PROGRESS REPORT NO. 1
December 3, 1927

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DON'T DISCLOSE IDENTITIES

From [illegible] of the [illegible] under study have [illegible] confide[illegible] [illegible] on this trust. Please guard the privacy of the persons involved by substituting fictitious names, or code symbols for real names.

PROGRESS REPORT

ON TEST TO DETERMINE THE EFFECT OF REST PERIODS AND HOURS OF WORK

RELAY ASSEMBLY OPERATION

UP TO AND INCLUDING DECEMBER 3, 1927

EXPLANATION:

This report has been compiled of data which represent the first steps of the study, and will be supplemented as occasions warrant.

The intention has been to place in the first five sections only that material which is of a descriptive nature, and which it will not be necessary to change.

The section comprising the questionnaire mentioned in Section No. 5, Page No. 3 is not included in this report, but will be, when a more complete selection has been made of the available material.

As the study progresses, those sections which are composed of material of a changeable nature, such as, Sections Nos. 6, 7, and 8, will be revised and brought down to date, until the conclusion of the study has been reached and a final report can be issued.

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TEST TO DETERMINE THE EFFECT OF REST PERIODS AND HOURS OF WORK

SECTION NO. 1

OBJECT OF THE TEST

PURPOSE

The object of the test to be described in this paper is to determine what effect rest periods and various hours of work will have in increasing the efficiency of an operator.

Studies made in the past regarding methods to improve working conditions, the establishment of piece rates and reduction in the cost of manufacture, have shown large variations in outputs over different periods of the day.

Tests are being conducted to determine an answer to such questions as the following:

1. Why does output drop in the afternoon?
2. Do operators actually get tired out?
3. Desirability of establishing rest periods.
4. Changes in equipment.
5. What is the attitude of the operators?
6. Effects of a shorter working day on output.

PROCEDURE

In order to investigate these conditions, it is proposed to select and segregate certain groups of operators to study. The initial group is composed of girls working on relay assembly. They have been placed in a separate room and are indirectly supervised by one of their number who is considered an "expert" and whose capacity is that of "layout operator."

Each phase of the study has been taken up in separate sections in the following pages:

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SECTION NO. 2

BEGINNING OF TEST AND ESTABLISHMENT OF TEST ROOM

A. Location of Test Room and reasons for selection.
B. Equipment of Test Room and design of equipment.
C. Test conditions differ from regular work conditions.

The test began on April 25, 1927. The relay assembly job was selected as the one on which the initial study would be conducted, as it represents a high degree of repetitive work. Five operators experienced on this work were chosen, together with a sixth to act as a layout operator. This group was permitted to remain in the regular department from the beginning of the test April 25, 1927 and until May 10, 1927, at which time the test room was equipped and in readiness.

A. Location of Test Room and Reasons for Selection

The test room is located in the southeast corner of Building 47-5, and is formed by inclosing two sides with temporary board partitions. In selecting this location it was felt that better ventilation could be had since the room was equipped with fans, and because it would not be exposed to the afternoon sun during the summer months. The lighting effect in the test room is approximately equivalent to the light in the Relay Assembly Department, except that the distribution is more uniform. This is made possible by the use of lighting fixtures remaining in this room that were used in a former Illumination Study.

The location was also chosen as it afforded a better opportunity for segregation where the operators would not come in constant and direct contact with the main group, thereby reducing the possibilities of the test group keeping familiar with the activity of the main group, thus reducing the tendency of similarity of performance.

B. Equipment of Test Room and Design of Equipment

A regular assembly bench of sufficient length to accommodate five positions and space for the layout operator was installed. Each of the five assembly positions was connected to a recording device so that each time an operator finishes an assembly (or completes a cycle), it is automatically registered by an electrical recorder perforating a hole in a moving tape. (The perforating mechanism is selective and

each operator's respective position is therefore positive, as they occupy the same bench position at all times.) out

In addition to the assembly bench there are three other small benches upon two of which the recording apparatus is mounted, and the third serves as a stock bench for piece parts. A table, file cabinet, and drafting table comprise the rest of the equipment (with the exception of the recording devices which are described in the following paragraphs.) out

A comprehensive view of the test room is shown in Photographs (No. 149586 and No. 149587, forming a part of this chapter.) out

A hole which operates the recording device is cut in the bench to the right of each operator's position, sufficiently large to accommodate the passage of a relay. When the relay is dropped through this hole, it passes into a chute mounted at a 45° angle to the bench, passing by and operating a "flapper" gate or switch and on out into the receptacle. (The gate is attached to an axis which extends through the side of the chute. A cam is attached to that portion of the axis extending beyond the chute and this cam when operated engages contact springs thereby closing a circuit and operating the recording perforator which punches a hole in the tape traveling across the mechanism.) revise out

The perforating recorder proper consists of a perforator for the printing telegraph, modified to meet the conditions of the test, in that the circuit from each operator's position is connected to a respective coil in the perforator which operates the recording punch associated with that position. A view of this apparatus is shown in Photograph No. 149583.

The travel of the tape through the perforating recorder is accomplished by connecting a 110-V A.C. motor of a 1/6 H.P. rating, through proper gears to friction rollers through which the tape passes. These friction rolls pull the tape through the recording device at a definite speed of 1/4" per minute.

In the circuit of the perforating machine a set of five message registers has been included. These registers correspond to the five rows of perforations in the tape, and are therefore selective for each assembly position. Each register functions when the corresponding coil in the perforating device is actuated, and therefore, provides accumulative totals of relays assembled at the particular assembly position to which the register is connected. The advantage of these registers is that a ready means is provided whereby a direct reading of each operator's output may be had for any period.

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An automatic temperature and humidity recorder was used for a period to keep a graphic record of atmospheric conditions; however, operating difficulties minimized the advantages to such an extent that this machine was abandoned in favor of the Hygrodeik from which hourly temperature and humidity readings are made.

C. Test Conditions Differ from Regular Work Conditions

The equipment for the assembly of the relays is practically the same as in the regular shop. The greatest variance is that the holes have been provided for each operator to deposit the finished work into, instead of having to replace it in the compartment boxes from where the coils have been taken.

The conditions surrounding the test are the principal differences. These are the segregation features; more uniform distribution of day light, as the day light value is much higher since the building in which the test is being conducted is equipped with full sectional width sky lights. Besides these, there is the absence of customary supervision, less interruption due to changing of jobs, visiting, etc. In addition to the material and physical differences, there are the mental or psychological, which obviously would surround a group of people selected for such a test.

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FRONT VIEW OF TEST ROOM

NO. 149586

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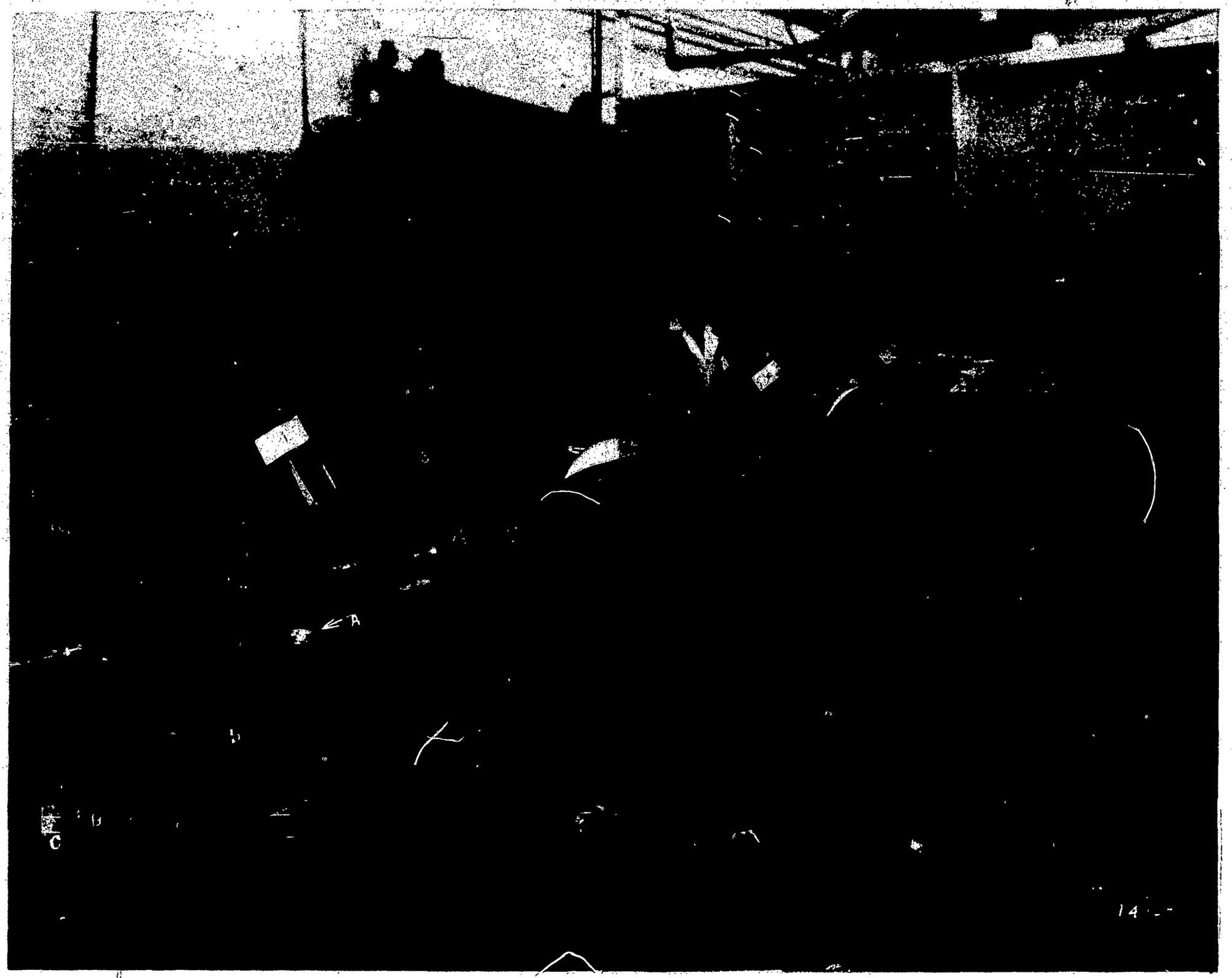

