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THE SOCIAL RESPONSIBILITY OF THE ENGINEER[1]

By Dr. F. G. COTTRELL

RESEARCH ASSOCIATES, INC., WASHINGTON, D. C.

IT is with very genuine pleasure and appreciation that I come here to-night, for in thus responding to your friendly and generous invitation and in adopting your chairman's suggestion for the subject and title of my remarks, I feel that it is primarily as a group representative for certain social ideas or way of life rather than as an individual that I am speaking to you.

There seems to be a wide-spread feeling, with which I heartily sympathize, that scientists and engineers as a class have a peculiar responsibility to society for leadership in certain directions which they have on the whole as yet, perhaps, not fully appreciated.

While this has been a matter of long standing, the acute social and economic problems facing the world to-day emphasize the importance of an awakening to the issue.

[1] Address on the occasion of the presentation of the Washington award at a meeting of the Western Society of Engineers, Chicago, February 23, 1937.

Thorstein Veblen has perhaps most clearly sounded this challenge in "The Engineers and the Price System." The gist of Veblen's plaint is that while scientists and engineers are largely responsible for our material progress in the present age, they are so preoccupied and satisfied with these functions that they allow themselves to become mere cogs in the social-economic machine, which falls thereby all too readily and exclusively into hands whose training has been purely in trade and finance and thus dominantly directed to the goal of profits as contrasted with use or service.

There is sound wisdom in Veblen's exhortation of the scientists and engineers to take a more active interest and responsibility in the social economic side of life, for both by temperament and training we have a right to expect them to think most naturally in terms of service and utility.

However, the young engineer in college and just as he is emerging therefrom is in a very difficult situation to-day with regard to these deeper lying social responsibilities of his profession, because our whole social order, if not actually undergoing a profound fundamental change in the relative weight assigned to property and human values, is at least a battle ground for the forces representing the struggle between conservative and radical thought and interest, divided along just these lines of cleavage.

The engineer's work has to do naturally with material things, and with material things on a large and expensive scale—in other words, primarily with property values. He thus comes in ever increasing degree, as his experience and responsibilities multiply, to be thrown with and have to look to men whose primary training and duty it is to consider everything from this property aspect. Our whole industrial system has perforce been built up chiefly upon this plan, while its impacts on human needs and relations, in so far as not automatically adjusting themselves under a *laissez-faire* system, have been vaguely left to the professional sociologists, economists and legislators to ponder and attempt solutions through education of the public and regulatory legislation.

What I want to bring out is the crying necessity and splendid opportunity for the young engineer of creative imagination and moral courage to join forces with his brother specialists from the humanitarian side and thus insure a really comprehensive picture of what *homo sapiens,* in this year of grace 1937, should be driving at as the immediate and conscious goal for the species.

I believe we must fairly face the fact that whether we like it or not, our fundamental and generally accepted basis for morality, including the fundamental principles of democracy, has finally run head-on into some of our most solidly established legalistic extensions and interpretation of man's earlier, simpler and more personal conception of property ownership. Ironically enough, the doctrine of sanctity of property apparently originated in the mind of man largely to protect him against the dangers of unemployment. But now in its modern extensions to corporate ownership it is receiving chief blame from many for national unemployment.

That is to say, from the democratic and *laissez-faire* standpoint, before the era of mass-production and giant power, the recognition of the essential sanctity of private property and the obligation of the state to protect the individual therein against marauders large or small, became the individual's best possible guarantee that with ability, industry and willingness to work, he could always create and maintain for himself and family a home and workshop furnishing shelter, productive employment and, through the latter, such other necessities and luxuries of life as to give him his fair chance in reference to the living standards of his age.

The coming of the industrial revolution and centralized factory system, first in Europe and later in our own country, followed many years later, but especially in this country, by the final closing of the frontier through progressive pioneering with the eventual absorption into private ownership of all worth-while land and other natural resources, tremendously reduced the significance of property ownership by the average man, in so far as security of employment was concerned. To be sure, there is still room for some little workshops and individually owned factories, but their possible number relative to population is so pitifully small that they are no longer a significant factor in unemployment. Even for the skilled craftsman, individual ownership of his tools has steadily waned almost to the vanishing point. The real tools of major industry are now so exclusively held in ever-growing corporate ownership that the relation of property rights to mass unemployment may justly be considered entirely from this standpoint.

