May 1933

TECHNOLOGY REVIEW

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THE TABULAR VIEW

WHAT H. G. Wells calls "a sense of state" is an attribute that is becoming, happily, more common in the engineering profession, but it is not yet common enough, as Dr. C. F. Hirshfeld so convincingly points out in the leading article in this issue. The Review welcomes an opportunity to present a discussion of the engineer's place in a democratic society by so important an engineer as Dr. Hirshfeld. He is Chief of Research at the Detroit Edison Company, and prior to affiliating himself with that company in 1913, he was professor of mechanical engineering at Cornell. He received his bachelor's degree from the University of California, his master's degree from Cornell, and the honorary degree of doctor of engineering from Rensselaer Polytechnic Institute. His recent appointment to the chairmanship of the Engineers Council on Professional Development (see The Review for January) is an earnest of his interest in the problems of the engineering profession. Dr. Hirshfeld's citation at Rensselaer last June was as follows: "Eminent as an educator, engineer, investigator, and author, a guide and counselor in many fields, a leader in the application of science, the director of a great research laboratory, and an illuminating contributor to the literature of his subject." ¶ In a notable article published in the November, 1930, Review, Stuart Chase, '10, aptly described the engineering mind about which Dr. Hirshfeld writes. "It is a mind," wrote Mr. Chase, "that is professional, not commercial; dedicated to building, not profit-making; that is done with false modesty and has the courage to accept the job of taming the billion wild horses which Watt let loose; that thinks straight and hard; hates waste and confusion, dirt and despair; that never stoops to the shoddy or the adulterated; that builds clean and strong for the greater glory of mankind."

AS DEAN of the Graduate School and as a Professor of Physics and Electrochemistry, Dr. Harry M. Goodwin, '90, is in a position to write intimately of Technology's Department of Physics. Immediately after graduation, he began his teaching as an assistant in that department. The following year he was appointed an instructor, in 1897 an Assistant Professor, in 1903 an Associate Professor, and in 1906 a Professor. In 1892 he was granted leave of absence for study abroad and was awarded the degree of doctor of philosophy from the University of Leipzig in 1893. The following winter he studied at the University of Berlin. ¶ Daniel C. Sayre, '23, is well known to Review readers as a former contributing editor. While he was Assistant Professor of Aeronautical Engineering at M. I. T., he piloted the daily flights of Technology's "flying laboratory."

READERS of The Review are reminded that there will be no June issue. The next and last issue of this volume will be the July issue, which will be in the mails on June 27.

The Painless Operation

. . . High up under the dome of Boston's Massachusetts General Hospital, far removed from the wards so that the screams of sufferers under the knife will not horrify the ward patients, is the Hospital's famed operating amphitheatre. Many a medical student dreads the operations he is privileged to watch, frequently faints. But one day last week Dr. John C. Warren, Boston surgeon, led a group of surgeons and students (class of 1847) up the long stairs, eager, hurrying.

For there beckoned an interesting experiment—surgery without pain. Dr. William Thomas Green Morton, 27-year old Boston dentist, thought it possible, had experimented to that end with ether, a volatile, pungent chemical compound capable of producing insensibility. He had tried it on animals, on himself, then on his patients while extracting the roots of decayed teeth. Finally he had obtained permission from Dr. Warren to let him test his drug before an audience. One Gilbert Abbott, with a tumor on his neck, was to be the first trial.

At 11 a.m. the last privileged student hurried into the amphitheatre. Experimentee Abbott, fidgeting on the operating-table, looked anxiously at the clock. Casual talk ceased, sudden silence prevailed as the minute-hand crawled past the hour, and Dr. Morton did not appear. "He and his anesthetic! Humbugs both, no doubt!" mumbled a doctor. It became five minutes past eleven, ten, then a quarter after. The patient stirred uneasily, Dr. Warren selected an instrument, advanced to the table—useless to delay proceedings any longer. As his knife poised for the incision, Dr. Morton, breathless, apologetic, rushed in. He held in one hand a curious globe-and-tube apparatus.

