RULES OF MANAGEMENT

WILLIAM LODGE

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WITH PRACTICAL INSTRUCTIONS ON MACHINE BUILDING

BY

WILLIAM LODGE

PRESIDENT OF THE LODGE AND SHIPLEY MACHINE TOOL CO.

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PUBLISHER'S NOTE

The author of this book is so widely known in the machine building trade as to need no introduction. However, in view of the usefulness of his suggestions in all lines of manufacturing, it seems wise to give the reader a brief outline of the extended experience and marked success of Mr. Lodge's career.

Wm. Lodge was born in Leeds, England, in 1848, a son of George Lodge, a skilled mechanic in the textile industry. He attended the common schools until at the age of 17 he became an apprentice at the machine shops of Fairburn & Co., of Leeds, where his term of indenture covered four years. He then came to the United States and resided in Philadelphia until 1872, when he went to Cincinnati, and shortly afterward became foreman in the shops of Steptoe, McFarland, Nottingham & Co. The senior member of the firm, John Steptoe, was the first machine-tool manufacturer west of the Alleghenies. After eight years with this concern, Mr. Lodge entered into partnership with Wm. Barker, and they conducted a successful business in the manufacture of machine tools under the firm name of Lodge, Barker & Co. In 1886 Mr. Barker disposed of his interest to Charles Davis and the company was reorganized under the name of Lodge & Davis. Six years later, 1892, Mr. Lodge withdrew from the firm and the same year organized the Ohio Machine Tool Co., the organization being continued until 1893, when he became associated with Murray Shipley, and the present company was incorporated under the name of the Lodge, Shipley Machine Tool Co., of which Mr. Lodge is president.

FOREWORD[1]

The subject of Management is a big one. Some of us grasp its meaning one way and some another; all of us apply our interpretation of it with more or less success. Those of us who have to do with its practical application realize certain experiences that differ radically because of the differences in our conception of the principles which are involved in it. My principles may be very different from each of yours, and may be subject to the criticism and argument of each of you.

Let me ask those of you who have more or less to do with practical management to consider for a few moments your own experience, together with the experiences of others that have come under your notice during the time that you have been in business, but particularly during the last ten years. Within this time the system of management of industrial establishments has changed very materially from

[1] Extract from an address by the author before the Efficiency Society, January, 1913.

what may be termed the individual type to the corporate, involving in many cases the acquiring of a number of companies and the amalgamating of them under one management. Frequently the men who built up each of the original separate companies have left them, voluntarily or otherwise, and have been superseded by others more or less unfamiliar with their conditions. Under such circumstances the new company no longer enjoys the benefit of the intimate experience with and knowledge of the affairs of the old companies that these men had. This has generally been a great loss and a source of considerable embarrassment to the new company, and has created the necessity for a different type of management.

But whether management is of one form or another, ultimately the manager must be the man who is responsible for the success or failure of the enterprise. He cannot shift the blame of failure upon others; others cannot claim the credit of success. It may be said that success or failure will depend upon the way some of the manager's subordinates perform their duties, and that is true; but it finally devolves upon the

manager to see that his subordinates perform their duties in such a way that their efforts coördinate in order to bring about a successful issue to the plans he has made.

Then again there is another situation which confronts every one of us sooner or later. Every manager who has had charge of an industrial establishment for a great many years finally begins to see that his hair is getting gray, that it will not be many years before it will be necessary to hand over the management of his business to someone else, and makes preparation for that end. Sometimes the man at the head of the concern is desirous of taking life easier and delegates his authority, with verbal instructions usually, to the men with whom he has surrounded himself and in whom he has confidence, and he must give them proper instructions so as to secure this coördination.

Sometimes this is difficult to do. In the first place there is no school where men are taught to be credit men, or financial experts, or advertising specialists, or salesmen, or purchasing agents, or superintendents and foremen of production. So the manager has

either to go out into the market and hire men who have had self-made experience in these fields, or he must start with fresh material and educate them himself.

Now suppose he adopts the first method. Usually the first thing the new managers, or the men who have filled the various subordinate positions in the past, do, is to go to the men who hold the purse strings and say, "It is necessary that we get more equipment at this point and better equipment at that point, and an addition to a building must be made here, a new building erected there," etc., and because it is supposed that these men know what they are talking about, these demands are met. The new equipment is obtained; the buildings erected, and then results such as would ordinarily be expected as obtainable are looked for; but surprises and disappointments come instead.

