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Studies of the Effects of Long Working Hours

(Part 2)

By

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Bureau of Labor Statistics

Bulletin No. 791–A

Letter of Transmittal

UNITED STATES DEPARTMENT OF LABOR,
BUREAU OF LABOR STATISTICS,
Washington, D. C., October 17, 1944.

The SECRETARY OF LABOR:

I have the honor to submit herewith Part 2 of the Bureau's studies of the effects of long working hours. Part 1 (published as Bulletin No. 791) covers the first 6 plants surveyed, and Part 2 includes reports on 6 additional plants. Other reports will be submitted as further surveys are completed. This report was prepared by Max D. Kossoris, of the Bureau's Division of Industrial Hazards. The collection of data in the plants was under the supervision of R. F. Kohler.

The summary of 12 plant surveys presented in this bulletin appeared in the October 1944 issue of the Monthly Labor Review.

A. F. HINRICHS,
Acting Commissioner.

Hon. FRANCES PERKINS,
Secretary of Labor.

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Bulletin No. 791-A of the
United States Bureau of Labor Statistics

Studies of the Effects of Long Working Hours
(Part 2)

Summary of 12 Plant Surveys

Studies by the Bureau of Labor Statistics of the effects of long working hours in 6 additional plants corroborate and shed further light on the tentative conclusions drawn from the first 6 plant surveys.[1] It appears that hours worked beyond 40 or 48 per week result in additional output, but at the price of continuous decreases in efficiency and marked increases in absenteeism as hours rise. A point is finally reached at which the longer work schedule is no more productive, and actually may be less productive, than a shorter work schedule. With few exceptions, the longer working time in the plants studied resulted in a general slowing down, not only during the added hours but throughout the entire workweek.

Another point illustrated by the survey of the additional plants is that the 7-day week, as a steady program, is uneconomic and may actually result in less production than the 6-day week.

Among the 12 metalworking plants studied, the operations varied from foundry and forge-shop work to bench operations which required the processing of metal parts weighing as little as one ounce. There was no intention to study metalworking operations exclusively; it simply happened that long working hours were found most frequently in these industries. The material worked, however—whether metal, or wood, or leather, or paper, or any other substance—is of no great significance. Given the same types of exertion requirements, control over speed, and wage incentives, the work performance under the same hours schedules will probably follow much the same patterns.

HOURS IN RELATION TO OUTPUT

The surveys make clear that there is no such thing as an "optimum hour schedule" for all of industry. What appears to be a satisfactory schedule of hours for a plant with light machining operations may be economically wasteful in a foundry. Further, there is a marked difference in the performance of men working under wage incentives and those working at straight hourly rates without any kind of wage incentive. Much depends on the type of work and the requirements it exacts from workers, the degree to which workers can control the

[1] See Bulletin No. 791: Studies of the Effects of Long Working Hours. (Part 1.)

speed of operations, and the incentives which motivate them—whether volume of pay, participation in the war effort, labor relations, or working conditions generally.

The available evidence indicates that, on the whole, the 5-day week and 8-hour day are more efficient than a work schedule with longer hours. That does not mean, however, that longer hours are not productive. There is little sacrifice of efficiency, for instance, if a sixth day of 8 hours or less is added.

The sharper break comes when daily hours are raised from 8 to 9½ or 10 or 11, provided the workers operate under an incentive-wage system. The primary effect of this lengthening of daily hours for workers on the day shift, when the 5-day week is maintained, is to wipe out the midweek spurt. The analysis of daily production patterns in several plants under a 40- or 48-hour schedule shows a building up of hourly efficiencies toward a peak on the third and fourth days of the week, with a slight drop thereafter. When daily hours were lengthened to 9½ or more, however, this peak disappeared. The production curve for the successive days of the week flattened out, and any one day was about as good as any other day. When a sixth day was added, the line of production remained flat, but dropped to a lower level. The data indicate clearly that workers adjust themselves to longer hours by slowing down, not because they want to, but because they have to.

For workers on the second or night shift, the pattern is somewhat different. Their daily efficiency performance under the 8-hour day and 5-day week looks much like that of the day shift on the 10-hour day. There is practically no midweek spurt, and production tends to flatten into a fairly level line. The reason for this appears to be that these workers are somewhat tired when they come to work, having been up for some hours and probably at work around home. In any case, they are not so refreshed when they come on the job as the men on the day shift who have their leisure hours after, not before, the day's work. When a sixth day is added to stretch the week to 58 or 60 hours, the result is likely to be a steady decline in the efficiency level, day after day, with the peak points on Monday or Tuesday, at the very beginning of the week.

These "fatigue patterns" furnish a reasonably accurate basis for anticipating, for incentive-wage workers, the result of changing (a) daily hours from 8 to 10, or from a 40-hour week to one of 50 hours, and (b) from this level to a still higher one, by adding a sixth workday. The first change may cause a decrease in efficiency of about 5 percent; and the second, of 7 to 10 percent if hours do not exceed 58 or 60, but may be as high as 20 percent if hours reach 66.

For men on straight day-work rates, the lengthening or shortening of hours seems of considerably less significance. This was observed in two foundries. In one, daily scheduled hours remained at 10, but the sixth day was dropped. In the other, daily hours during a 6-day week were raised from 8 to 9½. In each plant the hourly efficiency level remained essentially unchanged under the different levels of hours. Apparently the pace at the shorter hours was not so fast that the addition of extra hours caused a slowing down; nor did the shortening of hours bring about any quickening of the work tempo.

In plants in which work was light or very light, the general tendency for workers under incentive systems, and with weekly hours ranging between 55 and 58, was to produce about a 2-hour volume of pro-

duction for every 3 hours added above 48 per week (i. e., 6 days at 8 hours each). When work was heavy, as in foundries, the ratio was more nearly 1 hour's additional output for every additional 2 hours worked. One reason for this was the greater need for rest pauses.

The studies included two plants in which shorter hours were found to result in a volume of output as great as or greater than was the case under longer hours. In a forge shop, where the work was both hot and heavy, a 52-hour week was found to be as productive as a 58-hour week. In a shell plant, in which morale was excellent and the work medium heavy, the lengthening of daily hours from 8 to 10 for the day shift and 11 for the night shift, and of weekly hours from 40 to 60 and 66, had such unsatisfactory results that the plant eventually changed to a 48-hour week. The average increase in output under the longer schedule was only about 7 percent above that for the 40-hour week—a result which could have been achieved easily by increasing weekly hours from 40 to 43 or 44. The additional 20 hours were sheer waste of time.

The experience of one plant which had operated extensively on Sundays under a 7-day weekly schedule demonstrated the undesirability of continued Sunday work. While remaining on the 8-hour day, this plant worked a 7-day week for over a year. It then dropped out every third Sunday, later every other Sunday, and finally every Sunday. The analysis of this plant's performance shows that efficiency was lowest during the 7-day week, and highest during the 6-day week when no Sundays were worked at all, and that efficiency mounted as additional Sundays were dropped. The data indicate that efficiency was about 36 percent better and total output about 13 percent greater during the shortest work schedule. In terms of this performance, the 7-day week amounted to 8 days' pay for 5 days' output. The 30 identical operators traced throughout the entire period involved in these changing schedules actually produced one more day's output during the straight 6-day week than they formerly produced during the 7-day week.

HOURS AND ABSENTEEISM

The relationship between longer hours and absenteeism was found to be the same in nearly every instance: as hours increased—whether daily or weekly—absenteeism increased. In most cases the reason could not be determined from plant records. Some of the data suggest a higher incidence of illness. In some instances it was quite clear that workers wanted or required more time for leisure or to attend to personal matters. It is also likely that the strain of longer hours and the fact that the weekly pay envelope was higher than it had been for years combined to induce workers to pay more attention to their health and well-being. The fact that workers were limited in the items their money could buy was also cited by some plant executives as a reason why men took more time out, or why they absented themselves for reasons which they would not have heeded under shorter work schedules and with smaller earnings.

As a rule, absenteeism was higher for the night shift than for the day shift under the longer work schedules. This was particularly true of women, whose absenteeism rates generally exceeded those of men.

In the absence of effective safety programs, work injuries tended to occur relatively more frequently under longer hours. In one plant they occurred only one-third as frequently when the daily hours were reduced from 10 to 8. Where plants had good, active accident-prevention programs, the lengthening of hours did not bring about a disproportionate increase in work injuries.

Women were found to be more efficient than men at light, repetitive and rhythmic operations requiring nimble fingers and little physical exertion. On the other hand, men were superior on machines which required close adjustments or which were complicated.

The merit of an incentive-wage system as a spur toward greater production was well observed in a foundry. It was found that the change from day-work to piece-work rates resulted in slight increases in output even when hours remained at 10 per day and 58 per week. The result was dramatic when the introduction of the incentive coincided with a reduction in weekly workdays from 6 to 5, even though the 10-hour day was maintained. Output during the shorter workweek was 13 percent greater than it formerly had been under the 6-day week. In terms of the production level which had prevailed during the longer workweek, the men—at piece rates—produced as much in 5 days as they formerly had in 7 days without a wage incentive.

Case Study No. 7—Machining Metal Parts

SUMMARY

Man-paced machining processes on light metal parts were studied in a modern, air-conditioned plant in the Middle West. There was no observable resting time on the part of the operators during the machining processes.

The wage-incentive system in this plant provided for stratified hourly rates, depending on the average output level of the employee. As the worker reached specified output levels, he automatically qualified for a higher hourly rate.

During the year studied (1943) the plant operated on two schedules of hours: A three-shift system with 7½ hours per shift (and a half-hour lunch period) for 6 days a week; and, subsequently, because of labor shortages, a two-shift system with a total of 55 hours per week for the day shift and 57 hours for the night shift. Shifts were not rotated.

The performances of 311 identical operators, 263 of whom were women, were traced throughout the entire year.

During the longer work schedule, the hourly efficiency of the entire group dropped 5 percent below that of the shorter workweek. The drop in efficiency of the night shift was nearly twice that of the day shift. The relative losses were 6.5 and 3.5 percent. The efficiency level of women workers on the night shift dropped still more—8.7 percent. For the entire group of women on both shifts, efficiency was 6 percent lower than at the shorter hours.

Time lost because of absenteeism was 50 percent higher during the longer hours. There was little difference between the two shifts, or between men and women.

The additional hours increased output—to the extent of 2 hours of additional output for every 3 additional hours of work. Per employee-hour, output during the longer workweek was only 93 percent as good as during the shorter hours.

The survey indicated clearly that the output performance of women under a 9½-hour workday in the department studied was not as good as that of men.

As measured by the standard injury frequency rate, injuries did not occur more frequently during the longer work schedule.

NATURE OF WORK

The plant studied is known as one of the most modern in the Middle West. During the period surveyed, it produced bearings and washers for motors and other operating parts of airplanes. All production was toward the war effort.

The operations studied consisted almost entirely of machining processes on lathes, grinders, broachers, and similar metalworking equipment. Approximately 15 types of machines were used to perform about 45 operations. The pieces handled were relatively light, varying from less than 1 pound to 10 pounds.

Except for the operations on the grinders, the work was essentially man-paced. Most operations allowed the workers very little idle time. The small amount of waiting time on automatic machine operations was usually consumed in burring, gauging, and cleaning of finished pieces. The absence of idle time was apparent during all plant visits. Observations indicated that employees worked efficiently and consistently, and that workers and equipment were well utilized. At the same time, however, there was no evidence of "speed-up" or "driving."

On the whole, the work in this department may be described as light, man-paced machining operations.

TYPES OF OPERATORS

The employee force of this company had grown very rapidly during the few years prior to the survey. As a result, many of the 7,000 workers had been with the company for only a short time. Fully 40 percent had been with the company less than 1 year.

The machining operations required considerable skill because tolerances were very small. As the supply of machine operators was very limited, the company resorted to intensive training courses. Many of the operators had never been employed in manufacturing plants before joining this company and consequently were not accustomed to factory work. The estimate of the personnel department was that fully 90 percent of the workers had been in industry only since the beginning of the war.

During the period surveyed, more than half of the employees were women, primarily of Polish, Slavic, or Italian extraction. While no women were employed on some of the operations because of the weight of the raw stock, women composed about 50 percent of the operators on lathes, 95 percent on grinders, and 98 percent of the burring and inspection personnel.

