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TECHNOLOGY REVIEW

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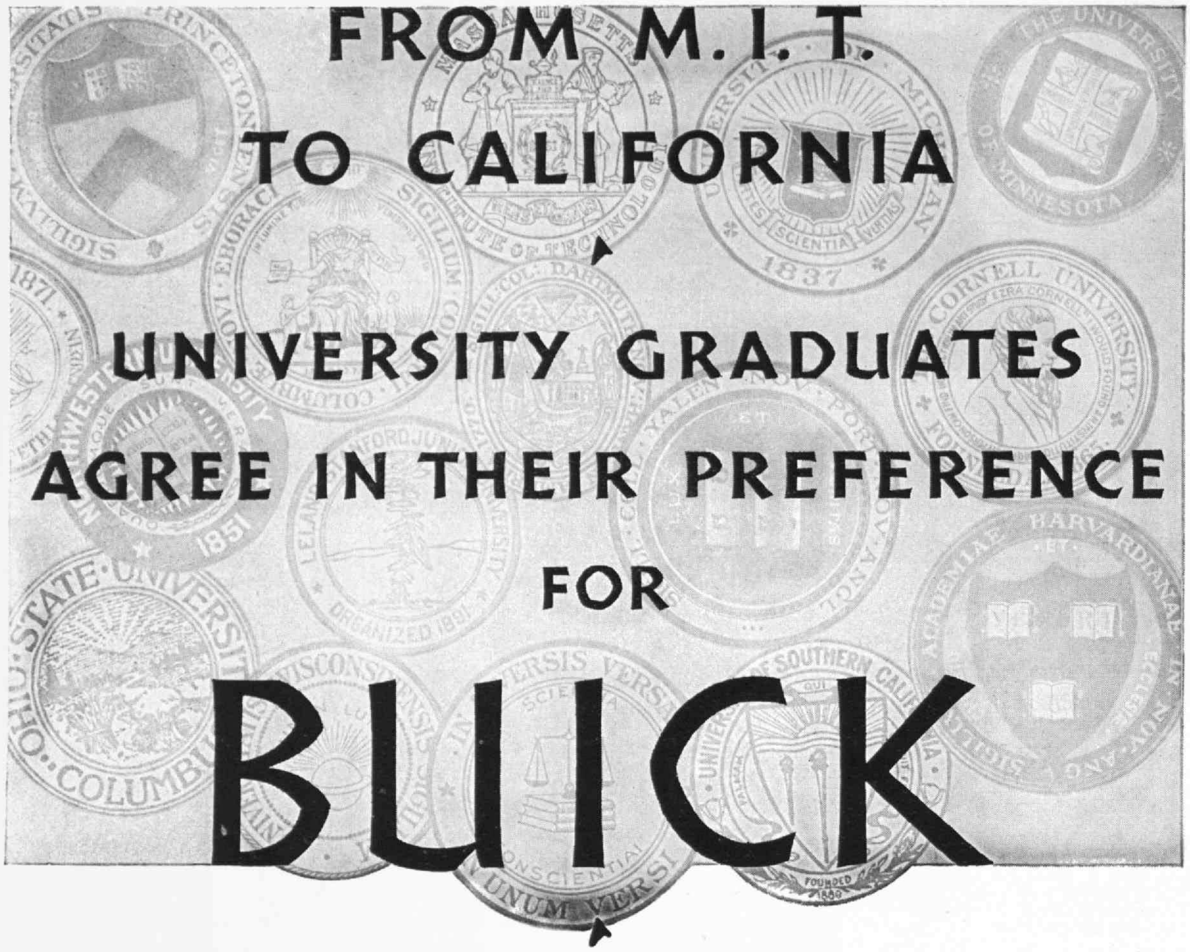

Facts concerning automobile ownership by the graduates of fifteen leading universities were recently compiled by the Graduate Group of alumni magazines and by the alumni associations of the universities.

And the facts are these: The number of Buicks owned by the graduates of these fifteen universities is nearly double that of the next automobile in Buick's price class.*

Isn't it significant that in the cool, calm judgment of these men and women who are trained to think, Buick should be the overwhelming preference?

