

UNITED STATES DEPARTMENT OF LABOR

L. B. Schwellenbach, *Secretary*

BUREAU OF LABOR STATISTICS

Ewan Clague, *Commissioner*

HOURS OF WORK AND OUTPUT



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UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
Washington, D. C., May 21, 1947.

THE SECRETARY OF LABOR:

I have the honor to transmit herewith a report on the effects of long working hours.

This report was prepared in the Industrial Hazards Division by Max D. Kossoris and Reinfried F. Kohler, assisted by Irving Zeig, Benjamin Minowitz, and Gladys C. Locke. This is one of the Bureau's pioneer studies in the general field of working conditions.

EWAN CLAGUE, *Commissioner.*

HON. L. B. SCHWELLENBACH,
Secretary of Labor.

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Hours of Work and Output

Introduction and Summary

“What constitutes the optimum workweek?” is a question frequently asked by management. Presumably, what is meant by this question is: “What schedule of working hours will give me the best results?”

The answer supplied by this survey is that there is no such thing as an optimum workweek. Workers perform differently under the same hours because of a variety of factors: the incentive to produce; the physical demands which the job makes upon them; the degree to which they control the work pace; the conditions under which they work; whether they work on day, evening, or night shift; whether or not, and how frequently, shifts are rotated; and—less tangibly—whether their relations with management are cordial or otherwise.

This study shows, furthermore, that the way in which a longer work schedule is achieved has a decided bearing on the results. Thus, a 55-hour schedule may be achieved by working 5 days at 10 hours and 1 day at 5, or 6 days at 9 hours, or 5 days at 11 hours, or 7 days at 8 hours. The results in terms of efficiency, absenteeism, and output may well be different for each of these schedules, even though the total hours worked per week are identical, or nearly so. Obviously, too, the labor cost per unit of output achieved may vary considerably under these various patterns.

Generally speaking, the study indicates that, everything else being equal, the 8-hour day and 40-hour week are best in terms of efficiency and absenteeism and that higher levels of hours are less satisfactory. The results of the same increases in hours may vary widely according to the physical exertion required and the degree of control which the worker has over the job. Where the controlling factor is the pace of the machine, and if the worker can retard or speed up production only during relatively minor intervals of time—such as taking 5 minutes to take off a completed part and place a part to be processed on the machine, while the machine operation may take a half hour or more—the controlling factor is the machine. If, on the other hand, the machine works as fast or faster than the operator, then efficiency definitely depends on the exertion of the worker. It is under these types of conditions, or the similar ones in which no machines are involved at all, that the fatiguing factor of long hours comes into play.

In the 78 case studies presented here, covering 2,445 men and 1,060 women workers in 34 plants in a considerable variety of industries, it was generally found that the longer schedules resulted in larger output. In only a few instances were lengthened hours so long that no increase in output resulted. At times, the increment of additional output hardly warranted the time expended and the cost involved. As a rule, however, the longer hours

yielded higher output—but at a regressive rate. As hours went up, the proportionate return decreased, and unit labor cost increased. But, during the war, cost was no consideration, and output was essential at any cost. During a peacetime economy, however, the emphasis is on efficient, low-cost operation. Then the relative costs of production at various daily and weekly schedules of hours are very important.

The survey does not include any studies—except in a few clothing plants—on the effects of hours less than 40 per week. It is not possible, therefore, to make any suggestions as to the relative value of shorter work schedules. It should be quite obvious, however, that the shorter the workweek, the less any worker can afford to absent himself. The longer the workweek, the greater is the pressure for some time out to attend to personal matters—shopping, seeing the dentist or physician, attending to family matters, or just a day off for additional rest—and the less is the urgency not to lose a day's pay. It is literally true that workers cannot afford to be ill when working shorter hours and that they frequently come to work in spite of great discomfort.

Much was said and written about absenteeism during the war. Some managements attributed the higher absenteeism during the longer hours to the fatigue engendered by the longer work schedules. In addition, they realized that the long hours imposed considerable hardships on workers, particularly women, who had duties outside the plant. Others thought workers were earning so much money that they didn't know what to do with it and consequently did not see the necessity of working a full schedule. At times, this explanation appeared to have considerable basis in fact. For instance, the labor in one large foundry had been recruited from the South and received much higher hourly pay than ever before. Absenteeism ran high—presumably because this type of labor had not yet raised its standard of living to a point high enough to require the pay for a full week's work. But, whatever the reason, one fact stands out clearly in the survey: the longer the hours, the more scheduled worktime lost through absenteeism.

As a rule, the absenteeism loss of women exceeded that of men. That was generally true at every level of hours. It is known that women lose more time than men through illness, and that the periodic menstrual cycle has a bearing on this problem. When home responsibilities and the care of a household or children are added, it is not difficult to find additional explanations for this difference.

Injuries also increased as hours increased, not only in absolute numbers, but also in the rate of incidence. In most of the observed instances, the number of injuries per million hours worked was very much higher at the longer hours. Sometimes an effective accident-prevention program managed to hold the rates down to about the same level. At other times the rates went up in spite of everything that was done.

Briefly, the findings for the various types of daily and weekly schedules of hours observed may be summarized as follows:

1. The 5-day workweek—with increases in daily hours

(a) Men at moderately heavy, but essentially machine-paced work, were nearly as efficient during a 10-hour day as they had been during an 8-hour day. Absenteeism remained at about the same level.

(b) Women at light and operator-paced work were 4 to 5 percent less efficient during a 9- or 9½-hour day than during an 8-hour day. There was, however, no marked change in absenteeism.

2. Adding a sixth day—with daily hours constant

(a) Men at moderately heavy work performed about as well during the 6-day week as they had during the 5-day week in terms of efficiency and absenteeism. As a rule, daily hours were held at 8.

(b) Women at light work were about as efficient during a 6-day week at 8 hours per day as they had been during a 5-day schedule. But absenteeism increased substantially.

(c) For both men and women, output increased substantially in the same proportion as hours.

3. Eliminating the sixth day—without changing daily hours

(a) Men at heavy or moderately heavy work were 5 to 10 percent more efficient during a 10-hour day, but with the sixth day eliminated. Their efficiency was 13 to 15 percent better during an 8-hour daily schedule. There was little difference in absenteeism.

(b) Women at light work were about 7 or 8 percent more efficient during the 5-day week, with daily hours at 8 under both weekly schedules. Absenteeism tended to be less during the 5-day week.

(c) The reason for the differences in efficiency and absenteeism when adding a sixth day and when eliminating the sixth day appears to lie in two factors: (1) When hours are not too long for the physical demands involved, the pace characteristic of the 5-day week can be maintained fairly well during the 6-day week. Absenteeism is held down fairly well because of the overtime pay for the sixth day. (2) When the sixth day is eliminated, workers try to recoup some of the lost earnings by speeding up during the 5-day week.

Any comparison of the 5- and 6-day schedules, with daily hours usually held to 8, must take into account whether the sixth day is to be added or taken away. The results are quite different.

4. Adding a sixth day—and increasing daily hours

(a) For both men and women at any type of work except work that was entirely automatic, the increasing of daily hours from 8 to 9 or 10 and adding a sixth day, resulted in substantially poorer performance. Particularly was this true when daily hours were raised to 10 and weekly hours to 60 or more. Absenteeism increased substantially for workers of both sexes, and particularly for women.

(b) In comparison with the pattern of the 6-day week without an increase in daily hours, the 6-day schedule with increases in daily hours to 9 or 10

was decidedly less desirable. In some instances the increases in daily hours appeared to have been a complete waste.

5. Changing from 6 days to 5½—but increasing daily hours

(a) For women, this usually involved working $8\frac{3}{4}$ hours for 5 days and 4 hours on Saturday. Efficiency was better in every instance during the 5½-day week.

The difference in absenteeism was obscured by opposite results. Some workers found it possible to take off the one-half day Saturday because they had earned more per hour during the other days of the week. Other workers, who had the one-half day off on Saturday, found it possible to work the other half, rather than take off the entire day to attend to other needs.

(b) For men, the number of cases observed was too few to warrant any conclusions. From results in other patterns, one may hazard the guess that efficiency would rise during the 5½-day week, but that there would be little difference in absenteeism.

6. The 6-day week—with increases in daily hours

When daily hours were increased during the 6-day week, usually from 8 hours to 9 or 10, with increases in weekly hours from 48 to 54 or 60, efficiency was substantially poorer during the longer workweek for both men and women at all types of work. Absenteeism was considerably higher. Generally, it took about 3 hours of work to produce 2 additional hours of output when hours exceeded 48 per week.

7. The 6-day week—with decreases in daily hours

(a) At moderately heavy or heavy work, the efficiency of men was substantially better during the 8-hour day than it had been during the 9- and 10-hour day. Only 1 hour's output was lost for every 2 hours taken off the schedule.

(b) No observations can be presented for women workers.

8. The 7-day week—Sunday work

(a) Given a regular daily 8-hour schedule, workers performed better when no Sundays were worked. After protracted periods of 7 days of work per week, workers actually produced as much, or more, in 6 days as they formerly had in 7 days. In the cases studied, it was literally true that Sunday work meant 8 days' pay for 6 days' output.

Absenteeism was high on Sunday. Men who worked on Sunday frequently took some weekday off.

(b) Occasional, but regularly scheduled Sunday work, appears to have been better than irregular overtime during other days of the week.

9. The pattern of daily efficiencies

The daily efficiency pattern does not emerge very clearly as daily and weekly hours are increased. The one which appears to fit observations most closely is about as follows:

(a) During a 40-hour week, with 5 days at 8 hours, efficiency builds up to a peak on Wednesday or Thursday, with a slight drop on the remaining days of the week.

(b) As hours are increased to 10 per day, for a total of 50 per week, the midweek peak disappears and the whole week's efficiency level remains fairly constant, at about the Monday level.

(c) When a sixth day is added, at about 8 hours, the daily efficiency level stays flat—but drops to a level lower than that which had prevailed during the 5-day week at 10 hours per day.

10. The pattern for daily absenteeism as workdays exceed 5 a week

(a) There appears to be no constant pattern for the 5-day week.

(b) When the week consists of 6 workdays, absenteeism for both men and women is highest on Saturday. The absenteeism rate is particularly high if daily hours are 9 or 10, rather than 8.

(c) Saturday absenteeism is particularly high for women. Their absenteeism rates, however, are higher than those for men on all other days of the week as well.

(d) For the night shift, absenteeism is highest on the first night of the week, if work begins Sunday night. There is, however, no week-end peak.

11. Work injuries

Work injuries increase disproportionately as daily hours are raised above 8 and weekly hours are raised above 40. The frequency rate of work injuries rises even more sharply as weekly hours are raised to 54 or more.

12. Output

With few exceptions, the longer hours resulted in greater output than that produced during the shorter schedules. As a rule, however, the increase in output fell considerably short of the increase in hours. For hours above 8 per day and 48 per week, it usually took 3 hours of work to produce two additional hours of output when work was light. When the work was heavy, it took about 2 more hours of work to produce 1 hour of additional output.

13. Work without wage incentive

The foregoing observations apply primarily to workers at piecework or under some fairly direct form of wage incentive. When work was done at day rates, without any wage incentive, the workers were as productive at longer schedules as they had been at shorter schedules. The work pace remained essentially the same.

It must be added, however, that long schedules had no adverse effect on workers operating under wage incentives if their pace during the shorter work schedule was moderate. Under such conditions they not only could maintain their efficiency at the longer hours, but were even capable of improving it. It is likely however, that this would not hold true for weekly hours above 60, because of the cumulative effects of fatigue.

CHAPTER I.—The Objective

The prevalence of the 8-hour day and 40-hour week in the manufacturing plants in the United States makes it difficult to determine the effects of longer schedules of daily and weekly hours over a protracted period of time. Except in cases of unusual emergency, the general objection to overtime penalties usually holds hours to these accepted levels.

During the war, however, cost was no barrier. The pressure for maximum output, coupled with the withdrawal of millions of men from the labor force for the armed services, created a tremendous labor problem which was solved in one, and usually both, of two ways: (1) by expanding the labor force by drawing on whatever reserves were available, and (2) by working longer hours. The considerable variety of hourly patterns worked during the war afforded the unusual opportunity to observe their results.

English studies during both World Wars have indicated the folly of working excessively long hours, such as 70 or 80 per week. Immediately after Dunkirk, efficiency dropped sharply and absenteeism increased alarmingly after only a period of weeks, in spite of the drastic emergency. During brief spurts, it was possible to draw on the reserve strength of workers and to obtain greatly increased output. Over extended periods, however, it was found that the output at the high levels of hours might be no higher, and sometimes was actually lower, than it had been at the shorter hours. Efficiency declined, absenteeism and injuries increased, and the inevitable result was an output level which fell far short of the corresponding increase in hours.

Workweeks of 70 and 80 hours were infrequent in this country, even during the worst manpower shortages during the war. But weeks up to 60 hours were not uncommon, and workweeks of 54 and 58 hours were scheduled quite generally.

The simplest way of increasing weekly hours was to retain the 5-day week, but to lengthen daily hours to 9, 10, or 11. The next step was to add a sixth day. Subsequently a seventh day might be added. In other plants, the 8-hour day was maintained at first, and the workweek was lengthened by the addition of a sixth day, frequently at 8 hours. As this schedule proved inadequate, daily hours were increased to 9 or 10, with a shorter schedule on Saturday, usually varying from 4 to 8 hours. Obviously, there was no uniform pattern. Each plant tried to adjust itself to a schedule in keeping with its labor supply, production facilities, and backlog of orders.

As a rule, the limiting factor in any consideration of the effectiveness of varying work schedules is that of fatigue. The human being is not a machine and cannot keep on working with the same efficiency hour after hour. His effectiveness will vary with the physical demands which his job makes on him. He will tire faster at some types of work than at others. Where the demands on him are greater than he can bear, he either breaks down or he

slows down so as to stretch his available energy over a longer working schedule.

This study, however, is not a clinical or physiological study of fatigue. The precise character of fatigue and the changes in muscular function or nervous reaction to stimuli that are involved must be left to the medical profession. This study is an attempt to determine, from industry's own experience, the ways in which this fatigue manifests itself as a practical factor limiting production—by lowering efficiency, increasing absenteeism, increasing the incidence of work injuries, and ultimately, by effecting the level of total output. As the objective of the longer work schedule is to increase output, the criterion of the effectiveness of any one schedule of hours is the output level which can be maintained consistently at that level of hours.

The task of finding plants suitable for study was difficult. Out of more than 800 plants visited, only about 50 met the necessary qualifications. The majority of the 800 plants were willing to cooperate and were interested in finding out what their experiences showed when subjected to objective statistical measurements. But most of the plants visited could not be included in the survey for a variety of reasons.

In order to permit the effects of various schedules of hours to emerge clearly, it was necessary to rule out all other variables. A plant, therefore, could not be studied if, during the various periods to be surveyed, hours were not maintained consistently at fairly fixed and definite schedules. During these periods, the operations performed by the workers to be studied had to remain essentially unchanged, and the number of identical workers involved had to be reasonably large. Obviously, if the nature of the work changed materially and if the composition of the work force was changed, factors other than hours could be responsible for the changes observed. Furthermore, output had to be measurable, and records had to be available on hours, output, and absenteeism for the group of workers to be studied.

Most frequently, the absence of records was the stumbling block. It was amazing to find hundreds of plants that had no records of output, except perhaps for entire departments, and that kept no records on absenteeism or work injuries. The plants which most frequently lent themselves to the survey were plants which used some method of wage incentive and consequently had to keep some record of output and earnings for individual workers. But even in these plants, the only record frequently available was one of pay-roll earnings.

The requirements of the survey demanded further that weekly working schedules must have been altered substantially, and that the contrasting schedules must have been in effect long enough—preferably at least 6 months to a year—to permit a valid comparison of worker performance for at least two distinct levels of hours. It usually was necessary to rule out transitional periods of 1 to 4 months, during which work schedules frequently fluctuated, for the effectiveness of the new schedule to emerge clearly.

In the presentation of the completed case studies, the objective was to state the findings simply; shorn, as much as possible, of statistical verbiage and con-

cepts. In contrast with the fairly comprehensive preliminary publications of the first 12 plant studies,¹ those included in this volume have been reduced to statements of essentials only. Each group of workers studied is presented as a separate case study; the industrial operations include plants engaged in the production of castings, forgings, radios, airplanes, industrial machinery, motors, shells, dental equipment, rubber products, cigars, clothing, hats, candles, and drugs.

No account was taken of sociological factors which undoubtedly influenced the effectiveness of workers in many ways. No attempt, for example, was made to evaluate the needs for changes in store hours so as to facilitate shopping for the industrially employed women with household duties, or the adequacy of transportation and housing facilities, or the myriad other factors which congested wartime conditions entailed. The objectives of this survey were more limited: to measure objectively the effects of working hours on the performances of workers and to determine how these schedules compared in obtaining the goal of increased output.

In the discussion of each work schedule, findings will be shown separately for heavy, moderately heavy, and light operations. In the first category are operations such as are found in forge shops and foundries, and in which the work normally involves the handling of heavy materials. The category of light work involves, as a rule, the manual handling of materials up to about 5 pounds, or the mechanical handling of somewhat heavier objects. The moderately heavy group falls somewhere between these two. The purpose of this classification is to indicate, in a general way, the type of physical demands made upon the workers.

Findings are classified also as to pace control. In some operations, such as those involving automatic or semi-automatic screw machines, the pace was entirely controlled by the machine. In other types of machine operations the pace was essentially controlled by the machine, but the worker could exert some control by means of the speed with which he removed a processed part from the machine and replaced it with another to be processed. As a rule, operations classified as machine-paced involved a cycle in which the time interval subject to operator control was quite small as compared with the interval required by the machine. The third category is the operator-paced operation, in which the speed of the operation was controlled either entirely or primarily by the efforts of the operators.

¹Studies of the Effects of Long Working Hours, Part 1 and Part 2, Bulletins 791 and 791-A, U. S. Bureau of Labor Statistics, 1944.

CHAPTER II.—5-Day Week

Only 2 of the 13 case studies falling into this pattern of schedules involved men. Both of these studies were made in the same department of a plant manufacturing gear couplings. The 39 men in case study 7 (a) were a group of operators who had been at this work for many years. The 50 men in case study 7 (b) were men hired during the war. They were experienced mechanics, but not as experienced on this particular job as the men in group 7 (a).² In both studies, the men were engaged in a variety of machining operations on metal working machines. The work was machine-paced and moderately heavy.

As table 1 shows, a change from 8 hours per day to 10, but with the retention of the 5-day week, resulted in a drop of 4 percent in hourly efficiency, even though the time interval subject to operator control was small. Scheduled work time lost because of absenteeism rose to 7 percent for each group, although the time loss for the group of "new" employees (7 (b)) was substantially above that of the old employees (7 (a)) during the 40-hour week.

TABLE 1.—*Effects of changes in daily and weekly hours on efficiency and absenteeism during the 5-day week*

Case study and type of work	Number of workers	Sex	Changes in hours				Efficiency percent change	Absenteeism rate ¹	
			Daily		Weekly			From	To
			From	To	From	To			
Machine-controlled pace:									
7a — Moderately heavy.....	39	Male	8	10	40	50	-4.0	2.7	7.0
7b — Moderately heavy.....	50	....do	8	10	40	50	-4.0	5.4	7.0
Operator-controlled pace:									
45a — Light.....	13	Female	8	9	40	45	-5.4	(?)	(?)
45b — Light.....	13	....do	8	9½	40	48	-16.2	(?)	(?)
46 — Light.....	24	....do	8	9½	40	46½	-1.0	3.2	4.6
47a — Light.....	10	....do	9	9½	44½	46½	-4.0	2.8	2.8
47b — Light.....	10	....do	8	9½	40	46½	-6.3	5.4	3.1
48a — Light.....	21	....do	8	9½	40	46½	-2.6	3.1	2.1
48b — Light.....	21	....do	8	9	40	44	-3.5	3.1	2.5
49a — Light.....	13	....do	8	9	40	44	-3.0	1.9	.8
49b — Light.....	13	....do	8	9½	40	47½	-1.3	5.5	4.3
58 — Light.....	28	....do	8	8 or 9	40	43	+1.3	8.4	16.7
66 — Light.....	9	....do	9	10	45	50	+1.2	5.3	5.8

¹ Percentage of scheduled worktime lost.

² Not determined.

The other 11 studies all involved women operators engaged in light work. Reference to the case studies themselves will show them as occupied most frequently in the stripping of tobacco leaves. In almost every study, the pace was fast and entirely controlled by the operators, who worked at piece rates.

In only one of these studies did weekly hours go as high as 50. As a rule they remained below 48. There were two reasons for this: (1) women frequently were barred from longer hours by State legislation, and it was neces-

² To facilitate comparisons, certain individual case studies have been broken down into groups (a) and (b), in both text and tables.

sary to obtain special permission to exceed the established limits; and (2), women frequently objected to working longer hours because of home duties.

In all but two of the case studies (58 and 66), the longer daily hours resulted in decreases in efficiency, ranging from as low as 1.0 percent to as high as 16.2 percent. In the two instances in which hourly efficiency increased, the increases were slight—1.3 and 1.2 percent, respectively. In case study 58, however, the absenteeism loss jumped from 8.4 percent of the scheduled employee-hours to 16.7 percent.

As a general proposition, the changes in absenteeism were minor. It is important to bear in mind that these operators were free from work on Saturday and Sunday, and that the women had the opportunity to do much of their shopping and household chores over the 2-day week end.

In every instance but one, the increased hours resulted in increased output. In that one (case study 58) the sharp increase in absenteeism overbalanced the slight increase in efficiency, so that a 43-hour week actually resulted in a somewhat lower output than obtained under the 40-hour week. Reference to table 2, however, indicates that in all cases but 2 (49 (b) and 66), the increase in output was not in direct proportion to the additional hours worked.

TABLE 2.—*Effects of changes in weekly hours on output during the 5-day week*

Case study and type of work	Weekly hours changed —		Percent change in —		Output-input ratio
	From	To	Hours	Output	
Machine-controlled pace:					
7a — Moderately heavy.....	40	50	+25.0	+23.5	0.9
7b — Moderately heavy.....	40	50	+25.0	+18.0	.7
Operator-controlled pace:					
45a — Light.....	40	45	+12.5	+6.4	.5
45b — Light.....	40	48	+20.0	+6	(¹)
46 — Light.....	40	46 ½	+16.3	+13.3	.7
47a — Light.....	44 ½	46 ½	+4.5	+2	.1
47b — Light.....	40	46 ½	+16.3	+11.8	.7
48a — Light.....	40	46 ½	+16.3	+14.2	.9
48b — Light.....	40	44	+10.0	+6.7	.7
49a — Light.....	40	44	+10.0	+7.9	.8
49b — Light.....	40	47 ½	+18.8	+18.6	1.0
58 — Light.....	40	43	+7.5	-1.1	—1
66 — Light.....	45	50	+11.1	+11.8	1.1

¹ Less than 0.1.

In the case of the men in studies 7 (a) and 7 (b), a 25-percent increase in hours resulted in 23.5 and 18 percent of increased output. As the output-input ratios show, for each additional workhour 0.9 and 0.7 of the hourly output at the lower level of hours resulted. In both of these studies, however, operations were machine-paced, so that the hours of actual machine time corresponded fairly closely to the actual working time.

All of the other studies show output depending primarily on the speed and endurance of the operators. In general, the data indicate that every 3 additional hours of work per week resulted in an equivalent output increase of only 2 hours. The ratio of output hours gained to the additional hours worked is 0.7 or less in case studies 45 (a), 45 (b), 46, 47 (a), 47 (b), 48 (b), and 58. In case 45 (b), the output of the 48-hour week was barely better than it

had been under the 40-hour week—apparently $7\frac{1}{2}$ hours were completely wasted. Similarly, in 47 (a), the $44\frac{1}{2}$ -hour week was as productive as the $46\frac{1}{2}$ -hour week.

The proportionate increase in output observed in case study 49 (b) reflects a persistent drive by management for increased output. In case study 66, the better ratio seems to be due primarily to the increase of 1.2 percent in efficiency at the light and repetitive task of winding small coils. The pace of these operators, however, was more moderate and could be maintained more easily.

It may be concluded from these results that, for women, at light, operator-paced operations, the effect of lengthening daily hours from 8 to 9 or $9\frac{1}{2}$, and weekly hours from 40 to 46 or 47, is a drop in efficiency of 4 to $4\frac{1}{2}$ percent. Except for one extreme case, the absenteeism loss was not affected materially.

Case study 7 for men at moderately heavy work (groups 7 (a) and 7 (b)), indicates that where the work pace is controlled by the machine, thus affording the operator some brief rest periods while waiting for the machine to perform its operation—for example, an automatic multiple-drill press—the increase in output is more nearly proportional to the increase in hours.

CHAPTER III.—5-Day Week vs. 6-Day Week

A.—Increasing workdays from 5 to 6; no change in daily hours

Another way of increasing weekly hours was to hold daily hours constant, but to add a sixth day to the workweek.

This method was observed in the 15 studies enumerated in table 3. In 8 of these, the work was moderately heavy, and, except for case study 7, usually involved a change from 40 hours per week to 48. In case study 7, in both groups (a) and (b), the change was from a 50-hour week to one of 58. In each instance, the group studied was composed of men.

The effects on efficiency of this lengthening in weekly hours in the moderately heavy work groups were nearly evenly divided: in three instances the addition of the sixth day resulted in decreases of efficiency, and in five, it resulted in increases. The changes were not markedly large in either group, and it may be concluded that the addition of a sixth day without increasing daily hours had no adverse effect on efficiency.

In most of these cases, the change in the percent of scheduled worktime lost because of absenteeism did not vary appreciably. The reduction in study 7 (a) from a time-loss rate of 7.0 percent under the 5-day week to 4.5 percent under the 6-day week reflects the efforts of a labor-management committee to reduce absenteeism. The efforts of this committee appear to have been less effective on the more recently hired workers in the same department—their rate increased from 7.0 percent to 8.1 percent.

Of the seven studies for light work shown in table 3, five involved women, and one, an increase in weekly hours from 50 to 58. The other six studies reflect the changes subsequent to the introduction of Saturday work, but with daily hours maintained at 8.

As table 3 shows, the addition of the sixth day had no adverse effect on efficiency in the light-work groups, even though all of it was operator-paced. Case studies 73 (a) and 73 (b) reflect the experiences of groups whose pace was moderate, as was true of case 74 in the table. It seems reasonable to assume that these groups responded to the wartime urgency as well as the chance to increase their overtime earnings by increasing their work pace.

It is to be noted, however, that in every instance the shift to a 6-day week resulted in marked increases in absenteeism for the female operators. The time-loss percentage was doubled and more than quadrupled in case studies 73 (a) and 73 (b), and more than doubled in 38. In case study 58, it rose from 8.4 to 10.3. As a rule, the absenteeism loss for women was higher than that for men under both the 5-day and 6-day weeks.

The composite effects of changes in efficiency and changes in absenteeism are reflected in the output changes shown in table 4.

In every instance, the longer workweek resulted in increased production.

TABLE 3.—*Effects on efficiency and absenteeism of increasing workdays from 5 to 6 per week, without changes in daily hours*

Case study and type of work	Number of workers	Sex	Daily hours	Weekly hours changed —		Efficiency percent change	Absenteeism rate ²	
				From	To ¹		From	To
Machine-controlled pace:								
7a — Moderately heavy . . .	39	Male	10	50	58	-2.1	7.0	4.5
7b — Moderately heavy . . .	50	do	10	50	58	-1.0	7.0	8.1
8 — Moderately heavy . . .	700	do	8	40	48	+1.0	1.8	(³)
Operator-controlled pace:								
51 — Moderately heavy . . .	32	do	8	40	44½	-1.9	1.2	4.2
69 — Moderately heavy . . .	21	do	8	40	48	+3.5	.7	1.7
70 — Moderately heavy . . .	8	do	8	40	48	+1.6	1.1	1.4
71 — Moderately heavy . . .	10	do	8	40	48	+1.9	1.7	2.8
74 — Moderately heavy . . .	14	do	8	40	48	+3.9	3.0	4.6
31 — Light	10	Female	10	50	58	+ .2	6.8	7.7
37 — Light	9	Male	8	40	48	+1.4	1.4	.5
38 — Light	8	Female	8	40	48	- .4	3.0	6.8
58 — Light	28	do	8	40	46	-1.6	8.4	10.3
72 — Light	13	Male	8	40	48	+ .8	1.0	1.7
73a — Light	9	Female	8	40	48	+1.2	2.0	4.7
73b — Light	9	do	8	40	48	+7.3	2.0	9.2

¹ Where weekly hours are less than 6 times daily hours, shorter hours were worked on Saturday.

² Percentage of scheduled worktime lost.

³ Not determined.

It is also apparent that the higher absenteeism rates were offset by the greater efficiencies, so that total output increased in about the same ratio as did hours. The instances that show serious deviation from this conclusion are studies 7 (a) and 7 (b), 38, 51, and 58.

Cases 7 (a) and 7 (b) differed from most of the other case studies because the regular daily hours were 10. In nearly every other case, daily hours were 8. It is significant that with a 10-hour day, only about 2 hours' output was realized for every additional 3 hours worked above 50, even though the pace at these operations was controlled by machines.

In case study 51, the increase in hours was from 40 to 44½, accomplished by introducing a 4½-hour Saturday. The additional Saturday half day resulted in an increase in total output equivalent to the work of 2½ additional hours. As a result, about half the Saturday hours were nonproductive.

In case study 38, the important factor was the increase in absenteeism during the 6-day week for the female workers. And in case study 58, both lower efficiency and higher absenteeism were involved.

The proportional increase in output in case study 31 requires some comment. Here, it will be noted, the 10-hour-day schedule prevailed. But contrary to the experience in case study 7, the female operators maintained the same efficiency during the 58-hour week as they had during the 50-hour week, although absenteeism increased slightly. The reason for the good performance during the longer workweek was better management. During the 58-hour week, materials were taken to and from the machines by other workers, thus enabling the machine operators to spend all their time at the machines. During the 50-hour week, the operators had to move these materials, meanwhile letting their machines remain idle. It is doubtful whether the same favorable result would have been obtained under the longer hours had this change not been introduced. As it was, the managerial change

TABLE 4.—Effects on output of changes in weekly hours by increasing workdays from 5 to 6, holding daily hours constant

Case study and type of work	Weekly hours changed —		Percent change in —		Output-input ratio
	From	To	Weekly hours	Output	
Machine-controlled pace:					
7a — Moderately heavy	50	58	+16.0	+10.1	0.6
7b — Moderately heavy	50	58	+16.0	+10.2	.6
8 — Moderately heavy	40	48	+20.0	+21.0	1.1
Operator-controlled pace:					
51 — Moderately heavy	40	44½	+11.3	+ 5.9	.5
69 — Moderately heavy	40	48	+20.0	+22.8	1.1
70 — Moderately heavy	40	48	+20.0	+21.4	1.1
71 — Moderately heavy	40	48	+20.0	+20.8	1.0
74 — Moderately heavy	40	48	+20.0	+22.8	1.1
31 — Light	50	58	+16.0	+15.1	1.0
37 — Light	40	48	+20.0	+22.8	1.1
38 — Light	40	48	+20.0	+14.9	.8
58 — Light	40	46	+15.0	+10.7	.7
72 — Light	40	48	+20.0	+20.2	1.0
73a — Light	40	48	+20.0	+17.9	.9
73b — Light	40	48	+20.0	+19.3	1.0

permitted as good a performance during the 6-day week, at 10 hours per day, as had obtained during the 5-day week.

For all other studies shown in table 4, output during the longer workweek increased directly with the increase in weekly hours. In some instances this could be attributed to the stimulus of the war effort. In others, it appeared that the constant building up of a backlog of orders stimulated workers to greater effort. Observation also indicated that in a number of instances the operator pace was only moderately fast, so that the pace could be increased without introducing much of an element of fatigue.

On the whole, it may be concluded that these studies indicate that the addition of a sixth day had no disadvantageous effect on output, provided daily hours were held to 8 per day.

B.—Decreasing workdays from 6 to 5; no change in daily hours

The difference between the 5- and 6-day week, with daily hours constant, can be measured not only in cases in which the sixth day was added, but also in cases in which the sixth day was eliminated.

It was pointed out in the preceding section that, for the 8-hour day at least, the addition of the sixth day had no appreciable adverse effects on efficiency and absenteeism loss. It would be reasonable to presume, therefore, that the elimination of the sixth day would not affect these factors either.

That exactly the reverse is true is demonstrated by tables 5 and 6. As a general rule, the elimination of the sixth day increased efficiency considerably during the shorter workweek.

The single exception to this rule is case study 29. Here, however, the reduction in weekly hours was part of a general retrenchment program, from an expanded wartime to a more modest peacetime scheme of operation, which involved lay-offs for a considerable portion of the work force. The slowing down during the shorter workweek may fairly be ascribed to a slowing down because of this factor rather than to the change in hours.

TABLE 5.—Effects on efficiency and absenteeism of decreasing workdays from 6 to 5 per week, without changes in daily hours

[Pace controlled by operator]

Case study and type of work	Number of workers	Sex	Daily hours	Weekly hours changed —		Efficiency percent change	Absenteeism rate ²	
				From ¹	To		From	To
1 — Heavy.....	45	Male	10	60	50	+0.7	(³)	(³)
6 — Heavy.....	16	do	10	58	50	+4.9	4.7	4.2
3 — Moderately heavy..	15	do	10	58	50	+11.2	5.0	5.5
29 — Moderately heavy..	33	do	10	58	50	—5.4	3.6	3.2
64a — Moderately heavy..	18	do	10	58	50	+7.4	3.6	3.4
64b — Moderately heavy..	18	do	9-10	58	45-50	+9.1	3.6	(³)
65 — Moderately heavy..	14	do	10	55	50	+3.0	3.5	3.3
69 — Moderately heavy..	21	do	8	48	40	+12.4	1.7	(³)
70 — Moderately heavy..	8	do	8	48	40	+16.1	1.4	(³)
58a — Light.....	28	Female	8-9	48	43	+5.0	10.7	16.7
58b — Light.....	28	do	8-9	46	43	+2.9	10.3	16.7
58c — Light.....	28	do	8	48	40	+3.7	10.7	8.4
59 — Light.....	17	do	8	48	40	+12.0	12.1	15.2
60 — Light.....	25	do	8	48	40	+6.9	13.7	13.8
61 — Light.....	26	do	8	48	40	+5.1	9.4	9.2
62 — Light.....	25	do	8	48	40	+1.5	6.4	9.6
63 — Light.....	9	do	8	48	40	+7.9	10.4	12.4
72 — Light.....	13	Male	8	48	40	+12.6	1.7	(³)

¹ Where weekly hours are not 6 times daily hours, shorter hours were worked on Saturday.

² Percentage of scheduled worktime lost.

³ Not determined.

In most instances involving heavy or moderately heavy work, the 10-hour day was retained for male operators under the shorter workweek. If case study 29 is disregarded, the dropping off of a full day on Saturday, usually an 8-hour day, resulted in efficiency increases ranging from 4.9 percent to 11.2 percent for men working under wage incentives. In case study 1, the pace of the 45 men in a foundry, working without a wage incentive, was about the same under both schedules.

Where the workday was only 8 hours the results were nearly as striking. Elimination of the sixth day increased hourly output, i. e., efficiency, by 12.4 percent in case study 69 and 16.1 percent in case study 70.

Just as there was little change in the absenteeism rate for men when the sixth day was added, so there was little change in absenteeism when the sixth day was removed. As will be pointed out later, this was not the case for women.

With one exception, the light operations observed in this change of work pattern involved women. As a rule, hours were reduced from 48 to 40 with the retention of the 8-hour day. In every instance efficiency was better under the shorter schedule, the improvements ranging from 1.5 percent to 12.0 percent.

Not only were the absenteeism losses for women greater than those for men under either pattern of the workweek, they also indicated opposite trends. In cases 58 (a) and 58 (b), the percentage of time lost under the shorter schedule was alarmingly high—16.7 percent, and more than half again as high as under the longer schedule. In case study 59, it rose from 12.1 to 15.2 percent. In case 63, it rose from 10.4 to 12.4 percent, and in 62, from 6.4 to 9.6 percent. As the shorter schedules usually came after VE-day, it is possible that there was a general relaxation and less emphasis on good

attendance. It may be observed also that many of these workers had no intention of continuing work in the plants indefinitely. For many of them, VE-day meant impending marriage and the setting up of households. For married women, it frequently indicated the resumption of household duties. These considerations obviously do not apply to men.

Table 6 provides the comparison between the additional hours worked on the sixth day and the resulting additional output. So as to provide a direct comparison with table 4, the computations in this table are shown with the shorter schedules of hours as a base—i.e., as though the longer schedule had followed the shorter schedule. A few studies shown in table 5 are omitted because output could not be computed because of the lack of essential data.

In case study 6, the 16 men at hot and heavy forge work turned out as much at 50 hours as they had at 58 hours. In fact, operations at 58 hours were discontinued when it was realized that the longer work schedule was no more productive than the shorter one had been. The data indicate that the output level might even have gone lower had the change not been made. However, the 10-hour day was maintained. It was not possible, therefore, to determine whether a shorter workday might not have proved as effective as the 10-hour day.

TABLE 6.—*Effects on output of changes in weekly hours by increasing workdays from 5 to 6, holding daily hours constant*

[Pace controlled by operator]

Case study and type of work	Weekly hours ¹ changed —		Percent change in —		Output-input ratio
	From	To	Hours	Output	
1 — Heavy.....	50	60	+20.0	+20.0	1.0
6 — Heavy.....	50	58	+16.0	0	0
3 — Moderately heavy.....	50	58	+16.0	—3.2	—2
29 — Moderately heavy.....	50	58	+16.0	+23.8	1.5
64 — Moderately heavy.....	50	58	+16.0	+7.7	.5
65 — Moderately heavy.....	50	55	+10.0	+6.5	.7
58a — Light.....	43	48	+11.6	+14.2	1.2
58b — Light.....	43	46	+6.9	+12.0	1.7
58c — Light.....	40	48	+20.0	+12.9	.7
59 — Light.....	40	48	+20.0	+11.1	.6
60 — Light.....	40	48	+20.0	+12.2	.6
61 — Light.....	40	48	+20.0	+13.9	.7
62 — Light.....	40	48	+20.0	+22.4	1.1
63 — Light.....	40	48	+20.0	+13.8	.7

¹For ease of comparison with table 4, percentage changes in hours and output have been computed from the lower level of hours.

In case study 3, the output level at 58 hours at moderately heavy work in a foundry was actually lower by 3.2 percent than that for 50 hours.

The reason why performance at 58 hours was better in case study 29 has been given. In only one other case, 58, was performance superior during the longer workweek of 46 to 48 hours than during the 5-day week of 43 hours. The 5-day week, however, involved irregular overtime and included, on the average, 3 days at 9 hours. In both instances a 6-day week at regular hours seems to have been superior to a 5-day week involving overtime.

The group of men in case study 1 were on day work. They retained their pace—which was not fast—under either schedule.

In every other case, the higher efficiency during the 5-day week was sufficiently better to offset from one-third to one-half of the additional hours formerly worked on the sixth day. There is no question that these cases indicate the marked superiority of the 5-day week over the 6-day week, with daily hours unchanged.

What, then, accounts for the apparently contradictory conclusions drawn from these cases and those examined in section A of this chapter, in which it was concluded that the sixth day, when added to a 5-day week, was nearly 100 percent effective in increasing output in direct proportion to the increased hours?

The answer very likely lies in the amounts earned. When hours were lengthened by the addition of the sixth day, all additional hours were paid for at time and a half. Under an incentive system, as most of the plants were, this meant one and one-half times the rates payable for work produced. Consequently there was a strong incentive to produce proportionately more on Saturday than on other days. The next day was Sunday, a day of rest. And, whereas daily hours were 10, the Saturday hours usually were 8.

On the other hand, when hours were cut back, this overtime was lost. Consequently there was the incentive to recoup as much of it as was reasonably possible during the shorter workweek—and therefore the higher efficiency and proportionately better output.

Obviously, then, the posing of the question whether, with daily hours kept constant between 8 and 10, there is any marked difference between the 5-day week and the 6-day week, involves determining first whether weekly hours are to go up or down. There is no question that, except perhaps for heavy work, a regular 6-day week results in greater output than is produced during the 5-day week. The case studies indicate that, as a rule, light operations could be carried on during the 6-day week at the same efficiency as during the 5-day week and that the additional output was almost in direct proportion to the additional hours worked. On the other hand, when hours were reduced after a sixth day had been worked for a protracted period of time, the 5-day week proved more efficient in terms of hourly output than was the 6-day week.

C.—5-day week vs. 6-day week; changes in daily hours

1. ADDING A SIXTH DAY.

In the 14 studies shown in table 7, comparisons are given for worker performances under 5- and 6-day weeks with changes (usually increases) in daily hours. In each instance, the comparison is for identical workers.

In the group of case studies for workers engaged in moderately heavy work, composed almost entirely of men, daily hours were usually raised from 8 to 9 or 10, and weekly hours from 40 to from 55 to 60. In spite of the fact that the work was machine-paced in study 7, both groups (a) and (b) performed more poorly at the longer hours. Efficiency was 5.0 and 6.0 percent

TABLE 7.—Effects on efficiency and absenteeism by increasing weekly workdays from 5 to 6, with changes in daily hours

Case study and type of work	Number of workers	Sex	Changes in hours				Efficiency percent change	Absenteeism rate ²	
			Daily		Weekly			From	To
			5 days at—	6 days at—	From	To ¹			
Machine-controlled pace:									
7a — Mod. heavy . . .	39	Male	8	10	40	58	-6.0	2.7	4.5
7b — Mod. heavy . . .	50	do	8	10	40	58	-5.0	5.4	8.1
Operator-controlled pace:									
20 — Mod. heavy . . .	65	{Male and female }	8	10	40	60	-22.3	5.7	10.8
21 — Mod. heavy . . .	55	do	8	11	40	66	-20.6	3.7	13.3
64 — Mod. heavy . . .	18	Male	8	10	40	55	-6.0	2.7	2.6
65 — Mod. heavy . . .	14	do	10	8	50	48	+3.2	3.3	3.1
67 — Mod. heavy . . .	14	do	8	10	40	55	+5.6	1.8	2.9
74 — Mod. heavy . . .	14	do	8	9½	40	57	+17.1	3.0	2.9
25 — Light	43	do	7½	10	37½	58	+15.3	2.1	3.3
26 — Light	25	Female	7½	(³)	37½	54	+16.9	3.0	3.3
38a — Light	8	do	8	8.8	40	48	+2.3	3.0	11.8
38b — Light	8	do	8	9	40	54	+3.1	3.0	14.4
50a — Light	24	do	8	9½	40	53	-9.2	4.5	9.4
50b — Light	24	do	8	9	40	48	-10.3	4.5	8.3

¹Where weekly hours are less than 6 times daily hours, shorter hours were worked on Saturday.

²Percentage of scheduled worktime lost.

³3 days at 8 hours, 3 days at 10.

lower at the higher hourly level. In case study 67, the reverse was true. Here, however, operations were performed by semi-automatic machines and the longer workweek permitted a higher degree of utilization of the machines. Consequently, average hourly output, as reflected by the measure of efficiency, was 5.6 percent better.

In case study 65, the workweek was cut by 2 hours, and daily hours were 8 during the 6-day week as against 10 during the 5-day week. The shortening of the workday increased efficiency by 3.2 percent even though a sixth day had been added.

The sharp increases in daily hours from 8 to 10 and 11 in studies 20 and 21 resulted in drastic decreases in efficiencies—22.3 percent and 20.6 percent. Simultaneously, absenteeism rates doubled and tripled. The workers in both of these groups were engaged respectively on the day and night shifts of a plant producing shells. There certainly could not have been any closer connection with the war effort, and morale in the plant was good. Nevertheless, the large increases in hours curtailed hourly output sharply, and even the urgency of producing shells could not keep workers on the job steadily.

In the group of light, operator-paced operations, daily hours were higher during the 6-day week than they had been during the 5-day week. Generally, they had been raised from 8 to 9 or 10. Except for the two experiences shown for case study 50, parts (a) and (b), workers performed better at the higher levels of daily and weekly hours. Particularly marked are the efficiency increases in studies 25 and 26, in which 8- or 10-hour days were substituted for 7½-hour days. In case study 25, a group of 43 experienced male machine operators were engaged in high precision machining of small parts for guns and a variety of control devices for lubricating systems. In study 26, the group consisted of 25 experienced female workers engaged in

assembling the small parts produced by men in study 25. In explaining the sharp increase in efficiencies of the two groups, plant management gave two reasons: (1) the participation of the employees in the war effort (during the longer schedule of hours) acted as a powerful stimulus to better worker performance; (2) the longer runs on each job during the longer workday spread unproductive time over a longer period of productive effort. Apparently the work during the longer workweek was not so hard as to cause a fatigue serious enough to bring about a slowing down of the workers. Conversely, the speed of the workers during the short workweek could not have been very fast, if it was possible for them to work so much faster during a very much longer workweek over a long stretch of time.

In study 38, efficiency was better at both 48 and 54 hours for a group of 8 women than it had been at 40 hours. The work performed was very light. It must be noted, however, that during the longer hours the percent of scheduled employee work-hours lost because of absenteeism rose to 11.8 and 14.4 percent, as against only 3.0 percent during the 40-hour week.

Case study 50 records the only serious drop in efficiency, 9.2 and 10.3 percent, respectively, when daily hours were increased from 8 to 9 or $9\frac{1}{2}$, and weekly hours were increased from 40 hours to 53 and 48. The 24 female operators were engaged in packing candles in a candle-manufacturing plant and worked under a bonus system with three-quarter pay for all units produced in excess of set standards. In 50 (b), daily hours had been raised from 8 to 9, with an additional 3 hours on Saturday. In 50 (a) daily hours had been lengthened to $9\frac{1}{2}$ with $5\frac{1}{2}$ hours on Saturday. Although the efficiency level at this schedule was still decidedly poorer than that for 40 hours, it was somewhat better than it had been for the 48-hour week. The data indicate that the 3-hour Saturday was much too short to compensate for the additional hours worked. Furthermore, absenteeism losses were twice as high during the longer workweeks as they had been at 40 hours.

Table 8 shows the comparison of increases in weekly hours and increases in output.

In the moderately heavy types of work, the results are decidedly mixed. In studies 20 and 21, only 0.1 of an hour's output, measured at the 40-hour performance level, was gained for every additional hour worked, or, to put it more clearly, 1 hour's output for every 10 hours worked in excess of 40. What was accomplished in 60 and 66 hours could have been accomplished in 42 and 44 hours, respectively. The other 18 and 22 hours were completely wasted.

In case study 65, the decrease of weekly hours by 2, from 50 to 48, reduced output by only 0.4 of an output hour, obviously because of the better efficiency during the 8-hour day.

The semi-automatic type of operation in case study 67 explains the proportionately better output during the longer workweek. For every 5 hours worked above 40 per week, the equivalent of 6 hours' output was obtained.

