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The Outlook of the Engineering Profession

By L. W. WALLACE, *Executive Secretary, F. A. E. S.*

By Courtesy of THE CORNELL CIVIL ENGINEER

MODERN civilization is largely the handiwork of the engineer. Its complete fruition is mainly dependent upon the correlated and joint efforts of the engineers of the world. These statements are not based merely upon the expressed thought of engineers, while indeed eminent engineers of vision and foresight do hold such views. But the real significance of the statements rests in the fact that in recent months distinguished and accomplished statesmen, financiers and members of other professional groups have given expression to such sentiments.

THE FIELDS OPEN

It will be recalled that Mr. Vanderlip, in his book entitled "The Allied Debt to the United States—An Effective Plan for Its Payment," and in a number of interviews, projected a plan for the rehabilitation of Europe and the solving of the war debt problems. His plan was essentially an engineering one. He suggested that the commission he proposed be headed by the internationally known and esteemed engineer, Herbert Hoover.

Doctor Stepanek, the brilliant ambassador to the United States from Czecho-Slovakia, in many public addresses and private conversations has said that the hope of Central Europe was dependent upon an international federation of engineers. Through such a federation Doctor Stepanek felt that the engineers of the world would then be in a position to bring to bear upon the problems of Central Europe their detached point of view and their constructive experience and handiwork.

It is apparent, therefore, that from an international viewpoint there is a broad and a promising vista for the engineering profession.

Those who would prefer to view a nearer horizon may do so with satisfaction, as there are many unsolved problems in the United States awaiting the engineering approach and method. One does not have to go far afield in the United States to find opportunities of unbounded promise. It is not true, as some are prone to think, that the major engineering problems of this country have been solved, and therefore the engineers of your generation will merely tend the works that your forefathers erected. It is probably true that most of the purely technical questions have been mastered, for the engineers of the past and present generations have wrought well and conclusively in dealing with the physical and material forces of nature. But they have neglected many factors of equivalent, if not of greater, importance with which the engineers of your generation most need to wrestle. These factors present large opportunities for professional attainment and remuneration commensurate therewith, not to mention the essential public service one may contribute through the solving of them. In fact it is my conception that no generation of engineers of the past had as great a potential possibility for professional achievement and for con-

tributing to the public welfare as you will have. In other words, the door of opportunity bids you enter a field full of riches awaiting to be harvested by the application of the scientific method of analysis and synthesis.

What are the problems? They are myriad. Time will permit of mentioning only a few. However, it is hoped that they will be sufficient to stimulate your thinking and your searching, which will inevitably answer fully and satisfactorily any question in your minds concerning the outlook of the engineering profession and what promise the future has for you as an engineer.

There are many phases of industrial leadership yet unsolved. This relates particularly to the distribution, financial, production and human factors of industry.

OPPORTUNITIES IN DISTRIBUTION

Throughout the commercial and industrial life of America, the factor of distribution is as little understood as any other one thing that touches our daily life. In the last analysis, distribution might be classed in general as a material handling process—with certain financial aspects. At any rate the mere physical handling of the materials being distributed presents a large problem which has not been adequately treated. One could with profit to himself and the country devote his life to the solution of the physical aspects of distribution. But the commercial and social (using the word "social" in its broad sense) aspects of distribution require the constructive and analytical thinking of the engineer. It is well to remember that a very large economic waste is occurring daily, because no adequate attention has been given to any phase of this matter by the engineering profession and others.

THE FIELD OF FINANCE

The engineer has been charged with having no knowledge of or interest in the financial aspect of industry. In general this is too true. Yet what body of men by training and general experience is better equipped to master the intricacies of the financing of industry? Those engineers who have acquired knowledge and experience in this field in addition to their technical qualifications have wrought well and have been amply rewarded. There is a growing tendency on the part of large banks to employ engineers as counselors in the financing of industry. It is believed that the future will see many engineers active in the realms of finance of American Industry and Commerce.

THE PROBLEMS OF WASTE IN PRODUCTION

Undoubtedly the United States is as far advanced in production procedure as any country in the world. In physical equipment none surpass. Indeed as far as physical development and mastery are concerned the work of the future will largely be that of perfecting and refining the equipment now evolved. Naturally from time to time there will be developed some piece of equip-

ment which will be quite revolutionary. But in the main, the fundamental principles and their application have been developed. But in matters of organization, production planning and control and in many other phases of industrial activity there is much painstaking work to be done. It is because these phases have not been developed to the same degree as have the physical and technical factors that accounts for the large amount of waste occurring daily in American industry. The report, "Waste in Industry," prepared by a committee of the Federated American Engineering Societies, discloses the many avenues through which waste is occurring. A careful reading of the report will indicate to you that there is ample opportunity in American industry for the engineer to do splendid work.

