March 1937

TECHNOLOGY REVIEW

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THE TABULAR VIEW

MAGAZINES, if they are to perform their maximum service, must serve as clearing houses of information for their readers, even beyond the exchange of ideas afforded in their reading matter. Each month, for example, the delivery of The Review evokes from readers letters and other requests for more information or special information on subjects covered in the magazine. These inquiries are welcome, and every effort is made to respond to them fully. In this service, which we would like to see grow, we are aided by the great resources of the Institute: its staff, libraries, and laboratories. Let it be noted, then, that with the generous aid of these various agencies The Review stands ready to answer or have answered any reasonable query arising out of its editorial and advertising content.

ALTHOUGH this is his first formal appearance in print as a brain tester, RALPH G. HUDSON, '07, is the author of five technical books that might at various times have been classed as brain testers by lackadaisical students. He is professor of electrical engineering at the Institute and is in charge of the Courses in General Science and General Engineering. Readers will recall his article, "Science and the Fine Arts," published in these pages last May. ¶ "Seeing Solid" was started as a 500-word article for The Trend of Affairs; when finished, it had grown to 5,000 words and a dozen illustrations, as you may observe on page 191*ff*. On the one hand, this tenfold increase in length reflects the growth in enthusiasm of the authors as they dug into the subject. On the other hand, the greater length bears an inverse ratio to the material available on stereoscopy; as the authors discovered how little had been said about the stereoscope's growing importance, they felt justified in speaking at length. The collaborators are both members of The Review Staff. ¶ "The Educated Workman" (page 198) reached the Editor via the Institute of International Education under the auspices of which the author, KARL POLANYI, has traveled, lectured, and observed in the United States. Although now living in London as the foreign editor of *Der Osterreichische Volkswirt*, Dr. Polanyi is an Austrian citizen and a native of Vienna where he has achieved a wide reputation as a political scientist, author, lecturer, and editor. ¶ The Review's editorial associates are its eyes and ears; they occupy outposts, each in a special field, where they scan the horizon for the new, the interesting, and the important. With this issue we bring the number of these associates to a round half-dozen by the addition of FREDERICK G. FASSETT, JR., Assistant Professor of English at the Institute, able journalist, shrewd observer of the pageant of science. Already he has contributed many thousands of words to The Review and made himself an invaluable member of The Review family. ¶ The Review again issues a call to amateur photographers to submit prints for consideration by the Editors.

MAIL RETURNS

P. S. to a Comeback

FROM JAMES H. CARR, JR., '36:

I read with interest your article in the December issue of The Review entitled "Wooden Bridges Stage a Comeback." To what the author has said I should like to add my views on what I believe is one of the most important considerations in this new appreciation of timber for structural purposes.

Probably the greatest aid to the economical use of structural timbers and the main factor in the coming back not only of wooden bridges but also the building of structures previously thought of as being possible only in steel (*e. g.*, radio towers, ski jumps, wide-span warehouses, and many other large construction projects) is the development and use of modern timber connectors. By their use the full strength of the wooden members is utilized, whereas in former days the joints so limited allowable stresses that large pieces were necessitated to obtain safe joinings. Wooden structures have found their renaissance through these connectors and in less than four years over 9,000 structures have been built in the United States with connectors in one form or another.

It might also prove interesting to the readers to know of the very latest development in the connector field, which is the spiked grid. This connector is especially adaptable to wharves, piers, and trestle bents where the connection of round timbers is involved. These connectors are in several forms, but in all cases consist of square malleable iron castings with teeth on opposite sides. The most important forms are those with two flat sides for connecting two rectangular timbers together, those with one flat and one curved side for connecting a round timber to a rectangular timber, and those having two curved surfaces for use in connecting two round timbers. The railroads have shown much interest in this connector. One railroad has found the use of Teco grids in its piers has prevented shearing of one-inch bolts under heavy impact load.

Washington, D. C.