Thus over the years the legal fiction of the corporation has gradually insinuated itself between the artisan and his tools. Nor would his saving and investment in his share of these tools through ownership of the shares of the corporation give him, under existing law, any assurance of access to these tools whereby to earn his livelihood. Thus has one of the most fundamental and significant meanings of property rights undergone a terrifying change for the vast majority of our population and largely without our realizing it.

Here again the engineer should be in a most strategic position to intelligently yet sympathetically understand and interpret the situation to the ultimate authorities, both public and private, for it behooves us to remember in all this that the corporation as a fictitious legal person is the creation of the state, and it has been largely through the interplay of both physical and human engineering that corporate methods and management have now come to play so large a part in our national life and in our destinies as individuals.

These corporate structures and methods have certainly been a most powerful, if not indispensable, tool in the development of present-day science and engineering; but I think it is safe to say that the public, as a whole, to-day has greater confidence and respect for the ability and judgment of the engineer than for that of the business and financial management. In a sense the engineer stands as a connecting link between the public and the management, for the engineer in dealing more closely with physical details comes also more closely in contact with labor and the human side of these problems, and this is the aspect which the late

depression has so vividly shown us to be the part of our industrial structure which most needs attention and revision.

It is true, the fundamental conception and even the structure of our corporate law has come down to us with little change from the Romans, beginning there with the state and its minor subdivisions and extending to various social groups, but it is only the last half century which has seen its full flowering into the dominant and almost universal form of larger business undertakings.

The legalistic conception of the corporation as a fictitious person has apparently left even to the present day much interpretation still pending as to how completely the corporation is to assume not only human rights but human responsibilities. Perhaps the corporation is only showing a human characteristic in tending at times to stress its rights more than its responsibilities, feeling perhaps, again quite humanly, that the public, in the long run, can adequately take care of its own interests. However, there seemed until recently to have been a rather general, even if tacit, assumption that the more personal and intangible elements of human character and responsibility should hardly be looked for in a corporation, as tersely expressed in the old and well-worn saying that it "has neither a body to be kicked nor a soul to be damned."

But under the growing intricacy and intimacy of corporate relations with every detail of human life, may we not logically expect the public to progressively demand a higher and higher development within the corporate brain or management of something more analogous to what we think of as the finer and more intangible portions of human personality and responsibility? It seems to me that in his opportunity to help develop and rationalize some of these tendencies, the engineer holds a unique position both from his training and his peculiar position in the corporate structure. He is under less direct pressure than the business management to act exclusively under the profit motive, but is distinctively associated in everybody's mind with the function of service.

With an over-dominant financial- and promotional-minded management, he may, it is true, be under considerable pressure to focus these service efforts not so much on broad utility to the ultimate consumer nor improvement in working conditions of the staff and labor force, but rather with a single eye to increase profits and decrease costs at any cost. Just here, however, comes perhaps his real opportunity for social service in quietly and tactfully resisting undue pressure in this regard, even if it means a certain amount of hardship and risk to his advancement or even his position itself. In the extreme case, he may have the decision to make as to whether he can accomplish more for the general good by staying on where he is and systematically exercising this influence for whatever gains he may thereby be able to accomplish or whether he will be more useful on the whole by stepping out in favor of some one either more pliant or already committed to the management's point of view, while he himself seeks more promising soil in which to plant or cultivate these newer challenging variants of our social evolution.

Fortunately there is already a great deal of such ground to build upon, and it distinctly represents a two-way channel of exchange. I know of nothing more inspiring in business and industry than to see the deep-rooted and sincere loyalty of many employees and officials to their corporations. They, at least, certainly sense them as something more than a purely fictitious personality. On the other hand, there is an ever-growing circle among the corporations coming to appreciate their more human responsibilities in a deeper and deeper sense, and making every effort to find ways of expression. But especially in the larger corporations this often becomes a herculean task, chiefly from the size of the organization and the background of legal tradition and conservatism built up over the years out of our earlier limited interpretation of corporate personality. Where these traditions have been most directly broken through and a more progressive attitude established, it can usually be traced back to the presence of one or more outstanding individual personalities within the corporate management and staff, who have gradually built up their circle of sympathetic and vigorous spirits about them working in this direction. And here again is where the engineer can play so strong a part not only in his primary leadership in the matter, but in his helpful cooperation with others, both superiors and subordinates, in working to establish such traditions.