In the first place practically every industry is carrying the wasteful burden of an excessive variety of products. This means added carrying charges on buildings, equipment, materials and finished products. All of which may mean, and does mean in a great many instances, the difference between profit and loss—between success and failure.

Happily many manufacturers are awake to the situation and through individual and collective effort are bringing about a change. A few examples will suffice to show what the conditions were and what changes have been made.

A survey disclosed that there were 725 varieties of interior tile being manufactured. The industry through conference reduced the number to 115.

The paving brick industry was producing 66 different styles of paving brick. Some time since, through a conference called by the Department of Commerce, which was attended by representatives of paving brick manufacturers, highway and city street officials, engineers and governmental officials, 59 varieties were eliminated. Pipe and fittings are very simple. One would naturally think that there were only a few varieties, yet 17,000 different types have been on the market. Manufacturers of plumbing equipment have recently agreed to produce only 610 different varieties.

Similar examples could be cited as to the reduction in the variety being manufactured. The list, however, would not be very long. Unfortunately a list of those products that have not been reduced in variety would be many times longer. This is a long-time undertaking that will require the attention of engineers for years to come. It is pleasant to be able to tell you that engineers individually and collectively are devoting a great deal of time and thought to this problem. Valuable results have been obtained, sufficient indeed to indicate the savings yet to occur from such efforts.

Upon something like final accomplishment depends in a large measure the stabilization of industry, which means uniform production throughout the year for years at a time.

THE WASTE DUE TO INTERMITTENT OPERATION

Another large source of industrial waste is the seasonal or intermittent operation of many industries. This means for a considerable period in each year, and indeed in some industries for sev-

eral periods each year, many industrial plants are practically closed. This signifies idle plants, equipment, materials, labor, capital and a large unearned overhead. Even more serious are the social values involved. It is in the seasonal or intermittent industries that there exists the largest and most serious labor unrest and conflict.

Notwithstanding the large economic and social values thus wasted, scarcely any effort has been made to correct the situation. As a consequence such important industries as coal mining, construction, clothing and many others are idle from thirty-five to fifty per cent of the year. Yet it is known that in many instances the difficulties to be overcome in order to secure fairly uniform production are not insuperable. Your generation of engineers must tackle and contribute to the solution of this exceedingly serious economic and social phenomena.

The construction industry presents one of the most serious problems from the standpoint of seasonal activity. The building trade workman is busy on the average about 190 days per year, or two-thirds of his time. The records from a large number of contractors disclose the monthly fluctuations in the number of men employed to be in January, 1920, the maximum or 100%, February 72%, March 95%, May 82%, July 95%, September 100%, October 80%, and December 50%. Such changes in personnel mean a serious loss in esprit de corps effectiveness and an increased urge to soldier on the job in order to be employed more continuously. It also means other losses, such as that accruing from idle equipment, materials and the like. It is recognized that owing to climate conditions some of the seasonal aspect of the industry is unavoidable—but through the lack of foresight on the part of owners and contractors and due to the fact that nothing like scientific planning has permeated the industry, the evil of seasonal activity has become much greater than warranted. There are instances where the interference of climatic conditions has been materially offset through careful planning of the work.

In the matter of highway construction the detail of letting contracts for construction of roads and streets in the fall rather than waiting until March or April would add 30% to the length of the construction period per year. Such a procedure would also mean that many men engaged by the material and equipment manufacturers and indeed by the contractors could be kept employed throughout the winter.

Many other phases of construction industry require careful analysis and the application of the scientific method of dealing with them.

THE HUMAN FACTOR IN INDUSTRY

American industry is now confronting a serious labor shortage, especially that of unskilled labor. Many are demanding letting down the bars so that there may be a large influx of immigrants. There may be some justification for an increase in the number of immigrants to be permitted to enter the United States, but I do not believe it is necessary to either entirely drop the bars nor do I believe it would be to the good of this country to do so. If managers of American industry

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would eliminate much of the waste of human effort in our industries, such a large supply of additional labor would not be required. It is understood, of course, that managers cannot accomplish the most without the full co-operation of labor as such.

What are some of the facts regarding the waste of human labor? The 42,000,000 gainfully employed in the United States lose on an average 252,000,000 days per year due to illness. Authorities agree at least one day per year could be saved by the practice of physical examinations, preventive medicine and hygiene. To reduce by one day the illness of each person gainfully employed would be equivalent to adding 140,000 to our labor supply.

