January 1939

TECHNOLOGY REVIEW

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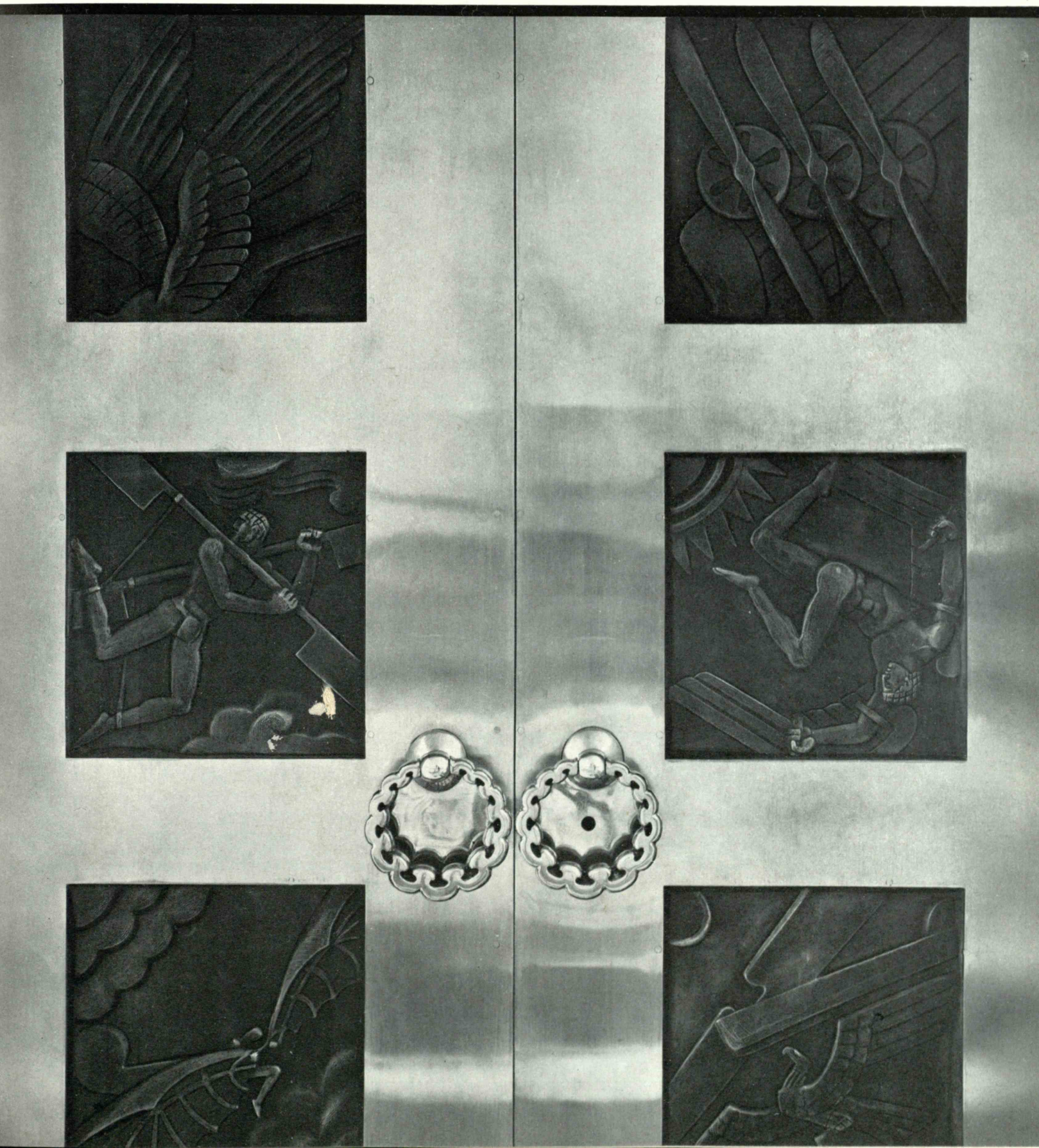


MY NEW YEAR'S RESOLUTION

Chesterfields

FOR MORE PLEASURE

THE TECHNOLOGY REVIEW, January, 1939. Vol. XLI, No. 3. 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

TO detect and encourage sound books on science written for the layman or, rather, for the intelligent reader who wishes to be informed about "the greatest triumph of the human mind" is a proper function of this magazine, and we are exercising it to a greater extent than ever before. You will note, for example, the thoroughgoing review by NORBERT WIENER in this issue's Trend of Affairs section and you may recall the extensive review last month of Hogben's "Science for the Citizen." The Review feels that it has one of the best opportunities of any magazine to provide readers with sound appraisal of popular science literature, and it expects to do so.