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WAGE RATES AND INCENTIVES

The wage structure in this plant is built on a highly integrated placement and advancement program. Beginners start as low as 60 cents per hour, although most of them start at 65 and 70 cents. Until the three-shift plan gave way to a double shift, the second shift received a bonus of 5 cents per hour, and the third shift a bonus of 10 cents. Under the double-shift arrangement, the night shift received an hourly bonus of 10 cents.

Interestingly, too, there is an allowance of 25 cents per shift as "shower pay" in departments handling lead, in which an intensive cleaning up is part of the personal hygiene phase of the safety department.

Under a comprehensive time-study and job-analysis system some thirty-odd job classifications have been established, varying with the skill and experience required for various operations. Each of these classified jobs has a starting rate, a qualifying rate, and a standard rate. The operator starts at the lowest rate and is required to reach the production level called for at the qualifying rate within 3 months. If he does, he is advanced to the standard rate, provided he has reached the minimum standard production level within the next 3 months. As the employee gains in experience, he is promoted to work in higher job classifications carrying higher wage rates, when there are openings. The transfer is made at the employee's rate of pay at the time of the promotion. The raise to the higher qualifying and standard wage rates becomes effective when the operator has reached the required production levels within the required time limits. The top rate is $1.25. Raises beyond this point depend on merit and length of service.

A new but experienced employee usually starts at the qualifying wage rate at the machine with which he is most familiar, and is raised to the standard rate as soon as he qualifies. The management claims that this system has the advantage of flexibility and permits workers to fit into the operations for which they display the greatest aptitude.

A "placement requirements table," based on time and motion studies, sets out the requirements for each job—education, experience, height, weight, strength, etc. As far as possible, the assignments of workers are made in keeping with the specific job requirements.

A new and inexperienced employee is put through a training period of 1 month. This includes short trips through the plant, training movies, lectures on shop practices and safety, and, primarily, training at machines. The last takes about 3 weeks. During this period the worker becomes acquainted with the various types of machines and operations of the plant. Then he is transferred to an operating department for specific training.

To make the employee feel at home, to further good morale, and to open an avenue of cooperation between labor and management, members of the personnel, personnel-relations, and safety departments stop by every few days to discuss with the new employee any questions he wishes to raise. This method was claimed to be particularly effective in building up the morale of workers new to industry, and in curtailing turnover.

HOURS AND SHIFTS

The period studied covers the calendar year of 1943. During the first 5 months of the year the plant operated 3 shifts for 6 days per week, for a total workweek of 45 hours. (Each 8-hour shift had a half hour off for lunch.) Because of turnover, separations for military reasons, and a general tightening of the labor market, a two-shift system of operation replaced the three-shift system. Under the second schedule of hours the day-shift employees worked 5 days at 9½ hours and a sixth day, Saturday, at 7½ hours, for a total of 55 hours per week. The night-shift employees generally worked 6 days at 9½ hours, or 57 hours per week.

The shifts were not rotated. Workers on the night shift could transfer to the day shift as openings occurred, preference being given to workers with the longer seniority in the available job classifications. As already indicated, the night shift received a bonus of 10 cents per hour.

Data for the 2 months (May and June) during which the transitions were made were excluded from the comparisons of performances under the two schedules of hours.

WORKING CONDITIONS

Working conditions are exceptionally good. The plant is housed in several very modern buildings which are unusually attractive. The facades are on modified modern lines, of buff and glass brick, and are pleasingly landscaped.

All departments are housed on the first floor. There are no windows. The air is filtered and washed. The high ceiling is soundproofed. The floors are made of treated wood blocks. Aisles are defined by painted lines and are kept clear. Except for the immediate area around the punch presses, the noise is moderate. There are no fumes or dusts. Lighting is excellent. As aids toward safety and to facilitate better vision, the top half of each machine is painted cream white, while the bottom half is painted blue. All equipment is well-guarded and well-spaced and is kept clean.

The large cafeteria serves food at or below cost. Workers may take their own lunches to the cafeteria. The walls of the cafeteria are decorated, and its general appearance would be a credit to any good commercial cafeteria.

There are no organized rest periods. Coffee wagons, selling coffee, cakes, candy, cigarettes, etc., pass through each department once in the middle of the morning and again during the middle of the afternoon. The half-hour lunch periods are staggered, to prevent crowding in the cafeteria.

INDUSTRIAL RELATIONS

The Mechanics Educational Society of America is the recognized employee bargaining agency in the plant. The handbook which the company furnishes each employee explains: "There shall be no discrimination on the part of the company against any employee for or on account of membership in the union, nor any coercion or intimidation against any employee by the union for nonmembership in the union."

Relations between the union and management appear to be very good. The shop steward of the union, in fact, has his office in the personnel-relations department.

In its effort to secure and retain a high level of worker morale, the management takes care to assure its employees that it is very much concerned with their welfare. Every new employee is given a medical examination to facilitate proper placement. No discrimination is made against handicapped workers if they can be fitted into jobs in which their handicaps do not prevent satisfactory performance. Employees at their option are furnished with free annual medical examinations. There is a Federally controlled credit union. Workers are given the opportunity to obtain life insurance, hospitalization insurance, and pensions, by contributing part of the insurance cost.

SAFETY

As already indicated, the safety of employees was one of the primary considerations in the plant lay-out. All equipment is well guarded and all new employees are given safety training, as well as printed safety rules. Goggles, special-type shoes, shields, and uniforms are furnished by the company where required. Prescription goggles are furnished at less than cost. Safety shoes, sold at cost, are recommended for all but the lightest types of work.

Women working at machines are required to wear hair nets or caps. The uniforms, sold by the company (but furnished free, with laundry service, on some jobs), are designed for safety as well as for looks.

Safety inspectors circulate through the plant constantly. One of their tasks is to inculcate safety habits in new employees.

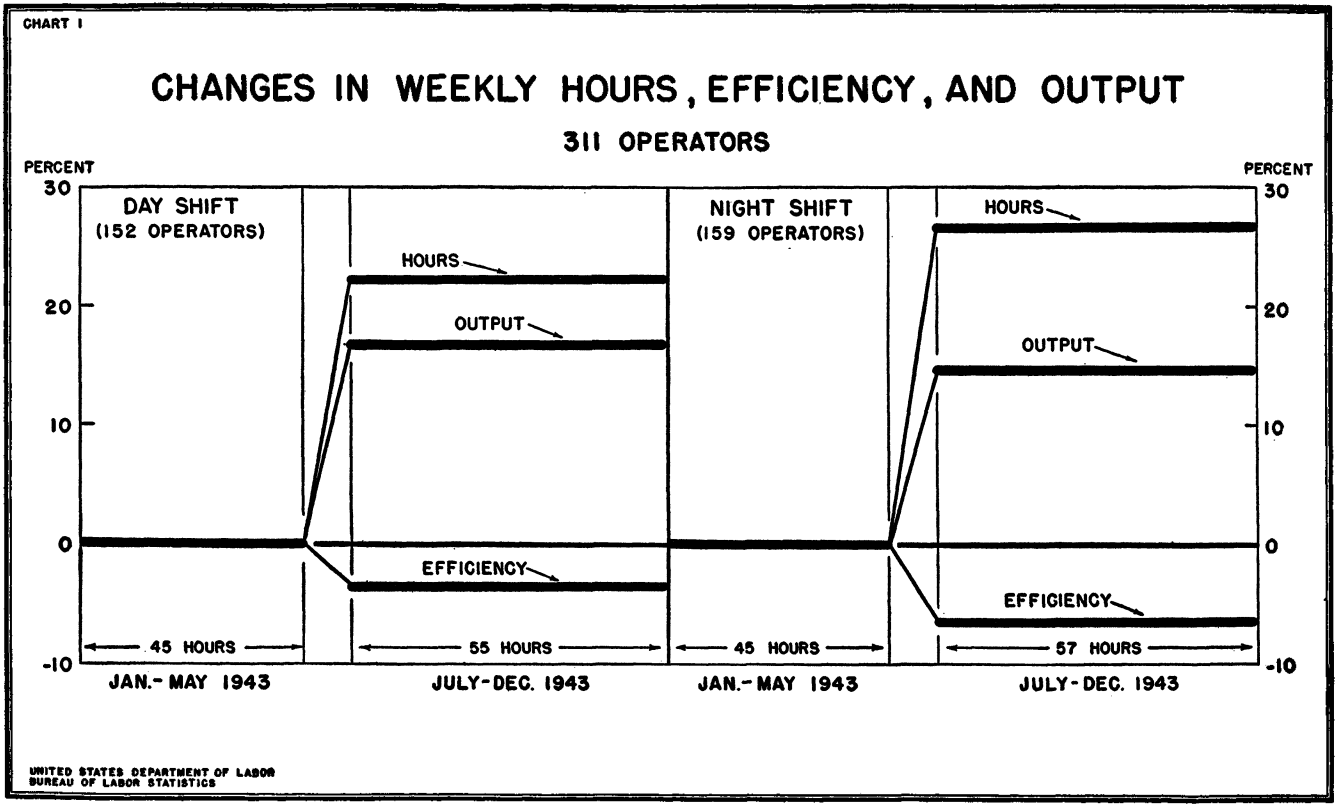
The first-aid and medical-examination rooms are well equipped. The several part-time doctors are on call at any time. Several nurses are on duty throughout all working hours. There is an ambulance for emergency hospital cases.

FINDINGS

1. For the entire group of 311 operators (263 of whom were women) efficiency—i. e., the average output per employee-hour worked—decreased by about 5 percent during the longer workweek.

The drop was most marked during the month following the one in which the transition was made, and was sharp for both the day and the night shifts. Against an efficiency index of 71.4 in May, that for July was 61.1—a decrease of 14 percent. The fact that July was a summer month should not have affected the results appreciably, as the plant is air-conditioned. During the next few months, however, the efficiency level recovered somewhat, indicating an adjustment to the longer work schedule after the sharp initial set-back.

2. The efficiency drop for the 159 workers on the night shift during the longer workweek period studied was nearly twice that of the group of 152 workers on the day shift. Whereas the efficiency level of this last group declined by 3.5 percent, that of the night shift declined by 6.5 percent. As the male operators—representing the more experienced group—were almost evenly distributed between the two shifts, this difference can be ascribed directly to the difference in the efficiencies of day- and night-shift operations.



The drop in the efficiency of female operators of the night shift was in sharp contrast to the experience of the men. Whereas the efficiency level of the women dropped by 8.7 percent, that of the men actually increased by 0.7 percent. For the men, therefore, efficiency during the longer hours of the night shift was as high as during the shorter hours. For the women, it was substantially lower.

Of interest, too, is the fact that the efficiency of the men on the day shift during the longer work schedule was 5.8 percent lower than during the shorter hours. No reason was apparent for the substantially better performance of the men on the night shift.

For the entire group of female workers, performance during the longer workweek was 6 percent poorer. Most of this decrease was due to the sharp drop in the efficiency level of the night shift pointed out above. In comparison, the drop for the women on the day shift was 3.1 percent—about one-third of that for the night workers.

3. The time lost because of absenteeism increased more than one-half during the longer workweek, rising from 2.7 percent of scheduled hours to 4.2 percent. There was practically no difference in the absenteeism rates between the two shifts during this period. This observation is particularly true for the female employees, whose absenteeism rates remained nearly the same on the two shifts. These rates, incidentally, exclude time lost because of work injuries.

The company officials believed they had done well to keep the absenteeism rate at these levels. They readily admitted, however, that further improvement was possible. New methods were being tried constantly as the novelty or effectiveness of those being used wore off. The company used posters, slogans, articles in the plant paper, talks over the public address system, exhibits of wrecked German plane wings, "shot-up" allied motors, etc., to bolster morale. The emphasis throughout was on the necessity of speeding the war effort.

If an employee reports back after an absence because of illness, he is required to report to the first-aid room for a check-up before going to work. On the other hand, if the employee did not report his absence, he is required to clear through the personnel office with an explanation of his absence, before reporting for work.

Several investigators are employed who make calls on absentees when requested to do so by the foremen. It is claimed that absences are usually shortened by these interviews.

4. For the entire group, total output increased by 15.8 percent during the longer workweek. In comparison, hours were lengthened by an average of 24.5 percent. Roughly, 3 hours of additional output were obtained for every 5 hours of additional work. Putting the comparison in a different way, workers during the longer workweek were 93 percent as effective per productive hour, as they had been during the shorter working schedule.

The hourly output drop of 7 percent represents the combined effects of lowered efficiency and greater time losses because of absenteeism.