In eager concentration, tensely expectant, the waiting group of surgeons and students watched while the newcomer—a charlatan perhaps, a genius possibly—adjusted his peculiar inhaling apparatus to the patient's mouth and with tense composure administered his anesthetic. Veiled skepticism revealed itself when the patient reacted suddenly in wild exhilaration, but this exuberance subsided, relaxation took its place, then unconsciousness. Skepticism was routed, amazement paramount. Said Dentist Morton to Surgeon Warren: "Your patient is ready."

Dr. Warren began to operate, proceeded quickly, in five minutes had finished. From the patient came no cry of pain, no agony of distress, only slight movements, mumbled words as from one who stirs on the borderland of sleep . . . .

"This, gentlemen," exclaimed Surgeon Warren. "is no humbug."

Awake, Gilbert Abbott said, "I felt no pain."

So, in part, had TIME been published in October, 1846, would TIME have reported the first public demonstration of ether as a surgical anesthetic. So, too, would TIME have reported how one Dr. Crawford Williamson Long, of Georgia, came forward later saying that he had used ether four years previous, had given it up as impractical . . . . So, too, would TIME have reported the bitter persecution that came to Dentist Morton when he patented his discovery as "Letheon"; the seizure of "Letheon" by the U. S. Government for its own uses; the claims of Dr. Charles T. Jackson, the Boston chemist from whom Dentist Morton had obtained his ether; the division of the Paris Academy of Medicine's 5,000 franc Monthyon Prize for 1852 between these two, with Morton proudly refusing his share; the long Congressional investigations resulting in nothing, and Dentist Morton's death in poverty in 1865.

Cultivated Americans, impatient with cheap sensationalism and windy bias, turn increasingly to publications edited in the historical spirit. These publications, fair-dealing, vigorously impartial, devote themselves to the public weal in the sense that they report what they see, serve no masters, fear no groups.

TIME

The Weekly Newsmagazine

YEARLY SUBSCRIPTION $5 : 205 EAST 42nd STREET, NEW YORK CITY : 15 CENTS AT ALL NEWSSTANDS

G-E *Campus News*

IN A PADDED CELL

RESEARCH moves in devious ways its wonders to perform. G.E. has a padded cell in its general engineering laboratory at Schenectady—for the isolation of extraneous sounds. Confined in it, at intervals, are motors, fans, and other equipment which serves best when heard least. The cell is a room within a room. The outer wall is of sound-absorbing plaster; then come hollow tile, air space, felt, another layer of plaster, more air space, sheet iron, air space, lathwork, and a thick layer of cotton waste. Total thickness, a foot and a half. Within the chamber a "noise meter" tracks down outlawed decibels.

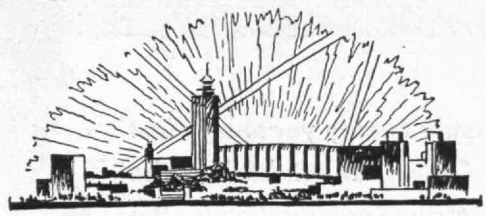
Last year, the noise meter left its padded cell and traveled to Manhattan's Metropolitan Opera House. Ensconced in a grand tier box next to that of Manager Giulio Gatti-Casazza, it measured voices, orchestra, and applauding hands while "Rigoletto" was sung. The meter discovered that Beniamino Gigli registered 77 decibels,—a street car in full progress makes only 65. Laboratory devices do have their big moments.

FORE!

"WOW! What a drive! If I could hit 'em like that, I'd sure break a hundred." Just a few comments as a national driving champ smacked a golf ball out of sight. Occasion—the demonstration of a new G-E device for measuring speeds heretofore not measurable because of their nature. The apparatus registered the speed of the champ's club head at 125 miles per hour; an average player is lucky to register 70. No wonder the champion can hit them so far.

The ball is driven from a low platform. Just back of the ball, two parallel beams of light are at right angles to the path of the club head. Each beam hits an "electric eye" or photoelectric tube. A split second before striking the ball, the driver cuts the first beam, and almost immediately afterwards cuts the second beam. Both phototubes operate Thyratron tubes, the first one causing a condenser to begin charging and the second one stopping it. The charge is measured by a meter which is calibrated in terms of miles per hour.