The improved equipment which has been added by the new management does not realize anything like the amount of earnings, in percentage of capital invested, that the old equipment did when the industry was younger. The new management are astonished about it,

wonder why it is, and they begin to inquire and say "Why can we not earn as much money in percentage of capital invested now, when our equipment in jigs and tools, machinery, buildings and organization, etc., is far better than it used to be," and they go back to the books and say "There must be some mistake here, let us look over the accounts." They examine the statement from end to end and find there is no mistake; that although more capital is invested in the business the earnings do not materialize.

Somebody who can diagnose the trouble and apply a remedy must get on the job at this point or the enterprise will die. If the man who built up the business still has enough interest in it, enough energy and good health to take hold again himself, as he did when he was younger, in the endeavor to ferret out where the trouble lies, it is possible that it may be found and the remedy applied. It is probable, however, that by this time the conditions would be so strange to him that he could be of little assistance. What would probably be needed would be a man informed in modern methods of management, with a sufficiently wide experience to recognize the new conditions, who

would see that new methods must be introduced to meet them, and who could instruct the working force in those methods, so that they could be applied. Such men are now becoming available. They are the Efficiency Engineers.

In my own case when I decided to relinquish the reins of my business and let a younger generation take up the management, I realized what would probably happen if I simply handed them over to others who had never learned how to drive, so I endeavored to see what I could do to prevent the immediate development of a new set of conditions with which the organization I had built up would not be able to cope. I commenced to teach them how to handle things just as they were. In carrying out my plan the following record of personal experience, put in the form of rules and comment, was written to give information to the succeeding manager of the shops of the Lodge & Shipley Machine Tool Co. It is the result of an endeavor to give him, in permanent, written form, a knowledge of facts and a scheme of organization that will enable him to carry on his work with the feeling that he is on a sure footing on the ground over which he must

travel. It is hoped, however, that these instructions may be found applicable and beneficial in many lines of machine building, and may aid in continuing the rapid progress that is now with us.

In this record, the duties and work of each department are outlined in some detail. This extends from the general manager of the shop down to janitors and watchmen.

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RULES OF MANAGEMENT

I

The Exceptional Employee

THE most valuable acquisition to business that an employer can obtain is the exceptional young man. There is no bargain so fruitful.

By the exceptional young man is meant the one who is always looking out for his employer's interest, the young man who keeps his eyes open, who is always trying to make suggestions for improvements in the business, who is always studying for something better, simpler, more efficient ways of doing things.

Never before was there such a demand for the exceptional, the resourceful man, the man who can think, who can devise new and original ways of doing things, the man who can grasp the needs of the situation and solve them with his own resourcefulness.

Napoleon said that his soldiers fought so well because every man carried a field marshal's

baton in his knapsack. In other words, every man in Napoleon's army *expected advancement and was prepared for it.*

The principle of advancement, of growth, of progress, is the same whether in employer or employee. Business grows because of enterprising, progressive, pushing, up-to-date methods. Promotion for the employee requires the same pushing, vigorous, alert methods.

If you want to be advanced, you must be dead in earnest, and enthusiastic over your employer's business. You must go to the bottom of it; study it, get a comprehensive view of it; know just as much about it as possible. If you intend to take up the same line of business yourself, your present opportunity of observation and study will be of untold value to you. At present you are really an apprentice, being well paid for your work, besides having the opportunity to learn the business.

When your employer finds that you have a lot of enterprise, that you are trying to learn as much about his business as he himself knows, he will begin to think that you are made of promotion material. But if he sees that your

ambition is just to get your salary and have as easy a time as you can, you will never attract his attention, except for a possible discharge. An employer wants no dead-wood around him. He wants live wires. He wants employees who have ambition enough to be willing to pay the price for promotion.

The first thing the successful employee must realize is that he is really working for himself. Every bit of work he does heartily, honestly, thoroughly, is developing his own capacity, making him a bigger, broader, more capable man. If he robs his employer of time or energy, he is robbing himself more, because he is practising dishonesty, and cultivating a weakness that will slowly undermine his character and destroy his reputation for trustworthiness.

The men who have done great things in the world have been prodigious workers, particularly during the time when they were struggling to establish themselves in life.

Young men who are sticklers for hours, who are afraid of working overtime, who want to leave the office on the minute or a little before, who are always a little late in the morning, or

who take their employer's time for their own personal uses—such employees never get very far.

If *YOU* want to be something more than the average worker, you must do something more than average work. If you expect to become an important figure in the world of commerce, a captain of industry, instead of a common soldier in the ranks of labor, you must put your shoulder to the wheel and push, and push hard.

It is astonishing how many young men are trying to get a living without hard work. It does not seem possible that so many people could live off one another without really producing anything themselves. Everywhere we see young men looking for easy places, short hours, and the least possible work for the greatest possible salary.

