The work done in both branches of the service is ably and comprehensively reviewed in Vol. II, Chs. 11 and 12, of the Copley biography.[19]

Because of the ability with which it was directed and the complete establishment of the worthwhileness of the results obtained, even more than because of the long continued controversy to which it gave rise, the work of General William Crozier stands out as one of the most valuable contributions made to the Scientific Management cause.[20] The high level reached in the management of the Ordnance Department during the war was due almost entirely to the acts and influence of this splendid officer and man.

Because of the picture afforded of the present status of scientific management work in some of our principal navy yards, I quote from a recent letter from A. H. Van Keuren, Commander, U. S. N.:

> My introduction to the system was through Hathaway at Philadelphia about fifteen years ago, when his guiding hand was felt in the Central Tool Dressing Plant on which he worked with James Reed. It must have been Hathaway's enthusiasm that led us at that time to start a Planning and Estimating Section at Philadelphia, which later expanded into the present organization.
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> When I left Philadelphia and came to Mare Island in 1911, I found that Holden A. Evans and his disciples had become firm converts to the Taylor System and had left behind them a well organized Central Planning and Estimating Section with a smooth running routing system, shop planning, etc., and with the Halsey Premium System in full operation in the Flag Loft, Sail Loft, and Boat Shop. It was an education to me in management and as Shop Superintendent, I planned to extend the working of this system to the Sheet Metal Shop, Shipsmith Shop, and elsewhere that it seemed applicable. In this I had the hearty support of Naval Constructor Ruhm, then Construction Officer, and of Naval Constructor Gleason, his successor. As you know, however, these plans were handicapped when Congress refused to spend any part of the Naval Appropriation for work involving the use of a stop watch, time studies, etc. Although premium systems passed out, the results of all the work put into them are yet fruitful in setting up standards that we know can be lived up to.
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> In 1916, I went to the Bureau of Construction and Repair and for four years, before, during, and after our participation in the World War, was connected with design work. While not so evident as in a Navy Yard, the principles of scientific management were in use in the Bureau during those trying times and such men as Furer, Ackerson, Henry, and others could scarcely have carried on their burden of work without being able to organize, schedule their program and keep intelligent progress reports of field work and without their knowledge and training in correct principles of management. I know they sought advice from leading industrial engineers and welcomed eagerly any suggestions that might tend to the sole object of their lives at that time, ships—and yet more ships.
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> In 1922, after two years in the New York Yard, spent first in starting the building of the South Dakota and Indiana, both stopped after the Washington Conference, afterwards as Outside Superintendent, in both of which jobs it was attempted to utilize the best systems evolved for Navy Yard work,—though not always with success, due to lack of funds—I return to Mare Island, to find much the same organization that existed six years before.
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> There is no question but that millions of dollars have been saved by the application of Taylor principles to the varied work of Navy Yards, even though such application in many instances has been far from thorough. It is impossible to gauge the cumulative effect of the absorption of a few correct ideas in the minds of a number of responsible persons in Government employ. If the result is merely to make them receptive to suggestions along the line of systematizing their work, the gain is incalculable. If, to add to this, they reach the pitch of enthusiasm where they begin to spread the doctrine, the chain is endless. I wish I could state that the portions of Mr. Taylor's "Principles" we have learned and applied in the past have been maintained and extended in Navy Yards down to the present time. Unfortunately, such is not always the case. The main principles of organization have usually survived, but many important details have fallen by the wayside due to lack of appreciation on the part of those responsible for appropriating funds. Any outlay not directly contributing to so-called "productive" labor has often been looked on with suspicion and expenditures therefor curbed. In spite of handicaps, however, the improvements that can be noted since Mr. Taylor's philosophy began to permeate to Navy Yards are striking, and step by step major items of improvement are still being made. It must be admitted that at one time, due to a flood of literature on the subject, and the pretensions of a lot of incompetent "efficiency engineers," many government officials became distrustful of the whole movement, but now with a subsidence in ill-advised advertising, and the accomplishment of improvement without so much use of the word "efficiency," thoughtful executives are turning again to a study of the Taylor principles.