REAR VIEW OF TEST ROOM

NO. 149587

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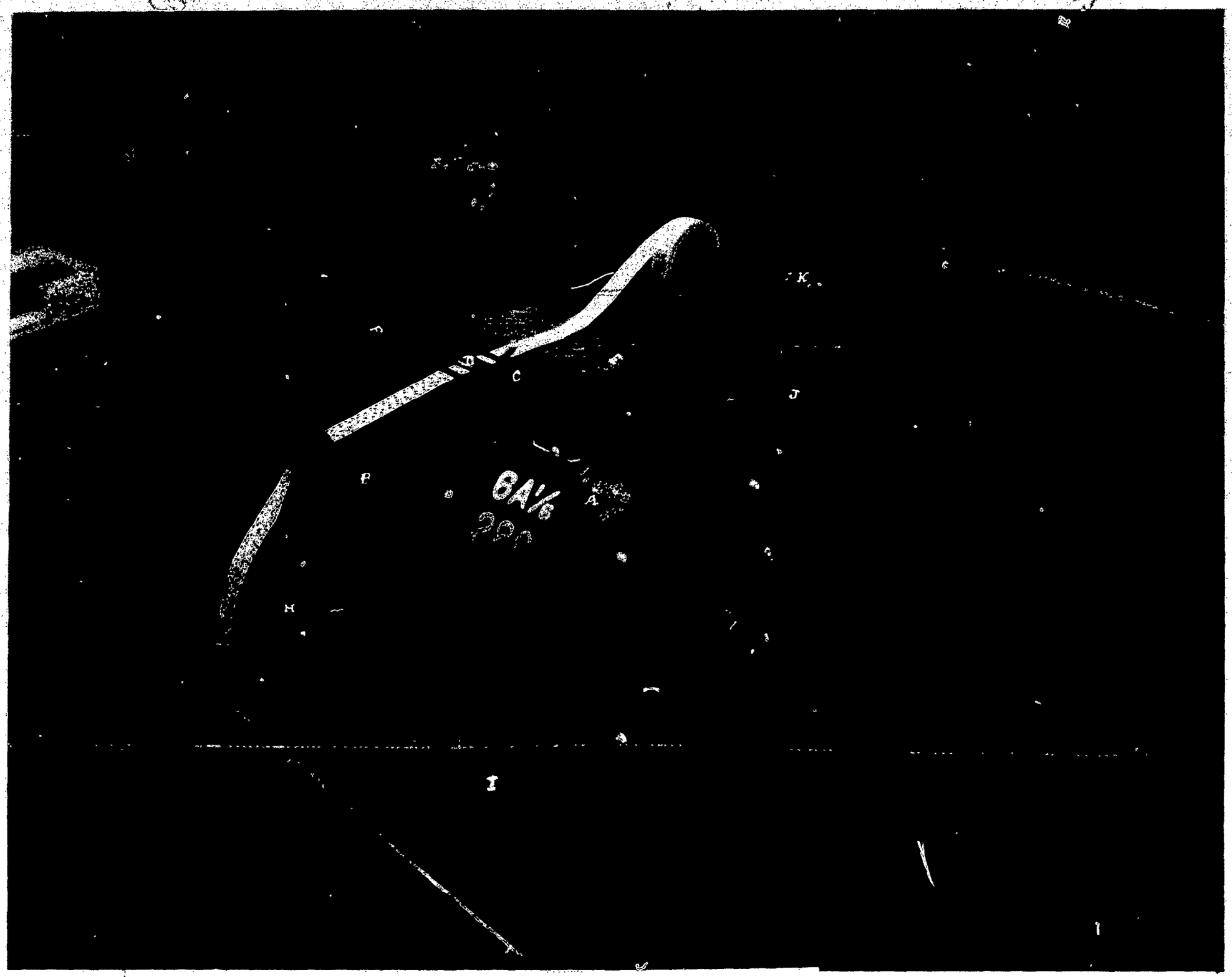

TAPE PERFORATING MACHINE

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SECTION NO. 3

METHOD OF RECORDING OUTPUT DATA

A. Reading of message register record and perforated tape.
B. Records taken for average hourly outputs.
C. Pertinent records.
D. Uniformity of performance.

Considerable attention has been given the recording of output, since with adequate and correct records any short periods may be selected for separate study as well as the longer periods.

A. Reading of Message Register Record and Perforated Tape

During the course of the study, readings of the message registers have been taken at half hour intervals. The figures are entered upon a form and when not immediately used in plotting curves, have been filed for future reference.

The perforated tape is being used in obtaining the exact output during the fifteen minute intervals and this is done by counting the number of perforations. Before the tape or perforations are counted, it is necessary to make an exact division of each fifteen minute interval. Since, as previously mentioned, the speed of the tape through the perforating machine is 1/4" a minute, it is obvious that a distance of 3-3/4" represents a fifteen minute interval. The tape is then divided into intervals of 3-3/4", and the number of perforations in these intervals is counted. This number is an accurate record of the total relays assembled during that period. There is a slight variation in the length of the tape from day to day. This variation, however, is compensated for when the tape is divided into intervals.

In counting the number of perforations in each fifteen minute section, care is used in determining how close the first or last perforation comes to the sectional markings. In this way it is possible to divide the fractional portions of partially completed cycles, and record the nearer correct number in each interval.

The outputs thus obtained are converted to a common basis. This is necessary as the schedules of the various type assembled are not sufficient to permit continuous performance on any one type, and the operators at times are forced during one day's run to work on more than one type. This sometimes causes a fluctuation in the output as some

types require a different length of time to assemble than others.

Daily curves may be plotted on the basis of these outputs over fifteen minute intervals for each operator. The curves give a picture of the variation in rate of production at any hour of the day and from them it is possible to select the periods of lessened or increased activity on a very definite basis, and to determine at what periods rest pauses should be introduced in order to be most effective. The curves also bring out any improvement in regularity of performance from day to day as various experiments, such as rest pauses, are tried out.

B. Records Taken for Average Hourly Outputs

Records of the total daily output of each operator and the corresponding total operating time are kept. The outputs are converted to a common basis and an average hourly output for the day is determined.

Continuous curves are plotted from this data for each operator and a combined curve showing the average performance of the whole group is maintained. These curves show the progress, insofar as average production is concerned, of the individuals and of the group over the periods of the experiments and it also presents a ready means of comparing the performance of one period against another.

C. Pertinent Records

Other records pertinent to the test and of value as an aid in interpreting results and psychological effects are maintained as follows:

C-1. The temperature and relative humidity which is recorded each hour and then averaged, is plotted on the daily average hourly output curve.

C-2. A complete report of the daily happenings (History Sheets) of the test is made and this records what changes are made; what transpires during the day; operators' remarks; our own observations and anything that will assist as an explanation when rationalizing the performance curve.

C-3. A "Log Sheet" is maintained on each operator upon which the starting time is entered and the finishing time as well, also the time at which changes from one type to another are made and all intervals, or non-productive time, such as, personal time out, changes in

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type, repairs, and anything detracting from the actual production time.

C-4. An original hospital report, or record of physical examination is kept. This has been supplemented each time the group is re-examined which occurs in periods of one month to six weeks. In this record an attempt has been made to classify each operator, giving her a definite place in the list as concerns her physical fitness, reactionary tendencies, etc.

C-5. An attempt was made to discover the home and social environs under which each girl lives. A set of questions was prepared and answers were obtained to as many of these as possible. These questions and answers are being kept as a matter of record. This record together with the one outlined in paragraph (C-4) are used in determining to what extent the more personal elements influence the individual's activity.

D. Uniformity of Performance

In order to determine the effects on uniformity of performance resulting from the various features tried out, a system of obtaining and recording this data has been worked out as follows:

When the tape has been divided into the fifteen minute intervals, and these intervals counted and recorded, they are changed or corrected to be comparable to the type of relay which had the longest run on the particular day being considered. By doing this, the intervals all become consistent in their relation to each other. The average output on the basis of fifteen minute intervals is then obtained. This is arbitrarily taken to represent ideal performance, and which obviously would have produced the same total output provided it were actual.

Since it is hardly to be expected that ideal performance can be maintained where the rate of output depends approximately one hundred per cent on the individual's efforts, it was decided to consider a variation of plus or minus one relay from the theoretical average as being representative of ideal performance. This was done and upon the plotted curves a line representative of the average was drawn. Two other lines were then drawn, one above the average line to represent the plus one relay allowance, and one below to represent the minus one relay allowance. This arrangement produces a band or field of relatively ideal performance and any points of the curve falling outside of this arbitrarily established field are counted, and an index of the total variation for any operator for any day or division of a day is thus obtained.

A further advantage is gained by this method in that it permits of the extent of the variation to be shown singly, i.e. the total

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variation on the plus side of the band or the total variation on the minus side of the band may be seen as well as the grand total for the day.

The figures representative of this variation are tabulated for each operator daily, and are then totaled at the conclusion of a specific feature. The average variation for any particular feature is then obtained from which the value of the feature in terms of uniformity of performance may readily be seen. By this system fluctuations as small as one-tenth of one relay are included in the total, which directly represent the increased or decreased amount of fluctuation in the rate of working.

As an expedient, however, the uniformity of performance curves are plotted direct from the data and the actual plotting of the fifteen minute interval curves is done only when it is desired to know the trend of the daily production.

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SECTION NO. 4

METHOD OF PAYMENT

Under regular operating conditions the work which was selected for the test is done by one large gang, the individual members of which share proportionately in the earnings of the gang as a whole. The operators selected for the test were members of this large gang. Under this system individual effort is not always actually recognized or rewarded to the fullest extent. Also no definite figures on individual outputs are kept.

For the purpose of the test it was necessary that it be known what each of the assembly operators selected was capable of doing in the way of daily outputs, and it was also desirable that some method of payment should be introduced which would pay them in direct proportion to their efforts while on test. It was felt that, unless the latter were done, the operators would not respond with the fullest cooperation that would be essential to a test of this nature.

Also, it was necessary that the operators should feel assured that they would not suffer financially in any way as a result of their participation in the test. They were told, then, that a method of payment would be introduced after the test was well under way, which would assure them earnings equal to what they had been getting in the past, with the possibility that these earnings would actually be increased should their outputs obtained in the test room increase over those obtained in the regular gang.

For two weeks previous to the start of the test, accurate records were kept of the individual outputs of the operators while working under the normal conditions of operation in the regular department. These records gave a picture for use as a basis of comparison with later results and also made it possible to establish piece rates for use in the test room.

The average earnings of the operators used in the test were computed by totaling the hourly piece work earnings for March, April, and May, 1927, from their respective attendance records. During this period the operators averaged $.553 per hour or 64.66% earnings over their average hourly day rate. These average hourly earnings were increased 23.8% as an allowance to cover the rate of the layout operator who participates in the earnings but who has no direct output. This allowance brought the average hourly rate which must be earned by each assembly operator up to $.686. Thus, piece rates figured to return earnings of $.686 per hour on the basis of average outputs would permit all of the operators in the gang to make earnings of 64.66% over their hourly day rate.