From what has already been said about efficiency of the two shifts, it would be expected that the performance of the night shift suffered more than that of the day shift. It did. The output levels indicate that the 22.2-percent increase in weekly hours for the day shift resulted in a 16.9-percent increase in output. For the night

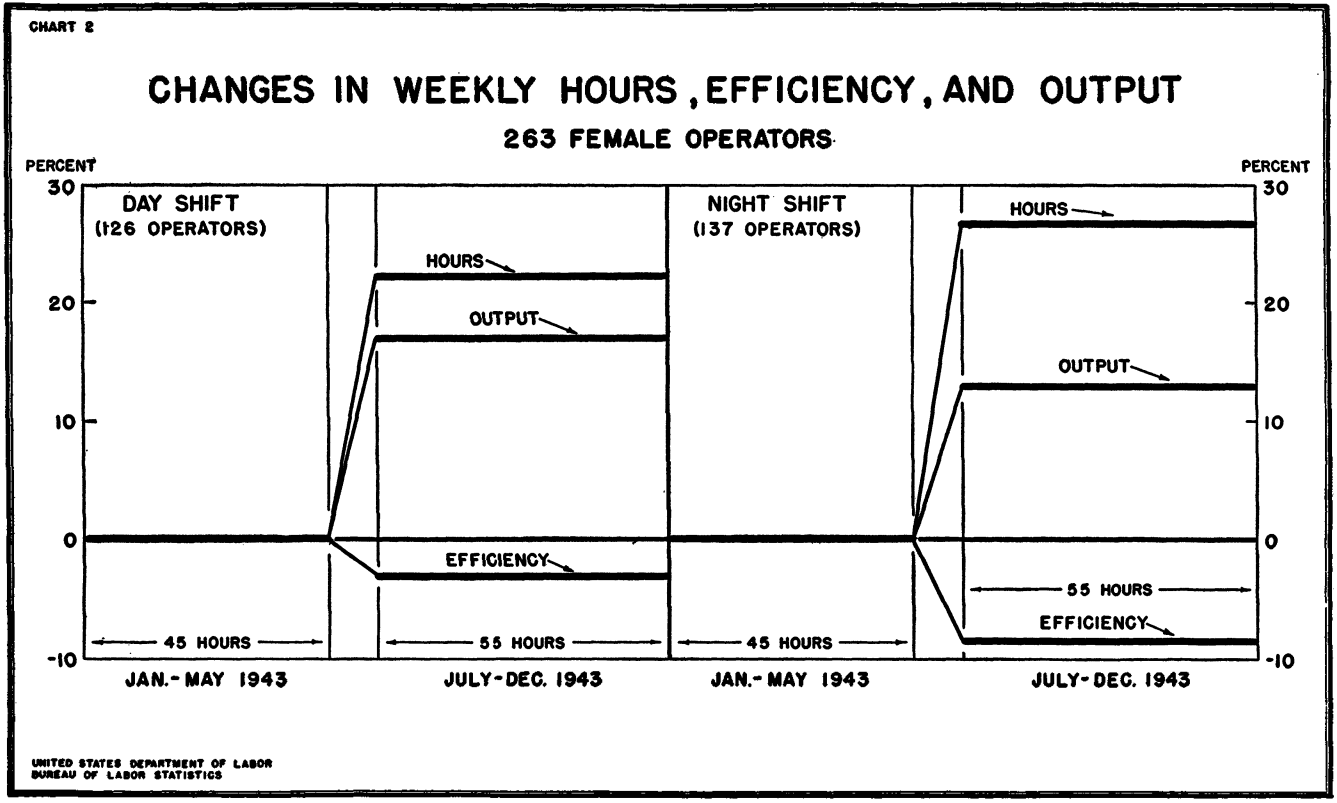
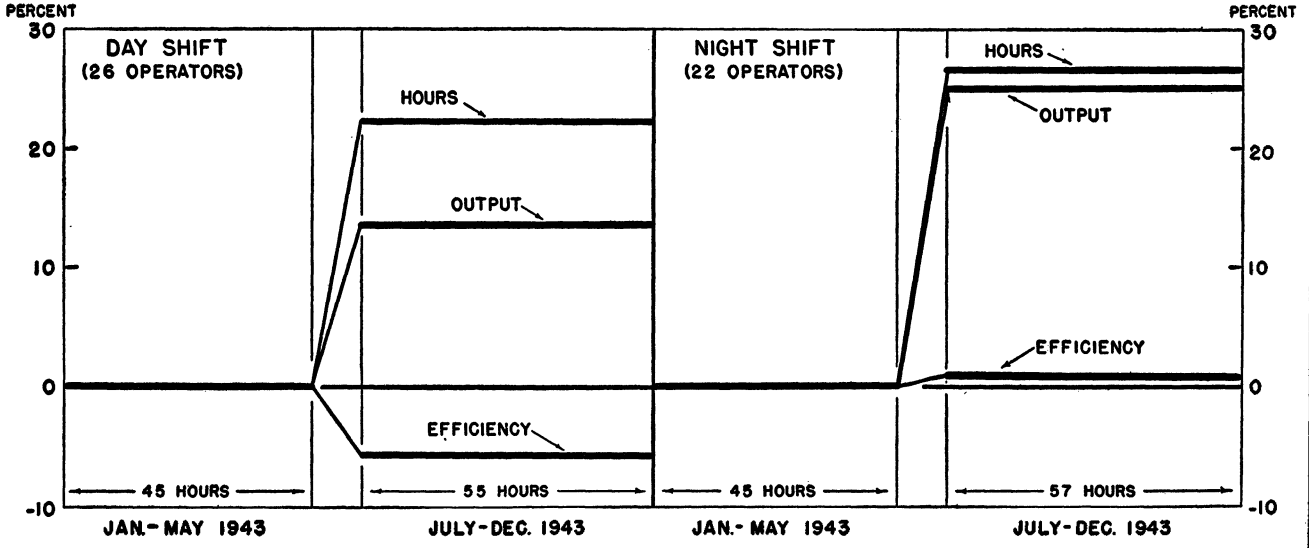


CHART 8

CHANGES IN WEEKLY HOURS, EFFICIENCY, AND OUTPUT

48 MALE OPERATORS



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shift, on the other hand, a 26. 7-percent increase in hours resulted in only a 14. 8-percent increase in output. In comparison with the shorter workweek, the hourly output of the day workers during the longer week was about 96 percent as effective. That of the night shift, however, was only 91 percent as good.

As the female operators composed the major part of the group, their output averages closely approximated those of the department. A 24. 5-percent increase in hours resulted in a 14. 9-percent increase in output. Mainly because of the sharper drop in the efficiency of the night shift, the 26. 7-percent increase in its hours resulted in only a 12. 9-percent increase in output, or 1 hour's additional output for every 2 additional hours of work. In comparison, the corresponding increases of 22. 2 percent in hours and 17. 0 percent in output for the day shift indicate about 1½ hours of additional output for every 2 hours worked.

The experience of this department indicates that the output performance of women under a 9½-hour workday is not as good as that of men, and that the adverse effect of the longer hours is particularly marked for female operators on the night shift.

5. In terms of the standard injury frequency rate—i.e., the average number of disabling injuries per million employee-hours worked—there was no evidence that disabling injuries occurred more frequently during the longer working hours.

Case Study No. 8—Metal Bearings

SUMMARY

Although belonging to the same company as the plant described in case study No. 7, this plant was considerably older and lacked many of the modern facilities of the new plant. Nevertheless, working conditions were good.

The operations studied were essentially man-paced machining processes on metalworking equipment. The work was medium heavy, weights ranging up to 70 pounds.

Nearly three-quarters of the 150 workers studied were men, most of whom were experienced operators. The wage-incentive system is that described in case study No. 7. As in that study, a three-shift system of 7½ hours each had given way to a 55-hour week for the day shift and a 57-hour week for the night shift. Shifts remained fixed.

The drop in hourly efficiency of the entire group during the longer hours exactly matched that of the group of workers studied in the other plant—5 percent. And again the night shift's loss in efficiency was nearly twice that of the day shift—6.7 percent against 3.6 percent.

Absenteeism losses under the longer work schedule were nearly double those under the shorter workweek. In sharp contrast to case study No. 7, however, the absenteeism loss of the night shift was nearly twice as high as that of the day shift.

For every additional 5 hours worked, 3 additional hours of production were gained.

NATURE OF WORK

The plant in which this study was made belongs to the same company as the one described in case study No. 7. The plant covered

in this survey, however, is located in a different part of the city, is considerably older, and lacks many of the modern facilities of the new plant.

The department studied is engaged in the production of metal bearings. The operations consist almost entirely of machining processes on lathes, drill presses, grinders, millers, broachers, and similar metalworking equipment. The work is essentially man-paced with very little resting time for the operators.

The weights handled vary from about 1 pound to 70 pounds. All lifting of heavy parts is accomplished by means of hand cranes. Women operators are permitted to handle only the lighter materials. The work may be characterized as medium-heavy, man-paced machining operations.

TYPES OF OPERATORS

Of the force of approximately 150 workers in the department, about 75 percent were men. As this plant has been in operation for a considerable number of years, most of the operators had been with the company for some time and were experienced workers. Few of the men were below the military draft age limit. The composition of the group varied little during the period surveyed.

WAGE RATES AND INCENTIVES

The wage-rate structure and the wage-incentive system are those already described in case study No. 7.

HOURS AND SHIFTS

Prior to April 1943, the department operated three shifts. Allowing for the half-hour lunch period on each of the 6 working days, the actual work schedule during the week totaled 45 hours.

In April 1943, the department changed to two shifts because of a shortage of workers. The day shift's new weekly hours totaled 55, (5 days at 9½ hours and Saturday at 7½ hours), whereas those for the night shift were 2 hours longer, with 9½ hours worked on each of the 6 working days. The shifts were not rotated. The night shift, however, received an hourly bonus of 10 cents.

The period covered in the survey extends from October 1942 through December 1943. The transitional months of April and May were excluded from all comparisons so as to permit a clean-cut evaluation of the effects of the longer working schedules.

WORKING CONDITIONS

As already indicated, conditions in this plant were not as modern as those described in case study No. 7. Nevertheless, working conditions were good. While the building was not air-conditioned or soundproofed, ventilation was adequate. There were no fumes or smoke. Lighting was good. Floors, of wood-block construction, were clean. Aisles were defined by painted lines and usually were kept clear. There was some noise, but not in any appreciable volume.

The machines were modern and were maintained in excellent condition.

Showers and locker rooms were adequate and clean. A large, newly decorated cafeteria served food of high quality at low prices.

There were no organized rest periods. Coffee wagons, selling coffee, cakes, candy, etc., passed through the department twice during each shift.

INDUSTRIAL RELATIONS; SAFETY

The discussions concerning these subjects in case study No. 7 are also pertinent here.

FINDINGS

1. For the entire department, efficiency during the longer hourly schedules dropped by nearly 5 percent from the levels which had characterized the shorter workweek.

The drop for the night shift was nearly twice as severe as that for the day shift. Whereas the rate of output per employee-hour worked decreased by 3.6 percent for the entire day shift, the output rate for the night shift—composed for the most part of workers formerly on the second and third shifts—dropped by 6.7 percent.

It is also pertinent to note that the combined performance of the second and third shifts was slightly better during the three-shift schedule than that of the day shift. After the change to longer hours, it was not so good.

2. The time lost because of unauthorized absenteeism (exclusive of time lost because of injuries) nearly doubled under the longer hours. The comparative rates for the shorter and longer work-schedule periods were 2.7 percent and 5.2 percent, respectively.

The time losses for the late shifts exceeded those for the day shift considerably under both schedules of hours. In fact, the percentage in each case was nearly twice as high. Whereas the day-shift rate was 1.7 percent under the shorter hours, the combined rate for the second and third shifts was 3.6 percent. During the longer hours, the rate for the day shift rose to 3.6 percent, and that for the night shift to 6.1 percent.

3. For the entire group, output increased to a level 15.4 percent above that which prevailed during the shorter hours. This increase was effected by lengthening scheduled hours by 24.2 percent. In other words, 3 additional hours of production were obtained for every additional 5 hours worked.

Expressed in another way, during each hour worked under the longer schedules, workers were about 93 percent as effective as they had been under the shorter schedules of daily and weekly hours.