Yet, perhaps it is only natural after all because experienced motorists *everywhere* know that Buick is a surpassingly fine automobile. *Everywhere* ownership of Buick is accepted as a criterion of good taste and good judgment.

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If you are not a Buick owner yourself, may we suggest that you take the first step toward becoming one? Just drop in at the nearest Buick dealer's . . . inspect his display of new Buick Straight Eights . . . get behind the wheel of the car of your choice . . . and drive it. Then try to be satisfied with anything less!

** The Graduate Group, Inc., certifies the accuracy of these facts about the ownership of Buicks among 15 leading colleges and universities.*

STRAIGHT BUICK EIGHTS

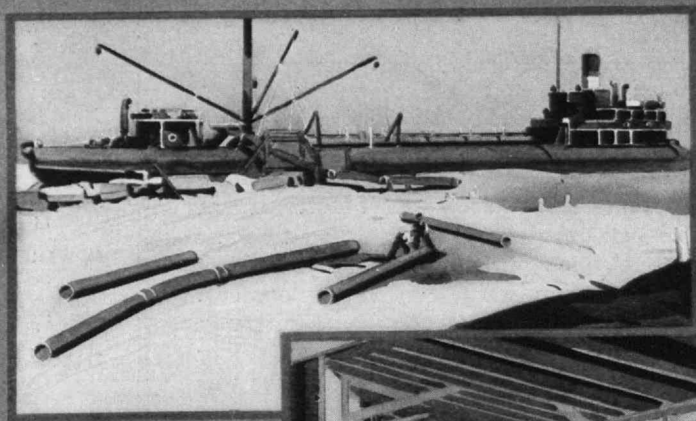
WHEN BETTER AUTOMOBILES ARE BUILT, BUICK WILL BUILD THEM . . . PRODUCT OF GENERAL MOTORS WITH BODY BY FISHER

THE TABULAR VIEW

THE judicious appraisal of television which opens this issue of The Review comes to us from J. Warren Horton, Chief Engineer of the General Radio Company. Before coming to Cambridge, Mr. Horton spent 12 years in the Bell Telephone Laboratories on carrier telegraphy and telephony problems, on precision frequency measurements, and on television development. After graduating from M. I. T. in Electrochemistry in 1914, he remained for two years more as a staff member of the Department of Physics. During the War he was engaged in problems relating to submarine detection, both in this country and at the U. S. Naval Headquarters in London. ℂ Dr. J. C. Boyce is a Research Associate in the Institute's Department of Physics where he is working in the field of spectroscopy in association with President Compton.

AS A PARTNER in the Boston firm of Arthur L. Nelson, Engineers, Edward H. Cameron is a consultant on power problems for public utility and industrial companies. A graduate in Civil Engineering from M. I. T. in 1913, he has had broad experience in contracting, in engineering work for the U. S. Navy, and in the engineering management of various enterprises. In 1931 he was President of the Northeastern Section of the American Society of Civil Engineers, and at present he is a Director of the Emergency Planning and Research Bureau, Inc., of Boston. In 1928 he was awarded the Clemens Herschel Prize for a paper entitled "Engineering Features of a Modern Glass Bottle Plant." ℂ For 20 years Thomas D. Perry, '00, has devoted himself to woodworking engineering, and at the present time he is Chief Engineer of the United Plywood Corporation as well as Works Manager and Engineer for the New Albany Veneering Company (Indiana). He has been President of the Plywood Manufacturers Association, Chairman of the Forest Products Section of the A. S. M. E., a member of the National Committee on Wood Utilization, and Chairman of the Executive Committee of the Wood Industries Division of the A. S. M. E. He is the author of the technical section of "Veneers and Plywood," editor of the woodworking department of "Collier's Encyclopedia," and a contributor to "American Industrial Biographies."