A GRADUATE of the United States Naval Academy in 1910, Commander HENRY E. ROSSELL, C. C. U.S.N. Retired, received his S.M. from the Institute in 1915, joined its staff in 1931, and became the head of its Course in Naval Construction, succeeding Professor Hovgaard, in 1933. The Review presents Commander Rossell's article on page 120 in response to requests from readers for a discussion of the importance of aircraft in warfare, and there is probability that other experts will discuss air offense and defense in later issues of The Review. Commander Rossell's article is presented only as the private ideas of the author. ¶ Anyone who carries in the back of his mind the amusing story of the American engineer, temporarily living in Mexico, who did not know there were termites in his home until the piano fell through the parlor floor will want to know more about these destroyers. CHARLES H. BLAKE, '25 (page 123), is an assistant professor of zoölogy, having joined the staff at M.I.T. in 1924. He is a fellow of the American Academy of Arts and Sciences, a trustee of the Boston Society of Natural History, and associate curator of mollusks for that society.

BECAUSE this issue is his last, the retiring Editor ventures to close it on a note more personal than normally is appropriate for these pages. He salutes The Review readers and contributors, for he knows well that they have given the magazine its chief strength and distinction during the 13 years — 115 issues — that he has known it. More specifically he bears tribute to these: to his chief, the Publisher, whose achievement it has been to make The Review a soundly organized and stable enterprise and a magazine with which one may be proud to be associated; to the Business Manager whose skill in breaking down the barriers between the counting room and the editorial desk has given The Review singleness of purpose along with abundant solvency; to the staff, named and unnamed on page 109 and experts all, who in every sense have been partners in our enterprises; and to all of the above together, for they have formed an organization of which it has been an experience in friendship to be one part. Finally he salutes the incoming Editor, for he has great contributions to make to The Review and abiding satisfactions to be obtained from it.

J. R. K.

MAIL RETURNS

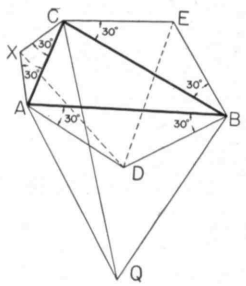
LETTERS FROM REVIEW READERS

Prize Puzzle, 4's, and Gears

FROM THEODORE M. EDISON, '23:

The prize offer for the best solution (with proof) of the puzzle (No. 4) which appeared in the Calibron Products, Inc., advertisement in your February, 1938, issue led to such a prodigious expenditure of effort that our conscience bothered us a little! However, your readers showed so much interest in problems for their own sake that the series was continued.

The $25 prize went to O. Brune, '28, for the following beautifully simple analysis:



The problem: Starting with *any* triangle ABC, construct three exterior triangles having base angles of 30° and vertices at D, E, and X — as indicated in the diagram. If the distance DE is taken as 100, what is the distance DX?

Solution: $DX = DE = 100$.

Proof: On the side AB construct also the exterior equilateral triangle ABQ and draw the straight line CQ. Now the triangles EBD and CBQ are similar, for $BC/BE = [BA/BD] = BQ/BD$ $(=\sqrt{3})$ and $\angle EBD = \angle CBQ$ $(= \angle B + 60°)$. Therefore, $QC/DE = BQ/BD$ $(=\sqrt{3})$. In the same way the triangles XAD and CAQ are similar, and $QC/DX = AQ/AD = BQ/BD$ $= [QC/DE$, as already shown$]$ $(=\sqrt{3})$. Therefore, $DX = DE$.

Q. E. D.

Most of the 67 solutions, sent in by 62 individuals, were long — one running to six pages of neatly listed formulas. Seven additional replies were ruled out because they were inadequate: They dealt with special cases or based their "proofs" on a statement of ours that the answer was a definite number.

We do not recall how we first learned of the relationship upon which our puzzle is based (we did not find it ourselves), but we here extend our congratulations to the discoverer of the fact that DEX is an equilateral triangle. A very good proof, received from L. B. Tuckerman, '06, of the United States Bureau of Standards, shows that the external isosceles triangles may be replaced with equivalent internal triangles to obtain a similar result.