The performance of the night shift, which worked 6 nights at 9½ hours each for a weekly total of 57 hours, suffered more than that of the day shift, which worked 55 hours. For an increase of 22.2 percent in hours, the day shift gained 15.9 percent in output. In comparison, the night shift put in 26.7 percent more hours for a gain of 14.8 percent in output.

In the terms of the comparison made above, the day shift was 95 percent as effective during the longer hours as it had been during the shorter hours. The night shift was only 91 percent as good.

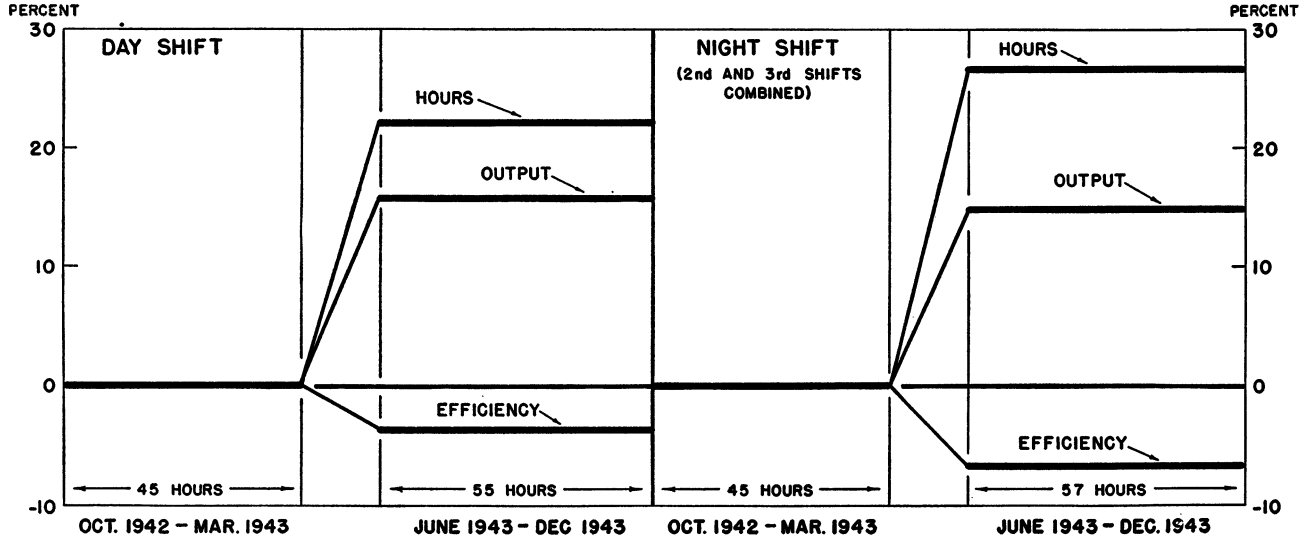
4. The effect of the longer workday and workweek was to wipe out the midweek production peak.

This was true of both the day and night shifts.

CHART 4

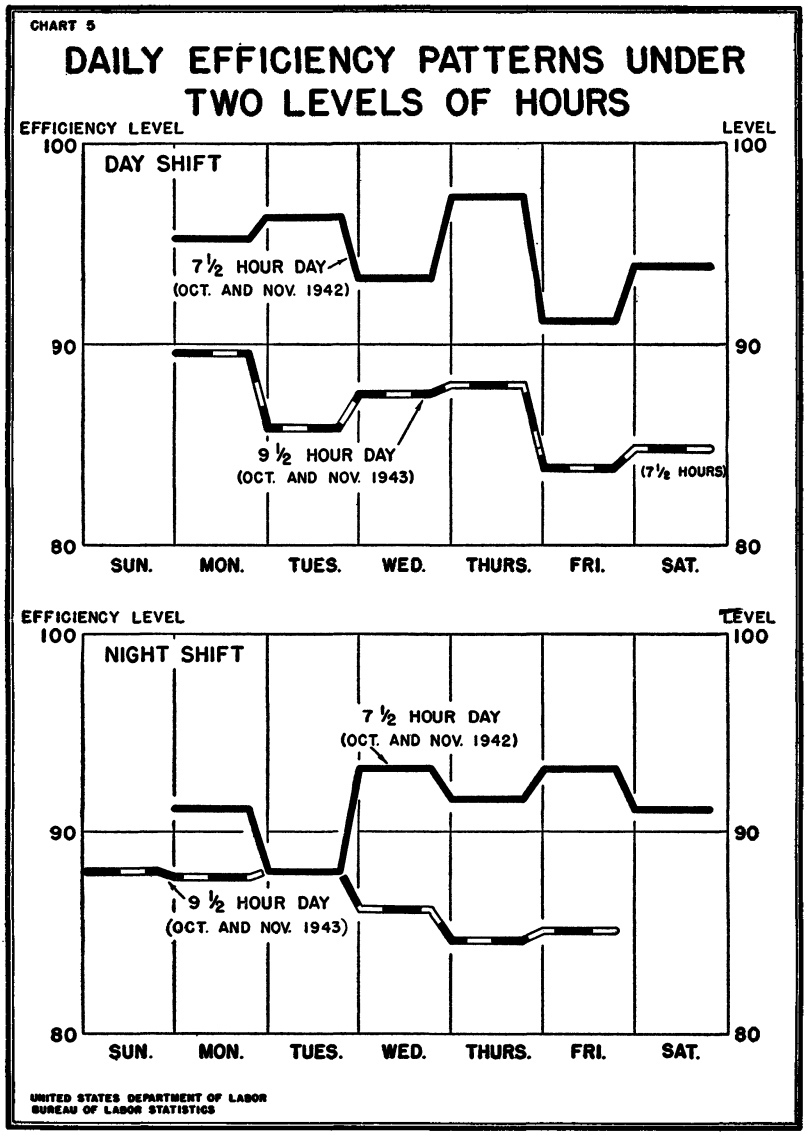
CHANGES IN WEEKLY HOURS, EFFICIENCY, AND OUTPUT

APPROXIMATELY 150 WORKERS



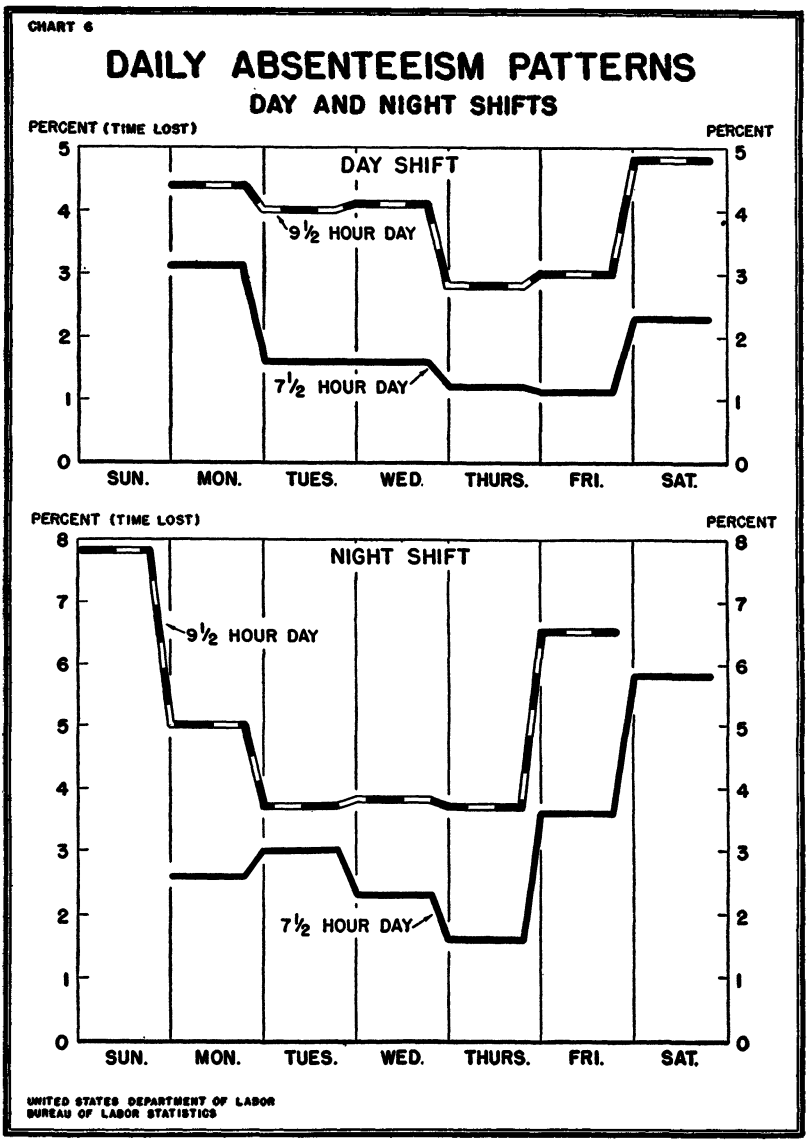
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

The day-shift pattern (chart 5) shows the fourth day of the week, i. e., Thursday, as the day on which production efficiency was best under the short workday. The fifth day, Friday, shows a considerably lower level, with some improvement on the sixth day, Saturday.



The level for each 9½-hour workday, in comparison, is definitely lower than that for the corresponding 7½-hour day. Except for the drop on Tuesday, there is little difference between the levels for the first 4 days of the week. Again there is the drop on Friday, with a slight improvement on Saturday. The higher Saturday level may be

directly related to the fact that only 7½ hours were worked on that day. The night-shift pattern under the shorter schedule of hours resembles that of the day shift fairly well. The third day is the peak day, but is closely matched by Friday, the fifth day.



The loss of the midweek peak is more marked for the night shift than for the day shift. The hourly production levels for the first 3 days of the longer workweek are constant. The level for Wednesday—formerly the peak day—is lower, with still lower levels for Thursday and Friday, the fifth and sixth days.

The periods used for comparison included October and November of 1942 and 1943, so as to rule out possible seasonal effects due to temperature and other factors.

5. The lengthening of daily hours occasioned no change in the daily pattern of time lost because of absenteeism, except to raise the loss percentages for every day to higher levels.

This was true for both shifts.

Under the shorter hours, absenteeism was highest on the first workday of the week for the day shift. On the following days of the week, the loss percentages dropped successively to a low on Friday, with a fairly sharp rise on Saturday.

The lengthening of the workday by 2 hours for 5 days of the week, while resulting in a raising of the level for each day, did not cause any significant changes in the relation of the levels for the individual workdays, except to raise the Saturday level to the highest in the week, slightly above that of Monday.

The night shift's highest absenteeism level during the short workweek came on Saturday. During the first 4 days of the week, absenteeism was at much lower levels, the lowest point being reached on the fourth day, Thursday. The fifth day, however, averaged a very much higher loss ratio, and the sixth day, Saturday, it was still higher.

During the longer hours, the pattern reveals a sharp Sunday peak, with a sharply lower rate on Monday, and a still lower but fairly even level for Tuesday, Wednesday, and Thursday—and a very sharp rise in absenteeism on Friday, the last workday of the week.

The fact that the pattern varied relatively little under the changed daily hours probably is due to the continued maintenance of the 6-day week under both schedules.

Case Study No. 9—Airfield Landing Mats

SUMMARY

The operations studied were those required in transforming steel sheets, weighing about 90 pounds, into airfield landing mats. In terms of physical exertion, the work was fairly heavy, and was about evenly divided between machining on metal working equipment and hand operations.

The survey concerns the effects of a reduction in weekly hours from 58 to 48, substituting an 8-hour day for a 10-hour day (with 8 hours on Saturday). Only one shift was used during the longer work schedule. Two shifts were worked during the shortened week. These shifts rotated every 2 weeks.

The wage-incentive system used in this department provided payment for output in excess of a fixed standard. On an average, the bonus earned averaged 25 percent of the base pay.

Hourly efficiency during the shorter workweek was 15 percent better than that which characterized the longer hours.

There was little difference in absenteeism under the two hourly schedules. The absenteeism rates were high—from 10 to 11 percent. Indications were that absenteeism was considerably higher on the night shift than on the day shift.

The composite result of higher efficiency and about the same absenteeism under the shorter hours was a reduction in output per

worker of 8 percent from the level achieved under the longer hours. However, hours had been decreased by twice that percentage—17 percent. For every 2 hours dropped from the work schedule, 1 hour's output was lost. Put reversedly, only 9 hours of production had been realized from 10 hours of labor, under the longer schedule.

