SETTING ROUGHING TOOL FOR 30" MACHINE

	TIME IN MINUTES
Obtain tool and wrench from tool stand	.06
Put tool in tool post	.04
Tighten Set Screw	.14
Remove wrench to stand	.035
	.28

The handling of materials or elementary operations identified with the materials worked on, seems at first to offer more difficulty, owing to variations and peculiarities of shape, weight and size, than do machines or implements used. However, if, as a preliminary step, we work up a classification and make studies of lifting and placing materials that may be handled without mechanical aid and of those that require such aid, the problem proves to be less complicated than when regarded as a whole. This is particularly true if time studies of this subdivision of work have been preceded by studies of moving materials to and from machines, work-places or material storage stations, and their placement with a view to convenience when performing productive operations.

Here again, as in the case of machine operations, it will be found that much of the work thought of as "handling materials" is really the utilization of facilities; for example, lifting and moving to position with a crane or hoist; putting on and taking off slings, tongs or other means of holding work while being lifted and moved. Not only does this procedure save time and expense but through it we are enabled to set accurate production standards for what are classed as "job-shops," such as the repair shops of a steel mill or one building special machinery to order.

I know that I shall be criticized, as in the past, for drawing on the machine shop for the foregoing illustrations of study of detached cycles of elementary operations. It is, however, almost impossible to find concrete examples of operations or processes with which those engaged in all lines of manufacture will be familiar. Nevertheless, I feel sure that anyone whose interest in the subject is a practical one can, from what I have said, together with what others have written, not only understand what it is all about but translate illustrations drawn from one class of manufacture into terms of his own, if he will only take the time and trouble to do so. But let us take an example with which everyone will be familiar. Suppose we want to set tasks for mopping floors of the office type with a standard mop and pail where standardized conditions prevail. This would consist of:

1. Procure mop and bucket from place stored.
2. Go to hydrant.
3. Place bucket under hydrant.
4. Turn on water.
5. Wait for bucket to fill.
6. Turn off water.
7. Pick up mop and place in bucket.
8. Pick up filled bucket and mop.
9. Walk to the floor to be mopped.
10. Place bucket.
11. Wring out excess moisture from mop.
12. Mop X square feet.
13. Return mop to bucket.
14. Rinse mop.
15. Shift bucket.
16. Repeat items 11 to 15 Y times.
17. Pick up bucket.
18. Take bucket to hydrant.
19. Empty bucket.
20. Repeat items 3 to 8 inclusive.
21. Walk to floor.
22. Repeat items 10 to 21 Z times, that is to say, until the job is finished.
23. Repeat items 17, 18 and 19 at finish of job.
24. Pick up empty bucket.
25. Return mop and bucket to storage place.

Items 1, 2 and 3 and 24 and 25, procuring and putting away tools, are one cycle which might be studied independently. Items 4, 5, 6, 7 and 19, filling and emptying bucket, may be performed and studied as an independent cycle. Items 9, 10, 17 and 18 may be studied together. The time for walking a unit of distance, independent of getting under way and coming to a stop, is incidentally determined. Items 11 and 14 constitute another independent cycle covering rinsing and wringing out. Thus, with four studies, we have the elementary time necessary for setting performance standards for any job of mopping in any building in any country where similar conditions prevail, with the exception of item 11, which would have to be studied for various kinds and conditions of floors. The foregoing, of course, covers only what might be classed as plain mopping. What an expert might class as fancy mopping would involve further research.

It will also be seen by the discerning eye that from these studies we would have some of the unit times for a number of other operations involving the use of a bucket of water.

Much time is still being lost by studying operations rather than isolated groups of the elements of which they are made up. It is urged that those engaged in methods study, even in repetitive industries, may profitably give more consideration to the study of isolated groups of elements and to methods for their classification and tabulation. In this we have a concrete, if limited, example of the need for a mental revolution which Taylor said was essential to an effective application of scientific management, of which methods study is such an important part. It is by this means that sooner or later the hope expressed by Taylor in 1895, in "A Piece-Rate System," may be realized. He said at that time:

> Practically the greatest need felt in an establishment wishing to start a rate-fixing department is the lack of data as to the proper rate of speed at which work should be done. There are hundreds of operations which are common to most large establishments; yet each concern studies the speed problem for itself, and days of labor are wasted in what should be settled once for all, and recorded in a form which is available to all manufacturers.
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> What is needed is a hand-book on the speed with which work can be done, similar to the elementary engineering handbooks. And the writer ventures to predict that such a book will before long be forthcoming. Such a book should describe the best method of making, recording, tabulating and indexing time observations, since much time and effort are wasted by the adoption of inferior methods.[88]

In this there is need for adequately financed and well-directed practical, co-operative effort by, or on behalf of, various industrial groups.

Classification and Tabulation of Data

The usefulness of time-study data is largely dependent upon their being readily accessible when wanted. The more complicated the industry, the more important this becomes. In the case of a company which manufactured a single product in large quantities, of a single grade and size, put up in only one kind and size of unit, as, for example, twine for harvesting machines, the classification and tabulation of data would present no problem. In such a case, all material would pass through identically the same fixed series of operations. Each one would be performed by a number of identical machines and appliances under identical conditions. Hence we might file our data quite satisfactorily under the operations to which they pertained or according to the machine or work-place classifications utilized in the performance of the operations. The latter course would probably be best, as changes and improvements might gradually take place in the equipment. The next step up the scale is in industries employing single-purpose machines or work-places which, although they perform the same kinds of operations, may work on products varying in size, shape and details of construction and use certain implements which are also employed in work of a quite different character.

As an example of this, let us take the winding of small magnet coils more or less similar to those used for electric bells. A number of these are wound at one time on a paper core or "stick." They may vary in three dimensions—length, outside diameter and bore. The size and kind of wire for different coils may vary as may the number of "turns" or layers of wire and the sheets of paper fed in between certain layers. The permutations of these variables make the possible number of different coils very large. In such a case it would obviously be undesirable to make time studies of the winding of each kind and size of coil. As in the case of machine-shop work, winding any coil to its capacity on a machine such as I have in mind consists of four different kinds of elementary operations: (1) adjusting and manipulating machines; (2) using implements; (3) handling materials; (4) machine running time. Under the first heading we have operations, such as: (a) starting and stopping machine; (b) adjusting tension for various sizes of wire; (c) adjusting holders for spools of wire; (d) changing speed of machine; (e) setting counter, etc. Some of these are constant for any coil while others vary for different coils. However, about fifty different elements would include all the elementary machine-handling operations occurring in the winding of several hundred different coils. If these elements were classified and filed according to product, they would be scattered through and mixed up with other elementary data relating to many different coils. The simplest and most effective proceeding is, therefore, to establish for this class of data a file having major divisions for kinds and sizes of machine and to provide sub-

[88] Pp. 875-876.