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A TREATISE

— ON —

Factory Management

By JOHN TREGONING.



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UNITED STATES OF AMERICA.

K. J. Jan. 3 '16

# A TREATISE

ON

# FACTORY MANAGEMENT.

BEING A

*COMPREHENSIVE AND PRACTICAL SCHEME  
FOR THE BETTER MANAGEMENT OF FACTORIES.*

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By JOHN TREGONING, M. E.

*Late Superintendent Thomson Electric Welding Company,  
LYNN, MASS.*



LYNN, MASS.

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1891.

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## INTRODUCTION.

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IT HAS been said that "System is the triumph of Mind over Matter," and there is no doubt about the truth herein contained; we only get suspicious of the fact when taking a measured survey of the inner workings of some large factories, and gaze sorrowfully at the triumph of *Matter* over Mind.

To work systematically is to work successfully. Method is the essential element on which every solid and substantial concern is based; and that factory, institution, or establishment of any kind which ignores it, conveys to the observer an impression that nothing permanent or abiding is intended, whilst on the other hand a systematized manner of working stamps it at once with permanency,—an establishment that means business, and intends to carry it on for all time.

I have heard it remarked that in business three things are necessary: knowledge, temper, and time; but I have seen all three prostrate and powerless for want of *method in the management*. Such is the evil of working in an unmethodical and slipshod manner, that it is not too much to say results have followed well-nigh ruinous to the concern.

In the following pages I have tried to set forth a few ideas which I consider in their way helpful to the more successful management of factories; and in as brief space as possible have detailed some of the more important items connected therewith.

There is no doubt that the subject of Factory Organization has been badly neglected in past years. That we have *not* advanced with the order of the times is the complaint I lodge against the doors of many managers. We are working on old systems which have served their day and generation, systems which "have had their day," but unfortunately, have *not* "ceased to be," for a brief glance at many of them, both great and small, will prove that little or no method is used, and that the concern moves under conditions which are disgraceful; the wonder is how it moves at all. My observations have led me to conclude—and I say it after twenty years' experience—that the first and foremost want of many of our large factories is not work, but a thorough revision of the machinery that manages and directs the whole concern. It is not a want of brains, it is not the difficulty of working out a vast and complicated scheme, it is not a matter of involving the company in a large outlay of money,—it is simply a question of *method*, the application of a few simple rules, and a respect for the time-honored principle that Order is the First Law of the Universe, and the nearer our approach to it the more harmonious will our arrangements work.

A perfect organization I consider an essential and vital element in securing success, in whatever form of institution we may wish to carry on, whether political or religious, mechanical or social; I contend that it is not possible to found a lasting power upon a management where systematic action is eliminated or ignored; a ramshackle condition of things is the ultimatum; and in many cases establishments have closed, simply through a break up from within of its *managing machinery*.

Many managers and officials may deprecate the follow-

ing ideas as consuming too much time in attending to their various ramifications, but such superficial observations only betray an incompetency to pronounce an opinion. True, I admit, like most things abuse is possible through being overdone; but the following ideas I have adopted myself, and many others have done the same, to our mutual satisfaction.

I can only hope in laying it before the public that the same beneficial results will follow. In conclusion, I would add that at some future date a more detailed method of factory organization, including labor, machinery and tools, will form matter for another edition.

J. T.

LYNN, MASS., *January 1, 1891.*

SHOP ORDER BOARD.							
Draughting Department	○	○	⊗	○	○	○	○
Pattern Shop	.	.	○	.	.	.	.
Machine Shop	.	.	○	.	.	.	.
Winding Department	.	.	○	.	.	.	.
Assembling Department	.	.	○	.	.	.	.
Testing Department	.	.	○	.	.	.	.
Stock Room	.	.	○	.	.	.	.

FIGURE 1.

## “WHAT IS THAT BOARD FOR?”

THIS QUESTION has been put to me by a great many prominent manufacturers from all over the country, and from abroad, who have had occasion to visit the office of the works where I am engaged. When told it was a Shop Order Board, by which the Superintendent can locate any shop order from the day it is issued until it is executed, many of them have been surprised; and when the complete system has been explained, all have endorsed it as a most simple and perfect one; and representatives from old established firms have asked for details, with a view of adopting it.