NOTABLE among the articles in the forthcoming issue of The Review is a discussion of domestic air conditioning by Walter L. Fleisher. The article cuts behind current ballyhoo on cooling and humidifying by presenting a discriminating engineering comparison of various systems together with data on their installation costs and operating expenses. ℂ Readers of this issue will note the large percentage of space devoted to charting the course of engineering accomplishments and progress. In coming months, projects that loom on the horizon will diligently be spied out and reported upon, and appraisals of current scientific and engineering developments, prepared by high authorities, will be presented.



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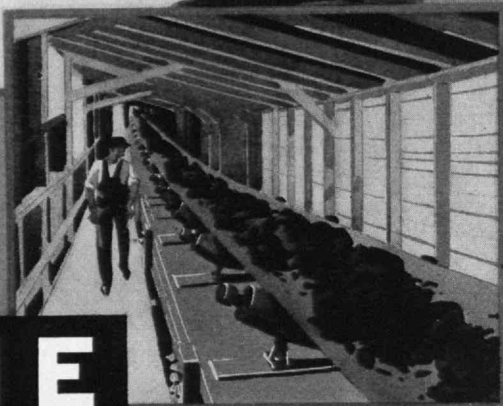

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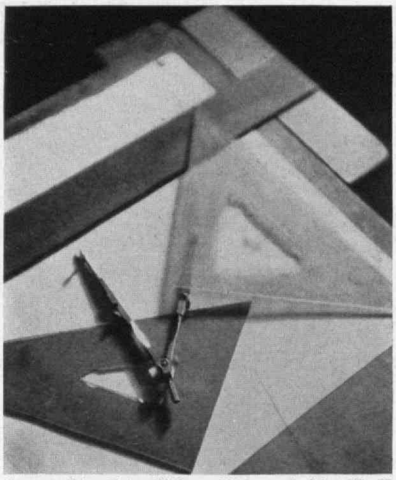

Composed by Peter Kilham, Photographed by W. H. Kilham, Jr.

