ing, as the single letter H, instead of the eight letters required to write hydrogen.

2. As far as possible, chemists make their symbols mnemonic. Having used P for phosphorus, they use K for potassium, taking the initial of the Arabic name of potash, "Kali." In this respect, industry has an advantage, for in chemistry, there can be only one name for the element to be symbolized, while in industry there are an infinite number of synonyms and alternatives for almost anything you wish to designate.

3. Chemists combine symbols to indicate combinations; they write H_2SO_4 to express the action of sulphuric acid in a reaction and thus are saved the awkwardness of saying "two parts of hydrogen, one part of sulphur and four parts of oxygen."

The natural antagonism to the adoption of a new language, so to speak, occasions some difficulty in introducing the Mnemonic Index into general use in an establishment, but where the symbols are truly mnemonic, and are so constructed that they classify as well as designate, they are soon found to be a more simple and natural form of expression for managerial purpose than words.

The idea of a comprehensive classification and a complete index was inherent in Mr. Taylor's conception of industrial control. He has always held that every industry could be reduced to a definite number of functions and things. Over twenty years ago he had worked out a classification and a mnemonic system of symbols for stores, tools, products and charges.

With the growing mass of material gathered by Mr. Taylor and his associates, the necessity for classifying and symbolizing instructions became apparent, and several definite and fairly successful efforts were made to bring together all of the instructions of a business into one co-ordinate whole. The standing order files of the American Society of Mechanical Engineers, and of the Plimpton Press at Norwood, and the Code Book of Day and Zimmerman, Philadelphia, are the best examples of such indexing. The dates of these range from 1908 to 1911.

Although there has been a vast amount of time spent in making mnemonic indexes, I have not been able to find that any rules for this work have as yet been compiled. When I started to make a mnemonic index recently, I found it necessary to formulate rules for my own guidance. The purpose of this paper is to present the conclusions resulting from this work, with the hope that, whether or not you agree with them, they may provoke a discussion which will lead to further developments of what I believe to be the next logical step in the development of Scientific Management.

That I may be fully understood, I should explain that the work from which my conclusions are drawn was done in connection with the intended introduction of Scientific Management into several concerns in the same industry at the same time, with a view to eventually having an unlimited number of concerns in the same industry operating under the same methods and instructions.

My index is made not alone to index and designate stores, functions, products, etc., but also to serve as one element in a medium through which I might visualize and perfect my plans of management.

I have in mind an ideal for Scientific Management, of devising a means for working out and visualizing management which shall be as separate and apart from actual management, as the working out and visualizing of a machine is separate and apart from its construction.

I believe the Mnemonic Index is the first step to this means, and as far as possible, I have sought to make it applicable, even where its use has not been fully developed.

It has not been many years since practically all experimenting was done by empirical test—actual practice. Since then, we have learned to experiment on a drawing board, and so to eliminate not only the excessive cost of the other method but also its demoralizing effect. To a large extent, Scientific Management has been developed through the old method, and must continue to develop in this way until we devise some adequate means of expressing management on paper—until we get some visualizing means comparable to chemists' symbols, engineers' drawings, or musicians' notes. Everyone who has tried to express management in words alone realizes this.

There has probably been more waste in management than in any other form of human endeavor. Until recently the quality which makes successful managers has been considered as intangible a thing as personality. The familiar phrase "a born manager" illustrates this.

In few other fields has there been so much transient achievement. Vast businesses and enterprises have risen within one generation, only to fall within the next, chiefly because the principles which underlay their success could not be visualized and handed on, so as to be maintained, and yet at the same time modified to meet changing conditions.

This has to some extent been overcome in our large organizations, partly because habits established among larger groups are more permanent, and partly because with the subdivision of management into small units, only one unit at a time is jeopardized by the death or displacement of a single man.

A new management taking hold of a business is in much the same position as an engineer would be if he took over the direction of a complex machine without any drawings, and was dependent for all knowledge concerning it upon the circumstantial information furnished by employees.

As an objective toward which to work, I have assumed that:

A Mnemonic Index should indicate the subdivision of accounts, for both accounting and statistical work, and it should co-ordinate every material thing and every function in the business concerned.

It should serve as an Accounting Classification, and as an Index for the main subdivision of files. It should also designate all equipment and materials, down to the smallest tool and most insignificant article of stores, and all products and functions with which the business is concerned.

It should be easy of reference, and the symbols should be strongly suggestive, easily remembered, and susceptible to use as shorthand in writing instructions.

DEFINITIONS

One or more letters symbolizing words are termed a Symbol:
FCM Symbolizing the Function of Make-ready in the Cylinder printing division.
CAD Symbolizing an item of Cost Apportioned to a given product and representing a Direct (special) purchase.

Each letter in a symbol, and the words for which it stands, are termed a Designation:
F—Function, M—Make ready, C—Cylinder Printing Division in the symbol FCM.
C—Cost, A—Apportioned, D—Direct Purchase in the symbol CAD.