TABLE 8.—*Effects on output by increasing workdays from 5 per week to 6, with changes in daily hours*

Case study and type of work	Weekly hours changed —		Percent change in		Output-input ratio
	From	To	Hours	Output	
Machine-controlled pace:					
7a — Moderately heavy.....	40	58	+45.0	+36.0	0.8
7b — Moderately heavy.....	40	58	+45.0	+30.0	.7
Operator-controlled pace:					
20 — Moderately heavy.....	40	60	+50.0	+5.5	.1
21 — Moderately heavy.....	40	66	+65.0	+0.0	.1
64 — Moderately heavy.....	40	55	+37.5	+29.6	.8
65 — Moderately heavy.....	50	48	—3.9	—7	.2
67 — Moderately heavy.....	40	55	+37.5	+43.6	1.2
74 — Moderately heavy.....	40	57	+42.5	+67.2	1.6
25 — Light.....	37 1/2	58	+54.7	+81.2	1.5
26 — Light.....	37 1/2	54	+44.0	+67.6	1.5
38a — Light.....	40	48	+20.0	+11.7	.6
38b — Light.....	40	54	+35.0	+22.6	.6
50a — Light.....	40	53	+32.5	+13.9	.4
50b — Light.....	40	48	+20.0	+ 3.3	.2

The explanation for the 1.6 output-input ratio for study 74, indicating 1.6 output hours gained for every hour worked above 40, is that the original pace under the 40-hour week had not been fast and that it was improved materially under the urgency of wartime needs. The 17 additional hours worked yielded the equivalent of 27 hours of output at the pace maintained during the 40-hour week.

In the group of light, operator-paced work, differences were less marked. Because of the sharp increases in efficiency, the output of the workers in studies 25 and 26 increased half again as much, proportionately, as did hours. But in each of the two other studies (38 and 50), output failed to keep up with increased hours. In study 38, nearly half the hours worked above 40 were nonproductive if the output level at 40 hours is used as a base of measurement. That observation is even more pertinent to case study 50, where 48 hours yielded only 41.3 hours of output (50 (b)), and where 53 hours of work yielded only 45.6 hours of output (59 (a)).

In comparison with the studies discussed in section A of this chapter, the performance of the workers discussed in section C is decidedly poorer. The obvious difference between the two groups is that the one discussed in this section experienced sharp increases in daily hours.

2. DROPPING THE SIXTH DAY.

In five studies, it was possible to observe the results of dropping the sixth day concurrently with changing daily hours. In two cases, 36 and 30, hours were lengthened during the 5-day week so as to offset the hours lost by dropping the sixth day, and still giving the workers a 2-day week end. In study 44, the company tried to accommodate itself to the needs of female workers under a 6-day week by using a schedule which gave them 3 days at about 6 hours, 1 at 5½ hours, and 2 at 8½. When the 2-day week end was introduced, hours were changed to a uniform schedule of 8.7 per day for each of the 5 days.

Case studies 72 and 78 present reductions in both daily and weekly hours. Operations in case study 78 were semi-automatic.

The 17 men in study 36 worked an 11-hour day and an 8-hour Saturday on the day shift, but shifted every 2 weeks to a 5-day, 12-hour schedule as a night shift. As table 9 shows, their efficiency was 6.1 percent better during the 5-day week, even though hours were 12 per day rather than 11.

The better performance of 10 female workers (case 30) during a 10-hour day, as compared with one of 7.7 hours, was due to a managerial change discussed earlier, which kept the operators at their machines constantly rather than requiring them to get and deliver their work materials. While the study shows that management can obtain better production by better work procedures, in spite of the lengthening of hours, it is not really a comparable measure of the effects of hours.

The regular workday of 8.7 hours proved more efficient than the irregular daily hours during the 6-day week in study 44. Efficiency was 2.1 percent better—but absenteeism during the longer workday schedule, although it provided for a free Saturday, rose from 2.2 percent for the irregular 6-day week to 9.7 percent under the longer workday.

TABLE 9.—*Effects on efficiency and absenteeism by decreasing weekly workdays from 6 to 5, with changes in daily hours*

Case study and type of work	Number of workers	Sex	Changes in hours				Percent change in efficiency	Absenteeism rate ²	
			Daily		Weekly			From	To
			From 6 days at ¹ —	To 5 days at —	From	To			
Operator-controlled pace:									
36 — Mod. heavy	17	Male	11	12	63	60	+6.1	7.9	6.1
30 — Light	10	Female	7.7	10	46	50	+9.5	4.9	8.3
44 — Light	26	do	(3)	8.7	40	43.5	+2.1	2.2	9.7
72 — Light	13	do	9	8	54	40	+2.7	2.3	(9)
Machine-controlled pace:									
78 — Light	30	do	8	7	48	35	-3.6	5.7	4.1

¹Where 6 times daily hours is less than total hours shown per week, shorter hours were worked on Saturday.

²Percentage of scheduled worktime lost.

³3 days at 5½ hours, 2 days at 8½ hours, 1 day at 5½ hours.

⁴Not determined.

The net effect of these changes is shown in table 10. Here again all computations were made from the lower level of hours, as though hours had been increased from this level rather than reduced to it, so as to make the results comparable with earlier tables.

In study 36, the 3 extra hours worked on the day shift were more than wasted—the longer schedule actually produced less than the shorter one. Not only were the 3 additional hours nonproductive—the total output fell short of the output produced at 60 hours by the equivalent of 2.4 hours' production. At the performance level of the 60-hour week, the day shift could have reached its actual output in 57½ hours rather than 63.

Similarly, the 40-hour week in study 44 was nearly as productive as the 43½ hour week had been. The 3½ extra hours netted only 1 hour's output. A 41-hour week, with a workday of scarcely more than 8 hours, would have netted the same result.

As pointed out earlier, the semi-automatic operation in case study 78 made the work schedule for workers relatively unimportant. Output increased in direct proportion to hours of operation.

Case study 30 presents a different result. Here, in light and operator-paced work, the additional 4 hours worked produced 6.8 hours of additional output. But, as already explained, this study really does not measure the effects of a change in hours.

While the studies shown here are instructive, there are too few of them to permit any conclusions to be drawn.

TABLE 10.—*Effects on output by decreasing workdays from 6 to 5, with changes in daily hours*

Case study and type of work	Weekly hours changed —		Percent change in —		Output-input ratio
	From	To	Weekly hours	Output	
Operator-controlled pace:					
36 — Moderately heavy.....	60	63	+5.0	—4.1	—0.8
30 — Light.....	46	50	+8.7	+14.9	1.7
44 — Light.....	40	43.5	+8.8	+2.6	.3
Machine-controlled pace:					
78 — Light.....	35	48	+37.1	+40.1	1.1

D.—6-day week vs. 5½-day week; no change in weekly hours

The frequency of high absenteeism rates for women during a full 6-day week has been mentioned briefly in preceding discussions. In some instances hourly schedules were altered deliberately so as to allow women time off for shopping and for attending to other personal matters that could be done only while stores and offices were open.

One such attempt was to provide for a half holiday on Saturday. So as not to lose any worktime, however, daily hours were increased sufficiently on the 5 full workdays to equal the total weekly hours during the full 6-day week.

The results of such a change were observed in six case studies, and are shown in table 11. While the number of workers observed in each instance was small, varying from 5 to 15, the results of these changes in work schedules were traced through periods of many months. Except for four men included in case study 39, all of the workers were women, and in each instance the speed of the operations was entirely under the control of the workers. All of them worked under group wage incentives in a plant manufacturing office supplies, and most of them were experienced workers who had been with the company for many years.

Except in one instance, study 41, daily hours on 5 days were increased from 8 to 8.8, and hours on Saturday were decreased from 8 to 4. In study 41, the hours on Saturday were 5½, and hours on the other 5 workdays were 8½.

In every instance the new arrangement of hours resulted in a higher efficiency. The increases ranged from as little as 0.3 percent to as high as 9.4 percent.

TABLE 11.—*Effects on efficiency, absenteeism, and output when changing from a 6-day week to a 5½-day week without changing weekly hours*

[Pace controlled by operator]

Case study and type of work	Number of workers	Sex	Hours per week	Daily hours changed —			Percent change in efficiency	Absenteeism rate ¹		Percent change in output
				From	To			From	To	
					6 days at —	5 days at —					Sat. at —
39 — Moderately heavy.....	8	(Male & female)	48	8	8.8	4	+9.4	7.5	7.1	+9.6
37 — Light.....	9	Male	48	8	8.8	4	+3.3	.5	4.4	—1.0
38 — Light.....	8	Female	48	8	8.8	4	+2.7	6.8	11.8	—2.8
40 — Light.....	5	...do	48	8	8.8	4	+3	22.1	12.5	+12.8
41 — Light.....	5	...do	48	8	8.5	5.5	+1.1	18.5	5.5	+17.4
42 — Light.....	15	...do	48	8	8.8	4	+2.7	8.0	4.7	+ 6.3

¹Percentage of scheduled worktime lost.

It may be of some significance that the highest efficiency increase took place in the group of four men and four women engaged in packing bundles for shipment, with the weight of materials handled varying from light to fairly heavy. The heavier work was done by the men. The effect of the new work schedule apparently was more marked where the physical exertion was greater.

The evidence as to the effects on absenteeism is not as uniformly in one direction. In study 39, the new arrangement had no effect on the absenteeism rate, which remained nearly the same. In studies 37 and 38, the absenteeism losses increased respectively from 0.5 to 4.4 percent of scheduled hours, and from 6.8 percent to 11.8 percent. On the other hand, the high rate of 22.1 dropped to 12.5 in study 40, from 18.5 to 5.5 in study 41, and from 8.0 percent to 4.7 percent in study 42. The higher absenteeism in studies 37 and 38 appears to have been due to a greater tendency to take off the half day on Saturday. On the other hand, the data suggest that the improvements in studies 40 and 41 may have been due largely to the fact that these workers frequently took off the one-half day on Saturday rather than a full day, as they had under the full 6-day week.

The increased absenteeism in studies 37 and 38 caused slight drops in total output, 1.0 and 2.8 percent, in these two groups. The other four groups, however, showed substantial improvements in the total output level, varying from a low of 6.3 percent to a high of 17.4 percent.

Generally, the 5½-day schedule appears to have been more effective than the full 6-day week for female operators.

CHAPTER IV.—6-Day Week

A.—Increases in daily and weekly hours

The most frequently observed method of lengthening weekly hours was to increase daily hours during a workweek of 6 days. The longer workday most frequently was of 9, 9½, or 10 hours' duration.

Except as other factors entered into the situation, hourly efficiency was poorer during the longer workday.

Case studies 22 and 23, involving men employed at hot and fairly heavy work in a foundry, show that hourly efficiency rose by 0.2 percent and 4.1 percent under the longer hours. These men worked at straight day-work rates and without wage incentives. As was found in similar instances elsewhere, the pace at the shorter hours under these conditions was not so fast at operations paced entirely by the operators but that it could be maintained during a longer schedule of hours—short, of course, of hours so long that fatigue would inevitably accumulate.

TABLE 12.—*Effects on efficiency and absenteeism of increasing daily and weekly hours, during a 6-day week*

[Pace controlled by operator]

Case study and type of work	Number of workers	Sex	Changes in hours				Percent change in efficiency	Change in absenteeism rate ²	
			Daily		Weekly ¹			From	To
			From	To	From	To			
5 — Heavy.....	48	Male	9	10	52	58	—3.0	3.3	2.8
22 — Heavy.....	65	do	8	9½	48	55½	+2	6.6	8.9
23 — Heavy.....	68	do	8	9	48	54	+4.1	6.9	8.5
9 — Moderately heavy.....	275	do	7½	10	45	58	0	4.2	6.9
74 — Moderately heavy.....	14	do	8	9½	48	57	+12.7	4.6	2.9
11 — Light.....	66	Female	7½	9½	45	55	+1	3.3	4.5
12 — Light.....	61	do	7½	9½	45	57	—7.0	3.0	4.7
13 — Light.....	26	do	7½	9½	45	55	—8.0	2.2	5.8
14 — Light.....	22	do	7½	9½	45	55	—7.1	3.3	4.1
15 — Light.....	59	do	7½	9½	45	57	—3.4	3.0	4.7
16 — Light.....	100	{ Male 8 female }	7½	9½	45	55	—3.6	1.7	3.6
17 — Light.....	50	{ Male & female }	7½	9½	45	57	—6.7	3.6	6.1
30 — Light.....	10	Female	7½	10	46	58	+21.4	4.9	15.4
31 — Light.....	10	do	7½	10	46	58	+20.1	5.7	7.7
32 — Light.....	15	Male	7½	10	46	61	+8.0	3.5	5.7
33 — Light.....	15	do	7½	10	46	61	+13.3	3.9	6.7
34 — Light.....	92	do	7½	10	46	58	+7.0	2.0	4.2
35 — Light.....	16	do	9	10½	54	61½	—4.3	5.1	6.3
37 — Light.....	9	do	8	9	48	54	—4.5	.5	3.8
38 — Light.....	8	Female	8	9	48	54	+3.5	6.8	14.4
42 — Light.....	15	do	8	9	48	54	+5.0	8.0	8.3
43 — Light.....	40	do	6 & 8	7½	40	44	+3.1	1.9	7.3

¹Where 6 times daily hours is less than hours shown, shorter hours were worked on Saturday.

²Percentage of scheduled worktime lost.

A 12.7-percent improvement in efficiency was found for the 14 men at moderately heavy work in a rubber plant. These workers, under an individual wage-incentive system, and under the urgency for much-needed rubber supplies during the war, found it possible to step up their average hourly output even though daily hours had been lengthened from 8 to 9½.

Case studies 30, 31, 32, 33, and 34 all reflect better hourly performances at light, operator-paced work during a 10-hour day than formerly at a $7\frac{2}{3}$ -hour day in a plant manufacturing air brakes. The workers were engaged in light operations at metal working machines, or in assembling and testing completed parts. Working conditions in the plant were exceptionally good, and the entire plant was air-conditioned.

The improvement in performance, while a real one, was not directly related to the change in hours, but to a managerial change which permitted the operators to spend all their time at their machines rather than spend part of it in getting new work materials and removing the loads of completed work. While these studies indicate the possibility of better worker performance under longer hours because of improvements instituted by management, the composition of the jobs themselves was so modified as to make the data non-comparable for the two work schedules. The studies are shown here to indicate that longer hours do not necessarily restrict production if other improvements can be made.

In the groups of heavy and moderately heavy work, studies 5 and 9 require comment. In study 5, 48 men were engaged in hot and heavy drop-forging work. When hours were lengthened from 9 to 10 per day, with 7 and 8 on Saturday, hourly efficiency dropped by 3.0 percent, although absenteeism remained fairly stable.

In study 9, 275 men were engaged in welding operations in the construction of various parts which were to go into battleships. The work involved considerable climbing about and permitted the use of individual initiative and resourcefulness. The work was not routinized, repetitive, or monotonous. Under these conditions, workers found it possible to maintain the same hourly efficiency under the 10-hour day and 58-hour week as they had under the $7\frac{1}{2}$ -hour day and 45-hour week. Their absenteeism, however, increased from a loss of 4.2 percent of hours scheduled to be worked to 6.9 percent.

In the group of light operations, all operator-paced, and generally consisting of repetitive, monotonous types of work, the general result of increasing daily hours—when no other factors were introduced to distort the comparison—appears to have been a drop in efficiency and an increase in absenteeism. Study 11, which indicates practically no change in efficiency, represents 66 female workers at day work without a wage incentive. The observation made earlier about the pace of day-rate workers under various levels of hours again applies here.

The ultimate criterion of the effectiveness of longer hours is the level of output. As table 13 shows, the longer daily work schedule, usually consisting of 10 hours or less, did result in appreciably more output than had been realized during the shorter schedules. Nevertheless, the increase in weekly hours rarely was matched by a proportionate increase in output. The only instances in which this did occur involved instances of managerial improvements (cases 30 to 34) and lack of wage incentives (cases 11, 22, and 23). The one exception in case study 74, in which the output gained paid off for the additional hours in a ratio of nearly two to one. This study was commented upon earlier.

Generally, however, the ratio of the equivalent of output hours gained to additional hours worked was about 0.6 or 0.7, indicating that 3 hours of work were required to produce the output of 2 hours at the shorter schedules. In terms of labor cost, at overtime rates, this means about 4½ hours' pay for 2 hours of additional output.

TABLE 13.—*Effects on output by increasing daily and weekly hours, during a 6-day week*
[Pace controlled by operator]

Case study and type of work	Weekly hours changed —		Percent change in —		Output-input ratio
	From	To	Hours	Output	
5 — Heavy	52	58	+11.5	+3.7	0.3
22 — Heavy	48	55½	+15.6	+13.2	.8
23 — Heavy	48	54	+12.5	+13.5	1.1
9 — Moderately heavy	45	58	+28.9	+25.9	.9
74 — Moderately heavy	48	57	+18.8	+36.2	1.9
11 — Light	45	55	+22.2	+20.9	.9
12 — Light	45	57	+26.7	+15.2	.6
13 — Light	45	55	+22.2	+8.4	.4
14 — Light	45	55	+22.2	+12.6	.6
15 — Light	45	57	+26.7	+20.0	.8
16 — Light	45	55	+22.2	+15.9	.7
17 — Light	45	57	+26.7	+14.8	.6
30 — Light	46	58	+26.1	+36.4	1.4
31 — Light	46	56	+26.1	+48.2	1.8
32 — Light	46	61	+32.6	+39.9	1.2
33 — Light	46	61	+32.6	+45.9	1.4
34 — Light	46	58	+26.1	+31.9	1.2
35 — Light	54	61½	+13.9	+4.2	.3
37 — Light	48	54	+12.5	+3.9	.3
38 — Light	48	54	+12.5	+6.7	.5
42 — Light	48	54	+12.5	+17.8	1.4
45 — Light	40	44	+10.0	+7.4	.8

B.—Decreases in daily and weekly hours

In five studies the available data permitted conclusions as to the effectiveness of reducing daily and weekly hours while maintaining a 6-day week. This is the reverse of the schedule change discussed in section A.

As is apparent from table 14, all of the operations involved were heavy or moderately heavy and the speed of work was within the control of the operator.

The 48 men in case study 5 working at hot and heavy upset forging had their daily hours reduced from 10 to 9, with a consequent reduction in weekly hours from 58 to 52. This cut-back occurred a few months prior to the conclusion of the survey in this plant, and the ultimate leveling-off point of the rising efficiency under the shorter hours could not be determined. At this point, however, efficiency was better than at any point during the 58-hour week. Although absenteeism increased slightly under the shorter hours, from 2.8 percent to 4.2 percent, the output level at 52 hours was as good as that at 58 hours. In other words, as a long-run proposition, and disregarding the periods of transitional adjustment of the workers to the different schedules, workers at heavy work produced as much in 52 hours as they formerly did in 58. It would have been interesting to determine if an even lower schedule would have done as well. However, no lower hours were worked.

In study 18, 140 operators—of whom about 20 were husky women, selected for size and strength, and all others were men—were engaged in the

TABLE 14.—*Effects on efficiency, absenteeism, and output of reducing daily and weekly hours, during a 6-day week*

[Face controlled by operator]

Case study and type of work	Number of workers	Sex	Changes in hours				Per cent change in efficiency	Absenteeism rate ¹		Per cent change in weekly —	
			Daily		Weekly			From	To	Hours	Output
			From	To	From	To					
5 — Heavy.....	48	Male	10	9	58	52	+8.0	2.8	4.2	-10.3	0
18 — Mod. heavy	140	Male and female	10	8	58	48	+15.1	10.7	10.4	-17.2	-7.9
51 — Mod. heavy	32	Male	9	8	53	48	+8.8	5.5	7.0	-9.4	-3.0
65 — Mod. heavy	14	.....do	10	8	55	48	+6.3	3.5	3.1	-12.7	-6.7
74 — Mod. heavy	14	.....do	9½	8	57	48	+1.3	2.9	(²)	-15.8	(²)

¹Percentage of scheduled worktime lost.

²This is the last value observed for a sharply rising trend in efficiency after hours had been cut back to 52.

³Not determined.

production of metal landing mats under a group wage-incentive system. Daily hours were reduced from 10 to 8, and weekly hours from 58 to 48. Efficiency increased by 15.1 percent. The absenteeism loss remained about the same under both schedules.

A reduction of only 5 hours, by reducing daily hours from 9 to 8, brought about an 8.8-percent improvement in efficiency in case study 51. Here, 32 men were engaged in general foundry work. In case study 65, 14 men were engaged in heavy machining operations and in welding. A reduction in daily hours from 10 to 8 was followed by an increase of 6.3 percent in efficiency.

The improvement was least marked in case study 74, in which the improvement in efficiency was only 1.3 percent when daily hours were reduced from 9½ to 8. (But see comment on case study 74 on p. 154.)

As already indicated, output was as good at 52 hours as at 58 in the heavy work described in case study 5. Except for study 74, in which final output could not be computed, the output lost because of the shortening of hours was the equivalent of half or less of the hours reduced. In case study 18, using the output level at the shorter hours as a yardstick, only 4 hours of output had been gained because of the 10 extra hours worked. A 52-hour week would have been as good as the one of 58.

Approximately the same ratio held for the 14 men in case study 65. About 3.5 hours of output were gained for the additional 7 hours worked.

The ratio of output gained was still lower in case study 51. The equivalent output hours gained by working 9 hours a day rather than 8, or 48 a week rather than 53, amounted to only 1.5. In other words, it took 5 hours of work to produce 1½ hours of output. In terms of actual occurrence, only 1½ hours of output were lost when 5 hours were taken off the work schedule.

The studies indicate that for heavy or moderately heavy work during a 6-day week, the 8-hour day is superior to the 9- and 10-hour day and that, on the whole, for every 2 hours added to the workweek, only 1 hour's output—or less—was realized.

CHAPTER V.—7-Day Week

The 7-day workweek is generally recognized as undesirable. In the course of this survey, only four clean-cut cases of regular Sunday work could be studied. There were other instances of occasional Sunday work to break bottlenecks in production, but in none of these was the 7-day workweek used as a regular schedule.

In studies 27 and 28, made in a plant engaged in processing metal parts on a variety of metal working machines, the performances of 29 experienced male operators and 22 experienced female operators could be studied. The men worked on materials varying in weight from 1 pound to over 100 pounds and operated lathes, milling, grinding, and similar types of metal working machines. The women worked on smaller machines and handled materials varying in weight from 1 ounce to several pounds.

For the men, the comparison is between a workday of 8 hours for a nominal weekly total of 48 hours and a schedule which involved work on two additional Sundays a month. Actually, however, the nominal 48-hour week without Sunday work involved considerable overtime, so that daily hours frequently came to 10, and sometimes to as high as 15. The change from this schedule to the one requiring work on two Sundays a month therefore meant substituting the Sunday work for the irregular overtime. A complication, the effect of which could not be evaluated, was that the irregular overtime schedule preceded our entry into the war, whereas the Sunday work schedule occurred during the war.

In any event, the shift in the schedule meant a substitution of an average (over a month) of a 53.9-hour schedule per week for one of 51.5 hours. This slight change in weekly hours—but with alternate Sunday work substituted for irregular overtime—resulted in an increase of efficiency of 16.3 percent.

Scheduled worktime lost because of absenteeism, however, rose from 3 percent to 7.2 percent.

Although the higher absenteeism offset in part the improvement in efficiency, total output was 16.6 percent better. In part, this increase was due to a slightly higher average number of hours—53.9 hours as against 51.5, or an increase of about 5 percent. The $2\frac{1}{2}$ additional hours netted the equivalent of $8\frac{1}{2}$ hours of additional output.

For the 22 women operators (case study 28) the 2 days a month of Sunday work and the nominal 8-hour day on 6 days averaged to 52.5 hours per week per month. Later, but still during the war period, this schedule was replaced by a nominal 8-hour day for 6 days a week. Both schedules included a paid one-half hour lunch period, so that daily hours actually worked came to only $7\frac{1}{2}$.

When Sunday work was eliminated, efficiency jumped by 22.9 percent. The reduction in the nominal work schedule, it will be observed, was from $52\frac{1}{2}$ to 48 hours, a curtailment of only 9 percent. At the same time, the absenteeism loss decreased from 10.9 to 7.4 percent.

Total output was 16.7 percent higher under the shorter schedule, with Sunday work eliminated. The reduction in the average workweek of about 4½ hours netted 9 hours additional output.

The third study was one of the most interesting and revealing in the entire survey. It covered 30 identical operators in a small plant employing about 100 persons engaged in the production of drills and reamers.

The work was light and almost entirely operator-paced. Each worker was paid in full for all production in excess of fixed standards, with fixed increases for specified percentages of output above the standard. However, a ceiling on earnings limited pay for additional output to 30 percent, beyond which workers received no pay. The data revealed that workers did not exceed the production necessary to yield this result, although they could have done so.

In June 1944, when the survey was made, the plant was on three shifts of 8 hours each, for 6 days per week. This schedule was attained after several years of experience with Sunday work. The original schedule was 5 days at 8 hours, or 40 hours per week. Then followed a 48-hour week, with a sixth day added. This was followed by a 7-day week of 56 hours, continued for 5 months. The plant's absenteeism record had grown so bad by that time that it was shut down, first, every third Sunday, then every other Sunday, and finally every Sunday.

This study, therefore, pertains primarily to the effectiveness of Sunday work. The findings were as follows:

1. Efficiency was highest during the 6-day, 48-hour week. In comparison with the average output per hour worked during the 7-day, 56-hour week, the average efficiency level during the shorter workweek was 29 percent greater.

There is reason to believe that the level during the shorter workweek would have been higher still had it not been for the company's bonus policy, under which production in excess of 30 percent above the standard was not compensated. This fact probably explains why there is only a 1-percent difference between the average hourly efficiency during the 6-day week and the schedule under which employees worked every other Sunday.

When employees were given every third Sunday off, after a long stretch at 7 days per week, efficiency jumped by nearly 17 percent. It went up another 11 percent when the plant worked only every other Sunday. If a similar improvement is assumed in the absence of a bonus scheme which sets a maximum limit on production, the estimated hourly output during the 6-day week would be still higher, by 6 to 8 percent. In other words, the data suggest that, had there not been the bonus limitation, the average efficiency during the 6-day, 48-hour week would have been one-third again as high as that of the 7-day, 56-hour week.

Not only was the 7-day week more costly: it was also only about 75 percent as efficient as the 6-day week.

As the chart shows, efficiency clearly improved as additional Sunday work

was dropped. Efficiency was lowest when all Sundays were worked, and highest when no Sundays were worked.

2. The time lost because of absenteeism by the 30 selected operators was lower when Sunday work was discontinued entirely, as against the schedule under which every other Sunday was worked. The relative percentages, 7.3 and 8.2, appear to be quite high. The average time losses during the two earlier periods—4.1 percent when every Sunday was worked and 7.8 percent when 2 Sundays were worked out of 3—are not directly comparable with these figures because during the earlier schedules the company paid an attendance bonus: \$5 for perfect attendance during the first month, \$10 for the second month, and \$15 for the third.

When Sunday work was scheduled, absenteeism was highest on Sunday. Next in order came Saturday; and third, Monday. Attendance was best on Friday—but Friday was pay day.

Management attempted to curb absenteeism by listing the names of the absentees. But the operators apparently did not care. In explanation of the high absenteeism rates, management advanced two reasons: (1) The 7-day week was too long. The men were tired and wanted some time off, even though it meant the loss of the attendance bonus and double pay for Sunday work. (2) Earnings were high, and the men had no time to spend their money. (The weekly bonus varied between \$5 and \$25, averaging about \$10 per employee. Good operators averaged earnings of \$1.50 to \$1.65 an hour.) Consequently the value of money shrank, and the social aspects of spending some time with their families and friends assumed larger proportions with the operators.

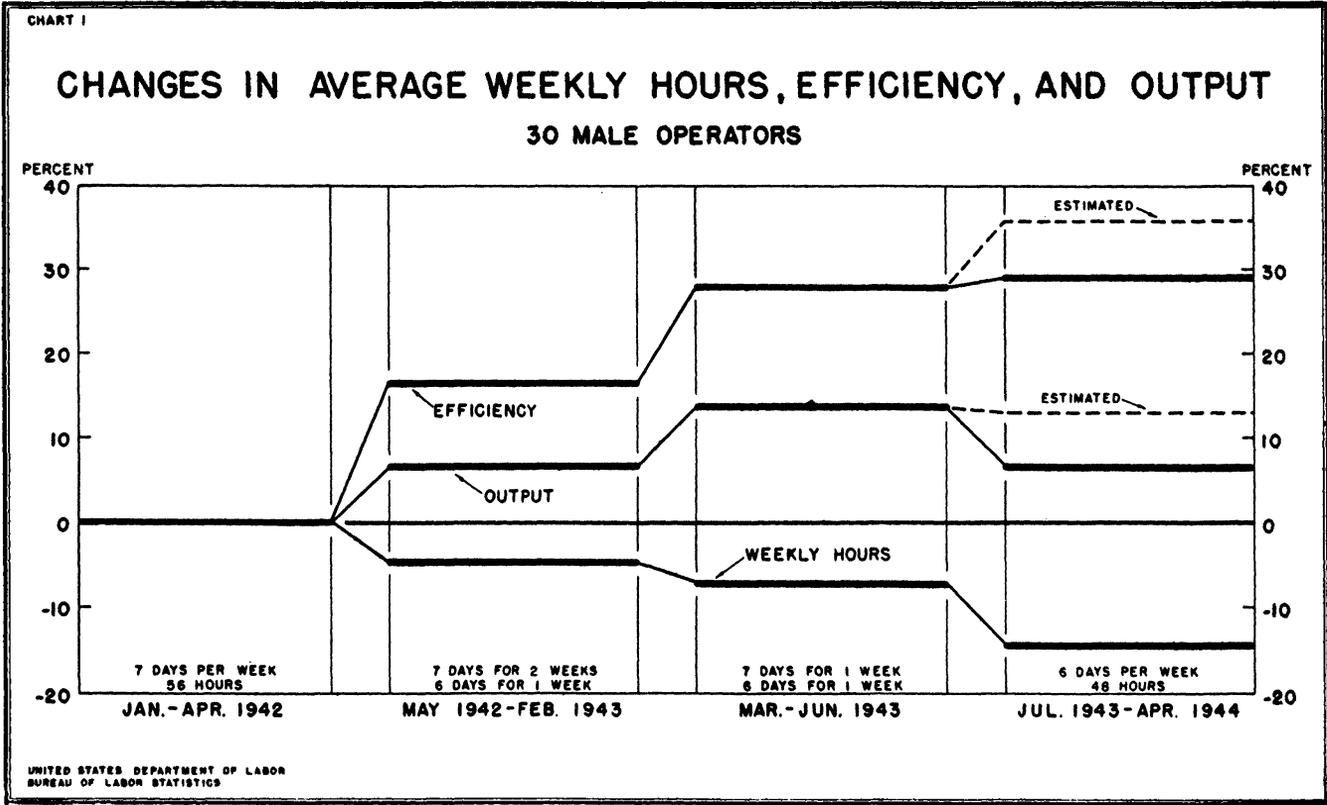
3. Under the limitations of bonus earnings, the output of the 30 selected—and skilled—operators was highest during the schedule calling for work on every other Sunday, i.e., 1 week at 7 days and the next at 6. If the assumption of the efficiency level in the absence of the bonus limitation is sound, however, it appears that the output level during the straight 6-day week, at 48 hours, would have been equally as high.

Sunday work clearly was not economical. Instead of increasing weekly output, it actually decreased it—and at higher labor cost.

In case study 24, the performances of 31 men were traced through two long periods, the first of which required 8 hours of work for 7 days a week for a 54-hour week, and the second called for a 10½-hour day, with 8 hours on Saturday, for a total of 58 hours, but with no Sunday work. (The 8-hour day included a 15-minute lunch period, and the second, a one-half hour lunch period, both of which were paid for by the company. The lunch period has been excluded in the computation of actual results.)

The men machined small metal parts for machine-gun tripods, aircraft engines, and other military equipment. The work was light and operator-paced.

Although there was no direct wage-incentive system, workers were paid specified hourly rates only if they maintained specified levels of output. Upgrading of rates was predicated on efficiency of performance.



Efficiency was better by 14.3 percent without Sunday work, even though daily hours had been lengthened from $7\frac{3}{4}$ to 10. Absenteeism was about the same under both schedules and amounted to a time loss of 5 percent of scheduled man-hours. The absence peak during the 6-day week fell on Saturday, reflecting the desire or need for a longer week end. Under the Sunday schedule, attendance was worst on Sunday, with Monday only slightly better. Operators who worked on Sunday, at double pay, frequently took Monday off, losing only straight pay.

The longer workweek was more productive than the Sunday work schedule. Although weekly hours had been increased by only about 7 percent, output increased by somewhat better than 22 percent. The elimination of Sunday work not only saved the cost of double pay for that day, but also netted 15 percent of output beyond the 7 percent of additional hours worked.

CHAPTER VI.—Intermittent Work Schedules

In some industries, of which clothing manufacturing perhaps is a good example, irregular hours were worked frequently during the war. In part, this was the result of shortages of materials at various times, and, in part, the pressure to get orders finished on schedule when materials were available. Case studies 52 to 57 trace the performances of workers at various types of operations in plants manufacturing clothing. Hours varied from 24 per week or less to as high as 55. As the work pace was fast, the results obtained at the various schedules are fairly good indications of the effects they engender should they be worked as regular, sustained schedules.

A Rural Plant

Studies 52 and 53 were made at a plant manufacturing men's trousers. The plant was located in a small rural community, and many of the operators had outside interests such as farming, gardening, hunting, and fishing. During the planting and harvesting seasons, their tendency was to hold work hours to an absolute minimum so as to have the time for these other activities. Most of the workers had high school educations, were self-reliant, and skeptical of anything that smacked of company patronage. In turn, management made no effort to make the plant or working conditions comfortable or attractive.

For the 96 women discussed in case study 52, work schedules varied from 24 hours to 48. All operations were performed at power sewing machines and were entirely paced by each operator working at piece rates. Hourly earnings averaged about 80 cents and ranged from as low as 60 cents to as high as \$1.25.

The highest efficiency level, i. e., output per hour worked, was obtained for a workweek of 24 to 28 hours. At successive levels of 32, 36, and 40 hours, efficiency was slightly lower, but did not vary appreciably. But the 48-hour week was 4 percent poorer in efficiency than the 40-hour week, and 7.1 percent poorer than the 24-hour week.

Because of the nature of available records, and the intermittent schedules, it was not possible to determine absences that lasted an entire week or more. The figures used reflect absences of less than a week. Measured on this basis, the absenteeism loss increased slowly but steadily as hours increased from 24 to 40, when it reached 6.3 percent of scheduled hours. But at 44 hours it was only 3.3 percent, and at 48 hours, 1.2 percent. Obviously the workers were anxious to earn the time-and-a-half pay for overtime.

As a general rule, weekly output increased in direct proportion to hours. As hours exceeded 40, the lower efficiency was offset by better worker attendance.

In the same plant, 13 male pressers were studied for work schedules vary-

ing from 20 to 55 hours (study 53). Here, too, the pace was fast. The physical demands on the operators of the presses, however, were much more severe. Work frequently was hot and humid. Earnings averaged \$1.10 per hour.

As in the case of the sewers, the efficiency of the male pressers was highest during the 24 to 28 hour week. Again, as in the case of the sewers, the efficiency level decreased slowly but steadily as hours rose to 40, for a total drop of about 3 percent. After 40 hours, efficiency dropped more sharply. The 55-hour week was 6 percent poorer than the 40-hour week, and 9 percent poorer than the 24-hour week. It is significant, however, that hours below 24 were not as efficient as those from 24 to 28.

Similar to the absenteeism experience of the women operators, the loss percentage for the men rose steadily to 7.8 percent at 40 hours. And again, as in the case of the sewers, work attendance at hours above 40 was very much better. At 44 hours, absenteeism caused a loss of only 1.9 percent of scheduled hours, and at 48 hours, attendance was perfect. At 55 hours, however, time lost had risen slightly to 1.2 percent.

Weekly output generally kept pace with changes in weekly hours, the lower absenteeism rates at the hours above 40 offsetting the lower efficiencies. The downward trend in efficiency, however, indicates that weekly output would have suffered rather severely had the long hours been sustained for any long period of time.

An Urban Plant

A direct comparison with studies 52 and 53 is provided by studies 54 and 55. Here, too, sewing and pressing operations were studied, but on the production of military and civilian overcoats. The plant belonged to the same company, but was situated in an industrial city. As in the rural plant, working conditions were only fair and entirely functional, without much regard for the comforts of the workers.

The experiences of 32 skilled female operators of power sewing machines furnish the material for study 54. Pace, wage incentive, and nature of work were the same as in case study 52. There was, however, this important difference—neither the women in this study, nor the men in study 55, were concerned with such outside activities as gardening and farming. Earnings averaged about 90 cents an hour.

During the 20-month period surveyed, weekly hours ranged from 28 to 52. The nominal workweek, consisting of 5 days at 8 hours each, was revised constantly, depending on the volume of work at hand and the work flow.

Contrary to the experience of the rural group, efficiency increased as hours were raised from 28 to 40. At that level, efficiency was 6.3 percent better. However, when hours exceeded 40, this trend was reversed. In spite of overtime pay, efficiency at 44 hours was 1 percent poorer, and at 52 hours, 3 percent poorer than at 40.

Contrary again to the experience of the rural operators, absenteeism remained fairly stable, at about 5 percent, for the schedules from 28 to 40 hours. But, as in the other case, attendance improved as hours exceeded 40—at 44 hours it was 2.3 percent, and at 52 hours, 0.6 percent. Here, too, the

better attendance may be attributed to the desire to take full advantage of the overtime pay and to make up for the loss occasioned by short work schedules. It is likely, however, that the picture might have been considerably different had the longer schedules been worked regularly rather than intermittently. As it was, total output kept pace with the increased hours, with lower absenteeism offsetting lower efficiencies.

The 22 hand and machine pressers in case study 55 afford a direct comparison with the pressers in study 53. The work required skill, and working conditions were similar to those described in the earlier study. The nature of the work—pressing overcoats rather than trousers—made for a steady but somewhat slower pace.

Hours fluctuated between 28 and 52. As in the case of the sewers in this plant, and contrary to the experience of the pressers in the rural plant, efficiency increased as hours rose from 28 to 40. At that level it was 4.9 percent better than at 28 hours. But as hours exceeded 40, efficiency leveled off. However, it remained fairly constant at 40, 44, 48, and 52 hours. The obvious explanation for this is the slower pace.

Contrary to the experience of the three other groups discussed thus far, absenteeism varied little with changing schedules of hours. Again, however, it is questionable whether a sustained 48- or 52-hour week would have had the same result.

Output increased in almost direct proportion to increased hours, with both efficiency and absenteeism constant above 40 hours.

Quality Rather Than Quantity

A third comparison was provided by sewers and pressers in the urban plant, but engaged in the manufacture of military and civilian jackets. This work, however, was subjected to much stricter quality controls. In spite of the piece-rate system, the emphasis was on quality rather than quantity of work. As a consequence, the pace was steady and unhurried. Furthermore, working conditions were considerably more comfortable.

Study 56 provides the findings for the results of constantly changing work schedules for 123 female operators of power sewing machines and hand sewers. Hours varied between 28 and 52.

As the study indicates, hourly output improved slightly as hours moved up to 40 per week, at which efficiency was nearly 3 percent better than at 28 hours. Efficiencies at 44, 48, and 52 hours were about 1 percent better. Working at a slower pace, these workers could maintain a steady hourly output in spite of the longer hours. These hours, however, were worked intermittently rather than steadily.

The absenteeism rate reached its highest point, 6.8 percent, at 32 hours, and was 6.1 percent at 40 hours. As in the other studies, absenteeism dropped sharply after 40 hours, with 2.1 percent for the 44-hour week and 1.1 percent during the 52-hour week. But, again, these rates probably would have been considerably higher had the longer schedules been worked steadily.

Improved attendance at somewhat better efficiencies and the higher hours

resulted in proportionately better output levels. Although the 44-hour week represented an increase of only 10 percent above the 40-hour level, output was 15 percent higher. When hours were increased by 30 percent to a level of 52, output was 39 percent higher.

The 29 male hand and machine pressers in case study 57 had much the same experience. Here, too, the emphasis was on quality, and the work pace consequently deliberate and steady, rather than fast.

Efficiency improved somewhat, 2.1 percent, as hours increased from 28 to 40. As in the case of the sewers, efficiency rose by about 1 percent above that at 40 hours when hours increased to 44, and remained at that level even though hours increased to 52.

Although the absenteeism rates were somewhat lower than for the female sewers, the trend was the same, with 3 percent at 40 hours. During the 44- to 52-hour weeks, absenteeism dropped to 1 percent or less.

Paralleling the output experience of the sewers, the output for the pressers was somewhat better during the 44- to 52-hour schedules than during the shorter workweeks. At 44 hours, output exceeded the proportional increase in hours by 3.1 percent, and at 52 hours, by 4.3 percent.

In conclusion, however, it must again be emphasized that the results observed apply to intermittent schedules. They show the drive of overtime pay during hours above 40—but for schedules worked irregularly and not sustained over a long period of time. Had these longer schedules been sustained, the results might well have been different.

CHAPTER VII.—Work Injuries

In general, the results of the survey indicate that work injuries increased disproportionately as hours increased.

In table 15 are shown the frequency rates of injuries—i. e., the average number of injuries per million employee-hours worked—at various levels of weekly hours. Most of the plants included in this table were not included in the basic survey on the effects of hours because the type of data needed for output computations was not available. The data covers the experiences of about 85,000 workers.

Where possible, frequency rates were computed for all work injuries—for those that were disabling as well as those that required only first aid.

A study of table 15 reveals some inconsistencies in the general upward trend of injuries. The reason for some of these can be explained because these studies were included in the more comprehensive survey. For example, plant S had a frequency rate of disabling injuries of 13.7 at 48 hours. At 54 hours, the rate was nearly the same, 13.1. The explanation is a very efficient system of accident prevention.

An entirely different reason explains the lower over-all frequency rate for plant T at 60 or more hours than had prevailed at 40 hours. These figures summarize the findings for case studies 20 and 21. Reference to these studies readily reveals that the operating pace had slowed down so much—by more than 20 percent—that injuries were somewhat fewer, in terms of the million-hour base. It is readily apparent, however, that the slight reduction, about 5 percent, stands in sharp contrast to the slowing down in the operating pace.

In five plants (D, H, L, M, and Q), the reasons for the better rates at higher levels of weekly hours could not be ascertained.

TABLE 15.—*Frequency rates of work injuries at various levels of weekly hours*

Plant	Frequency rates of injuries at weekly levels of —							
	40 hours		48 hours		54 hours		60 or more hours	
	Disabling	Total	Disabling	Total	Disabling	Total	Disabling	Total
A.....	.....	3,852	.....	5,839	.....	.....	.....	.....
B.....	.....	.....	.....	175	.....	225	.....	328
C.....	.....	.....	.....	.....	.....	275	.....	.....
D.....	6.6	.....	4.9	.....	.....	.....	.....	.....
E.....	.....	444	.....	596	.....	.....	.....	.....
F.....	.....	1,245	.....	1,363	.....	2,120	.....	.....
G.....	.....	1,391	.....	2,759	.....	.....	.....	.....
H.....	.....	155	.....	96	.....	.....	.....	.....
I.....	.....	595	.....	689	.....	.....	.....	.....
J.....	.....	.....	.....	1,008	.....	.....	.....	2,727
K.....	.....	2,558	.....	3,682	.....	2,975	.....	.....
L.....	15.4	.....	.....	.....	8.6	.....	.....	.....
M.....	46.4	.....	.....	.....	41.5	.....	.....	.....
N.....	60.0	.....	62.4	.....	.....	.....	.....	.....
O.....	26.5	.....	.....	.....	.....	.....	30.2	.....
P.....	8.1	.....	.....	.....	19.2	.....	.....	.....
Q.....	.....	.....	16.6	.....	.....	.....	11.1	.....
R.....	32.9	.....	37.1	.....	.....	.....	.....	.....
S.....	.....	.....	13.7	.....	13.1	.....	.....	.....
T.....	.....	6,337	.....	.....	.....	.....	.....	6,017

On the other hand, the evidence of the effect of longer hours on work injuries is rather striking. In plant A, with hours increased from 40 to 48, the frequency rate went up by more than 50 percent. Similar results were obtained in plant C, when hours went up from 48 to 54, and in plant B, when hours rose from 54 to 60. In plant G, an increase from 40 hours to 48 just about doubled the over-all frequency rate, and in plant J, an increase from 48 hours to about 60 nearly tripled the rate.

In plant N, the rate at 48 hours is only about 4 percent above that for 40 hours. It probably would have been higher had there not been a fairly sharp curtailment in average hourly output at 48 hours in this forge shop in which work was both hot and heavy.

In plant O, the increase in the frequency rate of disabling injuries reflects a rise of only about 14 percent. This considerably understates the situation because foremen "covered up" at the higher hours by not reporting the minor types of disabling injuries—i. e., those that disabled men for 1 or 2 days, but could be taken care of satisfactorily by the nurse.

An instance of the inability of an excellent safety program to cope with the disproportionate increase in injuries is supplied by plant P. Here the frequency rate for disabling injuries was 8.1 at 40 hours, but 19.2 at 54 hours.

Because of the difference in record keeping for minor injuries, the rates for the plants shown are comparable only for disabling injuries, but not for all work injuries. Basically, the findings reflect the effects of different work schedules and not plant differences.

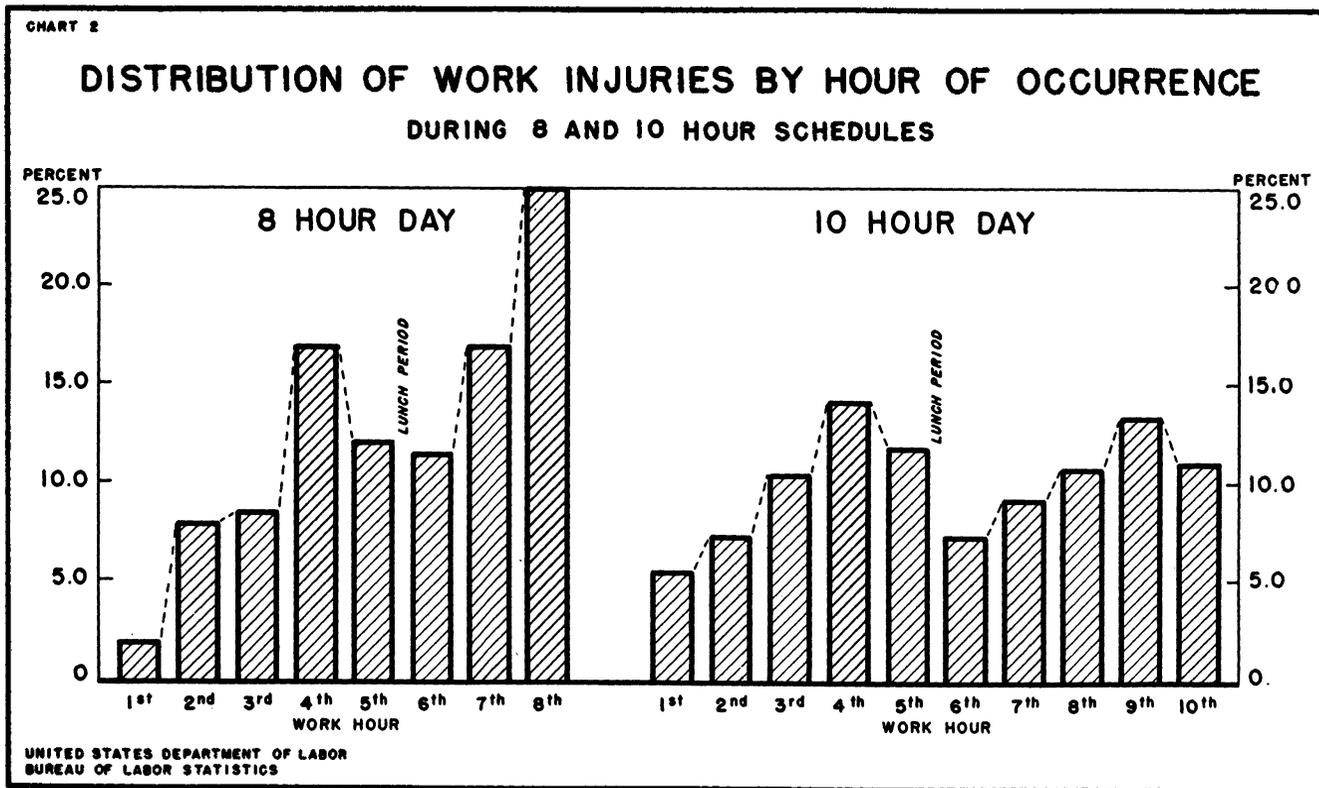
The Hourly Injury Pattern

Regrettably, it was not possible in a single instance to match injuries by hour of occurrence with hourly output, particularly when hours per day were increased. In one plant, however, it was possible to develop the hourly pattern of injury occurrence for all injuries, most of them nondisabling. The distribution of these injuries during both an 8-hour day and a 10-hour day schedule are shown in table 16, and graphically on chart 2. The 8-hour day schedule covered a period of about 7 months, and that of the 10-hour schedule, about 9½ months. The group surveyed consisted of 100 workers. (See pp. 39 and 40.)