In town and village industries of old, owners, workers and consumers blended into a single compact community, the three classes largely overlapping. With the coming of our national corporations, all this has changed and in the typical case the three classes are quite distinct, though of late years definite and even strenuous efforts have been made by certain corporations to again interrelate the groups, as by stock allotments under favorable conditions to employees or stock sales campaigns among the consumers or clientele, as notably, for instance, by the American Telegraph and Telephone Company and other utilities. A still older and more complete application of the principle is, of course, the mutual insurance company. But this is too special a case to serve as a general pattern.

Of much more significance as a widely applicable pattern is the consumer cooperative movement, which had its origin, strangely enough, in almost exactly its

present-day corporate form through the registration on October 24, 1844, of the "Rochdale Society of Equitable Pioneers" in Toad Lane of this little factory town in northern England. Its growth, though steady and important, has been so unspectacular that its possible wide-spread importance as a social-economic factor has crept on us rather unawares, especially in this country, until within the last few years. But the prominence that it is now receiving in both the public and the technical press is rapidly acquainting all classes with its history and present status. Its world-wide strength has naturally sprung from the people with small incomes, and its already impressive world-wide manufacturing and merchandising operations are controlled and directed almost exclusively by men who have risen modestly from the ranks. Though now claiming to serve over two hundred million people throughout the world, it has the distinction of a remarkable degree of all-over efficiency coupled with strict adherence to its original severely democratic principles. As a background against which to examine our own national typically capitalistic business structure, it furnishes much food for reflection. In fact, so much so that of late months it has been freely asserted in several of the national trade journals that certain of our largest chain stores and mail order houses were seriously considering the expediency of remodeling their structure and customer relations very much along these same lines.

As a strongly suggestive study in contrasts, I would earnestly suggest to my socially minded engineer friends the worthwhileness of becoming thoroughly acquainted with this movement's history and present rather amazing growth in this country, particularly among the farming element. My reason for saying this is not that the movement has notably invaded the engineering field, particularly in the latter's more pioneering aspect, but rather for just the reverse reason, namely, that it has gone so far in other directions without apparently attempting or encouraging any bold pioneering of the engineering or fundamental science research type. This is entirely natural and to be expected, since the most dominant principle running through the movement as a whole, and which has undoubtedly contributed most to its stability and steadiness of growth, is the sustained and consistent effort to eliminate speculative motive both among its members and in the organization itself. This may prove the very factor which will limit its ultimate growth in displacement of typically capitalistic industry as we know it to-day. For it is in pioneering in new technical and industrial developments which at the start seem too uncertain in their results to be considered anything but speculative that the combination of high engineering skill and American methods of finance and management has been most successful and won world-wide acclaim.

It may be that the combination or rather working side by side of these two strikingly contrasted industrial systems is what we shall come to. The one under individual initiative would provide for constant pioneering and development of the frontier of applied science and industry, thus insuring the element of diversification in both products and human activities under the frankly exciting and stimulating conditions of typical pioneering, with all its traditional hazards and rewards, its headaches and waste for those who have the temperament and the hardihood to consciously and with deliberate choice elect this road. The other, the Cooperative, perhaps less spectacularly but none-the-less importantly would take over the industries and improvements thus established as they gradually become standardized, and thus freed from their original speculative aspects, eliminate the waste of excessive competition, advertising and promotion, guard against paying unjustifiable tribute to any special interest or group, and give the great, relatively colorless but none-the-less deserving consuming public at last an impersonally measured fair equivalent for its money or its services in return for such goods and services as can be produced and exchanged in this standardized way.

Here again, I believe, in the interrelation of these two groups and the establishment of their most fitting and efficient boundary relation is a splendid opportunity for the studies of the real engineer who knows not only his physics and his chemistry, but can judge and weigh human and service values as well. For verily there is a place for everything and we shall all be happier as each thing moves at least toward its allotted place.

Somewhat as the consumers cooperative movement has already found this large and important place for itself in the field of well-established household commodities alongside of ordinary capitalistic business and industry, there is also another, as yet much less pretentious and more tentative set of experiments being made over on the side of strenuous scientific and industrial pioneering, which have particularly interested me over the past 30 years and perhaps largely influenced the view-point presented to you this evening.