Work injuries were three times as frequent during the longer hours.

NATURE OF WORK

This study deals with the reverse of the situations found in most of the studies presented thus far. It deals with the effects of a shortening of working hours; specifically, a reduction in daily hours from 10 to 8, resulting in a reduction in weekly hours from 58 to 48.

The department studied manufactured airfield landing mats. Prior to the war it produced steel office partitions.

The work consists of the processing of steel sheets weighing about 90 pounds initially, and is about evenly divided between machining and hand operations. It can be characterized as fairly heavy, in terms of the physical exertion required of the workers.

The steel sheets, about 2½ feet wide and 10 feet long, are trimmed to size, bead strips are embossed, holes are punched, bayonet fasteners and slots for interlocking the mats are punched and interlocked, the holes are embossed, and the resulting mats—now weighing about 65 pounds each—are degreased, painted, baked, bundled, and loaded into freight cars.

The mats are moved down the production lines by means of conveyors or overhead tracks. There are about 30 workers on each production line.

WORKING CONDITIONS

On the whole, working conditions in this department were good. Illumination and ventilation were adequate. There were no smokes or fumes except in the immediate vicinity of the spray-painting booths. The wood-block floors were kept clean. Aisles were defined by painted lines and usually were kept clear.

Although there was considerable noise around the punch presses, the rest of the shop was comparatively free from excessive noise. Smoking was allowed except in the vicinity of the paint rooms and a few other hazardous sections of the plant.

The introduction of women workers into the plant necessitated the construction of lockers for them. The male employees apparently were benefiting from this, as lockers were being built for them as well, at the time of this survey.

There were no showers; there was no cafeteria or lunch room—not even a coffee stand. Dry lunches and drinks could be obtained, however, from a lunch wagon which stopped outside the plant at lunch time. At the time of the survey, the plant employed about 800 workers. (Plans for a cafeteria, showers, etc., are part of the reconversion program of this plant.)

During the 8-hour day, there were no scheduled rest periods. It was estimated, however, that the length of voluntary rest periods averaged between 20 and 30 minutes per day, utility men replacing the workers who took time out, in order to maintain a steady flow of work on the production lines.

When 10 hours were worked, there was a scheduled rest period at the end of 8 hours.

After 1 year's service, employees were entitled to 1 week's vacation, and after 5 years' service, to 2 weeks.

Group insurance was optional and covered nonindustrial injury and sickness benefits as well as death benefits. Hospitalization insurance was available on a voluntary basis.

A nurse from the first-aid room visited homes to take care of redressings of work injuries. Every case of reported illness was visited, also—for treatment as well as verification. Every new employee was given a complete physical examination. Rest rooms with cots, heat pads, and simple medications were provided for female employees. A physician visited the plant daily and attended all serious cases of injury.

TYPES OF WORKERS

At the beginning of 1943, about 95 percent of the plant's operators were white men, mostly of Balkan origin or descent. There were no women operators.

In the spring of 1944, white men composed only 40 percent of the group. The remainder of the force were colored workers. Fully 45 percent of the total force consisted of colored men; the remainder, 15 percent, consisted of colored women. In the hiring of these women management selected large, heavy workers between the ages of 30 and 45.

There were very few "old timers" in the department surveyed, during the period studied. Employees were about evenly divided between those who had had some industrial experience before coming to this plant, and those who had had none.

WAGES

Both men and women helpers started at 80 cents an hour. Operators received 95 cents, utility men $1.05, and leadermen $1.25. The average hourly rates in the department studied varied between 86 and 89 cents.

A departmental bonus was inaugurated in June 1943. About 2 months earlier the company made public the fact that the bonus plan had been filed with the War Production Board for approval. The workers responded with an immediate spurt in output.

A bonus was paid on all steel mats in excess of a set quota. Scrap was allowed up to 0.5 percent; for each mat scrapped in excess of this percentage, 2½ mats were deducted from the total number of mats produced by the line in excess of the standard. The bonus varied from week to week, but averaged about 25 percent of the base pay. Average hourly earnings, therefore, averaged about $1.10.

The actual scrap percentage varied between 0.5 and 3.0 percent. The rates probably would have been higher were it not for the fact that spoiled large mats were reworked periodically into half mats.

The major reasons for scrap were claimed to be green help and carelessness of operators generally. The practice of laying off workers for spoilage of dies and mats because of carelessness is said to have helped materially in curtailing spoilage.

HOURS AND SHIFTS

In April 1943, daily hours were increased from 8 to 10, but the 8-hour Saturday was retained. This resulted in increasing weekly hours from 48 to 58. In December, however, the shorter schedule was reestablished because management was of the opinion that the 48-hour week and the 8-hour day were more efficient and less productive of absenteeism.

LABOR-MANAGEMENT RELATIONS

Relations between the C. I. O. union (which had the exclusive bargaining rights in this plant) and management appeared to be good. Up to the time of the completion of the survey in the spring of 1944, there had not been a walk-out or strike, directed at management, since the outbreak of the war.

Recently a labor-management committee was formed to deal with questions of production, absenteeism, and safety. This committee, however, was not in operation during the major portion of the period surveyed and consequently had little effect on the results of the survey.

THE GROUP SURVEYED

The period covered by this study extended from May 1943 through April 1944—a total of 12 months. During the first 7 months the weekly schedule consisted of 5 days at 10 hours, and Saturday at 8 hours—a total of 58 hours. During this period, only one shift was used.

From December through April the 48-hour week was predominant, with a few weeks in which slightly longer hours were worked. During this period two shifts were operated.

The average number of employees during the first period was about 80, and during the second period, about 140. As practically all of these employees were new to this type of work, there was little difference between the performance abilities of the employees during the two periods compared. Consequently the data used cover the entire personnel of the department without any attempt to follow through a selected group of workers.

The periods compared are from May through August of 1943, and from January through April of 1944. During these periods weekly hours remained fairly constant, with very little variation. (During the intervening months hours fluctuated considerably). The resulting comparison is between weeks of 58 and 48 hours; more specifically, it measures the relative performances during the 8-hour and 10-hour days.

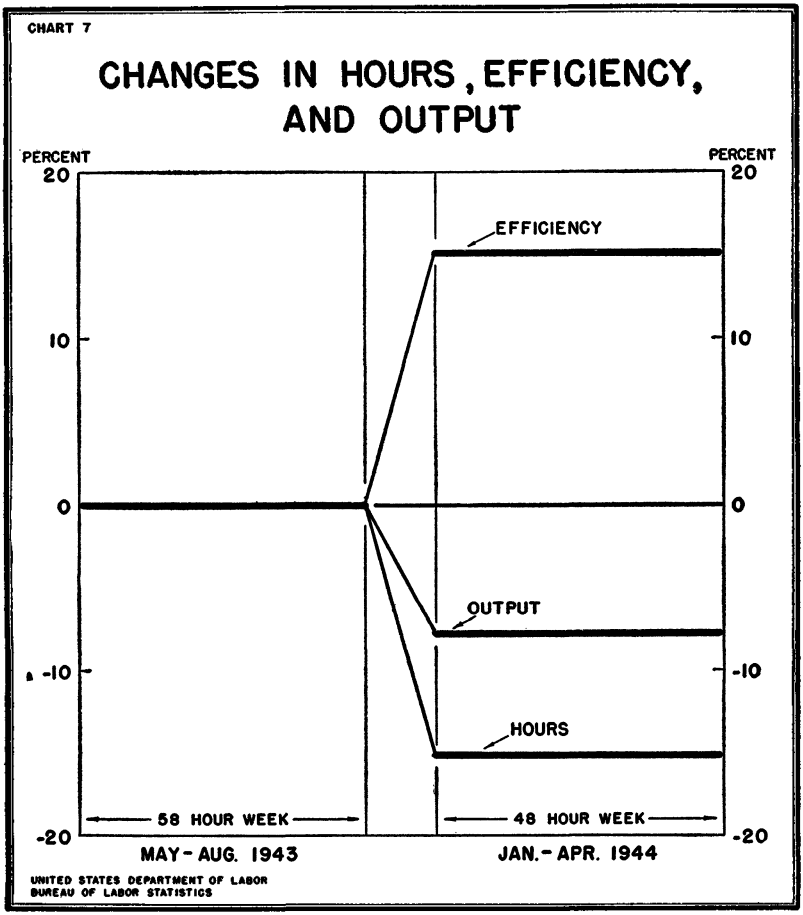
FINDINGS

1. Efficiency during the shorter workday was decidedly better. A comparison of the two periods shows an average increase of 15.1 percent during the shorter workweek over the level which had prevailed under the longer work schedule.

2. There was little difference in the average percentages of time lost because of absenteeism under the two schedules. During the 10-hour day, this time loss averaged 10.7 percent; during the 8-hour day, 10.4 percent. In either case, the loss was relatively high.

While data were not available to establish the point statistically, management was convinced that the night shift losses considerably exceeded those of the day shift. The conclusion to be drawn from this fact is that the day shift's absenteeism rate during the shorter hours was considerably lower than it had been during the longer hours, and that this reduction was a direct result of the shortening of hours.

Company records convinced management that absenteeism of colored workers was considerably higher than that of white workers.



Much of the high absenteeism during the shorter workweek was attributed to the belief that the colored employees earned more "take home pay" than ever before and that such high earnings were not conducive to steady attendance by a group of workers whose standard of living had not kept pace with the rise in earnings.

3. The composite result of the reduction in hours and the changes in the composition of the work force was an over-all production level during the shorter workweek that was almost 8 percent lower than the level during the longer schedule. For an average decrease of

15.1 percent in hours worked (and 17 percent in hours scheduled), the average output level dropped 7.9 percent. In other words, for every 2 hours dropped from the work schedule, 1 hour's output was lost. Putting this conclusion in reverse, every 2 hours added to the work schedule above 8 per day and 48 per week resulted in only 1 hour's additional output. Half of the time added was completely wasted.

4. Work injuries were about three times as frequent during the longer hours. Specifically, the average number of first-aid treatments per 100 workers during the shorter-schedule period averaged 208; the corresponding average during the longer-schedule period was 680.

The comparison of actual time lost from work because of industrial injuries reveals much the same result. For every 100 workers on the pay roll, 23 employee-days were lost per month under the shorter work schedule, as against 128 employee-days under the longer schedule.

Case Study No. 10—Drills and Reamers

SUMMARY

This study covers the performance of the entire productive personnel of a small plant employing about 100 persons.

The work was light and almost entirely man-paced. It consisted of cutting steel rods to proper lengths, and grinding, fluting, and tempering these lengths into drills and reamers.

The operations were generally carried on by operators working individually. Little teamwork was required. The wage-incentive system consisted of a bonus based on each worker's efficiency, with fixed increases for specified percentages of additional production above the standard. There was, however, a ceiling of 30 percent above base pay beyond which workers were not paid for additional output.

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 performances of 30 identical operators were traced through this entire period.

Efficiency was highest during the schedule in which the plant was shut down on Sunday. In comparison with the 7-day week, efficiency was 29 percent greater. If earnings had not been limited under the bonus plan, the data indicated that this increase probably would have been as high as 36 percent or more. Efficiency increased as additional Sundays were dropped out of the work schedule.

The output performance of the 30 operators studied was about 7 percent better when no Sundays were worked than when every Sunday was worked. Had there been no bonus restrictions, weekly output very likely would have been about 13 percent better, or on a par with the output when every other Sunday was worked.

The survey showed clearly that in this plant Sunday work, on any basis tried, was uneconomic. This condition was known to exist, but owing to war pressure the schedule was established and maintained as long as possible.

Work injuries were not more numerous, relatively, during the longer workweek.

NATURE OF WORK

This plant is small, usually employing about 100 persons. The product and processes have not been affected by the war.

The work is light and almost entirely man-paced. It consists primarily of machining light pieces of metal rods into drills and reamers. The work is continuous and affords the operators practically no rest pauses during the machine processes, although the work is not machine-paced.

The raw stock consists of soft steel rods 12 to 14 feet long and of various diameters. Those above one-eighth inch in diameter are welded into a continuous rod, which is fed through a hardening furnace at a fixed speed and temperature. The weld is then cut, the oxidized ends are removed, and the hardened rods are fed through a straightening device. After this they are tempered. Stock one-eighth inch or less in diameter does not go through this process, but is cut into drill lengths, which are then hardened in small furnaces.

