

6. For such work it appears to me that there is no better device at present than the Gilbreth's motion picture machine, as it can be made to illustrate by a picture a best method of performance, and at the same time register the time of performance of each elementary motion.

7. Nevertheless, I do not believe that it is the panacea for all ills as claimed by Gilbreth, for there is a useful field for both methods. I am thoroughly convinced that for ordinary, practical purposes the stop watch will continue to be the most convenient time-measuring device.

IV. A DEFENSE OF THE STOP-WATCH

By ROBERT T. KENT¹

1. The speaker is in a somewhat peculiar position. He was associated with Mr. Gilbreth in the development of micro-motion study; in fact he was the first person to whom Mr. Gilbreth confided his invention. He also had no little part in the preparation of Mr. Merrick's book on time study. He is, therefore, in a position to speak with some measure of authority upon both phases of the subject.

2. The speaker at once recognized the value of and has been from the beginning an ardent advocate of Mr. Gilbreth's method of time and motion study for certain classes of work. He believes that the method offers a great advantage over all previous developments for absolute accuracy in the recording of time and the transference of skill. For motions or cycles of motions which are so short and follow each other with such rapidity that it is difficult or impossible for the eye to follow, there can be no question but that the motion picture camera study is in a class by itself.

3. On the other hand, there are certain classes of work for which it is ill adapted. There is time study and time study. Certain studies can be made, with all accuracy needed, with no other instrument than an eight-day clock. Other studies will require instruments of greater refinement — an ordinary watch or possibly a stop watch. For still others, the micro-motion camera is the only device suitable.

4. Time study is simply a method of measuring time. The use of any instrument for time study is exactly on a par with the use of a two-foot rule or any other measuring instrument for the measurement of lengths.

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If we are to cut a piece of wood whose length will be close enough if it is within one-quarter inch on either side of a given dimension, a carpenter's two-foot rule will be a sufficiently accurate measuring instrument for the purpose. Having such a rule available, we should be foolish to use a machinist's scale reading to the sixty-fourth of an inch and to attempt to measure that closely. On the other hand, we should be equally foolish to attempt to measure with a two-foot rule, or even with a machinist's scale, a fine job in the lathe which has to be turned with a limit of error of plus or minus two one-thousandths of an inch. We should use the micrometer. Further, if we were making a reference gage, whose accuracy had to be within two or three one-millionths of an inch, no measuring instrument would be suitable except an interferometer. As it is with the measurement of physical objects, so it is with time study. In each case we must use the tool best suited for the job in hand, whether it be the two-foot rule or the interferometer, the stop watch or the micro-motion camera.

V. MAKE TIME STUDY OPEN AND ABOVE BOARD

By MORRIS L. COOKE¹

1. Mr. Taylor frequently expressed himself to me as being absolutely opposed to secrecy in time study when the results of such study were to effect in any way the wages to be paid to the individual on whom the observations were to be made. This of course was but one application of a broader principle, i.e., that we should never seek to induce or compel any man to do anything against his will or rather without first having gained his active consent to what it is proposed to do. Compulsion except in the matter of forcing people to live up to bargains freely entered into was abhorrent to Mr. Taylor as it is to any red-blooded man. On the other hand, Mr. Taylor felt that it might be entirely proper to make time studies on people whose interests were to be in no wise affected by them and without their knowing that it was being done. This saved the time required for explanations. I recall that this method was followed in the making of some of the observations needed for "Concrete—Plain and Reinforced" and "Concrete Costs." Such observations were made in the interest of accuracy of statement in the text and were of no interest to the employer on whose work the observations were made or

¹Consulting Engineer, Philadelphia, Pa.

to his employees. In fact the employer knew as little about it as did the workmen who were unobtrusively not to say secretly observed.

2. But I believe the time has now arrived when the Taylor Society should decide that it is unwise to make secret time studies under any circumstances. Under the best of circumstances such practices are likely to be misunderstood. Secrecy is generally out of harmony with the spirit of scientific management. I happen to know of more than one shop where under one excuse or another secret time studies are being made. I am thankful to say that I know of no member of the Taylor Society who makes secret time studies. If we can declare studies so made as unprofessional then the possession of the paraphernalia that goes with them becomes taboo. It would be a good thing if someone would invent a stop watch that barks every time it is taken out of the pocket. Both the stop watch and time study are of a piece with the industry of the future; the less mystery there is about them the more promptly they will come into generally accepted use.

VI. STANDARD TIMES FOR STANDARD "WORK ELEMENTS"

By THOMAS W. MITCHELL¹

1. In addition to ordinary time study there is another important purpose for which the Gilbreth micro-motion recording apparatus should be very useful, namely, for the purpose of determining the degree of effectiveness of alternative methods and to determine the best basis on which to select from the mass of varying readings the standard time for an element.

2. It is remarkable in a profession that advocates scientifically determined standards that the very methods of determining element-time standards even when the same instrument, the decimal watch, is used, have not been standardized. Mr. Sanford Thompson uses one method, Mr. Merrick a second, Mr. Knoeppel a third and other practitioners use other methods. Element data obtained by one is not usable by the others. They cannot all be best.

3. It is a common experience in making studies to obtain on successive units of work a number of different readings for the same element. These variations may be produced by three different

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causes. First there may be a variation in the amount of work contained in the element. Thus one leaf sight back may be a thousandth part of an inch wider than another, creating a greater difficulty in either inserting it into or extracting it from a drilling jig. Second there may be a variation in the worker's performance due either to a greater or less dexterity and speed from piece to piece or to variation in the constituent motions. Third, the variations may be due to errors in reading the running watch.

4. To the observer with the running watch these causes are concealed. A photographic record, however, will eliminate the observer's errors, show the variations in motion combinations and sequences and even many of the variations in the amount of work. Simultaneous studies made by first class decimal watch observers, by observers with H. H. Williams time study machine and by an observer with the Gilbreth apparatus on the same operations and same operators should go far toward giving us criteria whereby to ascertain these causes by an internal examination of the study, and lead us to a standardized procedure and method.

5. Another kind of research that probably would be helpful would be a series of "before and after" studies, i.e. time study made upon experienced operators before they are put on piece work or on task and bonus and time studies made upon the same operators and same operations after they have been put on piecework or task and bonus long enough to have adjusted their speed to the new incentive. A comparison of the readings obtained for the same elements under such before and after conditions should shed a flood of light upon the question of what is the proper basis on which to select the standard time for an element and of what constitutes a satisfactory time study.

6. I still have faith in the idea that out of the myriads of operations there are comparatively few classes of work elements, just as all thought can be expressed by various combinations of less than a hundred written characters. I have had startling success in many instances in closely predicting the time of composite work elements by synthesizing the time I had in mind for such constituent elements as "pick up," "put down" and the like. However, very little progress has been made in this direction. One reason for this is that most of these constituent elementary motions are very short, some of them as fine as .008, .005 or even .002 min-