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The total outputs of each type of relay assembled during the two weeks previous to the start of the test were reduced to an average hourly basis which, when divided into $.686, gave a piece rate to be used for that particular type in the test room.

It should be mentioned here that the types assembled just previous to the start of the test were the ones selected to be run in the test room so far as possible.

The rates figured as above were checked by applying them against the outputs obtained for the two weeks previous to the test, and the results showed that the earnings returned would have been on the basis desired. This was done to prove the adequacy of the proposed rates before putting them into effect.

After the start of the test, the operators worked for five weeks in the test room under exactly the same conditions as those in effect in the regular gang. They used the same piece rates as were in effect and shared in the earnings of the whole group as formerly. This was done to enable them to become thoroughly familiar with the new conditions and surroundings before introducing any changes whatever.

At the end of the five week period, the new piece rates were introduced and the test room group was separated into a special gang to be paid on the basis of earnings obtained from the piece rates effective for the test room work only. This was done in order that the entire earnings resulting from their efforts would be returned directly to them and not distributed over a large number of people. By these means, we were able to easily convince the operators that any gains in output would be returned entirely to them and we were thus reasonably assured of their full cooperation.

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SECTION NO. 5

PHYSICAL EXAMINATIONS

A. Introduction
B. Physical condition of operators at beginning of test.
C. Home and social environs

A. Introduction

It is universally considered that, when an individual's physical condition is impaired, that person is unfit to render satisfactory or efficient service.

The operators selected were, therefore, given a physical examination at the beginning of the test and re-examined at intervals of about six weeks to detect the presence of any condition of a detrimental nature that might develop.

The home conditions under which a person lives, and their social environs, contribute to such an extent to the individual's efficiency, that attempts were made to discover these conditions insofar as possible, and to apply the knowledge thus gained when analyzing the daily performance curves of the test operators.

B. Physical Condition of Operators at Beginning and at Last Examination

The physical rating given the girls before starting the test was of a certain value and was intended to establish their fitness to participate in the test. It is also used as a gauge or standard when making the re-examinations to determine what physical advantages or disadvantages, if any, the test is having on the operators.

The original examination for the test was made during the early part of May, 1927. The first re-examination was made on May 24, 1927, and it was found that the general condition of the girls was improved and in two or three cases, those of Operator Nos. 1, 2 and 6, a noteworthy improvement was found and the girls had gained weight as well. This improvement in the general health and gain in weight is felt to be due to the psychological effects which produce a more contented state of mind and which in turn is fostered by the novelty aspect, the realization of their having been chosen; the experiencing of something new; the anticipation of impending and continued changes, etc., all of which tend as a whole, to assist in accomplishing the thing we are endeavoring to accomplish, and that is, to determine the essential features required to overcome monotony and the establishing of the relationship existing between

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monotony and efficient performance.

Aside from the necessary information which was needed in connection with the study, the operators were given the added advantage of having this medical advice without cost to themselves. The examinations were presented to the girls as something they were fortunate in being able to get, as so complete and frequent an examination would cost them a considerable amount of money and time.

The reactions from the first examination were not altogether favorable, as each girl had an independent reason and complained of not wanting to go through with it again. Some of the objections raised were: "I hope it doesn't occur too often," and "That's all the bunk, those doctors don't understand you." These and similar expressions made it evident that a feeling existed which was antagonistic and which would react unfavorably in the test.

To afford an opportunity for analyzing and to overcome this feeling, it was decided that, when the girls were finished with their next examination, they would be assembled in Mr. Hallett's office, so that expressions of opinions could be had of the proceeding. This would also tend to create a more friendly and cooperative spirit between the hospital people and the girls. At this gathering there were present, besides the operators, Messrs. Hallett and Kraft, the examining doctor, and an observer of the study group. During the meeting or "get together" one of the operators called it a "party," and made remarks about serving ice cream. One girl said she would "bake a cake" and Mr. Hallett suggested that he (Mr. Hallett) serve "tea."

It was decided to continue these meetings and incorporate the idea of refreshments. Arrangements were made to serve the ice cream at the subsequent examination. When the next examination was held, one of the operators baked a cake which, together with the ice cream, gave the "party" effect. This served to break down the opposition which had existed and a pronounced increase in cooperation was evident.

The extent to which a more favorable reaction was created by the "party" is evidenced in the offer of a second operator to "bake a cake or make cookies" for the next party. This offer came from a girl who had previously raise the loudest objections to the examination and was therefore, of particular significance.

The original intention was to have the examinations every three weeks. This was seen to be too frequent and the interval between examinations has been from five to six weeks. Whenever conditions at

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the hospital and in the test room permit, the examinations are to be made each six weeks.

C. Home and Social Environs

In attempting to gain an insight into the home and social environs, we were animated by the belief that the influence exerted by these was of importance also. The method used in obtaining this information was condensed into a list of thirteen questions, these questions covering as much of the field as possible.

This list of questions follows and it will be seen that the intention was to include those questions which could be used to assist in determining the extent of the psychological and mental pressure surrounding the operator outside of working hours, also the fatigue producing activities.

No. 1 - What responsibility rests on each girl at home?
2 - Does she contribute her entire earnings to the family budget?
3 - If not, approximately how much does she have for herself?
4 - Any domestic scruples at home, which might react unfavorably?
5 - What routine duties around the house are theirs?
6 - If any, on which days do they perform them? (Anything of a strenuous nature, sweeping, washing, scrubbing, etc.)
7 - How is time usually occupied between supper and bed time?
8 - Have they their own room or do they sleep in a room with someone else?
9 - Is their bedroom removed from any distracting street noises which might effect the sub-conscious?
10 - Have they gained or lost weight since being on test?
11 - What are they most interested in doing outside of work?
12 - Are their parents exacting in discipline?
13 - If given three wishes what would they be?

The completed questionnaire will be found in a separate section and forms part of the report of records mentioned in Section No. 3, Paragraph C-5.

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SECTION NO. 6

REST PAUSES

A. Introduction
B. Five Minute Rest Pauses
C. Ten Minute Rest Pauses
D. Three-five minute Rest Pauses
E. Combination Lunch and Rest Pauses
F. Combination Lunch, Rest and 4:30 Stop.

A. Introduction

It is a commonly accepted opinion that long spells of repetitive work tend to produce monotony, which is accompanied by mental fatigue and to a somewhat lesser degree, physical fatigue as well.

Studies which have been made of monotony in repetitive work have usually succeeded in reducing this element by the introduction of rest pauses.

Obviously, no better relief measures are necessary since rest pauses of the correct duration and when interposed at the proper time, have a threefold advantage offering as they do a "novelty" feature; reduction in the length of the work period, and permitting a partial recuperation of expended energy. Because of this, it was decided to introduce rest pauses as the first and principal factor when making this study.

Between the beginning of the study on April 26th, and the first rest period on August 8, 1927, a lapse of fifteen weeks occurred. This time was divided into two periods, one of which was used in permitting the operators to become familiar with their environs, and the other in working with the new special gang rates as covered in Section No. 4. These are the rates computed for the test and are the ones to be used during the remainder of the time. These two intervals are considered as secondary to the prime factors of the study (no rest periods vs. rest periods), but are being considered in relation to the combined features tried thus far as a matter of comparison.

When establishing the rest pauses it was necessary to consider the time at which they were to be interposed, as well as the duration. To do this, curves of the daily production for ten days were plotted. These curves were plotted from production data taken throughout a ten day period previous to the beginning of the rest periods and were on the basis of 15 minute intervals. The high and low periods

of the day were shown, and from these, the time at which the rest pauses would apparently be the most effective, were selected.

The opinions of the operators were also considered as to when they would rather have the "rest" and from this combined information, ten o'clock in the A.M. and two o'clock in the P.M. were fixed as the proper points. These fixed points for rest were used when the five and ten minute periods were being tried, but were not used during the third rest feature (three-five minute periods) as will be described under that title.

The length of the pauses was arbitrarily set at five minutes for the first experiment and ten minutes for the second, which represents 2% and 4% respectively of the total operating time. The principal factor in the rest pauses of course, is to determine the maximum length of time to be so consumed which in turn will be determined, by the most efficient performance as reflected in the production data, "Efficiency" here applying to uniformity of performance as well as increased activity. To do this it was decided to begin with the minimum length of time and then increase, rather than start with a longer pause, which it was felt might present a mental handicap to the operators.

B. <u>Five Minute Rest Pauses</u>

The five minute rests were begun on August 8th, and continued until September 10, 1927, a period of five weeks.

The advances made during this time may best be seen by a comparison of each operator's output prior to the rest pauses. The figures representing the gains are being shown in Table No. 1, Section No. 7.

During the different rest pause plans which have been tried, the operators have always been permitted to leave the room, and in fact encouraged to do so. It was felt that a more marked break in the monotony would be realized by this practice and the girls have always appeared eager to take advantage of the pause. During the last few days of the five minute pauses, more of the period was actually being spent outside of the test room than during the first days of this feature.

As the operators became more accustomed to the pause, they began to express a desire for longer periods since they had proven to their own satisfaction that their earnings were not falling off even when the "personal time off" was added to the compulsory pause. Expressions were made by them, such as, "You don't feel so tired when you get home." "It's better now with the rests, you feel fine when you start in again." During one of the pauses Operator No. 4 said, "Make it ten minutes this time."

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When the time for extending the pauses was near, the operators were all questioned concerning their feeling about a ten minute pause. The answers to this follow:

Operator No. 1 - "I would like ten minutes."
" No. 2 - "I would like ten minutes too."
" No. 3 - "Oh! Ten or fifteen minutes is all right."
" No. 4 - "Say! Fifteen minutes would be swell."
" No. 5 - On vacation when others were interrogated.

Other advantages are gained by the "rests" as the operators claim it gives them a chance to "wake up" following late hours the previous night, or a too heavy meal at noon time.

C. Ten Minute Rest Pauses

The increase from the five minute to the ten minute rest pause was made after a five weeks' trial of the former.

The increase in efficiency during the first experiment, was a favorable indication that rests would not be detrimental to the operators so far as their earnings were concerned, but, quite to the contrary, would be beneficial. This was pointed out to them during a meeting which preceded the change from the five to the ten minute rest.