And don't worry about swinging too fast. H. W. Lord, who perfected the apparatus, says it will measure speeds up to about a thousand miles per hour. What a drive that would make! Incidentally, Lord is a '26 grad of the California Institute of Technology.



"A CENTURY OF PROGRESS"

THIS summer, if you go to Chicago, you will visit an Aladdin fairyland; "A Century of Progress" will be the greatest night exposition ever held. You will see a veritable aurora borealis, artificially produced. Walter D'Arcy Ryan, veteran G-E illuminating engineer, is working in Chicago to help make the exposition the most spectacular ever seen. And well qualified for the job he is. An engineer-artist—schooled at St. Mary's, in Halifax—he has directed the illumination for many similar events. When you go to Chicago, you will agree that a masterpiece has been created.

And you should not miss the G-E "House of Magic," the most amazing part of the General Electric display at the exposition. There, recent discoveries and developments of our Research Laboratory will be presented in a fascinating manner. "Bill" Gluesing, a '23 grad of the U. of Wisconsin, will have charge of the lectures and demonstrations. In addition, many G-E machines and appliances in the great circular hall of the electrical building will dramatize the rapidity of electrical progress. We'll see you at the exposition. Remember, it's from June 1st to October 31st.

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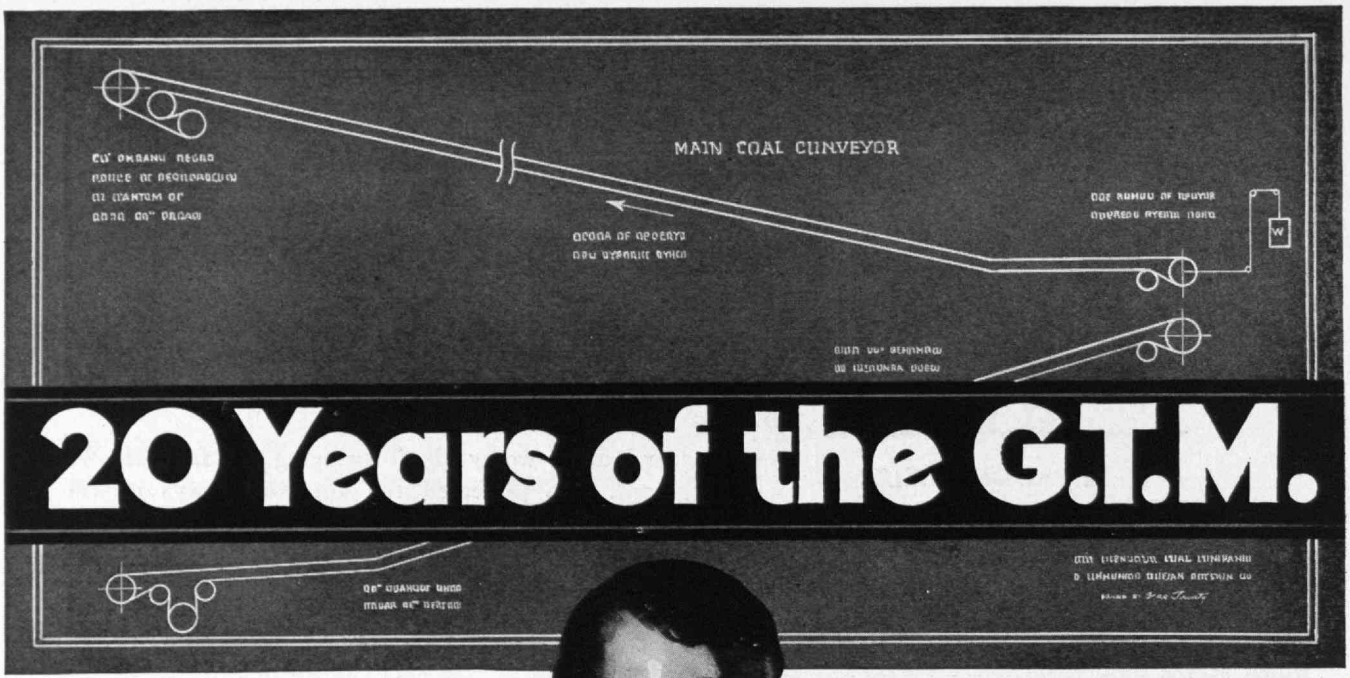
GENERAL ELECTRIC