It sounds trite to say that some undertakings which are fairly complete failures as regards the accomplishment of their more immediate purposes are brilliant successes in the light of their influence on subsequent events. It will be some years before we shall see the full effect of the splendid efforts made just after the war by our own fellow member, Otto S. Beyer, representing the administration of the Ordnance Department, and by our highly respected and genial co-operator, R. L. Cornick, who represented the Rock Island Arsenal workers, to stabilize employment at the arsenals and in the navy yards and to effect such stabilization under conditions which would enlist the fullest possible interest of the workers in effective production. With the signing of the armistice, of course, work at these government manufactures came almost to a standstill. Then the proposition was made that a reasonably full peace time organization be kept engaged on making articles required by other departments of the Government. The saddlers at Rock Island would make the leather mail pouches for the Post Office Department. The workers agreed to do everything in their power through a detailed study of manufacturing methods and costs—even to employing expert assistance—to make it possible for the Government to have its requirements satisfied at the lowest possible cost. Simply because the Government was not in competition with anyone else it seemed to afford a field where labor was without any excuse for doing other than its best. Opposition originating from two quarters—first, from manufacturers previously supplying to the Government the articles it was proposed to manufacture, and second, from officers of the Army who sincerely feared the encroachments of organized labor on the discipline of the department—ultimately caused the abandonment of the scheme.[21] But much good has come of it in a better understanding between the organized workers and the technicians as to the field and function of Scientific Management. These experiments in cooperation between men and management, together with efforts along the same line a little later on the railroads, was one of the influences leading to the organization of the Labor Bureau, Inc., which so far as I know is the first continuing agency organized to provide labor with technical information about industry interpreted in the light of the labor philosophy. Not only for its historical interest but because of the wealth of information it contains bearing on this general plan, I wish this society could obtain for its library from the International Association of Machinists a report made to that organization in May, 1922 by O. S. Beyer on "The Intensive Utilization of the Army and Navy's Industrial Facilities."

In the same sense that necessity fosters invention, in the face of danger individually and collectively we are prone to utilize means admittedly effective which for one reason or another we disregard or purposely ignore when nothing threatens. Viewed from this angle the many, many ways in which our Government utilized the mechanisms, personnel and principles of Scientific Management when confronted with the task of making the largest and quickest contribution to the defeat of Germany is the best possible augury that in due time these methods can be made current in our everyday, peace-time affairs. Even to catalogue the distinguishable efforts which taken together constitute the contribution of Scientific Management to the winning of the war would be a lengthy task. Perhaps some day it will be done. It would be especially valuable to the nation if someone could record the work done by the late Henry L. Gantt and Hudson W. Reed in the early days of the war in the matter of developing follow-up methods. This work was of such a high order that all subsequent work in the same field was measured by it.

I know of very few contributions to the success of our American war effort which compare in originality, succinctness, practicability and importance to that made by our fellow member Henry P. Kendall, first in discovering the entire absence of any provision for storage facilities in our war plans, and then in moving as a private citizen, but nevertheless effectually, to have the omission rectified. It was a notable piece of work! At my request Mr. Kendall has described the early stages of this effort as follows:

> In the latter part of March, 1917, just a week or ten days after the Council of National Defense was formed, I returned from the South and stopped off in Washington and circulated among several of the members. I discovered that they had taken into consideration and had attempted to organize so as to cover such matters as transportation and purchasing of materials, but had failed to consider that without provision for storage and without any place to which to ship and assemble and from which to distribute large purchases they would be in a very bad mess. It was at that time that I conceived the idea that the manufacturers of the country who had a common knowledge and experience of stores methods might cooperate in a movement to develop storage facilities and supply the organization and supervision. Our first meeting was held on a Sunday morning at the Bellevue-Stratford Hotel in Philadelphia. Those present were convinced of the emergency and took train for Washington. Later I brought together at luncheon a group of prominent Eastern Massachusetts manufacturers who were in hearty accord. Afterwards a similar luncheon was held at the Engineers Club in New York. These activities, I think it fair to say, established the idea in Washington and caused the appointment of a Storage Committee in the Council of National Defense under Frank Scott, later taken over by the War Industries Board.
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> Thus was started an effort which resulted in an ex-

[19] "Frederick W. Taylor, Father of Scientific Management," by Frank B. Copley, Harper Bros., 1923.

[20] See address by General Crozier, U. S. A. delivered before Philadelphia School of Commerce and Accounts and reprinted in *Taylor Society Bulletin*, October, 1915; also Senate Document No. 800, 63rd Congress, 3rd Session.

[21] We are informed that this work has not been without permanent effect on the operations of the arsenal.