The Shop Order Board is not new, but some of the details which go with it are original, if not new, and may be interesting to those who have no

system whatever by which the cost of the product can be ascertained. The latter has come under my notice in the past years in many concerns.

I will first explain the Shop Order Board and its use, as illustrated in Figure 1. This board is made to represent any number of departments, also any number of shop orders, and is placed in the Superintendent's office, where it is under the care of some one connected with this room, say the stenographer, who will see to the proper distribution of the tags that are hanging on the board with corresponding numbers to those on the orders sent into the factory, when there is any notice placed on the table of the *party in charge* to show that certain tags should change departments on the board.

Draughting Dept.	325
Pattern Shop.	325
Machine Shop.	325
Winding Dept.	325
Assembling Dept.	325
Testing Dept.	325
Stock Room.	325

---

A. B. CO.

Shop Order No. 325      Date, July 3, '90.

*Build Six Dynamos, Type 4 C<sup>2</sup>*

*Field Magnets, S. Nos. 60, 61, 62, 63, 64, 65*

*Armatures S. Nos. 80, 81, 82, 83, 84, 85*

Date Executed, .....

FIGURE 2.

The shop order card, illustrated in Figure 2, is filled out and is shop order No. 325, with the serial numbers for the six machines to be built. Attached to the shop order card are *coupons* on which are written the departments corresponding with those on the board, also the shop order *number*.

The order is first sent to the draughting room. On its being received, the head of this department removes the coupon which is intended for him, and puts it in a box for that purpose. He then prepares the drawings, and sends all that are necessary with the shop order to the pattern shop; the foreman here also removes the coupon intended for him, and prepares the patterns for the foundry. The drawings are then sent with shop order to the machine shop. The order now being received in this department, the coupon for this room is also removed and put into its box. The office boy, whose duty it is to collect the coupons and bring the same to the office (this being done once or twice a day), the party in charge of the board finds coupons from the draughting room, pattern shop, and machine shop, showing that shop order 325 has reached the latter department, and moves the tag 325 that was placed in the draughting department when the order was issued down into the machine shop, and so on as indicated by dotted lines until the work is finished and sent with shop order card to the stock room; from here the order card is sent to the factory office and dated when received; the order also in the shop order book is checked off as "finished." So

it will be readily seen that the coupon is a receipt for the order from the department in which it is received.



## THE DRAWINGS.

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**A**LL DRAWINGS should be carefully prepared, and all *important* dimensions *accurately* and *plainly* figured; also all necessary information written on every sheet, so that the workman will have very little cause to leave his work to ask questions of his foreman.

With the above precautions in view, I find it a very good plan to have each drawing proof-read by a second party, — not that any man is mistrusted, nor for want of confidence in him, but simply to check up each other's figures, for the best of us are liable to make a mistake in figures occasionally, and two or three wrong dimensions in a set of drawings will sometimes terminate in very expensive errors.

The sheet shown in Figure 3 is a blue print mounted on heavy cardboard, and is made with a variety of detail, more perhaps than is necessary, but it will show what a variety of work can be put on the same sheet for the factory, and leave a very small chance for a mistake, no matter what depart-

S. O. No. 325  
 SN 60 61 62 63  
 64 65

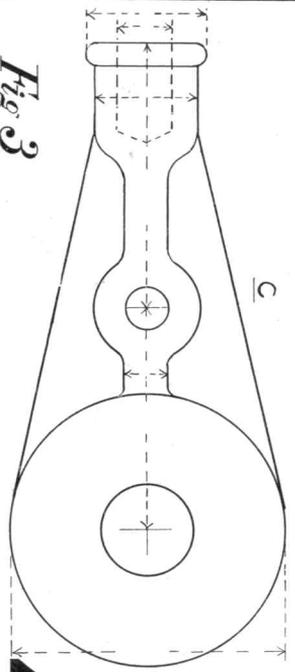
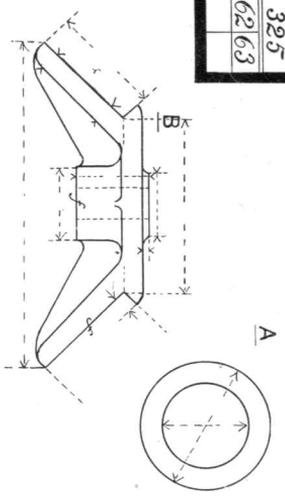


Fig 3

LIST OF PARTS.