After being cut to proper lengths, all drill blanks are rough-ground, pointed, tested for straightness, and then fluted. The fluted drills are degreased and tempered. The shank ends are annealed, and the drills are then polished. The operations of finish-grind, cleaning, sharpening, and stamping complete the process.

Most operations are carried on by individual operators. Little teamwork or operation by groups of workers is required.

Observation indicated that employees worked consistently, and that operators and equipment were well utilized.

WORKING CONDITIONS

The plant occupies two small adjacent one-story buildings. Because of the crowding of equipment, aisles are narrow, but they are generally unobstructed. There are no fumes, and ventilation is good. Illumination is adequate, and noise is moderate. Except in the immediate vicinity of the furnaces, there are no excessive temperatures.

Locker rooms, containing wash basins, are adequate and clean. There is a rest room for women. Because of the small size of the plant, and especially because it is filled to capacity with equipment, there is no lunch room. Coffee, milk, and sandwiches are brought in on order.

LABOR FORCE

The plant normally employs about 100 persons. By June 1944 it had expanded to about 175; this number seems to represent the maximum force the plant can accommodate.

Approximately 35 percent of the operators are "old timers" who have been with the company for years. Having lost about 100 workers to the armed services, the company has had a rather high labor turnover. Of the operators hired since the outbreak of the war, about

two-thirds were new to industry. Only about 5 percent were skilled operators.

During the year preceding this survey, the company found it necessary to employ women. This was done reluctantly, as the data compiled for the plant executives indicated that it took longer to train new women workers—most of whom had not had any previous industrial experience—and that, in general, women had not proved as efficient as men. As experience with women workers accumulated, it was found that turnover rates among women were high.

Only about a third of the force consisted of experienced operators. The others had to be trained for the work, usually "breaking in" with the easiest jobs and occasionally being paired with "old timers" for more specific training.

WORKING HOURS AND SHIFTS

At the time of this survey (June 1944), the plant was operating three shifts of 8 hours each. The actual working time was 7¾ hours because of the 15-minute lunch period—paid for by the company. The three shifts were fixed, i. e., workers did not rotate from one shift to another. Employment on first, second, and third shifts was in the ratio of 55 : 25 : 20, respectively. As the new employees were hired for the third shift, with older employees moving to the second or first shift as vacancies occurred, the third shift was predominantly female. This shift worked from midnight until 8 a. m.

Women operators were given a rest period of 15 minutes during each half of the working day.

Until October 1941, the plant had been on a 5-day, 40-hour week. In that month it started working on Saturday, a sixth day, raising weekly hours to 48. By January 1942 the urge for increased production had become so strong that employees were required to work 7 days per week. This schedule was kept up until May 1942. In that month the plant began to shut down every third Sunday. In February 1943, the working schedule was again revised, the plant closing down every other Sunday. Beginning with July 1943 the plant went back to the 6-day week, on which schedule it has remained.

WAGE RATES AND INCENTIVES

Wage rates were the same for men and women. The starting rate for an unskilled employee, at the time of the survey, was 75 cents per hour and was later raised to 85 cents. (These high starting rates clearly reflect the critical labor situation in the city.) The wage rate was increased 5 cents a month until a rate of 90 cents per hour was reached. From that point on, raises were based on minimum pay for the operation; the top rate was $1.20 per hour. There was, in addition, a bonus of 5 cents for the afternoon and night shifts.

The wage-incentive system, installed in September 1941 while the plant was on a 40-hour week, consists of a bonus based on each worker's individual efficiency. Using a fixed level of hourly production as a base, the company pays 17 cents per hour for the first 5-percent excess above this level. Additional hourly increases in pay are made for specified increases in efficiency, thereafter—but the increase stops at 130 percent, at which rate of efficiency the additional pay per hour is 40 cents. No bonus is paid for production above this

level. This arbitrary level was established because some operations could be speeded up greatly, whereas others, particularly hand operations, were limited by the skill of the operators. The purpose of the limitation was to prevent discontent due to differences in bonus earnings. To eliminate ups and downs in the weekly pay envelope, the company computes the weekly bonus on the average efficiency for the preceding 5 weeks.

Only about 70 percent of the operators were earning bonuses at the time of the survey. The reason for this was given as the influx of green help, particularly women operators.

Since 1940, a C. I. O. union has been the exclusive bargaining agent. The relationship between union and management appears to be good.

The union contract also provides for a 2 weeks' vacation with 80 hours of base pay after 1 year of service, and 1 day of vacation for each 2 months of service if the employee has been with the company for less than 1 year. For the duration of the war, employees were allowed to take pay in lieu of time off.

SAFETY AND WORK INJURIES

Because of the small size of the plant, it had no safety engineer. A labor-management safety committee, however, has been fairly active, and has been particularly effective in helping new employees.

Safety goggles and face shields are issued to all workers engaged in grinding or polishing operations, and these are usually worn by the operators. Nevertheless, a considerable number of injuries were due to foreign particles striking eyes.

The other major type of injury consisted of cuts and abrasions of hands, particularly among women, and resulted from the winding operations.

Because of the light nature of the work, safety shoes were uncommon.

There was no first-aid room. On each shift were a number of men who were trained in first aid. Injuries beyond the scope of these men were referred to nearby physicians or hospitals.

SCOPE OF THE SURVEY

The records of 30 identical male operators were traced throughout the entire period from January 1942 through April 1944. The comparisons in the findings cover four distinct levels of weekly hours: (1) The straight 7-day, 56-hour week, for a period of 4 months; (2) 2 weeks of 7 days and 56 hours followed by a third week of 6 days and 48 hours, or every third Sunday off, worked for a period of 10 months; (3) a week of 7 days and 56 hours alternating with one of 6 days and 48 hours, or every other Sunday off, worked for 5 months; (4) a straight 6-day, 48-hour week with every Sunday off, worked for 9 months.

FINDINGS

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 chart 8 shows, efficiency clearly improved as additional work—on Sundays—was dropped. Efficiency was lowest when all Sundays were worked, and highest when no Sundays were worked.

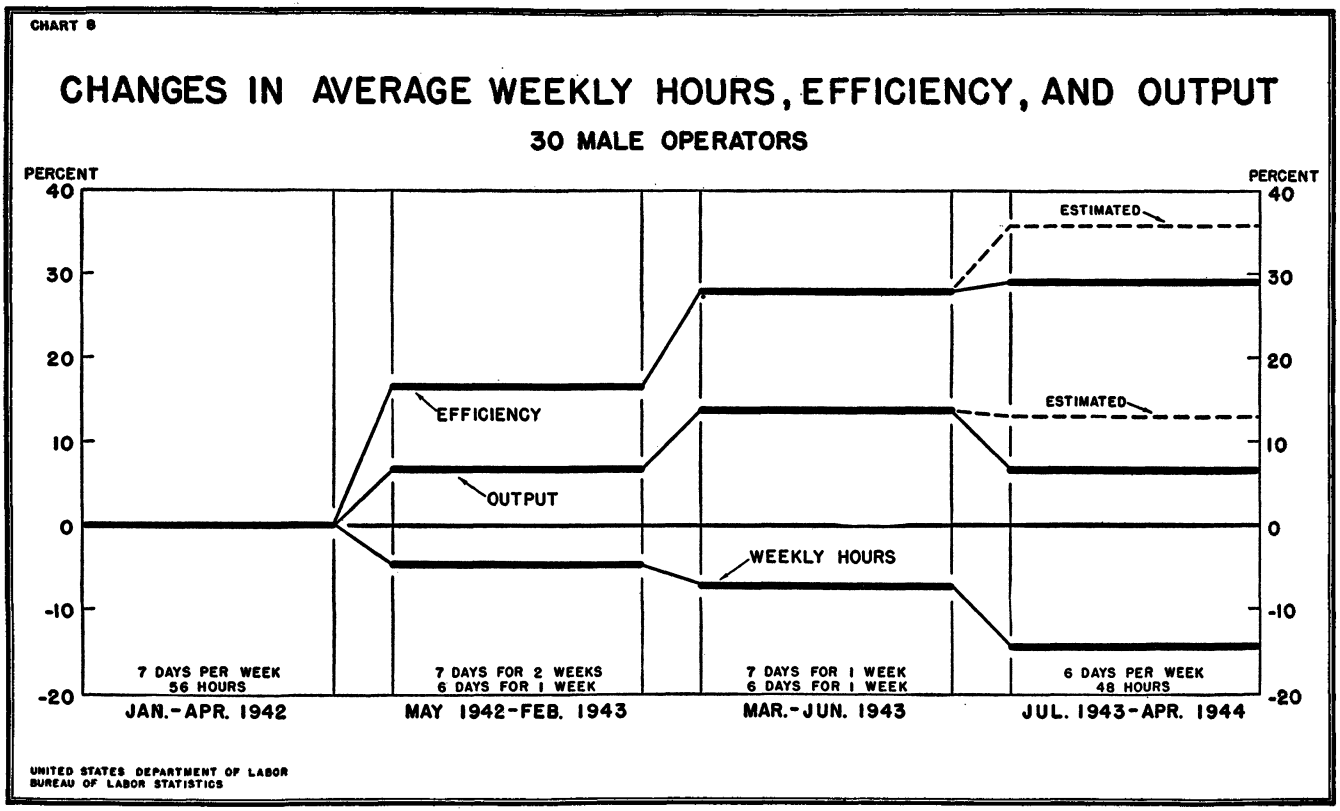
2. The time lost because of absenteeism by the 30 selected operators was lower when Sunday work was discontinued entirely, as against the schedule under which every other Sunday was worked. The relative percentages, 7.3 and 8.2, appear to be quite high. The average time losses during the two earlier 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.

For the plant as a whole, the absenteeism loss was lowest for the first shift. Frequently the second shift matched the record of the first. Although the third shift had only about one-fifth of the entire force, it was said to account for about 50 percent of the total absenteeism.

This distribution is partially explained by the fact that the first shift had the highest proportion of old-time employees, and the third shift the lowest. The introduction of women operators—most of whom were assigned to the third shift—further aggravated the situation. The absenteeism rate of the women was reported to be about twice that of the men. This fact, however, must again be viewed in the light of the preponderance of women on the night shift.

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 per hour.) Con-



sequently 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 limitation 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., one 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.

In any case, the data clearly point to the fact that total weekly output was better as fewer Sundays were worked. The longer the week because of Sunday work, the lower the total level of weekly output. The output performance of the 30 operators studied was about 7 percent better when no Sundays were worked than when every Sunday was worked. Had there been no bonus restrictions, weekly output very likely would have been about 13 percent better or on a par with the output when every other Sunday was worked.

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

4. The incidence of work injuries did not vary in any discernible relation to the work schedules. As very few of the injuries were disabling, the comparison was made on the basis of all injuries, most of which required only first aid.

The average number of injuries per 100 workers per month were as follows:

Work schedule:	*Number of injuries*
7-day week	3.6
Every third Sunday off	3.8
Every other Sunday off	3.1
Every Sunday off	3.7

These figures are for the total work force. The fact that the 6-day week had a higher average than the schedule with every other Sunday off may be due to the heavier percentage of female operators during the shorter schedule, and the greater tendency of these operators to suffer cuts and abrasions of the hands.

Case Study No. 11—Manufacture of Shells

SUMMARY

This department produced 105 mm. shells. About 30 operations were performed on 14 types of metalworking machines. Operations were man-paced and medium heavy. The shell, during most processes, weighed about 26 pounds.

Morale in this plant was excellent, and working conditions were fairly good. A daily and weekly bonus was paid for all shells above a daily and weekly quota, and was based on the output of the entire department of about 100 operators.

The comparison presented here is between a 40-hour week (5 days at 8 hours), and a 60- and 66-hour week with daily hours at 10 for the day shift and 11 for the night shift.

Efficiency was markedly lower during the longer workweek. Whereas hours had increased by 47 percent, efficiency decreased by nearly 22 percent.

Absenteeism losses were about 2½ times as high during the longer schedule. The increase was particularly sharp for the night shift.

The composite effect of lower efficiency and higher absenteeism was an increase in output of only 7 percent—against an increase in actual weekly hours of 47 percent. In terms of the output rate which characterized the shorter workweek, this increment in output could have been achieved by lengthening hours from 40 to 43 or 44 per week. The difference between this level and the 60 and 66 hours actually worked appears to have been wasted.

After 7 months at the longer hours, the department went on an 8-hour day and 48-hour week, in the middle of 1944.