They were told that the additional time being used in "rests" would not affect their earnings so long as they were able to compensate without any noticeable increase in effort. They were told also that it was the plan to try a rest of fifteen minutes and were requested to express their opinions in this respect; the consensus being that the ten minute would be the better to try, as it had been explained to them that by going from the five to the fifteen minute rests might constitute too great a handicap and that their earnings would therefore be jeopardized. The ten minute rests were, therefore, decided upon with no change in the starting time for that of the five minutes.

This experiment was started on September 12th, and continued until October 8, 1927 inclusive, a period of four weeks. Of the two experiments tried out, up to this time, the ten minute rests were the better liked and the operators expressed themselves accordingly.

A record of the expressions and opinions of the operators has been kept during the entire study and these are to be found in a separate section "Comments of Operators." At this point, however, a few of the more outstanding comments concerning the ten minute rest pause will no doubt be of value.

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On the first day of the ten minute rest pauses, the operators' increased efficiency returned them an earning of 80.6%, which was the highest since the test had been running. When notified of these increased earnings the girls remarked:

Operator No. 1: "80.6 per cent! No?"
"Hurrah for our side, and on Monday too, isn't that nice?"

Operator No. 2: "Gee, we made 80% yesterday, today we ought to make 90%."
"We all feel better now with the ten minute rest periods."

They were all in favor of the ten minute rest, and when asked if it would not be hard to occupy the increased time when fifteen minutes was tried, expressions such as; "It passes fast, it isn't too long" and "I don't think fifteen minutes would be too long," were obtained. However, these expressions were in connection with a single rest pause of fifteen minutes which we contemplate trying as a separate feature some time in the future.

The advance or gains made in efficiency during the ten minute rests may be seen by referring to Table No. 1, Section No. 7, Increase in Average Hourly Output.

D. Three-Five Minute Rests

The three-five minute rests were begun on October 10, 1927, and continued until November 5, 1927, a period of four weeks. Before beginning this rest period, the operators were assembled for a conference in order to gain their views of previous experiments and opinions of the succeeding.

The opinions expressed by them when the relative merits of a fifteen minute rest vs. a three-five minute rest were discussed, were that the fifteen minute rest would be best, and that the three-five minute rests would be too short and would cause too much "breaking up" of the work. It was decided, however, to introduce the three-five minute rest pauses at this time, inasmuch as the next experiment to be tried (the lunch period) would necessarily require a fifteen minute pause to be adequate. In the three-five minute rest pauses the uniformity of performance showed improvement and only a slight decrease resulted in the average hourly output when compared to the ten minute rest, although the operators' reactions and impressions were unfavorable to this experiment.

Assuming that the results of the test group may be taken as an indication of the reaction of an entire department's personnel, the

three-five minute rest period may be considered highly effective. This conclusion is reached when it is seen that the least favorably accepted rest pause resulted in a uniformity of performance, which is third in the list in order of "Efficiency" as shown in Table No. 2-B, Section No. 7. Besides this there was only a 1.6 per cent decrease in the average hourly output when compared to the better liked rest pause of ten minutes as shown in Table No. 1, Section No. 7.

Table No. 2 in Section No. 7, shows the A.M. and P.M. daily average variation of uniformity, as well as the total average daily variation for each operator by the successive steps, in wh'ch the different rest periods or features were tried.

Emphasis is being placed on this comparison, since the five minute period being the first one tried, had more of a "novelty" aspect to the operators than had the one under discussion, and very good results were obtained notwithstanding the adverse opinions of the operators themselves.

E. Combination Lunch and Rest Period

The combination lunch and rest period was begun on November 7, 1927. At the time of changing to this feature the operators were again assembled for a short meeting, where an attempt was made to establish a time and a menu that would be acceptable to the group. The period from 9:30 to 9:45 was decided upon, as it came nearer being the half way point between the time of breakfast and the noon lunch. The afternoon rest pause was set at 2:30 to 2:40 making a total of 25 minutes rest each day.

The mid-morning lunch feature was introduced with the idea of eliminating the early afternoon slump which the production curves indicated was common to all operators. This slump is attributed to a feeling of drowsiness or a dullness of faculties occurring about 2:00 P.M. each day, and this condition in turn is attributed to the heavy lunches indulged in by each operator at noon.

A check made of outside circumstances revealed that the operators, without exception, had very light breakfasts, usually taken at an early hour, and not sufficient to break the fast from the evening meal of one day to the noon lunch of the following day. The result was that they required heavy lunches to compensate. It was felt that a lunch introduced during the morning would have the effect of lightening the lunches eaten at noon, and this would tend to eliminate or at least reduce the drowsy feeling at two o'clock and at the same time, afford the needed stimulant to overcome the mid-morning slump.

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A record was made of the lunches eaten for a short period some time before the beginning of the morning lunch experiment. This record covered the week ending August 13, 1927, a hot month, when in general, the intake of food is less than during the winter months.

The Medical Department was consulted as to what foods and combinations would be most beneficial to serve as lunches and they recommended a variety from which the daily lunch menus are arranged.

The lunches eaten by the operators at noon previous to the introduction of the lunch experiment, as well as those eaten at noon after the morning lunch was instituted, are listed on following sheets of this section. The menus furnished for the first two weeks at the 9:30 lunch period are shown as examples. These lunches were supplied by the Works Restaurant and served to the operators at their bench positions. The service to the operators is efficient and thorough, and has a flattering effect. A good impression is thus produced.

The results of this phase of the study may be seen in Table Nos. 1 and 2-B of Section No. 7, and are representative of the data compiled over a period of eleven weeks which is the length of time this feature was permitted to run.

F. <u>Combination Lunch, Rest and 4:30 Stop</u>

On Monday January 23, 1928, a subsequent phase of the study was begun. This phase of the investigation was for the purpose of obtaining data covering what effects a shortened working day would have on output, and is the one being tried at the present writing. It is the same as the preceding phase or feature, except that work stops each day at 4:30 P.M. instead of 5:00 o'clock. This is the only difference in the arrangements of the two periods or features. At the beginning of this feature it was found necessary to replace Operators Nos. 1 and 2.

In accordance with past practice the operators were assembled at a meeting previous to changing the feature. At this meeting the expressions and opinions of the girls were obtained as heretofore.

In Section No. 9 of this report, the comments of operators are to be found. These comments are only those of completed features, but, as the one being described is incompleted, some of the more outstanding opinions and remarks are being given here.

When the girls were told that the half hour off would be in addition to their present twenty-five minutes rest, expressions as the following were made; "Oh, I didn't know we would still have the

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rest periods too." "Won't that be swell." "We're still going to have lunches, Gee! that's nice, etc." During the elapsed time of this feature to date, which is approximately four and one-half weeks, the girls have expressed themselves as extremely pleased, and when directly questioned concerning their reasons for favoring going home at 4:30, the majority of opinions centered around a feeling of favoritism being shown them, which permitted an escape from the crowded and congested traffic conditions encountered at regular stopping time. Other advantages were mentioned and were to the effect that the extra half hour afforded time to engage in things they liked to do such as; helping around the home in preparing supper and in going to the store for their mothers, etc., all of which each girl claimed she enjoyed doing.

The favorable acceptance by the entire group of the additional one-half hour is of particular significance. By this, it is meant that the operators, no doubt, have become conscious of a reserve efficiency, or ability, and for this reason feel confident of maintaining as high an earning as previously. Further credence may be attached to this analysis when it is remembered that, an objection was raised at the time it was planned to increase the rest periods from five minutes to fifteen minutes, at which time, the feeling was that the increase was too great and that it would be better to go from five minutes to ten minutes instead.

This point is being brought out here because it affords some light on two of our major questions as given among the original six questions shown in Section No. 1 of this report which are: "What is the Attitude of the Operators?" and No. 6 "Effects of a Shorter Working Day on Output."

The hesitancy to accept the fifteen minute rests may have been due to a practice of restricted output, or, it may have been due to an honest fear of lowered earnings. Irrespective of the dominating motives at that time, these influences are absent in the present period, as the girls are making up almost twice the time lost due to rest periods and to going home early.

The results of this period in terms of average hourly output are shown in Table No. 1, Section No. 7 where it will be seen that the gains are greater when compared to the period of "No Rests" than in any other period.

The total variation in uniformity of performance is less. This is an indication that it is necessary for the girls to concentrate on their work. This is done without a noticeable increase in effort or any appreciable increase in the amount of fatigue as would be evidenced

by adverse results. These figures and analysis of the Combination Lunch, Rest and 4:30 Stop period are for the first four weeks of the period, and may require some changes when the period is completed.

9:30 A.M. LUNCHES
SERVED TO OPERATORS ON TEST TO DETERMINE EFFECTS OF REST PERIODS AND HOURS OF WORK

	1st Week	2nd Week
Monday	- Postum, tomato sandwich (whole wheat bread) Apple (raw)	Coffee, tongue sandwich (rye bread) Sliced pineapple
Tuesday	- Coffee, tongue sandwich (rye bread) Orange	Postum, tomato sandwich (whole wheat bread) Rice pudding
Wednesday	- Tea Peanut butter and jelly sandwich (whole wheat bread) Sliced pineapple	Vegetable soup Apple (raw)
Thursday	- Vegetable soup Stewed prunes	Orange juice Peanut butter and jelly sandwich (whole wheat bread) Banana
Friday	- Orange juice, marmalade sandwich (whole wheat bread) Banana	Tea Egg salad sandwich (whole wheat bread) Orange
Saturday	- Oatmeal and cream Apple (raw)	Oatmeal and cream Stewed prunes

NOON TIME LUNCHES OF OPERATOR NO. 1 ([redacted])

Before Introduction of 9:30 A.M. Lunch		After Introduction of 9:30 A.M. Lunch — Lunch - 1st Week		Lunch - 2nd Week	
Mon. Aug. 8,	- Spanish rice, potato salad, orange and milk.	Mon. Nov. 7,	- Veal sandwich, bottle of milk and an apple.	Mon. Nov. 14,	- Pork sandwich, pie and apple.
Tues. Aug. 9,	- Sandwich, milk, tomatoes, pear and orange.	Tues. Nov. 8,	- Bologna sausage, sandwich, bottle of milk, apple and banana.	Tues. Nov. 15,	- Ham sandwich, apple, banana and milk.
Wed. Aug. 10,	- Sandwich, pie ala-mode, and milk.	Wed. Nov. 9,	- Summer sausage sandwich, bottle of milk, and apple.	Wed. Nov. 16,	- One-half sandwich, 2 cookies and apple.
Thurs. Aug. 11,	- Ham sandwich, pie ala-mode, and milk.	Thurs. Nov. 10,	- Ham sandwich, pie, bottle of milk and apple.	Thurs. Nov. 17,	- One-half B&B sandwich, 4 cookies, apple and milk.
Fri. Aug. 12,	-- Spaghetti, pie, milk, and orange.	Fri. Nov. 11,	- Absent	Fri. Nov. 18,	- No record
Sat. Aug. 13,	- Hamburger sandwich, and coffee.	Sat. Nov. 12,	- Absent	Sat. Nov. 19,	- Absent