PART	QTY	WANTED	PATTERN NUMBER	MATERIAL	NAME OF PART.
A	4			WROG T IRON	RING
B	6	113		BRASS	SUPPORT PARTS.
C	1	46		CAST IRON	RECEIVER LEVER

SIDE ELEVATIONS.  
 SCALE: HALF SIZE.

PROOF READER (L.J.) AUGUS 1890.  
 DETR

4EE-5000

ment it gets into. It will be seen by referring to Figure 3, in the right hand upper corner of the sheet, that a *list of parts* is made out, necessary for one machine; each detail has a different reference letter which is found in the first column; the second column contains the number of parts wanted; the third column, the pattern number, which is also recorded in the pattern shop; column four, the material required; column five, name of parts.

In the left hand upper corner is secured a suitable card-holder, in which is placed a card bearing the shop order number, also the serial number for each machine to be built in this lot, so that it will be readily seen that it is not necessary for any foreman to wait for the shop order card (if he should receive drawings ahead) that may be held in some other department for an unknown cause, but he can at once refer to the card, where he can find the shop order and serial numbers, from which he can tell how many of each part contained on the drawing are necessary to be made. On this particular card are six serial numbers, which means that there are six sets of each part wanted for shop order 325.

In the right hand lower corner is to be found the last, but perhaps not least, item of information, as it contains the class or type of machine (4 E E), and the number of drawing (5000). The latter is also recorded in a book in the drafting room, against which is put the contents of the drawing, and the name of draughtsman, proof reader, the date the drawing was finished, the scale of drawing, and

the name of the manufacturer. And when standard details are adopted and made up in this way, such drawings will wear for years, as little remains to be done to prepare them for a new order, which is accomplished by simply removing the card on the left hand upper corner, and replacing it with one for the new shop order.

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## THE SERIAL NUMBERS.

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**M**ANUFACTURERS and builders of machine tools, agricultural implements, steam engines, electric machinery, or any class of machinery where records are kept (or should be) for future references, will find this system of serial numbers invaluable for many purposes. The object being to classify all machines built, each class of machine bearing its own consecutive serial number should have a book kept for that purpose, for instance:—

Lathes, no matter whether a six-inch or a fifty-four-inch swing, they will take their serial number from the shop orders as they are issued, and so be classed as such. The same with planers, drill presses, mowing machines, dynamos, electric generators, steam engines, etc. Now, for instance, it may be found necessary to build one or two machines on

a certain shop order, with a different attachment from the others on the same order, to accommodate some special work for a particular customer; where this is the case, it is a very easy matter to record such alterations against the serial number of its class. It will also appear on the drawings that are made for these changes, and be recorded in the draughting room with the same serial number and

SERIAL NO.	DYNAMO FIELDS TO WHOM SHIPPED	S. O.	TYPE	SHIP'G NO.
60	. . . A . . .	325	4 EE	30
61	. . . B . . .	do.	do.	31
62	. . . C . . .	do.	do.	32
63	. . . D . . .	do.	do.	33
64	. . . E . . .	do.	do.	34
65	. . . F . . .	do.	do.	35

FIGURE 4.

shop order number; this will be found very convenient when repairs or additional parts are wanted.

I have illustrated one page from each of two books, Figures 4 and 5. The first column contains the serial numbers; the second, dynamo fields, (which are really the complete machine frame without the armature) and to whom shipped; the third, the shop order under which it was built; fourth, the type or class; fifth, the shipping number; the

latter number has nothing to do with the serial number, and is only put on the *name plate*, when it is known to whom it is to be shipped; then the number is entered in consecutive order with the name of the party in the book of its class; the shipping number is also the manufacturer's number.