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JUST exactly twenty years ago last month Goodyear established the Goodyear Plant Analysis Plan for the better equipment of industry, and entrusted the specification of that equipment to the expert hands of the G. T. M. — Goodyear Technical Man.

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Big or little, an entire new plant or a single installation, your requirements may be much better supplied and serviced by G. T. M.-specified Goodyear Mechanical Rubber Goods. It costs nothing to discuss your plant conditions with the G. T. M. Just write or call Goodyear, Akron, Ohio, or Los Angeles, California, or your nearest Goodyear Mechanical Rubber Goods Distributor.

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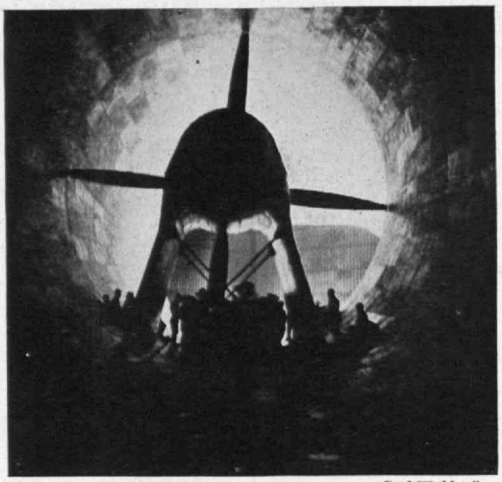

Carl Wahlström

Inside the huge full-scale wind tunnel at the Langley Memorial Aeronautical Laboratory, Langley, Va., — the great center of research established by the National Advisory Committee for Aeronautics