NOON TIME LUNCHES OF OPERATOR NO. 2 [redacted]

Before Introduction of 9:30 A.M. Lunch		After Introduction of 9:30 A.M. Lunch — Lunch - 1st Week		After Introduction of 9:30 A.M. Lunch — Lunch - 2nd Week	
Mon. Aug. 15,	- One-half sandwich, 2 pieces of cake, peach, pear, and bottle of milk.	Mon. Nov. 7,	- Ham sandwich, 4 graham crackers and orange.	Mon. Nov. 14,	- B&B sandwich, 2 pieces of cake and apple.
Tues. Aug. 16,	- Two sandwiches, pickle, cake, orange and milk.	Tues. Nov. 8,	- Jelly sandwich, two doughnuts, two cookies, one-half banana and orange.	Tues. Nov. 15,	- Corned beef sandwich, pie, cake and grapes.
Wed. Aug. 17,	- Sandwich, 2 pieces of cake, 2 pears and milk.	Wed. Nov. 9,	- Corned beef sandwich, 2 pears, cake, bunch of grapes.	Wed. Nov. 16,	- Ham sandwich, cake and 6 plums.
Thurs. Aug. 18,	- Sandwich, pickle, 2 pieces of cake, orange, and milk.	Thurs. Nov. 10,	- Ham sandwich, 2 pcs. of cake and orange.	Thurs. Nov. 17,	- Ham sandwich, cake and apple.
Fri. Aug. 19,	- Potato salad, spaghetti, doughnut, banana, pie, and milk.	Fri. Nov. 11,	- Absent	Frid. Nov. 18,	- Cheese sandwich, 2 pieces of cake and apple.
Sat. Aug. 20,	- One pork chop, 2 slices of bread, cake and root beer.	Sat. Nov. 12,	- Pot roast, mashed potatoes, pie and tea.	Sat. Nov. 19,	- Soup, beef stew, potatoes, pickle, cake and tea.

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NOON TIME LUNCHES OF OPERATOR NO. 3 [redacted]

Before Introduction of 9:30 A.M. Lunch		After Introduction of 9:30 A.M. Lunch: Lunch - 1st Week		Lunch - 2nd Week	
Mon. Aug. 8.	- Sandwich, pear, 4 plums, and bottle of milk.	Mon. Nov. 7.	- Liver sausage sandwich, slice of cake, piece of pie, banana, apple and milk.	Mon. Nov. 14.	- One-half liver sausage sandwich, spanish rice, milk, banana and apple.
Tues. Aug. 9.	- Sandwich, pie, 2 bananas, 2 pears and milk.	Tues. Nov. 8.	- Ham sandwich, apple, and milk.	Tues. Nov. 15th	- Doughnut, 2 bananas, apple and milk.
Wed. Aug. 10.	- Sandwich, pineapple pie, orange, banana, pear, plum and milk.	Wed. Nov. 9.	- Minced ham sandwich, orange, apple and milk.	Wed. Nov. 16.	- Pie, 2 bananas, apple and milk.
Thurs. Aug. 11.	- Sandwich, corned beef hash, orange, banana, 2 pears, plum and milk.	Thurs. Nov. 10.	- Ham sandwich, pie and milk.	Thurs. Nov. 17.	- Hamburger sandwich, orange, banana, apple and milk.
Fri. Aug. 12.	- Two slices of bread, spaghetti, orange, 2 bananas, plum and milk.	Fri. Nov. 11.	- Egg sandwich, pie and milk.	Fri. Nov. 18.	- One-half egg sandwich, pie, banana, orange, apple and milk.
Sat. Aug. 13.	- Cake and coffee.	Sat. Nov. 12.	- Ham sandwich, cake and coffee.	Sat. Nov. 19.	- Frankfurter sandwich and coffee.

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NOON TIME LUNCHES OF OPERATOR NO. 4 [redacted]

Before Introduction of 9:30 A.M. Lunch		After Introduction of 9:30 A.M. Lunch — Lunch - 1st Week		Lunch - 2nd Week	
Mon. Aug. 8.	- Sandwich, 2 sweet pickles, cake, banana and pear.	Mon. Nov. 7.	- Piece of cake, 2 apples and orange.	Mon. Nov. 14.	- Two pork chop sandwiches, orange and apple.
Tues. Aug. 9.	- Sandwich, cake, 2 bananas, and pear.	Tues. Nov. 8.	- Two apples and orange.	Tues. Nov. 15.	- Two ham sandwiches, orange and milk.
Wed. Aug. 10.	- One-half sandwich, banana and 2 pears.	Wed. Nov. 9.	- Piece of pie, orange and apple.	Wed. Nov. 16.	- Ham sandwich, orange and apple.
Thurs. Aug. 11.	- Chop suey, rice, 2 buns and tea.	Thurs. Nov.10.	- Pork chop sandwich, tangerine, and apple.	Thurs. Nov. 17.	- One-half sandwich, piece of cake, orange and apple.
Fri. Aug. 12.	- Sandwich, pie, 2 hard boiled eggs, 2 bananas and 2 pears.	Fri. Nov. 11.	- Egg sandwich, tangerine and apple.	Fri. Nov. 18.	- Two peanut butter sandwiches, apple and orange.
Sat. Aug. 13.	- Hamburger steak, 2 slices of bread, cake and coffee.	Sat. Nov. 12.	- Hamburger sandwich and coffee.	Sat. Nov. 19.	- Spaghetti and coffee.

NOON TIME LUNCHES OF OPERATOR NO. 5 ([redacted])

Before Introduction of 9:30 A.M. Lunch		Lunch - 1st Week		After Introduction of 9:30 A.M. Lunch Lunch - 2nd Week	
Mon. Aug. 8.	- Two sandwiches, apple and peaches.	Mon. Nov. 7.	- Cheese sandwich, apple and pear.	Mon. Nov. 14.	- Roast pork sandwich and apple.
Tues. Aug. 9.	- Two sandwiches, sweet bread, 3 plums and grapes.	Tues. Nov. 8.	- Pork chop sandwich and apple.	Tues. Nov. 15.	- Jelly sandwich, 1 pear and grapes.
Wed. Aug. 10.	- Two egg sandwiches, sweet bread, peach and pear.	Wed. Nov. 9.	- Egg sandwich, and tangerine.	Wed. Nov. 16.	- Ham and pickle sandwich, and apple.
Thurs. Aug. 11.	- Two cheese sandwiches, apple and pear.	Thurs. Nov. 10.	- Ham sandwich and grapes.	Thurs. Nov. 17.	- Ham sandwich and apple.
Fri. Aug. 12.	- Two sandwiches and apple.	Fri. Nov. 11.	- Cheese sandwich and apple.	Fri. Nov. 18.	- Pork chop sandwich, orange and apple.
Sat. Aug. 13.	- Corned beef and cabbage, cake and coffee.	Sat. Nov. 12.	- Meat, potatoes, corn, pie and coffee.	Sat. Nov. 19.	- Meat balls, cabbage, potatoes, coffee and cake.

NOON TIME LUNCHES OF LAYOUT OPERATOR ([redacted])

Before Introduction of 9:30 A.M. Lunch		Lunch - 1st Week		After Introduction of 9:30 A.M. Lunch Lunch - 2nd Week	
Mon. Aug. 8.	- Sandwich, cookies, milk, orange and pear.	Mon. Nov. 7.	- One-half sandwich, apple, banana, and 4 cookies.	Mon. Nov. 14.	- Ham sandwich, piece of cake, apple and banana.
Tues. Aug. 9.	- Sandwich, orange, 2 pears and cookies.	Tues. Nov. 8.	- Ham sandwich, orange, banana, grapes and 2 cookies.	Tues. Nov. 15.	- Ham sandwich, apple and banana.
Wed. Aug. 10.	- Two sandwiches, orange and pear.	Wed. Nov. 9.	- Minced ham sandwich, apple and banana.	Wed. Nov. 16.	- Veal sandwich, apple and orange.
Thurs. Aug. 11.	- Two sandwiches, and 2 oranges.	Thurs.Nov. 10.	- Steak sandwich, and 2 bananas.	Thurs. Nov. 17.	- Ham sandwich, apple and banana.
Fri. Aug. 12.	- One sandwich and 2 oranges.	Fri. Nov. 11.	- One-half cheese sandwich, orange and banana.	Fri. Nov. 18.	--Cheese sandwich, apple and tangerine.
Sat. Aug. 13.	- Veal, creamed gravy, potatoes, coffee and cake.	Sat. Nov. 12.	- Veal stew, potatoes, tomato salad, coffee and cake.	Sat. Nov. 19.	- Soup, roast pork, baked potatoes, cabbage, coffee, bread and butter.

SEC.
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SECTION NO. 7

RESULTS

A. Average Hourly Output - Each Period
B. Uniformity of Performance
C. Table Showing Average Weekly Output
D. Curve Showing Record of Performance
E. Curve of Quality Variations.

In this section the results of the various periods are shown in tabulated form, and are contrasted with the "No Rest" period. Table No. 1 is of the Average Hourly Output, and Table No. 2 is that of the Variation in the Uniformity of Performance.

A. Average Hourly Output - Each Period

In Table No. 1 on the following sheet, are shown the average hourly outputs for each operator by periods. The average hourly outputs are supplemented by a percentage column which shows the individual's increase or decrease in any period, as compared to the "No Rest" period, and is also shown for the entire group.

C. Table No. 3 shows the total production (in the equivalent of E-901 type relay) of each operator for each period, and also the average weekly production for each period of the test.

D. A graph is also included showing the output per hour actually worked for each period expressed as a percentage of the output during the two weeks in the regular department previous to beginning work in the test room.

E. All assembled relays found defective and for which each operator is held responsible, are returned to be repaired by the individual. A record of the number of defects daily charged to each operator represents the variation in degree of quality.
Chart "E" shows the daily average repairs for each week of the test.