* * *

Turning now to the two other problems which stirred up most discussion, here is the answer to Puzzle No. 2 (December, 1937, Review). The numbers 32, 36, and 64 can be expressed with two 4's and symbols as follows:

$$32 = \sqrt[4]{4^4},\ [= 4^{\frac{4}{4}}];\quad 36 = \frac{4!}{\sqrt{.4}},\ \left[= \frac{4\times3\times2\times1}{\sqrt{.4444\cdots}} = \frac{24}{\sqrt{4/9}}\right];\quad 64 = \sqrt{\sqrt{\sqrt{4^{4!}}}}.$$

In Puzzle No. 10 (November Review), our specifications would be all right for simple rollers, but with gears, the dimensions must be changed to keep the teeth from jamming. The gears will run properly on their pitch lines when the diagonal dimensions have certain definite values only. One of these is about .007″ less than the 4″ dimension specified. Starting with an arrangement in which the four gears are in perfect mesh on their pitch lines, one diagonal dimension can be increased slightly, provided that the other diagonal dimension is *also increased!* Thus, in our problem, the 4″ dimension can be retained if the 3″ distances between gear centers are increased a little — still using 3″ gears. In spite of the fact that the fit would then appear to be loose, the system will run with practically no lost motion.

West Orange, N. J.

Air Conditioning in England

FROM ARTHUR B. MARSH, '29:

I have noted with considerable interest the article on page 10 of The Review for November — the article on the L. M. S. centennial. It was of interest to me not only because of the opportunity I enjoyed this summer of seeing the displays of rolling stock and locomotives here in London's Euston Station but because the article referred to the more modern phases of air conditioning as applied to British railway carriages.

At the present time I am representing the Carrier Corporation of Syracuse, N. Y., as liaison officer to J. Stone and Company of London. Believing it might be of interest to you, perhaps I can elaborate somewhat on the article. The "air conditioning" referred to on L. N. E.'s *Coronation* and *Coronation Scot* is in reality not true air conditioning as we know it. These trains do possess "pressure ventilation," which is filtered air circulated by a fan to the car interior through a concealed air-distribution system. It incorporates no cooling, humidifying, or dehumidifying provisions. This system was installed by the company with whom I am associated here in London.

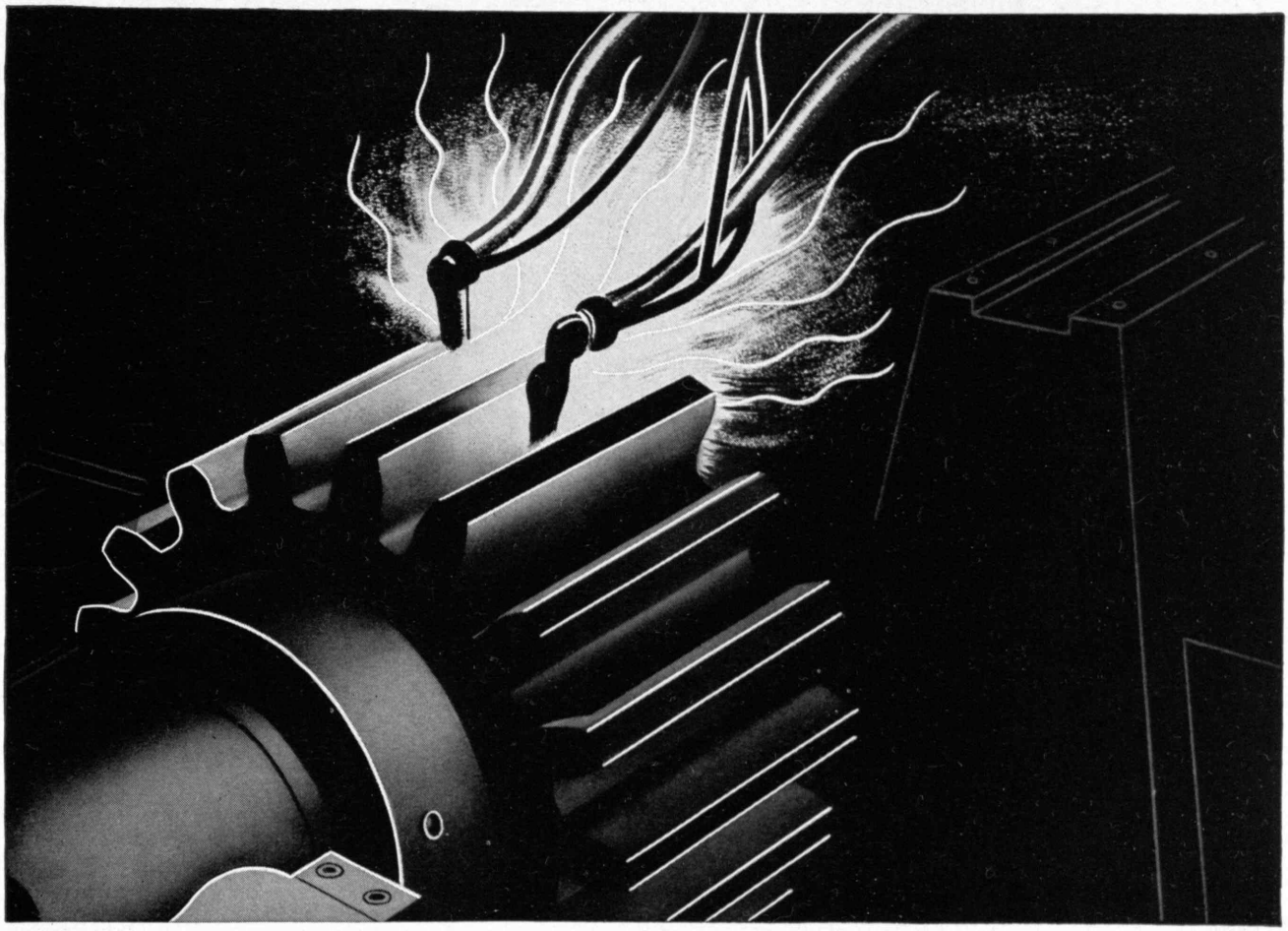
It is interesting to note that in this type of ventilation plus filtering of the air, the British roads were somewhat ahead of American roads, as this type of system was in use in England and some of the Dominions before true air conditioning was devised for railway cars.

