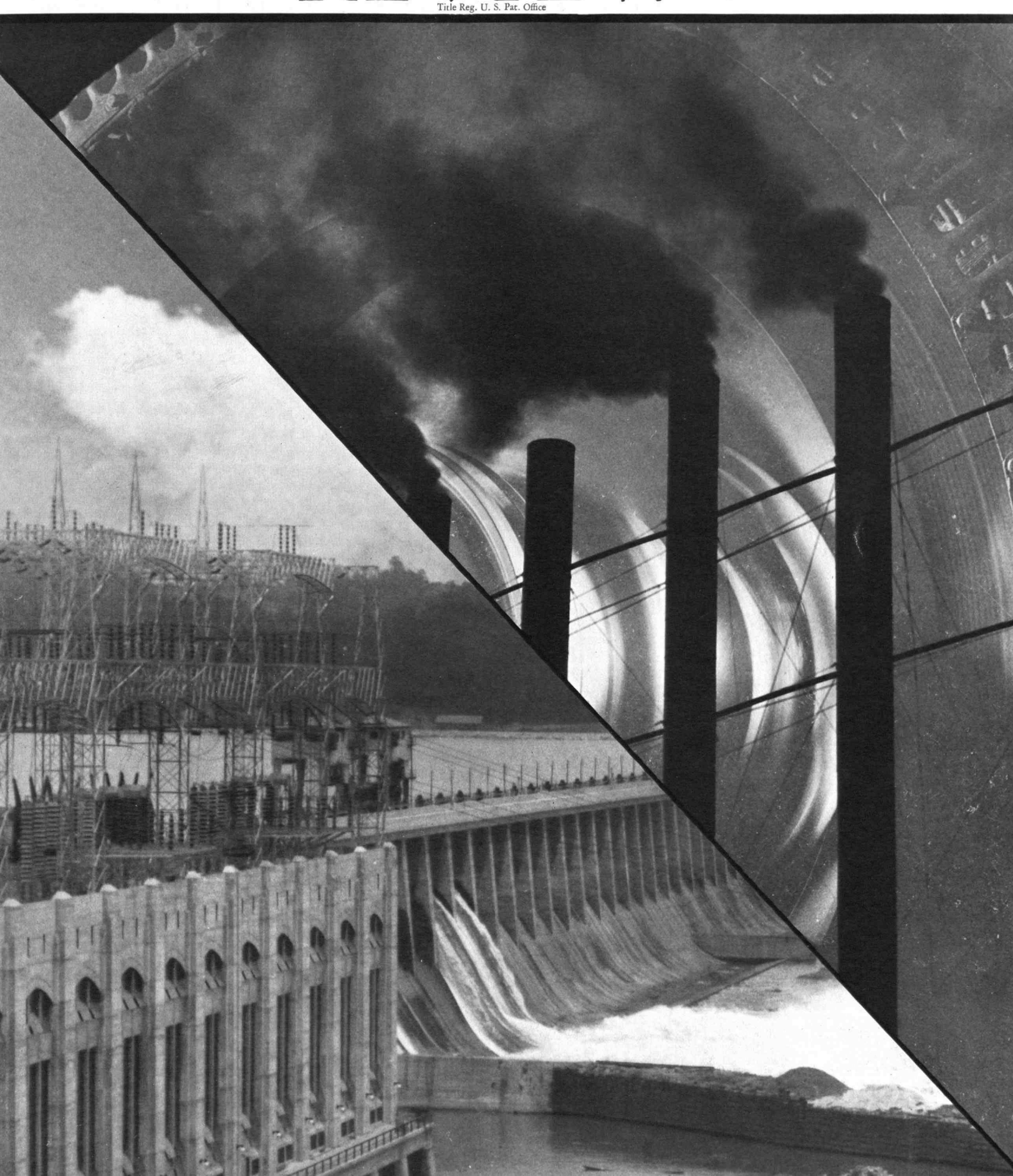
October 1933

TECHNOLOGY REVIEW

Title Reg. U. S. Pat. Office



Let's hear you say "They're Milder, Mate"

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—the cigarette that's Milder
—the cigarette that Tastes Better