Behind the Scene

FROM W. T. WHITE:

On page 141 of the February issue of The Review there appears a short paragraph covering the new "quota-control" elevators recently installed in the International Building at Rockefeller Center. Perhaps you may be interested to know that all of these elevators, together with those in the main Tower — buildings number 6, 4A and B, the English and the French buildings — were installed by the Westinghouse Electric Elevator Company of Chicago, of which Frank C. Reed, '03, is president and Ross H. Rathbun, '12, is general sales manager.

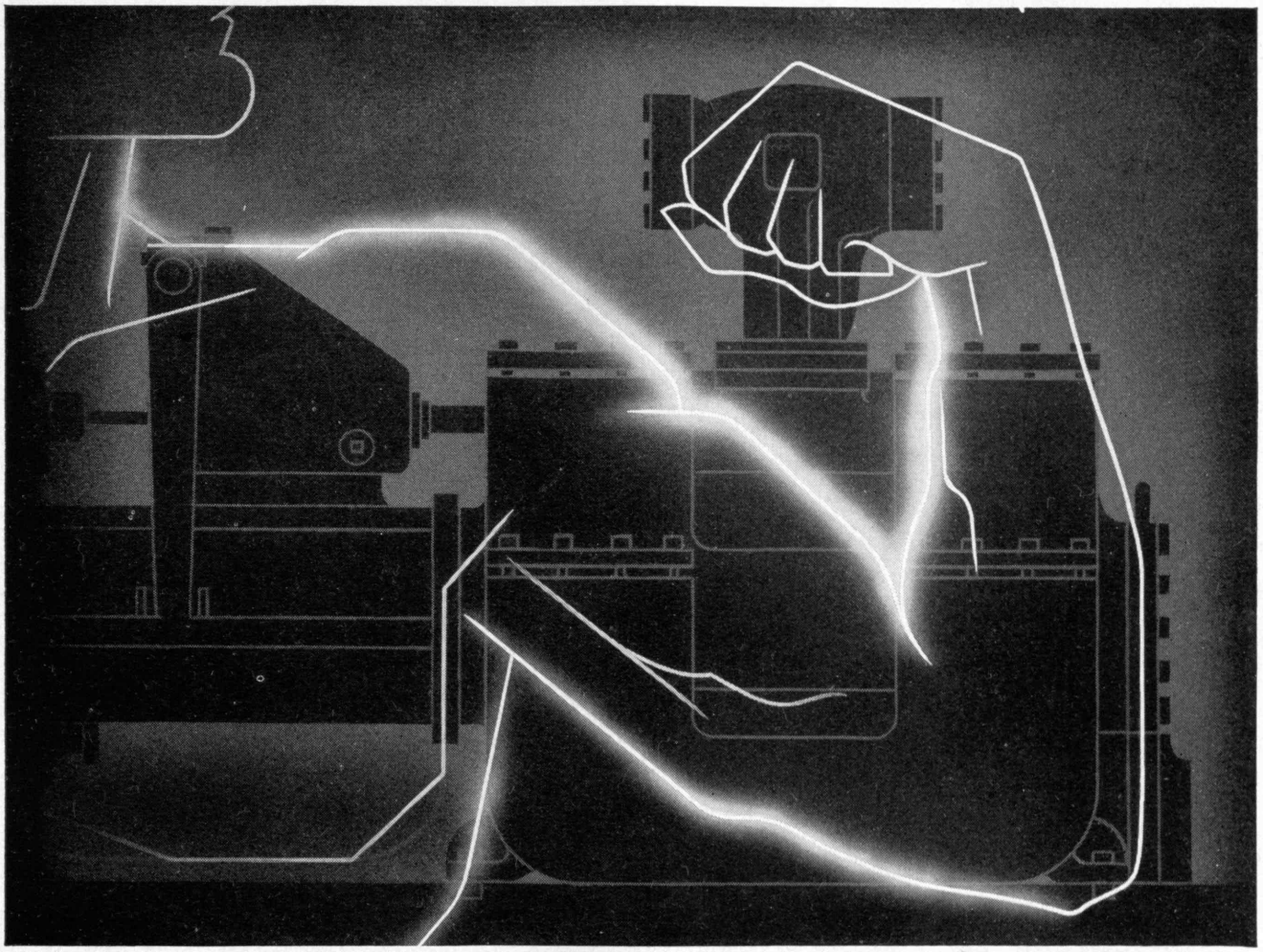
Chicago, Ill.