The L. M. S. will actually be the first British road or, rather, the first in England proper, to inaugurate true air conditioning when the new royal train goes into operation sometime during the year. It will make provision for cooling the air in addition to proper filtering of the air in summer and will heat and filter the air in winter by means of its specially designed air conditioner. Elaborate separation of the air supplying the smoking lounge from that supplying the royal suites is made for purposes of refinement. The carriages, when completed, will in every way incorporate the finest the railway and its suppliers are able to offer Their Majesties.

The air-conditioning industry is naturally interested in developing the railway market to the utmost, and while a marked improvement in the "feel" of the air will definitely result even in moderate climates, it is easy to understand the British point of view when during a summer the maximum temperature on perhaps six occasions reaches 84 degrees F. accompanied by moderate humidities.

I believe, however, there will be a very gradual adoption on English roads of the benefits of air conditioning that we now take as an accepted fact.

London, England



ECONOMY — WITH A MORAL

FLAME HARDENING of steel where exceptional wear resistant properties are required is comparatively new, but the economies resulting from its application in conjunction with Molybdenum steels, are most significant. They are graphic proof of the cash value of constantly re-studying your production processes and material specifications in the light of improved methods and Moly steels.

When high wear resistance plus good physical properties are required, flame hardening makes the use of relatively inexpensive alloy steels possible. Molybdenum steels, particularly SAE 4140, 4150 and high Carbon (0.40-0.50% C) Manganese Molybdenum, are exceptionally suited for flame hardening. They are practically fool-proof. Molybdenum (next to Carbon) is the most effective hardening agent normally added to steel.

Molybdenum steels and irons make production dollars go further in many ways. Our booklet, "Molybdenum in Steel", containing a great deal of practical data will be sent free on request to technical students and others interested.