Even if it were possible to get a living with a very little effort, you could not afford it. You could not afford to coin your brain into dollars, to make dollar-chasing the ambition of your life. There ought to be something larger in you than that. There is something in you that will not be satisfied with this sort

of a life, something that will protest against selling yourself so cheaply. You cannot respect yourself unless you are doing your best, making your greatest effort to bring out the best thing in you.

II

The General Manager

THIS official of any manufacturing corporation should not try to perform personally the duties of his office and those of every other official in the plant. The duties of the latter are set forth in the following brief instructions, but the general manager must know that each one thoroughly and continuously performs his own work, in keeping with his instructions. Everyone in the organization should keep a copy of his instructions before him. The exceptional man scarcely needs to be reminded of them, for he will do more work than they call for. But some day such a man will be wanted higher up, and when he is promoted, the instructions stay with the job and must govern the man who takes up the work.

The 30 or 40 men in the organization, for whom these instructions are written, grade from the exceptional man down. It takes

years of care and study to fit each one for his place. The teaching and training to bring about this fitness must be carefully done, and then as much care must be exercised to keep him there and keep him satisfied. It is largely through correspondence that we keep in touch with the outside world. Thus the man who handles this needs to use particular care that the good qualities of the product are brought to the attention of customers.

No former or prospective customer should have cause to complain of being unable to obtain, in reply to his first request, full and complete information. Every complaint that comes in, whether through the mail, by telephone, or telegraph, should be seen and acted upon by the general manager. If it should happen that any of the following instructions are not clear enough to fix responsibility, they must at once be changed so that their meaning is unequivocal.

The general manager should call and preside at a meeting, held once a week, if only for a half hour, to include the assistant manager, chief engineer, superintendent of manufacture and superintendent of assembly. Each one of

these will have learned of some matter during the preceding week, which should be brought to the knowledge of all. To see and do every day the things that all other executives miss will keep the general manager well occupied.

In addition to all complaints, all orders should be called to his attention. His own judgment will tell him which of these he will need to take up in person. He should make it an especial point to see what is being done in the drawing room every day. It is exceedingly important that incorrect drawings should not find their way into the shop. Drawing-room mistakes are very costly in the shop.

He must keep the shop supplied with new blood and new men from our own University of Cincinnati, our city high schools, Pratt Institute, the Worcester Polytechnic Institute, the Massachusetts Institute of Technology, and other engineering colleges. With proper shop training and experience, such men are of great value in a manufacturing organization.

Particular care must be exercised in changes of design. He should look beyond the reasons presented, and particularly look into what is ordered. This is especially true of the work in

the toolroom, in the special manufacturing department, and of all the work under the charge of the superintendent of manufacture. He cannot use too much care or effort to keep the inspection in A1 shape. To help in performing this general inspection work with sureness, the instructions to all other departments should be read over by him until he is thoroughly acquainted with them. Such a knowledge of them will save many a shop journey.

He should study carefully all so-called non-production departments, including the pattern-making department and the toolroom, and remember also that the superintendent of manufacture will need much of his attention and best assistance. The superintendent of assembly must be capable of handling foremen and helping them in the niceties of the work in their various departments. He must have the ability to keep work moving through.

Everything in the nature of shop politics that is harmful to the company should be eliminated. The assistant manager should be cultivated and guided where necessary. There must be a capable understudy for every important position. He should keep building up the organi-

zation along permanent lines and be careful about tearing down. The assistant to the superintendent of manufacture should be an especially capable understudy, and able to fill the place, should occasion arise.

The chief engineer should go the entire journey of his own work, seeing the end clearly himself, and also the importance of making every item clear to the men who follow him. (The general manager should note this particularly.) He should be prolific in ideas, but exercise great care in making changes in designs, and still greater care in establishing the means to serve the end for which it was designed. When this means has been successfully obtained, he should not change. It is ruinous in cost and prevents economy in manufacturing. Never use two pieces where one will serve; but when designing the one piece, be sure that it can be manufactured in an inexpensive and successful manner.

The man in charge of the drawing room should be an expert on machine-tool design, as well as a capable foreman. This calls for a capable man. The modern machine tool is a highly organized machine, and in its design calls for a knowledge

of all kinds of engineering and mechanical work. The drafting department is one that always needs the assistance of the executives. It is important that in this room there should be a thoroughly competent checker, through whose hands every item of design must pass.

Good men must be kept in the cost, the tracing and routing departments. The latter should have thorough, continuous study, for it is capable of progressive improvement. Definite standards of performance are always necessary; thus, a list of machines to be produced for a month, scheduled for as long a period in the future as possible, should be prepared and given to everyone concerned. This might be made out something as follows:

Number of lathes to be delivered each month	Size of lathe
40	14 in.
40	16 in.
30	18 in.