NATURE OF WORK

This study covers the experience of a shell department under a 5-day, 8-hour schedule in comparison with a subsequent 6-day, 10- or 11-hour schedule.

This shell department was organized at the outbreak of the war and manufactures 105-mm. shells. It did not exist before the war. The rest of the plant is engaged, for the most part, in the production of machine tools, as in peacetime.

The work consists primarily of the operation of metalworking machines, such as grinders, millers, lathes, drill presses, and similar equipment. Most of these operations are man-paced, with the workers controlling the speed of operations. About 14 types of machines perform about 30 operations on the shell. The rough casting weighs about 30 pounds; after the first two operations it is reduced in weight to about 26 pounds, and remains at about that weight thereafter. It passes from machine to machine by means of gravity conveyors.

Operators have very little idle time during machine processing, even at the fully automatic machines. When not operating their equipment, operators are engaged in passing the processed shell to the next operation, or readying a shell for the machine.

In general, the work may be classified as medium heavy, essentially machining, primarily man-paced, and affording very little rest to the operators. A number of observations showed the department to be operating efficiently and consistently, with good utilization of the equipment.

Although women were employed on the production lines, the operations they performed were confined to burring, marking, and inspecting. These operations do not require them to lift the shells onto the machines.

WORKING CONDITIONS

Lighting and ventilation were good. There were no fumes or smoke. Aisles between machines were narrow, but free of obstructions. There was, however, a considerable volume of shrill noise.

There was a locker room for the women but none for the men. Sanitary facilities were adequate and clean. A small lunchroom was located in an adjacent building, and a privately operated cafeteria was about half a block away. One-half hour was allowed for lunch.

Two rest periods permitted the operators a 10-minute break in the middle of both the first and the second half of shifts. During these periods a coffee station offered milk, coffee, cakes, pie, and candy.

LABOR FORCE

The work force of this department numbered about 100 at the time the survey was made (spring of 1944). About four-fifths of the operators were white men and the remainder mostly white women. There were a few colored men.

Practically all of the operators were new to the company when hired. (As already indicated, the shell department was a wartime addition to the company's regular activities. It was necessary, therefore, to recruit a new and additional work force for this department.) Very few of these new operators had any experience of the type required for the work in this department. Consequently, practically all of them had to be trained by the company. In the absence of a formal training program, new workers—selected for general intelligence—were trained on the job.

The morale of the workers appeared to be high, primarily because they could see their direct contribution to the war effort.

The department was not unionized until January 1944. The recognized union is a branch of the Independent Welfare Association. The relationship between the union and management appeared to be good, and relations between workers and supervisors appeared to be informal and friendly.

WAGE RATES AND INCENTIVES

The range of hourly wage rates for male machine operators was from 70 to 90 cents. For set-up men, the level was considerably higher, from 90 cents to $1.15. A bonus of 5 cents an hour was paid to workers on the second shift. Women received 5 cents less per hour than men, but were not required to operate machines. Management was of the opinion that women did not perform as well as men on machine operations.

A daily and a weekly bonus were paid for output above a set level of production. These bonus payments were computed on the output of the entire department. Three-fourths of a cent was paid for each shell produced above the daily quota, and one-fourth of a cent for each shell above the weekly quota. In order to participate in the daily bonus, an operator had to work the full day. Participation in the weekly bonus was based on the number of days of participation in the daily bonus.

Additional individual earnings because of the bonus during 1943 averaged about 35 cents per hour. Hourly earnings of machine operators therefore ranged, on the average, between $1.05 and $1.25.

Workers were given 1 week's vacation after a year's service, with an additional day for each additional year, up to a maximum of 2 weeks. Vacation pay was based on the hourly rate and bonus on a 40-hour week

WORKING HOURS AND SHIFTS

The survey covered a period of 17 consecutive months, from January 1943 through May 1944. During the first 5 months of this period, the work schedule called for 5 days at 8 hours, or a total of 40 hours per week. Two shifts were operated, and they were not rotated.

In June, the second shift was dropped, and the first shift went on a 55-hour week, putting in 5 days at 10 hours and a half day on Satur-

day. In October, however, the second shift was again started. The men on the day shift stayed on this 55-hour schedule, while those on the night shift worked 55 hours during 5 days, putting in 11 hours per shift. The women workers on these shifts worked the same number of days as the men, but put in only 50 hours per week. In November, all workers on the day shift—both men and women—went on a schedule of 6 days at 10 hours (60 hours per week) and all workers on the night shift went on 6 days at 11 hours (66 hours per week).

In July 1944, however, the company switched to a three-shift schedule, with 8 hours per shift, because management was dissatisfied with the output performance under the longer hours.

ACCIDENT PREVENTION AND FIRST AID

During most of the period surveyed, the company employed both a safety director and a woman assistant. Frequent safety inspections were made periodically. New employees were given complete physical examinations and were instructed in both safety and health precautions. (The company even went so far as to give its employees a blood pressure check-up every 6 weeks.) Although the wearing of safety shoes was not mandatory, about 85 percent of all employees wore them. The company contributed 50 cents toward the purchase of each pair.

A full-time registered nurse was in charge of the first-aid room during each shift. The room was well equipped and was kept neat and clean. Injuries requiring other than a nurse's care were referred to a nearby physician during the day and a nearby hospital during the night.

SCOPE OF THE SURVEY

Because very few of the approximately 100 employees of this department were experienced before working for this company, it was inadvisable to select any particular group for study. In the comparison between the 40-hour week and the longer work schedules, therefore, the experience of the entire department was considered.

Similarly, it was deemed advisable to omit the comparison of any schedules except the 40-hour week and the 60- and 66-hour weeks. This permitted a comparison of the performances of an average of 85 workers during the shorter week, and about 103 workers during the longer week. For both periods, data are given for each of the two shifts.

The first period extends from January to May 1943, a total of 5 months. The second covers a comparable seasonal period, from November 1943 to May 1944. The caliber and quality of workers during the two periods were about the same, permitting a direct comparison.

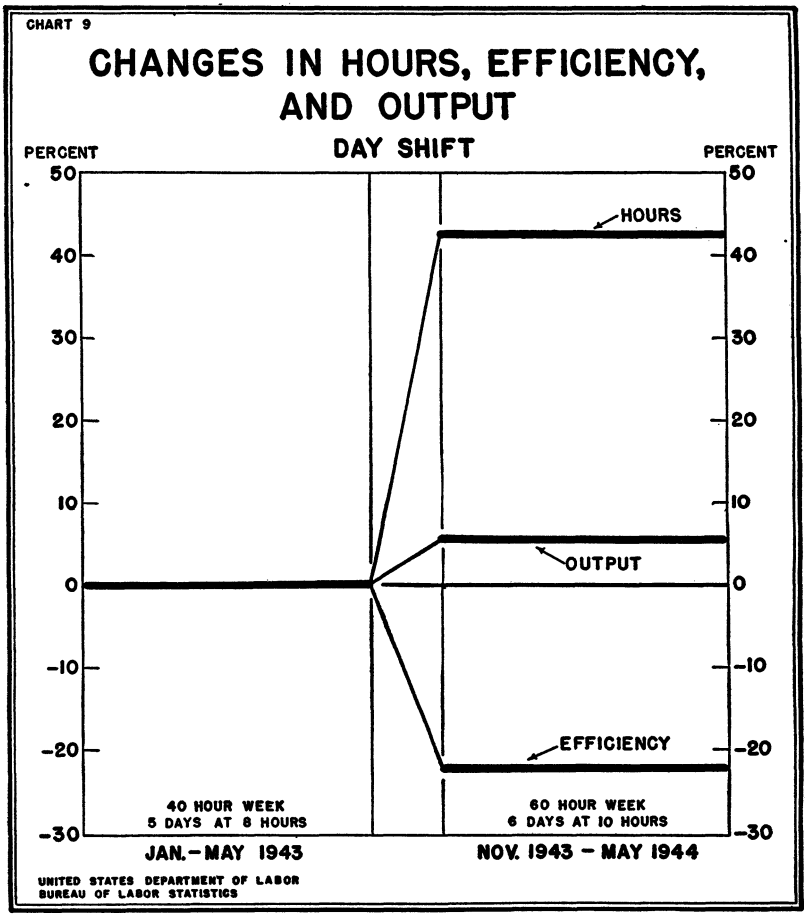
FINDINGS

1. During the longer workweek, the average efficiency (average number of shells per productive employee-hour) decreased markedly. Whereas weekly hours *increased* on an average of nearly 47 percent, efficiency *decreased* by 21.5 percent.

The decrease was slightly more for the day shift, which worked 60 hours per week. The increase of 42.5 percent in actual average weekly hours (and 50 percent in scheduled hours) was accompanied by

a decrease of 22.3 percent in efficiency. For the second shift, with a scheduled 66-hour week, and an increase of 51.2 percent in actual average weekly hours, efficiency decreased by 20.6 percent. The data indicate also that, for some unexplained reason, the efficiency of the night shift actually was somewhat better than that of the day shift during each of the two periods.

2. Absenteeism losses increased sharply during the longer work hours. During the 40-hour week, the entire group lost 4.7 percent of

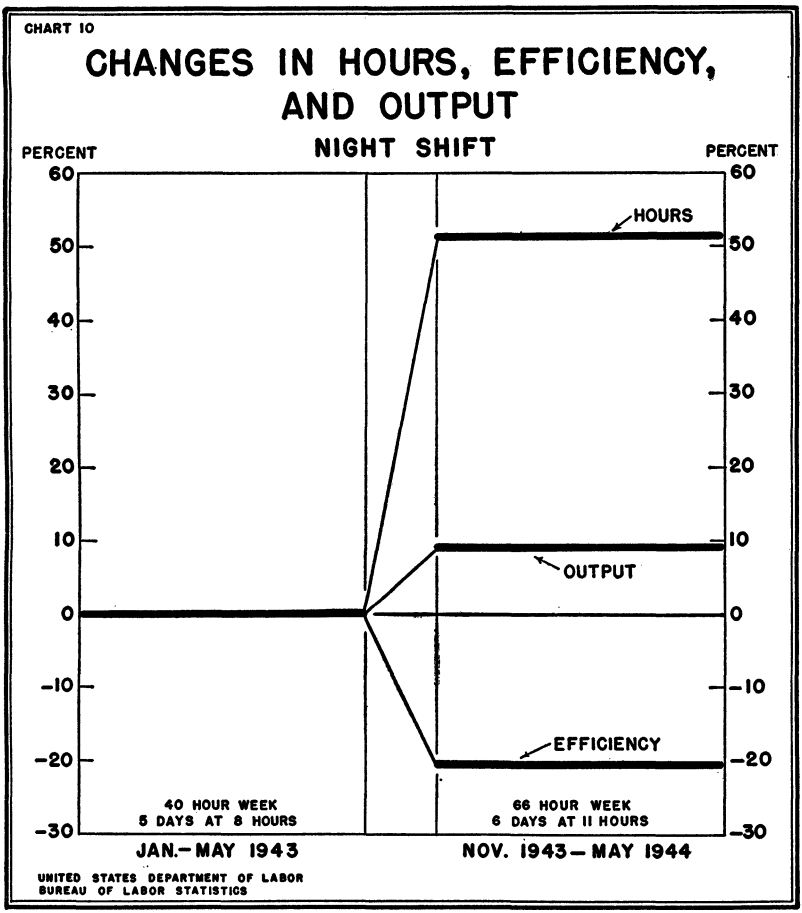


the scheduled working days. During the longer schedules, this percentage rose to 12.2.

The rise of the absenteeism-loss rate was much higher for the night shift. The rate of the day shift rose from 5.7 percent to 10.8 percent. The night shift's loss rate, in comparison, rose from 3.7 percent to 13.3 percent. It must be noted, however, that the day-shift schedule called for a 10-hour day, whereas that of the night shift called for an 11-hour day.

Company officials were of the opinion that, in part, the higher rates were due to fatigue and to sharply increased earnings.

3. In terms of total output, the longer hours hardly seemed justified. For the entire group, the increase of 46.9 percent in actual average hours—and more than 50 percent in scheduled hours—increased production by only 7.1 percent. (Production was measured in terms of average number of shells per employee per week.) This output figure reflects the changes in both hourly efficiency and absenteeism. Given the same hourly efficiency and absenteeism loss 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. On this basis of comparison, about 18 hours per week were entirely unproductive during the longer work schedule.