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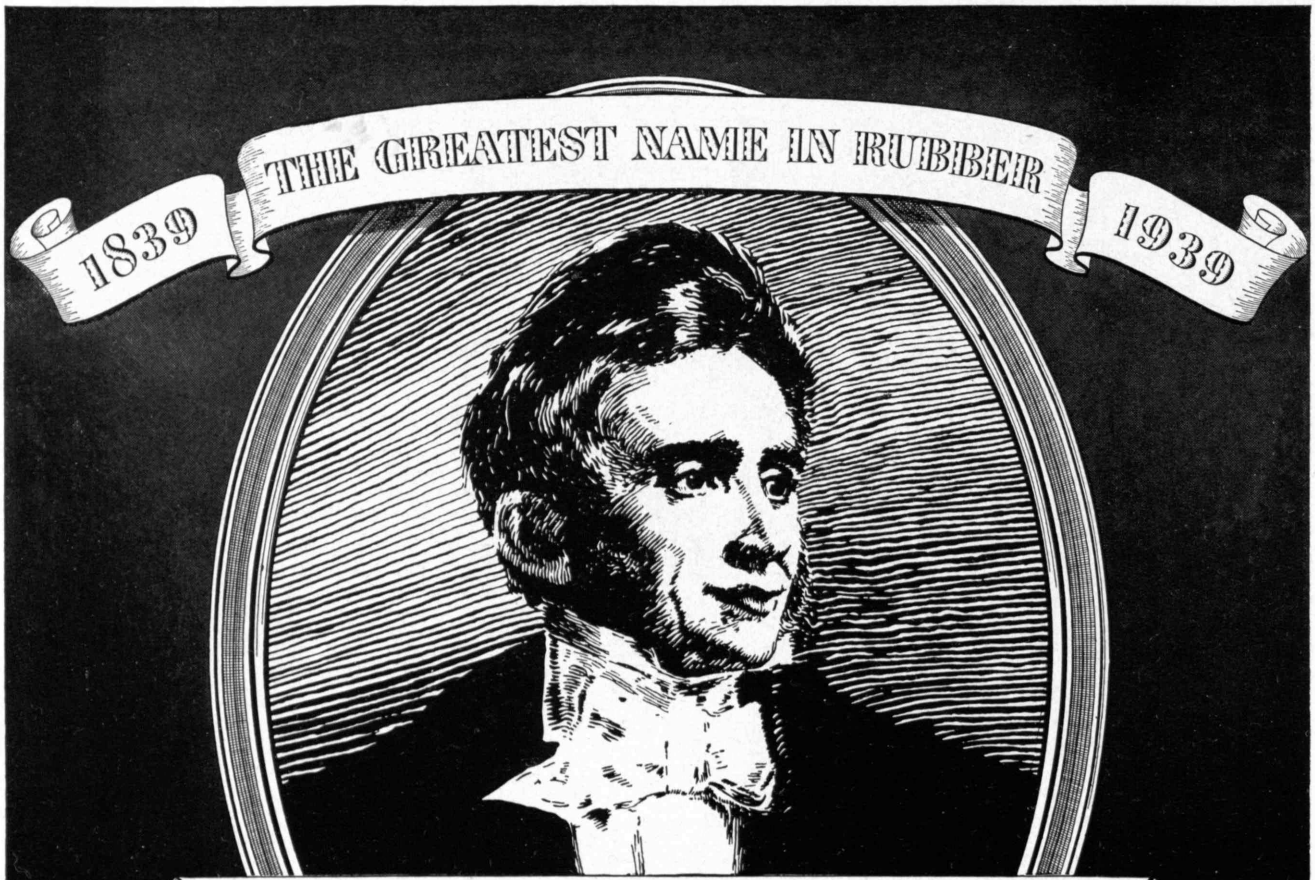


Chas Goodyear

THIS year marks the One Hundredth Anniversary of the discovery of the vulcanization of rubber. In recognition not alone of Charles Goodyear's contribution to the world, but also of the self-sacrifice, the faith and courage of the man, this tribute is published by an enterprise which, though founded long after his death, has striven under the inspiration of his example, and seeks by serviceability to deserve his name.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

HE walked the streets in downpouring rain in a strange garment of rubberized cloth.

He met the jeers of the world with a faith that neither disaster nor seeming disgrace could conquer.

He laid upon the altar of his work all the dear things of life — health, family, friends, fortune, happiness.

He was cast into prison for debt.

He felt himself "appointed of God."

He discovered the vulcanization of rubber.

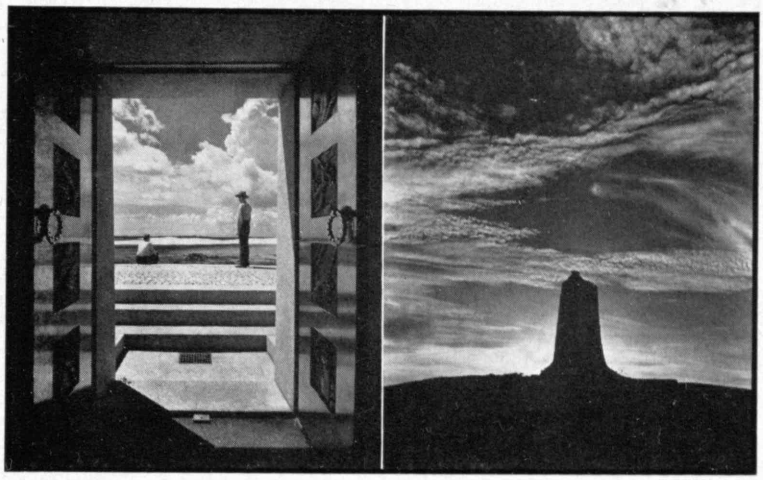
His name was Charles Goodyear.