Lucid Observations on Education

Professor Tenney L. Davis' article in the December Review elicited the following observations:

FROM JOHN E. WOODS, '16:

. . . A consideration of the facts discloses a few points which are presented so logically in your recent article, "Toward a Liberal Education." The average student at the Institute enters after three or four years in high school or prep school, during which time he is really preparing his mind for an education. He is then immediately launched into a relatively rigorous curriculum in which he has (*Concluded on page 214*)



SINEWS FOR SERVICE

IF THE service is tough — so are Moly irons and steels. Take slush pumps in the oil fields . . . driven continuously and operating under severe conditions.

Since no pump is better than its parts, many pump builders use Moly irons and steels for the vital parts . . . because they have proved their capacity to withstand the toughest going.

One manufacturer, for example, uses carburized Nickel-Moly (SAE 4615) for pump cylinders. It was selected primarily because it takes a case impervious to the abrasion of well cuttings; and pressure is always constant. Minimum distortion from heat-treating was also a factor. . . . Just one of many cases where Moly steel or iron has settled a difficult problem — to the mutual advantage of the manufacturer and the user of the product. From either standpoint, Moly steels and irons will prove well worth their investigation.

Our technical books, "Molybdenum in Steel" and "Molybdenum in Cast Iron," will be found of unusual interest to engineering and production heads in any industry using or producing ferrous products. A simple request brings either or both — and, if desired, puts your name on "The Moly Matrix" monthly mailing list. Our experimental laboratory facilities are available for the study of any special problem in alloy steel or iron. Climax Molybdenum Company, 500 Fifth Avenue, New York City.

PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

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MOLY

YOU WON'T BELIEVE US

UNTIL YOU USE THIS AMAZING NEW 5-R BELT!

NOTHING STOPS IT—Goodyear engineer "snowing" fine baby talcum powder on pulley side of Goodyear 5-R Belt in test on 100 h. p. dynamometer. Yet even under this abnormally slippery condition 5-R continued to pull a heavy load at slack tension—*proof of its remarkable grip!*

YOU are bound to be skeptical — for any description of the new Goodyear 5-R Belt's astounding *slack-tension* operation sounds too good to be true. Yet every one of the following facts has been proved by nearly two years' test service on hundreds of different industrial applications:

HIGHEST COEFFICIENT OF FRICTION — *the 5-R is treated with a new Goodyear-perfected non-rosinous rubber compound, completely impregnated* THROUGH *the fabric, that affords a tenacious pulley-grip unsurpassed by any other type of belt!*

PERMANENT FACE ADHESION—*a high ratio of tensions may be obtained temporarily by recourse to one of many impermanent surface compounds. 5-R is unique in that it offers a minimum ratio of tensions of 5 at 180° of contact—its surface friction is lasting. It is a compound that will not crumble, ball-up, chatter or slip.*

OPERATES AT 25% TO 50% LOWER TENSION—*because of its high coefficient of friction, 5-R pulls heaviest loads at surprisingly slack tensions; greatly lessening strain on both belt and fasteners, and greatly increasing belt life.*

REDUCES BEARING PRESSURES 25% TO 50%—*because of lower operating tension, 5-R increases bearing life, lessens lubrication problems, lowers frictional losses and cuts power costs.*

APPLICABLE TO ANY DRIVE — *5-R is a square-edged flat belt, made in roll lots in all sizes and widths; easily applied with any standard fastener.*

Let the GTM show you

The G.T.M.—Goodyear Technical Man—will gladly explain 5-R's unequaled efficiency and economy. To bring this friendly consultant to your plant, write Goodyear, Akron, O., or Los Angeles, Calif. — or the nearest Goodyear Mechanical Rubber Goods Distributor.