The hourly distribution of injuries under the two patterns of daily hours is very similar. In both cases, the first hour has the lowest number of injuries. During the 8-hour day, the curve rises slowly during the 2nd and 3rd hours, but reaches a peak with nearly 17 percent of all injuries during the fourth hour of a 5-hour stretch. During the fifth hour, the percentage drops to 12, reflecting the slowing down in pace as the lunch hour approached.

During the 3-hour stretch in the afternoon, however, injuries rise steadily and sharply. Beginning at 11.4 percent, the increase is to 16.8 percent, and, finally, 25.0 percent in the last hour.

With hours unevenly divided for morning and afternoon work—5 and 3 hours rather than 4 and 4—the 3 hours in the afternoon account for 53 per-



cent of all the injuries. The high percentage of injuries falling into the last hour may reflect fatigue or a burst of speed, or both.

TABLE 16.—*Distribution of work injuries by hour of injury occurrence, for an 8- and a 10-hour day*

Hour of injury occurrence	8-hour day		10-hour day	
	Number of injuries	Percent of total	Number of injuries	Percent of total
Total.....	167	100.0	429	100.0
First hour — 7 o'clock.....	3	1.8	23	5.4
Second hour — 8 o'clock.....	13	7.8	31	7.2
Third hour — 9 o'clock.....	14	8.4	44	10.3
Fourth hour — 10 o'clock.....	28	16.8	61	14.1
Fifth hour — 11 o'clock.....	20	12.0	50	11.7
Sixth hour — 1 o'clock.....	19	11.4	31	7.2
Seventh hour — 2 o'clock.....	28	16.8	39	9.1
Eighth hour — 3 o'clock.....	42	25.0	46	10.7
Ninth hour — 4 o'clock.....	.....	.....	57	13.3
Tenth hour — 5 o'clock.....	.....	.....	47	11.0

Like the 8-hour day, the 10-hour day also reaches its morning peak during the fourth hour and then drops off during the hour immediately preceding the break for lunch. During the 5-hour afternoon, the distribution of injuries has not nearly the intensity displayed by the 8-hour day. The first and second afternoon hours are comparable to the second and third morning hours. In fact, the fourth hour morning peak is not reached at all in the afternoon. Like the fourth hour in the morning, the fourth hour in the afternoon stretch is the high point for the half day. The 5-hour afternoon accounts for exactly 50 percent of the injuries. The sharp upward surge during the last hour of the 8-hour day is entirely missing. Instead, there is a dropping off during the last hour, which is not much worse than the third morning or third afternoon hour.

In the absence of hourly production data, any attempted explanation for these differences can be no more than informed guesses. The explanation that suggests itself most readily is that the operating pace during the 10-hour day, with the day divided evenly by the lunch hour, is a more steady pace than that for the 8-hour day. There, too, the injury distribution might have been different had the day been divided into two stretches of 4 hours each. But with only 3 hours in the afternoon, with a pause for lunch to refresh them, it seems that the operators worked up to another production peak during the afternoon, as they had during the fourth hour in the morning, but to a higher level. In other words, the poorer injury experience during the short afternoon stretch may have been the direct result of a fast production pace.

CHAPTER VIII.—Daily Patterns of Efficiency and Absenteeism; Various Levels of Hours

It was hoped that the data on efficiency and absenteeism might reflect daily output and absenteeism patterns that might be characteristic for the various levels of daily and weekly hours.

Efficiency

Owing to the scattered instances in which it was found possible to obtain data in sufficient detail, the patterns for efficiency are not numerous enough to permit any definite conclusions. Some of them, however, reveal a definite trend when performances at various schedules are examined for the same group of workers.

In table 17 are shown daily efficiencies on 8-, 9-, and 10-hour days with workdays varying from 5 to 7.

TABLE 17.—Daily efficiency patterns at various schedules of daily and weekly hours

Case study and type of work	Sex of workers	Work schedules	Daily efficiencies						
			Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
8-hour day									
7 — Mod. heavy	Male	5 days at 8 hours	99.0	98.3	99.8	102.2	100.6	..	..
78 — Light	do	do	98.8	100.6	100.0	100.6	99.7	..	..
59-63 — Light	Female	do	100.0	99.1	100.1	100.7	100.2	..	..
78 — Light	Male	6 days at 8 hours	99.2	100.1	100.9	99.8	99.8	100.1	..
59-63 — Light	Female	do	99.9	101.0	99.4	101.2	98.7	99.5	..
24 — Light	Male	7 days at 7.7 hr.	98.3	98.2	97.6	97.6	102.3	101.1	104.6
28 — Light	Female	7 days at 8 hours	98.6	101.2	100.4	100.8	102.2	99.1	97.8
9-hour day									
5 — Heavy	Male	{ 5 days at 9 hour. 1 day at 7 hours }	94.8	105.9	109.6	96.1	94.8	98.5	..
10-hour day									
7 — Mod. heavy	do	5 days at 10 hr.	99.4	101.0	99.4	100.2	100.2	..	..
5 — Heavy	do	{ 5 days at 10 hr. 1 day at 8 hours }	98.0	99.3	102.0	102.0	100.7	98.0	..
24 — Light	do	do	99.8	99.6	100.1	99.8	99.5	101.1	..
7 — Mod. heavy	do	do	99.8	98.9	99.8	100.6	100.6	100.6	..

During the 40-hour week, with an 8-hour schedule for 5 days, case study 7, with men engaged at moderately heavy work, suggests a gradual building-up to a peak on Thursday. In study 78, with men at light work, the pattern is somewhat similar, except that a high plateau prevails on Tuesday, Wednesday, and Thursday, with somewhat lower efficiencies on Monday and Friday, the first and last days of the week. The grouped results for the women operators in case studies 59 to 63, however, suggest a fairly constant daily pattern, except for a slight drop on Tuesday.

Adding a sixth day at 8 hours does not appear to have altered the pattern much for the male operators in case study 78. However, it definitely de-

pressed the level of the daily performances of the women operators in case studies 59-63.

The 7-day patterns shown for studies 24 and 28 do not follow a similar distribution. In case study 24, the men performed better on the last 3 days of the week, with particular emphasis on Sunday, when the best performance was turned in. This is rather surprising because the work was not done at piecework or under any other direct incentive system. Although double time was paid for Sunday, the pay would have been the same even if a lower output level had been reached. The reason for this pattern is anything but clear.

The pattern supplied by the women operators in case study 28 shows Sunday performance to be poorer than that of any other day, but not substantially so—only about 2 percent below the average for the week. Here, moreover, workers were paid in full for all time saved from the standards allowed for each job.

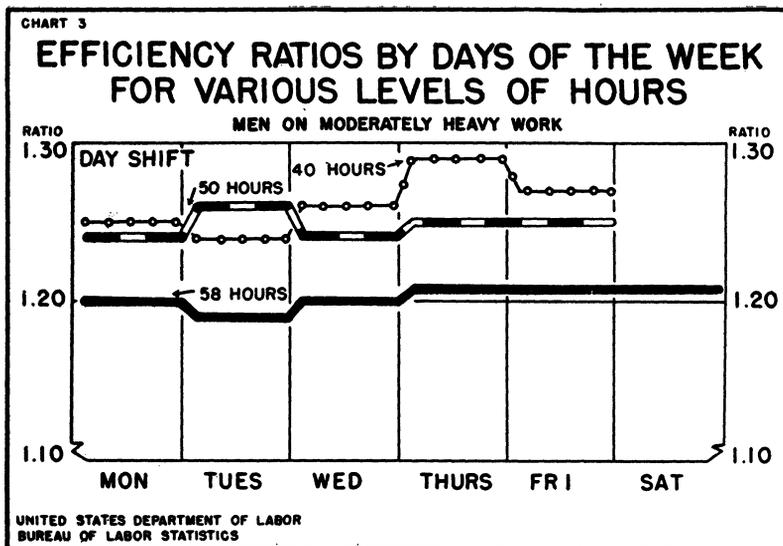
Only case study 5 supplies a pattern for the 9-hour day. The schedule actually consisted of 5 days at 9 hours, with Saturday at 7 hours. The pattern, for men at heavy work, shows a surprisingly sharp rise from a low of 94.8 on Monday to a high of 109.6 on Wednesday—but with sharp decreases on Thursday and Friday, with Friday back to the Monday level. Performance recovered to an index of 98.5 for the shorter Saturday. The reason for the sharp spurt on Tuesday and Wednesday is not apparent.

During the 10-hour day, the men in case study 7, at moderately heavy work, performed almost uniformly well on each of the 5 days of the workweek. In comparison with the 8-hour day, however, it is quite clear that the midweek spurt disappeared. The addition of a sixth day at 8 hours, lengthening weekly hours to 58, also reveals the absence of the midweek spurt, and indicates that the level for the entire week was somewhat lower than that for the 50-hour week. In other words, as daily hours were raised from 8 per day to 10, but with the retention of the 2-day week end, the midweek spurt was lost. When a sixth day was added, the curves remained flat, but dropped to a still lower level. (See chart 3.)

The men at heavy work in case study 5 reveal the same experience under the 9- and 10-hour day patterns. A reference to table 17 shows the sharp spurt on Tuesday and Wednesday substantially reduced. Here, too, the effect of lengthening daily hours was to curtail the spurt, and to level out daily production. It is to be noted, however, that performance on Thursday and Friday was substantially better during the longer work schedule.

The performance of the men in case study 24 also indicates that for a 10-hour schedule, the performance on any one day was about as good as on any other day. Here again, efficiency was better during the shorter Saturday.

Although available details are insufficient to justify any definite conclusions, the available data suggest that the 6-day week at 8 hours a day is nearly as good in terms of efficiency as the 5-day week at 8 hours. But when hours are raised to 9 and 10, the midweek peak tends to disappear, and the curve becomes flat. As a sixth day is added, the curve remains flat, but drops to a still lower level.



This trend suggests one other conclusion: As efficiency drops at longer daily and weekly schedules, the performance of each day of the week is poorer under the longer schedule. Lower hourly production does not manifest itself merely during the additional hours worked—it pervades the entire work schedule. At longer hours, workers tend to slow down so as to be able to stretch their energies over the longer schedules.

Absenteeism

Attention has been called earlier to two important aspects of absenteeism: (1) the generally higher absence rates for women and (2) the general increase in scheduled worktime lost when hours were raised substantially above 48 per week.

Table 18 shows how the absenteeism pattern varies, by days of the week, under various schedules of daily and weekly hours.

Although the levels of absenteeism rates vary considerably between plants, no definite daily pattern is discernible for any one plant during the 5-day week with the 8-hour day, except, perhaps, a somewhat higher rate on Monday, the first day of the week.

When the workweek was lengthened to 6 days by the addition of another 8-hour day, the pattern displays a markedly higher rate for Saturday.

In case study 69, the Saturday rate is twice that for any other day in the week, although the rate of 3.8 is low in comparison with the rates of most of the other worker groups shown. Case study 70 indicates not only the tendency to take Saturday off, but also to take Monday off. One obvious explanation for this is that the men who worked on Saturday found it necessary or desirable to take time out on Monday. There is little time for shopping or for attending to personal matters or needs when the workweek encompasses 6 full days.

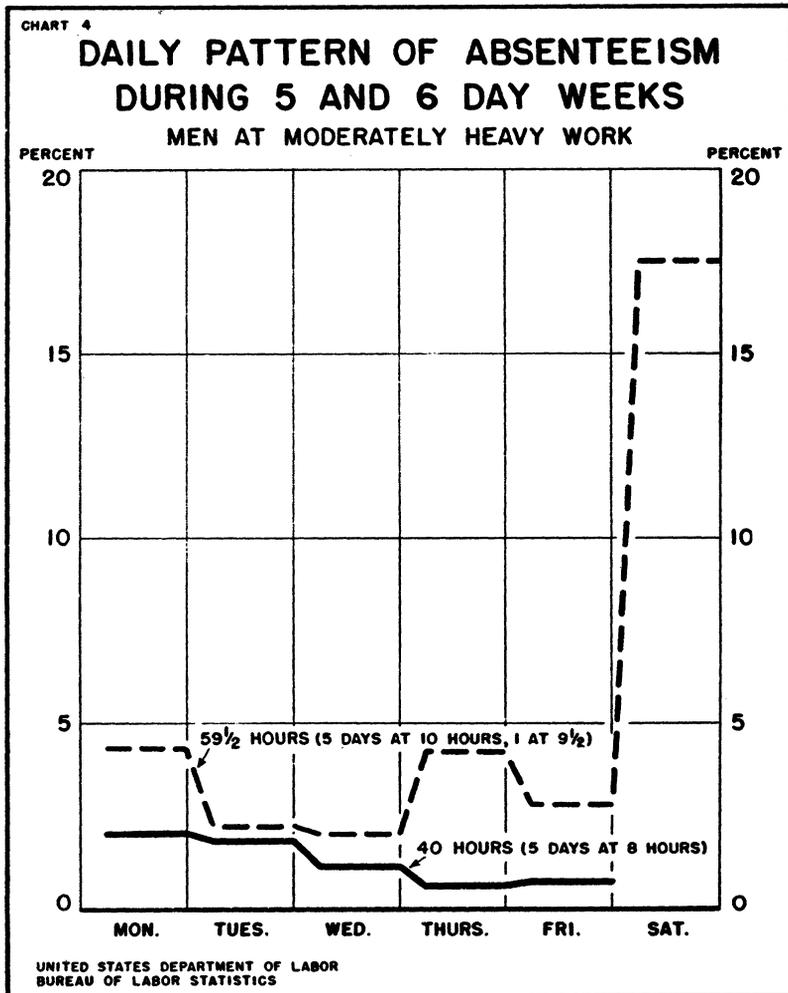
TABLE 18.—Daily absenteeism patterns at various levels of daily and weekly hours

Case study	Sex of workers	Schedule	Percent of scheduled worktime lost through absences						
			Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
8-HOUR DAY									
78.....	Male	{ 5 days at 8 hr.	9.7	9.2	7.7	6.1	10.5	..	..
		{ 6 days at 8 hr.	5.2	6.0	5.1	5.5	5.4	7.6	..
7.....	do	{ 5 days at 8 hr.	4.0	4.0	6.8	6.5	5.0	..	..
77.....	do	{do	2.0	1.8	1.1	.6	.7	..	..
69 (day shift).....	do	{do	2.0	.2	..	..	.9	..	..
		{ 6 days at 8 hr.	1.9	.8	1.4	1.2	1.8	3.8	..
70 (afternoon shift).....	do	{ 5 days at 8 hr.	2.8	.9	..	..	..	..	..
		{ 6 days at 8 hr.	5.6	2.8	3.0	3.4	4.5	6.6	..
71 (night shift).....	do	{ 5 days at 8 hr.	..	8.3	5.0	1.7	..	..	..
		{ 6 days at 8 hr.	13.7	4.1	2.9	3.6	1.1	2.0	..
59-63.....	Female	{ 5 days at 8 hr.	10.7	12.3	12.7	9.4	8.7	..	..
		{ 6 days at 8 hr.	11.2	10.2	10.5	9.6	8.8	20.8	..
77.....	do	{ 5 days at 8 hr.	1.3	.7	1.3	1.5	1.9	..	..
		{ 6 days at 8 hr.	4.1	3.3	3.5	3.7	3.5	20.5	..
28.....	Female	{ 5 days at 8 hr.	10.9	7.2	6.2	6.5	5.6	8.0	..
		{ 7 days at 8 hr.	11.3	10.1	11.3	9.8	10.0	9.7	7.9
24.....	Male	{ 7 days at 7.7 hr.	7.5	5.0	3.9	2.6	3.6	3.9	9.9
WORKDAYS ABOVE 8 HOURS									
35.....	Male	{ 6 days at 9 hr.	5.1	4.6	5.0	4.1	4.8	7.4	..
		{ 5 days at 10 hr.	..	..	..	..	..	..	..
24.....	do	{ 1 day at 8 hr.	2.4	4.4	3.3	4.3	5.5	8.2	..
		{ 5 days at 10½ hr.	..	..	..	..	..	..	..
35.....	do	{ 1 day at 9 hr.	6.2	5.4	4.6	3.5	5.3	9.8	..
		{ 5 days at 10 hr.	..	..	..	..	..	..	..
7.....	do	{ 5 days at 10 hr.	5.8	3.5	1.3	1.3	1.8	..	..
		{ 1 day at 8 hr.	2.8	3.0	2.0	1.5	1.8	11.0	..
77.....	do	{ 5 days at 10 hr.	..	..	..	..	..	..	..
		{ 1 day at 9½ hr.	4.3	2.2	2.0	4.2	2.8	17.5	..
		{ 5 days at 11½ hr.	7.2	6.1	6.0	5.1	5.6	..	..
75.....	do	{ 5 days at 10 hr.	..	..	..	..	..	..	..
		{ 1 day at 8 hr.	6.3	5.3	5.2	4.3	5.1	10.4	..
		{ 5 days at 11½ hr.	10.9	9.4	9.4	8.1	10.1	..	..
75.....	Female	{ 5 days at 10 hr.	..	..	..	..	..	..	..
		{ 1 day at 8 hr.	9.3	8.2	8.1	6.9	8.5	12.5	..

The situation was reversed for the night-shift crew of men in case study 71. There, work began on Sunday night—and, as one might expect, absenteeism was highest on this first night of the week rather than on the last. In fact, it averaged 13.7 percent of the hours scheduled for work on that shift. Here the explanation is based on social grounds. After spending the day with his family and friends, the worker is not apt to feel fresh enough to report for work at night. The alternative is to sleep away a considerable portion of the day—but that means foregoing the social intercourse which is such an important part of life.

The absenteeism rates for the combined group of female operators in case studies 59 to 63 illustrate the generally higher absenteeism pattern for women. The same is true of case study 28. On the other hand, this pattern is not true of all women, as shown by the operators in case study 77. But here, as in studies 59 to 63, the significance of Saturday work is unmistakable: absenteeism rose to above 20 percent. In other words, on an average, fully one-fifth of the total work force consisting of women stayed away from work. This, it will be observed, represents an absenteeism loss about three times as high as that observed for men.

The explanation suggested for the men applies with even greater force to the women. To it must be added the fact that many women workers have home responsibilities and, often, the responsibility of taking care of children.

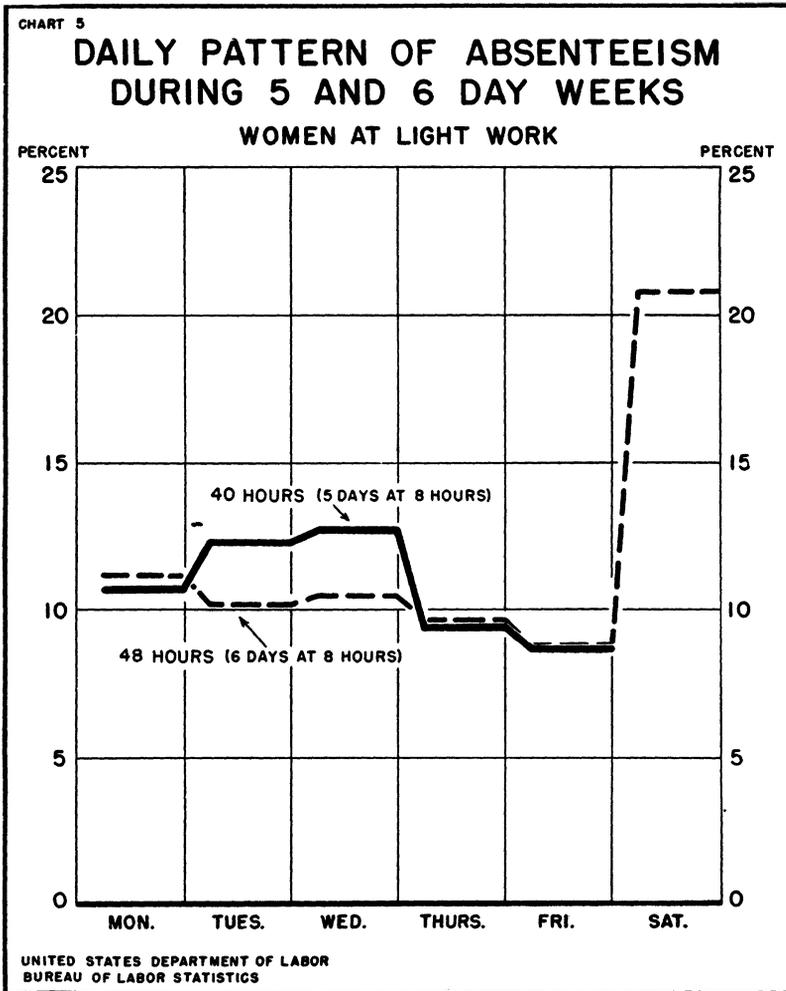


When a 7-day week was worked, absences were more frequent during each of the 6 days of the week than during the corresponding days of the 6-day week—but lowest on Sunday for the women in case study 28. Quite understandably, the operators worked Sunday at double pay, and took time out on some other day of the week, preferably Monday.

The men in study 24, however, were absent more frequently on Sunday during the 7-day week, with the second-highest absence rate on Monday.

The patterns for the 9-hour and 10-hour days are about the same as for the 8-hour days, except that absenteeism on Saturday, the sixth day, reached much higher levels for men than during the 8-hour day. Except for case study 75, all of the studies shown concern men.

The men in case study 7 had the highest rate, 5.8, on Monday during the 5-day week, with daily hours at 10. But when a sixth day was added, at 8 hours, for a 58-hour week, the high point shifted to Saturday—with 11.0



percent. For the rest of the week, the absence rates under the two schedules are very similar. The difference comes on Saturday.

Similarly, absenteeism for the men in case study 77 reached 17.5 percent on Saturday, and 10.4 percent in case study 75.

Because women were limited by State laws from working long hours, and because management quickly discovered that long hours were not advisable even when possible, few women operators were found at the higher levels of daily and weekly hours. The daily pattern for one group at 10 and 11½ hours is shown for case study 75. It will be noted that the time lost because of absenteeism was lower during the 10-hour-day schedule than during any corresponding day under the 11½-hour schedule, even though the latter involved a 5-day week and provided a 2-day week end. During the 6-day week, as in other cases listed, absenteeism was highest on Saturday.

CHAPTER IX.—Effects of Introduction of Wage Incentives

During the war there was considerable agitation for a more widespread use of wage incentives as a means of increasing output. Such schemes could effect such results only when the pace of operations was controlled by the worker either in whole or in part. As pointed out in connection with individual case studies, when the pace was controlled entirely or primarily by the machine, then output tended to increase proportionately with increases in hours, because nonproductive time—getting ready, cleaning up, etc.—was spread over a longer workday, and offset the lower efficiencies of workers.

To increase output by inducing workers to speed up requires two basic conditions: (1) that the original pace, without the use of the incentive, is moderate or slow and can be speeded up, and (2) that the work is such that a faster pace can be maintained over the schedule of hours to be worked, so that it will not be vitiated by a gradual or sharp dropping off in efficiency or a sharp rise in absenteeism.

The most graphic demonstration of the effect of the introduction of a wage incentive system is provided by case studies 1 to 4. These four groups of men worked in a nonferrous-metal foundry in which work was both hot and heavy. Working conditions were noisy, smoky, and quite hazardous. All of the workers studied were males, and about 60 percent of them were Negroes, many of whom had developed into highly skilled operators through years of service with the company.

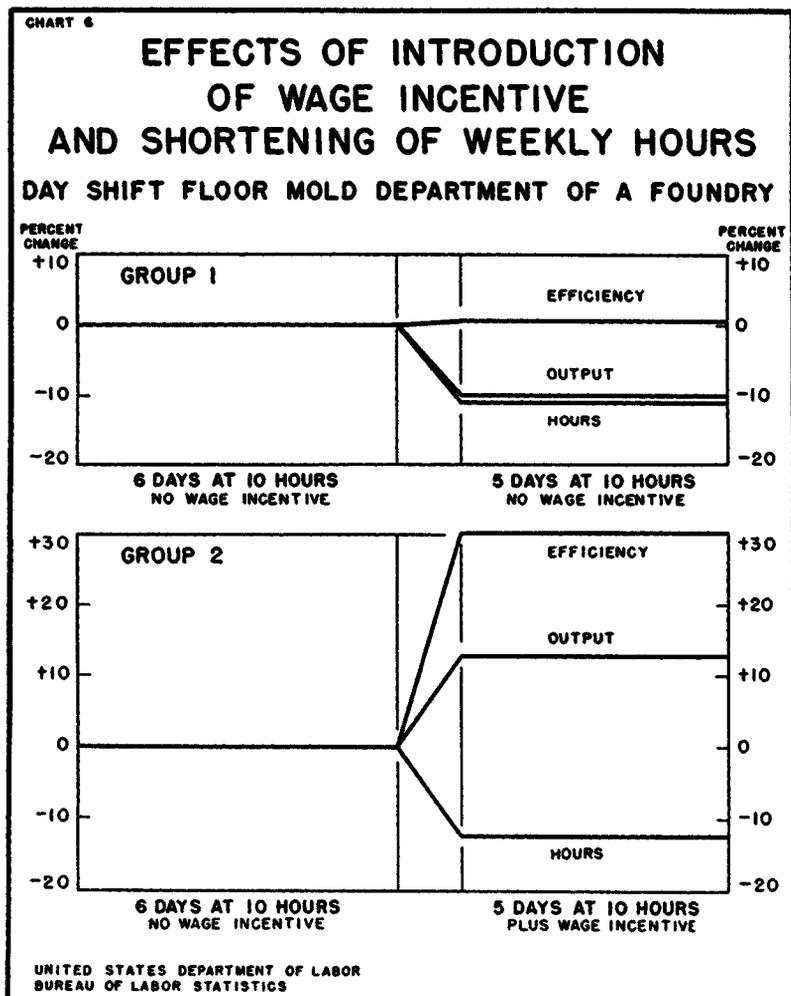
The records of about 200 men were studied. These men were classed into 3 groups, which differed in wage incentives and weekly hours. Group 1 included about 45 men on the floor-mold-department day shift. Although weekly hours were reduced by the dropping of Saturday work, the men did not go on piecework, but continued at day rates. Group 2 included two subordinate groups consisting of (a) about 80-90 selected men in 13 crews on the day shift of the floor-mold department, who worked at time rates until November 1942, when they went on piecework simultaneously with shortening the workweek, and (b) a group of about 15 men on the night shift of the squeezer department, whose changes in weekly hours and methods of wage payment were the same as those for the selected men on the floor-mold day shift. Group 3 included about 35 selected men on the day shift in the squeezer department who went on piecework in November 1942, but whose scheduled weekly hours remained essentially unchanged—about 58 per week.

Group 1 therefore illustrates the performance of a group of men who remained on day work throughout, without any wage incentive, but experienced a reduction in weekly hours. Group 2 illustrates the performance of men who experienced both a change in method of wage payment and a change in weekly hours. Group 3 illustrates the performance of men who had a change to a wage incentive but no change in scheduled weekly hours.

Findings of Study

1. Without the stimulus of an incentive wage, a reduction in average weekly hours from about 60 to about 53 resulted in no appreciable change in hourly efficiency and, consequently, brought about a proportionate reduction in total output.

As already indicated, this finding results from an analysis of the performance of a group of about 45 men in the floor-mold department. For a number of reasons, principally because records were not so adequate as for the men on piecework, it was not possible to develop for this group the same production yardstick as for the selected group. A fairly reliable though rougher



method of comparison was obtained by computing an average number of man-hours per casting, even though the types of castings varied throughout the entire period studied. The assumption that the differences in castings

would average out during the two levels of hours used for comparison was justified by the fact that the plant remained at essentially the same type of production throughout the period.

As is apparent from table 19, a reduction in weekly hours of nearly 11 percent resulted in a reduction in output of 10 percent. The difference of nearly 1 percent is attributable to the fact that efficiency increased slightly, by about 0.7 percent. This increase may have been the result of the elimination of Saturday work, or the contagious effect of the faster pace set by the men on piecework, or both. In any case, it was practically negligible in its effect on total output.

TABLE 19.—Comparative performances on foundry work at various weekly hours

Period	Average weekly hours	Scheduled days per week	Efficiency rate	Indexes of —			Incentives
				Average weekly hours	Efficiency (output per man-hour)	Total output	
<i>Floor-mold department</i>							
Nonselected men:							
2/42-10/42 (exclusive of July-September).....	59.7	6	100.2	100.0	100.0	100.0	None
11/42-1/43 (transition period).....	53.7	5 +	94.3	90.0	94.1	83.5	Do.
2/43-5/43.....	53.3	5 +	100.9	89.2	100.7	90.1	Do.
Selected men:							
1/42-10/42 (exclusive of July-September).....	59.7	6	89.8	100.0	100.0	100.0	Do.
11/42-1/43 (transition period).....	57.1	5 +	100.1	95.6	111.5	110.4	Piecework
2/43-5/43.....	52.4	5	117.0	87.8	130.3	112.7	Do.
<i>Squeezer department</i>							
Selected men, day:							
1/42-11/42 (exclusive of July-September).....	58.4	6	96.3	100.0	100.0	100.0	None
12/42-5/43.....	55.3	6—	101.9	94.7	105.8	102.7	Piecework
Selected men, night:							
1/42-11/42 (exclusive of July and August).....	58.2	6	97.0	100.0	100.0	100.0	None
12/42-1/43 (transition period).....	55.9	5 +	100.3	96.2	103.3	110.5	Piecework
2/43-5/43.....	50.4	5	108.0	86.8	111.2	103.3	Do.

The fact that average weekly hours fell only to about 53 (instead of about 50), after the dropping of Saturday work, was due to the fact that the men remained at the end of each day to complete the molds already started.

2. A sizable reduction in weekly hours because of the elimination of Saturday work, coupled with the introduction of the incentive wage, resulted (a) in a sharp increase in hourly efficiency and (b) in a total-output level higher than that experienced at the longer weekly hours.

Both the day shift in the floor-mold department and the night shift in the squeezer department illustrate this point.

The floor-mold group consisted of 80 to 90 men. Because these men were on piecework, it was possible to compute an adequate measure of efficiency for them, both for the period during which they worked at piece rates as well as for the preceding period at day work. In judging the performance of this group, it is pertinent to bear in mind that these men represented the more experienced group on the day shift, and that they were put on piece rates for precisely that reason.

If the performance level during the 60-hour week is taken as a base, the reduction of weekly hours of about 12 percent finally resulted in an increase of efficiency of 30 percent and in total output of nearly 13 percent. In other words, even though the men did not work on Saturday, they produced 13 percent more during the shorter week.

The performance of the 15 men on the night shift in the squeezer shop was less spectacular, but still in the same direction. By dropping Saturday work, average weekly hours were reduced from 58 to about 50, or about 13 percent. Efficiency went up 11 percent, however, with the result that total output increased by more than 3 percent. As in the case of the floor-mold day-shift men at piecework, the total output of the squeezer-shop night-shift men was higher during the shorter workweek than it had been during the longer workweek.

The difference in the relative performances of the day-shift and night-shift men discussed here may be explained by the fact that the men on the day shift had longer seniority and consequently represented the "older hands" or better-skill group. The day shift also had the advantage of more supervision and more "long-run jobs." The night shift cleaned up orders started by the day shift and consequently could not maintain so steady a production stride.

It is also likely that the night men were not able to put forth as much sustained effort because of their habit of sleeping upon their return from work and of being up and around for several hours before going to work. The day-shift men, on the other hand, had their leisure hours after the day's work was over.

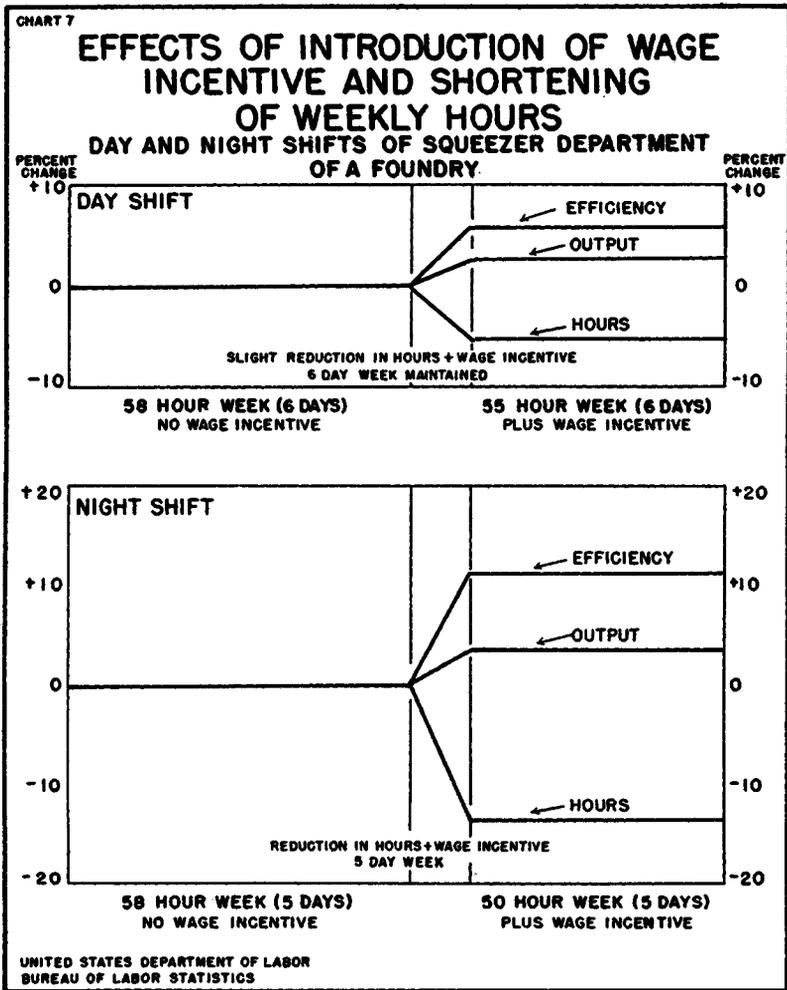
3. The introduction of incentive wages, but with the longer workweek essentially maintained, resulted in a slight increase in efficiency and a small increase in total output.

As chart 7 indicates, average weekly hours for the approximately 35 men studied on the squeezer department's day shift actually were reduced from about 58 to 55. The reasons for the apparent 5-percent reduction were that some of the men did not work on Saturday, and that occasionally the entire group worked only 6 or 6½ hours on Saturday instead of the customary 8. As the crews which did not work the sixth day kept changing—apparently because of some system of rotation—the group had to be studied as a whole.

For all practical purposes, however, scheduled hours may be considered as having remained essentially unchanged. The changes in efficiency and output, although influenced to some extent by periodic stoppages on Saturday for a small part of the group, were due primarily to the introduction of the incentive wage. Efficiency went up by nearly 6 percent, and total output by nearly 3 percent.

The introduction of piecework caused the men to speed up, but the increase in pace was not nearly so great as when the incentive system was coupled with a shorter workweek.

4. With the introduction of an incentive system, the reduction in weekly hours caused by the dropping of Saturday work is estimated to have resulted



in an increase in efficiency of 24 percent and in output of 10 percent above the levels which prevailed at the longer hours.

This conclusion follows from the comparison of the day shifts of the floor-mold and squeezer-shop departments. Both groups went on piecework at the same time. Both were composed of experienced men who had been with the company for some years. The principal difference between them was that the men in the floor-mold department stopped working on Saturday, while the men in the squeezer shop continued. Although the methods of preparing the molds differed, working conditions for the two groups were identical. Had Saturday work been stopped for the squeezer-department men, there was no reason why their efficiency could not have spurted like that of the floor-mold men.

The net effect of the reduction in hours is found by obtaining the differences between the performances of the two groups. The introduction of piecework resulted in an increase in efficiency of the squeezer-department men

of about 6 percent. Assuming that this is a fair measure of the effect of the incentive wage in itself, the difference between this rate of increase and the 30-percent rate for the floor-mold men leaves an increase of 24 percent as the net result of the reduction in hours. Similarly, the difference between the increases in output of about 13 percent and 3 percent (i. e., 10 percent) measures the increase in output which may be attributed primarily to the effect of the shortened hours.

Although the shorter hours appear to have been the more decisive of the two factors involved, it is clear that there would have been no increase at all in the absence of the incentive-wage system.

Absenteeism as Related to Hours and Earnings

The records of the foundry did not permit a detailed, or even a comprehensive, analysis of the absenteeism problem. It was possible, however, to gauge for each of the three shifts studied the relative performance under the different patterns of working hours and wage determination.

By assuming that the maximum number of workers on the pay roll during any one day of a week represented the total crew supposed to be at work on each working day of the week, it was possible to obtain a measure of absenteeism by deducting from this figure the number of men who actually worked each day. Although this is not a highly accurate measure of absenteeism, it appeared to be the best possible and did reveal significant results for the periods analyzed.

The day shift in the floor-mold department experienced a sharp drop in absenteeism when hours were reduced by eliminating Saturday work. Absences decreased by more than a third from an index of 100 during the period of long hours to about 61. During the remainder of the period at shorter hours, but with more than half of the department on piecework, absenteeism increased to an index of about 79.

The same general trend, but with greater differences, appeared in the averages for the night shift in the squeezer department. There, as was the case for a part of the day shift in the floor-mold department, hours were reduced and the entire crew went on piecework. The first result of the change was a drop in absenteeism to half of what it had been at the level of longer hours. Thereafter, however, the index rose to 110, or 10 percent above the level for the longer workweek.

The day shift of the squeezer shop, it will be recalled, stayed at essentially the same hours, but went on piecework. After the introduction of piecework, absenteeism was higher by 25 percent.

The data suggest some interesting conclusions. The first result of the shortened workweek was a decided drop in absenteeism. The subsequent rise in absenteeism appears to be connected with increased earnings. This conclusion gains credence from the fact that the absenteeism level during the last period studied was highest for the day shift of the squeezer shop (which underwent no change in hours) and was higher for the squeezer-shop night shift (with all men on piecework) than for the entire day shift of the floor-mold

department, with only about two-thirds of the crew on piecework. (Unfortunately it was not possible to obtain a separate measure of absenteeism for the two groups on the day shift of this last department.) The data indicate that—

(1) Absenteeism increased very appreciably with the introduction of piecework and the retention of a long workweek.

(2) The effect of increased earnings was to increase absenteeism even after hours had been shortened.

The fact that increased earnings were a material inducement toward absenteeism was freely admitted by the workers. In one instance, for example, a worker commented that he had had several "very good weeks," and he thought he and his "old lady" would take a "little trip for most of next week."

Absenteeism was very high on Saturday during the 6-day week, and it was also high on Monday.

The main reason for the high absenteeism on Saturday appears to have been the fact that pay day was on Friday. Attempts by management to shift pay day to Saturday were resisted by the union, which insisted that the men be given an opportunity to cash their checks, which was difficult to do after working hours. To meet this objection, management invited into the plant a check-cashing service on Friday. This service cost 10 cents per check, but made it possible for the workers to cash their checks without leaving the plant. The experiment met with so little response from the workers that it was given up after a few weeks.

Effects of Changes in Hours on Plants With and Without Wage-Incentive Systems

The preceding study was told in considerable detail because it represented an instance in which it was possible to gauge the difference caused by the introduction of the incentive system itself. It is also pertinent to note differences in the relative performances of worker groups under various types of incentive systems, or under straight day work.

The experiences of 18 worker groups are shown in table 19. These cases were selected because they involved no extraneous factors that might leave the measures of performance open to question. For example, the comparisons shown are, for each study, either entirely within or entirely without the war period. They involve no problems of Sunday work, reductions in force, managerial changes to improve the flow of production, etc.

In the first three of these studies, the men worked at straight day rates, and without any kind of wage incentive. In each case, output changed directly in proportion to the change in hours, indicating that the same pace was maintained regardless of hours. As output for men at piecework or other forms of direct incentives usually increased proportionately less than hours when they were raised substantially, the conclusion seems warranted that the slower pace which characterized the longer schedule for the men at straight

day rates also prevailed during the shorter schedule. In short, operators who stood to gain nothing by working fast would not do so. Consequently, it was possible to increase hours—within reasonable limits—without impairing output. An hour's output resulted for each additional hour worked.

All of the cases shown under group incentive systems involved moderately heavy work. In only one case (9) was the level of efficiency—which reflects average hourly output per hour worked—as good at the higher level of hours as it had been at the lower level. The fast pace maintained during the shorter work schedule could not be maintained during the longer hours. In some instances, the drop in efficiency was drastic in spite of the fact that the workers were concerned with the production of shells (studies 20 and 21). Under group incentive systems, however, the pace of the less efficient workers becomes the limiting factor.

Ten case studies in table 20 reflect experience under individual incentive systems, either piecework or bonus systems. As a rule, all output in excess of a set standard was paid for in full.

TABLE 20.—*Relation of performance at various schedules of hours and incentive systems*

Case study and type of operations	Incentive system	Change in scheduled weekly hours —		Percent change in —		
		From	To	Hours	Efficiency	Output
1 — Heavy foundry work.....	None	60	50	-16.7	+0.7	-17.0
22 — Mod. heavy finishing of steel castings.....	do	48	55½	+15.6	+2	+13.2
23 — Mod. heavy molding of steel castings.....	do	48	54	+12.5	+1.1	+13.5
9 — Moderately heavy welding.....	Group	45	58	+28.9		+25.9
18 — Mod. heavy machining & assembling.....	do	58	48	-17.2	+15.1	-7.9
20 — Mod. heavy machining of shells.....	do	40	60	+50.0	-22.3	+5.5
21 — Mod. heavy machining of shells.....	do	40	66	+65.0	-20.6	+9.0
39 — Mod. heavy shipping operations.....	do	48	54	+12.5	-3.7	+9.9
7 — Moderately heavy metal machining.....	Individual	40	50	+25.0	-4.0	+23.5
35 — Light metal machining.....	do	54	61½	+10.2	-4.3	+4.2
45 — Light shipping of tobacco leaves.....	do	48	40	-16.7	+19.3	— .6
58 — Light hot finishing operations.....	do	48	40	-16.7	+3.7	-11.4
67 — Moderately heavy metal machining.....	do	40	55	+37.5	+5.6	+43.6
69 — Moderately heavy — rubber industry.....	do	40	48	+20.0	+3.5	+22.8
70 — Moderately heavy — rubber industry.....	do	40	48	+20.0	+1.6	+21.4
71 — Moderately heavy — rubber industry.....	do	40	48	+20.0	+1.9	+20.8
72 — Light operations — rubber industry.....	do	40	48	+20.0	+8	+20.2
74 — Moderately heavy — rubber industry.....	do	40	48	+20.0	+3.9	+22.8

In case study 7 in which the operating pace was controlled primarily by machines, the change in hours was matched by a nearly equal increase in total output. Where the speed of machining and assembling operations rested primarily with the operators, as in case study 35, efficiency could not be maintained during the longer hours. The pace slackened.

The strippers of tobacco leaves (study 45) tried to earn as much in 40 hours as they formerly had in 48, and just about succeeded. To do it, however, they had to speed up their pace during the shorter schedule by nearly 20 percent.

The women in case study 58 could not do it. Even though they worked faster during the 40-hour schedule, they could make up only about one-third of the earnings they had lost through the reduction of 8 hours in the work-week.

Studies 67, 69, 70, 71, 72, and 74 show an opposite result: in each case the lengthening of the workweek, usually from 40 to 48 hours, resulted in a slightly better efficiency during the longer hours. Observations of the workers during the longer schedules, however, indicated that the pace of these operators was moderate, and was considerably slower than the pace observed in other operations in which the physical demands of the job upon the workers were similar. It follows that the pace under the shorter schedule could have been faster. Regardless of the reason for the speed of the work pace, it is obvious that individual incentive systems do not ipso facto mean that operators work at their optimum efficiency. Where the pace is moderate, therefore, output can be increased in direct proportion to the increase in hours, even though these are raised to 55, and perhaps to 60. This appears to be particularly true of operations which allow the operator considerable initiative and are not strictly routinized and monotonous. Although it was not possible to study such situations, instances were found in which the production of tool makers held up well under 60- and 70-hour weeks.

Limitations on initiative—Some of the studies cited seem to suggest deliberate production pacing by operators; management at times reached the same result by limiting the amounts workers could earn. In case study 8, workers definitely held their earnings to less than \$1 an hour under several of the schedules studied because they knew that their piece rates would be cut if they exceeded this amount.

Similarly, the workers in study 19 held down their earnings—and output—because of a 30-percent ceiling. In another survey of men producing shells—not included here for various reasons—a 25-percent ceiling held production in each of a great variety of operations to a fixed level. The records showed exactly the same number of units produced, day after day, month after month.

Just what induced management to impose such ceilings, it was sometimes hard to see. With quality inspection to guard against defective production, it would seem that the higher the output, the lower the over-all unit cost. There is, of course, the danger that haste may increase spoilage which cannot be reclaimed. But that fact, one may presume, ought to be established through actual experience rather than by managerial fiat—as it was in the three cases cited.

CHAPTER X.—Prewar and Postwar Performances

The charge has frequently been made that workers performed less efficiently after the war than before or during the war. One might expect that the fact that we were in the war would have a perceptible influence on the will to work. A reading of the case histories will reveal case after case in which—for the same or even higher hours—worker performance improved during the war. In many of these cases, management explained this as the direct result of our participation in the war. Millions of workers had sons or other relatives in the war and were determined to do their part.

A let-down after the end of the war might well have been expected. The shot-in-the-arm which the war supplied was gone. Furthermore, many plants cut back on their operations and reduced not only hours, but the number of workers as well. Being human, workers could not be expected to continue to work at high speeds if that meant working themselves or others out of jobs.

Table 21 presents comparisons between efficiencies at similar prewar, war, and postwar schedules. The last two cases shown on the table, 78 and 29, illustrate the point just made about the effects of reductions in force. In both cases, the cut-back in hours was accompanied by decreases in efficiency because of the simultaneous sharp reduction in force.