We will now issue a shipping order to demonstrate Figures 4 and 5:

SERIAL NO.	ARMATURES TO WHOM SHIPPED	S. O.	TYPE	SHIP'G NO.
80	. . . A . . .	325	4 EE	30
81	. . . B . . .	do.	do.	31
82	. . . C . . .	do.	do.	32
83	. . . D . . .	do.	do.	33
84	. . . E . . .	do.	do.	34
85	. . . F . . .	do.	do.	35

FIGURE 5.

“Ship to Mr. F. dynamo No. 35 (as we find in our book that this is the next consecutive shipping number, and we enter it as such), composed of field magnets or frame, serial No. 65, and armature, serial No. 85; the armature taking the same shipping number as the dynamo frame. (In case we ship a spare armature, it would be shipped under its own serial number.)”

You may ask why the armature numbers run higher than the dynamo fields, — It has been found

necessary to build spare armatures in case of accident, as they have been known to burn out. I might say here that it does not signify that the serial numbers contained on the shop order should always make up a machine just as it is written in the shop order. It is not very often known before the dynamo is to be shipped what it will be composed of; when it is ascertained, the name of the party and shipping number is recorded against the respective serial number.

By referring to Figures 4 and 5, we will find that Mr. F. has dynamo, No. 35, composed of field magnets, serial No. 65; armature, serial No. 85; type, 4 EE; and built under shop order No. 325. When the shipping order is returned to the office, the book-keeper also finds the serial numbers very convenient, and can always refer to this book to find the shop order under which any machine was built to make up the cost and fill out the invoice. In fact, by getting the serial number, any machine can be traced from the time the shop order was issued until the machine is mechanically dead.



## TIME-KEEPING.

**T**IME-KEEPING with the check system is a very important factor in factory management, and has been tried in various forms, and is yet in

some ways very unsatisfactory. The method that I have introduced into factories that I have organized and re-organized is as simple as complete, and requires as little or in fact less time to execute than what has come under my notice in many other places.

The Check Board is placed at the entrance of the factory with the time checks hanging thereon, the latter usually being made of brass and numbered from one upwards. Each employee has one check for his own use only, which he removes on entering the factory, and puts into a box placed near the check board.

At the time for commencing work the check board is closed, and those coming late pass through the time-keeper's office, and the time is recorded accordingly; those whose checks are placed in the box are checked up and replaced on the board by the time-keeper. The checks are removed from the board only on entering the factory. Any one who wishes to leave the factory during working hours can do so by applying to his foreman for a *pass check*, which gives his check number and time of leaving; this he leaves at the time-keeper's office on going out of the factory.

This system of checks works well, although there may be a much more complete system. Every morning the time-keepers (if there are more than one) go to the different departments allotted to them and take up the time for the previous day, which is entered in a suitable time book. Each employee is given a page, which is sufficient for one week's time,

with his check number on the top of the page. It is not deemed necessary to write the name of each man, as it is a great deal less work to enter the check number. The time is then taken from each one and the shop order number recorded as follows: A.  $\frac{5}{325}$ ,  $\frac{5}{400}$ , B.  $\frac{5}{325}$ ,  $\frac{5}{350}$ , and so on. The top figures representing the number of hours worked, the bottom figures the shop order on which he has been working. The name with the time and amount is then posted in the cost ledger, which has two columns at the right of the page, one for labor the other for material. These entries are made daily or weekly (as business may require) under their respective shop order numbers; the time is also carried from the time book to the pay roll, which is spaced for check numbers, name, number of hours worked each day, total number of hours, price per hour, and the total amount due each one named on the pay roll.

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## MATERIAL.

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THERE is nothing that requires *more* attention, and probably gets *less*, than the stock received into a concern which is to be used for manufacturing purposes. Where this negligence is found, discrepancies often arise at stock taking. It is highly im-

portant that all goods should be carefully received and properly disposed of, especially so in factories doing a large business.

All goods should be received by the receiving clerk or stock keeper and be examined; an entry should then be made of the same in a suitable receiving book; after which the goods are "in stock" and should not be removed without a *requisition* card from the foreman to draw material for a certain shop order.