This, of course, is to be extended for the entire line of machines produced. The general manager should work diligently, earnestly and continually to better and improve the *esprit de corps* of his organization. Whenever the fore-

man of any department is not a big enough man to handle his work successfully, he should be replaced as soon as the right man is found. It is not out of place to emphasize again that understudies must be present in all departments, so that the place of any important man may be filled at any time and for any cause.

In regard to his own qualifications and attitude toward his work: The general manager should not make the far too common mistake of failing to fit himself for the position. Men frequently accept managerial positions without having any adequate conception as to how little fitted they are to fill such a responsible position. They seemingly hope to get along by simply having the title. Such men lack the first requisite, namely, initiative, or the ability to at once see what is wanted, and then bring their experience to bear upon it with confidence in their own judgment. Iniative selects that part of the work to be attacked first, where intelligent effort will do the most good.

Let us outline the experience and qualifications of a man fitted for the position of manager in a large machine-tool shop, and then trace the method by which he should take up his

new duties and responsibilities. Such experience might be first a technical education, then a regular machine-shop apprenticeship, followed by four years of work as a journeyman in some one of the best machine-tool shops in the world, then four years as foreman, in charge of a toolroom in one of the best gasoline-engine factories in this country, followed by six years as general manager of a large machine manufacturing company. Proofs of this experience, a pleasing personality, and good recommendations from former employers would be sufficient to qualify a man for the position of general manager, such as we are discussing.

In order that he may have full knowledge of every department of the plant he is to handle, and how it is organized and officered, a set of written instructions, such as these, is given to him for his information. In addition to this, the routine of work, from its conception to its finish, in the different departments, is given. Following these preliminaries, the following simple method will assist wonderfully in helping him to be at home in his new position in a short time.

Any live, going machine-making concern has

on its books orders in all stages of completion. The new manager being well posted in machine making in all its branches, will make headway by taking a list of all orders, with their promised dates of delivery, to see if any are overdue, and if so, what is needed to complete them, and assist immediately in getting them completed, then take the next most urgent orders in like manner and so on, until all of the details are well in hand. In two weeks this work will put the new manager in contact with every department and every executive in the establishment.

While getting this experience, he will have come in touch with any lame spots in the organization, and begin in a small way to better conditions in every department, in so far as they need his help. If he has initiative, his vision will enlarge with his new experience. He will see what is needed and soon begin to really improve the quality of the work.

When all this has been properly cared for, if he has ambition to increase the output, he will next get from the cost department a statement as to what each department is capable of producing. Then he can add or increase

such departments as have the least relative capacity, in order to bring about the needed balance. This process can be continued throughout the plant.

It is unwise, and may be ruinously expensive, to upset any department by making drastic changes too soon. It is far better to obtain both better quality and greater output by getting the limit from a department as it stands. This will frequently change the manager's viewpoint, as to what additional equipment may be required, and may, on the other hand, result in consolidating one department with another. This is the course of speeding up, as opposed to getting swamped with too much equipment.

Finally, the general manager must be very strict with the foremen, in regard to the matter of frequent changes of men. Too frequent changes prevent an up-to-date condition, and the building up of a well-posted set of men. Each foreman must be exceedingly explicit in giving out work to his men, especially such work as they are not thoroughly acquainted with. He must require them to repeat back to him the instructions given, and get them to state

how they will do the work, at the same time putting into their hands every facility for doing it well and quickly, and thus avoid spoiled work and lost time.

III

Assistant Manager

YOUR first duty is to see that the head of every department carries out his written instructions, and to show him, should occasion arise, that upon the more or less efficient manner in which instructions are carried out depends his future advancement in pay and position. Study all orders as they are received, give delivery to the order department on them, and especially where they have any special features. Keep in touch with the drawing room, pattern room, toolroom, cost department and purchasing department, until the job is on its way in the shop. Then keep in touch with the head tracer to see that work does not lag and that our promised delivery is kept.

Observe whether the office routine blocks the movement of orders in any way and whether the handling of the orders through the drawing

room is right. Observe, too, if the method can be improved upon. All this, of course, with the consent of the head of the department. See that all materials are of the right quality for the work the parts have to do and that all items required in the construction of the various orders are in the raw stockroom. If not, a special effort should be made to have them there in advance of the time they are wanted by the first operation department.

Keep in close touch with the pattern shop, carpenter shop, storekeepers, sweepers, porters, painters, pipe fitters, engineers, firemen, electricians and the shop fire department. See that engineers clean the boilers every two months with mechanical cleaner and report immediately when coal or oil is not up to the standard of quality. Prepare samples of coal and oil for analysis every three months.