TABLE 21.—Comparison of efficiencies during comparable prewar, war, and postwar schedules

Case study	Weekly hours —			Efficiency index —			Percent gain in efficiency —		
	Prewar	War	Postwar	Prewar	War	Postwar	War over	Postwar over —	
							prewar	War	Prewar
6.....	50	50	.....	100.0	108.0	.....	8.0	.....	.....
8.....	48	55 1/2	.....	101.0	105.0	.....	4.0	.....	.....
26.....	37 1/2	54	.....	100.0	116.9	.....	16.9	.....	.....
27.....	51 1/2	54	.....	100.0	116.3	.....	16.3	.....	.....
45.....	.....	48	45	.....	100.0	112.9	.....	12.9	.....
46.....	.....	45	40	.....	100.0	104.9	.....	4.9	.....
47.....	.....	44 1/2	40	.....	100.0	105.5	.....	5.5	.....
48.....	.....	44	40	.....	100.0	103.6	.....	3.6	.....
49.....	40	47 1/2	40	100.0	117.8	119.3	17.8	1.3	19.3
51.....	40	48	.....	100.0	112.4	.....	12.4	.....	.....
50.....	.....	48	40	.....	100.0	112.0	.....	12.0	.....
60.....	.....	48	40	.....	100.0	106.9	.....	6.9	.....
61.....	.....	48	40	.....	100.0	105.1	.....	5.1	.....
62.....	.....	48	40	.....	100.0	101.5	.....	1.5	.....
63.....	.....	48	40	.....	100.0	107.9	.....	7.9	.....
64.....	40	50	45	100.0	113.0	114.8	13.0	1.6	14.8
65.....	.....	50	48	.....	118.6	122.4	.....	3.2	.....
66.....	.....	45	45	.....	100.0	101.3	.....	1.3	.....
67.....	40	55	40-48	100.0	111.1	110.1	11.1	-1.9	10.1
68.....	54	60	.....	98.3	99.0	.....	.7	.....	.....
69.....	40	48	40	100.0	121.1	116.3	21.1	-4.0	16.3
70.....	40	48	40	100.0	123.0	118.0	23.0	-4.1	18.0
71.....	40	48	40	100.0	129.0	117.6	29.0	-8.8	17.6
72.....	40	54	40	100.0	110.5	113.5	10.5	2.7	13.5
73.....	40	48	40-48	100.0	107.3	106.9	7.3	-4	6.9
74.....	48	57	48	103.9	117.1	118.6	12.7	1.3	14.1
78.....	.....	48	35	.....	100.0	96.7	.....	-3.3	.....
29.....	.....	58	50	.....	100.0	94.6	.....	-5.4	.....

The other studies listed on the table demonstrate two points: (1) that wartime efficiencies were generally higher than prewar efficiencies in spite

of longer hours; and (2) that, where comparison was possible, the efficiency during the postwar week (after an adjustment period) was substantially better than it had been during the same work schedules during the prewar period studied.

Frequently the higher efficiency during the war was offset in part, and sometimes entirely, by increased absenteeism during the longer work schedules. The data indicate very definitely, however, that men and women worked harder, particularly when stimulated by wage incentives. The efficiency indices during the war period were superior to those of the prewar period in every instance in which comparison was possible.

In some cases, the better wartime performance failed to hold up after the war ended. In spite of reductions in hours, the efficiency indices in cases 67, 69, 70, and 73 decreased from the wartime levels. In most instances, however, the reverse was true. In 15 cases out of 20—if the two reduction-in-force examples are excluded (78 and 29)—postwar performance was superior to war performance. The reasons for this, undoubtedly, were (1) that it was possible to maintain a faster pace because of the shorter hours, and (2) that workers wanted to work harder so as to make up some of the pay they lost when hours were curtailed.

Of still greater interest, however, are the postwar—prewar comparisons. In nine case studies it was possible to compare the efficiency during a postwar schedule with an identical prewar schedule. The postwar performance was always better, and the improvement in efficiency was 10 percent or better in every instance but one (study 73), for which it was 6.9 percent. Generally, the increase in average hourly output was about 15 or 16 percent, and went as high as 19.3 percent (study 49).

No data are available to indicate the extent to which these results reflect general industry experience. They are presented here as findings based on careful analyses of industry records. They were not selected to prove any particular point. It is significant, however, that they all point in the same direction.

CHAPTER XI.—Methods

A.—Collection of Data

As indicated at the outset, one of the most difficult features of this survey was to find plants with the changes in hourly schedules and type of operations and records that would lend themselves to the basic purpose of the study.

Having located a cooperative plant in which at least two substantially different levels of hours had been worked over a period of not less than 6 months each, and having determined that the available records could be used, the next step was to select the group of workers to be studied. That frequently proved to be a stumbling block because of the great turn-over during the war.

Care was taken to select for study a group of workers as homogeneous as possible. New and inexperienced workers were excluded. Where the workers in the plant or department—depending on which was being studied—did not have the same daily and weekly hourly schedules, only those workers were selected for study who could be grouped into similar patterns of hours. Similarly, data were obtained separately for shifts, and differentiated by sex.

The period to be covered under any one schedule was another problem. Obviously, it had to be long enough to permit the effect of the schedules being studied to emerge clearly. It was apparent after the first two or three studies—for which, fortunately, continuous data were available over a period of years—that a shift to a new schedule did not result in an immediate change to readily ascertainable new patterns of efficiency, absenteeism, and output. It was found, for example, in case study 1, that it took about 4 months for the patterns of the 50-hour week to emerge clearly after a change from a 60-hour schedule. Similarly, in case study 7, the efficiency of the 40-hour week was maintained for 3 months after weekly hours had been raised to 50, and then decreased sharply to a lower level. Then, as hours were increased still further to 58, coincident with our entry into the war, efficiency not only was maintained, but actually increased. This new level held for nearly 6 months. At that point, however, fatigue finally forced a drop in efficiency to a level below that which had characterized the 50-hour week.

In this case, the work was primarily machine-paced and workers were afforded some rest—at least a partial relaxation of effort—while the machines performed. It was expected that in operator-paced work done at considerable speed, the transitional periods would not be nearly as long. But it was clearly recognized that the selection of any 1-, 2-, or 3-month period, subject to the possible vagaries of transition, would not be satisfactory. The effort, therefore, was to cover a year's period under each schedule. The wisdom of this decision was apparent in the analysis of the data obtained in subsequent studies, when considerable deviation from the nominal work schedules was found for considerable numbers of workers.

It was believed, furthermore, that it was essential to cover longer periods where the groups of workers were small so as to eliminate the effect of erratic individual experiences. Where the group of workers was large, it was believed safe to cover shorter periods of time.

In nearly every study, the group of workers studied consisted of selected individuals. As already indicated, these were selected for comparability of operations under the schedules to be compared, consistency in adhering to these schedules, work experience, and similar factors. The findings for the group actually represent the composite experiences of individuals for whom data were obtained. In the few instances in which only group data were available, the data were used only after it had been ascertained that the composition of the group had either been constant, or that turn-over had been small and that operators who had left had been replaced by others of approximately the same degree of experience. (For example, case study 8.)

Minor changes in hours were excluded from the survey except as they were incidental to more substantial changes. For example, a plant was not studied if hours changed from 52 to 54 per week. It was studied if the change involved shifting from an 8-hour day to a 9- or 10-hour day, or if weekly hours were increased by at least 5 or 6. This might be accomplished either by increasing daily hours, or adding an additional workday, or both.

The periods selected represented either increases in hours or, late in the war or after it had ended, decreases in hours. In a number of plants it was possible to trace the data back so as to obtain comparable data for prewar, war, and postwar schedules, thus spanning a period of 4 or 5 years.

As far as possible, periods were selected to cover a year or more under each schedule. Where the various schedules were in effect for a shorter period, care was taken to select the same months in the year so as to rule out the effects of temperature, holidays, and of such outside attractions as hunting and fishing seasons.

Data were obtained for each selected worker on hours worked, volume produced, time lost, and injuries. Turn-over could not be taken into account in most cases except as it applied to the entire staff of the plant or department. For the relatively small group of men or women that satisfactorily met the rather stringent requirements of the methods used for selection, turn-over data would have been rather meaningless.

After the statistical processing and analysis of the data, which was done by the Washington staff, a copy of the report and findings was sent to the management of each plant studied, in part to invite criticism or comments, and in part to appraise management of the results of the survey. In that way, the cooperation and assistance by management were at least partially repaid. (It may be added, parenthetically, that some of these findings were at complete variance with the opinions expressed by management during preliminary discussions.)

It should be added also that, in every instance, the data were selected and transcribed by members of the Bureau's staff and that the data are substantially comparable throughout the survey.

B.—Statistical Methods

Hourly schedules.—The data concerning scheduled hours consisted either of actual schedules, or data on hours or days worked, and hours or days absent for each worker. Where possible, data were gathered on a daily basis. Where this was not possible, weekly data were used.

In the analysis, the schedule for each workweek was determined by dividing the total of all days worked and lost by the number of workers so as to obtain a measure of the average hours actually scheduled. Weeks in which this average fell substantially below or substantially exceeded the nominal schedule were excluded. In checking back with the plant, it was found frequently that the variation was caused by a shortage of material or an attempt to break a temporary bottleneck in production. In any case, if the variation was more than about 2 hours, the data for the week were excluded from the analysis. Sometimes it was possible to rule out the data for individual workers if the analysis clearly indicated that their schedules for the particular week were considerably in excess or below the basic schedule for the group. Thus, for example, the performance of a man who worked 60 hours was excluded when the rest of the group worked 48 or 50 hours. If his performance during the next week fell markedly below his usual performance either in output or work attendance (reflecting the effects of the preceding week), the data for him for this next week were also excluded. In short, every attempt was made to make the findings as accurate as possible and to remove distorting factors.

The total hours worked by any one survey group was obtained by adding up the hours worked by the individuals of the group.

Absenteeism.—Absenteeism is defined as worktime lost because workers did not show up or stay on the job when they were scheduled to work. The absence could have been caused by illness of the worker or of some member of his family, by accident, or by any other personal reason. Scheduled vacations or time lost because of lay-offs, however, were not included because workers involved were not scheduled to be at work. Periods containing strikes were excluded.

The percentage of scheduled worktime lost was computed by the formula:

$$\text{Absenteeism rate} = \frac{\text{total employee-hours lost}}{\text{total employee-hours scheduled}}$$

Where absenteeism was reported in days, the days lost were converted to scheduled hours lost.

Obviously, the hours actually worked and the hours lost through absenteeism added up to 100 percent of total employee-hours scheduled to be worked.

Efficiency.—Efficiency is the average hourly output per hour actually worked. Hours lost through absenteeism were excluded in this computation. What was wanted was a measure of average performance under any one schedule of hours while operators were actually on the job.

The basic formula for efficiency was:

$$\text{Efficiency} = \frac{\text{total weekly output}}{\text{total hours actually worked}}$$

The methods to obtain this result varied considerably, however, because of the types of records available in the plants studied.

(a) Where no records of output was kept, but where piecework earnings were recorded by the plant, efficiency was measured by average hourly earnings. The base-period earnings were used as an index of 100, and variations in earnings were computed from this base.

Involved in this problem was the complication of overtime pay. This was resolved by increasing hours actually worked to the total hours which were paid. For example, if a man worked 48 hours and received 1½ pay for hours above 40, he actually was paid for 52 hours. In the computation of hours earned, his time was figured at 52 rather than 48 hours.

In a few instances, notably case study 8, the situation was complicated further by periodic increases in the basic hourly rates which were used to establish piece rates, and by a deliberate loosening of time standards, so as to increase the take-home pay of workers when wage increases were forbidden. The first of these adjustments was simple to make because the percentages of increase and the times they went into effect were definitely known. The second could be made only where the loosening of standards came at one time, or during a short interval during which all rates were restudied. But where the data indicated a gradual loosening of standards over a long period of time, the data could not be used.

This applied, incidentally, not only to piece rates but to all other measures of performance based on time standards rather than on actual number of units produced.

(b) When the actual number of units produced was reported, the problem was simple. The formula used was:

$$\text{Efficiency} = \frac{\text{total units produced}}{\text{total employee-hours worked}}$$

(c) Where time standards had been established, the basic data recorded both the hours actually worked by each individual and the total number of standard hours or minutes of production. A variety of systems were encountered, but basically the data were the same regardless of the degree to which workers were compensated for the time they saved from the standard time. In these cases, the formula used was:

$$\text{Efficiency} = \frac{\text{standard hours produced}}{\text{actual hours worked}}$$

(d) A variation of this formula was used when the number of unit hours produced were reported in relation to the number of hours of output called for by the standard. In this case the formula was:

$$\text{Efficiency} = \frac{\text{number of units produced}}{\text{standard number of units required for hours worked}}$$

(e) In a few instances, the company computed efficiencies by one of these methods (except (a)) for purposes of its own. Where such efficiencies were available, the computation of efficiency consisted simply of averaging these efficiencies for the selected workers over each schedule period.

Output.—Because of the variety of methods used to compute efficiency, a formula was developed for the output computation which could utilize the rates already computed for efficiency and absenteeism. Obviously, output is the composite result of average hourly output and the number of hours actually worked. The difference between hours scheduled to be worked and hours actually worked is the number of hours lost because of absenteeism. Following this line of reasoning, the output formula used was:

$$\text{Output} = \text{Scheduled hours} \times (100 \text{ percent} - \text{percent of time lost through absenteeism}) \times \text{efficiency}.$$

A brief example will indicate the practical application of the formula. Suppose efficiency, in relation to the selected base, was 95 percent, time lost through absenteeism was 10 percent, and scheduled hours were 54 per week. According to the formula, the index of output was:

$$\text{Output}_x = 54 \times .90 \times .95 = 46.17$$

Suppose that during the 40-hour week period used as a base for both changes in hours and efficiency, the efficiency index was 100 and absenteeism was 6 percent. Then, by formula—

$$\text{Output} = 40 \times .94 \times 1.00 = 37.60$$

Comparing the two schedules, we find that the increase in scheduled hours was $\frac{54 - 40}{40}$ or 35 percent. Similarly, the increase in

$$\text{output was } \frac{46.17 - 37.60}{37.60} \text{ or } 22.8 \text{ percent.}$$

The obvious conclusion is that an increase of 35 percent in scheduled hours (from 40 to 54) resulted in an output increase of 22.8 percent. Roughly, 2 hours of output—at the performance level at 40 hours—were gained for each 3 hours worked between 40 and 54.

Injuries.—In computing the frequency rate of work injuries, the standard formula was used:

$$\text{Frequency rate} = \frac{\text{number of injuries} \times 1,000,000}{\text{total number of exposure hours}}$$

This formula yields the average number of injuries per million employee-hours of exposure.

CASE STUDIES

1: *Workweek of 60 hours vs. one of 50 hours, no wage incentives; hot and heavy, man-paced floor-mold operations in a nonferrous metal foundry; men.*

Work was devoted entirely to the production of castings for airplane motors, superchargers, and similar materials essential to the war effort. After the hand-made molds were dried and hardened through a baking process, they were sent to the floor-mold department, which produced the heavy castings. Work was generally done in crews consisting of six men each.

The crew was led and the pace set by a finisher or molder who assembled the cores or supervised the assembly of the larger molds, inspected and repaired completed molds, and generally was responsible for the operation of his crew. The metal was then poured. The "shake-out" and "knock-out" men moved the cooled castings (still in the molds) by crane to the shake-out section where the air vibrator loosened the sand sufficiently to allow each casting to be freed. The knock-out man's particular task was to guard the casting against damage during this process.

The work was heavy, hot, smoky, and entirely man-paced.

Working conditions.—The noise in the foundry was so great that frequently the warning signals of cranes or trucks could not be heard by the workers. The volume of fumes emitted from the baking ovens and from the exhaust of plant trucks was considerable. The chemically treated sand, when baked into molds, gave off a searing smoke which made the eyes smart and parched the throat. A large amount of dust was created by sand. The temperature was always high in the vicinity of some operations, particularly so during the summer months. Air vents were insufficient to cope with the amount of dust, fumes, and heat existing in the foundry. Lighting was exceptionally good. The shop lacked showers and lunchroom facilities. Washroom facilities met only minimum requirements. On the whole, working conditions were noisy, smoky, and quite hazardous.

An average of 45 minutes a day was spent by the men in waiting for the metal to be poured.

Industrial relations.—During the nearly 1½ years covered by the survey, the relations between labor and management were bad. This resulted largely from the company's policy of paying wage rates somewhat lower than prevailed in the area. Contemplated raises were prevented by the wage freeze in 1942. A majority of the operators in the plant were Negroes.

Wage incentives.—Workers received straight hourly pay during the period studied. There were no wage incentives. The survey covered the performance of a group of about 45 men on wartime schedules of 60 hours per week (6 days at 10 hours) and subsequently one of 50 hours (with some overtime)

during which Saturday work was eliminated. Under each schedule daily hours remained at 10. The workers studied belonged to a nonrotating day shift.

The period covered by the survey extended from February 1942 through May 1943.

Safety.—Working conditions were hazardous, and not much attention was paid to safety. Housekeeping was bad, and there was a great deal of congestion and crowding. Many of the operators did not wear adequate protective clothing and goggles, and there was little attempt to make them comply with basic safety regulations.

FINDINGS OF STUDY

Efficiency remained practically unchanged when workdays were reduced from 6 a week to 5, but with the retention of the 10-hour day. The change in weekly hours brought about an increase in average hourly output of only 0.7 percent.

The pace of the workers—on straight day work and without a wage incentive—remained essentially the same under both weekly schedules.

Absenteeism could not be measured for the group of workers represented in this case study. The data did not permit a factual determination of who was scheduled to work on specific days. By making some assumptions, however, it was possible to arrive at approximations of time loss for the entire department, of which the group represented here composed about one-third. The rates are undoubtedly understatements in view of the nature of the work, the type of workers involved, and the difficulty of getting good work attendance on Saturday and Monday.

The relative estimates indicate that the decrease in workdays from 6 to 5 decreased time lost from work slightly, from a level of about 3.8 percent to one of 3 percent.

Output varied almost directly with the change in hours.

2: *Workweek of 60 hours with no wage incentives vs. one of 50 hours with individual wage incentives; floor-mold operations in a nonferrous metal foundry; men.*

The men belonged to the same shift of floor-mold workers as those discussed in the preceding case study. Working conditions were the same as those already discussed.

The group studied consisted of about 80–90 men in 13 crews on the day shift of the floor-mold department. During the scheduled 60-hour workweek (6 days at 10 hours) these men were on straight hourly rates. But when hours were reduced to 50 per week by dropping Saturday work, a piecework system was introduced simultaneously.

FINDINGS OF STUDY

Efficiency.—Elimination of Saturday work, coupled with the introduction of the incentive wage, resulted in a sharp increase of 30 percent in hourly efficiency. Total output was 13 percent higher than it had been during the

longer workweek. Inasmuch as the remainder of the day shift continued to work without a wage incentive, the marked difference in performance between the men covered in this and the preceding case studies may be attributed largely to the introduction of the wage incentive. It is questionable, however, whether the change would have been as marked had the hourly schedule remained at 60 per week. (See case study 4.)

Absenteeism, as indicated in case study 1, was difficult to measure. The data indicate, however, that the immediate effect of the curtailing of the workweek was a sharp drop in unauthorized absences from work. This was an expected result, as attendance on Saturday had been poor at the longer work schedule.

After a transitional period of several months, however, absences increased again, although remaining below the level that had prevailed during the 6-day schedule. Management believed that this rise in absenteeism was directly related to the greater take-home pay of the men on piecework. The explanation advanced was that many of the men had recently moved up from southern states and were earning far in excess of what their customary standard of living required.

3: *Workweek of 58 hours, night shift, with no wage incentives vs. one of 50 hours, with individual wage incentives; hot and medium-heavy, man-paced, squeezer-mold operations in a nonferrous metal foundry; men.*

This is the third group of men studied in the foundry described in case study 1. This department differed from the floor-mold department discussed in the two preceding cases in two important respects: (1) The castings were not as heavy; (2) the smaller molds in the squeezer department were hardened through compression ("squeezed") and were not baked. Working conditions were essentially the same as those described in case study 1.

As the moldings were smaller, a crew of two men usually performed all the necessary operations.

The group of 15 men studied were on the night shift during the entire period surveyed, from January 1942 through May 1943. During the 58-hour workweek, consisting of 5 days at 10 hours and Saturdays at 8, these men worked on straight hourly rates. With the elimination of Saturday work and a consequent reduction in weekly hours to 50, they went on piecework.

FINDINGS OF STUDY

Efficiency.—The reduction in weekly hours from 58 to 50, by the elimination of the 8-hour Saturday, together with the introduction of the wage incentive, resulted in an increase of 11 percent in average hourly output. The total output level during the shorter workweek was about 3.3 percent higher than that experienced at the longer weekly hours. These findings parallel those of the preceding case study, although the increases were not as marked.

Absenteeism.—As in case studies 1 and 2, the measure of absenteeism indicates only relative work attendance during the periods surveyed, and not an actual measure of time lost. The available data indicate, however, that immediately after the shortening of the workweek and the introduction of piecework, absenteeism was cut to half. After several months at the shorter schedule, but with higher earnings, absenteeism increased steadily and finally stabilized at a level somewhat higher than the one which had prevailed during the 6-day week. The explanation advanced by management has been stated in case study 2.

4: *Workweek of 58 hours, day shift, with no wage incentives vs. one of 55 hours, with individual wage incentives; squeezer-mold operations in a nonferrous metal foundry; men.*

This is the last group of men studied in the foundry described in case study 1. The 35 studied were on the day shift and belonged to the same squeezer department discussed in case study 3, which was concerned with night-shift workers.

Although these men shifted to a wage-incentive system, their working hours remained nearly unchanged. The change was from 58 hours per week to 55, and was accomplished by shortening Saturday from 8 hours to 5.

FINDINGS OF STUDY

Efficiency.—The introduction of the wage incentive, but with the longer workweek essentially maintained, resulted in a slight increase in efficiency and a small increase in total output. Average hourly output rose by about 6 percent and total output by nearly 3 percent.

Because the reduction in weekly hours had been slight, this change appears to be attributable primarily to the introduction of the wage incentive.

Absenteeism.—With the introduction of piecework, the rate of absenteeism increased from 4.8 percent at 58 hours to 6 percent at 55 hours.

5: *Prewar workweek of 52 hours vs. war workweeks of 58 and 52 hours, day shift, individual wage incentives; hot and heavy, man-paced upset-forge operations; men.*

The shop produced axles, shafts, gear blanks, small forgings, and during the war, shells. The operation consisted of heating one end of a steel bar and forging it by means of dies. The hot steel was virtually squeezed into shape by the horizontal motion of one half of the die, set in the forge, against the stationary half of the die. The heater kept the heating oven loaded while the hooker held the bar and the operator guided and turned the bar in the several slots of dies set in the forge. The process was completed by sawing off the forging from the bar, striking a stencil number on it, and putting it into a bin.

Working conditions.—Completed forgings weighed up to 250 pounds. The bar stock, 10 to 18 feet long, from which the forgings were made, was, of course, much heavier. The furnace, the forge, and the bins of finished forgings formed a semicircle, and together they radiated a great deal of heat. Temperatures frequently exceeded 100 degrees and reached 120 degrees in the summer. There was considerable dust and smoke, and the constant hazard from flying sparks. Lighting was fair, and there was adequate work space for the operations involved. Washing facilities were excellent.

Waiting time (i. e., heating cold bars or reheating hot bars until they were nearly white in color) between heats was considerable and ranged from 10 to 25 minutes. When not busy changing dies, the men used the waiting time to rest or to eat. There was no set lunch period. The average amount of waiting time in a 10-hour day came to about 1½ hours.

The work force.—The selected group of operating crews on the day shift represented 48 men. The shift did not rotate. The average crew was composed of operator, heater, hooker, and helper. Turn-over was small, as most workers were old-timers in the company, and wage rates and earnings were relatively high.

Wage incentives.—The forge crews were on a piecework system with a guaranteed hourly minimum rate. Set-up and down-time was paid for at rates 5 and 10 cents less per hour respectively than the base rate.

The plant's safety record was very good. The wearing of goggles and safety shoes was compulsory. First-aid room facilities included special equipment to treat eye injuries caused by flying sparks, excessive light, steel particles, and dust.

Hourly schedules.—Up to December 1941, the nominal workweek consisted of 52 hours, with 5 days at 9 hours and Saturday at 7. With the beginning of the war, the workweek was increased to 58 hours by raising daily hours to 10 and Saturday hours to 8. In September 1942, the department returned to the 52-hour schedule worked before the war.

FINDINGS OF STUDY

Efficiency.—When weekly hours were raised from 52 to 58 at the beginning of the war, a period of 5 months elapsed before performance stabilized under the longer hours. During the early months of the war, efficiencies actually rose above the prewar level, even though weekly hours had been lengthened. After the transitional period, efficiency leveled off at a point 3 percent below that of the former 52-hour week, while absenteeism dropped 0.5 percent below the 52-hour rate of 3.3 percent. The percentage of unproductive time, however, increased markedly under the longer hours, rising from 22 percent at 52 hours to 27 percent at 58. As a result, total output during the 58-hour week increased by only 3.7 percent above that for the 52-hour schedule. When it became apparent that over-all production during the 58-hour week was only slightly above that formerly obtained during the 52-hour week, management reverted to the earlier schedule.

After this cut-back, efficiency increased steadily for 5 months, to the end

of the period surveyed. It was higher at this point than during any other month of the entire period covered. It was not possible to tell from the data whether this point represented the level at which efficiency would stabilize during the 52-hour war week, and it is possible that the level ultimately reached may have been higher.

Output.—In any case, output during the 52-hour war week was as high as it had been during the 58-hour war week. The addition of 6 hours had not helped to increase output. In fact, the data suggested that the total output during the 58-hour schedule, if continued for any length of time, might have been only 95 percent of that obtained during the shorter workweek.

The data also indicated that the output level of the 52-hour war week was about 8 percent higher than that of the 52-hour prewar week. At the same time, however, the proportion of unproductive time remained at about the same level (25 percent) as that which had prevailed during the 58-hour week (27 percent). Although the men worked harder, they had to take just about as much time out from actual production.

Absenteeism.—Absenteeism was not an important problem when hours were increased. It exceeded 2.5 percent in only 3 out of the 9 months during which the longer schedule was in effect. During the subsequent 52-hour week, however, the absenteeism loss never fell below 4.2 percent and went as high as 7.8 percent. The posting of absences had only a temporary effect. A visiting nurse, who investigated absences of more than 2 days, found that workers frequently were “just resting.” Frequently, however, she found it possible to persuade the men to return to work by appealing to their patriotism.

These facts—the high unproductive time and the higher absenteeism rate—during the final 52-hour week strongly suggest that the effects of fatigue made themselves felt at this time. It should be added also that there was no indication that the 52-hour week was the optimum workweek, and that a shorter schedule might not have proved as productive. It shows only that, in this operation, a 52-hour schedule was as good as a 58-hour schedule.

Work injuries.—There was no appreciable difference in the work-injury experience under the various levels of hours. The plant had an excellent safety program and a consistently good safety record.

Daily output pattern.—The effect of increasing daily hours from 9 to 10 and Saturday hours from 7 to 8 was to eliminate the midweek spurt of output which had been characteristic of the shorter week prior to the war. During the shorter schedule, output rose from Monday through Wednesday, the peak day. The output levels for Thursday and Friday were somewhat lower, but on a par with that of Monday. Saturday’s level was higher, probably because it was a shorter day.

During the longer workweek, this peak disappeared. The output level throughout the week remained fairly constant—at the Monday level. In addition, there was a sharp drop on Saturday—the output level was nearly 25 percent lower than for the Saturday under the shorter workweek, probably reflecting accumulated fatigue.

6: Prewar workweek of 50 hours vs. war workweeks of 58 and 50 hours, night shift, individual wage incentives; hot and heavy, man-paced upset-forge operations; men.

The men selected for this study worked on the nonrotating night shift of the same department described in the preceding case study. This survey will present only those points in which the night-shift workers differed from the day-shift workers.

The performance of four crews, accounting for a total of 16 men, was traced through the 21-month period studied, from June 1941 through February 1943. Changes in the weekly schedules coincided with those of the day shift. The prewar schedule was 50 hours per week (5 days at 10 hours). By the introduction of Saturday work, usually of 8 hours, the weekly schedule was raised to 58 during the early part of the war. When the day-shift hours were reduced to 52 per week, those of the night shift were put back to 50.

FINDINGS OF STUDY

Efficiency.—When hours were reduced from 58 to 50 a week, efficiency increased by 5 percent. The efficiency trend of the night shift generally followed that of the day shift, except that it reached very much higher levels. This trend may be due to the fact that nights are cooler and that fewer forges were operated at night, thus creating less heat in the shop.

As in the case of the day shift, the efficiency of the night shift increased up to 6 percent upon our entry into the war, in spite of the addition of the extra day. After 5 months at longer hours, however, efficiency dropped to about the level maintained during the prewar schedule of 50 hours. When hours were cut back to 50 a week, efficiency rose steadily up to 17 percent above the prewar level for the same schedule, then dropped back to 5 percent. The average efficiency level during the wartime week of 50 hours can fairly be set at about 8 percent above the level for the same hours before the war, and at about 5 percent above the average performance level for productive hours during the 58-hour week.

The percentage of productive time was slightly lower during the 50-hour week than during the 58-hour week, and in general, was lower than that of the day shift. Stated conversely, there was more unproductive time on the night shift.

Output.—When the 8-hour Saturday was added to the workweek, the average increase in output was directly proportional to that of weekly hours. When the workweek was reduced to 50 hours by the elimination of Saturday work, an increase in efficiency and a slight reduction in unproductive time resulted in keeping the volume of output at the same level as under the longer hours. In other words, the 50-hour week was as productive as the 58-hour week.

Absenteeism.—The prewar schedule of 50 hours per week had the lowest rate of absenteeism, 2.3 percent.

When Saturday work was added, the absenteeism loss increased to 4.7 percent of scheduled man-hours. The war period of 50 hours resulted in a

slight drop in the absence rate to 4.2 percent—which was still above the prewar rate for the same weekly schedule.

Daily output pattern.—The effect of extending the workweek by the addition of 8 hours on Saturday was to eliminate the midweek spurt of daily output which resulted in a peak on Thursday. As in the case of the shorter workweek, the output level remained lowest on Monday—but at a much lower level. This was followed by a rise on Tuesday; but after that, nearly every day was at a lower output level than the one preceding it. Production on Saturday was about as low as on Monday. In general, the average output level for the 58-hour week was considerably lower than that for the 50-hour week on every day of the week from Monday through Friday.

Absenteeism—Injuries.—The comments made in case study 5 on absenteeism and work injuries apply to this group of workers as well.

7: *Workweek of 40 hours vs. workweeks of 50 and 58 hours, individual wage incentives; medium-heavy, machine-paced operations; men.*

The operations studied consisted almost entirely of machining processes, such as those on lathe, shaping, drilling, grinding, and polishing machines, for the production of gear couplings. The work may be characterized essentially as medium, machine-paced operations, affording some rest to the operators on most of the processes. The materials handled varied in weight from 5 pounds to 1 ton, but averaged about 25 to 50 pounds.

Working conditions.—Working conditions may be characterized as fairly good. Ventilation and lighting were good. There were no fumes or dust, no congestion, and the department was quite clean, except for some cutting oil and shavings on the floors. There were no organized rest periods.

The work force.—A control group of about 39 productive workers on day and night shifts, who had been in the department for at least 2½ to 3 years prior to the end point of the survey, were studied. Findings were also obtained for all productive workers in the department. The number of these ranged from 38 to 62, averaging about 50.

Wage incentives.—The department operated on an individual incentive system, which consisted of a guaranteed hourly wage plus a premium based on production in excess of standard.

FINDINGS OF STUDY

Findings cover three distinct hourly levels. From March 1939, through February 1941, the workweek consisted of 5 days at 8 hours, or 40 hours. The following period, March to December 1941, comprised a 50-hour workweek of 5 days at 10 hours. At the beginning of the war an 8-hour Saturday was added for a workweek of 58 hours. This schedule was surveyed for the period January 1942 to March 1943.

Efficiency.—When hours were raised from 40 to 50 a week, efficiency declined by 4 percent, after a lag of 3 months during which efficiency level of the shorter workweek was fairly well maintained.

When an 8-hour Saturday was added at the beginning of the war, the level of efficiency rose somewhat at first, apparently as a result of war morale. But after 6 months at the new schedule, efficiency decreased to a level about 6 percent below that of the original 40-hour workweek. This it will be noted, was only 2 percent below that of the 50-hour week.

Efficiency of the night shift was consistently about 5 percent below that of the day shift and reacted more quickly to changes in hours, but in the same direction.

The efficiency level of the uncontrolled group was consistently below that of the control group, but the experiences of the 2 groups were parallel at the different hourly schedules. This uncontrolled group represented a less experienced group of workers.

It must be remembered that these operations were essentially machine-paced, and that operators could not speed up or slow down operations except for the short period of time necessary to put new work on the machines and remove processed work from the machines. Consequently output varied fairly closely with the number of hours worked.

Daily Efficiency Pattern

During the 5-day week and 8-hour day, efficiency on the day shift built up almost steadily from Monday to a peak on Thursday, with a slight drop on Friday. The effect of the addition of two daily hours was to level out the daily pattern, so that, except for a slight rise on Tuesday, one day was as good as another, but each day's level was lower than that under the 40-hour schedule. When Saturday work was added, the pattern was similar to that of the 50-hour week, but the entire level was still lower.

For the night shift, the 40-hour week pattern of efficiency showed a spurt on Thursday, but this was preceded by a drop from Monday through Wednesday. Friday showed a slight falling off from the Thursday peak. During the 50-hour week, there was a sharp drop on Wednesday with a generally stable level for the other days of the week, all daily averages being below those of the previous schedule. When Saturday was added to the workweek, the pattern was one of a steady downward trend from Monday through Friday, with a slight spurt on Thursday. There was a somewhat higher level on Saturday, which was an 8-hour day.

Absenteeism.—During the 40-hour workweek the average time lost through absenteeism was 2.7 percent.

When the workweek was lengthened to 50 hours, absenteeism, after a period of 3 months reflecting the transition from one schedule to the other, reached an average level of 7 percent.

During the 58-hour workweek, the stabilized level of absenteeism was held to about 4.5 percent, owing to the efforts of a labor-management committee. The data indicate that in the absence of this effort, a level of 10 percent or more might have prevailed.

During the 40-hour workweek, the rates of absenteeism for both shifts were about the same (nearly 3 percent). When hours were lengthened to 50, the

average for the day shift rose to 5.5 percent, and for the night shift to 11 percent. During the 58-hour schedule, the rates were 4.4 percent for the day shift and 4.9 percent for the night shift.

The uncontrolled group's rate of absenteeism rose from 5.4 to 7 percent when hours were changed from 40 to 50. It increased to 8.1 percent under the 58-hour schedule. The efforts of the labor-management committee were not nearly as effective with this group as with the older workers.

Daily Absenteeism Pattern

During the 40-hour week, absenteeism for the day shift was highest on Wednesday and Thursday. On the whole, it was higher during the latter half of the week. When daily hours were changed from 8 to 10, the peak of absenteeism shifted to Monday, with successive declines on Tuesday and Wednesday, followed by a stabilized level the rest of the week. The pattern reflects the desire for a longer weekend. During the 58-hour workweek, there was a fairly steady decline in absenteeism from Monday through Friday, and a sharp increase on Saturday. Saturday absenteeism represented nearly half of the time lost during the week.

For the night shift, absenteeism during the 40-hour schedule was highest on the first day, which in this case was Sunday night. Except for Thursday, the remaining days were nearly free of absenteeism. When daily hours were lengthened from 8 to 10, the first day had the lowest rate of absenteeism, with a slight rise on the second day, and a very sharp rise the third day, followed by a stabilized level at this high rate. During the 58-hour schedule, absenteeism was low the first 5 days of the week, with a moderate peak on Saturday. In this case, Saturday work was actually performed Friday night, giving the workers all of the next day to attend to personal affairs. Consequently the rate was not nearly as high as for day-shift workers.

Output.—For the men in the control group, the 25-percent increase in weekly hours from 40 to 50 brought about an increase of 23.5 percent in output. The failure of output to rise by the same percentages as did hours was due to the slight decrease in efficiency and the rise in absenteeism. The rate of increase in output kept pace with that of hours primarily because workers had relatively little control over the speed of operations and because unproductive time (getting ready, cleaning up, etc.) was spread over a longer workday, permitting a proportionately higher utilization of the time for actual machine operations. In terms of hours, 1.9 output hours were gained for each 2 hours added to the schedule.

The 45-percent increase in hours from 40 to 58 per week was matched by an increase of 36 percent in output, a gain of little more than $1\frac{1}{2}$ hours for each 2 hours added to the schedule.

For the newer group of workers, the 25-percent increase in the schedule from 40 to 50 hours brought about a rise of 18 percent in output, or less than $1\frac{1}{2}$ output hours for each additional 2 hours scheduled. The 45-percent increase in hours from 40 to 58 resulted in a 30-percent increase in output, or $1\frac{1}{3}$ output hours for each 2 hours added to the schedule.

8: *Workweeks of 40 hours vs. 48 (6 days) vs. 48 (5 days) vs. 55 (6 days), individual wage incentives; medium-heavy, mostly operator-paced machining operations on small gasoline engines; ceilings on earnings; men.*

The majority of operations included such metalworking processes as cutting, drilling, boring, grinding, and polishing. The plant produced gasoline engines ranging from 3 to 9 horsepower.

Operations were well-planned and efficiently organized. Work appeared to be done at a fast pace with little evidence of idle time. The weight of parts manually handled ranged up to 75 pounds and averaged between 25 and 50 pounds. The pace of production was controlled by the operator on the majority of operations. Work was medium-heavy.

Working conditions.—Plant conditions were fairly good. The limit of space-utilization seemed to have been reached without crowding. Lighting was only fair, noise was considerable, especially around a few machines. Washroom facilities were inadequate. There was no plant cafeteria. The first-aid room was well-equipped.

The work force.—During the period selected for study, from October 1940 to September 1942, the work force increased from 261 to 700 men. All of these operators, however, were selected for skill and experience, and consequently the data used cover the entire plant. Subsequent to the period covered by this survey, the labor market had tightened sufficiently to induce management to resort to less experienced operators.

It was not possible to obtain data separately for the day and night shifts. Shifts were not rotated. The day shift started at 7 a.m. and was allowed a half hour for lunch. The night shift began at 5 p.m. with no time out for lunch. The men ate when they wanted to eat.

Wage incentives.—Contrary to a frequently found practice, the night shift received no shift bonus. Pay for Saturday was at time and a half, for occasional Sunday work at double time, even though weekly hours for the first 5 days of the week might have totaled less than 40. This policy was adopted to make work over the weekend more attractive. All work was done under a piece-rate system.

As a form of rest period, workers were allowed a specified 5-minute period, both morning and afternoon, to buy refreshments from a lunch cart.

Hourly schedules.—The survey covers the 24-month period from October 1940 through September 1942. Thereafter shortages of materials and a dilution of the average skill of the work force precluded any valid conclusions based on changes in hours.

During the 2-year period, hours went from 40 to 48, from 5 days at 8 hours to 6 days at 8 hours. Then operations dropped to 5 days a week, but with 9½ hours per day for a weekly total of 47½ hours. Finally, a sixth day at 8 hours was added for a weekly schedule of 55½ hours.

FINDINGS OF STUDY

Efficiency and output.—Average hourly output was as good at each of the

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schedules of longer hours as during the 40-hour week, output increasing in direct proportion to the increase in hours. Thus, the output rate was about equally good at 40, 48, 47½, and at 55½ hours a week.

These findings, however, are subject to the important qualification that output at 40 hours undoubtedly would have been better had the workers not feared to earn more than \$1 per hour. When, later, management lifted the hourly base rates above \$1, and repeatedly assured the men that rates would not be cut, the men really tried to earn all they could.

The facts obtained, therefore, merely prove that workers can work as efficiently at 55½ hours a week as they did at 40—provided they did not extend themselves fully at the shorter schedule because of a managerial policy of limiting hourly earnings.

Absenteeism.—Time lost because of absenteeism was three times as high during the 55½-hour week as it was during the 40-hour week. The respective rates were 5.8 percent and 1.8 percent.

At 55½ hours absenteeism losses rose up to 10 and 11 percent during the summer months. During the 6-day week, absenteeism was highest on Saturday. More time was also taken off around holidays as evidenced by a December rate of absenteeism of 11.9 percent during the 55½-hour, 6-day week, as against one of 2.3 percent for the same month under the 40-hour, 5-day week.

During the 5-day week, the absenteeism loss was fairly well distributed throughout the workweek. When a sixth day was added, absenteeism was marked on Saturday. Furthermore, it was considerably higher for the 55½-hour week than for the 48-hour week, both consisting of 6 work days.

Injuries.—Work injuries were considerably more frequent as weekly hours increased beyond 40. The average rate of 44 injuries per 100 workers per month during the 40-hour week involved almost entirely first-aid cases only. At 48 hours, there were 76 such injuries per 100 workers per month. With the dropping of the sixth day for a 47½-hour week, the rate decreased to nearly 70, but increased again slightly to 71 under the 55½-hour, 6-day week. In the experience of this plant, the workweeks of 55½, 48, and 47½ hours were about equally hazardous—but each level was decidedly more hazardous than the 40-hour week.

9: Workweek of 45 hours vs. one of 58 hours, group wage incentives; fairly hot and heavy, operator-paced welding operations; men.

The work consisted of assembling, clamping into place, and welding large metal parts, many of them used on battleships. The process usually involved climbing up and around the framework and required considerable agility. All of the work was operator-paced. It was fairly hot and heavy. Because of the danger of flying sparks, welders were required to wear heavy protective clothing even during hot summer weather.

Working conditions.—Conditions were good, considering the type of work performed. As the shop was completely open on one side and well-ventilated,

there was little danger of discomfort from welding fumes. There was plenty of room. Although there were no organized rest periods, workers took time out when they thought it desirable. Smoking was permitted in the shop. The men carried their lunches and ate in the shop during the half-hour lunch period. Although the first-aid room was well-equipped, workers in this shop usually did not bother to report there and saved time by receiving first-aid treatments from the foreman.

Wage incentives.—The welders worked on a premium wage-incentive system under which each man was paid as premium his proportionate share of the hours saved from the established time standards, many of which stretched over days and weeks until the specific piece of work had been completed. The welders were paid on a straight hourly basis. Premium was paid when a task was completed. Time standards had remained unchanged during the few years preceding the survey period, so that the performance of the 275 welders in this shop was a good indication of their efficiencies under various patterns of daily and weekly hours.

In addition to time-and-a-half pay for all overtime, a 2½ to 5 percent bonus was issued every 3 months based on the over-all plant output. The bonus was paid on each man's total earnings, including overtime and premium pay. A shift bonus of 7 cents per hour was paid to the second shift and 11 cents to the third shift.

Hourly schedules and shifts.—Shifts were rotated every 3 weeks. Workers, however, often interchanged shifts to suit themselves. Prior to November 1942, the welding shop was on a 45-hour schedule, with 6 days of 7½ hours each. The shop worked around the clock, having three shifts. When male welders became scarce, the shop went to two shifts, working 5 days at 10 hours and Saturday at 8 hours for a weekly total of 58 hours.

FINDINGS OF STUDY

Efficiency.—During the 45-hour week, the welders produced on the average 21 percent above what the standard called for. The same rate of efficiency was maintained when weekly hours were increased to 58.

Absenteeism.—Department-wide absence data were not available. A check of the percentage of scheduled time lost due to absenteeism among 70 individual welders revealed that an average of 4.2 percent of working days were lost during the 45-hour week and 6.9 percent during the 58-hour week. This increase resulted from the lengthening of daily hours, as 6 days per week were worked during both schedules.

During the longer workweek, absences because of alleged illness more than doubled—the rate was 0.7 percent during the 45-hour week and 3.1 percent at 58. The absence rate for “personal reasons” was 2.7 percent at 45 hours per week and 3.6 percent at 58. Time lost because of work injuries was 0.7 percent at 45 hours and about the same at 58 hours. If the losses from injuries and illness are combined, the comparative rates for short and long hours are 1.4 and 3.1 percent, respectively.

Output.—The increase in output lagged only about 3 percent behind the increase in hours, due almost entirely to the higher absenteeism loss at 58 hours. The workers were 97 percent as effective per hour during the 58-hour weeks as they formerly had been at the 45-hour week.

10: Comparisons of efficiencies by shift and by sex of workers; light, operator-paced, and automatic-machine operations at hourly schedules varying between 45 and 66 hours per week; indirect wage incentives.

This plant was engaged in the processing of a large variety of metal parts for war purposes, most of them small and light. About 70 percent of the workers were women. All employees were paid at hourly rates. Individual efficiency records were kept, however, to serve as bases for promotions. Fairly "tight" time-study production standards were used to measure efficiencies. Erratic working schedules and insufficient absence records limited the study to comparisons of efficiencies of men and women by shifts in several departments.

Working condition.—Floors were kept clean and equipment was modern and well-maintained. Washroom facilities and lockers were insufficient in number because of lack of space, were poorly lighted, and not very clean. The size of the cafeteria was entirely inadequate for the 9,500 workers of this plant. Lighting and ventilation were fairly good.

Hourly schedules and shifts.—Women generally worked 45 hours a week, 6 days at 7½ hours each, on three nonrotating shifts. Hours for men varied greatly, as indicated in the selected departments. Most departments had a half-hour lunch period, frequently paid for by the company. Women usually were allowed 15 minutes and men 10 minutes for rest in the middle of each half of the workday. Working schedules were staggered and 22 different starting times during the day were used to ease problems of transportation. The survey extended from the middle of 1942 to the middle of 1943.

A 10-percent premium was paid to both of the second and third shifts.

Turn-over.—According to company officials, turn-over rates of 30 to 40 percent were not uncommon, and occasionally levels of 60 to 70 percent were reached in individual departments. Many of the women workers were new to plant operations and apparently did not like them, and many others found better pay elsewhere.

Although most of the turn-over was due to "quits," a considerable number of the separations were regarded by the company as "discharges." An absence of 1 week without notice to the company was cause for a "discharge." Obviously, many of the discharges more properly could be labeled as "quits."

Absenteeism.—Absences, although claimed to be frequent, were not followed up. During the time of the survey, no effective method had been found to reduce losses due to absenteeism, or even to halt the upward trend. Because of the nature of plant records and practices, it was not possible to obtain satisfactory measurements of absenteeism.

Safety.—The first-aid room was well-equipped. Trained nurses and physicians were in attendance. Information on injuries was limited to the data compiled by the safety department, which showed a very low frequency rate of 4.3 for 1942. Safety conditions were generally good.

Departments A, B, and C

The three departments were doing similar work on operator-paced, light machine operations. The weight of pieces handled ranged up to 1 pound. Most operations consisted of picking up a part, fitting it into the machine, operating a hand lever or foot pedal, and removing the processed part. Many of these operations moved very quickly and involved the maintenance of a steady work rhythm.

The following statement presents the findings for these departments:

Workweek	Efficiencies, by shift			
	All shifts	First	Second	Third
<i>Department A</i>				
Men: 45-60-hour week.....	96.5	97.1	.....	95.3
Women: 45-hour week.....	97.9	98.8	98.0	94.0
<i>Department B</i>				
Men: 45-hour week.....	95.4	96.9	95.1	93.9
Women: 45-hour week.....	97.8	105.3	95.7	89.2
<i>Department C</i>				
Men: 45-hour week.....	99.1	99.1	.....	.....
45-66-hour week.....	97.6	97.6	.....	.....
Women: 45-hour week.....	102.8	100.4	104.6	103.5
60-hour week.....	104.7	102.9	106.3	105.5

These data may be summarized as follows:

Women were more efficient than men at light machine operations which involve rhythmic and fast handling of light parts.

The first shift was usually the most efficient and the third shift the least efficient for both men and women. The difference in efficiency between the first and third shifts was more marked for women than for men. The data for women workers in department C ran counter to the findings for departments A and B, but the reason for this could not be ascertained. Working conditions and supervision for departments A and C were identical.