AVERAGE HOURLY OUTPUT - ALL PERIODS

TABLE NO. 1

1	2	3	4	5	6	7	8	9	10
Operator No.	Average Hourly Output "No Rests" in Regular Dept.	Average Hourly Output "No Rests" Working in Test Room	Column #3's Increase or Decrease over Column #2 %	Average Hourly "No Rests" Working on Special Gang Rate	Column #5's Increase or Decrease over Column #2 %	Average Hourly Output 5 Min. Rests	Column #7's Increase or Decrease Over Column #2 %	Average Hourly Output 10 Min. Rests	Column #9's Increase or Decrease Over Column #2 %
1	50.7	47.8	-6	48.6	-4.3	50.8	+.2	52.7	+3.9
2	49.8	49.3	-.1	50.9	+2.2	51.3	+3.0	54.0	+8.4
3	50.4	49.7	-1.4	53.8	+6.7	53.1	+5.3	55.3	+9.7
4	49.0	51.4	+4.9	52.6	+7.3	52.7	+7.5	54.3	+10.8
5	48.5	49.0	+1.0	50.9	+4.9	50.2	+3.3	51.7	+ 6.6
Group	49.7	49.4	- .6	51.3	+3.2	51.6	+3.8	53.6	+ 7.9

Operator No.	11 Average Hourly Output Three-5 Min. Rests	12 Col. #11's Increase or Decrease Over Column #2 %	13 Average Hourly Output Comb. Lunch and Rest	14 Column #13's Increase or Decrease Over Column #2	15 Average Hourly Output Comb. Lunch, Rest and 4:30 P.M. Stop	16 Column #15's Increase or Decrease Over Column #2
1	52.5	+3.5	*52.3	3.1	**60.2	+18.7
2	51.9	+4.2	51.8	4.0	**61.5	+23.5
3	55.9	+6.9	55.9	10.9	59.1	+17.3
4	55.7	+9.6	55.4	13.1	60.2	+22.8
5	52.1	+7.4	52.3	7.8	54.2	+11.8
Group	52.8	+6.3	53.6	7.8	59.1	+18.9

(Note) Figures in Columns #15 and #16 are based on four weeks performance only, as this feature is incompleted.

(*) This figure includes the work of a substitute operator during the third and fourth weeks when the regular test operator was absent.

(**) The results of Operator Nos. 1 and 2 in Column Nos. 15 and 16 are not directly comparable to the results of these positions in Column No. 2. This is due to these operators entering the test the third day of the 4:30 P.M. stop feature, and is being shown to complete the table.

B. Uniformity of Performance.

The following figures are those which indicate the trend of the uniformity of performance for the periods shown, and are given by morning spell and afternoon spell for each operator. These figures are known as "Indexes."

TABLE NO. 2

WORKING AND AFTERNOON VARIATIONS

Oper.	No Rests			5 Min. Rest			10 Min. Rest			3-5 Min. Rests			Comb. Lunch and Rest		
No.	A.M.	P.M.	Tot.	A.M.	P.M.	Tot.	A.M.	P.M.	Tot.	A.M.	P.M.	Tot.	A.M.	P.M.	Tot.
1	5.0	4.1	9.1	2.9	3.3	6.2	6.5	5.5	12.0	5.7	3.8	9.5	3.6	3.8	7.4
2	4.9	7.1	12.0	3.9	3.6	7.5	5.9	4.8	10.7	3.7	5.1	8.8	3.2	4.4	7.6
3	3.2	5.9	9.1	2.4	4.1	6.5	2.0	3.2	5.2	1.4	2.4	3.8	2.3	3.7	6.0
4	2.3	2.5	4.8	1.7	3.5	5.2	3.2	4.5	7.7	1.4	2.0	3.4	1.5	3.1	4.6
5	5.5	3.2	8.7	3.8	2.8	6.6	2.3	3.4	5.7	2.8	3.5	6.3	3.3	3.6	6.9

	Comb. Lunch, Rest and 4:30 P.M. Stop		
	A.M.	P.M.	Tot.
1	2.0	2.1	4.1
2	2.3	2.4	4.7
3	2.0	3.0	5.0
4	.5	1.4	1.9
5	2.9	2.3	5.2

4.7
5.7.4

NOTE: In this division of the data, the effectiveness of the various periods may be noted both in the A.M. and P.M.

When considering the relative efficiency in terms of uniformity of performance, the operator's rank is shown in its relative position in the following:

TABLE NO. 2-A

TOTAL AVERAGE VARIATION ALL PERIODS (INDIVIDUALLY)

Operator No.	Average Total Variation
1	4.1
4	4.6
2	4.7
3	5.7
5	6.6

NOTE: The figures for operators No. 1 and No. 2 are for the 4:30 P.M. stop period only, and therefore, are not directly comparable with the figures of Operator Nos. 3, 4 and 5 which are averages of all periods.

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TABLE NO. 2-B

TOTAL AVERAGE VARIATION-GROUP

When considering the relative efficiency of the five completed periods, or features, tried in terms of uniformity of performance for the group, they take respective places as follows:

Period or Feature	Total Average Variation
1st - 5 Min. Rest	6.3
2nd - Comb. Lunch and Rest	6.5
3rd - Three-5 Min. Rests	6.7
4th - 10 Min. Rest	8.3
5th - No Rest	8.8

NOTE: The total average variation for the first 24 days of the Combination Lunch, Rest and 4:30 P.M. stop period, is 4.2.

RECORD OF PRODUCTION IN EQUIVALENT TO E-901
BELAKS OF TEST OPERATORS
TOTAL WEEKLY OUTPUTS AND AVERAGE WEEKLY OUTPUT BY PERIODS
OF TEST
TABLE NO. 3

Period	Week	OPER. NO. 1 Total Weekly Output	OPER. NO. 1 Average Weekly Output	OPER. NO. 2 Total Weekly Output	OPER. NO. 2 Average Weekly Output	OPER. NO. 3 Total Weekly Output	OPER. NO. 3 Average Weekly Output	OPER. NO. 4 Total Weekly Output	OPER. NO. 4 Average Weekly Output	OPER. NO. 5 Total Weekly Output	OPER. NO. 5 Average Weekly Output
In Regular Department	1	2422		2463		2374		2374		2294	
	2	2426		2309		2400		2394		2338	
		4848	2424	4772	2386	4774	2387	4768	2384	4632	2316
In Test Room	1	2384		2187		2411		2539		2305	
	2	2410		2616		2525		2592		2440	
	3	2270		2204		2400		2438		2299	
	4	2341		2193		2097		2309		2289	
	5	2246		2345		2446		2397		2404	
		11471	2294	11545	2309	11879	2376	12275	2455	11737	2345
Special Rates	1	2276		2347		2477		2400		2418	
	2	2225		2307		2539		2448		2494	
	3	2131		2238		2521		Vac.		2406	
	4	2333		2362		2606		2453		2333	
	5	2281		2457		2616		2585		2500	
	6	2412		2513		2612		2589		2418	
	7	2502		2560		2607		2537		2443	
	8	2434		2543		2630		2529		2419	
		18594	2324	19347	2418	20608	2576	17539	2505	19421	2427
5-Min. Rest	1	2491		Vac.		2501		2477		2400	
	2	2452		2302		2598		2508		2374	
	3	2348		2381		Vac.		2567		2362	
	4	2384		2430		2430		2460		2428	
	5	2457		2443		2587		2597		Vac.	
		12132	2426	9556	2389	10106	2526	12609	2522	9564	2391
10-Min. Rest	1	2501		2602		2587		2510		2501	
	2	2438		2449		2710		2628		2455	
	3	2577		2621		2588		2578		2394	
	4	2478		2569		2630		2634		2427	
		9994	2498	10241	2560	10515	2629	10350	2588	9777	2444
Three-5 Min. Rests	1	2547		2580		2498		2493		2390	
	2	2487		2522		2510		2595		2501	
	3	2458		2371		2582		2553		2477	
	4	2491		2434		2693		2645		2510	
		9983	2496	9907	2477	10283	2571	10286	2571	9878	2469
Comb. Lunch	1	2519		2506		2623		2532		2480	
	2	2508		2558		2641		2576		2537	
	3	2516	Sub.	2528		2740		2569		2484	
	4	2575	"	2585		2641		2584		2493	
	5	2496		2520		2544		2505		2438	
	6	2435		2418		2675		2676		2301	
	7	2254		2271		2607		2675		2429	
	8	2437		2404		2683		2799		2463	
	9	2433		2386		2726		2702		2558	
	10	2510		2371		2822		2760		2529	
	11	2491		2573		2861		2856		2510	
		27176	2470	27120	2465	29563	2688	29234	2658	27222	2475
4:30 P.M. Stop	1*	2622	Note	2584	Note	2681		2676		2416	
	2	2721		2795		2658		2743		2453	
	3	2694		2787		2607		2700		2412	
	4	2712		2880		2707		2746		2475	
	5	2675		2784		2753		2748		2539	
		13424	2685	13830	2766	13406	2681	13613	2723	12295	2459

Note: Where hours actually worked were less than full week, the totals have been increased to basis of full week.

(*) On the third day after the beginning of the 4:30 P.M. stop period, two new operators were put on the test to replace old operator Nos. 1 and 2 who had been on the test from the start. Because of this change the output records of operator Nos. 1 and 2 for the 4:30 P.M. stop period are not directly comparable with previous records for these positions.