It is also significant to note that the levels of efficiency, absenteeism, and output remained fairly steady, month by month, during the longer workweek. In contrast, they fluctuated during the shorter workweek, although not to any great degree.

The output performance of the second shift was slightly better than that of the first shift, even though it put in a longer workweek. For

a 42.5 percent increase in actual weekly hours, the output of the first shift went up only 5.5 percent. That of the second shift went up 9 percent, for a 51. 2 percent increase in actual average hours worked.

As already indicated, the department went on an 8-hour day and three-shift operation in the middle of 1944, after about 7 months on the schedules of long weekly hours.

4. Work injuries were more than half again as frequent under the longer hours. During the shorter schedule, there were about 109 injuries (mostly first-aid cases) per 100 workers during a month. Under the longer hours, this average rose to 163.

The increase in injuries, however, was roughly proportional to the increase in hours. The increase in average weekly hours worked was 51 percent. The increase in work injuries was slightly above 50 percent per 100 employees.

(These high rates were due partly to management's insistence that every injury be treated, no matter how slight, in order to prevent infection.)

5. Another probable result of the long work schedule was a sharply increased rate of voluntary quits. During the 5-month period studied under the shorter work schedule, 3.5 workers voluntarily left the company for every 100 workers on the pay roll. Under the longer hours, the average rate of quits during the 7-month period studied was 7.1—slightly more than twice as high.

It is impossible to indicate 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 are reflected in the sharp increase in the quit rate.

Case Study No. 12—Finishing Department in a Foundry

SUMMARY

The operations studied were those usually found in the finishing department of foundries—chipping, grinding, welding, and cleaning of castings. All the work was man-paced, and ranged from medium heavy to heavy, depending on the size of the castings. Voluntary rest periods consumed from 30 to 45 minutes per day.

During 1942, the department had a work schedule of 6 days at 8 hours. During 1943, hours were increased to 9 per day and about 55 per week. There was no wage incentive.

The survey revealed that the efficiency of the men was as good under the longer hours as it had been under the shorter schedule. This parallels a similar finding when weekly workdays were reduced from 6 to 5, with daily hours remaining at 10.[1]

Absenteeism increased by about one-third. Because of this increase, the output level did not increase in direct proportion to the increase in hours. For each 3 hours added, only 2 hours of output were achieved.

NATURE OF WORK

This study covers the finishing department of a small steel casting foundry. The operations studied are identical with those of the usual

[1] See Case Study No. 1—Nonferrous-Metal Foundry, in Bulletin No. 791, p. 5.

small foundries. They embrace the operations of cleaning, grinding, chipping, and welding of castings delivered to this department after having been poured in the molding department. Nearly all of the production is directly related to the war effort, the castings being for parts of landing barges, tanks, and similar war materials.

Risers on the castings are cut off with acetylene torches. The castings are then sandblasted and moved to the grinders. Small pieces which can be manipulated easily by hand are processed on stationary stand grinders. Large pieces are placed on work tables, are securely fastened, and are then processed by the use of swing grinders. These grinders are mounted on cranes, are well balanced, and are easily moved. After the grinding, the castings are taken to the chippers for rough chipping. Cracks in other than vital areas are welded; then the castings are sent to the annealing furnace, and after being annealed they are again sandblasted, chipped, and ground.

All of these processes are entirely man-paced. The work ranges from medium heavy to heavy, depending on the size and weight of the castings (which vary between twenty and several hundred pounds in weight), and affords very little time for rest during machine operations. The operators take time out occasionally. These voluntary rest periods total from 30 to 45 minutes per day.

Observation indicated that the operators in this department worked consistently and efficiently. (The molding department was excluded from the survey because of evidence of deliberate pacing during the shorter workweek.)

WORKING CONDITIONS

The plant is comparatively new and has been enlarged several times during the last few years. Consequently, the plant lay-out and facilities are, in some respects, better than those found in the average foundry.

Foundry work usually is dirty, heavy, and sometimes hot. This foundry followed the usual pattern. Illumination was adequate, generally, and very good in some sections of the department. There was considerable noise due to the chipping, grinding, and blasting operations. Sand on the floor absorbed some of the noise.

Powerful fans in the roof exhaust smoke and fumes during the summer and usually keep the average temperature from going above 90 degrees. During the cold winter months, however, the ventilating problem is complicated, because only a small amount of cold outside air can be admitted without causing a faint haze to collect throughout the plant (but considerably above the heads of the workers).

While there is evidence of some congestion owing to the piling of waste materials, aisles generally were clear of obstructions.

Hand or power cranes are provided for the lifting of heavy castings. The men usually limit manual lifting to about 75 pounds.

Locker rooms and showers are large, neat, and clean. There is no lunchroom, and no coffee stand. Most employees bring their own lunches or eat at nearby lunch rooms during the half-hour lunch period.

LABOR FORCE

The force for the entire plant numbered about 160 at the time of the survey (early summer of 1944). The force of the department studied varied from an average of 80 during 1942 to 65 during 1943.

The personnel in the finishing department, as in the plant generally, consisted largely of men from Balkan countries, or first-generation Americans of Balkan descent. About a third of the men were colored. Of the total group, about half had been with the company for several years. Most of the remainder were new to industry.

The armed forces have drawn away about 150 men since the outbreak of the war, thus creating a severe turnover problem. It has been difficult to attract new help because of the nature of the work, and because of the availability of light work at higher pay at a nearby plant producing planes. The decrease in the average work force is due largely to these factors, as is also the lengthening of hours.

WAGE RATES AND INCENTIVES

Wage rates, early in 1944, varied from 82½ cents per hour for grinders to $1.15 for welders. All work was done at straight hourly rates. There was no wage incentive of any kind.

There are two A. F. of L. unions in the plant, representing, respectively, the molders and coremakers, and the other foundry workers. Neither of the unions appears to have much strength in this plant.

The union contracts call for 3 days' vacation with 20 hours' pay after 6 months of service, and 1 week's vacation with 40 hours' pay after 1 year's service.

HOURS AND SHIFTS

During 1943 the finishing department worked 5 days at 9½ hours and on Saturday from 4 to 8 hours. Some individuals, however, worked 7 days per week on occasions, and at times 11 hours per day.

During 1942, the department averaged between 44 and 48 hours. The prevailing schedule called for 6 days at 8 hours, although frequently only a half day was worked on Saturday.

There was only one shift throughout the 2-year period studied. Work began at 6 a. m.

WORK INJURIES

First aid was administered by a member of the office staff who had been trained in giving such service. The first-aid room was equipped to render routine service. Injuries demanding more skilled attention were sent to a neighborhood physician, or, if necessary, to a hospital. A doctor was in the plant three afternoons each week. All new employees were given physical examinations.

Most of the injuries were minor cuts, abrasions, or contusions. Foreign particles in eyes and sprains constituted the next highest groups and indicate the desirability of the enforced wearing of goggles, and education in the proper methods of lifting.

Protective clothing and protective devices, such as goggles, gloves, leggings, and aprons, were furnished by the company for occupations which required them. Safety shoes were worn by only about 10 percent of the workers. Because of the manpower shortage, management was reluctant to enforce the use of protective clothing and devices—the men generally seemed apathetic to the safety measures available.

With a view to lessening the turnover of new employees, applicants for jobs were taken through the plant to see the advantages and dis-

advantages of the work. Upon being hired, employees were instructed in the basic safety regulations; there were no other organized accident-prevention activities.

SCOPE OF THE SURVEY

The survey covered the years 1942 and 1943. The months of June, July, and August—during which scheduled hours were somewhat erratic because of summer heat—were excluded in each of the two years. The comparisons are between the shorter hours during 1942 and the longer hours during 1943. In 1942 the average weekly hours were slightly less than 48 (47.6) and in 1943, nearly 55 (54.7).

Production records were available only in terms of pounds of castings produced, and only for the entire department. As the types of castings produced remained essentially the same during the two years, the use of weight as a criterion of efficiency and total output seemed adequate.

In the absence of production data for individual workers, the department was studied as a whole. In view of the turnover during the period, especially among new employees who disliked the work or left for better-paying jobs, the comparison between the two periods tends to overstate the efficiency of the longer work schedule because of the heavier proportion of experienced workers during the year in which this schedule was worked. During the shorter schedule the average work force averaged 80 men. This number had shrunk to 65 during the year with the longer daily and weekly hours.

FINDINGS

1. Efficiency (i. e., average pounds of castings produced per productive employee-hour worked) remained essentially unchanged during the longer hours, as compared with the shorter hours during the preceding year. It actually increased slightly, by 0.2 percent.

Apparently the operators were able to maintain the same pace under the 8- and 9½-hour days. The finding that the efficiency of men on day work and without any wage incentive remained about the same at levels of long and short hours, parallels a similar finding in an earlier study,[1] also in a foundry, in which scheduled hours had been decreased from 60 to 50 by retaining a 10-hour day but eliminating Saturday work.

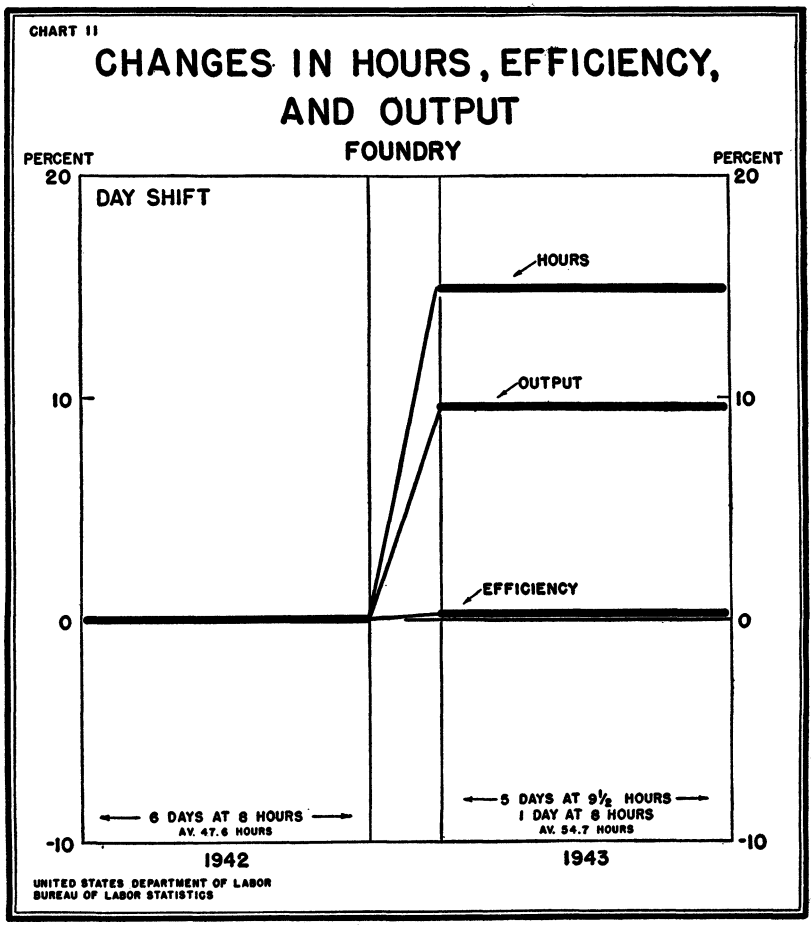
In the light of other findings for men working under wage incentives, the conclusion appears warranted that, in this department at least, men on day work—and apparently operating at a slower tempo than if on piece work or under other wage incentive—can perform as effectively under a 9½-hour day and 55½-hour week as they can under an 8-hour day and 48-hour week. In other words, the pace under 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 appreciably had the longer hours been in force under peacetime conditions. A high morale was clearly evident in the spring of 1944, when this survey was made.

[1] See Case Study No. 1—Nonferrous-Metal Foundry, in Bulletin No. 791, p. 5.

2. Scheduled workdays lost because of absenteeism from work increased from 6.6 percent to 8.9 percent, or by about one-third.

3. Because of the increase in absenteeism, the average output per man per week increased only two-thirds as much as did average hours worked per week. Against an increase of weekly hours of 14.9 per-



cent, output increased by 9.5 percent. For every 3 hours of additional worktime, output increased by the equivalent of 2 hours' production under the shorter work schedule.

Even though efficiency remained as high, the average effectiveness of each productive hour under the longer work schedule was only about 95 percent as high as it had been under the shorter workweek.

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