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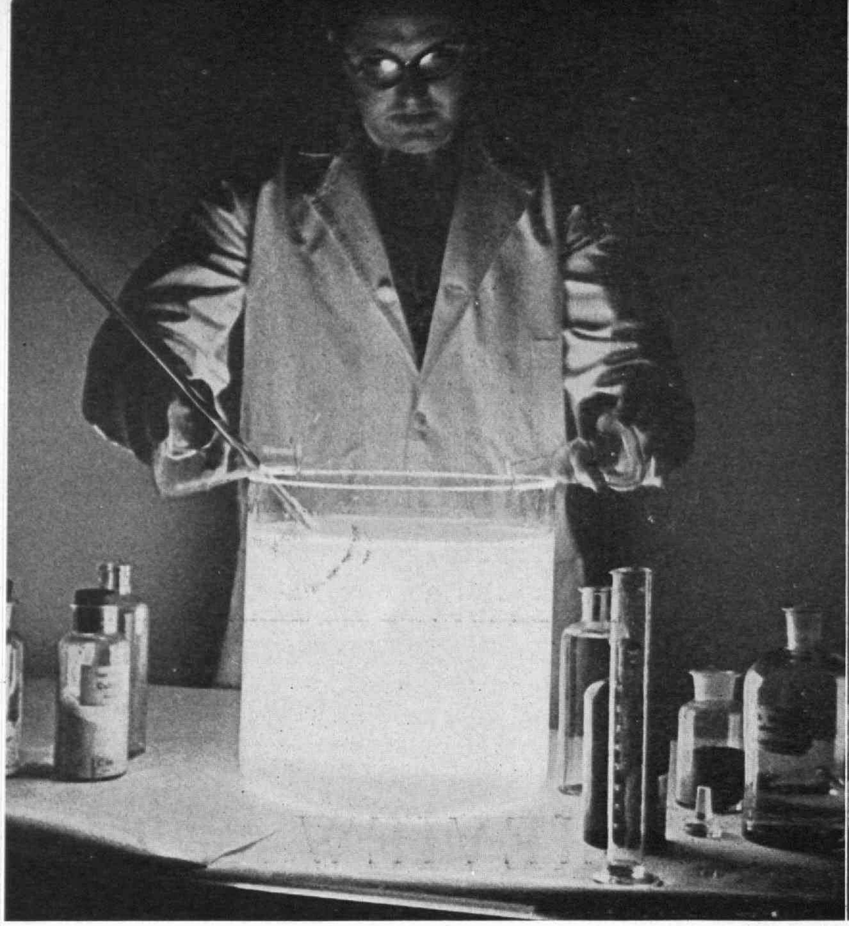
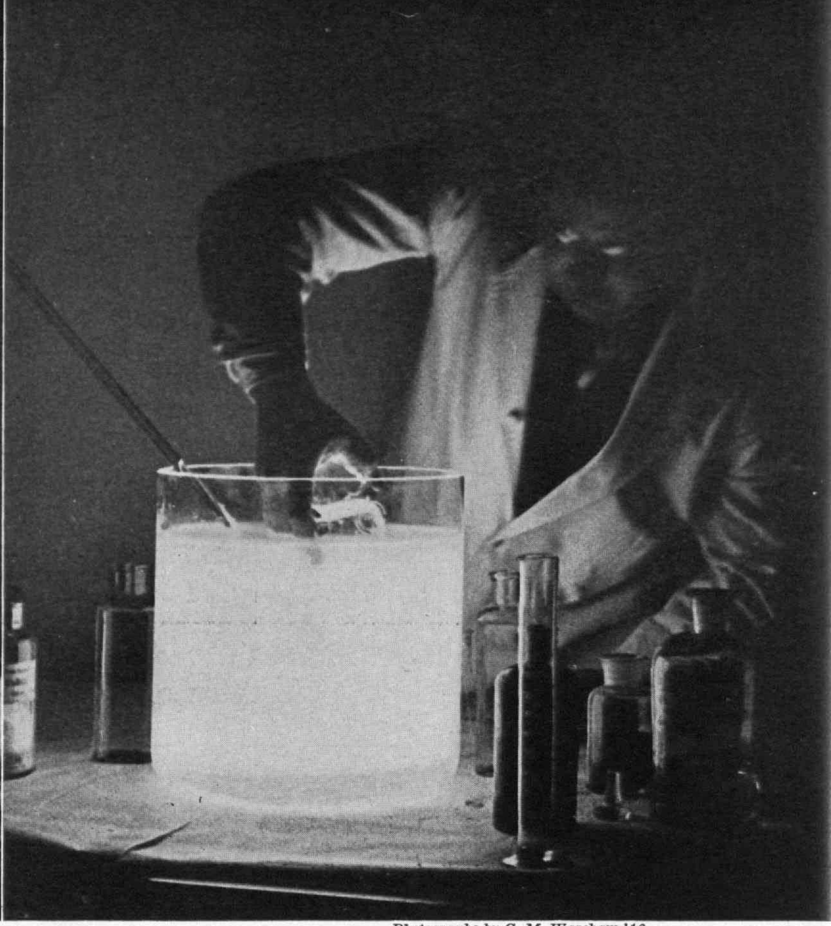