See that electricians blow out generators and motors every two weeks, and clean out every electric hoist once every six months even to taking grease out of the gear box. Arc lamps must be properly trimmed and cleaned and incandescent lamps must be protected by wire guards and kept clean. Keep in touch

with all late-comers, absentees and those who fail to ring in; also take note of any production department in which numerous changes of help take place. Discover the trouble if possible and supply the remedy.

See that each department has its full quota of men and *no more*. Supervise the cost department and storeroom. Lay out a fixed number of machines for erectors to finish each week and name them. Issue orders to the chief storekeeper for all stock orders to go through the shop, and regulate their sequence, always bearing in mind that all sizes of lathe groups are on hand for assemblers to draw from, and not too many of the sizes that *do not sell well.*

Keep check on all defective and spoiled work to see that it is properly charged back and returned by the receiving departments and stores and purchasing departments at the end of each month. Check the monthly report from the storeroom, of incoming and outgoing material. Also check the monthly report of the cost of sales of the previous month, as compiled by the cost department. These two reports should be out by the fifth

of each month. Send daily reports to the Metal Trades Association of all persons entering and leaving our employment. Keep records of all accidents to employees and have them reported to the insurance company.

Observe particularly that simple repair orders are not delayed through red tape. For instance, an order for a steady-rest, compound, full-swing, taper attachment, apron parts of any date, sliding tumbler, or in fact all repairs, should be classified as to date of design, pattern, style, etc., and kept on hand in a quantity to suit the demand, this demand to be determined by the number of orders received during the last six months. In fact, these could be kept on hand finished. Many of them are so trifling that the cost of keeping them is hardly to be considered. They are too costly, however, to put through alone.

See that the routing department allows 30 minutes for setting-up for all pieces six in number or less. See that all heads of departments assist in moving their production toward the store department. Also see that the fire drill is practised not less than once a month and that all armatures and brushes on motors

for shop use are in apple-pie order as to cleanliness and smooth, even surfaces upon which the brushes operate. Also inspect the general shop orderliness.

Keep a *daily running* list of *all* hourly rates except the office payroll, and have the time department show you every hourly rate set. Keep in daily touch with the premium earned, by whom and for what. Large premiums are only due where the job shows they were increased month by month and through long periods of time. When the earnings are large on the first performance of the work, a mistake has been made in the first setting. The incoming-material department, for erection work, will need the coöperation of the cost department, and for spoiled work that of the purchasing department.

On receiving the weekly production report from the man in charge of moving the work, check it over carefully and determine whether the machines specified will be finished. If not, notice must be given at once so that the customer can be advised of the delay, thereby obviating unnecessary correspondence.

Whenever a piece is changed or canceled,

the drawing department must notify the cost department in writing, to be filed with the corresponding parts list, and the cost department in turn must notify the tracing department to recall both the ticket and the premium tickets for that particular piece. The pieces, with the ticket attached, must be delivered to the storeroom and the premium tickets to the cost department. Foremen must examine the work coming into their departments and see that it corresponds to the material called for on the attached shop-order ticket.

The premium ticket should, where possible, remain with the work until the inspector has O.K'd the quality of the work. These tickets are to be signed by the inspector and turned into the cost department. No changes are to be made on any premium ticket without consulting the cost department. No premium will be paid on any ticket where this rule has been violated. Eliminate wherever possible the use of continuation and helper's tickets. Receive the report of the man in charge of the assembling as to whether his requirements are being thoroughly met by the stores department.

When you find yourself unable to carry out all the items of work that seem to belong to the successful operation of any one department, it is suggested that you adopt the plan of investing the man in charge of the delinquent department with a little more responsibility. If he cannot carry it, perhaps some of his subordinates can. Good men are occasionally discovered by this method.

When you satisfy yourself that any man in charge of a department has no interest in it beyond his pay, or the ending of the day, try to correct his point of view. If this cannot be done look around for someone to replace him and in order that his department may not be forgotten place over it the sign □▽L +. Interpreted this means: □ needs to improve; ▽ should be replaced; L this department needs an assistant; + double up with some other department, etc. Keep careful watch on the sneak, the fourflusher, the man who tells tales, and particularly on anyone making a false statement, through laziness or indifference, or because he is a liar. Fire such men; they only do harm.

IV

Chief Engineer and Designer

THE chief engineer and designer shall design all new machines, attachments therefor, and all special appliances for orders that carry with them guarantees of time or production. The engineering work of the plant, covering the power, sprinkler system, labor-saving appliances for expediting the movement of work, etc., shall also be designed by him.

His decision is final on designs, but the superintendent of manufacture must, at all times, be consulted where modifications in designs are necessary to shop economies. He must also listen to suggestions from the man in charge of the pattern shop and the head of the toolroom force.

