Veblen and the Political Economy of the Engineer:

The Radical Thinker and Engineering Leaders Came to Technocratic Ideas at the Same Time

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ABSTRACT. *Thorstein Veblen*'s case for a *Technocracy,* "*The Engineers and the Price System,*" has long posed an enigma: Why would a thinker as *radical* as Veblen align himself with a group as *conservative* as *engineers*? But engineers themselves had developed a *political economy* with important points in common with Veblen's analysis. Starting from their positions as technological experts in *corporations,* engineers came to believe that *business methods* were not efficient for *production;* this belief led them to develop systems of *scientific management* as an antidote to old-style *management.* Later, they expanded these ideas into a system of *social management* called *Technocracy.* This system of Technocracy represented an engineering effort at formulating an *industrial democracy,* with the cooperation of *labor.* Veblen was able to write a more systematic version of these ideas, because they fit in well with his own theoretical analysis.

I

Veblen's System: 'Scientific Collectivism'

AT A LATE STAGE in his writing career, Thorstein Veblen raised the question of whether engineers had the potential to establish an industrial system wherein they would organize and plan national economic production.[1] In light of his reputation for radicalism, Veblen's interest in this question has always seemed out of place. Edwin T. Layton, Jr., for example, has concerned himself with explaining why Veblen envisioned a new economic organization being directed by a group as socially and politically conservative as engineers. Layton accounts for Veblen's interest by detailing his personal relationships with engineers, including the spurious technocrat, Howard Scott, the efficiency expert, H. L. Gantt, and the liberal reformer, Morris L. Cooke.[2]

The purpose of this study is to place the explanation of Veblen's interest in engineers on a firmer foundation than the influence of personal contacts. It will be argued here that Veblen had a latent interest in engineers throughout

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his career. Furthermore, he would learn that engineers were producing an analysis of the business system similar to his; while his personal contacts with engineers may have been influential, those engineers could also have directed Veblen to a body of engineering literature and journal articles containing ideas reflective of his own views. With this discovery, Veblen concentrated his analysis on the activities of engineers to a greater extent than he had before.

Veblen's concern with engineers has also led to the criticism that he was a technical elitist. Daniel Bell, for instance, has concluded that Veblen, due to his interest in engineers, "must be ranked on the side of the elitists." Bell has further asserted that this technical elitism was something new; throughout his life Veblen had argued for a rational science of production, according to Bell, "yet he had never before tied these themes to the engineer."[3]

The criticism that Veblen was a technical elitist can be offset readily by pointing to passages where he argues for the necessity of a combination of engineers and organized labor in pursuit of a revolutionary overturn. These passages will be discussed in a succeeding paper. The ideas these passages represent form a defense against Bell's charges of elitism provided by Rick Tilman. Tilman has summarized Veblen's position as, "If the industrial part of the system is to function efficiently, it must have a division of labor which places the engineer, the technician, the skilled workmen and the economist in position where they can wield power and influence over the rest of the labor force. Apparently this will be done with the consent of the labor force. . . ."[4]

Such a widespread sharing of power and consent indicates that Veblen's views do not place him among the technical elitists. Yet, as Tilman has also pointed out, "Veblen does not tell us what mechanisms of representation will be used to determine the views of the labor force."[5] On Tilman's interpretation, Veblen was an "anarcho-syndicalist", supportive of workers' participation in social decisions.[6]

The position reached in this study is that Veblen favored a system that may best be described as "scientific collectivism." Under this system the production of industry would be controlled and planned by a collective workforce, all of whom would share a common set of scientific values.[7] With this perspective Veblen had to have been curious about the activities of both engineers and workers. In his early works, written when workers were being unruly vis-à-vis their relations with business, Veblen emphasized their efforts to implement "scientific collectivism" under the rubric of socialism; but he did not ignore engineers. Only later did he begin stressing the importance of the engineering profession, especially when its members indicated their own restlessness with the business system of the U.S. economy.

As Layton has also described, the years immediately following World War I were marked by an engineers' revolt against business.[8] Veblen reacted to the engineers' discontent with business; he thought engineers might be able to set up a system of national economic planning. Because the system of "scientific collectivism" Veblen favored placed a heavy reliance on national economic planning, he eventually foresaw that the planning techniques of engineers would be vital to its success. Equally important, a group of engineers were setting forth in engineering journals a system of technocracy strikingly similar to Veblen's.[9] By the end of World War I, Veblen and engineers were thinking and writing along similar lines as to how industry should be organized and planned.