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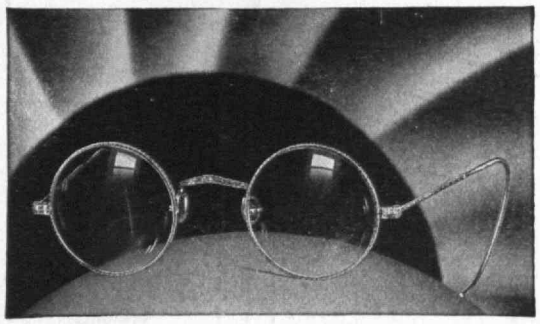
THE TABULAR VIEW

WITH degrees from the Universities of Colorado (B.A.), Wisconsin (M.A.), and Illinois (Ph.D.), E. B. MILLARD came to M. I. T. in 1914 as an instructor in organic chemistry. At the present time he is Associate Professor of Physical Chemistry and Assistant Director of the Division of Industrial Coöperation. His publications include "Physical Chemistry for Colleges," "Laboratory Manual of Physical Chemistry," and papers in scientific journals. ¶ After attending the University of California, ROSS F. TUCKER came to Technology and received its S.B. in 1892. Before returning to the Institute in 1926 as Head of the Course in Building Construction, he was on the construction staff of the Thompson-Starrett Company. A skilled engineer and gifted teacher, he writes with eloquence and understanding on the problems of housing. ¶ T. C. PATTON, '25, is a Technical Assistant in the Institute's Department of Physics. ¶ Beginning with this issue, JOHN E. BURCHARD, 2nd, '23, joins The Review staff of regular contributors. He is the author of numerous papers on engineering and housing subjects, and he collaborated with A. Farwell Bemis, '93, in writing "The Evolving House: A History of the Home."

LAST July the Institute of Radio Engineers, Inc., was unintentionally omitted from the table entitled "Chronology of American Professional Engineering Organizations and Related Bodies" (pp. 332, 333). Not unimportant, the I.R.E. should have been included in the list of "Professional Engineering Bodies." ¶ Connoisseurs of train speed and train lore will be interested in the following excerpts from a letter written by GEOFFREY ROBERTS, '25, of Johannesburg, South Africa: "I have enjoyed reading the articles on railroad trains that have appeared from time to time in The Technology Review. . . . You might be interested in a little data on the fastest train in South Africa, the *Union Express*. The train runs once a week, bringing the mails and passengers up from Cape Town, that arrive every Monday. . . . The run of 956 miles is completed in 29 hours 47 minutes. On the face of it, there is nothing particularly remarkable in this performance, but the route is quite mountainous and the standard African gauge of three feet six inches is a heavy handicap. . . . The heavy mountain type locomotives used on this train resemble American locomotives in appearance. . . . The coaches are all new, built since 1930, wood throughout, panelled on the outside, and finished in a natural shade. The sleeping cars are very long and articulated at the center, where there is a third truck. I noticed that the car bodies were mounted on rubber discs separating them from the steel under-frame. In addition to the dining car, a second car is carried, containing the kitchen and sleeping quarters for the dining car staff. A compartment is also provided in each sleeping car for the porter. . . . There is an observation compartment at the end of the train, entirely glassed in. . . ."



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Edward C. Fogg, Managing Director

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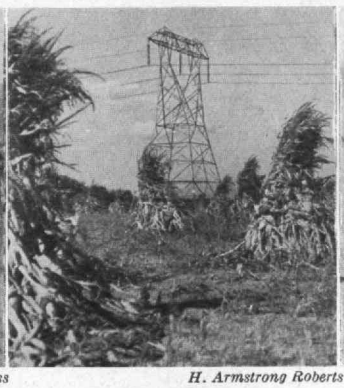
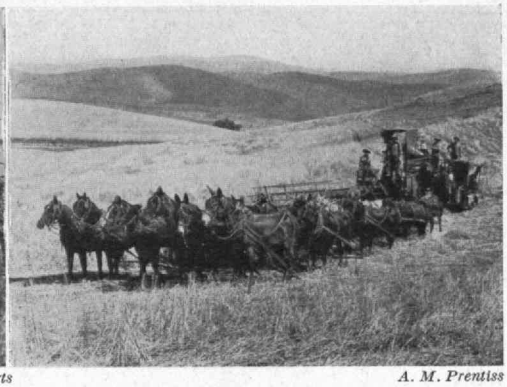