He shall be called upon by the selling department when information on questions of performance of product are requested in their daily mail, should the man in charge of the

correspondence not have sufficient knowledge to answer them safely. He should also see the first machine of any new design thoroughly tested as to the work it must perform before leaving the shop, and insist that no part is passed upon and shipped if in any way incomplete as to strength, ease of handling, and thorough adaptability for top-notch performance of the work it is designed for and sold to do.

When a report from the user of the tools makes expense necessary and the fault is ours, the engineer must either assume responsibility or fix it on the department head at fault. The general manager shall then take the matter up with the responsible party. He shall do everything possible to assist the drawing room to establish every economy of operation and consult the manager when any new equipment is found advisable in the drawing room. He shall keep well posted on the text and advertising pages of technical journals, regarding up-to-date drawing-room practice as well as improvements in our line.

Designs must be complete as to all important details before going to the drawing room.

Patterns must be examined before going to the foundry so as to catch and correct any ruinous weakness before castings, forgings, etc., are made. It is also the chief engineer's duty to pass upon the purchase of new machinery and equipment when the need of this is advocated by various department heads. He must listen to all suggestions from department heads and in fact all employees, and when such suggestions are considered of value, use them, or if thought advisable, bring them up in meeting.

It is his further duty to make mechanical tests of the various types of machines manufactured by the company. These tests shall include horse-power consumption, the cutting tools used, frictional losses, and all items covering the general efficiency of the tools. These data should be tabulated and kept for permanent records.

V

Drawing Room

THE man in charge of this department must be responsible for prompt delivery to the routing departments of every repair order coming to it, the same day that the order appears in the drawing room. If the order deals with special work, the drawing room must advise the special department how many hours or days it will require to deliver the drawing for the order to the routing department.

If the order deals with new transient work, the drawing-room superintendent and assistant must advise the correspondence department how soon it can be delivered to the pattern shop, the time to be based on the present work in the drawing room, men available, and the hours of performance. It must then be delivered in accordance with the time given.

Separate filing places, for repairs, transient

new work, and permanent manufacture should be provided for and *rigidly* kept. Transient drawings and even sketches should be provided with filing facilities that will make them instantly procurable when needed. These should be divided and subdivided in the index under different headings such as repairs, transient, crankshaft, stud work, etc., this to include devices to turn pipe rolls, small and large blank gear jobs, pulley jobs, armature shafts, crankshafts of different throws, in inches, in number of throws, in diameter size, in length, also the special equipment used in each case.

The tracing of drawings should be assigned to girls, if deemed wise, and a separate room can be provided accessible only to the head draftsman, his assistant, and the filing clerk. An aide for this blueprinting, and possibly filing, may relieve the head draftsman and assistant to whatever extent may be deemed wise; this same aide being responsible for the delivery and time promised on repairs and transients.

When a call for the man in charge comes from the shop he should demand to be told on

what business; then if the subordinate will answer, send him in response. Both chief and assistant should keep thoroughly posted on up-to-date practice, as published in the technical journals and index the good things or put them in a scrap-book. If drawings that cause great expense by reason of mistakes in either design or lack of care are delivered to the shop, the greatest fuss possible must be made by the man in charge.

When the man in charge decides that anyone in his department is either indifferent or lazy, discharge him or her at once. Keep a strict eye on this and eliminate continually until a reliable force is obtained. Never discharge a person until after careful consideration, it is decided that such discharge is warranted.

New orders for repairs and specials must receive *instant* attention, and the one who deals with them must be trained to understand and carry out their delivery to the routing department the same day they are received, even if additional help must be used now and then.

You are at liberty to inquire of the manager or assistant manager at all times the routing

order of routine or new work. An order has been given and posted in the stenographers' room that the number of all drawings sent out shall be written in the letter pertaining to them.

VI

Purchasing Agent

THE purchasing agent must look after all new building contracts and the maintenance of plant and buildings. He is invested with the purchase of all material, small tools, supplies, etc., and must look after all purchases until they are received. It is his further duty to see that all material that is short is obtained as promptly as possible. When the requisition is handed in by the storeroom or shop foremen, he must look up purchases for the previous six months and then determine whether by buying in quantity a better price can be obtained. This should be done for all items.

He must audit all invoices as soon as material is received; keep check on all defective and spoiled material, and see that it is charged back monthly to the proper party by the receiving and stores departments; tabulate all material

received according to classification; check off the storeroom report each month for inventory purposes and see that the incoming-material report balances with the cashier's report.