At this type of work a 60-hour week and 10-hour day for women was as efficient as the 45-hour week and 8-hour day (included ½ hour for lunch). In fact, the efficiencies at the higher hourly levels were slightly better. This was ascribed by the supervisors to the fact that a steady rhythm was reached after a warming-up period at the beginning of the day, and that this rhythm could be maintained satisfactorily for the remainder of a 10-hour day. In department C, each of the three shifts at the longer hourly schedule had a higher average efficiency than during the shorter schedule.

For men, working up to 11 hours per day, this did not seem to be the case. Data were available only for the 19 men studied on the day shift in department C. Here the efficiency level during the 45- to 66-hour week (97.6) was slightly lower than that for the 45-hour week (99.1).

Department D

This department processed small parts for aircraft engines, such as bolts, studs, nipples, screw bushings, set screws, plugs, nuts, and adaptor bolts. As a high degree of precision was required, emphasis was on accuracy rather than speed. As a consequence, time standards were very liberal. Work consisted mostly of operator-paced machine operations, such as drilling, grinding, tapping, threading, cutting out slots, polishing, burring, counterboring, and countersinking.

Efficiencies for men were recorded for workweeks of 45, 55 to 66, and 60 hours. For the same periods, the weekly schedule for women remained constant at 45 hours. The groups studied consisted of 24 men on the first shift, 14 on the second, and 20 on the third during the 45-hour week. During the longer workweek, consisting first of alternating 5 and 6 days at 11 hours, and later 6 days at 10 hours, only two shifts were operated, with 30 men on the first shift and 28 on the second.

The 29 women were evenly divided among three shifts, with 10 on each of the first and second shifts and 9 on the third.

The findings are as follows:

Workweek	Efficiencies, by shift			
	All shifts	First	Second	Third
Men:				
45-hour week	101.3	101.5	101.2	100.9
55-66-hour week	101.6	101.8	101.3	.....
60-hour week	102.3	103.3	100.9	.....
Women:				
45-hour week	103.3	103.6	102.9	103.0

At light and simple machine work requiring great accuracy, women were more efficient than men. This was true from the groups as well as for each shift.

For men, efficiency was as high during an 11-hour day as during a 10-hour day, although there was some indication that—for the day shift at least—a 10-hour day was slightly better. The data for the 60-hour week, however, did not cover a long enough period to justify a definite conclusion. As in the case of the three departments already discussed, the work involved a warming-up period and the maintenance of a rhythm. In department D, however, the rhythm was slower because of the greater accuracy required.

There was relatively little difference between the shift averages of men or women during the 45-hour week. The slight differences tended to reinforce the point made in connection with departments A and B, to the effect that the first shift had the highest and the third shift the lowest efficiency level. The fact that there was so little difference probably was due to the nature and tempo of the work.

Department E

In sharp contrast with the work in the preceding four departments, that in department E was entirely machine-paced. All work was done on automatic screw machines. Raw stock bars, up to 500 pounds in weight, were fed into a battery of machines from trolleys. Most of the "first operation

machines," performing up to six operations, were run by men. Women did "second operation" work on smaller stock, using screw machines that performed only up to three operations. Work was fully automatic. The operator's task was to keep the machines fed, gauge the finished pieces, adjust the die sets, regulate the flow of the cutting oil, and generally watch the performance of the machines.

Men worked 46 to 69 hours a week, two shifts of 11½ hours each. Off days were staggered so that a man could work from 4 to 6 days a week. Women worked three shifts of 8 hours each. No time was set aside for rest or lunch periods, as considerable idle time was involved during machine operations. The equipment was modern. There was relatively little noise, and lighting was good. Of 28 male operators, 14 were on each of the two shifts. The 39 women operators were almost evenly divided, with 12 on the first shift, 13 on the second, and 14 on the third.

The findings for this department are as follows:

Workweek	Efficiencies, by shift			
	All shifts	First	Second	Third
Men: 46-69-hour week	101.9	100.1	104.2	.....
Women: 45-hour week	98.9	96.4	99.6	100.3

The findings for this department were in direct contrast with those of the other departments already discussed.

1. As operators of automatic multiple screw machines, men were more efficient than women. The average efficiency level for all men was 101.9, while that for all women was 98.9. The general finding held for the individual shifts as well.

For men, working 11½ hours a day, the second shift's performance level was superior to that of the first shift. For women, working 8 hours a day, the third shift had the best and the first shift the lowest efficiency level. The second shift's average, however, was not much below that of the third.

Without additional study of similar operations, the relative performance of the various shifts cannot be held to be typical of this kind of work. The possible explanation that seasonal heat during the day might have influenced the lesser performances of the first and second shifts does not hold here because the period surveyed did not cover the summer months.

11: Workweek of 45 hours vs. 55 hours for women, day shift, indirect wage incentives; light, operator-paced machining operations.

Operations consisted of machining processes on lathes, grinders, broachers, and similar metal working equipment involved in the production of bearings and washers for motors and other operating parts of airplanes. The pace followed was quite fast and permitted the operators very little idle time.

Working conditions.—Working conditions were exceptionally good. The department was air-cooled and sound-proofed. Noise was moderate except around the punch presses. There were no fumes or dust. Lighting was excel-

lent. Aisles were well-defined and kept clear. All equipment was well-guarded and well-spaced. There was an intensive safety effort, which included lectures, use of special safety equipment, and constant inspection by safety engineers. The success of this program was reflected in the fact that injuries as measured by the standard injury frequency rate did not rise when the workweek was lengthened from 45 to 55 and 57 hours in the department.

Wage incentives.—There was no wage-incentive system of the usual type in this department. Measures of efficiency were maintained to determine workers' promotions and wage increases. Wage rates were stratified, depending on the average hourly output of the employee.

FINDINGS OF STUDY

The experience of a selected group of 66 women on a day shift was studied.

Efficiency.—When daily hours were increased from 7½ to 9½ hours for 5 days of the week with the retention of a 7½-hour Saturday, efficiency showed no change.

Absenteeism.—Absenteeism rose from 3.3 to 4.5 percent when the workday was lengthened. In any case, the rates in either period were not excessive. Company officials attributed this to an intensive campaign to keep absenteeism down.

Output.—Output rose 20.9 percent as a result of the 22.2 percent increase in hours with a stable level of efficiency and a slight increase in absenteeism. Thus, the change from a 7½- to 9½-hour schedule for 5 of the 6 work days had the effect of furnishing almost 1.9 additional output hours for each 2 hours added to the schedule.

12: Workweek of 45 hours vs. 57 hours for women, evening (second) shift, indirect wage incentives; light, operator-paced machining operations.

Operations and working conditions, except for the working hours of the day, for this group are similar to those in case study 11, as these women were in the same department.

FINDINGS OF STUDY

Findings are for a selected group of 61 women who experienced a change in scheduled hours from 45 to 57 per week by the addition of 2 hours to the original 7½ hours for 6 days of the week.

Efficiency.—The change from the 7½- to the 9½-hour day resulted in a decrease of 7 percent in efficiency for women on this shift.

Absenteeism was 2.7 percent during the shorter workweek. The rate rose to 4.8 percent when the hours were lengthened.

Output increased by 15.3 percent with the increase of 26.7 percent in the workweek. The disparity resulted from the drop in efficiency and higher absenteeism during the longer schedule. As a result, for every 2 hours added to the schedule, only about 1 hour's additional output was obtained.

13: *Workweek of 45 hours vs. one of 55 hours for women who changed from an evening (second) to a day shift, indirect wage incentives; light, operator-paced, machining operations.*

These women were in the same department as those in case study 11. Operations and working conditions were identical. These workers moved up to the day shift when the workweek was lengthened. The change resulted in the loss of a shift bonus of 5 cents an hour, and a new orientation to transportation requirements, home duties, eating and sleeping habits, shopping practices, etc.

FINDINGS OF STUDY

The experience of a selected group of 26 women was studied. The change from a 45- to a 55-hour workweek was effected by changing daily hours from 7½ to 9½ for 5 days in the week, with the retention of a 7½-hour Saturday.

Efficiency declined 8 percent during the longer workweek, and with the changed shift.

Absenteeism rose from 2.2 percent to 5.8 percent under the longer schedule.

Output rose only 8.4 percent when the workweek was increased by 22.2 percent. In effect, only about three-fourths of an hour of additional output was achieved for each 2 hours added to the schedule.

14: *Workweek of 45 hours vs. one of 55 hours for women who changed from a night (third) to a day shift, indirect wage incentives; light, operator-paced machining operations.*

These women worked in the same department as those in case study 11. Operations and working conditions were identical, except that the change in shift meant for these workers the loss of a shift bonus of 10 cents an hour, and the necessity of acclimating themselves to new transportation schedules, a revised program of home duties, eating and sleeping habits, etc.

FINDINGS OF STUDY

Findings are based on the experience of a selected group of 22 women who changed from a night shift to a day shift when the workweek was lengthened from 45 to 55 hours. The change in daily hours consisted in the addition of 2 hours to the previous 7½-hour day for 5 days of the week, with the retention of a 7½-hour Saturday.

Efficiency.—The lengthening of the workweek and the change in shift brought about a 7.1 percent decrease in efficiency.

Absenteeism averaged 3.3 percent during the shorter hours. The rate rose to 4.1 percent after the change.

Output rose 12.6 percent when the workweek was lengthened 22.2 percent. Thus a little more than 1 output hour was added for each 2 scheduled hours added.

15: *Workweek of 45 hours vs. one of 57 hours for women who changed from a night (third) to an evening (second) shift, indirect wage incentives; light, operator-paced machining operations.*

Operations and working conditions were identical with those in case study 11. These women worked in the same department as those in the previous study. The change in shift meant for these women revisions in transportation facilities, home duty schedules, eating and sleeping habits, etc.

FINDINGS OF STUDY

The findings are for a selected group of 59 women who experienced a simultaneous change in working hours and work schedules. The workweek was lengthened from one of 6 days at 7½ hours, or 45 hours a week, to one of 6 days at 9½ hours, or 57 hours a week.

Efficiency.—The change in shift and the increased hours brought about a decline of 3.4 percent in efficiency.

Absenteeism before the change averaged 3 percent. The rate under the longer hours rose to 4.7 percent.

Output rose 20.1 percent during the second period when the workweek was extended by 26.7 percent. Thus, a little better than 1½ hours of output were added for each 2 hours added to the schedule.

16: *Workweek of 45 hours vs. one of 55 hours, day shift; indirect wage incentives; light, operator-paced machining operations; men and women.*

The plant studied was engaged in the production of metal bearings. It belonged to the same company involved in case studies 11 to 15, but was located in an older, less modern building. Operations consisted almost entirely of machining processes on lathes, drill presses, grinders, millers, broachers, and similar metalworking equipment. The weights handled varied from 1 to 70 pounds, the heavier parts being lifted by hand cranes. Women worked on the lighter materials. The work may be characterized as light, operator-paced machining operations.

Working conditions.—Working conditions were good. Ventilation and lighting were adequate, and noise was moderate, although there was no air-conditioning or sound-proofing. There were no fumes or smoke. Aisles were defined and kept clear. There were no organized rest periods.

Wage incentives.—Wage rates were based on a detailed placement and advancement program. There was no wage-incentive system of the usual type. Efficiency measures were maintained as a basis for workers' promotions and wage increases. The method used was the same as described in case study 11.

FINDINGS OF STUDY

Findings are for all workers on the shift. During the period surveyed there were about 100 workers in the group. About 75 percent were men and the remainder, women.

Efficiency.—Efficiency declined by 3.6 percent when hours were lengthened from 45 to 55 per week. (This was accomplished by increasing daily hours from $7\frac{1}{2}$ to $9\frac{1}{2}$, but retaining $7\frac{1}{2}$ hours on Saturday.) The pattern of daily efficiency shows that the fourth day, Thursday, was the best day during the period of the short workday. There was a considerably lower level of efficiency on Friday, with some improvement on the sixth day. During the $9\frac{1}{2}$ -hour day, the level of efficiency was lower for each day than in the preceding period. Except for a slight drop on Tuesday, there was little difference between the levels for the first 4 days. Again, there was a drop on the fifth day, with a slight improvement on the sixth, this last being related perhaps to the fact that only $7\frac{1}{2}$ hours were worked on that day.

Absenteeism.—Absenteeism rose when the workweek was lengthened. The rate was 1.7 percent during the shorter workweek and 3.6 percent under the longer schedule. In both periods, the rate was not excessive. Under the shorter hours, absenteeism was highest on the first workday of the week, dropping successively to a low on Friday, with a fairly sharp rise on Saturday. The lengthening of 5 of the workdays by 2 hours each raised the level of absenteeism for each day but did not cause any significant change in the relation of the daily levels, except to raise the Saturday level to the highest of the week, slightly above that of Monday.

Output.—Output showed a 15.9 percent rise when the workweek was lengthened by 22.2 percent. In other words, slightly less than $1\frac{3}{4}$ hours of output were gained for each 2 hours added to the schedule.

17: Workweek of 45 hours vs. one of 57 hours, night shift, indirect wage incentives; light, operator-paced machining operations; men and women.

This study covers the experience of all workers on the night shift in the same department and on the same operations as those in case study 16. During the period studied there were about 50 workers in this group, approximately 75 percent of whom were men. During the period of the shorter workweek these workers were divided into an afternoon and a night shift. When hours were lengthened the two shifts were combined into one night shift.

Working conditions were similar for both groups.

FINDINGS OF STUDY

Efficiency.—Efficiency dropped 6.7 percent when the workweek was lengthened from 45 to 57 hours by increasing daily hours from $7\frac{1}{2}$ to $9\frac{1}{2}$. Daily efficiency patterns indicate that during the period of the $7\frac{1}{2}$ -hour day, the third day, Wednesday, was the peak day, but was closely matched by Friday. During the longer workweek, the week began on Sunday night. During this period the midweek peak was lost and the levels for the first three days, Sunday through Tuesday were constant. The level for Wednesday was lower, with levels for Thursday and Friday still lower.

Absenteeism.—Absenteeism rose from a level of 3.6 percent during the 45-hour workweek to 6.1 percent during the 57-hour workweek. Under the

shorter schedule, daily absenteeism was low during the first 4 days of the week, the lowest point being reached on the fourth day, Thursday. Friday showed a much higher rate, and Saturday had the highest daily level of the week. During the longer hours the pattern showed a sharp peak on Sunday, the first workday, a marked drop on Monday, a lower but fairly even level for Tuesday through Thursday, and a very sharp rise on Friday.

Output.—Output rose by 14.8 percent with the 26.7 percent increased in the schedule, a gain of about 1 hour of output for each 2 scheduled hours added to the week.

18: Workweek of 58 hours vs. one of 48 hours, group wage incentives; medium-heavy, operator-paced machining and assembling operations; men and women.

The operations consisted of processing steel sheets, which weighed about 90 pounds initially, into airfield landing mats. The processes used were evenly divided between machining and hand operations. The steel sheets, about 2½ feet wide and 10 feet long, were trimmed to size, embossed, holes were punched, bayonet fasteners and slots for interlocking the mats were punched and interlocked, and the resulting mats—now weighing about 65 pounds—were degreased, painted, baked, bundled, and loaded into freight cars.

The mats were moved along the production lines by means of conveyors or overhead tracks. In terms of physical exertion, the work was medium. The speeds of individual operations were entirely within the control of the operators.

Working conditions.—On the whole, working conditions were good. Illumination and ventilation were adequate. Except for the immediate vicinity of the spray-painting booths, the air was clean. Housekeeping was good and there was little congestion or crowding.

There were no showers and no eating facilities of any kind—not even a place to eat.

During the 8-hour day, there were no organized rest periods. Estimates of time voluntarily taken out from work at the production lines, with utility men stepping in as replacements, ranged between 20 and 30 minutes per day. During the 10-hour day, a rest period was called at the end of 8 hours.

The work force.—During the first period surveyed (the 58-hour week), the number of workers studied numbered 80. Only one shift was operated. During the second period (the 48-hour week), the number of workers had grown to 140, and two shifts were used. None of these operators had any prior experience in the production of landing mats, and most of them were new to the plant. Only about half of them had some industrial experience before coming into this department.

The work force during the 58-hour week period surveyed—May through August 1943—consisted entirely of men. During the 48-hour period—January through April 1944—about 15 percent were colored women, selected for size and strength. In view of the kind of operations performed, it is believed

that the change in the size and composition of the group should not have influenced the results of the survey.

Wage incentives.—A bonus was paid for all production in excess of a fixed quota, and averaged about 25 percent of the base pay. A penalty was assessed for spoilage above a set limit. Average hourly earnings came to about \$1.10.

FINDINGS OF STUDY

Efficiency.—When daily hours were decreased from 10 to 8 for 5 days of the week, with the retention of the 8-hour Saturday, hourly efficiency increased by 15 percent.

Absenteeism.—Absenteeism remained at about the same high level during each of the two periods—10.7 percent during the 10-hour day schedule and 10.4 percent during the 8-hour day schedule. (It should be noted that 6 days were worked under either schedule, so that Saturday absenteeism was a problem in each case.)

Output.—The net effect of the decrease in daily hours from 10 to 8 was a lowering of the total output level by about 8 percent. Against this, the decrease in scheduled hours amounted to 17 percent. Consequently, 1 hour's output was lost for each 2 hours dropped from the schedule. Stating this finding in reverse, the plant had gained only 1 hour's output for every 2 hours worked above 48 per week. Half of the added hours were wasted.

Injuries.—Furthermore, work injuries were about three times as frequent during the longer hours. Although most injuries consisted of minor cuts and bruises, the department averaged 208 such injuries per 100 workers during the 48-hour week, as against 680 during the 58-hour week.

The time lost because of disabling injuries showed much the same picture: For each 100 workers, 23 days were lost during the shorter work schedule, as against 128 during the longer schedule.

19: The effectiveness of Sunday work for workers on light, operator-paced machining operations; individual wage incentives; men.

The plant studied manufactured drills and reamers. Operations consisted of cutting steel rods to proper lengths and grinding, fluting, and tempering these lengths into drills and reamers. This work may be described as light, operator-paced machining operations.

Working conditions.—Working conditions were good. Light was adequate as was ventilation. There were no fumes, and noise was moderate. Aisles were narrow but were kept unobstructed.

Wage incentives.—The wage incentive system consisted of a bonus based on each worker's individual efficiency, with fixed increases for specified percentages above the production standard. There was a ceiling of 30 percent above base pay beyond which the workers were not paid for additional output.

Safety.—A safety program was carried out by a labor-management safety committee.

Hourly schedules.—The performances of a selected group of 30 male operators on three shifts were studied under 4 different levels of scheduled hours. These schedules were: (1) A straight 56-hour workweek of 7 days of 8 hours each; (2) 2 weeks of 56 hours, and one of 48, or every third Sunday off; (3) alternating weeks of 56 and 48 hours, or every second Sunday off; and (4) a straight 48-hour workweek of 6 days of 8 hours each.

FINDINGS OF STUDY

Efficiency.—Efficiency increased 17 percent when the schedule was changed from a straight 7-day week to one with every third Sunday off. It rose another 11 percent when the men worked only every other Sunday. It rose only 1 percent more when Sunday work was eliminated entirely. It is believed, however, that it would have risen still further—by about 6 to 8 percent—had it not been for the 30 percent ceiling on bonus. This ultimate level would be one-third again as high as it was under the 7-day workweek. In any case, the 6-day schedule is clearly indicated as having been the most efficient of those studied.

Absenteeism.—Absenteeism averaged 4.1 percent during the straight 56-hour workweek, and 7.8 percent during the period of 2 weeks at 56 hours and 1 at 48 hours. At this time the company paid an attendance bonus of increasing amounts for every month of perfect attendance during a 3-month period. This bonus was discontinued when the schedule was changed to one of alternating 56- and 48-hour workweeks. During this period the rate of absenteeism was 8.2 percent. When Sunday was eliminated from the workweek entirely, the rate was slightly less—7.3 percent. When Sunday was scheduled, it had the highest daily rate of absenteeism. Next in order came Saturday; and third, Monday. Attendance was best on Friday, which was pay day.

For the plant as a whole, the first shift, with the highest proportion of old-time workers, had the lowest absenteeism rate. It was not much higher on the second shift. The third shift, with about one-fifth of the labor force, and with the lowest proportion of old-time workers, was said to account for 50 percent of the absenteeism. This shift also had the highest proportion of women, whose absenteeism rate was reported to be twice that of men.

Among the reasons advanced by management for the high rates of absenteeism were: (1) The 7-day week was too long; (2) earnings were high and the men had no time to spend their money.

Output.—Output increased 6.8 percent when the average workweek was decreased by eliminating one out of every three Sundays as a work day. It was increased by a total of 13.8 percent when the workweek was further shortened, making only alternating Sundays workdays. During the 48-hour workweek period, output showed a net gain of 6.8 percent. Output was highest during the schedule calling for work every other Sunday. If the assumption as to the true efficiency level in the absence of bonus limitations is sound, however, it appears that the output level during the straight 6-day week would have been equally as high. In effect, this means that the workers were capable of producing as much on a straight 6-day week as during a

straight 7-day workweek or under schedules requiring work on every second or third Sunday.

Injuries.—The incidence of work injuries, as expressed in the average number of disabling and nondisabling injuries per 100 workers per month, showed no appreciable variation during the different work schedules, as shown by the following averages:

<i>Work schedule</i>	<i>Number of injuries</i>
7-day week	3.6
Every third Sunday off	3.8
Every second Sunday off	3.1
Every Sunday off	3.7

20: *Workweek of 40 hours vs. one of 60 hours, day shift, group wage incentives; medium-heavy, operator-paced machining operations; men and women.*

This department produced 105 mm. shells. The work consisted primarily of the operation of metalworking machines such as grinders, millers, lathes, drill presses, and similar equipment. About 14 types of machines performed about 30 operations on the shell. The rough casting, weighing about 30 pounds, passed from machine to machine by means of gravity conveyors. In general, the work may be classified as medium in physical effort required, essentially machining, primarily operator-paced, and affording very little idle time to the operators.

Working conditions.—Working conditions were fairly good. Work areas were adequate in size and unobstructed. Lighting and ventilation were good. Noise, however, was shrill and of considerable volume. Two 10-minute rest pauses were permitted during each shift.

The work force.—During the period studied, approximately 50 men and 15 women were employed on the day shift. Employee morale appeared to be excellent. This was attributed to the immediate and obvious relation of the product to the war effort.

Wage incentives.—A daily and weekly incentive bonus were paid for all shells produced in excess of a fixed departmental quota.

Hourly schedules.—A 40-hour workweek (5 days at 8 hours) was scheduled through May 1943. Responding to the need for increased production, management increased the scheduled workweek to 55 hours (5½ days at 10 hours and finally to 60 hours (6 days at 10 hours). The data permit a comparison of labor performance during the 40- and 60-hour workweeks.

FINDINGS OF STUDY

Efficiency averaged a drop of 22.3 percent during the longer workweek.

Absenteeism losses increased sharply during the longer work schedule. The absenteeism rate rose from an average of 5.7 percent during the 40-hour week to 10.8 percent during the 60-hour schedule.

In terms of total output, the increase of 50 percent in scheduled hours resulted in an increase in output of only 5.5 percent. Thus, given the same

hourly efficiency and absence rate which prevailed during the shorter workweek, the additional output gained during the longer workweek could have been obtained by increasing scheduled weekly hours from 40 to about 43.

Injuries (nearly all minor and requiring only first aid) increased in rough proportion to the increase in hours. During the shorter workweek, approximately 109 injuries were sustained by 100 workers per month. The corresponding average rose to 163 during the longer workweek.

Another apparent result of the long work schedule was a sharply increased rate of voluntary quits. During the 40-hour workweek, an average of 3.5 workers voluntarily left the company each month for every 100 workers on the pay roll. The corresponding average during the 60-hour schedule was 7.1. It is impossible to determine to what extent this higher figure reflected experience with different types of workers, and to what extent it was due to longer hours. It is very likely that both of these factors were involved in the sharp increase in the quit rate.

After 7 months at the longer hours, the work schedule was cut back to a 48-hour week, with 6 days at 8 hours each.

21: Workweek of 40 hours vs. one of 66 hours, night shift, group wage incentives; medium-heavy, operator-paced machining operations; men and women.

This study deals with the performance of a group of night-shift workers in the plant described in case study 20. The operation, working conditions, and pay incentives were the same for this group as those indicated in the previous case study.

The company employed about 45 men and 10 women on this shift. The workweek was increased from 40 hours, 5 days at 8 hours, to 66 hours, 6 days at 11 hours.

FINDINGS OF STUDY

Efficiency.—A comparison of the levels of efficiency achieved during both schedules reveals that the group was 20.6 percent less efficient during the longer hours.

Absenteeism.—The absence rate rose from 3.7 percent during the 40-hour workweek to 13.3 percent during the longer workweek.

Output.—The composite effect of a 65-percent increase in scheduled hours, reduced efficiency, and higher absenteeism was an increase in output of only 9 percent. In terms of hours, the addition of 26 hours to the workweek resulted in an increase of only 3½ hours of output. The same result could have been achieved by extending the original 40-hour week to 44 hours. The additional 22 hours worked up to the 66-hour level were completely wasted.

After 7 months at the longer hours, the shift was cut back to 6 days at 8 hours each, or 48 hours per week.

22: *Workweek of 48 hours vs. one of 55½ hours, no wage incentives; medium-heavy and heavy operator-paced chipping, grinding, and welding operations; men.*

This study was conducted in the finishing department of a small steel casting foundry. The operations consisted of cleaning, grinding, chipping, and welding of castings delivered to this department after having been poured in the molding department. All of the operations were entirely operator-paced. The work ranged from medium-heavy to heavy, depending on the size and weight of the castings (which varied between 20 and several hundred pounds) and afforded the workers very little idle time.

Working conditions.—Foundry work usually is dirty and frequently hot. This foundry conformed to the usual pattern. Illumination in the department was good. Powerful fans removed fumes and smoke and, during the summer, helped in keeping the average temperature from rising above 90°F. Aisles, generally, were clear of obstructions. While there were no organized rest periods, voluntary rest periods consumed from 30 to 45 minutes per day. All work was done at straight hourly rates. There was no wage-incentive system of any kind.

Hourly schedules.—During 1942, the company scheduled a 48-hour workweek, 6 days at 8 hours for the average work force of 80 men in the department. In 1943, the labor force declined to 65 men and weekly hours were raised to 55½, 5 days at 9½ hours and Saturday at 8 hours.

FINDINGS OF STUDY

Efficiency.—A comparison of departmental performance during both levels of hours reveals that efficiency remained essentially unchanged when weekly hours were raised from 48 to 55½. It actually increased slightly by 0.2 percent.

Apparently, the operators were able to maintain the same pace during the 8- and 9-hour days. The finding that the efficiency of men on day work and without any wage incentive remains about the same at levels of long and short hours parallels a similar finding in an earlier study.³

In the light of other findings for men working under wage incentives, the conclusion appears warranted that, in this department at least, men on day work—and apparently operating at a slower tempo than if on piecework—can be as efficient during a 9½-hour day and 55½-hour week as they can during an 8-hour day and 48-hour week. In other words, the work pace during the shorter workweek was not so fast as to be impaired when the workday and workweek were lengthened.

It is also likely that the high morale of the workers during 1943—a wartime morale—had an important bearing on the maintenance of an efficiency level which might have dropped had the longer hours been in force under peacetime conditions.

³See case study 1.

Absenteeism.—Scheduled workdays lost because of absence from work increased from 6.6 percent to 8.9 percent during the longer workweek.

Output.—Against an increase of weekly hours of 15.6 percent, output increased 13.2 percent. For every 3 hours of additional worktime, output increased by the equivalent of 2½ hours' production under the shorter work schedule.

23: *Workweek of 48 hours vs. one of 54 hours, no wage incentives; medium-heavy and heavy operator-paced foundry operations; men.*

This department performed molding and metal-pouring operations in the same foundry which furnished the material for case study 22. The weights handled by workers varied with the size of the castings and ranged from 20 pounds to several hundred pounds. As a rule, all weights above 75 pounds were lifted by means of manually or power operated cranes. Work was usually done in crews of three: a molder, a helper, and a core setter. The molds were assembled from oven-dried cores and backed with sand. When the molds were large—and consequently heavy—the molten metal was poured from crucibles which were transported by crane to the assembly floor. Small molds were moved by crane to the pouring floor where the metal was poured. When the castings had cooled, they were moved to the shake-out floor where a crew of shake-out men removed them from the flasks. The physical demands of the operations may be characterized as medium-heavy to heavy. The work pace was entirely controlled by the operator.

Working conditions and hourly schedules.—Plant conditions were essentially the same in this department as those described in case study 22. Employees were paid on a straight hourly basis. There was no wage-incentive system of any kind.

The schedule in effect through March 1943 was 48 hours a week, or 6 days at 8 hours. In the spring of that year, the scheduled workweek was increased to 54 hours by adding 1 hour to each workday. The average work force decreased from 88 men to 68 men during the longer workweek.

FINDINGS OF STUDY

Efficiency was about 4.1 percent better during the 9-hour day as compared with the 8-hour day. As was found in case study 22, the absence of a wage-incentive system apparently resulted in a pace under the shorter hourly schedule which could be maintained and, in fact, improved even though hours were increased.

Absenteeism increased from 6.9 percent to 8.5 percent when the workweek was lengthened.

The net effect of the increase of 12.5 percent in working hours was an increase of 13.5 percent in over-all output. The increase in efficiency more than offset the increase in the time lost because of increased absenteeism. In terms of hours, the addition of 6 hours to the workweek resulted in an increase of 6½ hours of output.

This study again illustrates that the pace of workers at straight hourly rates was not so fast under a 48-hour schedule but that it could be maintained, and even improved, when hours were increased to 54 per week.

24: *The effectiveness of Sunday work during a 54-hour week vs. a 58-hour week without Sunday work, indirect wage incentives; light, operator-paced machining operations; men.*

The operations in this department consisted almost entirely of machining small metal parts for war materials: machine-gun tripods, aircraft parts, and similar equipment. The operations, primarily drilling, grinding, and machining of small aluminum and steel parts, may be characterized as light and operator-paced.

Working conditions.—Working conditions were good. Ventilation was adequate, noise was moderate and lighting varied from adequate to good. There were no fumes or smoke. The wood block floors were kept clean and aisles were usually free of obstructions. Considerable attention was given to safety by management. There was no cafeteria. Lunch tables were provided, and a private caterer brought in hot dishes, sandwiches, etc.

Wage incentives.—The department operated on a measured day-work system. Employees attained specified rates provided they maintained certain prescribed levels of output. Although there was no incentive system in the sense of earnings which fluctuated with the volume of output, the wage system required employees to maintain at least average efficiency in order to qualify for certain wage brackets.

Hourly schedules and shifts.—In 1942, the selected group of 31 experienced male operators were scheduled to work 7 days a week. The schedule called for three nonrotating shifts of 8 hours each, which included a paid lunch period of 15 minutes.

A year later, in 1943, Sunday was eliminated from the schedule, but daily hours were lengthened to 10½ per day, including a paid ½-hour lunch period, with 8 hours on Saturday. The resulting workweek, excluding the lunch period, was 58 hours, as against the earlier 54-hour week. The longer schedule was operated on a two-nonrotating-shift basis.

FINDINGS OF STUDY

Efficiency was higher during the 6-day week than during the 7-day week, although daily hours had been increased from 8 to 10. Average hourly output was 14.3 percent better when there was no Sunday work.

Absenteeism was about the same during both schedules, with an average of about 5 percent. The absence peak during the 6-day week came on Saturday and reflects a desire for a longer weekend.

During the 7-day week, attendance was worst on Sunday, with Monday only slightly better. Operators, working on Sunday, at double pay, frequently took Monday off.

Output.—The longer workweek, with Sunday work eliminated, was more productive than the 7 days at an 8-hour schedule. Although weekly hours had

increased by 7.4 percent, output increased by 22.5 percent. With very little change in the absence rate, this increase was due entirely to the improved efficiency during the 6-day week.

By eliminating Sunday work, the plant not only saved the cost of double pay for work on that day but actually gained about 15 percent of output beyond the 7.4 percent of additional hours worked.

25: Workweek of 37½ hours vs. one of 58 hours for men, individual wage incentives; light, operator-paced machining operations.

This study was conducted in a plant which produced small precision parts for guns and a variety of control devices for lubricating systems. Most of the work involved the operation of metalworking machines such as grinders, millers, drill presses, riveting machines, lathes, and similar equipment. The weight of the parts handled rarely exceeded 5 pounds. The work required a high degree of precision because of the small tolerances allowed on most jobs. The operations surveyed were light and, except for the work at a few automatic machines, were entirely operator-paced.

Working conditions.—Conditions in the plant were good. Lighting ranged from fairly adequate to good. There were no fumes, smoke, or dust. Noise was moderate. Working space was somewhat crowded. A well-equipped first-aid room was staffed with three registered nurses. Rest periods were voluntary and were taken when the work flow permitted.

The work force.—Forty-three experienced male operators were selected for study. Most of them had been employed by the company for many years. A spirit of friendly cooperation between foremen and workers, and among the workers themselves was clearly apparent. Industrial relations were very good.

Wage incentives.—Workers were paid on an individual piece-rate basis. All rates, set by means of time studies, required the approval of the labor organization representing the employees.

Hourly schedules.—The periods compared were January to August 1942, and a comparable period in 1943. During the first period, 3 shifts of 7½ hours each were worked for a workweek of 37½ hours. During the second period, when the plant was entirely on war work, daily hours were increased to 10, with a sixth day of 8 hours added, for a weekly total of 58 hours.

FINDINGS OF STUDY

Efficiency.—In spite of the 54.7 percent increase in hours, the efficiency level during the longer workweek actually increased by 15.3 percent.

Two reasons were advanced by management to explain this experience: (1) The participation of employees in the war effort acted as a powerful stimulus to greater efficiency; and (2) the longer runs on each job during the longer workday spread unproductive time over a longer period of productive effort. Apparently, the work during the longer workweek was not so hard as to induce fatigue serious enough to bring about a slowing down on the part of the workers.

Absenteeism.—The absence rate rose from 2.1 percent to 3.3 percent during the longer workweek. In both periods, the rates were low and were indicative of the effectiveness of a labor-management committee's effort to curb absenteeism.

Output.—The extension of the hourly schedule by 54.7 percent and improved efficiency were responsible for an 81.2-percent rise in total output. In terms of hours, for every hour added to the workweek, approximately 1½ hours of output were achieved.

26: Workweek of 37½ hours vs. one of 54 hours for women, individual wage incentives; light, operator-paced assembling and machining operations.

The performance of 25 experienced female operators was surveyed in the same plant which furnished the data for case study 25. The group was engaged in assembling, with the aid of light hand tools, the small parts described in the previous case study. A small percentage of the women performed light machining operations.

Working conditions, pay incentives, and worker-management relations were identical with those described in case study 25.

Hourly schedules.—The scheduled workweek was lengthened in 1943 from 37½ hours (5 days at 7½ hours), to 54 hours (3 days at 10 hours and 3 days at 8 hours).

FINDINGS OF STUDY

Efficiency.—A comparison of labor performance during both schedules reveals an experience similar to that found in the previous case study. The change in hours represented an increase of 44 percent. The workers, however, were 16.9 percent more efficient during the longer workweek. The reasons advanced for the comparable reaction in the analysis of case study 25 also apply here.

Absenteeism rose slightly from 3 percent during the 37½-hour schedule to 3.3 percent during the longer workweek.

The combined effect of an increase of 44 percent in scheduled working hours, stable attendance, and improved efficiency was an increase of 67.6 percent in output. Stated differently, for every hour added to the workweek about 1½ hours of output were gained.

27: Irregular overtime vs. a fixed 8-hour daily schedule with occasional Sunday work for men, individual wage incentives; light to medium-heavy, operator-paced machining operations.

The operations studied in this plant consisted of machining processes on lathes, mills, grinders, and similar metalworking machines. The material handled varied in weight from one pound to over 100 pounds. Heavier pieces were lifted with the aid of mechanical hoisting equipment. The operations were largely operator-paced and afforded very little idle time to the workers.

Working conditions.—Working conditions in the plant were good. Work

space and aisles were adequate. Noise was moderate. There were no fumes or dust. The fluorescent installation provided adequate light. Rest rooms including shower facilities were clean and ample in number. Well-prepared lunches were served at nominal prices in the plant cafeteria. Industrial relations were good.

Wage incentives.—An incentive system based on standards established through time studies, provided for additional pay for work done in less than standard time. Operators were paid at their hourly rate for all minutes “saved.”

Hourly schedules.—The performance of 29 experienced male operators who worked in the department under both schedules were studied. The working schedules compared were those existing during the first 6 months of 1941, and the same period in 1943. During the first period, the nominal workweek was 6 days at 8 hours. Actually, however, daily hours usually varied between 8 and 10 and occasionally went as high as 15. During the second period, the irregular overtime had been replaced by Sunday work, with the requirement that each operator work two Sundays a month. The purpose of the survey, therefore, was to determine the desirability of working a fixed 8-hour daily schedule which included two Sundays a month as against sporadic overtime which, on occasion, stretched the day to 15 hours.

FINDINGS OF STUDY

In evaluating the changes in efficiency and output it must be borne in mind that the first period preceded our entry into the war and that the second period involved direct participation in the war effort. Unquestionably, the results reflect the effect of war morale, although the extent of this cannot be measured.

Efficiency.—Even though weekly hours increased slightly by 4.7 percent from an average of 51.5 hours during the prewar period to 53.9 hours during the war period, labor efficiency increased by 16.3 percent.

Absenteeism.—Time lost from work because of unauthorized absence amounted to only 3 percent during the first period. With the change to Sunday work, the rate more than doubled to 7.2 percent.

Output.—The net effect of greater efficiency, a higher absence rate and a slightly longer workweek was an increase of 16.6 percent in total output. The primary reasons for the better output record appear to be: (1) The regular work schedule, although it meant work on two Sundays during each month; and (2) the psychological impetus of participation in the war effort.

28: *The effectiveness of Sunday work for women, individual wage incentives; light, operator-paced machining operations.*

The department surveyed in this study is in the same plant discussed in case study 27. All of the 22 employees were engaged in light metal-machining operations and were women. The material handled varied in weight from one ounce to several pounds. The work may be characterized as light operations at operator-paced metalworking machines.

Working conditions and wage incentives were the same as those described in case study 27.

Hourly schedules.—In 1943, the nominal workweek consisted of 6 days at 8 hours each, which included a paid $\frac{1}{2}$ -hour lunch period, and, in addition, work on two Sundays a month. The average workweek consisted of 52.5 hours. In 1944, Sunday work had been discontinued and the workweek consisted of 6 days of 8 hours each for a total of 45 actual hours of work.

FINDINGS OF STUDY

The purpose of the survey was to measure the effect of the discontinuance of Sunday work on two Sundays a month, with the reduction of total weekly hours from 52.5 to 48, each period including a paid $\frac{1}{2}$ -hour lunch period.

When Sunday work was dropped from the schedule, the hourly rate of output increased by 22.9 percent. It is significant that the change in nominal weekly hours consisted of a reduction of only $4\frac{1}{2}$ hours, from $52\frac{1}{2}$ to 48, or only 9 percent. Apparently, the important point is that the change involved the complete elimination of Sunday work for the women operators.

Efficiency.—Another factor, but of unmeasurable effect, was that the reduction in schedule followed D-day (June 1944). This may have stimulated efficiency beyond the effect of the dropping of Sunday work. The data indicate, however, that the effect of this shot in the arm—if it was one—continued unabated, for hourly efficiency was as good in December as it had been in July, the month immediately after D-day.

Absenteeism.—Unauthorized time lost from work decreased from 10.9 percent to 7.4 percent.

Output.—The combined effect of increased efficiency and improved attendance was an increase in total output of 16.7 percent. Thus, although the workweek was reduced $4\frac{1}{2}$ hours by the elimination of Sunday work, total weekly output was increased by the equivalent of almost 9 hours.

Daily Pattern of Efficiency and Absenteeism

The data permitted the determination of daily patterns of efficiency and absenteeism. During the longer workweek, efficiency was lowest on Sunday, slightly better on Monday, and then rose to a better level which was fairly well maintained through Friday. On Saturday, however, it dropped again to about the Monday level.

During the shorter workweek, hourly efficiency was best on Monday and was maintained at a slightly lower level for the rest of the week. The efficiency level for every day in the week was substantially higher during the shorter week than during the period with Sunday work.

Absenteeism was markedly lower during the shorter workweek on each day except Monday; and even on that day it was slightly lower.

The outstanding feature of the absenteeism pattern for the period with Sunday work is the low absence rate on Sunday—when work was paid at double rates because it was the seventh day in the week. But workers tended to make

up for this by taking time out on other days of the week, notably on Monday and Wednesday.

The pattern for the 48-hour, 6-day week reveals a tendency to stretch the week end by taking off either Monday, or, to a lesser extent, Saturday. Many of the operators studied, however, were married women with home duties, a fact which may explain this pattern even under the 48-hour week.

29: Workweek of 58 hours vs. one of 50 hours, and the effects of reductions in the work force, for men, individual wage incentives; medium-heavy, operator-paced machining operations.

This plant produced textile manufacturing machinery. Operations involved work on metalworking machines, such as lathes, drills, and milling machines. A high degree of precision was required, as tolerance allowances were very small. The work may be characterized as medium-heavy, operator-paced machining operations.

Working conditions.—Plant conditions generally were good. Ventilation and lighting were adequate. There were no fumes or dust. Noise was moderate. Aisles were wide and clearly defined. Housekeeping in general was good.

The work force.—The period surveyed involved a reduction in the work force as well as in work hours. Average employment in the plant dropped from about 500 to about 325. A high percentage of the operators were highly skilled on a number of operations.

Wage incentives.—The wage-incentive system consisted of an individual premium for time saved from standard time allowed, in addition to the standard hourly rate.

Hourly schedules.—Findings are for a selected group of 33 male operators who changed from a 58-hour workweek of 5 days at 10 hours and Saturday at 8, to a 50-hour week with Saturday work eliminated.

FINDINGS OF STUDY

Efficiency.—Efficiency was 5.4 percent poorer under the 50-hour week than it had been under the 58-hour week. Apparently this drop was the result of fear concerning the cut-back in the work force which was occasioned by the reduced volume of work available. The change in efficiency appears to be attributable to a stretching of available work rather than to the change in hours.

Absenteeism.—Elimination of Saturday work had only a slight effect on absenteeism. The change was from 3.6 to 3.2 percent, which points up a successful effort by the company to keep absenteeism down during the longer workweek.

Output.—The combined effect of the 15.3-percent decrease in hours, the lower efficiency, and the nearly constant absenteeism rate, was a reduction in output of 19.2 percent. Thus, the 8 scheduled hours saved by eliminating Saturday work resulted in a loss of the equivalent of 11 hours of output.

30: *The effects of changes in hours and improvements in working methods for women, day shift, individual wage incentives; light, operator-paced machining operations.*

This plant manufactured air brakes. The women in the department studied were on machining operations, such as broaching, boring, grinding, and drilling on small stock. The work may be characterized as light, operator-paced machining operations.

Working conditions.—The plant was air-conditioned. There were no fumes, smoke, or dust. Fluorescent lighting was good. Noise was moderate. Equipment was in excellent condition, and was well-guarded. Aisles were narrow but adequate.

Wage incentives.—Workers in this department worked under a wage-incentive system. Earnings were based on the percentage which actual production was of standard output, as determined by time studies. However, workers were not paid for additional output beyond 125 percent of the standard. Few workers reached the upper limit.

Hourly schedules.—The experience of a selected group of 10 women on the day shift was studied at three distinct hourly levels. In the first period the workweek consisted of 6 days at $7\frac{2}{3}$ hours, or 46 hours. This was followed by a workweek of 50 hours comprising 5 days at 10 hours. In the succeeding period a sixth day of 8 hours was added for a total workweek of 58 hours.

FINDINGS OF STUDY

Efficiency.—When the workweek was raised from 48 to 50 hours, but with Saturday work eliminated, the efficiency rate went up 9.5 percent. When the workweek was lengthened by the addition of a sixth day of 8 hours, efficiency rose another 10.9 percent. The net increase over the original 46-hour week was 21.4 percent. The better efficiency of these workers during the longer hours, however, was not due to better performance, but to the fact that management introduced changes which enabled workers to spend nearly all their time at their equipment. These changes consisted of the addition of separate groups of workers to perform such tasks as getting or removing materials, work previously performed by the operators. Consequently all of the operators' time was productive time.

Absenteeism.—The elimination of the sixth day of $7\frac{2}{3}$ hours with the increase from $7\frac{2}{3}$ to 10 hours for the other 5 days of the week, was accompanied by an increase in the rate of absenteeism from 4.9 to 8.3 percent. But when Saturday was again added to the schedule with the maintenance of the longer workday, absenteeism rose still further, to 15.4 percent.

Output.—The 8.7-percent increase in the workweek from 46 to 50 hours, brought about an increase in total weekly output of 14.9 percent, an increase of about $1\frac{3}{4}$ output hours for each hour added to the schedule. When an

8-hour Saturday was re-introduced, the increase of 26.1 percent over the 46-hour schedule was accompanied by a rise of 36.4 percent in output, adding almost $1\frac{1}{2}$ output hours for each hour added to the workweek. Thus, in spite of considerable increases in the absenteeism rate, output increased markedly during the longer workweek. As indicated, however, the increase was due to managerial changes in the method of operation. This study demonstrates that it is possible, by means of such changes, to overcome the usually adverse effect of substantially higher work hours.

31: The effects of changes in hours and improvements in working methods for women, night shift, individual wage incentives; light, operator-paced machining operations.

The workers in this study were employed in the same department and on the same operations as those in case study 30. Working conditions and wage incentives were similar.

Hourly schedules.—The findings are for a selected group of 10 women. During a workweek of 6 days at $7\frac{2}{3}$ hours, or 46 hours, they worked on an afternoon and a night shift. When Saturday was eliminated and daily hours increased to 10, lengthening the workweek to 50 hours, the two shifts were combined into one night shift. In a third period, an 8-hour Saturday was re-introduced, making a 58-hour workweek.

FINDINGS OF STUDY

Efficiency.—When the workweek was changed from 46 to 50 hours, efficiency increased by 19.9 percent. When the 8-hour Saturday was added, there was practically no change in efficiency, the level being 0.2 percent higher. Compared with the original 46-hour workweek, efficiency during the last period was 20.1 percent higher. The increase was not due to better performance under the longer schedules, but was brought about by the introduction of more workers to take care of indirect labor tasks, allowing the operators to spend nearly all their time on actual production.

Absenteeism.—During the 46-hour workweek absenteeism was 5.7 percent. With the workweek reduced to 5 days, but with daily hours lengthened from $7\frac{2}{3}$ to 10, the rate rose somewhat, to 6.8 percent. When the 8-hour Saturday was added, it again rose, to 7.7 percent.

Output.—The 8.7 percent increase in hours, from 46 to 50 per week, brought about a rise of 28.8 percent in output. In terms of hours, the 4 hours added to the workweek resulted in $13\frac{1}{4}$ additional hours of output. The increase in the schedule of 26.1 percent, by the change from 46 to 58 hours per week, was accompanied by a 48.2-percent rise in output, or an increase of 22 hours of output for the 12 additional scheduled hours. The greater increases in output in comparison to hours were the result of the changed work-flow methods which made for better utilization of productive time.

32: *The effects of changes in hours and improvements in working methods for men, day shift, individual wage incentives; light, operator-paced machining operations.*

The men in this study worked in the same department, and on the same operations as the women in case study 30. Working conditions and wage incentives were similar.

Hourly schedules.—The experience of a selected group of 15 men on the day shift was studied under two levels of scheduled hours. In the first period the workweek consisted of 6 days at $7\frac{2}{3}$ hours, or 46 hours. In the second period daily hours were lengthened to 10 for 5 days, and Saturday was maintained as an 8-hour day. There was also frequent work on an 8-hour Sunday. The average workweek during this period was 61 hours.