◆ ◆ ◆

"NOTWITHSTANDING *all the difficulties he encountered, he went on. If there was reproach, he bore it. If poverty, he suffered under it. But he went on, and people then saw, when his invention was completed, that what they had been treating with ridicule, was sublime; that what they had made the subject of reproach, was the exercise of great inventive genius; that what they had laughed at, the perseverance of a man of talent with great perceptive faculties, with indomitable perseverance and intellect, had brought out as much to their astonishment, as if another sun had risen in the hemisphere above . . .*

"I believe that the man who sits at this table, Charles Goodyear, is to go down to posterity in the history of the arts in this country, in that great class of inventors, at the head of which stands Robert Fulton . . . in which class stand the names of Whitney, and of Morris, and in which class will stand 'non post longo intervallo' *the humble name of Charles Goodyear."*

From the address of DANIEL WEBSTER *before the U. S. Circuit Court, District of New Jersey, in 1852.*



F. S. Lincoln, '22

On the cover of this issue are reproduced the handsome doors of the Wright Memorial, Kill Devil Hill, N. C. Here the doors stand open (left). The nearer picture shows the memorial silhouetted against a cloud-flecked sky

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CONTENTS

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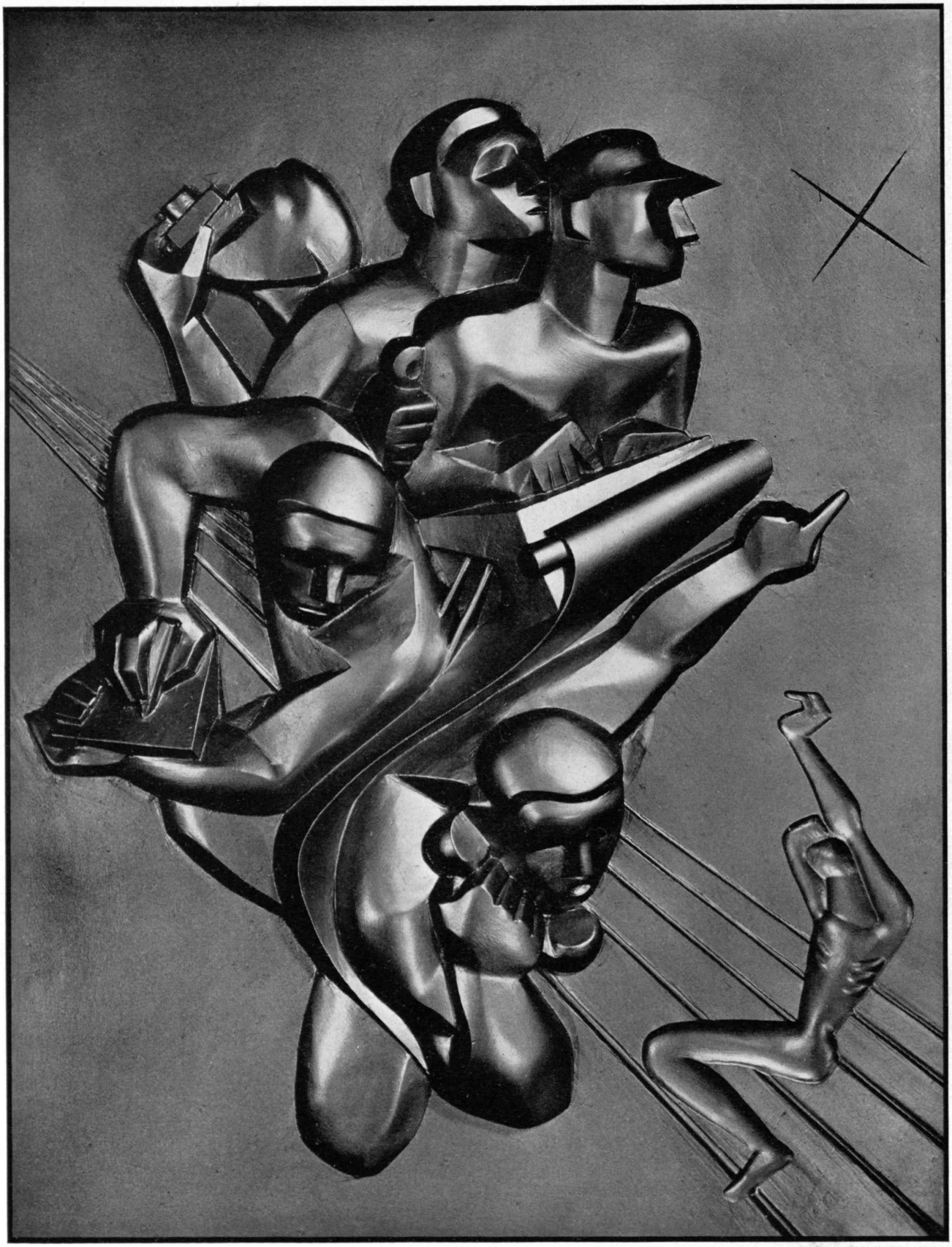
THREE WEEKS MUST BE ALLOWED TO EFFECT CHANGES OF ADDRESS. BOTH OLD AND NEW ADDRESSES SHOULD BE GIVEN.