In 1919 there were 3,000,000 accidents causing at least one day's disability. There were 33,000 fatal accidents and 57,500 non-fatal accidents causing more than four weeks of disability. The total direct cost of industrial accidents in the United States in 1919 for medical aid, insurance and overhead was not less than \$1,014,000,000.

Yet authorities agree and statistics show that at least seventy-five per cent of these accidents may be eliminated by the application of proven methods and practices. For sake of argument, assume that only 50% are avoidable. Then the total equivalent addition to the labor supply per a year of 260 days would be approximately 27,000. Therefore, through a reduction in the amount of illness and the number of accidents there may be added an equivalent labor supply of 167,000 workers. This is approximately 50,000 more than the net gain by immigration for the eight-year period from 1915 to 1922, inclusive.

The construction industry is one of the worst offenders in the matter of accidents. The annual loss due to accidents in this industry is estimated to be \$120,000,000.

Indeed it may be said that the understanding of, the control of, and the results accomplished with the human factor in industry is many, many years behind our comprehension of the physical forces of industry. There is no factor of American industry that so needs a scientific approach and treatment. The engineer is in a particularly advantageous position to deal with this question, as in a sense at least he occupies a position midway between management and men. He occupies a detached relationship to both capital and labor.

There is no phase of industry of greater seriousness and importance than that of human relationship, and none that promises as large returns for an unbiased and an intelligent effort.

THE POLITICAL FIELD OPEN TO THE ENGINEER

The foregoing brief statement of the problems of industry does not preempt the field of potential possibilities, opportunities and responsibilities for the engineering profession of the present and the future. It would be remiss if the great avenue of public affairs was not called to your attention. More and more the really serious and significant problems that confront the executive and legislative departments of national, state and municipal governments involve engineering.

As Executive Secretary of the Federated American Engineering Societies, an agency formed and operated by the engineers of the United States through which they might render an essential public service, it has been my duty to carefully study the questions that concern the executive and legislative departments of the Federal Government. It has been my observation that very few really significant questions arise in any of the departments but that engineering factors are involved.

The question of allied debts is involved with the factors of national resources, transportation facilities, productive capacity and labor supply and effectiveness.

The Department of Interior, Commerce, Post Office, War and Navy and other departments as well as the several bureaus and independent establishments deal with engineering and scientific questions in no small degree. Some are almost entirely so concerned.

Such matters as tariff, immigration, merchant marine and scores of other topics, while possibly remote in some instances, yet many times affect industry, hence should receive attention of engineers.

In the present session of Congress, such bills as the reclassification and compensation of government employees, because it involved the engineers and scientific employees of the government, concerned the engineering profession.