He is further required to maintain a perpetual inventory of all material charged to the storeroom; make up raw-material prices for use each month by the cost, stores and statistical departments; see that all equipment for machines to be supplied to the customer is in the shop in time to keep the promised delivery; keep up-to-date catalog files for general reference purposes, issue orders to the shop for all work for stock machines; send samples of drilling of all steel bars received to the chemist in order to see that the shipment comes up to contract specifications; receive the report of lathe beds on hand each Monday and make up an order from this on the basis of four months' requirements, as shown by the sales of previous years.

When a good article used in construction, such as steel, bronze, paint, etc., is found do not change unless for exceptionally good reasons. Particularly, do not allow the price alone to be the cause of changing. This also applies to

all shop supplies. Be courteous in your treatment of all salesmen; some day you may be one yourself.

Be fair and just in all deals. Use your knowledge of prices if you think it advantageous, but never disclose names. The man receiving such information from you will always make use of it to your disadvantage. Should a salesman sell you goods at a loss through error in figures, and later come and tell you of it, allow him to change his price, after you have satisfied yourself as to what the right price is. By granting him this favor, you make a good friend.

The attitude of the executives in the shop toward you will, in a large measure, be a reflection of your attitude toward them. When quick action is required of you to get material, give it the very best attention you know how; for lack of material to complete a job means a halt in the system, consequently a loss of time—and time is the equivalent of dollars.

VII

Incoming Material and Stores Department

THE man in charge of this department shall have charge of all help used in connection therewith. He shall be responsible for the delivery, in the department where delivery is wanted, of every item needed, either for routing special or repair parts. This shall include all steels bought cut to length, or cut from the bar, and all castings either in iron, steel, bronze or aluminum.

He must, therefore, keep in exceedingly close touch with the purchasing and routing departments. He must instantly report to the assistant manager when parts are unobtainable, putting this information in writing and giving the date when ordered. A duplicate of this should be made so that the assistant manager may see at once where the fault lies. He must get his order O.K'd by the party

receiving it in the purchasing department. He shall have general supervision of the stores department and of incoming and outgoing stores. This includes both rough and finished material and parts; also assembled machine groups awaiting setting up into larger groups and finished machines.

When accommodation is lacking in the stores department he shall see the assistant manager as to ways and means, and consult him also as to rates paid all help in his department. He must check up all standard parts. If all the material is in the first operation department and the order has no special attachment, it can be marked O.K. and filed.

If the order has a special attachment and no parts are in stock, he must immediately visit the drawing room and see that drawings are made and delivered in order that the promised delivery be kept. The speed at which the job passes through the drawing room determines the date of delivery of the order.

After drawings have been issued, he will see that the patterns are promptly started upon, seeing the head of the pattern department in

regard to delivery. By using good judgment in getting patterns started before all drawings are out of the drawing room, much time can be saved. He should give preference to the parts that have the most work on them in the pattern shop and foundry. The pattern shop should always get out the most difficult pieces first, leaving the small jobs for later, in order to give the foundry ample time to make good connection.

When all drawings are out it will be necessary to follow up the routing department to see that the job is routed. The cost department must then get out tickets and deliver them to the receiving department, so that when castings and all material are received, the tickets can be instantly attached and the parts moved to the first operation department.

As soon as the first pattern is completed it must not be allowed to lie around the pattern shop waiting for the remaining patterns, if there are any, but should immediately be sent to the foundry and a delivery obtained from the man in charge, who should be held responsible for the delivery. After castings are completed, close watch must be kept that they

are loaded on the first wagon that delivers castings to the shop, otherwise they are likely to be sidetracked for days, as past experience proves.

Nine-tenths of the special castings should be put through the foundry in from one to three days. It is very important that the man in charge of the material and stores department visit the foundry every day, if necessary, to look after castings that are in a hurry. He should keep close watch on the foundry to see that hurry orders are expedited, otherwise castings which are plain heavy pieces and which are not wanted for months will be given the preference. Great care must be exercised in ordering lots through the foundry to see that heads, carriages, aprons, tails, cone pulleys, quadrants and gear covers are rushed through first, because of the slow headway that is made in the shop on these parts. As soon as castings are received they should immediately be cleaned and stored until all parts are received. This means *everything*.

The cutting-off department will be under the jurisdiction of the material and stores head so that he can take care of all cut-off parts,

such as steel bars and brass tubing. He will consult the purchasing department if an order requires any of the following parts which are not in stock, and keep a daily follow-up system with the purchasing department: Steel castings, brass tubing, drop forgings, pipe fittings, lead-screw stock, controller rod stock, pans, pumps, countershaft steel covers, all bought screws, nuts, washers, pins, keys, springs, oil cups, oil-hole buttons, wicks for oiling aprons and spindle journals, name plates, index plates, instruction plates, ball bearings, turrets on bed, carriage and tool post, motors, controllers, resistance boxes and all electrical attachments, triple gear head, internal gears bought from parties on outside, white metal for lathe journals and all steel bars and brass tube stock.