The total system of the political economy of technocracy was never set down in any coherent fashion either by Veblen or by engineers. For engineers, it reflected their concerns as to the suitability of business leaders to achieve efficient production in their firms. Ultimately, it developed into a plea for a system of national planning based on the coordinating efforts of engineers. Herbert Hoover, an engineer himself, gave perhaps the most succinct statement of this new political economy when he told engineers "to visualize the nation as a single organism and to examine its efficiency towards its only real objective—the maximum production."[10] Engineers had come to believe that maximum profits and maximum efficiency were not necessarily synonymous, a point Veblen often made. But this belief was not new. Rather, it represented a discontent with business methods on the part of engineers dating back nearly half a century.

II

The Engineer as an Economist

ENGINEERS TOOK UP the formulation of a political economy from their perception of a technical necessity. As F. A. Hayek once pointed out, the engineer "has complete control of the particular world with which he is concerned." The outside economy, however, often impinges on that narrow world through the operation of the market.[11] Profit-conscious, nontechnical managers of the firm where the engineers work, because of their perceptions of market demand, often impose limits on the projects the engineer desires to undertake; workers do not perform according to the specifications of the engineer's plans; and the prices of all inputs vary with market forces thereby upsetting the engineer's careful calculations. As a result, the engineer loses control over his own little world and must continually revise his plans. To keep his little world secure, the engineer is forced to extend his control over these outside variables and transform them into constant factors.

Economists tend to think in terms of two types of efficiency; physical efficiency (measured by physical units of output per unit of input) and cost efficiency (dollar value of output per dollar cost of input). Given a choice of techniques with varying input ratios, relative prices of inputs will determine which technique will bring about physical efficiency and cost efficiency. The mind set being ascribed to engineers in this essay rebelled against this process. For them, physical efficiency would be the ultimate arbiter of which technique to use. They could find that "one best way" to produce; such a method would also be the lowest cost method, if only input prices would not change.

To attain the best form of physical efficiency, engineers would need to take on greater responsibilities as business managers, a point made by Henry R. Towne in an article written in 1886. Towne saw too much randomness in business practices, mainly because ideas about management were scattered. "But," he continued, "the remedy must not be looked for from those who are 'business men' or clerks and accountants only; it should come from those whose training and experience has given them an understanding of both sides (*viz.*: the mechanical and clerical) of the important questions involved. It should originate, therefore, from those who are also engineers. . . ."[12] This placement of engineers in management positions would require, however, that they have a special attitude toward business methods. There was no clear-cut agreement as to the primacy of technical over financial efficiency.

Writings by engineers on business and economic matters were few and published mainly in engineering journals. But early on engineers were told, "Engineering is the art of making a dollar earn the most interest."[13] As a result of this maxim, engineers were to consider interest charges on all expenses associated with technical efficiency. In this vein, another article warned, "It is certainly poor engineering to construct works so massive and with such a surplus of strength and solidity that the interest on the original amount invested far exceeds the cost of repairs, renewals and interest on a differently designed work which would provide a similar service."[14]

At the same time, engineers also heard of the depredations of finance. Too often, the financiers in charge of corporations overvalued the stock of their firms leading to inefficient utilization of resources.[15] So which business principles should the engineer follow? We can see why they would desire to develop their own. But until they did, the position of engineers contained an internal conflict, as Samuel Haber has noted.[16]

This conflict can be seen clearly in an engineering remedy to a social problem. In a series of articles in *The Engineering News,* commenting on the great anthracite coal strike of 1902, a point was made on behalf of labor by the editors. Wages were high enough per diem to allow workers a decent standard of living, they argued, but a work distribution wherein the mines operated only 190 out of 300 possible work days a year did not provide an annual living wage. Here was a simple engineering problem with an easy solution. The editorial noted, "We see that from the earliest times down to the present lack of storage facilities brought by desire to save interest charges on stored coal have made necessary an excess of workers, and correspondingly low annual earnings for each worker, though day wages were high." The solution was for management to increase its storage capacity and thereby provide for year-round work.[17] Whether this program met with the test of financial efficiency, the article did not explain. Business-oriented engineers and businessmen would surely have made the case that this engineering remedy could not meet the profit maximizing test.