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PAVING A DETOUR

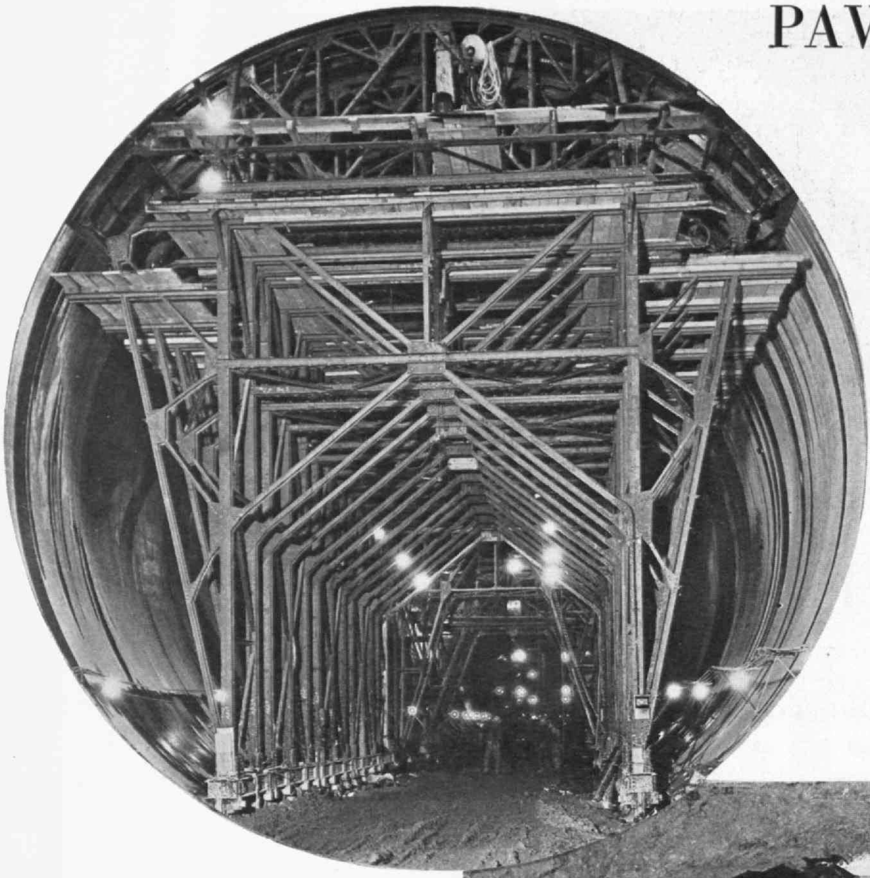
for the

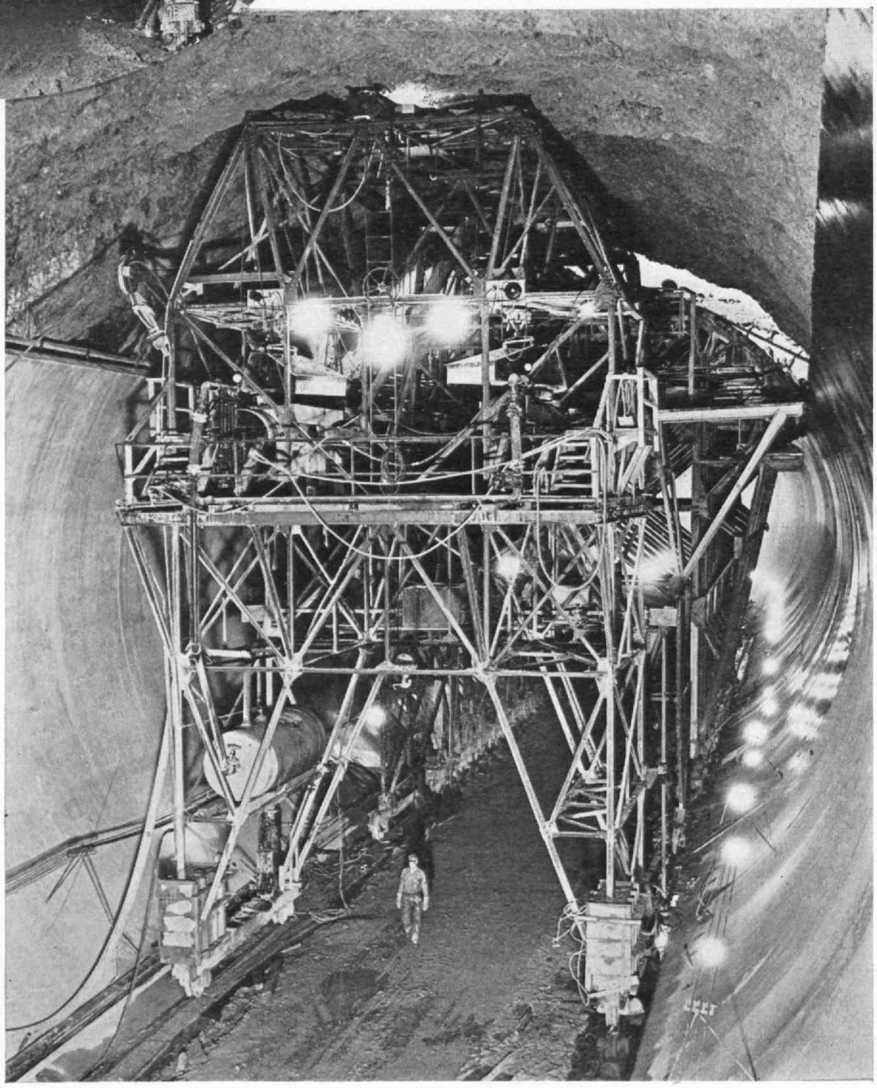
COLORADO RIVER

Lining the Huge Diversion Tunnels at Hoover Dam with Concrete

See page 17

Photos by courtesy of the U. S. Bureau of Reclamation





Above: Steel-frame carriage supporting form for 110° top-arch concrete in diversion tunnel lining. The surface of the top concrete is painted with an asphaltic coating immediately upon the removal of the form to prevent a too rapid dissipation of the concrete's moisture content