Photographs by C. M. Wareham '16

Liquid Light

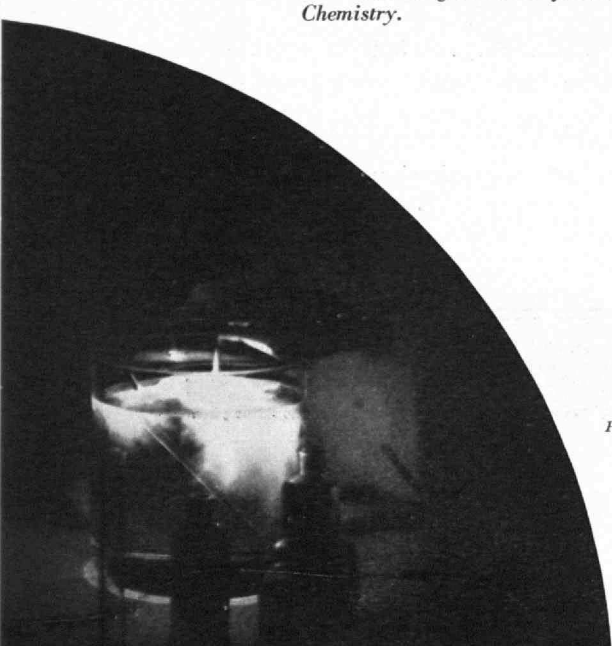
A startlingly beautiful demonstration of chemiluminescence — the production of visible light by chemical reaction occurring at relatively low temperatures — has been devised by Assistant Professor Ernest H. Huntress '20 of the Institute's Department of Chemistry. The accompanying pictures of this experiment were taken in an otherwise completely dark room by means of the visible light given out by the chemical reaction taking place in the jar. This reaction involves the oxidation of an organic compound (called "luminol" by Professor Huntress) induced by a mild alkaline oxidizing agent. In the experiment shown in these pictures, the concentration of "luminol" is approximately 0.006%.

A familiar example of chemiluminescence (see page 295) is the slow oxidation of phosphorus, which produces a very feeble, pale light. It was this phenomenon which gave rise to the term phosphorescence. Many examples of bioluminescence, or light produced by living organisms, are known, including luminous marine organisms and certain fish. Many organic compounds are known to oxidize with resulting production of light but, in most instances, light intensity is very small and is often perceptible only with difficulty. In the experiment of Professor Huntress, however, the light is relatively bright and may be observed even in daylight.

Unlike ordinary incandescence, radiation from this reaction is given off at low temperatures. In the picture above on the right, this is graphically demonstrated by the piece of ice which is being removed from the solution. At the dilution employed in this experiment, there is no perceptible heat effect during the reaction.

The light given off is bluish white in color, but it may be modified under certain conditions. Radiation continues only so long as the solution is alkaline and the duration of the chemiluminescence is a function of its intensity and of the conditions prevailing in the solution.

The study of chemiluminescence and related phenomenon is one of the projects being carried on in the research laboratory of organic chemistry at M. I. T. A public demonstration of the experiment shown here was given by Professor Huntress before a meeting of the Northeastern Section of the American Chemical Society at the Institute on April 29 — a meeting held in conjunction with the dedication of the George Eastman Research Laboratories of Physics and Chemistry.



Photograph by E. A. Averill

THE
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Straight Thinking

How the Engineer Can Improve Democratic Government

BY C. F. HIRSHFELD

CAN DEMOCRACY BE SAVED FROM SELF-DESTRUCTION BY APPLYING THE ENGINEERING METHOD TO SOCIAL, ECONOMIC, AND POLITICAL PROBLEMS?

DURING the time that America's comparatively young democracy has been in existence a very sweeping change has occurred in human affairs. Practically all of what we call modern science has been developed and out of it has come an industrial culture which we have grafted upon an earlier and more natural civilization based fundamentally upon agriculture. When asked how this thing has come about the average person would undoubtedly attribute it to scientific discovery and to invention. I think we can be more fundamental in answering such a question. To me it has come about through the intensive application of a new method of thought, what we define grossly as the scientific method.

This method is characterized by requiring proof of each step that is taken mentally. Past teachings, traditions, precedents, convictions are not sacred; they are accepted only so long as they stand the test of the most rigorous experimental proof that can be devised. Just so soon as any one of them fails to meet such test it is unceremoniously dumped overboard to make room for its successor. The process is a rigorous, unsentimental sort of a thing but it does produce results. It represents the straightest sort of thinking that mankind has yet indulged in for the simple reason that it does not trust his intelligence beyond the last experimentally proven step in the thought process.

The scientist has used this method with wonderful success in uncovering the workings of the universe in which we have our existence. He expends his energies in uncovering truth for truth's sake. In general he has no particular interest in or concern for useful applications which may be made as a result of his discoveries. To him the discovery is the all sufficient aim and end. In one sense he is the great idealist of our present culture.