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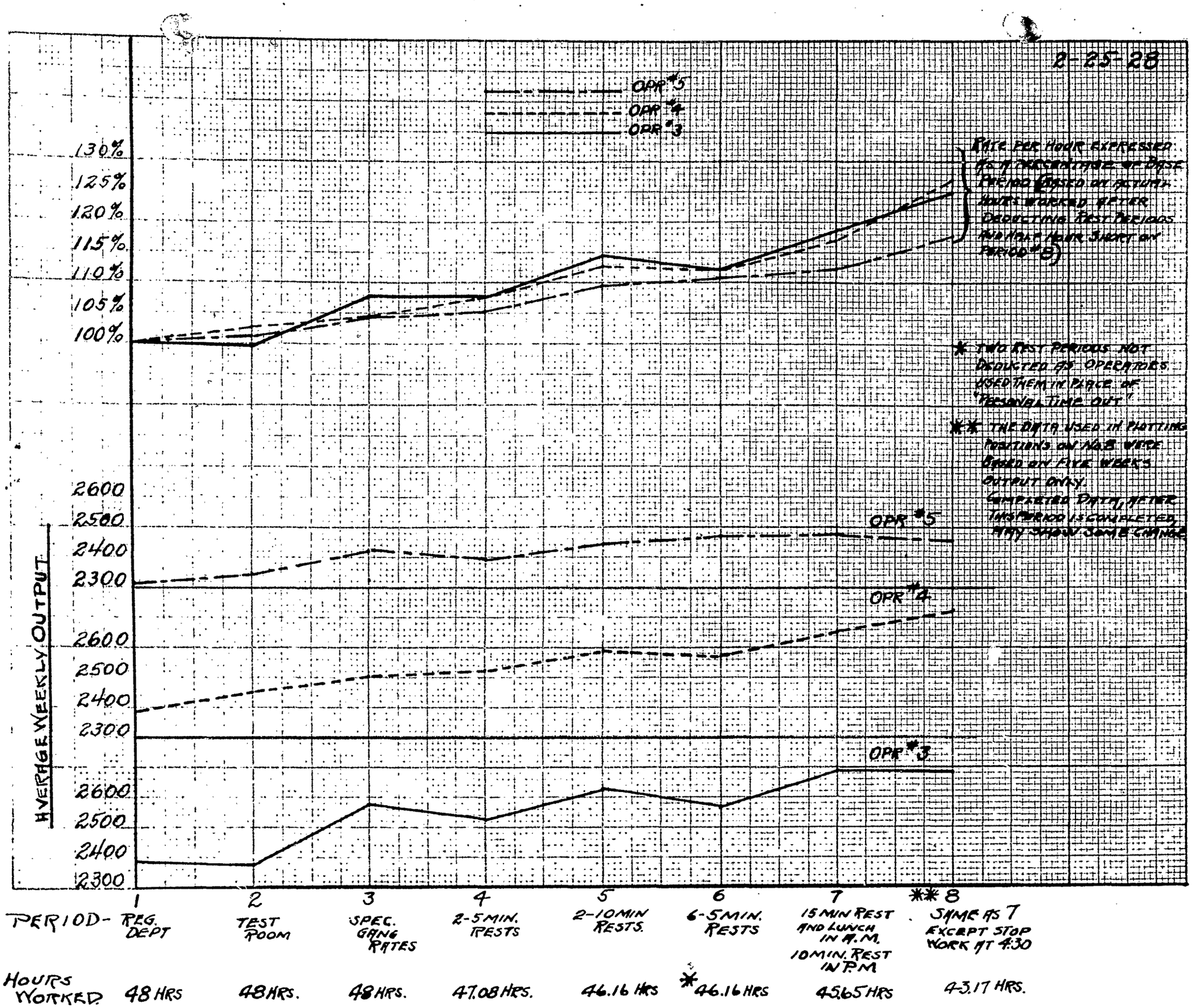

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SECTION NO. 8

OBSERVATIONS AND CONCLUSIONS

The observations and conclusions given here have been suggested by the results of the experiments conducted thus far. They are not, therefore, to be construed as final, since further experiments may warrant changing.

The results to date show that:

1. The late morning slump which was thought to be due to fatigue, is largely due to production time lost on account of personal time taken by the operators just previous to noon.

2. The slump in production in the early afternoon apparently is the result of drowsiness brought about by the heavy lunches indulged in by the operators. This is particularly true during the warmer months. These heavy lunches are required because of the long interval between breakfast and lunch time of shop employees.

3. The rest pauses have a distinct effect on the uniformity of production. This effect has varied. The short rest pause of five minutes has in general resulted in a more uniform rate of production than the other experiments completed to date. The longest rest pause (10 minutes) gave the greatest amount of fluctuation.

4. The highest fluctuation in the rate of working encountered to date exclusive of the "No Rest" period, was during the ten minute rests. Fear of lowered earnings due to maximum amount of time off and consequent spurt in production after each rest, no doubt, caused the irregularity in the rate of working during the 10 minute rests.

5. The highest average hourly output of relays assembled throughout any experiment completed thus far was obtained over the periods of the "Ten Minute Rest" and of the "Combination Lunch and Rest."

6. The total daily outputs are not reduced by rest pauses but are increased.

7. The physical condition of the operators under test has improved steadily. This may, no doubt, be partly attributed to a greater freedom of mind due to the absence of the closer supervision customary in the regular department.

8. The psychology of the test has resulted in creating an eagerness on the part of the operators to come to work in the morning.

9. Outside influences tend to create either a buoyant or a morbid spirit which is reflected in production.

10. The improvement in physical conditions has been so gradual that no distinct or unusual reflections can be noted in the performance due to this improvement.

11. The earnings constitute only a fraction of the incentive, and that the "novelty" feature predominates.

12. That instinctive imitation partly accounts for the similarity of performance between individuals of a group.

13. That the amount of freedom exhibited in talking, laughing, and general inattention to work, is an indication that maximum efficiency has not as yet been attained.

14. With but very few exceptions, the most favorable results are obtained during the morning's work as reflected in the index for the uniformity of performance.

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SECTION NO. 9

COMMENTS OF OPERATORS

A. Introduction
B. Working in Test Room
   B-1. Period of Special Gang Rate
   B-2. Five Minute Rest
   B-3. Ten Minute Rest
   B-4. Three-5 Minute Rests
   B-5. Combination Lunch and Rest

A. The comments of the operators are being given wherever they have a direct reference or bearing on the study. Each subdivision of this section is devoted to the individual operators' expressions. These are recorded in the chronological order in which the features were tried. This is done so that an individual's opinions, likes, wishes, reactions, in fact her entire attitude toward any phase of the study may be analyzed in relation to any given feature, or for contrasting with the other operators.

In some cases the operators were questioned concerning their feeling and whenever the "comments" are involuntary, the question will be given in conjunction with the replies.

B. Working in Test Room

Operator No. 1

Question: "How do you like it in here?"
Answer: "I like it." "I liked it from the first day, I wouldn't want to go back." (Meaning to the regular department). "It's nice in here, not so crowded."

Operator No. 2

Nothing of direct application.

Operator No. 3

Nothing of direct application.

Operator No. 4

Nothing of direct application.

Operator No. 5

Nothing of direct application.

B-1. Period of Special Gang Rate

Operator No. 1

When special gang rates were introduced this girl did not have anything to say, but wanted to know, however-
"When are we going to have rest periods?"
"We like it better in here because some of the girls out there didn't get along with us so well."

During this period or feature, this girl received an engagement ring which caused considerable distraction.

"I think we ought to get a Saturday off because we worked so hard the past two days."

Question: "Do you have to think about the work or not?"
Answer: "Oh, I can think about other things, but it's better when you can talk."

When informed of the rest periods to come, this operator favored a 10 minute rest.

Operator No. 2

"The next time they ask us to tell them what we want, [redacted] and I are going to tell them we want to eat our lunch about 11:00 o'clock. You get so hungry by then."

"Last week we made a pretty good percentage didn't we?"
"I'm tired and don't feel like working hard today."
"Oh, I know what we're going up there for, we're going to be bawled out." (This was with reference to the meeting in Mr. Pennock's office prior to the beginning of the five minute rest period).
This operator was in favor of a rest period of ten minutes duration.

Operator No. 3

This operator was asked if she thought she did more, less, or about the same amount of work when compared to yesterday (6-12-27).

Answer: "More, I'm almost up to [redacted] and I have a bigger relay."
"I went to bed at 9:00 o'clock last night and feel OK today."

B-1.

Operator No. 3 (Cont'd.)

Question: "How do you account for the higher output?"
Answer: "Oh, if I don't keep making them you will mark it down." (The reference to "marking it down" was due to our practice of recording pauses, by marking a code number on the tape).

We told her not to speed up on that account.
"I'm not speeding up on that account." "If I don't get $30.00 next week I don't know what I'll do."
"If I get $30.00 I'm going to ask my mother for half of it."
"I give her all of it, and when I ask her for $.50 she tells me I spend more than I make."

Operator No. 4

"I feel great today." (6-21-27)
"I like to work in here better than in the regular department, because one doesn't have so many changes of layouts, it's nice when we run along on one kind of relay."

This girl is of a quiet nature and had no suggestions to offer covering rests.

Operator No. 5

This girl has made no direct reference to the work unless questioned directly. Her physical condition is such as to cause her to complain of being sleepy, having a headache, the heat bothers me very much, etc.

When beginning rest periods this operator was in favor of a rest period between 10:00 and 10:30, but did not have a suggestion as to length.

B-2. Five Minute Rest Period

Operator No. 1

"We'll be getting spoiled with these rest periods."
"Gee, that's the berries." "It rests you to have five minutes like that."
"I wonder if this study will be a success?"
"Gee, you're dead tired now when you come home at night."
"When Wednesday night comes I'm too tired to go out."

B-2.

Operator No. 1 (Cont'd.)

"Before we had the rest periods, I would get so sleepy, I would almost fall off of the chair and I was more tired when I got home."
"It's better now with the rest, you feel fine when you start in again."

When the question of increasing the rest periods to ten minutes was discussed, this operator said she would like a ten minute rest.

Operator No. 2

This operator returned from her vacation, during which time rest periods had been introduced. Asked by Operator No. 1, "Don't you feel like working now when you have a rest?"
Ans. "Yes, I do."

This operator purchased a cushion for her chair, saying "These chairs are so hard!" (8-16-27)

"Gee, we can't always make a big percentage, some days you feel more like working than others."
"Out in the other room they'd come around and tell you when you didn't make your rate, and they would bawl you out too."
"Nobody ever said anything when you made over your rate."
"But in here (test room) with the rests, you don't feel so tired and can work better."
"You ought to make 20,000 piece parts now, [redacted], with nobody to talk to." (This was prompted by the friend of one of the girls being on a vacation).

When the 10:00 A.M. rest period was up, this operator remarked:
"Oh, so soon?"
"It doesn't go so good today, I'm more tired."
"I would like a ten minute rest."

Operator No. 3

"I like the rest periods."

When asked, at one time, how the work was going now that rest periods were being used, replied:
"It goes like always."

B-2.

Operator No. 3 (Cont'd)

At another time; "Oh, I would like ten or fifteen minutes, that would be all right."
"Five minutes is too short."

Operator No. 4

"I like the rest periods, but I think one every hour would be better."

Question: "How does the work go today?"

Answer: "Oh, about the same, I think it's a little too warm today and that makes me sleepy, but I woke up during the rest period."

Question: "How do you like the rest periods?"

Answer: "All right, but I think fifteen minutes would be swell."

Later, this operator decided ten minutes would be better, saying, "You might not be able to make up the fifteen." (9-8-27). (This was, no doubt an honest impression, as looking back from the present when :55 minutes are being consumed instead of :10 minutes or the anticipated total of :30 minutes, the output is still maintained).

"We were saying the rest periods ought to be 15 minutes long." (8-6-27).

Operator No. 5

"It rests you a little bit."
"I don't think I'll move, because I'm tired."
"I'm so sleepy today."

Question: "How does the work go today?"