Engineers were trapped in a conflict between science and profits. The most thoroughgoing attempt to resolve this conflict was a program advanced by Frederick W. Taylor under the name of scientific management. By involving engineers in the calculation of financial costs as well as engineering efficiency, scientific management could earn a place for engineers in the corporate hierarchy.

As Frederick Taylor often admitted, the ideas contained in his principles of scientific management were not new; the use of differential piece rates, very similar to the Taylor task and bonus system, had been used and discussed by engineers. But Taylor and his disciples extended the method by making it more systematic and by attempting to measure accurately how much work could be accomplished by a standard worker in one day. Once that measurement was established, there would be no obstacle in determining how much the standard worker should be paid. Wages would be based on a scientifically determined amount of output that the worker could produce; Taylor would substitute an engineer's calculation of the value of production for a determination usually left up to either a labor market or negotiations between labor and capital.

The freshness of the idea rang true in engineering circles, where standardization always held high priority. In his aspiration to calculate scientifically a standard wage, Taylor realized that he would be setting profits, too; he believed that his improvements in work would increase productivity, so both wages and profits could be increased. Employers might try to take an unfair share of profits by reducing wages; engineers would prevent this greed from operating. As part of his overall system, Taylor expected to treat managers as he had workers. The tasks of managers would be broken down and standardized; clerks would be able to handle the details of management. Old fashioned managers were not scientific, so could not manage efficiently.[18] In their place Taylor proposed the engineer operating as an organizer in a planning department. The little world of the engineer was expanding to include the whole corporation.

There were economic problems associated with the engineers' promise to increase both wages and profits by increasing worker productivity. First, Taylor's experiments with finding the most efficient method of production required time and money; he assumed the benefits would be worth the costs, but businessmen were not so readily convinced. Second, and more important, Taylor ignored the market effects of his proposals. The scientifically-determined wage was dependent on the price of the final product. In all his examples, Taylor held the market-wage and the price of the product constant. If productivity increased the result could be lower prices for the final product which could cause profits, wages and employment to decline. In any event, the ultimate effect throughout the marketplace of Taylor's changes in productivity would be difficult to determine and even harder to promise.

These difficulties are especially evident in the confusion over the market system contained in an early primer on industrial engineering written by Charles Buxton Going, managing editor of *The Engineering Magazine*. At first, Going emphasized the need for industrial engineering by relating it to the lack of control business had over the prices of inputs and outputs, which are "fixed by competition and market conditions." Since these economic factors were exogenous to a firm, the firm must improve its industrial efficiency to increase its profits.[19] Yet three pages later, Going characterized industrial engineering as dealing "with markets, with the economic principles or laws affecting them and the mode of creating, enlarging or *controlling* them."[20]

When it came to explaining how markets could be controlled, Going begged the question by admitting that markets, "though equally susceptible to scientific treatment, are not included in the scope of this study."[21] This exclusion was unfortunate, for Going could not decide on whether markets were beneficial. He explained economic progress as a cycle, wherein mass production techniques reduced prices thereby leading to a larger market for each industry; these markets, which resulted in increased demand, also improved employment prospects for workers.[22] At this point Going appreciated that market competition worked well in terms of inciting and rewarding efficiency. But he also indicted markets as creating economic problems. As Going put it, "And yet, by a paradox, in another way competition has been one of the great sources of waste, by causing duplication of plant, of organization, of equipment, of sales effort, and of middlemen—none of which may have any better reason for existence than someone's desire to share in tempting-looking profits, but all of which must be paid by the consumer—all of which become a burden on society at large." Too much competition could upset his cycle of economic progress by altering wages and prices. Going never drew the line on where competition should stop. Instead, he was satisfied merely to promulgate an engineer's maxim, "Efficiency is a concept . . . much finer than competition. . . ."[23]

Without competition however, other problems arose. Mass production led to larger firms which undersold their competitors, leading all firms to act collectively for their own interests.[24] Large businesses resisted technological change, and sought "to control a market by masterful salesmanship, by combinations to regulate products and prices."[25] As a result, Going concluded, "It is a serious fact that in a large way we have nationally devoted too much thought to obtaining and raising prices. . . ."[26]

Going's analysis typified an engineering ambivalence toward markets. Too much competition led to waste, while too little competition, which may have resulted from the elimination of waste, stifled the cycle of economic progress. Were markets an exogenous factor placing controls over business? Were they susceptible to control? If so, by whom, engineers or businessmen? Going never answered these questions, but just by raising them he placed himself in the same camp as Thorstein Veblen, who had already provided systematic answers.