BELTS
MOLDED GOODS
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THE GREATEST NAME IN RUBBER

GOODYEAR

F. S. Lincoln, '22

THE TECHNOLOGY REVIEW

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EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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THE COVER

From a photograph by Young and Phelps

PUBLISHED MONTHLY FROM NOVEMBER TO JULY INCLUSIVE ON THE TWENTY-SEVENTH OF THE MONTH PRECEDING THE DATE OF ISSUE AT 50 CENTS A COPY. ANNUAL SUBSCRIPTION $3.50; CANADIAN AND FOREIGN SUBSCRIPTION $4.00. PUBLISHED FOR THE ALUMNI ASSOCIATION OF THE M.I.T. DONALD G. ROBBINS, PRESIDENT; C. A. SAWYER, JR., H. B. RICHMOND, VICE-PRESIDENTS; CHARLES E. LOCKE, SECRETARY; J. RHYNE KILLIAN, JR., TREASURER. PUBLISHED AT THE RUMFORD PRESS, 10 FERRY STREET, CONCORD, N. H. EDITORIAL OFFICE, ROOM 11-203, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE A, MASS. ENTERED AS SECOND-CLASS MAIL MATTER AT THE POST OFFICE AT CONCORD, N. H. THREE WEEKS MUST BE ALLOWED TO EFFECT CHANGES OF ADDRESS. BOTH OLD AND NEW ADDRESSES SHOULD BE GIVEN.

The stereoscope, as reported on page 191ff, has become an indispensable tool of science, an ingeniously adapted aid to visual understanding, and an instrument of pleasure with ever-widening possibilities.

The Technology Review is designed to be an editorial stereoscope for presenting Science's new world picture in the startling clarity of relief. It goes beyond the mere reporting of science and engineering news *in plano;* it adds the third dimension of *interpretation.*

Readers who seek a more realistic picture of the techniques, the products, and the new ways of living and thinking nurtured in laboratories, readers who desire the roundness, solidity, and depth of the stereoscopic view — it is for such modern-minded readers that The Review selects or prepares its interpretive articles.

It is for such readers that The Review presents each month a *salon* of brilliant photographs with an able supporting cast of three-dimension captions. In these illustrations readers find both interpretation and beauty, the unexpected, otherwise unseen beauty caught by cameras-in-the-laboratory and by engineer-inspired cameras on the mammoth dams and bridges and in the great industries of today and tomorrow.

THE TECHNOLOGY REVIEW

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The Trend of Affairs

Surprising Casey Jones

AS far as the public is concerned, the entire field of railroading has for the past several years been enjoying a technical renaissance which makes recovery from its economic slough almost a certainty. There are the Diesel-electric streamliners, which will perform miracles on a pint of cheap oil. (The smoke of publicity surrounding these newcomers is backed by plenty of fire.) And there are these new streamline steam locomotives (see next page) whose sleek steel envelopes, designed presumably to maintain the supremacy of steam in railroad power, seem better fitted to fascinate naive passengers. Commonly overlooked, however, is the fact that underneath their tastefully decorated false fronts is the same boiler and engine which one might have supposed the renaissance had shouldered into limbo.