Right: Concrete gun carriage used in placing 110° top-arch concrete in diversion tunnels. Concrete is hauled by truck in dump-buckets into position under carriage, hoisted to upper deck by bridge crane operated overhead, dumped into hoppers, and compelled into forms by compressed air through two eight-inch steel and rubber pipes

The combined length of the four 56-foot diversion tunnels totals 16,000 feet and the rock which had to be broken and removed amounted to a million and a half cubic yards — a volume matching that of the world's longest railroad and water tunnels. Only a little more than a year was required for this gigantic task

THE TECHNOLOGY REVIEW

Vol. 35, No. 1 October, 1932

Looking 'Round the Corner

Television Still Faces the Pocket-Book Test

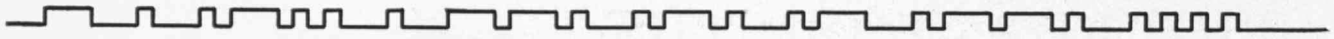
By J. Warren Horton

An Engineer, Confronting Rosy Prophecy with Sober Fact, Refutes a Chinese Philosopher by Demonstrating that a Picture is Not Worth a Thousand Words

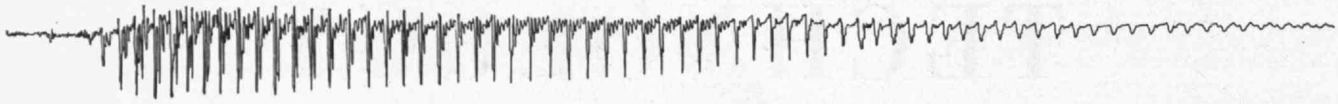
TELEVISION has a peculiar significance in the progress of the machine age, not because of any grandeur of its technical achievement or because of its contribution to human well being, but because it marks the final defeat of the skeptic. It seems probable that this most recent accomplishment of electrical communication has rung down the curtain on that scornful chorus which has chanted the refrain, "It can't be done," at the approach of each new application of science since the steam engine, if not since the wheel and the lever. For perhaps the first time in history the public has foreseen an invention in advance of its realization, and, encouraged by the results, has replaced its old pessimism by a too abundant optimism. The technically sophisticated, however, will do well to temper their scorn; they are merely reaping their own whirlwind.

When our grandfathers predicted the ignominious failure of any attempt at heavier-than-air flight, their judgment was supported by some fairly extensive data as to the difficulty of getting ponderous matter to remain long away from substantial support. It is true that they lacked much of the quantitative information necessary for a complete solution of the problem, but within certain limits they had a working knowledge of the everyday manifestations of matter and energy on which we have improved but little. At all events, when confronted by the suggested possibility of the railway, of steam navigation, or of aviation they were able, on the basis of their own experience, to estimate the difficulties which had to be overcome. Today the subdivisions of knowledge are so complex that only a few specialists are in a position to evaluate the magnitude of any projected enterprise; the experience of the remainder of us suggests that, as the seemingly impossible so frequently comes to pass, we may confidently expect anything to happen. While it is true that we may without shame leave the slide rule work to those best qualified to manage it, we all become involved when the time arrives to apply the last quantitative measure — the universal measure of cost. It may be sufficient for the research scientist to confine his attention to concepts such as the laws of motion and of thermodynamics; the engineer, however, must govern himself in accordance with the laws of supply and demand as well. We may all have a more or less casual interest in how television has been brought about, but as members of the consuming public we have a very real concern in those factors which are of economic rather than of technical importance.

