well argues, is a matter of direct concern to the Federal government for several reasons, conspicuous among which are the functions of universities as centers in which undergraduates are recruited to research, as the chief centers of initial training in research, as sources of personnel for temporary appointment in government service, and as centers of advanced training for government workers, in addition to their importance as centers of pure research and forcing beds in which research problems originate. Although in one section the report speaks rather crisply of the fact that the government "is now spending more on research than any other one agency, and more than all the universities combined," it also presents estimates of research disbursements which significantly suggest the importance of the work done by colleges and universities. For example, expenditures of $50,000,000 by the universities represent the allocation to research of as much as 25 per cent to 32.5 per cent of the total expenditures by some institutions. Government normal expenditure for research is set at about $70,000,000 — or two per cent of the regular current expenses of the Federal government — which in 1936–1937 was increased by some $50,000,000 more from emergency funds. Industry meanwhile expends on research about $100,000,000 a year — some corporations allocating to this purpose as much as four per cent of their gross income.

The employment of this total of $220,000,000 — from which the government's emergency expenditures of $50,000,000 are omitted — engages about 50,000 research workers, according to the committee's report. This census is at best approximate but is arrived at by two different methods. Since the problem of securing able research workers for governmental activity is highly