In response to these problems, engineers began expanding their little world to include all of society. As one engineer in the electrical industry put it, "In proportion to their numbers, training and general qualifications, no class have had much less to say than engineers about what economic conditions shall be. There are some indications that the situation is about to change. Is not the time ripe for engineers to work out their own political economy. . . .?"[27]

A new political economy was being worked out by engineers, especially the followers of Taylor. Its main features as well as its part in a program of engineering-led reform have been well described by Layton and Bell.[28] Under the leadership of engineers, existing business management would be improved and made scientific and the lives of workers improved,[29] all of which would enhance industrial production. This political economy would attract Veblen's attention. He would also seek evidence that it was a widespread movement.

Engineers appeared to be launching a widespread movement during their attempt to secure for themselves a larger role as planners of the overall economy during a campaign of preparation for war. Prior to the entrance of the United States into World War I, engineers joined with other groups in urging for a program to ensure the country's readiness to fight. Howard Coffin, a vice president of Hudson Motor Cars and a member of the Society of Automotive Engineers, led this movement and saw it as an opportunity for engineers to gain a national role. As he put it, "The time has come for the engineer to take that place in the national life which must be his if this country is to hold its own in the great world contest of the years to come."[30]

Other engineers also recognized that engineers could attain increasingly vital responsibilities in social affairs through their wartime activities. At a meeting of the American Society of Mechanical Engineers (ASME), titled "Discussion on Industrial Preparedness," Charles Whiting Baker maintained that ". . . the best service that a Board of Engineers can do for the country will be take care of the big things, and let the little things be done by somebody else."[31] Another panelist approved of this social service engineers could provide for society and thought it should be made permanent. He asked, "Why not have a General Industrial Staff or bureau as a continuing body, outside of politics, . . . to plan a national industrial campaign . . .?"[32] The implication of these briefs for technical control of overall economic organization was that business methods failed to achieve the cohesive action wartime planning required.

This lack of organization could be traced to the vagaries of relying on markets. Ira N. Hollis, a president of ASME, challenged the blanket acceptance of a *laissez-faire* ideology that argued for the achievement of social good through the unfettered action of individuals. In particular, Hollis pointed out that a conflict existed in trying to establish efficiency in segments of the economy as opposed to making the total economy perform well: "We must again keep in our minds the fact that there are two efficiencies: one the efficiency of the individual; the other, the efficiency of the collective mass. Our efficiency as a whole will maintain the republic but the efficiency of the individual action alone will create such division as to destroy it." As examples of divisive individual efficiencies Hollis cited both business and labor for putting their own interest in achieving higher incomes before the greater social interest of maximum national production.[33]

III

Engineers and Technocracy

ENGINEERS HAD TO SOLVE two stubborn problems before they could realistically hope that they could provide for any restructuring that was needed to revive the national efficiency they saw as lacking in the United States. First, through what organizational format could engineers most effectively pursue their collective interest as leaders of industry? Second, from whom could they attain political and economic support in their quest for industrial leadership? In formulating a solution to the second problem, engineers determined to seek the support of organized labor.[34] This solution probably quelled any doubts Veblen might have had concerning whether engineers and labor would be able to join together in a common effort.

It would be the solution to the first problem that Veblen would find attractive. Engineers had proposed they organize as a body during World War I. One engineer, William H. Smyth, represents the culmination of this idea. In a collection of articles in *Industrial Management* dealing with the broader concern of the role of engineers in society, Smyth outlined a view of science in well-chosen words, "Science knows neither morals nor ethics, and is equally potent for social 'bad' as for social 'good'. Science works just as effectively in criminal hands as in those of a saint."[35]

The viewpoint Smyth expressed here was one intellectuals might have learned from the fighting of World War I, where science had served the ill-thought-of German masters of destruction as capably as it had aided the forces of democratic America. With a subtle insight unusual at the time, Smyth, for one, worried that a nefarious application of science might even occur in the United States. To offset the potential societal abuses that would befall a nation if science fell into the wrong hands, he proposed an experiment in industrial democracy under a name he claimed to invent, "Technocracy."