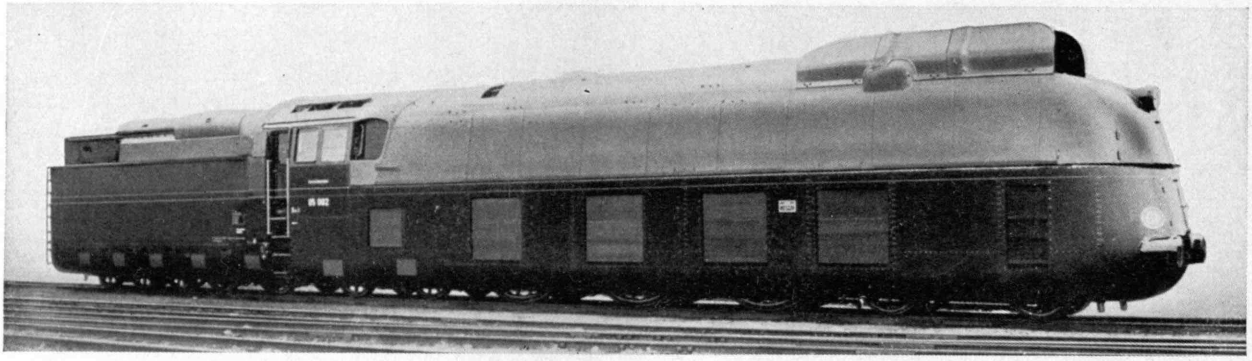
Ever since the time, more than a century ago, when it became less expensive to operate than a horse, the steam locomotive pursued its career without serious competition and, consequently, without much improvement in performance. Furthermore, its engineering, for the greater part of its history, has been dictated by "practical" men, so that it is, like its centenarian contemporaries — the textile mill and the steamship — basically empirical in design. The result is a standardized, highly dependable engine, which, in its latest and most efficient forms, has few features aside from size which would startle Casey Jones and an overall efficiency of not more than nine per cent. By contrast the best central steam power stations will convert about 30% of the heat energy in the fuel into useful work.

Compared with the not uncommon pressures of 1,400 pounds per square inch, temperatures of 900 degrees F., and fluid-boiler design encountered in stationary plants, the railroads, with a decade of chronic depression behind them and an unlimited prospect of good times ahead, still cling to the fire-tube boiler and maintain the upper limit of accepted practice at 300 pounds per square inch. (It is only fair to record, however, that water-tube boilers of high pressures have been tried experimentally and that increase of working pressures in this type of engine has been hampered by legal limitations.) During the past 20 years, improvements in thermal efficiency have resulted mainly from higher superheating temperatures and better use of waste heat, with few attempts at more radical changes.

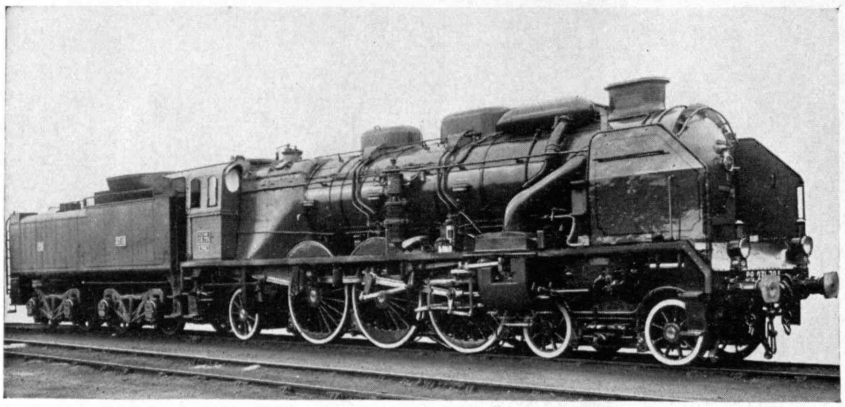
The net effect has been to lower fuel consumption until it now takes 15 pounds of coal on the average to pull a passenger car one mile, while in 1922, 18 pounds were required for the same task. But — the *Comet*, a New Haven owned Diesel-electric unit carrying 160 passengers, travels 1.6 miles on one gallon of fuel. And — fuel for locomotives accounts for over one-quarter of railroad operating costs.