H. Armstrong Roberts



A. M. Prentiss

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THE COVER

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DAY'S END

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THE
TECHNOLOGY
REVIEW

Vol. 36, No. 1 October, 1933

Falling Apples

Hints to the Young Scientist in Search of an Opportunity

By E. B. Millard

Chemical Uses of Unheard Sounds — How a Bacillus Lowers Costs — The Search for New Persuaders — Aluminum Sheets vs. Wool Blankets — Modern Textile Chemistry from The Dark Ages

Of the serious problems which arise early in the mind of a scientist recently crowned with his degree and inclined to press on in his studies, one of the most perplexing is whether to elect pure science or applied science for his field of endeavor. When this basic decision has been made, he must then select a suitable research problem in his field, and it is a matter of grave concern to choose one which can be solved in a reasonable time with the facilities at his disposal, and which will be likely to attract more than passing attention among the vast number of researches being published.

This young man has probably heard it said that some person is interested in pure science, or in applied science, with the implication that he is not much concerned with the other branch of science. Yet these branches are each indispensable to the other, and frequently indistinguishable from one another. If pure science does not continue to make new basic discoveries, applied science will shortly have nothing to apply. And if applied science does not adapt these discoveries so that industry may prosper and support pure science, research will languish. For one might justly consider the purer aspect of science as industry's "white-haired boy," sometimes too busy in the pursuit of its own ends and enjoyment to think of its source of nourishment. Most of the instruments used in pure science research are the products of industrial science, and without an industrial source for apparatus, vacuum tubes, wire and chemicals, modern research would be beyond the means of a "pure" scientist, though King Midas endowed him with all his gold.

Coöperation between them must always be more than an exchange of courtesies, it must be a real interlocking of their interests. If they meet only at the tea table, and never at their work, both will suffer the consequences of their isolation. It has been truly said that man cannot live by bread alone, and it seems equally probable that science (pure or applied) cannot live long on tea.

The fact that opportunities in science surround us on all sides is not so commonly appreciated as it should be. Scientific research offers unbounded opportunities, whether for achieving academic distinction, service to one's fellow men, personal enrichment, or the thorough enjoyment of a busy life spent in doing something worth while; and it would be a most unusual research which recompensed a scientist in one of these ways to the total exclusion of the others.

A young man who wishes to find a suitable place to begin need only think logically through any important process he has studied with moderate thoroughness. The first suggestion to occur to him will doubtless be obvious enough to have occurred to someone else, but careful thought, pressed through to the end, will inevitably find something worthy of more careful examination. Not many people think at all, and of those who do so,

only a few think straight for very many minutes at a time. The apple which is supposed to have set Newton upon the path of discovering the laws of gravitation was not the first falling object to be observed; it was only the first apple to hit the right head.

The purpose which prompts me to point out a few instances illustrating how opportunities may be found under foot is not to make fun of those who have missed them. My purpose is primarily to stimulate young scientists to consider whether they are not missing opportunities similar to them, and in plain sight. In particular, it is to suggest that they inquire why or how any common scientific or industrial process is carried out, especially when it has been done in the same way for a long time.

Both sound and light are manifestations of wave motion, in different media of course, and of varying wavelength for both, but having some aspects in common. The eye is sensitive to light of brightness ratios, from that barely visible to that barely tolerable, of about one to ten billion. By a curious physiological coincidence the ratio of intensity of the faintest perceptible sound to the loudest bearable sound is also about one to ten billion. If visible light and audible sound are compared, it is found that light waves are very very short compared to sound waves; and that light moves incomparably faster than sound.