The goods taken are carefully noted on the card or slip, for example, 500 lbs. of iron casting, 75 lbs. brass casting, so many bolts and screws of a given size, etc. No goods should be issued without a shop requirement, giving the shop order number from those in charge of the department.

The store-keeper has day books, in which all entries are made of goods issued on slips for the day; and it is here found a good plan to have two books for this purpose, one for Monday, Wednesday, and Friday; the other for Tuesday, Thursday, and Saturday. When the entry is made against the shop order number, the cost of each entry is also made in the store books, and we will say that Monday's book is sent to the office on Tuesday, and the entries are transferred to the cost ledger in the column for material, and each day the book-keeper exchanges books with the store-keeper, and if this system is carried out properly, we then find in the cost ledger all time and material charged to the proper shop orders, and the exact cost up to date of what the order calls for is

accurately given, the time in one column and the material in the other, they being separate, the results are easily seen.

The bills for goods when received are sent to the store-room, and are correctly checked off and returned to the main office, where they are then entered in the journal for that purpose.



## FACTORY SYMBOLS.

HAVING explained the method by which the shop order is executed from the time of its issue, together with the factory cost of what we will call the *production* side of the books, we have another very important item to be accounted for, known as the *expense* account; and in a general way, even this account has to be met by the production, but I divide this expense up into different accounts, whereby the manager can tell by a condensed statement from the book-keeper after each pay day whether the cost of any article has been excessive, and if so, where to reduce such expense.

For this purpose I have used with good results, what I call factory "symbols." In other words, each expense account should have a different letter as a standing order to which all time and material can be

charged, and by referring to the cost ledger (where these accounts are also entered), you can tell at any time how much money has been paid out for each item.

These symbols can be used in any business, but I will confine myself to the mechanical or engineering industries, and give below some items which are considered expense accounts, but can be carried still further, if found desirable, to know what any particular branch of the business (not being considered as production) costs.

As for example, let the following letters be standing symbols for the different accounts, named :

- A*, Factory furniture.
- B*, Tools bought or manufactured.
- C*, Repairing tools.
- D*, Experiments.
- E*, Pattern-making.
- F*, Draughting-room.
- G*, Office.

*A* is charged with benches, drawers, tool closets, store-room fixtures, etc. All tools bought are received by the store-keeper, who issues the same on a requirement slip and charges to *B*. Any tool manufactured on a shop order is also passed through the store-room and charged to *B*.

Repairing tools run up quite an account for time and material, and it is worth knowing what they cost at the end of the year.

In most factories experimenting is carried on more or less, and is a very expensive department, but this expense can be kept separate from other accounts by charging to *D*.

Pattern-making is looked upon as one of the greatest of necessary evils, and should have its own private account; and by putting all labor and material under the proper symbol, we find the valuation for the patterns at the time when it is wanted, by making a reasonable reduction for depreciation.

The same scheme of symbols answers equally as well for the draughting department; but in case patterns or drawings are made on a shop order for any special party, the same is charged for and put to the production account. It is also well that every firm should know what it costs for labor, stationery, etc., to run the office, so that by giving this department a separate account, the cost can be readily found at the end of the month. It will thus be clearly seen that the expense account of the factory can be sub-divided as may be found necessary.



## ABSTRACT OF PAY ROLL.

THIS is a phase of office work, which goes to complete the factory books that have been described and shows the disbursement of each pay

roll, and has been appreciated by the general management of several corporations.

The sheets (or if in book form) is spaced off for check numbers of employees and total amount each has received for the week ending a given date. Then follow spaces for each symbol and shop order numbers, which are placed at the top of each space, and the amounts charged to each symbol or shop order, which is found in the time book, is placed in the space to which the time is to be charged. For example: If *A* puts in five hours on shop order No. 325, at twenty-five (25) cents per hour, the amount would be \$1.25. This amount is placed in the space under 325, and if he has put in three hours to *C*, at twenty-five (25) cents per hour, it would be seventy-five (75) cents; this amount is placed in the space under *C*, and when we have distributed the amounts paid to *A* in the spaces from right to left, the sum total should correspond with the amount in the space for that purpose next to his check number; and after entering each man's time as found in the time-book. In this way the amount paid out for each symbol or shop order is added up and placed at the bottom of the page. Then at the bottom of the page is found the total amount of the pay roll, and the sum total in each space from right to left should correspond with the pay roll; the abstract when complete, also verifies the correctness of the amount paid out for wages for each week, as well as giving the amount paid for production and the expense account.

