

vides for taking such a large number of pictures on a foot of film that the cost is negligible. Its greatest immediate merit is that it pays in actual savings. Most important of all, even to those who misunderstand, ignore or oppose it, the work has come to stand for precision, for fairness and for permanence.

REPLY TO MR. MERRICK

45. The discussion of our friend Mr. Merrick shows his usual fair spirit. In his second paragraph he sums up briefly and accurately our claims for the micromotion method, and the relative importance of motion and time records.

46. In paragraphs 3 and 4, he gives the real reason why both he and Mr. Barth underestimate the importance of the newer methods and believe the stop-watch gets results on "time data" that are "close enough." If "time data" is all that is wanted, a stop-watch probably is close enough. It certainly is close enough for those who are interested in the work only temporarily. Because Mr. Merrick and Mr. Barth have had occasion to study machine time perhaps oftener than they have handling time is not sufficient reason for their not having accurate observations showing *all* conditions, as often as they would snap a stop-watch. In answer to his argument, it is to be said that where it is desired to take observations at long intervals, such as where the handling time is but a small per cent of the total time, only enough pictures need be taken during machine time to record the conditions as they actually are, slates being photographed along with the operation, as we have already explained.

47. It must be remembered that those who know about the possibilities of savings by motion study and also those who want permanent data regarding the surrounding conditions are not looking for mere handling time data and machine time data only. Therefore, even on the rare and unusual jobs to be found only on the heaviest machine work,—and our organization has been and is working with "repeat order" satisfaction on that kind also,—there is no commercial or scientific argument for not getting better and more permanent records.

48. During the handling time the full possibilities of the micromotion method are available and ready instantly to record the combinations of motions used and the method in detail. There seems to be no excuse for substituting the stop watch on a hypothetical ninety-five per cent of the observation,

as the micromotion equipment is acknowledged superior even on the hypothetical five per cent, and can furnish a continuous or intermittent, homogeneous, permanent record of the entire work process. We have jobs running today such as Mr. Merrick describes, and can furnish indisputable correct time and motion records, such as never have been and never can be furnished on any work that has been studied by the stop watch only.

49. The amount of percentage of the handling time to that of the task is irrelevant to this discussion, in any case. The argument here is on the accuracy of times, *together with indisputable records of attending conditions* at the time that the times were taken, and on the relative cost of the two methods of obtaining these. The micromotion method has been proved, in the original paper, unsurpassed in these respects, as mentioned.

50. In paragraphs 5 and 6, Mr. Merrick outlines and concedes the need for the micromotion method on highly repetitive hand work. It is true, as he states, that recording times on such work with the stop watch requires "intense application." It is to be added that such application does not insure accuracy of times and it precludes the possibility of also recording conditions, thus no method study or skill study can possibly run concurrently. The reason that stop-watch time study men have done so little Fatigue Study, comparatively, is because they have no complete records of the fatigue-causing factors which they can study leisurely. The micromotion method records rapidly performed small cycles with the same ease that it records slow work, and, after the apparatus has been set up, the observer is free and ready without distraction to study or coach the worker under observation. As we said in 1915 in a paper "Motion Study and Time Study Instruments of Precision,"¹ "No specially gifted observer, combined with the most willing and efficient recorder, can compete with it for observing and recording facts."

51. It should be remembered that more than ten million American workers have life work that consists principally of a comparatively small number of cycles of less than ten seconds each. Practically all of the skill-requiring motions of the textile trades consist of a very few cycles of less than five seconds each. In such cases, the ordinary speed of the motion picture camera is entirely inadequate

¹"Applied Motion Study"—Chapter IV.

to record with sufficient speed the skill of the super-expert. In some such cases, we have been obliged to devise special cameras that operate as high as 115 pictures a second and then for a second time, an entirely new motion world was opened to us. A moment's consideration of any unbiased critic will result in admitting that any record of say, five to ten cycles, less than ten seconds long, that represent a life work of craft skill achieved, is warranted.

52. Moreover, we have found that micromotion and cyclegraph records may be made of mental as well as physical work,¹ which makes them essential to recording the work of a far larger per cent of workers.

53. Mr. Merrick has made no mention of, or excuse for, the reams of time study data which he has made and has not used in his book. He has made no attempt to answer our indictment sentence by sentence, paragraph by paragraph, or subject by subject.

54. We have indicated stop watch time study in general, and his methods, as representing the best of that inaccurate practice, in particular. Mr. Merrick replies to our indictment by saying he is "thoroly convinced that for ordinary practical purposes the stop watch will continue to be the most convenient time measuring device."

55. If *convenience of device* is all that one demands of records of workers, then it is perhaps quite natural to feel satisfied with inaccurate equipment, and inaccurate temporary results.

56. We have invited Mr. Merrick many times to visit us and to become familiar with our methods, and he has not as yet availed himself of the opportunity. We have enjoyed an uninterrupted friendship with him for fourteen years, have advised him as to cameras,—which he did not buy,—sent him a copy of our latest book, and indicted his methods in this paper, and we do not know what more we can do for him.

REPLY TO MR. KENT

57. Mr. Kent was, as he states in paragraph 1, the first person outside of our own family, organization, and patent attorney, to be told about the micromotion process. He worked with it with us after the devices were perfected, and was, we be-

¹"Motion Study For the Handicapped," Pages 93, 94, Pages 7 and 8.

²Transactions of the A.S.M.E. Pages 1187-1189.

lieve, the first to appreciate the benefits of the process. He wrote, in 1912,² "Micromotion study is the most powerful tool ever offered the engineer to measure the efficiency of the worker." "Time study is the basis of all modern management. The provision of a machine to make time study should be as revolutionary in the art of time study as was the invention of the power loom in the art of weaving. Among other things, it absolutely eliminates the human equation. It provides a method in which there is not only no possibility of error in measurement, but which furnishes at once a true statement of the time elapsed in the performance of any operation and a record and instruction card of the best method of doing a job." And again, "Micro-motion study revealed the deficiencies of previous methods and permitted the development of the final accepted methods in a small fraction of the time and expense which would have been necessary under conditions existing before its invention."

58. Now let us analyze what he now says after nine years reflection. He states that he has "had no little part in the preparation of Mr. Merrick's book," and is "in a position to speak with some measure of authority upon both phases of the subject." In paragraph 2, he states that he has been an "ardent advocate of Mr. Gilbreth's methods of time and motion study for certain classes of work." The entire paragraph suits us to the letter, and it ends with the phrase "in a class by itself." Still he limits his advocacy by the phrase "for certain classes of work." We see in the two remaining paragraphs what classes he refers to,—namely, certain classes of *time study*.

59. Mr. Kent knows that our time study and motion study data can be used when they are "cold" just as efficiently as when they are new. We would suggest that he compare them in this respect with any stop watch time study data.

60. We would like to have him describe the various conferences where the accumulated stop-watch time study data which was collected by Dr. Taylor's "direct disciples" was reviewed by Dr. Taylor and Mr. Kent and others in 1914 and 1915, with the object of including it in a book on time study which later became Mr. Merrick's book "Time Study for Rate Setting."³ We should like to have him explain why voluminous time study data, such as that of the Link Belt Company and the

³See "Time Study for Rate Setting." Page XIV.