FINDINGS OF STUDY

Efficiency rose 8 percent during the longer workweek, as the result of the addition of indirect labor workers, allowing the operators to spend almost all of their time on actual production.

Absenteeism rose from 3.5 to 5.7 percent when the workweek was lengthened.

Output.—The increase in the workweek from 46 hours to an average of 61 hours, a rise of 32.6 percent, brought about a 39.9-percent increase in output. Thus the improvement in working methods served to add $18\frac{1}{3}$ output hours when an average of 15 hours was added to the workweek.

33: *The effects of changes in hours and improvements in working methods for men, night shift, individual wage incentives; light, operator-paced machining operations.*

This study covers the experience of men on a night shift in the same department and on the same operations as the women in case study 30. Working conditions and wage incentives were similar.

Hourly schedules.—The findings are for a selected group of 15 men under two levels of hours. During the first period, when the workers were divided between an afternoon and a night shift, the schedule consisted of a 46-hour workweek of 6 days at $7\frac{2}{3}$ hours. In the second period the two shifts were combined into one night shift, and the schedule was lengthened by increasing daily hours to 10 for 5 days, maintaining Saturday as an 8-hour workday, and by scheduling a frequent 8-hour Sunday. The average workweek during this period was 61 hours.

FINDINGS OF STUDY

Efficiency.—There was an increase in efficiency of 13.3 percent during the period of the longer workweek, resulting from the elimination of unproductive labor by the operators.

Absenteeism was 3.9 percent during the 46-hour workweek. The rate rose to 6.7 percent under the longer schedule.

Output.—The 32.6 percent increase in hours from 46 to an average of 61 per week was accompanied by a 45.9-percent increase in output. The addition of an average of 15 scheduled hours per week thus effected an increase of about 21 hours of output.

34: *The effects of changes in hours and improvements in working methods for men, group wage incentives; light, operator-paced assembling and testing operations.*

The men in this study worked in the same plant, but in different departments from the women in case study 30.

Operations consisted of assembling and testing the parts machined in the previous department. The work may be described generally as light, operator-paced assembling and testing operations.

Working conditions.—Working conditions were similar to those in the other department.

Wage incentives.—The wage-incentive system worked on the same principle as in the previous department, except that the workers were paid on the basis of group efficiency. This was done because operations were interdependent.

Hourly schedules.—The experience of a selected group of men in four assembling and testing departments, on day and night shifts, was studied under two levels of hours. During the first period the schedule consisted of 6 days at $7\frac{2}{3}$ hours, or 46 hours. In the second period daily hours were increased to 10, for 5 days, and Saturday was maintained as an 8-hour day, making a 58-hour workweek.

FINDINGS OF STUDY

Efficiency increased 7 percent during the longer workweek. The better efficiency level, despite the longer hours, was the result of improvement in working methods, allowing productive workers to spend almost all their time on actual productive operations.

Absenteeism rose from 2 percent to 4.2 percent when the workweek was extended from 46 to 58 hours. During both periods the level was low.

Output.—The 26.1-percent increase in scheduled hours was accompanied by a 31.9-percent rise in output, or an addition of $14\frac{2}{3}$ output hours for the 12 hours added to the schedule.

35: *Workweek of 54 hours vs. one of $61\frac{1}{2}$ hours, individual wage incentives; light, operator-paced machine and bench operations in the manufacture of dental equipment; men and women.*

The operations studied were partly performed on machines—such as lathes, grinders, and polishers—and partly consisted of bench assembling. The weights of pieces handled varied from less than an ounce to one pound. All the work was light, and essentially operator-paced, with very little waiting during machine processing. The work required very close tolerances. The

product was dental equipment throughout the entire war period.

Working conditions.—Plant conditions were good, work space was adequate and aisles were wide and unobstructed. There were no fumes or dusts, and ventilation was good. Lighting was only fair. Noise was of moderate volume. Washroom facilities were good. The cafeteria was adequate in size. Workers took voluntary rest periods amounting to about 25 minutes per day.

Machinery was well guarded. Safety conditions were good, as was the plant's accident record.

The work force.—The shop employed about 150 workers. About one-quarter of the work force was composed of women who were mostly engaged in packing and shipping operations. The majority of the workers had long service records with the company and were highly skilled in their work.

Wage incentives.—Workers were paid under a piece-rate system with a guaranteed hourly rate. Rates were determined by means of time studies.

Hourly schedules and shifts.—In 1942, the company shifted from a 40-hour, 5-day week, to a 54-hour week of 6 days at 9 hours. In the following two years, hours were again increased to a 61½-hour week by lengthening daily hours to 10½ for 5 days and retaining Saturday at 9 hours. This schedule proved to be too strenuous for many workers and management permitted a choice between working 54 or 61½ hours a week. Only 16 workers could be found who had consistently worked the 54-hour schedule and the subsequent 61½-hour schedule. The resultant findings consequently are biased in the direction of understatement, as the sample consisted only of those workers who found the 61½-hour schedule not too fatiguing. Only one shift was operated throughout the entire period surveyed.

FINDINGS OF STUDY

Efficiency.—When the 6-day schedule was increased from 54 to 61½ hours a week, the average hourly efficiency was reduced by 4.3 percent. It is entirely probable that the longer schedule would have resulted in a considerably larger drop in efficiency had the entire shop been required to work the 61½-hour schedule.

Although no data were available for performance under the 40-hour week, it was noted that the efficiencies of the 16 selected men dropped sharply during the first 2 months under the 54-hour schedule. As the level at which efficiency stabilized under the 54-hour week was lower than the efficiencies during the two transitional months following the 40-hour week, there is good reason to believe that the efficiency level during the short workweek had been considerably better than that which prevailed during the 54-hour schedule. The data for the first 2 months under the 54 hours suggest that the drop in efficiency from that which had prevailed during the 40-hour week was at least 5 percent. When hours were raised to 61½, efficiency decreased again by 4.3 percent. There also was some evidence that time standards had been loosened under the 61½-hour schedule, as an additional incentive to the operators to work this schedule. This again indicates that the measured decrease of 4.3 percent in hourly efficiency understates the actual decrease. Indi-

cations are that the efficiency level for the observed operators was at least 10 percent poorer at the 61½-hour level than at the 40-hour level, and that this decrease would have been greater if the entire work force had been required to work the longer schedule.

Absenteeism.—Absenteeism increased gradually during the 54-hour week and stabilized at an average rate of 5.1 percent. The percentage of scheduled time lost increased still further when weekly hours were raised to 61½, the average absence rate stabilizing at 6.3 percent. Absenteeism, like efficiency, probably would have been higher had the sample included those men who found this schedule too strenuous and therefore confined themselves generally to a workweek of only 54 hours.

Output.—Lowered efficiency and increased absenteeism were reflected in the rise in output by only 4.2 percent when hours were increased by 13.9 percent for the 61½-hour week. Thus, it took slightly more than 2 hours to bring about the addition of 1 hour's production. The additional output gained under the 61½-hour schedule could have been produced in 56 hours, had the efficiency and absenteeism remained as under the 54-hour schedule.

Daily Pattern of Efficiency and Absenteeism

The daily efficiency levels were about the same for each of the first 5 days under the 9-hour schedule. Only the sixth day, Saturday, showed a poorer performance.

The daily efficiency levels under the 10½-hour day were decidedly lower than those under the 54-hour schedule. However, it is difficult to explain the constant rise for almost every successive day under the longer schedule. The better performance on Saturday, on the other hand, may be due to the fact that it was 1½ hours shorter than the schedule on the other workdays.

The daily absenteeism patterns under the two sets of hours were very much alike, except that the absenteeism rates under the long hours were at higher levels during the first two and last two days of the week. The difference was particularly marked on Saturdays. Under both levels of hours, the absenteeism rate dropped fairly steadily from Monday through Thursday, and then rose again on Friday, with a high peak on Saturday.

36: 6-day week vs. 5-day week for night work of biweekly rotating shifts; individual wage incentives; medium-heavy, operator-paced machining operations; men.

The department was engaged in the production of 105 mm. shells and 60 mm. mortars, which involved metalworking processes on lathes, millers, thread millers, and automatic screw machines. The work was medium-heavy. It was operator-paced and afforded little or no resting time for the operators during processing operations. The weight of materials handled varied from less than 1 pound to 47 pounds for the completed shell.

Working conditions.—The workshop was free from fumes and dust. It was clean and well-ventilated. Lighting was good, and noise moderate. With the

exception of a few crowded places, working areas were adequate and aisles wide and unobstructed. Clean-up facilities and lockers also were adequate and well-kept. Lunches were served in a cafeteria. The plant appeared to maintain very good safety conditions.

The work force.—All of the 17 operators studied in this survey were white males in the middle age groups.

Wage incentives.—The wage incentive consisted of payment for all standard minutes earned in excess of minutes worked. Standards were developed on the basis of time studies.

Hourly schedules and shifts.—Operators worked alternately two weeks on the day shift and two weeks on the night shift. Throughout the selected period, the day-shift schedule remained at 58 hours per week, with 10-hour days for 5 days and 8 hours on Saturday. During the first half of this period, the night shift worked 63 hours per week, consisting of 5 days at 11 hours and 8 hours on Saturday. During the second half, the night shift went on a 60-hour schedule by working 5 days at 12 hours and eliminating Saturday work.

There were no organized rest periods, though an estimated average of $\frac{1}{4}$ to $\frac{1}{2}$ hour of voluntary rest was taken each day. There was a $\frac{1}{2}$ -hour lunch period.

FINDINGS OF STUDY

Efficiency.—During the period of a 5-day night schedule and a 2-day weekend, the efficiency of the 17 men studied increased by 6.1 percent. This result was achieved by lengthening the hours for the night shift from 11 per night to 12 and by eliminating Saturday work, even though the shortened workweek came only in 2 weeks out of 4. As already indicated, the men worked 6 days during the 2 weeks on the day shift.

Absenteeism.—The 2-day weekend for the night shift also resulted in decreasing time lost due to absenteeism from 7.9 percent of the scheduled work hours to 6.1 percent.

Output.—Increased efficiency and decreased absenteeism resulted in an over-all output increase of 4.3 percent, even though the average weekly schedule for both the day and night shift combined decreased by 3.4 percent. The survey indicates that it was possible to increase output, in spite of long weekly and daily hours, by introducing a 2-day weekend in 2 weeks out of every 4.

37: Workweeks of 40 hours vs. 48 (6 days) vs. 48 (5½ days) vs. 54 (6 days), group wage incentives; light, operator-paced hand composition of printing type; men.

The work in this plant consisted of hand composition of type for printing office supplies. The work was light and entirely operator-paced, each man working on an individual assignment. The general pace of work in this plant was moderate. The operations required exacting workmanship.

Working conditions.—Physical working conditions in the plant appeared to have changed very little during the last 20 years and were far from modern. Lighting ranged from poor to adequate and a general atmosphere of gloom prevailed. Ventilation was adequate because of the large amount of wall space devoted to windows. The plant was relatively free from heat, dusts, fumes, or gases. Temperatures were moderate even during the summer. There was little noise. The operations, generally, were clean and necessitated only limited washroom facilities. There were no organized rest periods and no eating facilities of any kind. In spite of the crowded shop conditions, house-keeping was good enough to prevent injury hazards from this source. The operations themselves were not hazardous.

The work force.—Although the size of the department was small, the composition of the work force had remained practically unchanged throughout the entire 3-year period surveyed. Most operators, including the 9 men selected for this survey, had been with the company for many years. Turn-over was very low.

Wage incentives.—The department operated on a group wage-incentive system. The efficiency rate was developed from a comparison of total hours earned during each week with the total hours required under the time standards for the work performed during the week. The excess hours were paid at regular or at overtime rates for regular or overtime hours respectively. There were no artificial ceilings to incentive earnings.

Hourly schedules.—The department worked only one shift. The selected period extended from January 1942 to February 1945. During all of this time the plant was engaged in war work.

The work schedule was changed from 40 hours a week (5 days at 8 hours each) to 48 hours by the addition of an 8-hour Saturday. Then, the sixth day was shortened to 4 hours, but the 48-hour week was maintained by increasing hours on the other 5 days to 8.8 per day. Finally, daily hours were raised to 9 on every day for a total of 54 per week.

FINDINGS OF STUDY

The 48-hour week—6 days.—For the 9 men studied in this department, the change from 5 days at 8 hours to 6 days at 8 hours resulted in a slightly better efficiency (1.4 percent) as well as an absenteeism rate slightly lower (0.5 percent) than the very low rate which had prevailed during the 40-hour week (1.4 percent). As a consequence, the 20-percent increase in hours was more than matched by a 22.8-percent increase in total weekly output.

The 48-hour week—5½ days.—When the 48-hour week was worked in 5½ days, efficiency increased still more, and averaged 4.7 percent above that for the 40-hour level. Concurrently, however, there appeared to have been a greater tendency to prolong the week end by taking off the half day, for absenteeism rose to 4.4 percent. Increased absenteeism offset the rising efficiency enough to reduce weekly output slightly, but still leaving it at 21.6 percent above that for the 40-hour level. In comparison, hours had been increased 20 percent.

The 54-hour week—6 days.—The change to a 6-day week at 9 hours, however, resulted in an average efficiency level lower than that of any of the shorter schedules, and 3.2 percent below that for the 40-hour level. Although the absenteeism loss dropped slightly, to 3.8 percent, the total output was only 27.6 percent better under the 54-hour week as against the 35-percent increase in hours above the 40-hour week.

In terms of the 8-hour day and 6-day week, the additional hours worked during the 9-hour-day schedule of the same number of days per week netted only 2 more hours of output.

38: *Workweeks of 40 hours vs. 48 (6 days) vs. 48 (5½ days) vs. 54 (6 days), group wage incentives; light, operator-paced packing operations; women.*

This is another department of the same plant described in the preceding case study, 37. Except for the points cited below, the data presented in the preceding case study also apply to this department.

The work involved counting, assembling, and preparing cardboard folders for shipment. Work was light and entirely operator-paced, and was done on a day shift. The group consisted of 8 women. The changes in weekly hours scheduled were the same as in the preceding study.

FINDINGS OF STUDY

The 48-hour week—6 days.—The change from 5 to 6 days at 8 hours (from 40 to 48 per week) resulted in a slight decrease in efficiency, 0.4 percent. Time lost because of absenteeism, however, more than doubled, rising from 3 percent to 6.8 percent. As a result, weekly output rose by 14.9 percent against an increase in hours of 20 percent.

The 48-hour week—5½ days.—When daily hours were lengthened to 8.8 per day so as to provide for a 4-hour Saturday while still maintaining the 48-hour week, efficiency improved and was 2.3 percent better than it had been at 40 hours. But the shortened Saturday seemed to invite taking that day off. Absenteeism rose to 11.8 percent, nearly 4 times what it had been at 40 hours. The higher absenteeism offset the improved efficiency to the extent that total output dropped 2.8 percent below the level obtained during six 8-hour days for the same total weekly hours. As against the 40-hour week, the 20-percent increase in hours brought about 11.7 percent more output.

The 54-hour week—6 days.—When hours were raised to 9 per day for a total of 54 per week, efficiency went up again, to a level of 3.1 percent better than that of the 40-hour week and about 3.5 percent better than during the 48-hour week, with 6 days at 8 hours. But absenteeism went up still further, to 14.4 percent—nearly 5 times what it had been during the 40-hour week. As a consequence, the 35-percent increase in scheduled hours, from 40 hours to 54, resulted in only 22.6 percent more output. In other words, it took 3 hours to produce 2 more hours of output.

39: *Workweeks of 48 hours (6 days) vs. 48 (5½ days) vs. 54 (6 days), group wage incentives; medium-heavy, operator-paced shipping operations; men and women.*

This department belonged to the same plant described in case study 37. Cartons and boxes were received by means of conveyor chutes or elevator and were prepared for shipping. Light trucks were used to handle the heavier boxes. The weight of materials handled varied from light to medium. All work was paced entirely by the operators. The group studied consisted of 4 men and 4 women.

No data were available for the 40-hour week. The rest of the schedules worked in this department were the same as those cited in case study 37. All work was done on a day shift.

FINDINGS OF STUDY

The 48-hour week—6 days.—The change in the daily pattern of the 48-hour week, from 6 days at 8 hours to 5 at 8.8 and 1 at 4, resulted in a spurt of 9.4 percent in efficiency, while the rate of absenteeism remained unchanged, at about 7.5 percent. Consequently, there was a net gain in output of 9.6 percent even though weekly hours remained unchanged.

The 54-hour week.—When hours were lengthened to 9 per day for 6 days and weekly hours were increased to 54, nearly half of this increase in efficiency was lost. However, the efficiency level still remained 5.3 percent better under the 9-hour day than it had been under the 8-hour day. For some reason, however, and differing sharply from the experience in the other departments studied, absenteeism resulted in only 5.9 percent of lost time.

The net effect of the 12.5-percent increase in hours during the 54-hour week, as compared with the 48-hour week and 8-hour day, was an increase in output of 20.5 percent.

40: *Workweeks of 48 hours (6 days) vs. 48 (5½ days) vs. 54 (6 days), day shift, group wage incentives; light, operator-paced assembling operations; women.*

This study follows the performance of 5 women in another department of the same plant described in case study 37. The workers were engaged in punching and inserting metal or plastic tabs into slotted folders. The work was entirely operator-paced, with the pace fast and steady. The operations were light, repetitive, monotonous, and did not require any special skill. Operators performed their work while seated at benches. With the exception of the 40-hour schedule, for which data were no longer available in this department, the weekly schedules worked were the same as those of case study 37.

FINDINGS OF STUDY

The 48-hour week—6 days vs. 5½ days.—The change from a 48-hour week of 6 days and 8 hours per day to one of 5 days at 8.8 hours and 1 at 4, resulted in a slight improvement in efficiency—0.3 percent. The high rate of absenteeism

during the 8-hour, 6-day week, 22.1 percent, dropped to 12.5 percent under the new schedule. As a consequence, the simple change from a 6-day week to a 5½-day week, with weekly hours remaining at 48, brought about an increase in weekly output of 12.8 percent on the day shift.

The 54-hour week.—The lengthening of daily hours to 9 for a 6-day week of 54 hours, resulted in a net loss in efficiency of only 0.5 percent. The absenteeism loss increased only slightly, from 12.5 percent to 13.2 percent.

As a consequence, the increase in hours of 12.5 percent to the 54-hour week resulted in a net gain in output of 25 percent.

41: *Workweeks of 48 hours (6 days) vs. 48 (5½ days) vs. 54 (6 days), night shift, group wage incentives; light, operator-paced assembling operations; women.*

This department represented, in essence, the night shift of the small department described in case study 40. The work of the 5 women on the night shift was the same as that of the day shift. Working conditions and wage incentives were the same as those described in case study 37. Data were no longer available on the 40-hour week.

FINDINGS OF STUDY

The 48-hour week—6 days vs. 5½ days.—The first change observed was from 6 days at 8 hours to 5 at 8.5 and 1 at 5.5, but maintaining the 48-hour week. As a result of this change, efficiency improved slightly, 1.1 percent. The high absenteeism loss of 18.5 percent, however, improved decidedly under the new daily pattern, dropping to 5.5 percent. The combined effects of improved efficiency and greatly reduced absenteeism resulted in an increase in total weekly output by 17.3 percent, even though weekly hours remained unchanged.

The 54-hour week.—The next change in weekly hours to 6 days at 9 hours for a 54-hour week actually resulted in better efficiency on the night shift, rising to 1.7 percent above that for the 6-day week of 8 hours a day. On the other hand, however, the absenteeism loss for the night shift during the 54-hour week rose sharply to 22.3 percent.

As a consequence of the steep rise in the absenteeism, the net gain in output was only 9 percent for the night shift, whereas hours had been increased by 12.5 percent.

42: *Workweeks of 48 hours (6 days) vs. 48 (5½ days) vs. 54 (6 days), group wage incentives; light, operator-paced cutting and packing operations; women.*

This is the last of six studies conducted in the plant described in case study 37. Work in this department was operator-paced and very light. It consisted of cutting and packing celluloid signals, tabs, and corner rein-

forcers. The department consisted of 15 women whose length of service with the company ranged from 5 to 23 years. Most of these women had worked together for more than 10 years. The weekly and daily schedules worked were the same as those described in case study 37, except that the 40-hour period could no longer be studied. All other data pertaining to this plant were cited in case study 37.

FINDINGS OF STUDY

The 48-hour week—6 days vs. 5½ days.—As in the other departments already discussed, weekly hours were maintained at 48 by increasing daily hours from 8 to 8.8, with 4 hours on Saturday, while reducing the days worked from 6 to 5½. As a result of this change, efficiency improved by 2.7 percent and absenteeism losses were reduced from 8 percent to 4.7 percent.

The 54-hour week.—When hours were increased to 9 per day for a straight 54-hour week, efficiency increased still further, to 5 percent above the 6-day, 48-hour week. But absenteeism losses reverted to nearly the same rate as those for the former 6-hour day by rising to an average of 8.3 percent.

Because of the higher efficiency, however, total weekly output was better by 17.8 percent, as against an increase of weekly hours of 12.5 percent over the 6-day, 48-hour week.

43: Workweek of 40 hours vs. one of 44 hours, day shift, individual wage incentives; light, operator-paced operations in machine-stripping of tobacco leaves; women.

The operation studied consisted of machine-stripping the center stem from tobacco leaves in a cigar manufacturing plant. The stripping machine is controlled by foot pedals and is fed by hand. The work is done in a sitting position. The operational cycle consists of spreading out the wrinkled tobacco leaf and feeding it into the machine by holding it with both hands. The two halves of the leaf are separated from the center stem by passing the latter between the two cutting edges attached to the center of the rollers. One worker operated one machine.

The work was completely operator-paced, light, repetitive, and monotonous. Care not to tear or cut the tobacco leaves, attention and coordination of both hands and feet imposed a strain on eyes and nerves. The steady and fast pace was primarily due to the continuity of the workflow, the rhythmic nature of the operation, the direct relationship of the amount of output to the operator's earnings, and a moderate work schedule averaging not more than 44 hours per week.

Working conditions.—The stripping department was only moderately noisy. Although air conditioning kept the temperature warm and humid at all times, for the proper conditioning of tobacco, the temperature was not uncomfortable. Lighting was good. Dust was kept at a minimum. Adequate

safety aisles and work space, and proper safeguards on moving parts of machines, made this a nonhazardous operation. The first-aid room was well staffed and equipped. Two cafeterias, restrooms, and lockers provided for the employees' comforts. Smoking was forbidden in work areas.

The work force.—The department contained about 500 stripping machines operated by Negro women on fixed day and night shifts. The sample selected for this study consisted of 40 women on the day shift, whose performance was followed from June 1941 to September 1945. A training period of 3 to 4 weeks was considered sufficient to turn out an experienced stripping-machine operator.

Wage incentives.—Each operator was on piecework and was paid by the number of trays of tobacco leaves stripped. Earnings averaged 55 to 65 cents an hour. There was no ceiling on earnings.

Hourly schedules.—An unusual pattern of daily hours was worked, designed to meet the needs of women with home responsibilities, such as caring for children after school hours.

During the 40-hour week, the fixed day shift worked 6 days a week—3 days at 8 hours, 2 at 6, and 1 at 4. During the 44-hour week, the same shift worked 5 days at 7½ hours and 1 at 6½.

There were no organized rest periods. One-half hour was allowed for lunch.

FINDINGS OF STUDY

40 hours vs. 44 hours.—As already indicated, the change from 40 to 44 hours a week was accomplished by changing the daily schedule from 3 days at 8 hours, 2 at 6, and 1 at 4 to a schedule of 5 days at 7½ hours and 1 at 6½.

The first 6 months at 44 hours showed no change in the hourly performance or in the percentage of scheduled time lost because of absenteeism. During the succeeding months at 44 hours, efficiency increased by 3 percent above the 40-hour level, but absenteeism increased still more sharply, from 1.9 percent at 40 hours to 7.3 percent at 44. The gain in efficiency was offset by the increase in the absence rate, so that output increased only 7.4 percent against an increase in hours of 10 percent. In other words, the 4 hours added to the 40-hour schedule resulted in only 3 hours of additional output.

Sporadic overtime up to 48 hours a week was found during part of the 44-hour period, resulting in an average workweek of 44½ hours as compared with one of 43½ hours for the balance of the period of longer hours. While the absenteeism loss at 44½ hours remained the same as at 43½ hours, efficiency dropped 2.4 percent.

Injuries.—Information was available only for a combination of disabling injuries and first-aid cases, under 44 hours. The weekly rate of injury cases per 1,000 workers was 11 for the day shift. After Monday, the rate increased up to Thursday, then dropped slightly on Friday, and reached the lowest point of the week on Saturday, which was a short workday.

44: *Workweek of 40 hours vs. one of 43½ hours, night shift, individual wage incentives; light, operator-paced operations in machine-stripping of tobacco leaves; women.*

The fixed night shift belonged to the same department described in the preceding case study, 43. Only those factors will be cited here in which the night shift differed from the preceding day-shift study.

The 26 Negro women selected for this study worked a weekly schedule of 40 hours (3 days at 5⁵/₆ hours, 2 at 8¹/₂, and 1 at 5¹/₂) and a schedule of 43¹/₂ hours (5 days at 8⁷/₁₀ hours) during the survey period from June 1941 to September 1945.

FINDINGS OF STUDY

The 40-hour week vs. 43½ hours.—During the first 6 months of 43¹/₂ hours, the night shift maintained the same rates of efficiency and absenteeism which had prevailed under the preceding 40-hour schedule. Thereafter, efficiency increased by an average of 2.1 percent. (During both the 40- and 43¹/₂-hour workweeks, the night shift was slightly more efficient than the day shift—1.5 percent and 0.7 percent respectively.) At the same time, the rate of absenteeism rose sharply from 2.2 percent at 40 hours to 9.7 percent at 43¹/₂. A partial explanation of this increase may be that a greater number of hours were involved in a day's absence during the 5-day, 43¹/₂-hour week than during the 6-day, 40-hour week. The slight rise in efficiency did not suffice to offset the sharp increase in absenteeism. As a consequence, the 8.8-percent increase in hours above 40 a week resulted in only 2.6 percent more output. In other words, only 1 hour of additional output was obtained for every 3¹/₂ hours added to the 40-hour schedule.

Turn-over.—As in the preceding day-shift study, most separations were due to "quits". The night-shift quit rate rose from 5.6 per 100 persons to 20.9 when hours were increased. This increase is similar to that of the day shift which had remained at the 6-day work schedule, while the night shift went on a 5-day week during longer hours. Dislike of work accounted for fully half of the quits at 44 hours.

Injuries.—Data combining disabling injuries and first-aid cases were available only for the period of a 44-hour, 5-day workweek. The weekly rate of injury cases per 1,000 workers was 23 for the night shift. On Monday, the injury rate was the same for both shifts and represented the lowest point of the week for the night shift. After Monday, it rose sharply and remained at a level above the peak of the day shift (on Thursday) for the remainder of the 5-day week.

Pay increases.—The night shift also received a bonus of 10 percent on total weekly earnings during the 40-hour week. As on the day shift, efficiency increased for the following 3 months—rising 6¹/₂ percent above the pre-bonus level—after which efficiency gradually declined.

When the rate for piecework units was increased—equivalent to an 11.9-percent raise—during the longer workweek, the night shift showed an increase in efficiency up to 6 percent during the following 5 months.

45: Workweeks of 48 hours vs. 40 and 45 hours, individual wage incentives; light, operator-paced operations in machine-stripping of tobacco leaves; women.

The operation of machine-stripping tobacco leaves was identical with the one described in another cigar manufacturing plant, case study 43. The pace of work was fast and entirely controlled by the operator. There was no idle time. Work was light and continuous, demanding constant manual and visual attention. It was monotonous and repetitive, and required the rhythmic coordination of both hands and feet.

Working conditions.—There was only a moderate amount of dust in the selected department. The volume of noise also was moderate. Temperature and humidity were controlled and kept fairly high to keep tobacco in a proper condition for handling. Modern lighting and ample window space provided very good illumination. Music was played in the plant during various intervals of the day. Facilities for the comforts of workers generally were good.

The strong odor of tobacco and the warm and highly humid air occasionally caused headaches and nausea among workers. Exposure to industrial injuries was limited to minor cuts on fingers and hands. Work space and safety aisles were ample for the operation. The company had a good safety program and was well equipped to administer first aid.

Wage incentives.—Operators were paid under a piece-rate incentive system, and earned an average of 60 cents an hour.

Hourly schedules.—The performance of 13 selected women was followed from December 1943 to May 1946. During the selected period, the weekly and daily schedules worked were: (a) 48 hours (three 9½-hour days alternating with two 9¾-hour days); (b) 40 hours (five 8-hour days); and (c) 45 hours (five 9-hour days). One-half hour was allowed for lunch. Most of the selected female operators were of middle age and had 5 to 25 years' service with the company.

FINDINGS OF STUDY

The 9½- vs. 8-hour day.—When daily hours were decreased from 9½ and 9¾ to 8 with retention of the 5-day week, efficiency rose steadily up to the end of the 40-hour period, at which point it had reached an increase of 19.3 percent. It is possible that efficiency might have leveled off at a point even higher than this. But at this point hours were increased.

The 16.7-percent reduction in hours, from 48 to 40 per week, had resulted in a loss of only 0.6 percent in average weekly output due to the sharp rise in efficiency. The 40-hour week therefore was practically as productive as the 48-hour week.

When daily hours were increased to 9 a day and a total of 45 a week, efficiency dropped 5.4 percent below the highest point reached at the end of the 40-hour period, though still remaining 12.9 percent above the efficiency level maintained during the 48-hour week.

The increase in weekly hours from 40 to 45 represented a 12.5-percent

increase in hours and resulted in a 6.4-percent gain in output. The addition of 5 hours to the 40-hour week therefore resulted in approximately 2½ hours of additional output. In comparison with the 48-hour week, the 45-hour schedule represented a 6.2-percent drop in hours and a 5.8-percent gain in output. In other words, a gain of approximately 2¾ hours of output almost offset the 3 hours dropped from the 48-hour schedule.

The trend in absenteeism losses could not be related to changes in hours, as there were marked fluctuations in the monthly averages of absenteeism in all periods. The over-all level of absenteeism was 9 percent for the three levels of hours combined.

Turn-over.—A sharp drop in the number of separations was noted when hours were dropped, while accessions kept pace with separations. At 48 hours, the separation rate per 100 employees was 9.4; at 40 it was 4.4. When hours were again increased, to 45 per week, the separation rate remained almost unchanged (4.7) while the number of accessions rose to 8.7, indicating a period of expanded activities in which management made special efforts to keep its old employees. There were no discharges during the 45-hour week. The majority of separations were due to “quits for outside reasons” in all 3 periods. “Dislike of working conditions” was given for 12½ percent of the quits during 48 hours and for 8.7 percent during 40 hours, and 7.8 percent during 45 hours.

46: *Workweeks of wartime 45 and 47 hours and postwar 40 hours, individual wage incentives; light, operator-paced operations in machine-stripping of tobacco leaves; women.*

The operation of machine-stripping tobacco leaves in a cigar manufacturing plant was described in case study 43. Work was entirely operator-paced, light, rhythmic, monotonous, and repetitive. Coordination of both hands and feet was required in running the machine. Work was continuous and demanded constant visual attention. The pace of production was very fast in this shop.

Working conditions.—Humidity was kept high and temperature at a moderate level for proper handling of tobacco. Although ventilation was good, a strong odor of tobacco and ammonia pervaded the shop. Lighting was adequate and noise of medium volume. Facilities for the workers' comfort were strictly functional, restrooms often unattractive and even unsanitary. Smoking was forbidden in the plant.

Exposure to strong odors, the warmth, and the high humidity, resulted in frequent headaches and nausea. Work injuries consisted mainly of minor cuts on hands and fingers. First-aid facilities were adequate for the non-hazardous nature of this work.

Wage incentives.—Wages were paid at piece rates. As a measure of quality control, a ceiling was placed on earnings. Occasionally, an efficient operator reached her daily quota before the expiration of scheduled daily hours,

permitting her to go home early. As a rule, however, workers could not reach the ceiling on earnings without working a full day.

Hourly schedules.—The survey followed the performance of 24 women operating stripping machines. The period selected for study extended from October 1943 to March 1946. During the war, this period included a 45-hour workweek of 5 days at 9 hours per day, which was followed by a 47-hour week, and finally, by one of 46½ hours—with daily hours ranging from 9 to 9½. After the war, the performance during a 40-hour week could be studied, with daily hours reduced to 8. All schedule changes were obtained by changing daily hours without altering the pattern of a 5-day week.

FINDINGS OF STUDY

The 45-hour week vs. 47-hour week.—When hours were increased from 45 to 47 per week, efficiency remained fairly constant, actually rising by an average of 0.7 percent, while the average percentage of time lost because of absenteeism dropped from 4.1 to 3.3. The slight improvement in performance resulted in an output rise of 6 percent as compared to an hourly increase of 4.4 percent. In other words, about 2¾ hours of additional output were obtained when 2 hours were added to the 45-hour week.

The subsequent 46½-hour workweek represented a period of a concerted drive by management to step up the production pace in an effort to offset the exodus of workers to more remunerative war industries at a time when replacements were difficult to obtain. This drive resulted in raising efficiency 3.1 percent above the level maintained during the preceding 47-hour week. The percentage of scheduled time lost due to absenteeism increased slightly, the absence rate rising from 3.3 percent to 4.6 percent. The combined effect of these two factors was to increase total weekly output fractionally (0.4 percent) although hours had been reduced by 1.1 percent. On the whole, the change of ½ hour in the weekly schedule had little effect.

The postwar 40-hour week.—The postwar reduction of the workweek to 40 hours resulted in a sharp and steady decline in efficiency during the first few months immediately after the war. When workers had settled down to normal peacetime production, the efficiency level had risen 1.1 percent above the level obtained during the preceding period of stepped-up production. Attendance also improved, the average rate of absenteeism dropping from the earlier level of 4.6 percent to 3.2 percent. The combined effect of improved efficiency and reduced absenteeism was reflected in a decline in total weekly output by only 11.7 percent as against a decrease in hours of 14 percent. Consequently, the elimination of 6½ hours from the 46½-hour week resulted in a loss of only 5½ hours of output.

47: *Workweeks of wartime 44½ and 46½ hours and postwar 40 hours, individual wage incentives; light, operator-paced operations in hand-stripping of tobacco leaves; women.*

The process of hand-stripping tobacco leaves is similar to that of machine-stripping (see case study 43). While seated at a knee-high work bench,

the operator opens a wrinkled tobacco leaf, places it on the bench, holds the end of the tobacco leaf with one hand and, with a quick and even motion, tears the stem from the entire length of the leaf with the other hand. The cycle of the operation is completed when the two stripped halves of the leaf are stacked on the work bench.

Work was entirely operator-paced, light, rhythmic, monotonous and repetitive. The extreme boredom of the operation was enhanced by the lack of any machine noise and the minimum of conversation because of workers' preoccupation in their jobs. The work required dexterity of both hands and demanded continuous visual attention. The work pace was extremely fast.

Except for the absence of noise in hand-stripping, working conditions were the same as those described in case study 46.

The piece-rate incentive system was described in case study 46.

Hourly schedules.—The performance of 10 women, engaged in hand-stripping tobacco leaves, was followed from September 1943 to March 1946. During the entire period, only one shift was in operation, working 5 days per week.

Work schedules above 40 hours per week were obtained by adding $\frac{1}{2}$ to $1\frac{1}{2}$ hours to the 8-hour day while retaining the 5-day week. The 3 schedules observed were wartime workweeks of $44\frac{1}{2}$ and $46\frac{1}{2}$ hours, and a postwar week of 40 hours.

FINDINGS OF STUDY

The $44\frac{1}{2}$ -hour week vs. $46\frac{1}{2}$ hours.—The rise in the wartime schedule from $44\frac{1}{2}$ hours a week to $46\frac{1}{2}$ brought about a 4-percent drop in efficiency, while the rate of absenteeism remained at 2.8 percent in both periods. As a consequence, output increased only by 0.2 percent although hours had been increased by 4.5 percent. Thus, the 2 hours added to the $44\frac{1}{2}$ -hour week resulted in practically no increase in output.

When the labor shortage became acute and workers were leaving to go into better-paying war industries, management began a drive for more production to offset losses in personnel. Although weekly hours remained unchanged at $46\frac{1}{2}$, workers' response to the production drive was reflected in a somewhat higher level of efficiency, the general level being 3 percent higher than in the preceding period of the same schedule of hours. Absenteeism losses remained almost unchanged, rising slightly from 2.8 percent to 3.1 percent. The campaign for more production succeeded in raising the output rate by 2.8 percent above the previous level for the same schedule. It succeeded in adding the output of $1\frac{1}{3}$ hours to the weekly output total without an increase in working hours.

The postwar 40-hour week.—A postwar schedule of 40 hours per week was obtained by decreasing daily hours to 8. The immediate effect of this cut-back was a sharp rise in efficiency which reached a level 6.7 percent above that of the preceding $46\frac{1}{2}$ -hour week. Concurrently, absenteeism rose to 5.4 percent. Total output reflected the increase in the efficiency rate by declining less than hours. The 14-percent drop in the hours schedule was accompanied

by a 10.5-percent decrease in output—a loss of a little more than $4\frac{3}{4}$ output hours for a reduction of $6\frac{1}{2}$ scheduled hours from the $46\frac{1}{2}$ -hour week. Stated differently, the $6\frac{1}{2}$ hours above the 40-hour level had resulted in $4\frac{3}{4}$ hours of output, and this during an intensive campaign for higher production.

48: Workweeks of wartime 44 and $46\frac{1}{2}$ hours and postwar 40 hours, individual wage incentives; light, operator-paced operations in hand-stripping of tobacco leaves; women.

The process of stripping the stem from a tobacco leaf by hand was described in case study 47, which dealt with an identical operation done in another plant located in the same area. With the exception of the data cited below, the conditions enumerated in the preceding case study, 47, also apply to this case.

Temperature and humidity were more moderate in this department than in the one described in the preceding case study, as the only operation done in this plant was hand-stripping which does not require as high a degree of humidity as other cigar-making operations.

Hourly schedules.—The selected period extended from September 1943 to March 1946 and included weekly work schedules of 44 and $46\frac{1}{2}$ hours during the war, and 40 hours after the war. The workweek consisted of 5 days for all periods. Changes in total weekly hours were obtained by changes in daily hours between 8 and $9\frac{1}{2}$. A sample of 21 women, engaged in hand-stripping tobacco leaves, was selected for the survey.

FINDINGS OF STUDY

The 44-hour week vs. $46\frac{1}{2}$ hours.—The increase in the wartime schedule from 44 to $46\frac{1}{2}$ hours per week resulted in a slightly poorer performance: efficiency decreased by almost 1 percent and absenteeism losses increased slightly, from the former rate of 2.5 percent to 2.9 percent. As a consequence, output did not increase in the same proportion as hours, rising only 4.2 percent while hours had increased by 5.7 percent. Expressed in terms of hours, 1.8 additional output hours were obtained by lengthening the 44-hour week by $2\frac{1}{2}$ hours.

The drain on the wartime reservoir of available manpower, coupled with the exodus of workers from nonwar to war industries, induced management to step up individual production efforts. During this period, weekly hours remained unchanged from the preceding period— $46\frac{1}{2}$ hours per week. As a result of management's drive for more hourly output without increasing the work force or working hours, efficiency increased by almost 2 percent above the previous level for the same number of weekly hours. The decrease in the absence rate from 2.9 percent to 2.1 percent was negligible. The net effect of the production drive was a 2.7-percent rise in total weekly output, or a gain of $1\frac{1}{2}$ output hours over the preceding period of the same weekly schedule of $46\frac{1}{2}$ hours.

The postwar 40-hour week.—In the months immediately following the end of the war, the efficiency trend followed a sharp and continuous decline al-

though the workweek had been reduced to 40 hours. After 4 months, however, the downward trend of efficiency was reversed and a continued rise of efficiency was in evidence up to the end of the selected period. Although efficiency may have increased still further during subsequent months at 40 hours, the last available measure of efficiency—2.7 percent above the preceding level of $46\frac{1}{2}$ hours—represents at least the minimum of average performance to be expected for this level of hours. Absenteeism losses increased somewhat, rising from the previous rate of 2.1 percent to a level of 3.1 percent. Against a 14-percent decrease in hours (from $46\frac{1}{2}$ to 40 hours a week) the output level decreased only 12.4 percent. Expressed in terms of hours, a loss of $5\frac{3}{4}$ output hours resulted from a $6\frac{1}{2}$ -hour reduction in the weekly schedule.

49: Workweeks of prewar 40 and 44 hours, wartime 46, 45, and $47\frac{1}{2}$ hours, and postwar 40 hours, individual wage incentives; light, operator-paced operations in machine-stripping of tobacco leaves; women.

The process of stripping tobacco leaves by machine in a cigar-manufacturing plant was described in case study 43. General plant conditions were the same as those enumerated in case study 46, except for the differences cited below.

Hourly schedules.—The performance of 13 female operators of tobacco-stripping machines, selected for this survey, could be followed for a period extending from June 1941 to April 1946. The scope of the survey included, therefore, prewar as well as war and postwar periods of different work schedules. The standard workweek consisted of 5 days during the entire period surveyed. By increasing daily hours from 8 up to $9\frac{1}{2}$, different levels of weekly hours were obtained.

FINDINGS OF STUDY

Prewar 40 and 44 hours.—Lengthening the 40-hour week by 4 hours prior to the war resulted in an efficiency drop of 3 percent. The percentage of scheduled time lost due to absenteeism was low for both periods, with absence rates of 1.9 percent and 0.8 percent for the 40- and 44-hour weeks respectively. Due to the decrease in hourly output, the net gain in total weekly output was only 7.9 percent although hours had been increased by 10 percent. Slightly over 3 additional output hours were obtained by the addition of 4 hours to the 40-hour week.

Wartime 46 hours.—Although the first wartime schedule studied was 2 hours longer than the previous 44-hour week, hourly output increased sharply, by 13.8 percent, in spite of the fact that this plant was not engaged in war production. This increase must be attributed to a large degree to management's success in stepping up the pace of production to offset the labor shortage, which acutely affected nonwar industries. Absenteeism losses increased from 0.8 percent under the 44-hour week to 3.7 percent, indicating that the production drive was not as effective in keeping down absenteeism losses as it was in stimulating workers to greater efforts while at work. The

increase in hourly output, however, was sufficient to step up output sharply by 15.6 percent while hours were increased by 4.5 percent over the preceding 44-hour week. Consequently, total weekly output was increased by $6\frac{3}{4}$ output hours with only 2 hours added to the schedule.

Wartime 45 hours.—The subsequent 45-hour period represented a 1-hour reduction from the previous 46-hour week. Efficiency increased by 5.8 percent during this slightly shorter schedule, primarily due to the continued pressure to increase output per man-hour. Absenteeism losses, however, continued to increase slightly, the rate averaging 5.1 percent. As a result of the increased efficiency, total weekly output actually increased by 2 percent while hours were decreased by 1 hour. Thus, the workers were producing almost one more hour of output for one hour less work per week.

Wartime 47½ hours.—During the final wartime schedule studied, weekly hours had been raised from 45 to 47½. Approximately the same level of hourly output was maintained as during the previous 45-hour week. Efficiency actually rose by almost 1 percent. Pressure for added output had apparently reached the point at which efficiency began to stabilize. The absenteeism losses dropped to 4.3 percent from the preceding level of 5.1 percent. The lengthening of the workweek from 45 to 47½ hours represented a 5.6-percent rise in hours as against a 7.2-percent increase in total weekly output, reflecting the combined effects of a slight increase in efficiency and a somewhat improved work attendance. In effect, the 47½-hour week represented a net gain of 3½ output hours for 2½ scheduled hours added to the 45-hour week.

Postwar 40 hours.—The months immediately following the end of the war were excluded from the study of the 40-hour postwar week as they represented an unsettled period of work performance. Although the workers were not engaged in war production, they had been under pressure to accelerate their production pace during the war. With the cessation of hostilities, a reaction set in as evidenced by a temporary slowing up of the work pace. Toward the end of the period observed, efficiency seemed to stabilize at a level about 1.3 percent higher than that obtained for the preceding 47½-hour week. Significantly, the postwar level of efficiency was 19.3 percent better than that experienced before the war for the same 40-hour workweek. The accelerated production pace, acquired during the war, had seemingly carried over into the postwar period.

Absenteeism losses were not reduced by the shortened postwar schedule, the level being 5.5 percent as compared with 4.3 percent for 47½ hours and 1.9 percent for the prewar 40-hour week. The slight increase of 1.3 percent in efficiency over the 47½-hour schedule was offset by the rise in scheduled time lost due to absenteeism, so that approximately 7½ output hours were lost when 7½ scheduled hours were eliminated from the 47½-hour week. Compared with the prewar 40-hour level, the postwar schedule of the same number of hours resulted in 15.1 percent more output each week, representing a gain of $6\frac{1}{3}$ output hours over the prewar 40-hour week.

50: *Workweeks of 40, 48, and 53 hours for women, individual wage incentives; light, operator-paced packing operations.*

This study was conducted in a candle-manufacturing plant. The operation surveyed, hand-packing of candles, was light and required little special skill or training. The workers sat at long tables and placed a prescribed number of candles into market containers. The work pace was medium-fast, operator-controlled, and afforded very little idle time to the operators.

Working conditions.—Working conditions were good. The large work areas were free from dust, fumes, and noise. A modern ventilating system removed wax and acid odors; large windows and a complete fluorescent installation provided excellent light. Restroom facilities were sanitary and adequate. There were no eating facilities in the plant; employees brought lunches from home and ate at their work stations. Minor injuries were treated by an employee trained in first aid. There were no organized rest periods.

The work force.—Twenty-four female packers were selected for study. Their ages ranged from 25 to 65 years, with the largest concentration around 40 years. One-third of the work force had been in the company's employ for more than 10 years.

Wage incentives.—The workers operated under an individual bonus incentive system. They were guaranteed a minimum hourly base rate and received a premium for units produced in excess of a fixed quota.

Hourly schedules.—The period from April 1941 through December 1944 provided three levels of scheduled hours for study. During this period weekly hours changed from 40 (5 days at 8 hours) to 48 (5 days at 9 hours and a 3-hour Saturday) and subsequently to 53 (5 days at 9½ hours and a 5½-hour Saturday).

FINDINGS OF STUDY

Workweeks of 40 and 48 hours.—Efficiency was highest during the 40-hour week, with 5 days at 8 hours. When daily hours were increased from 8 to 9 and a 3-hour Saturday was added to the schedule, efficiency dropped 10.3 percent.

The percentage of time lost due to absenteeism almost doubled during the longer workweek. It increased from a level of 4.5 percent at 40 hours to 8.3 percent at 48 hours.

In terms of total output, the increase of 20 percent in scheduled hours resulted in an increase in output of only 3.3 percent. Thus, given the same hourly efficiency and absenteeism rate which prevailed during the shorter workweek, the additional output gained during the 48-hour week could have been obtained by increasing scheduled weekly hours from 40 to about 42.

Workweeks of 48 and 53 hours.—When weekly hours were raised from 48 to 53 by increasing daily hours to 9½ and lengthening the Saturday schedule to 5½ hours, efficiency rose slightly but was still 9.2 percent below the level which obtained during the 40-hour week.

The small improvement in efficiency, 1.3 percent, might indicate that the

Saturday schedule of 3 hours during the 48-hour week was too short. It is permissible to assume that the same amount of time was necessary to reach an operational level of efficiency during the 5½-hour as during the 3-hour Saturday. Consequently, the longer Saturday afforded an additional 2½ hours of production at the regular work pace.