While his ideas were spaced over several articles in *Industrial Management,* in one of them Smyth provided a succinct statement of how his version of "Technocracy" would be organized. To avoid the autocratic control that would evolve if science fell under the domination of despots, society must conduct its operations through the leadership provided by "a Supreme National *Council of Scientists*—supreme over *all* National Institutions—to advise and instruct us how *best to live.*" [36] Science was safe only in the hands of scientists, so no social force should be permitted to overrule the dictates of science. Since only scientists understood the dictates of science they must reign supreme. But the gain for society would be that technocracy eliminated the potential for a social decline into autocracy.

A supreme council of scientists may well represent another form of a technical elite. Yet Smyth had earlier on warned all of engineering that "Men and women were not born into a democracy to be cogs in an industrial machine for the efficient production and accumulation of 'wealth' ".[37] In a consistent development of this theme, Smyth criticized what he termed "mechanical efficiency" for placing too many controls over the activities of workers. Instead, Smyth asserted the structure of work must take into account the human spirit, which operated most effectively when unfettered by unhealthy rules of planning.[38] Quite simply, Smyth and other advocates of technocracy, including Veblen, took democracy for granted. For this reason they cannot be legitimately categorized as technical elitists. Whether they qualify instead as soft-headed utopians can never be answered; their theories were never put into practice.

The ideas contained in Smyth's articles did not take hold among the rank-and-file of engineers; no serious effort at achieving a system of technocracy emerged from the engineering profession. But Smyth's writings do indicate that engineers were thinking about a greater social role for themselves—they did not need outside prodding from liberal intellectuals or charlatans like Howard Scott to convince them of their own significance to society. Moreover, when Thorstein Veblen looked more closely at the engineer's campaign, he would find evidence of a social movement—and it was one that fitted neatly into his own theoretical framework.

IV

Conclusion

EGINEERING CAME OF AGE as a profession during the first twenty years of this century, as many engineers moved into positions in the expanding business world. But this movement did not take place smoothly. First, engineers found themselves subordinate to business managers within the corporate system; second, the engineers' values of technical efficiency often conflicted with the profit motive of these managers. Initially, a subgroup of the profession sought to resolve this conflict by promoting themselves as experts in industrial efficiency. Ultimately these engineers looked for an even wider scope for their expertise by pushing for a system of national economic planning, Technocracy.

The existence of Technocracy as an idea being written of by engineers in engineering journals has important implications for intellectual history. It is now clear that the idea of Technocracy should be interpreted as having been thought out by professional engineers and given a respectable hearing by them; it need not be maligned by the nefarious connotation accorded to its later use by Howard Scott and the "Technocrats." Furthermore, the ideas surrounding the notion of Technocracy existed independently of the writings of Thorstein Veblen. He amplified them in his writings only because they fitted in with his own thoughts on economic organization. But he was not the sole proponent of the political economy of Technocracy.

Notes

1. Thorstein Veblen, *The Engineers and the Price System* (New York: The Viking Press, 1944).

2. Edwin T. Layton, Jr., "Veblen and the Engineers," *American Quarterly,* 14 (Spring 1962).

3. Daniel Bell, "Veblen and the New Class," *The American Scholar,* 32 (1963), p. 617.

4. Rick Tilman, "Veblen's Ideal Political Economy and Its Critics," *American Journal of Economics and Sociology* 31 (July 1972): p. 312.

5. *Ibid.*

6. *Ibid.,* pp. 310 and 312.

7. For a comparison of Veblen's ideas on this system with those of socialist intellectuals in the U.S., see: Donald R. Stabile, "Thorstein Veblen and His Socialist Contemporaries: A Critical Comparison," *Journal of Economic Issues* 16 (March 1982).

8. Edwin T. Layton, Jr., *The Revolt of the Engineers* (Cleveland: The Press of Case Western Reserve University, 1971).

9. See below. It should be noted that the term "Technocracy" is being used in the sense that these engineers understood it, *i.e.,* as an industrial democracy.

10. The statement is from Hoover's presidential address before the American Engineering Council on February 14, 1921, as cited in Layton, *ibid.,* p. 190.

11. F. A. Hayek, *The Counter Revolution of Science* (Glencoe, Ill.: The Free Press, 1952), p. 95.

12. Henry R. Towne, "The Engineer as an Economist," *Transactions of the American Society of Mechnical Engineers,* 1886.

13. "Notes," *Engineering News,* (May 11, 1899), p. 300.