ABSTRACT OF PAY ROLL, JULY - AUGUST, 1890.

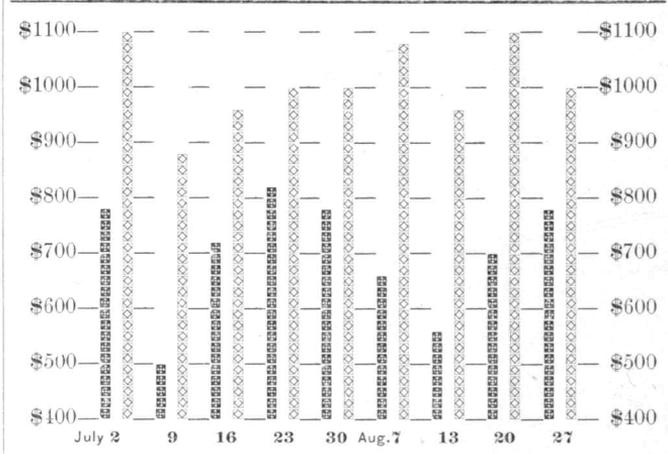


FIGURE 6.

To illustrate, suppose I imagine the pay roll for July 2, 1890, to be \$1880.00, as shown by the two lines in Fig. 6, over that date, of which \$1100.00 was paid for production, and \$780.00 paid to expense account, and by referring to the abstract, we find the following statement:

Production . . . . .	\$1100.00
Factory Furniture . . . . .	135.00
Tools Bt. & Mfg. . . . .	100.00
Repairing Tools . . . . .	75.00
Experiments . . . . .	175.00
Patterns . . . . .	150.00
Draughting . . . . .	120.00
Office . . . . .	25.00
	<hr/>
	\$1880.00

From the above statement, it will be found that there was for the week ending July 2, 1890, paid out in wages for production \$1100.00, and for the other accounts which we will call expense, \$780.00, the total being \$1880.00. Now then to show the difference between the production and expense accounts, I have made out the diagram Fig. 6, which gives at a glance the desired information by weeks and months, instead of having to look up the abstract statements, always remembering that the lines on the right over each week represent production, and the line on the left, expense.



## SHOP RULES.

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I HAVE seen in some mechanical papers, objections to factory rules, the argument being that good and faithful mechanics do not require such rules. I object to them myself, in a general way; but I certainly think that a few reminders are not amiss as guide for both officers and men. I submit the following, which, by the way, have never been objected to, but have been adopted in several factories since they were first printed. They are as follows:

---

## FACTORY RULES.

---

1. THE working hours of this company are from 7 A. M. to 12 M., and from 1 P. M. to 6 P. M., except Saturdays, which will be from 7 A. M. to 12 M., and from 1 P. M. to 5 P. M.

2. Each employee is furnished with a time check, which is numbered, for his individual use.

3. Each employee, on entering the factory, will remove his time check from a suitable board, which is placed at the factory entrance.

4. Employees coming late will report to the time-keeper.

5. Any one wishing leave of absence must notify his foreman.

6. Any employee absent for more than two days without reporting himself to the office, may consider himself discharged.

7. Employees are forbidden to wash up before closing time.

8. No employee is allowed in any department other than that in which he belongs, except he is sent by his foreman.

9. No material will be issued from the stores without a "Shop Requirement" slip from those in charge of departments.

10. All material drawn from the stores must be charged to the proper "Shop Order."

11. Employees working on contract work will share in the profits on same *pro rata* with the contractor (subject to change.)

12. Over-time will be paid for at the following rates: From 6 P. M. to 10 P. M., day time; 10 P. M. to 6 A. M., time and a half; and for Sundays, time and a half.

13. Smoking during working hours is strictly forbidden.