Absenteeism was highest during the 53-hour week. The percentage of time lost due to absenteeism rose steadily from 4.5 percent at 40 hours to 8.3 percent at 48 hours, and to 9.4 percent at 53 hours.

The 10.4 percent increase in hours above 48 was accompanied by a 10.3 percent gain in total weekly output. The slight improvement in efficiency during the 53-hour week was offset by increased absenteeism with the result that about 5 hours of additional output were obtained for the 5 hours added to the 48-hour week.

Compared with the 40-hour week, the 53-hour week represented a 32.5-percent increase in hours. Total output, however, rose only 13.9 percent. Thus, although 13 hours were added to the schedule, only about 5½ hours of additional output were achieved.

51: Workweeks of 40 hours, 44½ hours, 53 hours, and 48 hours, group wage incentives; medium, operator-paced foundry operations; men.

This study was conducted in a small nonferrous metal foundry. The operations included those usually performed in a foundry—coremaking, squeezer and floor-mold casting, shake-out, and chipping. The work pace was steady and unhurried, and controlled by the operator. The physical demands of the work were medium. The castings ranged in weight from 20 to 200 pounds.

Working conditions.—Working conditions in this plant compared favorably with those observed in the average foundry. Unpleasant conditions, incidental to foundry operations, such as excessive heat, dust, and noise, existed in this plant only to a moderate degree. Dust collectors near sandblast machines were effective in reducing the dust content in the air. The high ceiling, with opening skylights, large window space on two walls and large openings in the third side of the building made for relatively comfortable temperatures and good ventilation. Noise was sufficiently low to permit music, played in the plant, to be audible in the foundry.

Aisles were wide and generally unobstructed. Work areas were clean and uncrowded. A complete fluorescent installation provided excellent lighting. Restroom and comfort facilities, including showers, were sanitary and adequate in number. Good, inexpensive lunches were served in the plant cafeteria.

Safety clothing and appliances were supplied by the company. Two nurses treated injuries in a well-equipped first-aid room.

Rest pauses, while not formally organized, were taken when the work flow permitted.

The work force.—The plant was located in a highly developed industrial area which provided an ample supply of stable, skilled, and experienced

workers. As a result, when the foundry personnel was increased from 12 workers in 1940 to 56 in 1943, the effects on the quality of the labor force were insignificant.

The foundry workers were men whose average age was approximately 45 years. Of the original group of 12 workers, the majority were in the company's employ for more than 15 years. Management was of the opinion that the workers added to the labor force compared well with the old timers.

Wage incentives.—A group bonus system was in operation in the foundry. Workers were paid a guaranteed hourly rate and a premium based on the total foundry output. The hourly base pay rates amounted to \$1.05 for core-makers and floor-mold operators and ranged from \$.65 to \$.85 for laborers.

Hourly schedules.—The periods selected for study permit comparison of four stabilized hourly levels. During the period from January through August 1940, the foundry operated on a 40-hour schedule of 5 days at 8 hours. The next period, extending from June through November 1941, was marked by the addition of 4.5 hours on Saturday, thus increasing the workweek to 44.5 hours. In June 1942, 6 months after our entry into the war, the workweek was increased to 53 hours with 5 days at 9 hours and Saturday at 8 hours. This schedule was maintained through November 1942. From January through May 1943, a reduced schedule of 48 hours, or 6 days at 8 hours, was worked.

FINDINGS OF STUDY

The 40-hour week vs. 44½ hours.—When the level of hours was raised from 40 to 44.5 by adding Saturday at 4.5 hours to the workweek, efficiency dropped 1.9 percent.

Absenteeism increased from 1.2 percent to 4.2 percent.

Output increased to a level 5.9 percent above that which had prevailed during the shorter hours. This increase was effected by lengthening scheduled hours 11.3 percent. Stated differently, $2\frac{1}{3}$ additional hours of production were obtained for the additional $4\frac{1}{2}$ hours worked.

The 53-hour week.—The conversion to war production apparently acted as a strong stimulus to improved efficiency. When hours were increased from 44.5 to 53 per week, efficiency rose 5.3 percent.

The time lost because of absenteeism increased only slightly, from 4.2 percent to 5.5 percent.

The combined effects of a marked increase in efficiency and a small increase in absenteeism resulted in an output level appreciably higher than that of the prewar 44.5-hour schedule. Total output increased 23.6 percent during the wartime longer workweek. In comparison, hours had been lengthened 19 percent. In other words, an additional 10.6 hours of production were obtained when 8.5 hours were added to the schedule.

The 48-hour week.—After a period of 5 months on the 53-hour schedule, weekly hours were cut back to 48. The reduction in hours was accompanied by an increase in efficiency of 8.8 percent. The percentage of time lost, however, rose from 5.5 percent to 7 percent.

A decrease in scheduled hours of 9.4 percent resulted in a decrease in output of only 3 percent. In terms of hours, only 1.6 hours of output were lost when the workweek was reduced by 5 hours, from 53 to 48.

52: Intermittent schedules ranging from 24 to 48 hours a week for women, individual wage incentives; light, operator-paced machine-sewing operations.

The operations surveyed consisted of the various sewing operations entailed in the production of men's trousers. All operations were performed on electric-powered sewing machines and were entirely operator-paced. The pace was fast and the work required great manual dexterity. The speed and character of the operations were such that they induced a nervous rather than a physical strain.

Working conditions.—The plant facilities can be characterized as functional. No special effort was made to make the plant attractive or comfortable. The atmosphere was free from dust, smoke, or fumes. Summer and winter temperatures were moderate. Ventilation was good. The lighting installation, although not modern, provided adequate illumination. Noise was moderate. Aisles and work areas were usually unobstructed and were adequate in size. There was no cafeteria. There were no organized rest periods; pauses were taken when the work flow permitted.

The work force.—The plant was located in a small, rural, farming community. Most of the 96 female operators, whose performance was surveyed, had outside interests such as farming and gardening. During the planting and harvesting seasons, their tendency was to hold working hours down to an absolute minimum so as to allow them time for these outside activities. The workers ranged in age from 19 to 70 years, with a strong concentration in the late thirties. Most of them had high school education, were self-reliant, and skeptical of anything that smacked of company patronage.

Wage incentives.—All workers operated under an individual piecework system with a minimum guarantee of 40 cents per hour. The piece rates, based on company cost experience rather than time study, were set through negotiation between management and the labor organization representing the employees. Earnings ranged from 60 cents per hour to \$1.25 and averaged about 80 cents for the entire group.

Hourly schedules.—During the entire 20-month period surveyed only one shift was scheduled. Hours nominally were from 7:45 a.m. to 4:45 p.m. including 1 hour for lunch. Actual hours worked by individual operators, however, varied greatly; while some worked as few as 24 or 30 hours per week, others—in other sewing operations—worked 48 hours. Schedules varied because of shortages of materials, the presence or absence of workers in key operations (such as pocket makers), and the pressures and delays involved in the carrying out of military contracts.

As a result, there were no fixed and uniform patterns of daily and weekly hours. Because of the fast pace of the work, however, it was believed that the effects of long weekly hours would be felt quickly—particularly so because the processes were of a routine, repetitive, mass-production character. The findings reflect the experiences of employees who worked a specified number of weekly hours at any time during the period surveyed. Thus, the output experiences of all operators who worked 48 hours, for example, were grouped together regardless of the particular month during which that schedule was worked.

FINDINGS OF STUDY

Efficiency.—Analysis of the experience of the 96 female operators indicates that the highest efficiency levels were obtained during a workweek of 24 or 28 hours. Thereafter the average hourly rate of output dropped as hours increased, although it remained fairly stable at the 32-, 36-, and 40-hour levels. Efficiency was lowest at 48 hours a week. A comparison of the efficiency level at 24 hours with that achieved during the 48-hour week shows an efficiency decline of 7.1 percent. In comparison with the 40-hour week, efficiency during the 48-hour workweek was about 4 percent poorer.

Absenteeism.—Because hours of individual workers varied widely, it was not possible to determine actual absenteeism rates measuring the percentage of scheduled hours lost. It was possible, however, to determine relative rates for each of the weekly schedules during which employees lost only part of a week and returned to work during the same week. (The computed rates understate the actual amount of absenteeism loss because of the exclusion of absences lasting an entire week.)

As hours increased from 24 to 40 a week, the relative absenteeism rate increased steadily, reaching a maximum of 6.3 percent during the 40-hour workweek. Thereafter absenteeism decreased sharply. At 44 hours it was 3.3 percent and at 48 hours, 1.2 percent. Apparently workers were anxious to earn the time-and-a-half bonus pay for overtime.

Output.—Generally, weekly output kept pace with increasing hours. As hours went up, weekly output went up proportionately. The higher efficiencies during the shorter workweeks, together with low absenteeism losses, resulted in an output situation averaging about 4.5 percent higher than that which obtained during the 40-hour week. When hours rose above 40, total output increased only about 2 percent more than did hours.

96 women on machine-sewing operations

Item	Scheduled hours						
	24.0	28.0	32.0	36.0	40.0	44.0	48.0
Index of scheduled hours.....	60.0	70.0	80.0	90.0	100.0	110.0	120.0
Index of efficiency.....	103.7	103.6	102.6	100.8	100.0	98.9	96.3
Relative percentage of absenteeism ¹	2.2	3.3	2.6	4.0	6.3	3.3	1.2
Index of output.....	64.8	74.8	85.4	93.0	100.0	112.2	122.0

¹ Does not include full-week absences.

53: *Intermittent schedules ranging from 20 to 55 hours a week for men, individual wage incentives; medium-heavy, operator-paced pressing of men's trousers.*

The performance of 13 pressers was surveyed in the same plant which furnished the material for case study 52. Pressing, in this plant, was done by machine and foot-pedal-controlled hand irons and was entirely man-paced. The piecework incentive system and interdependence of all operations were conducive to a fast pace. Compared with other operations in the clothing industry, pressing appeared to be the most physically demanding.

Working conditions.—The atmosphere near the pressing machine was hot and often humid. Working conditions, otherwise, were similar to those described in the previous case study.

The work force.—Hourly earnings of the selected employees ranged from 85 cents to \$1.30 and averaged \$1.10. Most of the men owned and worked on small farms and vineyards. The supplementary income derived from this work served to make for a certain amount of independence in the workers' relations with the company. This manifested itself in several ways. It was almost impossible, for example, to schedule longer hours during the planting and harvesting seasons. The absence curve generally rose, according to management, during the hunting and fishing seasons. The introduction of new procedures often met with resistance on the part of workers who were skeptical of new-fangled ideas. In short, labor-management relations, while cordial, were marked by the particular influences found in a rural, farming community.

Hourly schedules.—There were no fixed and uniform schedules of daily and weekly hours. As was indicated in the previous study, hourly schedules were determined by the uneven work flow. Consequently, working hours frequently varied from week to week and differed among pressers during the same week. During the 20-month period surveyed the workweek for pressers ranged from 20 to 55 hours. The methods used to determine levels of efficiency and relative absenteeism rates during the various weekly schedules are the same as those described in case study 52.

FINDINGS OF STUDY

Efficiency was highest during a workweek of 24 or 28 hours. Thereafter hourly efficiency decreased as hours increased but remained fairly stable at 32, 36, and 40 hours. After 40 hours, however, efficiency dropped more sharply. The 55-hour week was about 6 percent poorer in average hourly output than the 40-hour week and about 9 percent poorer than the 24-hour week. It is also significant that hours below 24 per week were not as efficient as the longer hours and were on a par with the efficiency achieved during the 48-hour week.

Absenteeism.—There was no absenteeism during the 24-hour workweek. At 36 hours, it was 3.5 percent and at 40 hours it rose to 7.8 percent. But at 44 hours it was only 1.9 percent; at 48 hours, 0 percent; and at 55 hours, 1.2

percent. Apparently the incentive of overtime pay was responsible for the improvement in attendance during the longer workweeks. It is noteworthy that when hours fell below 24 per week, the percentage of time lost due to absenteeism rose to 4.4 percent.

Output.—Weekly output generally kept pace with increased hours, the decrease in absenteeism offsetting the decrease in efficiency. The output level was relatively as good at 44 and 48 hours as at 24 and 32 hours.

These conclusions are based on erratic hourly schedules. If the long hours had been worked steadily rather than intermittently, the value of overtime pay as an incentive to good attendance might have become less effective as fatigue accumulated. Furthermore, the downward trend in efficiency indicates that, had long hourly schedules been maintained for an appreciable length of time, the level of output would have been considerably lowered.

13 men on pressing men's trousers

Item	Scheduled hours								
	20.0	24.0	28.0	32.0	36.0	40.0	44.0	48.0	55.0
Index of scheduled hours	50.0	60.0	70.0	80.0	90.0	100.0	110.0	120.0	137.5
Index of efficiency	97.8	103.2	101.4	100.1	99.6	100.0	98.8	97.0	93.6
Percentage of absenteeism ¹	4.4	0	1.2	1.9	3.5	7.8	1.9	0	1.2
Index of output	52.0	67.3	76.0	85.3	94.0	100.0	115.8	126.4	137.1

¹ Does not include full-week absences.

54: Intermittent schedules ranging from 28 to 52 hours a week for women, individual wage incentives; light, operator-paced sewing operations.

Machine- and hand-sewing operations were surveyed in a plant producing military and civilian overcoats during the war. The weight of the material handled ranged from 4 to 6 pounds. All work was performed under an individual piece-rate incentive system. The work pace was fast and controlled by the operator.

Working conditions.—The plant was located in a residential area of an industrial city and belonged to the same company which owned the rural plant described in case studies 52 and 53. Plant facilities were fair. Lighting and ventilation were poor. Work areas and aisles were often crowded and obstructed. There was no lunchroom. Comfort facilities met only minimum requirements. There was little dust, and noise was moderate. There were no organized rest periods.

The work force.—The performance of 32 experienced female operators was surveyed. Their ages ranged between 45 and 55 years. The great majority of them were married and had numerous home duties to perform outside of working hours. The average earnings of the group was about 90 cents per hour.

Hourly schedules.—As was indicated in the previous studies conducted in clothing plants, no fixed daily or weekly schedules were worked. While the nominal workday was 8 hours and the workweek 40 hours, this schedule was

constantly revised depending upon the volume of work at hand and the work flow. As a result, schedules ranged from 28 to 52 hours a week during the 20-month period surveyed.

The methods used to compute levels of efficiency and relative absenteeism rates were the same as those described in case study 52.

FINDINGS OF STUDY

Efficiency.—An analysis of the performance of the selected group reveals a rise in efficiency of 6.3 percent as hours were increased from 28 to 40 a week. The improvement in efficiency as hours approached 40 a week indicates the added hours probably caused no fatigue and that actually the workers were able to utilize the added worktime to increase their earnings by increasing their hourly output.

The rising trend in efficiency, however, was reversed when the workweek extended beyond 40 hours. At 44 hours, efficiency dropped about 1 percent and at 52 hours about 3 percent from the efficiency level at 40 hours.

Absenteeism.—The percentage of time lost due to absenteeism remained fairly stable during the work schedules ranging between 28 and 40 hours a week. The relative percentages were 5 percent at 28 hours; 5.2 percent at 32 hours; 3.1 percent at 36 hours; and 4.8 percent at 40 hours.

As was true in case study 52, attendance improved when hours were increased beyond 40 a week. During the 44-hour workweek, the relative absenteeism rate was 2.3 percent. At 52 hours, it dropped to 0.6 percent. The increased attendance during the longer workweeks can be attributed to the workers' desire to remain on the job during those weeks when the extra— or overtime—hours were worked, in order to take advantage of the added overtime pay. The effect of a sustained period of long hours on absenteeism is not demonstrated in this study. It must be remembered that workweeks of 44 hours and more were scheduled only intermittently. It is likely, as previous studies have shown, that absenteeism would have increased had long hours been worked continuously for an extended period.

Output.—When weekly hours dropped from 40 to 28, the proportionate drop in total weekly output was 4 percent greater. At 36 hours, output kept pace with the change in hours. When hours were raised from 40 to 44, output increased by 2 percent more than did hours; at 48 hours output increased 1.9 percent more than did hours; and at 52 hours output increased 0.5 percent more than did hours. Thus, the drop in absenteeism offset the drop in effi-

32 women on sewing operations

Item	Scheduled hours						
	28.0	32.0	36.0	40.0	44.0	48.0	52.0
Index of scheduled hours.....	70.0	80.0	90.0	100.0	110.0	120.0	130.0
Index of efficiency.....	94.1	95.2	100.0	100.0	99.1	98.3	96.0
Relative percentage of absenteeism ¹	5.0	5.2	3.1	4.8	2.3	1.7	.6
Index of output.....	65.8	76.0	91.6	100.0	112.0	121.9	130.5

¹ Does not include full-week absences.

ciency, but at a decreasing rate with each additional increase in hours above 40. The effects of fatigue are indicated, though perhaps to a lesser extent than would be the case if the schedules of long hours had been worked continuously rather than sporadically.

55: Intermittent schedules ranging from 28 to 52 hours a week for men, individual wage incentives; medium-heavy, operator-paced pressing of overcoats.

The performance of 22 hand- and machine- pressers was surveyed in the same plant which furnished the material for case study 54. A piece-rate system of payment was in effect. The work required long experience and was highly skilled. The physical effort required of the workers ranged from light to medium. With the exception of the higher temperatures near the pressing machines in this department, working conditions were similar to those described in the previous case study, 54. The nature of the operation made for a steady and deliberate rather than a fast pace.

The work force.—The men selected were urban workers whose average earnings were about \$1.13 an hour. They ranged in age from 35 to as high as 71 years, with the highest concentration around 55 years. The selected group consisted of experienced workers who had spent from 15 to 50 years in the industry.

FINDINGS OF STUDY

Efficiency during irregular work schedules.—During the 20-month period surveyed, the workweek fluctuated between 28 and 52 hours. The methods used to compute efficiency levels and relative rates of absenteeism were the same as those described in case study 52.

A comparison of the performance of the selected workers during each schedule of hours reveals a steadily rising trend of efficiency as weekly hours were increased from 28 to 40. The level of efficiency during the 40-hour workweek was 4.7 percent higher than that of the 28-hour workweek and 4.1 percent higher than that of the 32-hour workweek. It would appear that when assured of a full week of work, the selected workers increased their hourly output.

When the workweek was increased beyond 40 hours, the upward trend in efficiency was arrested and hourly output leveled off. Efficiencies during the 44-, 48-, and 52-hour workweeks were approximately the same as that achieved during the 40-hour workweek.

The failure of efficiency to drop when hours were extended to 52 a week runs counter to the experiences noted in the previous clothing industry studies. In this connection, it should be recalled that (1) The work pace on this operation was deliberate rather than fast; (2) the workers were old-timers of a relatively high average age who had well-established ideas of what constituted a day's work; and (3) extended schedules of 44 hours and more per week were worked only sporadically rather than continuously.

Absenteeism.—Attendance remained generally stable during the entire 20-month survey period. The relative rates of absenteeism were 1.2 percent during the 28-hour workweek, 1.7 percent during the 40-hour workweek, and 1.2 percent during the 52-hour week. Once more, the comparatively low rates of absenteeism during long hours of work might be attributed to the workers' desire to earn the time-and-a-half pay for overtime. It is doubtful, however, in light of the experience observed in other industries, that the overtime pay would act as an incentive to good attendance, if long hours were worked continuously for an extended period rather than intermittently.

Output.—Output increased in almost exact proportion to the number of hours added to the schedules of 36 and more hours a week. When weekly hours dropped below 36, the approximate 4-percent drop in efficiency resulted in a comparable decrease in total output. The factors advanced earlier as possibly influencing the efficiency and attendance experiences of the group are also applicable in the analysis of its output experience.

22 men on pressing overcoats

Item	Scheduled hours						
	28.0	32.0	36.0	40.0	44.0	48.0	52.0
Index of scheduled hours.....	70.0	80.0	90.0	100.0	110.0	120.0	130.0
Index of efficiency.....	95.3	95.9	99.4	100.0	99.4	100.5	99.3
Relative percentage of absenteeism ¹	1.2	3.3	1.5	1.7	.8	1.7	1.2
Index of output.....	67.0	75.6	89.8	100.0	110.4	120.8	130.1

¹Does not include full-week absences.

56: *Intermittent schedules ranging from 28 to 52 hours a week for women, individual wage incentives; light, operator-paced sewing operations.*

This plant manufactured military and civilian jackets during the war. The work surveyed was about evenly divided between the operation of electric-powered sewing machines and hand sewing. As in case study 55, the operations in this plant required highly skilled and experienced workers. The production pace was importantly influenced by the strict quality control maintained by management. Although a piece-rate incentive system was in effect, the emphasis was on quality rather than on volume of output and made for a steady and unhurried work pace.

Working conditions.—Working conditions compared favorably with those described in the previous case study. Lighting and ventilation were good. Work areas and aisles were adequate in size and generally unobstructed. Noise was moderate. Comfort facilities were adequate. There was no cafeteria. Rest pauses were taken by individual workers when the work flow permitted.

The work force.—The performance of 123 female workers was surveyed for a period of 20 months. Most of the selected workers were between 45 and 55 years old and had worked from 5 to 25 years in the industry. They were characterized by management as experienced, stable workers who were dependent upon their jobs for their livelihood.

Hourly schedules.—This plant, like the clothing plants previously studied, could not maintain fixed daily and weekly schedules. The pressures of war contracts, the dislocations caused by material shortages, style changes, and the absence of key workers served to make the work schedules extremely flexible. Weekly hours ranged from 28 to 52 during the survey period. The methods used to compute levels of efficiency and relative rates of absenteeism were the same as those described in case study 52.

FINDINGS OF STUDY

Efficiency.—Analysis of the workers' performance indicates a small, gradual rise in efficiency as weekly hours were increased from 28 to 40. Hourly output during the 40-hour week was 2.8 percent higher than that achieved during the 28-hour week. When weekly hours were extended to 44, efficiency again rose slightly, less than 1 percent, and remained at that level during the 48- and 52-hour workweeks. Apparently, the workers, operating at a relatively slow pace, were able to maintain and even improve their hourly output during the intermittently scheduled longer workweeks.

Absenteeism.—The rates of time lost due to absenteeism reached their highest points, 6.8 percent at 32 hours and 6.1 percent at 40 hours. When weekly hours were lengthened beyond 40, the absenteeism rates declined sharply, dropping to 2.1 percent during the 44-hour week and 1.1 percent during the 52-hour week. The desire to earn the overtime bonus apparently acted as an incentive toward good attendance during the 44-hour and longer workweeks. But, again, the longer work schedules were worked only intermittently and the results achieved during these longer hours may not be indicative of what might have happened if they had been worked steadily over a long period of time.

Output.—Improved attendance and the relatively small increase in efficiency during the 44- to 52-hour workweeks resulted in a better total output situation than that which obtained during the shorter workweeks. While the 28-hour week represented a drop of 30 percent in hours from the 40-hour level, total output was 31.5 percent lower. During the 32-hour week, a 20-percent decrease in hours from the 40-hour level, total output was 23.4 percent lower. On the other hand, when hours rose 10 percent above the 40-hour level, output was 15.5 percent higher; when hours were increased by 30 percent (to 52) output increased 39.4 percent. The data indicate that the work pace was slow enough to permit the occasional scheduling of long workweeks without adversely affecting the performance of this group.

123 women on sewing operations

Item	Scheduled hours						
	28.0	32.0	36.0	40.0	44.0	48.0	52.0
Index of scheduled hours.....	70.0	80.0	90.0	100.0	110.0	120.0	130.0
Index of efficiency.....	97.3	97.7	98.5	100.0	100.6	100.8	100.7
Relative percentage of absenteeism ¹	5.5	6.8	3.1	6.1	2.1	1.8	1.1
Index of output.....	68.5	77.6	91.5	100.0	113.5	126.7	139.4

¹ Does not include full-week absences.

57: *Intermittent schedules ranging from 28 to 52 hours a week for men; individual wage incentives; medium-heavy, operator-paced pressing of jackets.*

The performance of 29 male workers doing hand- and machine-pressing operations was surveyed in the same plant which furnished the material for the previous case study. The operations were entirely man-paced and, as a consequence of the strict quality control maintained by management, relatively slow. Working conditions were similar to those described in case study 56. Most of the selected men ranged in age between 45 and 60 years. They were a stable group of urban workers who had spent from 20 to 35 years in the industry.

FINDINGS OF STUDY

Efficiency.—Analysis of the workers' performance during workweeks ranging from 28 to 52 hours shows an experience similar to that noted for the female workers in the plant. As weekly hours were increased from 28 to 40, efficiency rose about 2.1 percent. When the workweek was extended to 44 hours, efficiency rose less than 1 percent above the level achieved during the 40-hour week, and remained at that level during the 48- and 52-hour workweeks.

Absenteeism.—The rates of time lost due to absenteeism, although significantly lower, followed the same trend observed in the absenteeism rates of female workers in the previous study. The rates were: 3.1 percent at 28 hours; 3.6 percent at 32 hours; 1.4 percent at 36 hours; and 3 percent at 40 hours. Thereafter absenteeism decreased sharply, dropping to less than 1 percent during the 44- to 52-hour workweeks.

Output.—As a result of the better attendance and the slight rise in efficiency, total output was somewhat better during the 44- to 52-hour workweeks than during the shorter weekly schedules. At 28 and 32 hours, the decrease in total output was slightly greater (1.4 percent) than the corresponding decreases in hours from the 40-hour workweek. When hours rose above 40, the increase in total output was 3.1 percent greater at 44 hours and 4.3 percent greater at 52 hours than the corresponding hourly increases above the 40-hour workweek.

In conclusion, it must be pointed out that previous studies have shown that the value of overtime pay as an incentive to good attendance deteriorates quickly when long hours are worked continually for an extended period. The uncommon experience of improved attendance during workweeks ranging from 44 to 52 hours, observed in all groups surveyed in the clothing industry, might be attributed to the intermittent scheduling of the longer workweeks. It is likely that the absenteeism and efficiency trends would have been quite different had the long hours been worked steadily.

Note: Examination of the efficiency trends of the six groups studied reveals a relationship between the work pace of each group and its trend of

hourly output. In case studies 55 to 57, where the work pace was moderate or slow, the workers were able to maintain and in two cases slightly improve their hourly output as weekly hours rose to 52. On those operations where the work pace was fast, however (case studies 52 and 54), and in spite of the fluctuating nature of the schedule, increases in hours beyond 40 a week were accompanied by lowered efficiencies.

29 men on pressing of jackets

Item	Scheduled hours						
	28.0	32.0	36.0	40.0	44.0	48.0	52.0
Index of scheduled hours.....	70.0	80.0	90.0	100.0	110.0	120.0	130.0
Index of efficiency.....	97.9	98.9	98.2	100.0	100.6	100.8	100.9
Relative percentage of absenteeism ¹	3.1	3.6	1.4	3.0	.8	.7	.7
Index of output.....	68.6	78.6	89.9	100.0	113.1	123.7	134.3

¹ Does not include full-week absences.

58: *Workweeks of 48, 40, 46, and 43 hours for women, individual wage incentives; light, operator-paced hat-finishng operations.*

This study was conducted in the custom trimming department of a men's hat-manufacturing plant. The operation surveyed was the hand-sewing of hat bands and trimming. The work pace was fast and controlled by the operator. Work was light and of a routine nature. Rest pauses were taken as the work flow permitted.

The workers operated under an individual piece-rate incentive system.

Working conditions.—The working conditions in this shop were excellent. Work areas were large and unobstructed. Lighting and ventilation were good. There was practically no noise. Music was played at frequent intervals during the day.

Plant facilities were very good. Inexpensive meals were served in a large, pleasant cafeteria. A motion picture projection room, ping-pong tables, and lounge chairs were provided for the employees' recreation. A large, fully equipped hospital sponsored by the company treated the illnesses and injuries sustained by employees. Many welfare services, such as a mutual benefit association, voluntary group life insurance, and a retirement pension plan, were available to the employee and her family.

The work force.—The performance of 28 women was surveyed for a period of 3 years. The labor force was characterized by management as stable and experienced. The ages of the workers were generally high, with the majority ranging from 45 to 55 years. Most of the workers had been with the company more than 10 years.

Hourly schedules.—During the selected period—August 1942 through July 1945—four different levels of hours were scheduled: (1) 48 hours per week with 6 days at 8 hours; (2) 40 hours per week by eliminating the 8-hour Saturday; (3) a 46-hour schedule, with 5 days at 8 hours and Sat-

urday at 6 hours; (4) a workweek of 43 hours, consisting of 3 days at 9 hours and 2 at 8.

FINDINGS OF STUDY

48 vs. 40 hours.—When the workweek was changed from 48 to 40 hours, by the elimination of Saturday, efficiency increased 3.7 percent.

The percentage of time lost due to absenteeism dropped from 10.7 percent to 8.4 percent.

The combined effect of increased efficiency and decreased absenteeism when scheduled hours were shortened by 16.7 percent resulted in a loss of 11.4 percent in total output. In other words, for the 8 hours dropped from the 48-hour schedule, only 5½ hours of output were lost.

40 vs. 46 hours.—After the 40-hour week had been worked for 5 months, the workweek was increased to 46 hours by the addition of a 6-hour Saturday. Efficiency dropped 1.6 percent from the level achieved during the 40-hour week. It was, however, 2 percent higher than the efficiency level of the 48-hour workweek.

Absenteeism during the 46-hour week increased to a level of 10.3 percent, or comparable to the absenteeism rate of the 48-hour week.

Although hours were increased 15.7 percent above the 40-hour workweek, total output was increased only 10.7 percent. In terms of hours, for the 6 hours added to the schedule, 4½ hours of output were gained.

46 vs. 43 hours.—After a period of 5 months, the workweek was reduced to 43 hours by eliminating Saturday and increasing 3 days of the week to 9 hours. Efficiency rose 2.9 percent above that of the preceding workweek of 46 hours. In comparison to the original 48-hour workweek, efficiency on this 5-day week was 5 percent higher.

Absenteeism increased from a level of 10.3 percent during the 46-hour week to 16.7 during the 43-hour week. The data do not reveal a specific reason for this increase in absenteeism. (The period during which the 43-hour schedule was worked, however, included VE-day and the vacation months of June and July. The increase in absenteeism might have been caused by unauthorized extensions of allowed vacation periods.)

The rise in absenteeism caused a loss in total output disproportionate to the decrease in scheduled hours. When weekly hours were reduced from 46 to 43 hours, or 6.5 percent, output dropped 10.7 percent.

In comparison to the original schedule of 48 hours, the difference of 10.4 percent in the scheduled hours was accompanied by a loss of 12.4 percent in output. Stated differently, 6 hours of output were lost when 5 hours were dropped from the schedule.

The workers apparently were more efficient on the 5-day schedules than on the 6-day schedules. In terms of over-all output, taking into account both efficiency and absenteeism, the most economical schedule appeared to have been the straight 40-hour workweek, with 5 days at 8 hours.

59: *Workweeks of wartime 48 hours and postwar 40 hours for women, individual wage incentives; light, operator-paced operations in the packaging of biologicals.*

The plant in which the department surveyed was located, was engaged in the manufacture of pharmaceuticals and biologicals. The departments included in case studies 60 through 63 were located in this same plant.

Operations in the selected department consisted of filling and capping or flame-sealing biological market containers. Mechanical filling machines and analytical balances were used. Each team of two operators was seated in a sterile, glass-enclosed room about 6 feet square. One worker filled the container, the other capped or flame-sealed it, and placed the container in a storage box. The work may be described as light, operator-paced machine operations.

Working conditions.—Working conditions were good. Lighting was excellent. Air conditioning kept temperature at 65 to 70 degrees, and dust was at an absolute minimum. Work was done under sterile conditions. The workers wore white caps, gowns, and masks over their mouths. Noise was at an absolute minimum. There were even restrictions against talking. The fragile glass ampules had to be handled with bare hands and there was a work hazard of accidental self-vaccinations from broken ampules. Resulting illnesses lasted from 3 to 6 days, but after several such self-vaccinations the workers usually developed an immunity, and no longer suffered ill effects.

Wage incentives.—Workers in the department operated under an individual wage-incentive system. In addition to a fixed hourly wage, the workers received bonuses for production in excess of established quotas.

Hourly schedules.—The performance of a selected group of 17 women on the day shift was surveyed under working schedules of 48 and 40 hours a week. The period of the 48-hour week, comprising 6 days of 8 hours, covered the last months of the war. After the war the workweek was shortened by eliminating Saturday work.

FINDINGS OF STUDY

Efficiency.—When the workweek was reduced from 48 to 40 hours, efficiency began to rise gradually, but steadily. The rising trend continued through the period available for study, and a stable level under the shorter workweek had not yet been reached by March 1946, the end-point of the period. At that time it had reached a point 12 percent higher than the level of efficiency which existed in the wartime period of the longer workweek.

Absenteeism.—Attendance was poor in both periods. Absenteeism averaged 12.1 percent during the wartime 6-day workweek, and rose after the war to 15.2 percent despite the elimination of Saturday work. This postwar trend in absenteeism appeared as well in case studies 60 through 63 which represent other groups of workers in this plant. It is possible that a wartime pressure for reduced absenteeism was removed after the war, and the resulting feeling of relaxation offset the decrease in weekly hours.

Output.—A stable level of weekly output under the shorter workweek schedule had not been reached by the end of the period as efficiency was still rising. By the last month of the period it had reached a point at which the 16.7 percent reduction in weekly hours meant a loss of only 10 percent in output. In terms of hours of output lost, the 8 hours eliminated from the schedule was accompanied by a loss of only about $4\frac{3}{4}$ hours of output each week.

Daily Pattern of Efficiency and Absenteeism

A combined analysis of daily patterns of efficiency and absenteeism under the two workweek schedules was made for all the selected workers represented in case studies 59 through 63.

Efficiency.—During the 48-hour workweek there was not much change in the level of efficiency for the different days of the week. The difference between the level for any one day and that for the other days of the week was never more than 2 percent.

When the sixth day was eliminated from the week, efficiency was higher on every day. The pattern showed a slight decline in efficiency on Tuesday, a subsequent rise through Thursday, the peak day, and a slight decrease on Friday. The range between the high and low points of the week, however, was narrow, not exceeding about 2 percent.

Absenteeism.—During the 6-day week, absenteeism declined from a high-point of 11.2 percent on Monday to 8.8 percent on Friday. It jumped sharply on Saturday, to 20.8 percent.

When Saturday work was eliminated, absenteeism was highest the first 3 days of the week, rising slightly from 10.7 percent on Monday to 12.7 percent on Wednesday. Thereafter it declined to 9.4 percent on Thursday, and 8.7 percent on Friday.

60: Workweeks of wartime 48 hours and postwar 40 hours for women, group wage incentives; light, operator-paced operations in the packaging of biologicals.

The women in this study worked on group incentives on the day shift in the same department as the group in case study 59.

Operations consisted of boxing and labeling biological and ampule products by hand. The women worked in groups seated along both sides of long tables. The items traveled on a conveyor belt in the center of the table. Equipment included glue-rolling, labeling, and taping machines. The work may be characterized as light, operator-paced packaging operations.

Working conditions were similar to those outlined in the preceding case study.

Wage incentives.—A group wage-incentive system was in operation. In addition to fixed hourly wages, the workers received bonuses based on excess production over fixed quotas for the group.

Hourly schedules.—The performance of 25 women was surveyed under a wartime workweek of 48 hours (6 days at 8 hours) and a postwar workweek of 40 hours (5 days at 8 hours).

FINDINGS OF STUDY

Efficiency.—During the 40-hour workweek period, efficiency showed a steadily rising trend to an end-point 6.9 percent higher than the level which had prevailed during the longer workweek schedule. A stabilized level had not been reached at the end of the period, and it is not known how much further efficiency might have risen.

Absenteeism.—Absenteeism remained essentially unchanged when the workweek was reduced to 5 days. The rates were high in both periods, 13.7 and 13.8 percent. The failure of absenteeism to decrease during the shorter workweek may have resulted from a possible easing-off of the wartime pressure for good attendance.

Output.—Although output had not reached a stabilized level at the end of the period surveyed, it had reached a point at which the 16.7-percent decrease in the workweek meant a drop of only 10.9 percent in output. At that point, only $5\frac{1}{4}$ hours of output were being lost each week for the 8 hours dropped from the schedule.

Daily Pattern of Efficiency and Absenteeism

A combined analysis of daily patterns of efficiency and absenteeism under the two work schedules for all selected workers in case studies 59 through 63 is presented in case study 59.

61: *Workweeks of wartime 48 hours and postwar 40 hours for women, individual wage incentives; light, operator-paced operations in the packaging of pharmaceuticals.*

The department surveyed was located in the same plant as that described in case studies 59 and 60.

Operations of these women consisted of bottling, labeling, and packaging dry pharmaceuticals for shipment. Boxes or bottles were filled by hand. A strip of cotton was placed in the top of each bottle, and the bottle was capped with a special hand tool. Labeling was done either by hand or by machine. The bottles were then wrapped in transparent paper, a descriptive folder enclosed, and the wrapping sealed.

Working conditions.—Lighting was adequate and noise, moderate. Large window areas and electric fans kept temperatures at a comfortable level. There was a moderate amount of dust. Aisles showed some amount of congestion and blocking.

Wage incentives.—An individual wage-incentive system was in operation. Workers received a fixed hourly wage plus a bonus based on production in excess of fixed quotas.

Hourly schedules.—The performance of a selected group of 26 women on the day shift was studied. During the war a 48-hour workweek was

maintained, consisting of 6 days of 8 hours. After the war, Saturday work was eliminated, making for a 40-hour workweek.

FINDINGS OF STUDY

Efficiency.—When the workweek was reduced to 40 hours, efficiency began to rise, and continued to increase through the period surveyed. A stable level had not been reached by the end of the period, but efficiency had reached a point 5.1 percent higher than the level achieved during the earlier period of the 48-hour workweek.

Absenteeism.—Absenteeism was high under both schedules of hours with no appreciable difference in the rates: 9.4 percent during the wartime schedule of 6 days per week and 9.2 percent in the postwar period of the 5-day week. The continued high rate of absenteeism after the war, despite the cut-back in hours, as noted for the preceding groups surveyed (see case studies 59 and 60) may have resulted from a relaxation of the wartime pressures for good attendance.

Output.—Because of the steady rise in efficiency in the period of the shorter workweek, output had not yet reached a stabilized level. In the last month of the period, the 16.7 percent decrease in hours was accompanied by a 12.2 percent loss in output. At that point, $5\frac{3}{4}$ hours of output were being lost each week by the elimination of 8 hours from the schedule.

Daily Pattern of Efficiency and Absenteeism

A combined analysis of daily patterns of efficiency and absenteeism under the two levels of weekly hours for all selected workers in this plant is presented in case study 59.

62: *Workweeks of wartime 48 hours and postwar 40 hours for women, group wage incentives; light, operator-paced operations in the packaging of pharmaceuticals.*

The workers in this study were employed in the same department as those in case study 61.

The operations consisted of filling, capping, and labeling fluid pharmaceuticals. Bottles were cleaned by means of air jets and placed on a conveyor belt feeding a vacuum filling machine. Here the bottles were placed under filling nozzles, the nozzles lowered into the bottles, and the flow of liquid controlled by a foot pedal. The bottles were then capped and sealed by hand. The operations were performed while standing. They may be characterized as light, operator-paced, packaging operations.

Working conditions were the same as those cited in case study 61.

Wage incentives.—A group wage-incentive system was employed, whereby, in addition to an hourly wage, the workers received a bonus based on production in excess of fixed quotas achieved by the group.

Hourly schedules.—The performance of all workers in the group was surveyed under two levels of weekly hours. The number of workers ranged between 25 and 42. The working schedules were a wartime workweek of 48

hours (6 days at 8 hours) and a postwar workweek of 40 hours (5 days at 8 hours).

FINDINGS OF STUDY

Efficiency.—There was a slight increase of 1.5 percent in efficiency when hours were reduced from 48 to 40 per week.

Absenteeism.—The absenteeism rate was 6.4 percent during the 48-hour wartime workweek. It rose to 9.6 percent after the war despite the elimination of Saturday work, a possible result of an easing up after the pressures to maintain attendance during the war.

Output.—The 16.7-percent decrease in the workweek was accompanied by an 18.3-percent drop in output. The slight increase in efficiency was offset by the rise in absenteeism, with the result that $8\frac{3}{4}$ hours of output were lost by the elimination of 8 hours from the 48-hour workweek.

Daily Pattern of Efficiency and Absenteeism

A combined analysis of the daily patterns of efficiency and absenteeism under the two workweek schedules for all selected workers in the plant is presented in case study 59.

63: *Workweeks of wartime 48 hours and postwar 40 hours for women, individual wage incentives; light, operator-paced operations in the packaging of cough drops.*

The department surveyed was located in the same plant as the departments included in case studies 59 through 62.

The operations consisted of machine-wrapping and hand-packing cough drops. A roll of foil was hand-threaded through the wrapper machine. Cough drops were fed into the machine by a hopper, and were individually wrapped automatically. The operator hand-packed the wrapped cough drops in market containers, inserted a circular in the box, covered the box, and placed it on a conveyor. Although the wrapping machine was automatic, the operator was kept occupied in packing the cough drops, and her speed of operation was not limited by the speed of the machine. The work may be characterized as light, operator-paced, packaging operations.

Working conditions.—Excellent lighting was provided by fluorescent fixtures and white walls. The nature of the product required a controlled temperature of 75 degrees. There was a considerable amount of sugar dust in the air and on the floors. The floors were littered with cough drops and wrappers. The room was too small for the 14 machines installed in it. The noise of the machines was excessive and there was a high incidence of headaches. Unguarded moving parts of the machines extended into the aisles. According to the safety engineer, operators were inclined to insert fingers into moving parts of the machines to dislodge badly wrapped cough drops.

Wage incentives.—There was an individual wage incentive consisting of a bonus based on production in excess of a fixed quota in addition to the fixed hourly wage.

Hourly schedules.—This study surveys the performance of a selected group of 9 women on the day shift under two schedules of hours. During the war a 48-hour week of 6 days of 8 hours was worked. After the war Saturday work was eliminated, making for a 40-hour workweek.

FINDINGS OF STUDY

Efficiency.—The shortening of the workweek from 48 to 40 hours resulted in an increase of 7.9 percent in efficiency.

Absenteeism.—Absenteeism was high in both periods. During the 48-hour workweek the rate was 10.4 percent. It rose to 12.4 percent after the war in spite of the elimination of Saturday work. The trend is similar to that which occurred among the other groups of workers surveyed in this plant in the postwar period, and may have resulted from a possible relaxation in efforts to maintain good attendance.

Output.—The 16.7-percent reduction in the workweek resulted in a loss of 12.1 percent in weekly output. The elimination of 8 hours from the 48-hour workweek thus meant a loss of about $5\frac{3}{4}$ hours of output.

Injuries.—There was a sharp decline in the frequency rate of injuries in the department during the shorter workweek. In the wartime 48-hour workweek period, there was an average of 2,750 injuries (requiring first-aid treatment) per million man-hours of work among all workers in the department. After the war, when the workweek was cut back to 40 hours, the average decreased to about 1,400 injuries. The reduction of the workweek to 5 days thus reduced injuries by half.

64: *Workweeks of prewar 40 and 55 hours, wartime 58 and 50 hours, postwar 45 to 50 hours for men, individual wage incentives; heavy, operator-paced machining operations.*

Operator-paced machining processes on heavy metal parts were studied in this department. Work included grinding, single- and multi-spindle drill press, punch press, cold saw, assembling, sheet metal, arc, spot, and gas-welding operations. The work was heavy, and required a considerable amount of sustained physical effort. It entailed no idle operator time. The welding work imposed a nervous strain on operators. Continuous mental, visual, or manual attention was demanded on the majority of the operations.

Working conditions.—Within the limitations inherent in heavy metal-machining operations, care was taken to make the shop clean and safe. Lighting was adequate and noise of moderate volume. Some vibration, dust, and noise was caused by the punch-press operations. Soiled hands and clothing resulted from handling oily, greasy, and dirty materials. Heat and dampness were moderately high during the summer and rainy seasons respectively. Fumes and sparks were created by the welding operations.

The only food served in the plant was that offered by a mobile snack wagon which passed through every department twice each forenoon and

afternoon coincident with the four 5-minute smoking periods, which constituted the organized rest periods installed in the plant. Workers were permitted to smoke in designated areas during these periods. Washroom and locker facilities were sanitary and adequate in number.

Safety.—Machines were safely spaced and well-guarded. The wide aisles had safety markings. A variety of lifting devices were used to reduce the frequency of injuries from improper lifting. Goggles and protective clothing were supplied wherever necessary. Conveyor belts under the floor automatically removed scrap metal. A safety engineer consulted with an active safety committee composed of management and employee representatives. The operators were to a considerable degree responsible for their own safety and that of their fellow workers; for example, guarding against possible eye injuries when blowing out metal chips with compressed air. Although welders wore special helmets and spark-proof clothing, they were exposed to burns or infections from sparks. There was a considerable amount of exposure to cuts, abrasions, crushed toes or fingers, and similar lost-time injuries. One physician and three nurses were employed full time, and another physician part time. Extensive facilities were available for the treatment of work injuries.

Wage incentives.—The selected workers were on individual wage incentives. Under the Dyer incentive system, time-study standards were set for 60 units of good work per hour as 100-percent efficiency to be expected from the average worker. Experienced operators were expected to earn at least 25 percent above the standard through incentive premiums.

Ten different labor grades were established with four pay-rate levels within each labor grade. Thus, the lowest grade included a range from 75 cents to 87 cents an hour, the highest grade from \$1.38 to \$1.58 an hour.

Overtime bonus during the war was paid at time and a half for all hours over 8 a day and over 40 a week. Before and after the war, it was paid at the rate of time-and-a-half for hours over 8 up to 10 a day, over 40 up to 50 a week, and for all work on Saturday. Double time was paid for daily hours over 10 and weekly hours over 50, and for Sundays and holidays. Incentive workers on temporary day work were paid their regular hourly rate plus 80 percent of the average incentive bonus during the preceding fiscal quarter.

Hourly schedules.—Company records did not indicate the number of hours worked each day or the number of days worked per week. It was, therefore, necessary to rely on company estimates for establishing daily breakdowns of weekly schedules worked.

The selected period extended from June 1940 to December 1945. It included the following weekly schedules and approximate patterns of daily hours: Before the war, 40 hours (5 days at 8 hours) and 55 hours (5 days at 10 hours, Saturday at 5); during the war, 58 and 50 hours (5 days at 10 hours, with additional Saturday work of 8 hours for a 58-hour week); after the war, 45 to 50 hours (5 days at 9 to 10 hours). The plant operated

2 shifts. The 18 male operators selected for this study were on the day shift, which started at 7 a.m. One-half hour was allowed for lunch when weekly hours were below 55, one hour when hours exceeded this level.

FINDINGS OF STUDY

It is pertinent to an analysis of the findings in this plant to note that workers became aware of the demand for the company's products in the war effort by the amount of increases in the available work load, in the size of the labor force, and in the length of the workweek. Management also exerted pressure for more production, for good attendance, and for improved safety conditions.

Prewar 40- and 55-hour weeks.—The prewar change in hours occurred when the 40-hour week was increased to 55 hours by lengthening daily hours to 10 and adding a 5-hour Saturday. During the longer workweek, efficiency declined by 6 percent.

Absenteeism losses remained unchanged, 2.7 percent at 40 hours and 2.6 percent at 55.

Total weekly output increased by 29.6 percent as against an increase of 37.5 percent in weekly hours, due to the decline in efficiency during the longer workweek. In terms of output hours, the addition of 15 hours to the 40-hour week increased total weekly output by the equivalent of 11.8 output hours.