Answer: "All right, only I've got a bum layout again, but I'm going on my vacation tomorrow, and that makes it better."

B-3. Ten Minute Rest Period

Operator No. 1

Question: "To what do you attribute the high earnings of the last two days?"

B-3.

Operator No. 1 (Cont'd.)

Answer: "I think the rest periods is what causes it."
"I don't think the earnings have much to do with it."
(This reference to earnings was the result of their being told each day what per cent they had made).
"What's the use of working hard, only 60%."
(This remark was the result of a mistake in the percentage as figured by the clerk of the department and came at a time when the operators were conscious of added efforts). Also may be seen that this girl was interested in the earnings which she had previously stated were not of as much interest to her as the rest periods.

Question: "Wouldn't a 15 minute rest period be too long?"

Answer: "It passes fast, it isn't too long."

Operator No. 2

"Gee! we made 80% yesterday, today we ought to make 90%."
"We all feel better now with ten minute rest periods."
"When can we stay home on Saturday mornings?"
"I suppose we can when we make about $28.00 in five days."

Question: "To what do you attribute the high production for Monday and Tuesday?"

Answer: "Sure, the rest period does it, you feel better and can work better, and then you know you are making a little more money, and that makes some difference."

Question - Mr. Platenka:
"How is it you girls can make 75% in here (test room) and so much less when working in the regular department?"

Answer: "How can you make good out there, when one girl does only 7000 and another does 11,000?"
"I don't think 15 minutes would be too long."
(This was brought out during the meeting when an increase from 10 to three-5 minute rest periods was being planned).

Question: "Would you have speeded up as much in the regular shop, as you have in the test room?"

Answer: "Well if you have the steady running jobs."

B-3.

Operator No. 3

"Oh, the dickens with that place." (Said in connection with advice regarding a pending hospital visit).

Question: "To what do you attribute the high production for Monday and Tuesday?"

Answer: "I guess on account of the rests."

When told of a previous day's earnings, this girl said: "I'm not going to do more than 10,000 parts next Monday." When asked if 15 minutes would be too long a rest this girl said:

"I feel the same." (Meaning Operator No. 2's expression of, "I don't think 15 minutes would be too long" was satisfactory to her).

Operator No. 4

When the girls were informed of a previous day's earnings, this girl said:

"Oh, we earned 80%, but we'll only get 60%."

Question: "To what do you attribute the high production for Monday and Tuesday?"

Answer: "Maybe it's the rests, that's the only thing I can think of for going so high when it's so hot."
"I like to know how much I make so I can tell when I am making more."
"What do we work hard for, we never get the money."
(This operator was inclined to be rather skeptical about receiving her money, but this has disappeared). At another time;
"We'll never get all that money."

When assured there was nobody else that could get it, and asked if she could suggest some one that would, she replied, "The bosses, I guess."

Operator No. 5

Question: "To what do you attribute the high production for Monday and Tuesday?"

Answer: "Maybe it's the heat, and oh, you like to know how much you make."

B-3.

Operator No. 5 (Cont'd.)

This girl has complained of the heat during the hot weather, and often of an unusually hot afternoon, would express a wish to go home.

The tendency of this girl is toward a number of ailments, such as; being sleepy, a bad feeling in my head and neck.

B-4. Three-5 Minute Rests

Operator No. 1

"I don't like these rest periods, I just get started to work then have to stop, and when I come back I don't feel like working."
"I don't feel like working after the 3:15 rest period."
"I don't feel like working today, although I don't mind coming down in the morning, I really like to come."
"I don't intend to go back in the other department."
"I ate too much for dinner and now I can't work."

Question: "Does everybody like the three-5 minute rest periods?"

Answer: "It's too much breaking up."
"I can hardly wait until Monday comes." (First day of lunch).

Operator No. 2

"I don't like these rest periods."
"Tomorrow I'm going to work like a horse."

A departmental error in calculating the per cent of earnings brought this:

"Oh gee! they're cheating us."
"I don't mind coming down in the morning either, because there's such a difference in here than in the regular department." "We don't have to worry about getting bawled out about our rates, I wish this test would last two more years."
"I'm getting nuts on this job, I don't know what I'm doing."
"When the whistle blows tonight I wont have anything done."
"Everything seems to slip out of my fingers."
"If I get any more repairs, I'm going on strike."
"I went to church at 5:00 o'clock too, then I went to the store for my mother."

B-4.

Operator No. 2 (Cont'd.)

"You can work as hard as you want on this layout, but you can't make anything."
"Anyway with these crazy old rest periods they break it up."

When time to change to new rest period came, the girls were asked:

Question: "What rest appealed the most?"

Answer: "The ten minute rest."

"Tonight I have to clean house, scrub the floor and everything, still I'm getting fat."
"I work here and work at home too, but keep on getting fat."
"Tomorrow I have to wash the windows."

Operator No. 3

Question: "How do you like the present rest period?"

Answer: "I feel the same as [redacted] does, about it."
([redacted] is #4 and her reply is found under her paragraph).
"I feel stiff after the first rest period in the morning."
"I don't feel like working after the 3:15 rest period."
"I don't make a good rate on account of the rest periods."
"I feel goofy today."
"I ate too much for dinner, and now I can't work."
"I went to bed at 10:30 last night, but my mother wouldn't wake me up that early." (5:00 A.M. to go to church).

An unusual average hourly output (60 an hour) was made by this girl, and when asked if she could give a reason for it, said: "I'm working for a raise."

Question: "Why did your output reach such a high mark?"

Answer: "Mr. Hibarger told us the present rest system was going to be changed."

Operator No. 4

Question: "How do you like the present rest period?"

Answer: "I don't like it, I didn't like it yesterday or today, so why should I like it tomorrow?"

B-4.

Operator No. 4 (Cont'd.)

(The last part of this answer was occasioned by the observer's suggestion that perhaps she would like it better when tried longer).

"I would like to have a 10 minute rest at 10:00 o'clock and a five minute rest at 11:20 in the morning."
"I guess when it comes my turn to bake a cake, I'll have to bake two, they're not satisfied with one piece anymore."
(This remark was with reference to the hospital visit and "party" as explained in Section #5 Physical Examinations).
"I didn't go to church, I didn't get to bed until 11:30, we were putting up mushrooms."

Operator No. 5

Question: "How do you like the present rest period?"

Answer: "It's too much jumping up and running around, I don't like it."
"I'm so hungry I don't feel like working."

B-5. Combination Lunch and Rest

Operator No. 1

"Gee, that was swell you feel like working now."
"Now I can work better." (After the 9:30 lunch)
"I'm coming here the day before Thanksgiving and have a sandwich." (This girl was on a leave of absence at this time).

This girl was told that the results of the study might be spoiled and was requested to call out the defective parts in an attempt to distract her mind from a conversation trend. When this was done for one day, she said:

"Yes and say! was I tired, I could hardly wait 'till 5:00 o'clock."

Operator No. 2

This girl was told of the possibility of spoiling the results of this period by too much talking.

B-5.

Operator No. 2 (Cont'd.)

"Sure, you get too tired when you don't talk, that's what I used to tell Mr. Platenka (shop foreman), if you sit all day without talking it makes you tired."

"Let's work hard and make a lot of money this week."
"Let's all make 16,000 today." (This was said just after the lunch).

This operator is inclined to moody spells and her remarks and replies to questions are becoming vague and inadequate.

"I would like to be in bed today, I've got a terrible headache."
"I don't know what is the matter with me, everything is going wrong, and I'm glad today's over."
"I don't feel like working today."
"We worked like horses yesterday to make 15,000."
(These large figures are piece parts and denote the terms in which an operator has a mental conception of her work).

"I'm tired of the lunch period."
"I can't get started to work today."
"I can't eat so much now, I brought only one sandwich." (All operators claimed to eat less at noon).

Operator No. 3

"When we go over to the hospital again I'll weigh about 130 lbs.
Question: "What does your mother say about your getting so much heavier?"

Answer: "Oh, she says it's all right."
"How long are they going to feed us?"
"Gee! I thought yesterday was a week."
"I'm so hungry." (4:00 P.M.)
"You wont hear me say another word around here, you go and write it down right away."
"I'm so tired I think the weather makes me feel that way."
"I'm going to do 15,000 today, if I work until six o'clock."
"I thought 12:00 o'clock would never come."
"I can't work today, I'm too excited over one of my Christmas gifts."
"I'm so sleepy today, I'm just beginning to wake up." (4:45)
"I'm making up for yesterday, that's why I'm working hard."

B-5.

Operator No. 3 (Cont'd.)

"I'm getting sick I feel so weak." (An expression such as this is given because it is felt that its origin may be due to nervous exhaustion).

Question: "How do you girls feel about the rest periods?" Would you want to know you had to go your whole working life with or without rest periods?"

Answer: "I want rest periods."

Operator No. 4

"When they serve oranges I want mine peeled." "I don't like to peel an orange."
"My mother will save money now, she wont have to put any sandwiches in my lunch."
"They'll have to keep it up now, or we wont work here."
(Believing that the truth is often spoken in jest, the last remark was recorded. All of these, of course, are in connection with the Combination Lunch and Rest Period).

"I would like to have a sandwich at 4:00 P.M."
"I'm going to turn out at least 17,000."
"Yesterday was a long day and I was tired."
"I can't make anything with this layout."
"When I work fast all morning I feel like working in the afternoon."
"[redacted] you and I have to make 17,000 piece parts today."
(at 3:35) (This girl turned out 17,214 parts that day).
"I don't like to work on Saturday morning."

This operator and Operator No. 3 delight in engaging in "races", spurts of fast working in which each tries to drop a relay ahead of the other, etc.

When the time came to change the feature being tried, they were asked:

Question: "Would you rather discontinue the lunch or the rest?"

Answer: "I would rather continue with both, the lunch and the rest."

Operator No. 5

Question: "Will you share your lunch?"

Answer: "I should say not, I'm hungry about 9:30 or 10:00 o'clock, that I could eat a big lunch."

B-5.

Operator No. 5 (Cont'd.)

"My back hurts."
"I'm so lazy today."
"My neck and head hurts me."
"I wish today was over, I'm so tired."
"I'm so sleepy today I could fall right to sleep."
"I ate so much I can just about move."
"I don't feel very well today."
"That dressing on the sandwich made me sick, and I was so hungry today, I didn't get enough."

Question: "How is your sore finger?"

Answer: "It doesn't hurt today, this is Saturday and Saturday is only a half day, and that makes everything feel all right."

(Approximately 75% of this operator's remarks are about how sleepy she is, or how tired, or I don't feel so good today).