NEWS

Model of a plaque by Isamu Noguchi for the Associated Press Building, New York City

THE
TECHNOLOGY
REVIEW

Vol. 41, No. 3 January, 1939

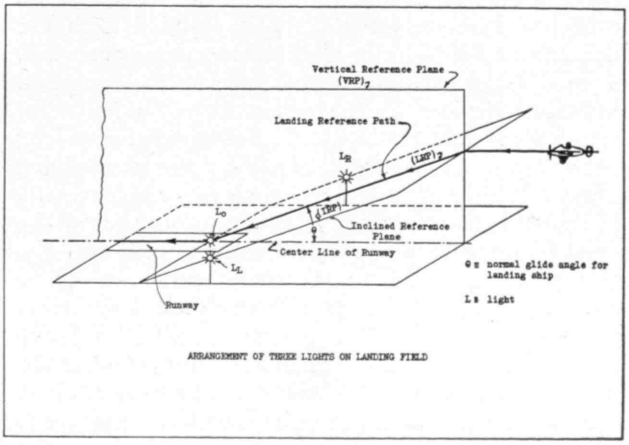
The Trend of Affairs

Trails in Space

THE power of coöperative investigation which is realistic enough to exhaust the possibilities of available existing materials before undertaking to construct new ones has been well illustrated at the Institute during the past year. The development of a blind-landing device for airplanes which bids fair to overcome one of the greatest hazards of aviation is the illustration. Previous systems utilizing "beam flying" have been only partially successful; a scheme which will give a fog-blinded pilot information about the position of his ship with respect to both its own horizontality and its relation to the landing field can be expected to come nearer complete satisfaction. And if the information can be got to the pilot in a form readily interpretable in geometric terms, so much the better.

If on a clear night an airplane nears a landing field, the pilot can be guided to a safe landing by means of three sources of light — one centered at ground level near the end of the field where the ship is to make contact, the others elevated aboveground opposite each other at each side of the field and some distance in front of the first light. The three thus sighted from above define a plane; if the pilot comes in on an imaginary line bisecting the plane, all will be well. This imaginary line is in fact a landing reference path. So reasoned Irving Metcalf of the Bureau of Air Commerce. Flying tests demonstrated the truth of his reasoning. Then developed the problem of getting the aid from such a light system reproduced in an airplane coming to land not on a clear night but in the midst of fog. An indirect application of the basic idea was needed.

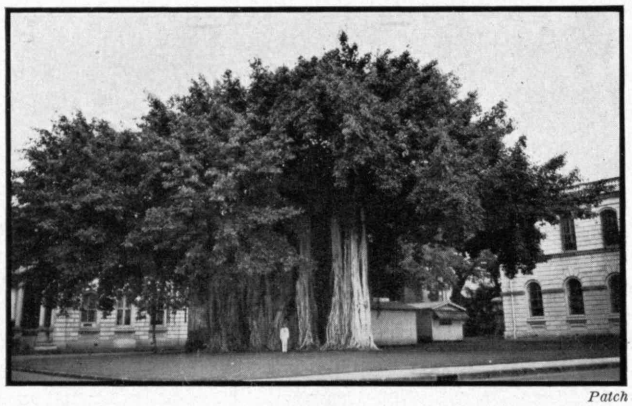
For this, the Bureau of Air Commerce had recourse to M.I.T. The problem posed to a group headed by Professor Edward L. Bowles, '22, of the Department of Electrical Engineering was essentially this: to produce in a fog-blinded plane in flight the illusion of the three lights, and to produce this illusion in such a way as to make clear the attitude of the plane and the direction of approach toward the field. Professor William M. Hall, '28, suggested that the gyroscopic equipment of the plane itself could be put to work in the solution, for this already gives information as to bank and climb, the aerial equivalents of the roll and pitch of a ship at sea. By the use of electrical circuits hooked to the gyro elements, involving the use of very delicate brushes only about three-thousandths of an inch in thickness, the gyroscopes were made to produce three spots of light on the screen of a cathode-ray oscillograph, thus creating the illusion in the plane of the unseen three lights on the field. Professor Charles S. Draper, '26, of the Course in Aeronautical Engineering brought his expertness with aerial instruments to bear on this phase of the problem.