This group is probably best known to most of you through the industrial research foundations of various universities. My own most direct experience has been with the Research Corporation of New York City and its two-year-old little brother, Research Associates, Incorporated, in Washington, D. C. These are both non-profit business corporations, if you will permit such an apparently self-contradictory definition; meaning in any case that while they attempt to func-

tion in the same manner and general field as any privately owned and ethically operated business, they pay no dividends to personal stockholders. All income above expenses not held for reserves or needed for operating capital is expended currently to aid scientific and educational institutions in the prosecution of research.

Briefly, these two corporations may be said to hold a place and typify a new class midway between such privately endowed research and welfare foundations as Carnegie, Russell Sage, Rosenwald, and the like on the one side, and university research foundations, such as those at Wisconsin, Purdue and, more recently established, Ohio State on the other. They differ from the first category in starting with no large monetary endowment, that interest or dividends on securities purchased as investment are not intended ever to be a significant factor in their income, but that normally they earn their way currently through services in invention development and production for use.

They differ from the university foundations on the other hand chiefly by being entirely free from commitments to any one institution and thus being able to work with any and all of them, either individually or collectively. Also as yet the university foundations appear to have been conceived and administered almost exclusively from the standpoint and hope of revenue for further scientific research in the universities than with definite intent to use them as laboratories in social economics, which latter I have particularly tried to emphasize as the outstanding opportunity and characteristic among the purposes of Research Corporation and the Associates. That is, they are frankly willing to risk or even sacrifice on occasion possible legitimate profits from the licensing or operation of patents or developments if thereby a more important public service can be rendered by demonstrating the relative value and pertinency of proposed reforms in business and social administration of such rights, monopolies or other social-economic structures as the corporation may control or operate at a given time.

It is this latter aspect of the corporations' purposes and activities that is felt to be the most nearly unique up to the present time, and these it is hoped will eventually spread to other existing or yet to be created organizations, for this appears a most promising but neglected field of social-economic endeavor and research. In fact, I feel my main justification for being here to-night is what it may mean for the stimulation of just such activity. Perhaps the most impressive lesson that 25 years' experience with Research Corporation has driven home to us is how small a part of the field any one group can or should try to cover. Decentralization of projects and variety of approach, with free and active exchange of knowledge and experience, constitute the ideal program. Each new project of course presupposes sound worth-while new ideas for its technical background and adequate leadership ready to stay with them through thick and thin, but that is just what red-blooded engineers are supposed to have.

(To be concluded)

OBITUARY

WILLIAM MORTON WHEELER

WILLIAM MORTON WHEELER, professor of entomology, emeritus, at Harvard University, died suddenly in Cambridge, on April 19, in his seventy-third year.

Professor Wheeler was born at Milwaukee, Wisconsin, on March 19, 1865. He first attended public school but later transferred to Engelmann's German Academy and graduated from the German-American Normal School, which was appended to the academy. Even as a boy he was intensely interested in natural history and haunted the old museum at the school. In 1884, an incident occurred which was to influence his whole subsequent life. This was the visit to Milwaukee of Professor H. A. Ward, of Ward's Natural Science Establishment in Rochester. Ward brought with him a collection of stuffed and skeletonized mammals, birds, etc., with the idea of having the academy museum converted into a free municipal museum. Then a boy of 19 years, Wheeler helped Professor Ward prepare the collection for exhibition and was offered, and promptly accepted, a position in the Rochester Establishment. His duties consisted of identifying, listing and arranging collections of birds, mammals, shells, echinoderms and sponges. The catalogue of shells which he then prepared is still used by conchologists. In the following spring (1865) he left Ward's and returned to Milwaukee, starting his career as a teacher. Dr. George W. Peckham, who had been making studies on spiders and on the behavior of wasps, induced him to accept a position as teacher of German and physiology in the Milwaukee High School, of which Peckham was principal. Within a very few years the Allis Lake Laboratory was established near the high school, and Professor C. O. Whitman was appointed its director. One of the assistants at the laboratory, Dr. William Patten, taught Wheeler the latest embryological technique and suggested that he investigate the embryology of insects. This resulted (1893) in the publication of Wheeler's "Contribution to Insect Embryology," now recognized as a classic.

Meanwhile, however, the Milwaukee Public Museum