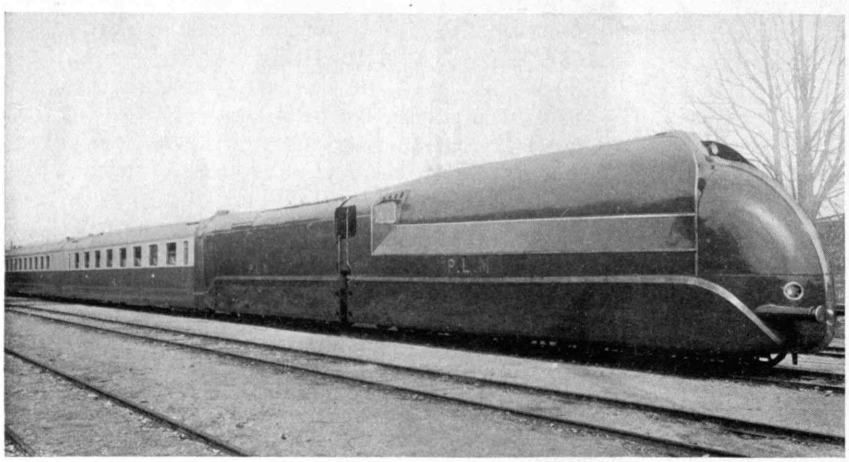
Although it is possible, even probable, that worried locomotive builders may reach efficiencies of 15% by progress along present lines, the process may be so slow that the patient will become a chronic invalid before the disease is overcome. Recourse to organized research may lead to faster progress. One promising result of this technique, joint product of the Union Pacific and General Electric, is a steam locomotive that is different. Of near record size, its two 2,500 horse-power units will pull a load of 1,000 tons at 110 miles an hour when operated in synchronism.

More significant than these statistics is the fact that this prime mover will be the first steam turbine-electric locomotive to ride American rails. Not that the turbine locomotive is new: Because of its efficient, reliable performance in stationary and marine plants, railroad engineers have been attracted to the turbine time and



Baldwin Locomotives





ON FOREIGN RAILS

With its hat pulled low over its forehead and its skirts tucked in under its knees, the German locomotive above, built by Borsig, is of a type which holds the world's record for steam; it can lap up distance at the rate of 119.2 miles an hour, drawing a train of 200 tons.

France offers contrasts such as the two steam locomotives on the left. The upper, a Pacific type which runs on the Paris Orleans Railway, with wind-swept wheels and its veins seeming to stand out from exertion, has been known to exceed 93.2 miles an hour when hauling a train of 400 tons, and it regularly draws the South Express between Tours and Bordeaux at 66.4 miles an hour. The lower, svelte model, of the Paris, Lyons, Mediterranean Railway runs 97.5 miles an hour when pulling 200 tons on the Paris-Dijon trip

time again, only to be repelled by the difficulty in adapting it to the savagely severe conditions encountered in railroad practice. Yet the promises held out by the turbine have been so bright that dozens of experimental units have been constructed in Europe since the first attempt by the Italian Belluzzo in 1907.

Beckoning the designer of condensing turbine locomotives, particularly for high-speed passenger service, is, first, a fuel consumption less than half that of the piston unit; second, lower maintenance costs for engine and roadbed; third, elimination of the unbalanced forces which are serious in reciprocating engines operated at the higher speeds toward which railroads are moving. To transmit thousands of horse power from whirling rotors to stationary track requires, however, costly, complicated design. Turbines are also nonreversing. Electric drive, instead of mechanical, of course eliminates this problem, as it does that of the turbine's low starting torque.

Past experience has shown, however, that the condenser is or, let us hope, was the greatest weakness. Prime element in lowering fuel consumption, it was, in previous designs, bulky, expensive, varying with the weather in its action, and unreliable. The latest European designs have shown, by a trend to noncondensing units, that engineers consider its disadvantages to outweigh any savings in fuel.

The Union Pacific locomotive, soon promised for delivery, is, nevertheless, a condensing unit, allowing the use of distilled water and the elimination of many boiler troubles. It is reported that the new boiler will look much like the usual streamline design, but there