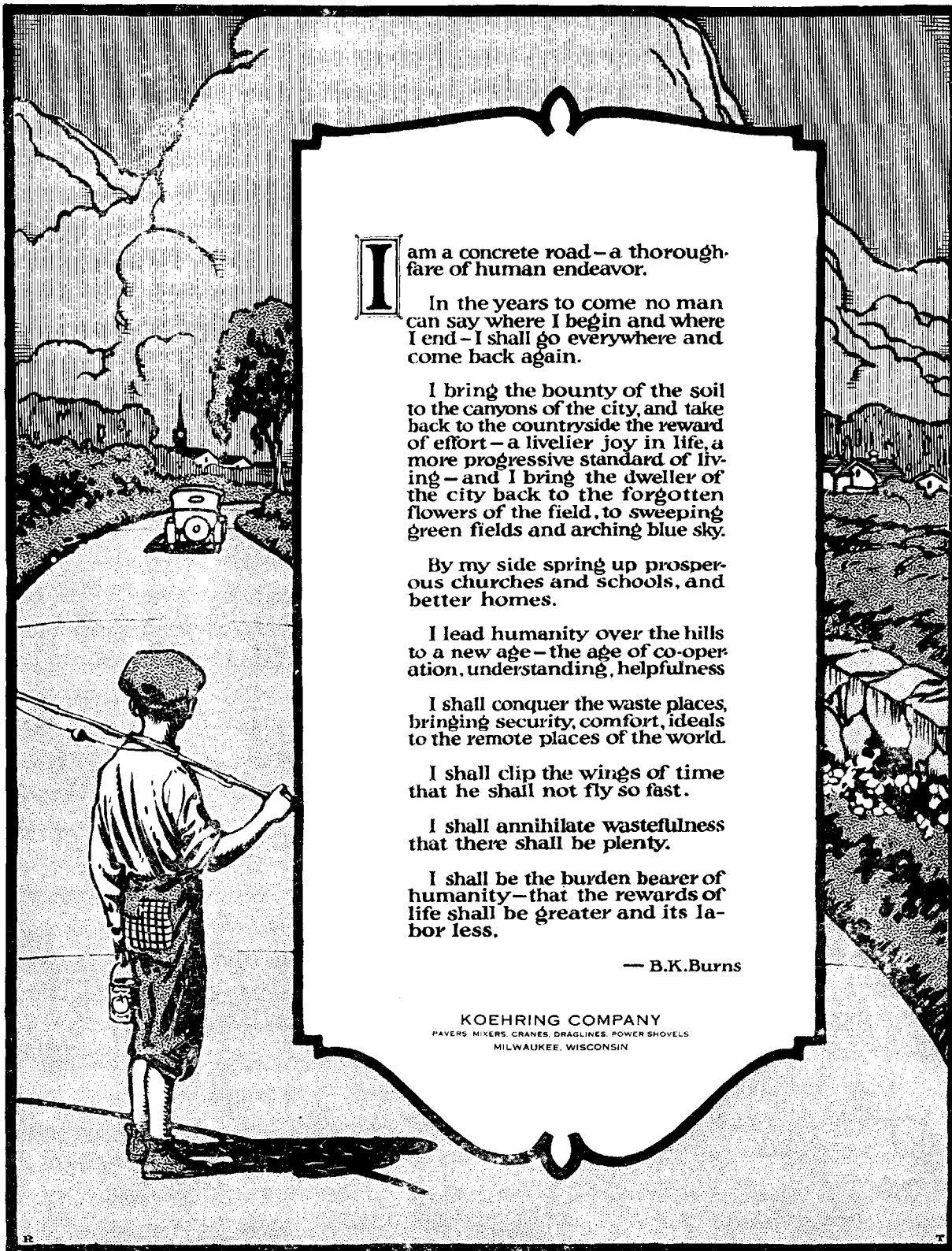
Appropriations for topographic surveys, Bureau of Public Roads, and other appropriations likewise come within the view of the engineer. The Muscle Shoals issue is essentially an engineering one, although it became involved in politics and personalities. The bill proposing a National Hydraulic Laboratory for the purpose of studying river flow and flood control and for developing scientific principles and data relating to the same is another example. Many other examples might be cited.

POLITICAL SERVICE THE ENGINEER'S DUTY

Suffice it to say that there is no small opportunity for engineers to participate in such fields. But it is particularly the duty and responsibility of the engineer as a citizen and in a personal capacity to devote time and effort to a thorough study of such problems, and then to exert his influence to the end that the best possible solution may be determined. There is no other group under greater obligations to render such public service. In the first place the engineer, largely by virtue of his engineering education, reaches a position of prestige and influence. His engineering education was largely made possible by expenditures made by the nation and by the state for his education. Hence he is under obligations to the state and to the nation and should meet it through public service.

In the second place, as a highly trained man, competent to analyze problems and to suggest plans of solution, he is better qualified to deal with the complex problems of state than those not so trained. Because of this fact he is peculiarly well qualified to render an essential public service.

It is a heartening and at the same time a wholesome fact that the engineers of this country have realized this public responsibility and through



I am a concrete road—a thoroughfare of human endeavor.

In the years to come no man can say where I begin and where I end—I shall go everywhere and come back again.

I bring the bounty of the soil to the canyons of the city, and take back to the countryside the reward of effort—a livelier joy in life, a more progressive standard of living—and I bring the dweller of the city back to the forgotten flowers of the field, to sweeping green fields and arching blue sky.

By my side spring up prosperous churches and schools, and better homes.

I lead humanity over the hills to a new age—the age of co-operation, understanding, helpfulness

I shall conquer the waste places, bringing security, comfort, ideals to the remote places of the world.

I shall clip the wings of time that he shall not fly so fast.

I shall annihilate wastefulness that there shall be plenty.

I shall be the burden bearer of humanity—that the rewards of life shall be greater and its labor less.

— B.K. Burns

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the Federated American Engineering Societies they are endeavoring to discharge it in behalf of the American public. In a span of a few short years this activity will be committed to your care; in its furtherance you cannot, you dare not, falter.

In this brief address I have endeavored to draw back the curtain, as it were, that you might view the professional vista ahead of you. I see it as a green pasture of opportunity over which float a few scattering clouds of disappointments, obstacles and some complex questions awaiting solution. But just beyond the horizon I see the generations of engineers that have gone before watching and beckoning you onward. On their faces is an expression of confidence in you and a mark of belief that as you pass through the green pasture you will partake of the bounties thereof in the way of professional attainments and emoluments, and that you will not forget that while you are an engineer, yet you are an American citizen first and therefore will contribute a full measure of your ability to the welfare of mankind and to the advancement of your country and of civilization.