14. John F. Wallace, "Engineering and Engineers," *Engineering News,* (July 19, 1900), p. 50.

15. J. Selwin Tate, "The Fruits of Fraudulent Railroad Management," *The Engineering Magazine* 11 (June 1896), p. 407; and Henry Clews, "The Relations of Finance to Industrial Success," *The Engineering Magazine* 11 (August 1896), p. 809. For a detailed discussion of the relationships between businessmen and engineers see also in *The Engineering Magazine* William D. Ennis, "The Engineering Management of Industrial Works," 22 (November 1901), and G. Siebert, "The Commercial Management of Engineering Works," 22 (February 1902), p. 653.

16. Samuel Haber, *Efficiency and Uplift* (Chicago: Univ. of Chicago Press, 1964).

17. See in the *Engineering News:* Editorial Notes on June 12, August 28 and October 16,

1902; "The Labor Problem in the Anthracite Coal Problem," quote from p. 401 (November 13, 1902); "Labor Cost of Coal Production," (November 13, 1902).

18. Frederick W. Taylor, *The Principles of Scientific Management* (New York: Harper & Brothers, 1919), p. 22.

19. Charles Buxton Going, *Principles of Industrial Engineering.* (New York: McGraw-Hill, 1911), pp. 2–3.

20. *Ibid.,* p. 6, emphasis added.

21. *Ibid.,* p. 50.

22. *Ibid.,* p. 31.

23. *Ibid.,* p. 9.

24. *Ibid.,* pp. 20–23.

25. *Ibid.,* p. 32.

26. *Ibid.,* p. 73.

27. George L. Hoxie, "Political Economy and the Engineer," *Electrical World* (June 12, 1915), p. 1549.

28. Layton, *Revolt, op. cit.;* Bell, *op. cit.*

29. Edw. D. Jones, "The Administrator as Diplomat." *The Engineering Magazine* 48 (October, 1914), pp. 24–25 and 31. See also, Horace B. Drury, "Democracy as a Factor in Industrial Efficiency." *Annals of the American Academy of Political and Social Science,* 65 (May 1916), pp. 15–23.

30. Howard E. Coffin, "The Council of National Defense," *The Engineering Magazine* 51 (September 1916), p. 789. See also William L. Saunders, "Industrial Preparedness and the Engineer," *The Engineering Magazine,* 51 (July, 1916); C. E. Knoeppel, "The Industrial Engineer and Preparation for War," *The Engineering Magazine,* 51 (July 1916), p. 554; editorial, "The Hour of the Engineer," *Industrial Management,* 53 (May 1917), p. 171.

31. "Discussion on Industrial Preparedness," *The Journal of the American Society of Mechanical Engineers,* 38 (June, 1916), p. 438.

32. *Ibid.,* p. 439.

33. Ira N. Hollis, "Efficiency and Democracy," *The Journal of the American Society of Mechanical Engineers,* 39 (June, 1917).

34. As part of this effort, *The Bulletin of the Taylor Society* published articles outlining the need to humanize control over work. See for example: "Scientific Management and Progress," (November, 1916); "Who is Boss in Your Shop?" (August, 1917); and "Man Management: A New Profession in the Making," (August, 1921). For a full treatment of engineering efforts to win support from labor see Milton J. Nadworney, *Scientific Management and the Unions* (Cambridge, MA: Harvard Univ. Press, 1955).

35. William Henry Smyth, " 'Technocracy'—National Industrial Management," *Industrial Management,* 57 (April, 1919).

36. William Henry Smyth, "Human Instincts in Reconstruction," *Industrial Management,* 57 (February, 1919), p. 91. See also " 'Technocracy'—Ways and Means to Gain Industrial Democracy," *Industrial Management* 57 (May, 1919), p. 385.

37. William H. Smyth, "Efficiency—Stop! Look! Listen!" *Industrial Management,* 56 (September, 1918), pp. 234–35.

38. William H. Smyth, "Working Explosively," *Industrial Management,* 53 (January, 1917), p. 503; and "Is the Art of 'Efficiency' Efficient?" *Industrial Management,* 54 (November, 1917), and William H. Smyth, "Efficiency—Stop! Look! Listen!" *op. cit.,* pp. 463–64.