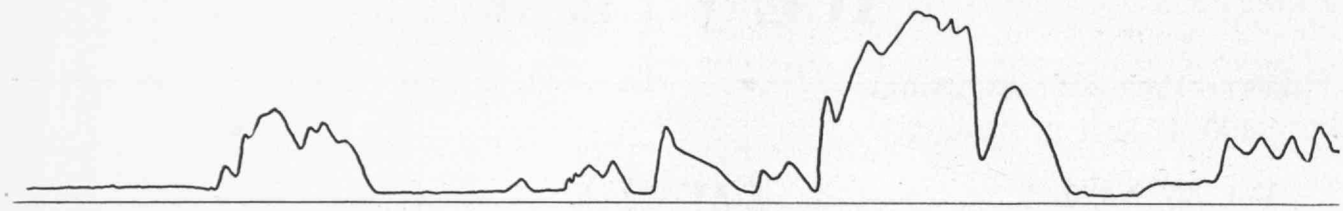
We are told that "television is just around the corner." As a matter of fact it definitely turned the corner of physical reality on April 7, 1927 when Herbert Hoover, then Secretary of Commerce, addressed an audience of over 700 publicists, seated in an auditorium



(A) THE WORD "TELEGRAPH" IN TELEGRAPHIC CODE



(B) THE SYLLABLE "PHONE" SPOKEN BY A MALE VOICE



(C) A SINGLE SCANNED LINE OF THE PHOTOGRAPH REPRODUCED ON THE OPPOSITE PAGE. THE LINE REPRESENTS 1/700TH OF THE COMPLETE PICTURE

FIGURE I

Records of the waves occurring in electrical communication systems. These waves have characteristics identifying them with the information they convey

in New York City, by means of long distance telephone and television circuits from Washington. The corner which remains is that where the value and the cost of obtainable performance meet. We may, perhaps, look speculatively around this corner by comparing television with other and more familiar forms of electrical communication systems, the economics of which have long since been brought within the fold of exact knowledge. Let us, therefore, examine some of these systems to determine *what* and *how much* they do.

Obviously the purpose of any electrical communication system is to transmit information, and information is an intangible sort of thing which at first glance does not appear to be susceptible of quantitative measurement. True, the Chinese have long maintained that "one picture is worth a thousand words," and the advertising profession has gone on record as sponsoring this comparative measure. It may be surprising to many to learn that the technique of electrical communication has evolved a method for reducing totally different forms of information to common terms whereby they may be compared rigorously, thus affording a means of confirming or disproving the Chinese proverb and of estimating the magnitude of the task confronting our contemplated television system.

There is no likelihood of attaching to our present telephone instrument some simple gadget which will exhibit before us an image of the person at the other end of the line. Not only is the circuit connecting us with the central office already loaded to capacity with the speech transmission, but it fails by a factor of at least ten of having the information-carrying capacity needed for even the crudest form of television image. Nor can we forget the fact, in considering communication between two individuals, that while in telephony we are willing to take turns in consigning our aural messages to the electrical channel, it is doubtful if we should be willing to take turns in looking at each other.

ELECTRICAL communication systems have come into being as a result of the possibility of transmitting an electric current over incredibly long distances in incredibly short intervals of time. This is true both in wire communication and in radio, except that in the latter case we generally speak of an electric wave instead of an electric current. The problem breaks down into three major parts: first, to impart to an electric wave characteristics identifying it with the information to be conveyed; second, to transmit this wave without too serious impairment of these identifying characteristics; and third, to reproduce, under the control of the received wave, a replica of the original form of the information. It is through the translation of various forms of information into a form suitable for representation by an electric wave that we find our desired basis for comparison.

These concepts are nowhere more strikingly exemplified than in the work of Morse. In a eulogy to Morse, written for the recently celebrated centenary of his birth, President Hoover referred with characteristic engineering precision to the invention of the telegraph code — not to the invention of the telegraph. The mechanism for the telegraph had been in existence some little time before it was used for the conveyance of information; in fact it could not be used for this purpose until the invention of a system of symbols corresponding to the letters of the alphabet and having characteristics which might be shared by an electric current. In recognition of the fact that an electric current can have but one intensity at a given instant, but can change from one intensity to another under suitable control, Morse devised what is nothing more nor less than a system of writing in which the inscribed line (see Fig. 1 — curve A) has never more than one vertical height for each horizontal position. It is, in other words, what our mathematical friends call a single-valued function. The succession of values represented by the height of this line, as it is scanned from