Pictorial diagram, supplementing the adjacent story, showing the principle of the new blind-landing system. Here we see the straight line reference path down which a landing airplane may fly at its natural glide angle

Patch

SAUSAGE



Patch

BANYAN

TREES

. . . are made by God alone, the poet has told and told and told us. Their names, however, are the product of man's vernacular fancy, as some of these photographs from Hawaii by Claude E. Patch, '02, and Carl B. Andrews, '28, disclose. The sausage tree advertises its cognomen in its pods; the rattle of dry fruits in the wind is basis for the characteristic masculinism of the title of the "women's tongues"; that not all bark will bark the knuckles appears at your left, where the disembodied fist smites, unhurt, the soft integument of the red gum eucalyptus

End result was a system whereby bank and climb — the attitude of the plane — were indicated by changes in the positions of these three spots.

With the pilot thus enabled to keep his ship steady with a minimum of difficulty, the next question was that of bringing him to the field on a true line, literally that of blazing him a trail in space. Here two possibilities were to be canvassed — the infrared rays and radio waves. Infrared's fog-piercing possibilities, already much investigated, were examined thoroughly. Radio waves offered more assistance. In the system devised, two beams of these directed angularly upward from the field, one under the other but overlapping somewhat, are modulated at different frequencies. Antenna and conversion devices in the plane serve to keep the center spot of light on the instrument in position as long as the ship is on the path defined by the overlapping beams. Deviation into the region above or below shifts the center light accordingly. Thus the position of the airplane above or below the reference path and the angle of its approach to the earth are cared for. A similar arrangement was provided to govern deviation to the right or left through changes in the relative position of the right and left lights. In this aspect of the problem, the fact that the beams had to be sent up at an angle from the earth was of importance, for it meant that the effect of the earth upon them might cause the path to vary undesirably in slope and linearity. Hence it was essential that true controlled beams be available. Dr. Wilmer L. Barrow's ('29) method of projecting extremely short radio waves in narrow flat beams from horns here found immediate and practical application, which has provided material for graduate instruction.

During the first year of investigation of the problem, these were the developments. The instruments and indicators necessary have been completed in experimental form. The first year's work was positive in all its results, both those dealing with blind landing and those dealing with the use of the same instruments in route flying. Under a new agreement with the recently established Civil Aeronautics Authority, the radio phase of the question will almost entirely engross the researchers for the next 15 months. The practical consequences of the development are distinctly great, as is indicated by the coöperation of the aviation industry, the Army, and other associated groups.

It Floats

WHEN we heard the other day of a way by which printing ink might be removed from repulped paper, we picked up a trail leading to a versatile industrial process that's gaining importance steadily. A curiosity in 1903, a trend in 1912, a method that is handling 300,000,000 tons of ore a year at present, and tomorrow perhaps an established tool for the chemical engineer, flotation — for that's the name of the process — deserves more publicity than it has received.

As with any successful process, it has spread (amid continuous patent squabbles) because it has brought otherwise unobtainable profits, but its specific advantages are that in the mining industry it can generally handle leaner ores than can other methods — in fact, it has recovered minerals profitably from the dumps left by older, less effective processes; it can handle, must handle, finely crushed ores that give trouble in other concentrating methods; and it can do these things with a more compact plant and a simpler flow sheet.

These very small particles are the substance of flotation. As Charles E. Locke, '96, puts it, most of the low-grade ores mined today require very fine grinding before each ore particle is freed from all material not like itself, and "flotation becomes automatically the only means of high recovery." The thoroughness required in this operation is attested to by its up to 50 per cent share of the operating costs, the flotation step itself taking perhaps another 25 per cent.