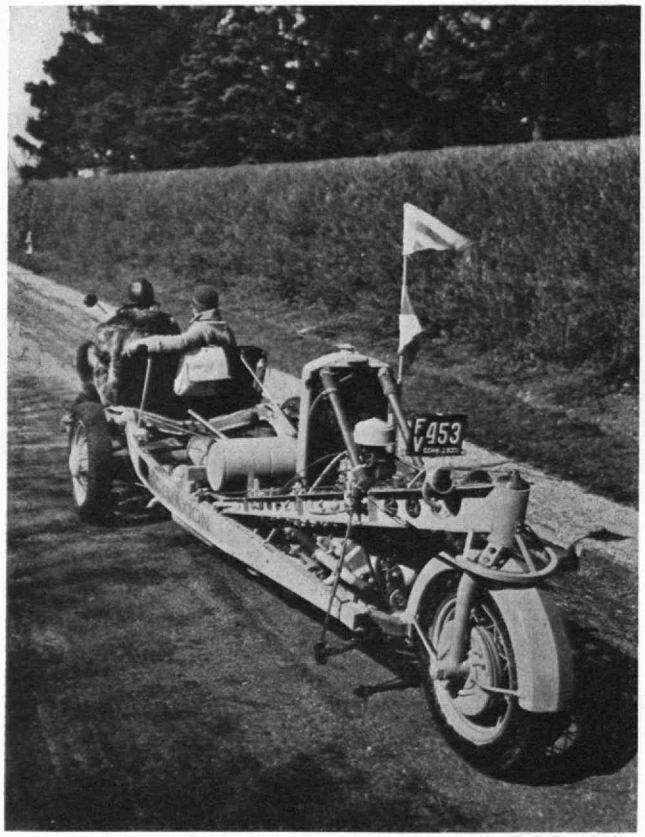
Physicists have extended our knowledge of light, in its broad sense of including all radiations, far, far outside of the single "octave" of radiations which constitutes the visible range. The frequencies from the longest radio-waves, a mile or so in length, to the shortest gamma rays, 10^{16} or 10^{18} to the mile, represent more "octaves" than one can comprehend. And there is no assurance that much longer or much shorter waves may not be discovered.

Our ears are readily able to hear six or eight octaves of sound, or even eleven octaves for extremely sensitive ears, and is it not curious that the development of supersonics, the extension of *sound* frequencies to a million times or so the audible frequency, should have lagged so far behind the parallel research in light?

This interesting sub-division of acoustics was born (or re-born) about 1918 or 1920, a child of the war-time development of submarine detectors. It has grown, and is still rapidly growing, along lines which may surprise its parents, as frequently happens in the development of children born to parents in their late maturity. (Before discussing this work, the reader may find it stimulating, or perhaps disappointing, to pause for a brief moment and assemble his own entire information, if any, upon "infra-sonic" waves, compression waves of lower frequency than the audible limit.)

It seems like a long step from acoustics to chemistry or biology; yet when sound waves of supersonic frequency pass through water containing dissolved oxygen, hydrogen peroxide is formed at once in considerable quantity, which is beyond question a chemical change. Similar oxidations of other substances are now under investigation, and many aspects of chemistry are yet to be studied in connection with supersonics. Already, some evidence is at hand that sound of very high frequency produces effects upon a photographic plate.

About all that would be required to complete this story is a report that someone had been impelled to try the effect of intense *audible* (*Continued on page 35*)



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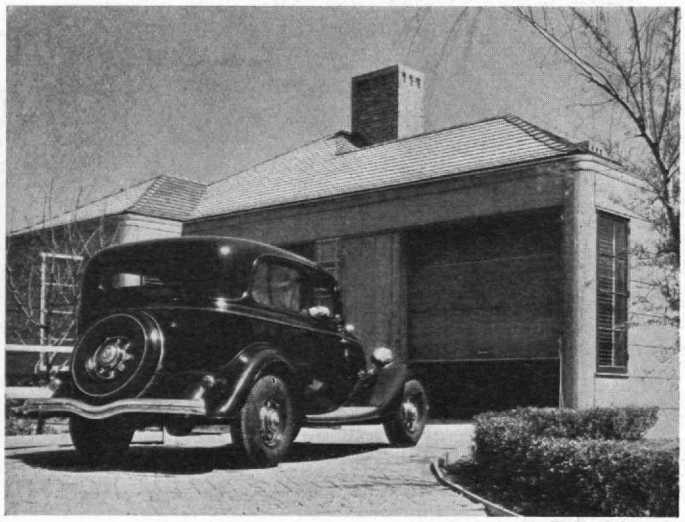

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Above: Radio-controlled garage door of the Lumber Industries House at the Century of Progress. The door opens and, at night, the garage lights are turned on, all automatically, when a small knob on the instrument board of the car is pulled by the driver as the car approaches the garage

Left: What Starling Burgess and Buckminster Fuller are pleased to call "Model C2 Dymaxion Transport." The two abreast wheels carry 75% of the total weight, serve as tractors and brakes; the single stern wheel serves as "rudder." The body, completely streamlined, is reputed to have an air resistance one quarter that of an ordinary sedan, conventional style