Other more materialistically minded individuals, however, have taken his products and by using his methods have succeeded in greatly changing the conditions of our lives. An outstanding group among these more practically minded individuals is that of the engineers. These men appropriate the results of the work of the scientists and apply them to the satisfaction of human desires of one sort or another. Their problem is more complicated than that of the scientist because of many limitations under which they work. These are partly economic in character, but limitations are also set by the characteristics of available materials and by such apparently extraneous things as individual and mass psychology.

Like the scientist, the engineer must start from proven facts and must think very clearly toward the next provable step. Unlike the scientist, he cannot always obtain all the necessary facts with which to start and he is also frequently confronted with the necessity of constructing before proving the correctness of all the underlying steps of his reasoning process. Further, he generally departs rather early in his problem from the simple consideration of the inexorable laws of Nature and wanders through various fields of approximation and compromise. His problem is indeed a difficult one. And yet we have engineers in abundance who do succeed in picking their ways safely through such poorly charted or even uncharted fields. We do have engineers who succeed in building upon the clean-cut and clearly stated laws of science the practical structures which make proper allowances for the idiosyncrasies of commercial materials, pertinent economic limitations, and the ever changing viewpoints and tastes of humanity.

Fundamentally his method requires that conclusions be based primarily upon proven fact and secondarily upon logical and, if possible, proven deductions therefrom. It is distinctly impersonal. It is directly opposed to emotional, traditional, partisan, and selfish methods. For want of a better comprehensive description I call it straight thinking for that is, in the ultimate, exactly and completely what it is.

It has always seemed strange to me that the engineers should be the only large group that has extensively adapted the methods of the scientists to the purposes of its own business. And, it has also always seemed strange to me that this group should, in general, have been satisfied to confine such rigorous and practically profitable thinking to problems of what we commonly call an engineering nature. I have been particularly impressed by the way in which most engineers slough off their carefully developed training and join the unthinking, whimsical mob when it comes to a consideration of political questions.

I have thought for a long time that if engineers could be made to apply their methods in the personal consideration of many of the problems of a nonengineering character with which we people of the world wrestle more or less impotently and if in addition they could be made articulate in such matters, they could and would supply the leaven of straight thinking that is so badly needed in modern life. I firmly believe that along such a route lie the means of so altering the conduct of democratic government as to save it from self-destruction and to make it attain at least to some of the heights that its idealistic advocates believe it capable. Barring an infusion of straight thinking from this or some other similar source I fear that our democracy and the other democracies of the world must ultimately give place to forms of government in which the great majority, instead of directing, is directed.

LET us consider just a few examples of very curious and seemingly crooked thinking that threaten unfortunate results. We may well start with the agricultural situation since it is at the present minute much in the public eye. For years we have paid taxes to our state and federal governments to support them in the development of new species and new methods capable of increasing greatly the yield per acre of agricultural land. At the same time we have also paid the Federal Government taxes for the purpose of making it possible to bring marginal land under cultivation, principally through provisions for irrigation. During the same time we have paid taxes to cover studies into the reasons why farmers were leaving the farms. Recently we have spent huge sums in attempting to maintain fictitiously high prices for certain farm products. Now our national law makers are engaged in discussing further strange and curious means intended to do the same thing. Having paid good money to put us in position to produce in excess of the demand, we are now engaged in what is equivalent to an attempt to repeal the law of supply and demand.

It does not appear to have occurred to anyone that straight thinking in connection with such matters requires that some balance should be struck between the total usable quantity of agricultural products and the expectable yield from existing lands with the improved stocks and improved methods, before we could justify the expenditure of public funds for increasing available acreage by bringing in lands of marginal character. It does not appear to have occurred to anyone that straight thinking requires that some balance be struck between the money expended for developing such new stocks and methods and the economic value of the results.

There are many other aspects of this very large problem, such as the effects of modern refrigeration and modern transportation methods. But, even if we ignore these, it is patent that we have been guilty of very loose thinking, I might almost say absence of thought, with respect to certain very fundamental matters. All human experience tends to show that in the end the law of supply and demand is just as potent and just as inexorable

Nesmith