Wartime 58-hour week.—The first wartime schedule studied was lengthened to 58 hours per week by increasing Saturday work from 5 hours to 8.

As cited in the introduction of the findings, workers were well aware of the need for the company's products in the war effort. As a result, their efficiency increased 11.9 percent above the hourly output level maintained during the prewar 55-hour week.

Absenteeism losses rose slightly, to 3.6 percent.

Total output increased by 16.7 percent over the preceding rate for 55 hours, although hours were raised by only 5.5 percent. In other words, the addition of 3 working hours to the prewar 55-hour week resulted in more than 9 additional output hours because of the higher level of wartime efficiency.

Wartime 50-hour week.—By eliminating the 8-hour Saturday, the next wartime schedule was reduced to five 10-hour days.

Efficiency increased by 7.4 percent over the preceding 58-hour week.

Absenteeism losses remained about the same, 3.6 percent for 58 hours and 3.4 percent for 50.

Output.—Because of the sharp rise in efficiency, output dropped only 7.1 percent as against a 13.8-percent reduction in hours—a loss of only 4 output hours for an 8-hour reduction in the weekly schedule.

Postwar 45- to 50-hour week.—The erratic postwar schedule ranged from 45 to 50 hours per week (five 9- to 10-hour days).

Compared with the prewar 40-hour week, postwar efficiency was 14.8 percent higher due to the accelerated production pace acquired during the war and carried over into the postwar period.

Absenteeism and output data could not be developed as the work schedule was very erratic and accurate information on absence rates was lacking for the postwar period.

65: Workweeks of wartime 58, 55, and 50 hours and postwar 48 hours for men, individual wage incentives; heavy, operator-paced machining operations.

The study follows the performance of 14 men on the day shift of the same department described in case study 64. Only points of difference from the preceding case study will be cited in this survey.

Hourly schedules.—As indicated in the preceding case, records revealed only total weekly hours, so that the number of hours worked per day, or days worked per week, were only approximations.

The selected period included wartime weeks of 58, 55, and 50 hours (5 days at 10 hours, with 5 or 8 hours on Saturday); and a postwar week of 48 hours (6 days at 8 hours).

FINDINGS OF STUDY

Wartime 58- and 55-hour weeks.—The wartime schedule of 58 hours per week was reduced to one of 55 hours by reducing Saturday work from 8 hours to 5, and retaining five 10-hour days.

Although some improvement in hourly output may be expected even for a 3-hour decrease from the schedule of 58 hours, the 15.1-percent rise in efficiency appears to be too drastic to be credited entirely to the slight reduction in hours.

Absenteeism losses remained relatively unchanged at 3.3 percent and 3.5 percent for the longer and shorter schedules respectively.

Total weekly output reflected the rise in efficiency by increasing 8.9 percent when weekly hours were reduced by 5.2 percent. Thus, the workers were producing about 5.2 more hours of output at 55 hours than at 58.

Wartime 50-hour week.—In the next war period, Saturday work was eliminated, leaving a week of five 10-hour days.

Efficiency rose 3 percent above the preceding 55-hour level.

The absenteeism rate of 3.3 percent was essentially the same as in the two preceding schedules.

The 9.1-percent decrease in hours from 55 to 50 per week brought about a drop of only 6.1 percent in total weekly output—a loss of 3 output hours as against a 5-hour reduction in scheduled hours.

Postwar 48-hour week.—The postwar 48-hour week was obtained by reducing daily hours from 10 to 8 and adding an 8-hour Saturday.

Efficiency increased 3.2 percent over the preceding 50-hour war period.

The absenteeism rate remained stable at 3.1 percent.

The 4-percent decline in hours was accompanied by a decrease of only 0.4 percent in total weekly output. In other words, the 2 hours eliminated from the previous 50-hour week resulted in practically no loss in output.

66: Workweeks of wartime 45 and 50 hours and postwar 45 hours for women, individual wage incentives; light, operator-paced manual and machining operations.

This study pertains to 9 women, on a day shift, engaged in manual bench and light machine operations involved in winding small coils. Work was light and repetitive, and the pace entirely operator-controlled. Continuous mental and visual attention was required.

Working conditions.—The work area was relatively quiet. Lighting and ventilation were adequate, as was the space available for work and safety aisles. Exposure to injuries was confined to minor cuts and bruises. In all other respects, working conditions were the same as those described in case study 64.

Hourly schedules.—As indicated in case study 64, the pattern of daily and weekly hours worked could only be approximated. When the workweek was raised from 45 to 50 hours during the war, the increase was obtained by lengthening the five 9-hour days to 10 hours each. After the war, the weekly schedule was again reduced to 45 hours.

FINDINGS OF STUDY

Wartime 45- and 50-hour weeks.—When the 5-day wartime week was lengthened from 9 to 10 hours a day, efficiency showed no apparent effect of the longer workday and actually increased by 1.2 percent.

Absenteeism losses also remained fairly stable at 5.3 percent during the 45-hour, and 5.8 percent during 50-hour schedules.

Total weekly output increased in almost direct proportion to the increase in hours, so that 5 hours added to the 45-hour week resulted in 5.3 hours of additional output.

Postwar 45-hour week.—When the postwar schedule was cut back to 45 hours by reducing daily hours from 10 to 9 for each of the five 10-hour days, the reduction in hours had no appreciable effect on efficiency, which improved by only 0.2 percent over the rate for the longer workweek.

Absenteeism losses, however, rose to 7.9 percent in the postwar period of shorter hours.

The 10-percent decrease in the schedule was accompanied by an 11.9-percent decline in total weekly output, so that the 5-hour reduction from the 50-hour week resulted in a loss of nearly 6 output hours. Compared with the wartime schedule of 45 hours, the identical postwar week showed a 1½-percent output loss equivalent to two-thirds of an hour's output. This

difference, however, was attributable entirely to the increased absenteeism rate.

67: Workweeks of prewar 40 and 55 hours, wartime 62 and 55 hours, and postwar 40 to 48 hours for men, individual wage incentives; medium-heavy, operator-paced machining operations in a repair shop.

The performance of 14 male workers on the day shift of a repair shop was followed during prewar, war, and postwar work schedules. These workers were highly skilled and experienced. The process of machining returned company products and manufacturing service parts required the use of such machines as punch presses, drill presses, grinders, lathes, handscrew and milling machines, and hand and power tools.

With few exceptions, work was medium-heavy, highly skilled, and operator-paced. Workers were responsible for careful planning and fine workmanship to avoid costly scrap. As a result, the work pace was deliberate rather than fast.

Working conditions.—The machine-shop noise usual in this type of work was of medium volume, except around punch presses and hand screw machines where noise and vibrations were greater. Boring mills created some dust. The handled material was oily, greasy, and dirty. On some operations, hands, face, and clothes were spattered from lubricants. Temperatures were moderate, the shop was well ventilated and lighted. There was no crowding. The danger of work injuries was fairly high because of the variety of operations involved in this work.

Wage incentives.—Work in this repair shop was sufficiently standardized to permit the installation of an individual incentive system. Standards were established for major repair jobs. At least 75 percent of an operator's time was done on measured work.

For additional information on such factors as working conditions, safety, wage incentives, and hours, see case study 64 which dealt with another department of the same plant.

Hourly schedules.—As mentioned in case 64, the length of the workday and the number of days worked each week could only be approximated, as company records showed only total weekly hours worked.

The period selected for study included the following weekly schedules: Before the war, 40 hours (five 8-hour days) and 55 hours (five 10-hour days and a 5-hour Saturday); during the war, 62 hours (five 11-hour days and a 7-hour Saturday) and 55 hours (as above); after the war, 40 to 48 hours (five to six 8-hour days).

FINDINGS OF STUDY

An analysis of the findings must include a consideration of the type of operator and work involved. As already mentioned, the operators were highly skilled. Work was greatly diversified. Close tolerances and exacting workmanship as well as careful planning was necessary to avoid costly scrap.

As a consequence, the work pace was deliberate rather than fast and could be readily maintained, or even stepped up, when the backlog of work—and with it scheduled hours—increased.

Prewar 40- and 55-hour weeks.—For a period prior to the war, a 5-day week of 40 hours was compared with a 55-hour week of 5 days at 10 hours and Saturday at 5.

Lengthening of the week was accompanied by a 5.6-percent increase in hourly efficiency.

The amount of scheduled time lost due to absenteeism was small during all hourly schedules, the rate rising from 1.8 percent at 40 hours to 2.9 percent at 55.

The gain of 43.6 percent in output when weekly hours were increased by 37.5 percent must be attributed to the rise in efficiency. Expressed in terms of hours, 17½ more output hours were obtained through the addition of 15 hours to the 40-hour schedule.

Wartime 62-hour week.—During the war, the weekly schedule was further increased to 62 hours by changing daily hours from 10 to 11 for 5 days and from 5 to 7 for Saturday.

Despite this additional increase in hours, efficiency increased 3 percent above the previous level at 55 hours.

Absenteeism losses remained low at 2.6 percent.

Total weekly output increased by 16.6 percent when the former 55-hour week was increased by 12.7 percent, again due to improved efficiency. Consequently, a gain of 9 output hours was obtained when 7 hours were added to the 55-hour week.

Wartime 55-hour week.—During a later war period, hours were cut back to the former 55-hour schedule (five 10-hour days and one 5-hour day).

The reduced workweek was 2.1 percent more efficient than the preceding schedule of 62 hours.

Absenteeism losses at 55 hours (1 percent) were almost negligible.

The combined effect of improved efficiency and lower absenteeism losses resulted in an output decrease of only 8 percent as against an 11.3-percent reduction in hours—a loss of only 5 output hours when 7 hours were eliminated from the former 62-hour schedule. Compared with the prewar 55-hour week, the wartime schedule of the same hours resulted in 7.2 percent more output, or an additional 4 output hours.

Postwar 40- to 48-hour week.—After the war, the workweek fluctuated between 5 and 6 days at 8 hours, for total weekly hours of 40 to 48. Efficiency dropped almost 1 percent below the last war period of 55 hours, due perhaps to less pressure for more production and a resultant slackening of the work pace. The faster pace developed during the war, however, was not entirely dissipated during the postwar period, as indicated by a 10-percent higher level of efficiency than that which had characterized the prewar 40-hour week.

68: *Workweeks of prewar 36, 43, and 54 hours, and wartime 60 and 52 hours for men, individual wage incentives; medium-heavy, semi-automatic operations.*

Most operations performed by the 10 day-shift men surveyed in this study were done on engine and turret lathes, with some work on boremetrics, internal, and surface grinders. Work was diversified and exacting, usually requiring close tolerances. Most operations involved a predominance of machine time during which the operator watched, checked, and adjusted the work. A high degree of skill and judgment was demanded of the operator to prevent costly scrap. The production pace, therefore, was deliberate and fairly uniform rather than fast. Work was semi-automatic and medium-heavy. The operators had only a limited control over the speed of operations.

Working conditions.—The usual machine-shop noises prevailed in this department. Some of the disagreeable features of the work were the dirt of parts handled, grinding sludge, mica dust, grease, and spray from coolants. Ventilation and lighting were adequate. The work areas were spacious and the safety aisles wide and unobstructed.

For additional information on plant conditions, see case study 64, which deals with another department of the same shop.

Hourly schedules.—Company data on work schedules were limited to total weekly hours, so that the break-down of the number of hours per day and the number of days per week worked during each schedule could only be approximated.

The period selected for study included a prewar period of 36 hours a week, consisting of 4½ days at 8 hours; a 43-hour week of 5 days at 8 to 9 hours; and a 54-hour week of five 10-hour days, and a 4-hour Saturday. A 60-hour week of five 11-hour days and a 5-hour Saturday, and a 52-hour week of 5 days at 10 to 11 hours, were studied during the war period.

FINDINGS OF STUDY

In general, this study demonstrates that semi-automatic precision work—with the emphasis on quality rather than speed of production—resulted in a deliberate and fairly stable work pace readily maintained by the operator regardless of the length of working hours.

Prewar 36- and 43-hour weeks.—Prior to the war, a change in weekly hours from 36 (four and one-half 8-hour days) to 43 (five 8- to 9-hour days) was accompanied by a 4.7-percent drop in efficiency.

In the light of subsequent schedule changes which brought about only small changes in hourly output, the 4.7-percent decrease in efficiency is not readily explainable.

There were almost no absenteeism losses at 36 hours (0.2 percent) while the 43-hour week showed a rate of 4.8 percent.

As a result of a 19.4-percent rise in hours, output increased 8.6 percent—the difference being due to the combination of lowered efficiency and

increased absenteeism. By adding 7 hours to the 36-hour week, only 3 additional output hours were obtained.

The prewar 54-hour week.—The next prewar schedule, of 54 hours per week, was achieved by working five 10-hour days and adding a 4-hour Saturday.

Compared with the preceding 43-hour week, efficiency rose by 3.2 percent. Absenteeism losses dropped from 4.8 percent to 3.3 percent.

Total weekly output was increased by 31.7 percent as against a 25.6-percent rise in hours. The equivalent of $13\frac{1}{2}$ output hours was obtained by the addition of 11 hours to the 43-hour week.

Wartime 60-hour week.—During the next schedule, a wartime 60-hour week, one hour was added to each day of the week for a workweek of five 11-hour days and a 5-hour Saturday.

Efficiency remained almost unchanged, the average being 0.7 percent higher than that during the preceding 54-hour period.

Absenteeism dropped slightly, to 2.3 percent.

The lower absenteeism losses together with the slight rise in hourly output, effected a gain of 13.1 percent in total weekly output as against an 11.1-percent increase in hours. This meant a gain of 7 output hours for an addition of 6 hours to the preceding 54-hour week.

Wartime 52-hour week.—During the last period studied, wartime hours were reduced to 52 a week by eliminating Saturday work, leaving the work schedule at 5 days of 10 to 11 hours each.

During the shortened wartime schedule, efficiency rose 2.3 percent above the previous 60-hour week, reaching a level of hourly output actually 1.3 percent above that maintained during the prewar base period of 36 hours.

The amount of scheduled time lost due to absenteeism rose slightly, to 3.9 percent.

A comparison of the two war periods of 60 and 52 hours indicated that a 13.3-percent reduction in hours resulted in a 12.9-percent loss in total weekly output. The elimination of 8 scheduled hours resulted in nearly the same reduction ($7\frac{3}{4}$ hours) of output. Compared with the prewar base period of 36 hours per week, the wartime week of 52 hours represented an hourly increase of 44.4 percent and an output gain of 41 percent—an addition of 16 scheduled hours for a gain of $14\frac{3}{4}$ output hours.

Analysis of Injuries for Case Studies 64 to 68

A study was made of the frequency of all disabling and nondisabling injuries occurring at the different hourly levels in the prewar, war, and postwar period. A plant-wide sample of 36 high-seniority and 31 low-seniority workers was selected for this study, representing the departments surveyed in case studies 64 to 68. The group of workers who had been with the company before the war (high-seniority workers) represented a heavy age concentration around 45 to 50 years. The other group of low-seniority workers hired since the beginning of the war were in the 30- to 45-year age

groups. The total number of injuries reported for each group was identical, 328.

High-Seniority Workers

A prewar change from 40 hours per week to 52 and 55 brought about a slight increase in the frequency rate of injuries per million man-hours of exposure from 863 to 910. This count consisted primarily of minor injuries requiring only first aid. In spite of the long workweek maintained during the war, the frequency rates were considerably lower than those before the war: 666 for workweeks from 57 to 60 hours, and 685 for weeks from 50 to 53 hours. Possibly, the reduction in the number of injuries was the result of increased stress on safety during the war in an effort to keep up production by saving man-hours. During postwar hours from 44 to 48 a week, the rate dropped to 475—a reflection of the combined effects of shorter hours and, possibly, improved safety conditions and practices.

Low-Seniority Workers

The newer workers, hired during the war, showed the opposite relationship between changes in hours and injury frequency rates. As hours went down, the frequency rate of injuries went up. During the wartime week of 57 to 60 hours, the frequency rate per million man-hours was 1,722 injuries (mostly first-aid), which rose to 1,803 for a weekly schedule of 50 to 53 hours toward the end of the war. For the postwar week of 44 to 48 hours, the rate was 2,163. The reason for this unexpected experience was not apparent.

Injuries by Hour of the Day⁴

An injury distribution by hour of the day was available for 167 cases requiring first-aid treatment during an 8-hour day and for 429 cases during a 10-hour day. The totals represent the experiences of 100 workers during a 17-month period, under either schedule. The workday began at 7 a.m., and lunch time was at 12 noon, under either schedule.

During the 8-hour day, the lowest percentage of the total number of injuries of the day occurred in the first hour of the morning—1.8 percent. After the first hour, the percentage increased sharply until it reached a forenoon peak of 16.8 percent during the fourth hour. The fifth hour, being the last hour before lunch, showed a slight drop to 12 percent.

The first afternoon hour (or sixth hour of the workday) had almost the same percentage of total injuries as the last forenoon-hour—11.4 percent. In the seventh hour the percentage reached a level equal to the forenoon peak; in the eighth and last hour, the high point of the day was reached—25 percent. The last figure may have been exaggerated if workers held off until the end of the workday before visiting the first-aid room for treatment of injuries incurred earlier in the day.

During the 10-hour day, the first morning hour again contained the smallest number of injuries—5.4 percent of all injuries for the day. As in the

⁴See table 16, page 41.

case of the 8-hour day, the percentage increased hour after hour until it again reached the forenoon peak in the fourth hour, 14.1 percent, with the fifth hour, the hour directly before lunch, again showing a slight drop, to 11.7 percent.

The benefit of a lunch-time rest apparently contributed to the drop to 7.2 percent in the first afternoon hour. Thereafter, the percentage increased steadily until it reached the afternoon peak of 13.3 percent in the fourth afternoon hour, the ninth hour of the day. The last hour of the day again showed a slight recession and represented 11 percent of the total number of injuries during the entire 10-hour day.

69: Workweeks of 40 and 48 hours, in prewar, war, and postwar periods, for men, day shift, individual wage incentives; medium-heavy, operator-paced press-molding operations in the manufacture of rubber products.

This plant produced a variety of rubber products. The department selected for study was engaged in the manufacture of molded rubber specialties such as washers, force cups, bottle covers, etc.

Operations of the selected group of 21 workers on the day shift consisted of press-molding rubber stock. Each worker operated a battery of presses. Stock was placed in molds which, when full, weighed between 15 and 60 pounds, the average being about 45 pounds. The molds were lifted by hand into the press, and, after processing, lifted off and unloaded with the aid of an air hoist. Very little idle time was afforded the operator. While one press was in operation, he was occupied with the loading or unloading on the other presses in the battery. The work may be characterized as medium-heavy, operator-paced, press-molding of rubber products.

Working conditions.—Working conditions were fairly good. Adequate lighting was furnished by overhead reflector fixtures, large window areas, and skylights. Noise was moderate. Ventilation was adequate, but was not successful in removing strong rubber odors. The temperature was generally moderate, but was hot in the immediate vicinity of the molding presses in the summer, the temperature sometimes reaching 140 degrees. Aisles were wide and generally unobstructed. In some areas liquid rubber drippings and dust from soapstone and talc (used in rubber processing) made floors slippery. Danger signs were prominently displayed in these areas.

The company conducted an active safety campaign. Two safety engineers worked in conjunction with departmental safety committees. Safety equipment was furnished where required. A first-aid room was staffed with a doctor and four nurses.

There were no formal rest periods. A paid lunch period ranged from 12 to 20 minutes for men, and 30 minutes for women.

Wage incentives.—An individual wage-incentive system was maintained. Earnings were based on the percentage of a fixed production quota actually achieved by each worker.

The maintenance of standards was complicated in the rubber industry during the war by the substitution of synthetic for natural rubber. This prevented study of most rubber manufacturing operations. In this department, however, the change in the type of rubber stock did not affect standards, and the findings were comparable in all periods.

Hourly schedules.—The first period studied occurred several months before the war. A 40-hour workweek composed of 5 days of 8 hours prevailed. In response to a need for increased production, a sixth 8-hour day was added, making for a total of 48 hours a week. This schedule was maintained for the remaining months before the war and through the period of war production studied. After VJ-day, the workweek was cut back to 40 hours by eliminating the sixth workday. The day shift worked from 8 to 4, and from Monday through Friday or Saturday, depending on the length of the workweek.

FINDINGS OF STUDY

The findings illustrate the effect of increased work loads and conversion to war production, and the extent to which such factors influence the effects of changes in work schedules. The six case studies which follow represent different groups of workers in the same plant. Analysis of their performance shows a general similarity of experience.

Prewar Experience

The efficiency level of this group of workers increased 3.5 percent when the workweek was lengthened from 40 to 48 hours. Apparently the longer workweek was not particularly fatiguing to the workers. Moreover, it would appear that the work pace prevailing under peacetime conditions required less than maximum effort, and the workers were able to raise the level of hourly output when confronted with an increased work load. It should be noted, however, that workers could increase their output only by shortening the periods necessary to load and unload their machines.

Absenteeism was very low during the period of the 40-hour workweek, and rose only slightly under the longer hours. The rate in the first period was 0.7 percent. It increased to 1.7 percent in the later period.

The increase in total weekly output kept pace with that of hours. Increasing scheduled hours by 20 percent effected a rise of 22.8 percent in output, a gain of about 9 hours of output for the 8 hours added to the workweek.

War Experience

During the war period, at a continued schedule of 48 hours, efficiency rose 17 percent above that for the same 48-hour schedule before the war, bringing the level to a point 21.1 percent above that of the original 40-hour workweek period. To the stimulus of an increased work load was now added one of war morale, with the knowledge that production was directly connected with the war effort.

Absenteeism rose during the period to an average of 2.3 percent. This, however, was still low.

Because of the higher efficiency during the war, output increased 16.3 percent over the level achieved during the 48-hour workweek before the war. This resulted in an increase of the equivalent of $7\frac{3}{4}$ hours of output per week.

Compared to the normal prewar 40-hour workweek, the 20-percent increase in the schedule was accompanied by a 42.8-percent rise in output. Thus the workers were producing 17 additional hours of output for the 8 hours added to the workweek.

Postwar Experience

After the war, when the 40-hour workweek was restored, efficiency dropped 4 percent from the wartime level. The workers apparently eased up somewhat in their work pace when the pressure of production for war was removed, and the work load lightened. However, the postwar level of efficiency was still 16.3 percent better than under the prewar schedule of identical hours.

Injuries

An analysis was made of the combined injury experience of the 61 workers in the department represented in case studies 69 through 73.

In the prewar period of the 40-hour workweek, there was an average of 444 first-aid cases per million man-hours of work. When the workweek was extended to 48 hours by adding a sixth workday, the average rate was increased to 596.

In the war period studied, the longer workweek was maintained, and in some cases further increased to 54 hours. However the rate of first-aid cases dropped to 242 per million-man hours, a decline of about 50 percent. This drop apparently reflected the effectiveness of an intensified safety campaign to keep losses of manpower due to injuries down to a minimum during the crucial war period.

The improvement in the frequency rate of first-aid cases was carried over into the postwar period. Hours at this time were reduced from 48 to 40 per week. The rate remained at about the same level as in the preceding period. The average was 247 first-aid cases per million man-hours of work.

70: Workweeks of 40 and 48 hours in prewar, war, and postwar periods, for men, evening shift, individual wage incentives; medium-heavy, operator-paced press-molding operations in the manufacture of rubber products.

The 8 men selected for this study were on the evening shift in the same department and on the same operations as the workers in case study 69.

Working conditions, wage incentives, and workweek schedules were identical for both groups. Working hours were from 4 p.m. to midnight, and the workweek extended from Monday through Friday, or Saturday, depending on the length of the workweek.

Prewar Experience

The workweek was lengthened from 40 to 48 hours by adding a sixth day of 8 hours, several months before the war, to meet requirements for increased production.

Efficiency rose 1.6 percent under the longer workweek schedule. The work pace apparently was originally sufficiently slow to allow the workers to accelerate the pace without increased fatigue in response to the demands for more output. A similar trend in efficiency was observed for the day-shift workers during this period.

Absenteeism was low under both workweek schedules. The rates were 1.1 and 1.4 percent in the two periods respectively.

Output kept pace with the change in hours. The 20-percent increase in the schedule resulted in a rise of 21.4 percent in output, a gain of about 8½ output hours for the 8 hours added to the schedule.

War Experience

With a continued work schedule of 48 hours per week, efficiency during the war rose 21.1 percent over the prewar 48-hour level, a net gain over the original 40-hour workweek level, of 23 percent. All-out production for war may have stimulated the workers to greater effort. Again the trend is similar to that among the day-shift workers, but the rise in efficiency was more pronounced in the evening shift.

Absenteeism rose to 3 percent in this period.

Output during the 48-hour war week increased 19.3 percent over that of the prewar 48-hour workweek, a result of the higher efficiency. This furnished an additional 9⅓ hours of output per week. The 20-percent increase in the hourly schedule over the prewar 40-hour workweek was accompanied by a gain of 44.8 percent in weekly output, adding 18 output hours per week for the 8 hours added to the schedule.

Postwar Experience

With the end of the war, the decrease in the work load, and the restoration of the 40-hour workweek, efficiency dropped 4.1 percent. It would appear that the work pace was slowed down with the removal of the wartime pressure for greater output. The experience of the men on the day shift was similar in this period. Despite the postwar decline in hourly output, the new efficiency level was still 18 percent higher than it had been under the same work schedule before the war.

71: Workweeks of 40 and 48 hours in prewar, war, and postwar periods, for men, night shift, individual wage incentives; medium-heavy, operator-paced press-molding operations in the manufacture of rubber products.

This study presents an analysis of the performance of 10 men on the night shift in the same department, and on the same operations as the workers in case studies 69 and 70.

Working conditions, wage incentives, and workweek schedules were the same as those outlined in case study 69. The workday comprised the hours from midnight to 8 a.m. The 6-day workweek began on Sunday night and extended through Friday night. The 5-day week began Monday night and extended through Friday night.

FINDINGS OF STUDY

Prewar Experience

Efficiency increased 1.9 percent when the workweek was lengthened from 40 to 48 hours. As was indicated for the workers on the earlier shifts, a slow work pace in the initial period, enabled the workers to maintain and even better their rate of hourly output when an increase in production necessitated longer weekly hours. The rate of increase, however, was not as great as that achieved by the men on the day shift.

Absenteeism increased from 1.7 to 2.8 percent when the sixth workday was added. The rate of absenteeism was somewhat higher than for the day- and evening-shift workers, but the percentage was not considerable.

The 20-percent increase in the workweek was accompanied by a proportionate increase of 20.8 percent in output. The addition of 8 hours each week thus resulted in $8\frac{1}{3}$ additional hours of output.

War Experience

The 48-hour workweek was maintained during the war period surveyed. Efficiency rose 26.7 percent over the level of the prewar week of 48 hours, and was 29 percent above the level of the original 40-hour workweek. As previously stated, production at this time was directly connected with the war effort, and knowledge of this fact may have spurred the workers to accelerate their work pace. The rate of increase was greater among the night-shift workers than among the day- and evening-shift workers discussed in case studies 69 and 70.

Absenteeism rose to 4.1 percent during the war period. Again the rate was higher than among the workers on the other shifts.

With no change in weekly hours, there was an increase of 24.9 percent in total weekly output as a result of the sharp rise in efficiency. This served to add 12 hours of output each week. The 20-percent increase in hours over the prewar 40-hour workweek was accompanied by a net gain of 50.8 percent in output. Thus the addition of 8 hours to the workweek resulted in a gain of 20 hours of output.

Postwar Experience

When the workweek was restored to 40 hours with the end of the war and the return to peacetime production, efficiency decreased 8.9 percent from the wartime level. The drop was greater than that experienced by the men on the earlier shifts. Despite the decline, however, efficiency was still 17.6 percent better than under the same schedule of hours before the war.

72: Workweeks of 40, 48, and 54 hours in prewar, war, and postwar periods, for men, day shift, individual wage incentives; medium-heavy, operator-paced operations in the manufacture of rubber products.

The 13 men selected for study worked on the day shift in the same department as the men on press-molding operations in case study 69. They performed a variety of operations in the manufacture of molded rubber specialties. These operations included machine-buffing rubber products; machine-cutting rubber stock into desired lengths; cutting spiral strips of rubber on a lathe; and table work, consisting of assembly of miscellaneous articles incidental to the preparations of the stock for processing. The work may be characterized as medium-heavy, operator-paced.

Working conditions and wage incentives were identical with those in case study 69.

Hourly schedules.—A normal 40-hour workweek of 5 days of 8 hours was increased to 48 hours by adding a sixth 8-hour day several months before the war. The weekly schedule was further increased to 54 hours during the war period surveyed by increasing daily hours from 8 to 9. The 40-hour week was restored at the end of the war.

FINDINGS OF STUDY

Prewar Experience

Efficiency showed a slight improvement of 0.8 percent during the period of the 48-hour workweek which followed the normal 40-hour workweek schedule. The possibility of an original slow, steady work pace that enabled the workers to maintain their level of efficiency under the lengthened workweek, which was noted for the press-molders in the department, existed for these workers as well.

When the workweek was extended from 40 to 48 hours absenteeism increased slightly, from 1 to 1.7 percent. The rates were low in both periods, and the percentages were similar to those of the press-molders on the day shift in the same periods.

Output rose in proportion to the increase in the workweek. The 20 percent increase in hours was accompanied by a 20.2 percent rise in output. The 8 hours added to the schedule thus resulted in an additional 8 hours of output each week.

War Experience

During the war, when the workweek was further increased by increasing daily hours from 8 to 9, efficiency rose an additional 9.6 percent, a net increase in efficiency over the original prewar level of 10.5 percent. The possible effect of conversion to war production on efficiency, as illustrated in case studies 69 through 72, for other male workers in the department is pointed up by the finding for this group. However, the rate of increase in hourly output was less in this instance. It may be significant that the workweek was extended to 54 hours during the war for these workers, while the other groups continued to work a schedule of 48 hours a week.

Absenteeism rose to 2.3 percent during the period. Again the rate is similar to that of pressmen on the day shift.

The 12.5 percent increase in weekly hours resulted in a rise of 22.7 percent in output. In effect, almost 11 output hours were gained by adding 6 hours to the workweek.

The 35-percent increase in hours over the prewar 40-hour workweek was accompanied by a net increase of 47.5 percent in output. The 14 hours added to the workweek therefore resulted in 19 additional hours of output.

Postwar Experience

When the workweek was restored to 40 hours after the war, efficiency rose 2.7 percent. This is in contrast to the decrease in efficiency among the other groups of men in the department during the postwar period. The difference may be attributed to the fact that there was a sharper decrease in the workweek in this case, from 54 to 40 hours. Efficiency in the postwar period was 13.5 percent better than under the same schedule of weekly hours before the war.

73: Workweeks of 40 and 48 hours in prewar, war, and postwar periods, for women, day shift, individual wage incentives; light, operator-paced trimming and finishing operations in the manufacture of rubber products.

The 9 women selected for study were engaged in hand- and machine-trimming and finishing operations in the same department as the men in case studies 69 through 72.

There was a variety of operations. Among them were hand trimming, in which the operator trimmed and finished the molded rubber articles with shears or knives; machine-trimming, in which the articles were placed on spindles and guided against knives; buffing; and machine-punch, or hydraulic-machine trimming, in which stock was trimmed by means of machine-operated dies.

Working conditions and wage incentives were the same as outlined for men in case study 69.

Hourly schedules.—An original 40-hour workweek of 5 days of 8 hours was lengthened to 48 hours several months before the war by the addition of a sixth 8-hour day. The 48-hour week was maintained during the war period surveyed. In the postwar period, intermittent workweeks of 40 to 48 hours were scheduled, depending on production needs.

FINDINGS OF STUDY

Prewar Experience

The increase in the workweek from 40 to 48 hours was accompanied by a 1.2 percent increase in efficiency. An original steady work pace, requiring less than maximum effort is suggested by the trend, which is similar to that for male workers in the department during the period.

Absenteeism rose from 2 to 4.7 percent with the addition of Saturday

work. The rates were higher than for men on the day shift under the same work schedules.

The increase in output did not quite keep pace with that of hours, because the increase in absenteeism more than offset the increase in efficiency. The 20-percent increase in the workweek was accompanied by a 17.9-percent increase in output. The addition of 8 hours to the workweek therefore netted 7 hours of additional output.

War Experience

During the war period surveyed, under a continued schedule of a 48-hour workweek, there was a further improvement in efficiency of 6 percent. The aggregate increase in efficiency over the level which obtained during the prewar 40-hour workweek period was 7.3 percent. While the trend is similar to that among the male workers during this period of production for war, the degree of increase was not nearly as sharp.

Absenteeism jumped to 9.2 percent during the war period. The sharp rise may indicate the possibility of an accumulation of fatigue over an extended period of a 48-hour workweek for women, many of whom undoubtedly had additional duties at home.

Output increased by only 1.2 percent over the preceding level, with no change in the workweek, the increase in absenteeism serving to offset the increase in efficiency. About two-thirds of an hour of output was gained each week during the period.

The 20-percent increase in hours over the 40-hour workweek was accompanied by a net rise of 19.3 percent in output. In terms of hours of output, the 8 additional scheduled hours per week resulted in a gain of nearly 8 hours of output.

Postwar Experience

Under an intermittent schedule of 40 to 48 hours a week after the war, efficiency was maintained at nearly the same level as that achieved during the war. The change was a slight decrease of 0.3 percent. Compared with the period of the 40-hour workweek before the war, there was a net gain of 6.9 percent in efficiency in the postwar period.

74: Workweeks of 40, 48, and 57 hours in prewar, war, and postwar periods, for men, day shift, individual wage incentives; light to medium-heavy, operator-paced operations in the manufacture of rubber tubing.

This department, in which the selected group of 14 men worked on the day shift, was located in the same plant as the department surveyed in case studies 69 through 73.

Operations in the department were connected with the manufacture of rubber hose. Rubber stock was extruded through a tubing machine in lengths of 50 feet or less, and passed over a mandrel. A cloth jacket was then wrapped tightly around the hose, and the hose vulcanized. After vulcanization, the cloth jacket was removed, the hose stripped off the mandrel,

and the ends of the hose trimmed and finished. The work may be characterized as light to medium-heavy and operator-paced.

Working conditions.—Working conditions were good. Lighting was adequate, noise was moderate, and temperatures were comfortable. Flooring was wooden and was somewhat slippery in spots from soapstone dust. Ventilation was adequate. There was considerable talc dust in the air, however, which management insisted no ventilating system could eliminate.

Wage incentives.—Earnings were based on an individual incentive system which operated in the same fashion as that outlined in case study 69.

Hourly schedules.—The workweek was increased from 40 to 48 hours several months before the war to meet demands for increased production. This was effected by adding a sixth 8-hour day to the original workweek of 5 days of 8 hours. During the war period surveyed the workweek was extended to 57 hours by an increase in daily hours from 8 to 9½. After the war, the workweek was cut back to 48 hours.

FINDINGS OF STUDY

Prewar Experience

When the workweek was increased from 40 to 48 hours, efficiency rose 3.9 percent. The observation is suggested that, as in the case of the workers in case study 72, the original work pace of these workers was not the best of which they were capable. Consequently they were able to accelerate their pace, and thus improve efficiency, when confronted with a need for greater output, despite the lengthening of the workweek.

Absenteeism rose from 3 to 4.6 percent when the sixth workday was added.

The 20-percent increase in the workweek resulted in a rise of 22.8 percent in output. In effect, the 8 hours added to the schedule resulted in a gain of a little better than 9 hours of output each week.

War Experience

Efficiency increased an additional 12.7 percent during the war period surveyed, under a workweek schedule of 57 hours, bringing it to a point 17.1 percent above the level achieved during the prewar period of 40 hours. The rise may be attributed to a possible acceleration of pace under the pressure of all-out production for war. A similar trend was noted for the workers in the other departments surveyed in this plant (see case studies 69 through 73) but the extent of the increase was not as sharp as it had been for the men in the previous studies whose weekly hours were increased to only 48.

Absenteeism decreased from the preceding level of 4.6 percent. The rate during the war period was 2.9 percent. No explanation was found for this decrease.

The 18.8 percent increase in hours from the 48-hour schedule resulted in a rise of 36.1 percent in output. For the 9 hours added to the workweek, output equivalent to 17⅓ additional hours was obtained. Compared to the original 40-hour workweek, the 42.5-percent increase in the schedule was

accompanied by a rise of 67.2 percent in output, a gain of 27 output hours for the 17 hours added to the workweek.

Postwar Experience

When hours were reduced from 57 to 48 a week as a result of a decrease in production demands after the war, efficiency showed a further increase of 1.3 percent.

Compared to the original prewar period of the 40-hour workweek, efficiency was 14.1 percent higher in the postwar, 48-hour week.

75: Absenteeism during 58-hour workweeks of 5 and 6 days in a plant manufacturing aircraft; plant-wide bonus; men and women.

This survey included all machining and assembling operations involved in the production of airplanes. In general, the work pace was medium-fast and steady, and controlled by the operator. All operations were light.

Working conditions.—The buildings were new and working conditions in the plant were excellent. High ceilings, outside walls consisting almost entirely of windows, and complete installations of fluorescent lights assured excellent lighting and ventilation. Dust, fumes, and noise were kept at a minimum. Work areas were extensive, allowing for wide aisles and plenty of working space. Housekeeping was exceptionally good. Two cafeterias and two restaurants provided meals for the employees. Carts with hot food traveled through the plant. There was a 10-minute rest period, paid for by the company, on each shift.

The most modern safety conditions existed in the plant. Aisles and intersections were clearly marked, machines well-guarded. By means of committees, workers in each department were kept alert to the observance of all possible safety precautions.

The work force.—Approximately 7,000 men and 3,000 women worked in the plant. About 75 percent of the operations did not require any previous experience. The labor force, drawn largely from cities and towns within a 40-mile radius of the plant, ranged widely in age—from 18 to 61 years. According to management, men and women of different nationalities and races worked together harmoniously, on both the day and night shifts.

Wage incentives.—A plant-wide bonus incentive system based on the number of completed planes produced each month was in operation in the plant. Examination of the bonus data revealed that changes in design, materials, and methods, rather than the efforts of the workers, were largely responsible for the variations in the percentages of average monthly bonus earnings. While the change in scheduled hours undoubtedly affected workers' efficiency, it was impossible to isolate the effects of this change from those of the other changes mentioned. Consequently it was not possible to measure the effect of changes in scheduled hours. Findings are restricted entirely to absenteeism.

FINDINGS OF STUDY

An analysis of plant-wide absenteeism percentages was made for the

period from March through December 1943. Although the workweek remained at 58 hours throughout the entire period, the daily schedule was changed from 5 days at 11.6 hours to 5 days at 10 hours, with Saturday at 8 hours. The effect of this change on the percentage of time lost due to absence was insignificant. The level of absenteeism for men changed from 6 percent during the 5-day week to 6.2 percent during the 6-day week, and absenteeism among female workers dropped from 9.6 to 8.8 percent. Absenteeism was generally higher for women than for men during both schedules.

Although there was very little difference in the weekly absenteeism rates during both schedules, examination of the daily patterns reveals that from Monday through Friday absenteeism during the 6-day week was lower than during the 5-day week. Saturday absence, however, on the 6-day schedule, was the highest of the week and served to dissipate the improvement noted during the rest of the week.

The best attendance of the week occurred on Thursday, which was pay day. The desire for a long week end probably accounted for the highest absenteeism rates on Monday and Saturday. For the other days of the week, the rates were relatively level.

76: Comparison of absenteeism by sex and shift; light, operator-paced machining and assembling operations; no wage incentives.

The absenteeism experience of men and women was studied on three shifts of one plant and on two shifts in another plant. Both plants were located in the same area and belonged to the same company. Operations consisted of machining and assembling small steel and brass parts, weighing less than 5 pounds, for carbines, rifles, and fuses.

Most of the work could be characterized as light and man-paced. It was done at a steady and moderate pace.

Working conditions in both plants were good. Temperatures were moderate, ventilation was good, lighting modern and adequate. There was little noise or dust. Ample space was allowed for the work area and for safety aisles. Safety conditions were excellent. Protective clothing was provided for wherever needed, machines were well-guarded, and safety rules were strictly enforced. First-aid facilities were very good.

The work force in both plants was almost equally divided between men and women. Of the 745 men, 404 worked on the day shift, 237 on the afternoon shift, and 104 on the night shift. Of the 704 women, 436 worked on the day shift, 196 on the afternoon shift, and 72 on the night shift.

The average age of the men was 40 to 45 years, and of the women, 35 years. As the wartime labor market was very tight in the area, help was inexperienced and had to be trained on the job, with many women operating machines formerly considered as men's jobs. A number of women of advanced age (up to 70 years old) were placed on light work that could be performed in a sitting position.

Wage incentives.—Workers were paid at straight hourly rates ranging

from 60 cents an hour for unskilled labor to \$1.50 an hour for the highest skilled operators. The afternoon shift received a 5-percent shift bonus, the night shift 10 percent. In the absence of wage incentives, no individual performance records were available for a possible study of efficiency.

Hourly schedules.—Wartime hours covered in this study included 48, 50, and 55 a week for an average workweek of six 8-hour days with an occasional seventh day at 8 hours. Starting times for the day, afternoon, and night shifts, respectively, were 8 a.m., 4 p.m., and 12 midnight. The company paid for a 20-minute lunch period.

FINDINGS OF STUDY

The highest percentage of absenteeism was recorded on the night shift for both men and women—7.1 percent for men and 11.9 percent for women. A somewhat lower absence rate was found on the afternoon shift for both sexes in both plants—6.2 percent and 5.8 percent for the men, 9.5 percent and 9.4 percent for women. The lowest rate of absenteeism was registered on the day shift in both plants—5.5 percent and 4.9 percent for men, 8.5 percent and 8.1 percent for women.

The amount of scheduled time lost due to absenteeism was lower for men than for women on each of the three shifts.

The rate of absenteeism increased more sharply for women than for men with each later shift. In one plant, female absence rates exceeded those for men on the day shift by 3 percent, by 3.3 percent on the afternoon shift, and by 4.8 percent on the night shift. In the other plant, female absence rates exceeded those for men by 3.2 percent on the day shift and 3.6 percent on the afternoon shift.

77: Daily patterns of absenteeism for men and women during 5- and 6-day workweeks, individual wage incentives.

The plant studied manufactured regulators, armatures, and generators. With the added work load during the war, plant conditions became increasingly congested and controls over accurate reporting of individual production data became progressively lax. As a result, individual efficiencies did not seem to bear any relationship to hours during weekly schedule changes from 40 to as high as 67 hours, nor was it possible to correct efficiencies in order to obtain true performance data. It was deemed necessary, therefore, to limit the study to a comparison of daily absences on a 5-day and a 6-day week for men and women. The 10 men selected for the study of wartime absenteeism belonged to the day shift of the final assembly department. They were engaged in assembling generators with the aid of hand or power-driven tools while standing at a long bench. Work was medium-heavy and man-paced. Working conditions were poor—aisles were obstructed and work areas congested. Lighting was inadequate. Safety conditions were poor because of crowding; machines were inadequately guarded and safety regulations were poorly observed.

The 22 women selected for study belonged to the day shift of the arma-

ture department. Work was performed with the women seated at a bench and included such manual operations as coil-winding, soldering, finish-turning, and testing. The work was light and operator-paced, requiring manual dexterity. General working conditions were good and the work area was less congested than elsewhere in the plant.

One-half hour was allowed for lunch.

FINDINGS OF STUDY

For the men, a 40-hour week of five 8-hour days was compared with a 59½-hour week of five 10-hour days and a 9½-hour Saturday.

For the women, a 40-hour week of five 8-hour days was compared with a 48-hour week of six 8-hour days.

The absenteeism rate was higher for each day of the week during the 6-day week worked by both men and women, with Saturday showing a very sharp increase in the rate.

Daily absences during the 5-day week ranged from less than 1 percent to approximately 2 percent for both sexes.

During the 6-day week, male absences ranged between approximately 2 percent and 4 percent for 5 days and rose to 17½ percent on Saturday.

Female absences during the longer workweek ranged between approximately 3½ percent and 4 percent for the first 5 days and increased to 20½ percent on Saturday.

78: Wartime workweek of 48 hours vs. postwar workweek of 35 hours, individual wage incentives; light, machine-paced machining operations; men and women.

This plant was engaged in the manufacture of piston rings for airplane and automobile motors.

Operations in the department studied consisted of machine-grinding rough castings. The castings were processed through a series of grinding machines which progressively shaped them into the specified forms and sizes. The work was of a semi-automatic nature, allowing the operator only a limited amount of control over the pace. The work entailed only moderate physical exertion, but constant visual and mental attention. The work may be characterized as light, machine-paced machining operations.

Working conditions.—Working conditions were good. Excellent light was furnished by a complete fluorescent lighting system. Good ventilation was provided by a large amount of window area, and an extensive fume removal system. Grinding wheels were enclosed to keep dust and flying particles to a minimum. Noise was kept to a level moderate enough to permit frequently piped-in music to be audible. Wide aisles and adequate work areas were kept clean and generally unobstructed.

Safety.—A full-time safety engineer conducted an active campaign with the assistance of a plant safety committee. Machines were well-guarded, and safety clothing and appliances were supplied where necessary. A modern first-aid room was operated by a registered nurse.

The work force.—The findings are for all the operators and helpers in

the department during the period of survey. All operators were males, and all helpers, females. No figures were available as to the proportion of men to women. In the earlier months of the study there were about 50 workers in the department. In the later months this figure was reduced to 30, as a result of a postwar decline in the work load and a consequent lay-off of personnel. Despite the change in the number of workers represented, it is believed that the findings in the two periods studied were comparable. The personnel remaining in the last period were all experienced workers who had been in the department in the earlier months. Thus the experience of 30 of the 50 workers is included in the findings in both periods.

Wage incentives.—A group wage-incentive system was in operation during the period studied. Under this system the aggregate excess production over time-studied standards was computed for the week for the entire department and each worker received, in addition to his base pay, a bonus of 1 percent of his pay for each 1 percent of production above standard.

Hourly schedules.—During the war period studied, the workweek consisted of 6 days of 8 hours, for a workweek of 48 hours. At the end of the war, faced with a cut-back in production, the company undertook several economy measures. These included a program of reduction in the labor force and a shortening of the workweek to 35 hours by eliminating Saturday work and decreasing daily hours from 8 to 7.

FINDINGS OF STUDY

Efficiency declined 3.6 percent from the level achieved during the war under the 48-hour workweek schedule. This may be attributed to a general feeling of uneasiness and insecurity induced by the falling off of available work and the lay-offs, which could cause a lowering of morale and a stretching of the work to make it last longer.

Absenteeism.—Attendance improved only slightly under the shorter workweek schedule. The rate of absenteeism during the wartime period of the 6-day workweek was 5.7 percent. When the sixth day was eliminated and the workday reduced from 8 to 7 hours, the level of absenteeism dropped to 4.1 percent.

Output.—The net effect of the 27.1 percent decrease in the workweek from 48 to 35 hours was a loss of 28.6 percent in total weekly output. In terms of hours, the 13 hours dropped from the weekly schedule resulted in a loss of $13\frac{3}{4}$ hours of output.

Injuries.—A comparison of the frequency of all injuries requiring first-aid treatment under the 48-hour workweek schedule of the war period, and a postwar schedule of 40 hours a week, which replaced the 35-hour workweek several months after the war, reveals that under the longer weekly hours work injuries (nearly all requiring only first aid) occurred at the average rate of 5,839 per million employee-hours of work. During the shorter workweek of 40 hours, this figure was reduced to an average of 3,852 injuries per million employee-hours. The decline in the rate is a measure of the effect of the elimination of Saturday from the workweek.