The first designation in a symbol is termed the Root Designation:
F—Function, in the symbol FCM.
C—Cost, in the symbol CAD.

The root designation in a symbol indicates the character of the symbol:
F—Function indicates the character of the symbol FCM.
C—Cost indicates the character of the symbol CAD.

All the rest of the designations in a symbol qualify the character of the symbol:
C—Cylinder Printing, and M—Make-ready, qualify the Function in the symbol FCM.
A—Apportioned, and D—Direct Purchase, qualify the item of Cost in the symbol CAD.

Turning first to physical characteristics, I suggest that a ring binder be used during the period of making, while the changes will be frequent. I also suggest using sheets of good strong bond paper, 20 pounds to folio, 8½ x 11, printed and punched as shown in exhibit A.
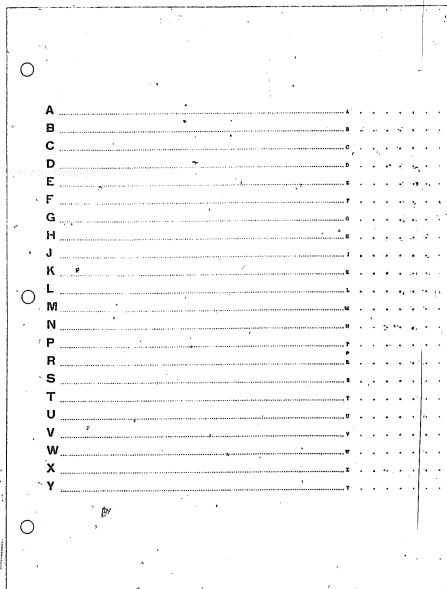
EXHIBIT A—Sheet used in laying out and perfecting the Master Index. The same sheet without the alphabet and lines to the left is used for final draft. See Exhibits B, E and F.

By writing the index letter of each sheet in the columns to the right of the sheet in the place corresponding to its place in the symbol, and cutting away the sheet beyond this letter, the sheets when put together will automatically index themselves. See Exhibits E and F.

Indexes for working purposes are best made in the form of Exhibits G and H.

It is the general practice to divide the alphabet into three groups, omitting I, O, and Q (exhibit C):
A to E to represent Expense Symbols.
G to W to represent Product Symbols.
X to Z to represent Construction Symbols.

A sub-index representing every desired qualification of each designation within these groups is then developed. The Expense Symbols are constructed so that they indicate the method of accounting, and the Product Symbols an analysis of production. By this method of limiting the number of roots so that they may be indicated by the group to which the symbol belongs, and to some extent depending upon the use of the symbol for some part of its meaning, there is a saving of one letter in some of the symbols.

The best results, however, are obtained through the use of the entire alphabet, without regard to groups, to designate every root under which there may be occasion to use symbols—the confining of the symbols developed from each root to the qualifications of the root proper—and the use of these symbols in combination (exhibit D).

This gives a series of small indexes, together constituting a master index from which separate working codes for use of departments and individuals are made. By keeping the symbols short and using them in combination, the least diversity and the greatest uniformity in the meaning of letters is accomplished, while it in no way lessens the fixity of the working codes. It offers in addition a scope of designation, flexibility, adaptability, and utility not otherwise obtained.
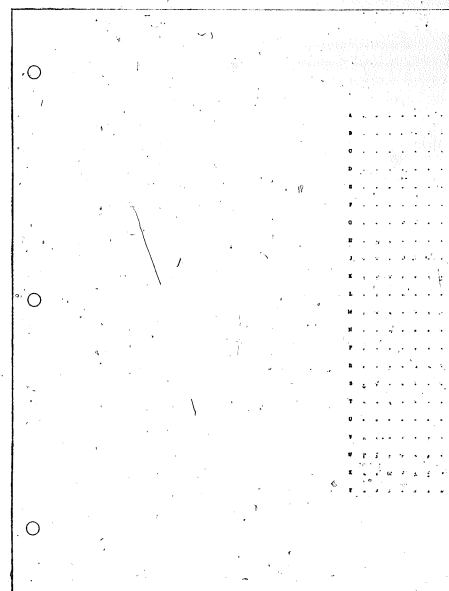
EXHIBIT B—Sheet used for final typewriter copy of Master Index. See Exhibit E and F.

For mere designation, there is very little need for using symbols in combination, but when we come to the use of symbols in writing instructions their utility is such as to create a real necessity for combining them, in which case they should be separated by spaces, as words are.

There is no apparent difference in the symbols as they appear in the working codes under the two methods, though the difference in the master index itself is very great. The accompanying illustrations, representing the first sheet of indexes under each method for the same industry will best illustrate this difference (exhibits* C and D). In referring to these methods, I shall hereafter speak of them as the "limited" and "unlimited" root methods.

No claim is made for the particular root letters or designa-

* The absence of definitions in Exhibit C has no significance other than that the index of which this page is a copy did not happen to contain them. They are given in exhibit F to illustrate certain features which will be dealt with presently.