Forgings for orders made in our shops will come under him. After all parts are received for order, they should have a ticket attached, be loaded on trucks and sent to the first operation department.

VIII

Superintendent of Manufacture

THE superintendent of manufacture may lose thousands of dollars to the company if men or boys in any department are allowed to lose time because they have not been instructed properly in each item of work they are to perform. Such instruction is required as it breeds confidence in employees.

In order that this confidence may be present in everyone, the foreman of the department must be thoroughly posted, that he may instruct each operative under him. He must also see that the proper tools, drawings and templates are given with the job, and then inspect the beginning of the job to know that it is being done properly. The foreman must also see that men start work with the starting whistle and continue until the stopping whistle.

Ten years ago, when our equipment of machine tools, jigs and templates was not

nearly so good as now, our earnings per the amount of capital invested were greater. I believe this was due to the fact that we made a more steady use of every man and machine, besides directing each man's efforts to better advantage. Every inspector should be seen *every day*, and every minute of his time should be devoted to some piece of work; his time might profitably be divided into details.

The superintendent of manufacture should make a complete round of the entire works every morning because the work in every department is changing almost with every hour and no trip can be made that will not disclose some item upon which economy may be practised. The absence of such a daily trip keeps these items from his sight. He should make notes on the trip in the morning and see that the work covered by the notes is properly on the way in the afternoon. He must not miss this trip one single day in the year.

In making the trip the superintendent of manufacture should begin at his office in shop 1, and notice whether each and every job in this department is being done as well and as econom-

ically as possible. The polishing department, the cutting-off department and the blacksmith shop should then be visited and every operation observed, noting especially whether the men are keeping their machines well oiled, their cutting tools in first-class shape and whether the blacksmith work and the heat treatment are being done as they should be, and whether more men are being used than the work requires.

He should glance through the stockroom noting conditions there, then visit the lower floor of shop No. 2, taking the same note of every job on tailstocks and headstocks, vise work, and then look carefully through the drilling department, noting the tools, the work and the men, to see what they are making of their time. The same attention should be given to the planers, the tool storage, grinders, roughing lathes, spindle boring, turret work, engine lathes, head boring, etc.

Shop No. 2 should be visited upstairs first, taking a look around the pattern shop, the babbitt bearing department, the lathe work in the countershaft department, and through the vise work in this department. Attention

should then be turned to the toolroom. In shop 1 the drill presses and the lead-screw lathes should be observed to see if any improvement can be made there. The trip should then continue through the grinding and special departments, watching for the same improvements.

In the milling and gear-cutting departments the actual work on each machine should be inspected, together with the machine and its surroundings. It should also be noted whether the operator thoroughly knows the job upon which he is engaged. The tool storage for this department must also be inspected, and anything that needs correction, corrected. The vise benches clear to the painting should next be inspected, giving each bench as much attention as it may need.

He should examine carefully the general handling of the stores department as to economies. When going over the assembling and routine work exceptional attention should be given to the special vise and some attention to the turret, motor-drive and repair departments.

The superintendent must not fail to make note of the things to be done, so that the after-

noon may actually do what the forenoon indicates is needed. Each day a trip should be made over all the planers to see that good and economical work is produced and that the men and machines are right.

He should everywhere note any time wasted through wrong impressions of nicety or accuracy imparted to the men by the foremen. In so far as lathes are concerned, where the work must be ground after leaving the lathe, it is not necessary to work exceedingly close to size, the limit for grinding generally being understood to mean a maximum of 0.025 in. and a minimum of .010 in. Micrometers or other fine gages must not be used where not needed.

Handling men and work is one of the most important duties of the superintendent of manufacture. If any routine work is without time limits, they should be established. No change in premium allowance should be made unless the method of doing the work, or the work, departs from the vogue when the premium allowance was first set.

Any department where a low grade of labor is used is likely to fall into bad practices. Attention in this particular is called to the cut-

ting-off department, which is likely to fall into great expense on machines and cutting tools through the neglect of the superintendent of manufacture to give daily attention to the grinding and setting of tools, the speeds, feeds and temper of tools; to whether the machines are well oiled, running smoothly and the place orderly; whether the men having the grinding tools are thoroughly posted on how to grind to the best advantage, and whether one man may not do all centering and hacksaw work on flat and square stock, while two others fill orders for all round work in their line.

Spoiled work should be exhibited once a week for each department although not necessarily taken to that department for the purpose. This work should be taken up item by item with each foreman so as to lessen the number of pieces coming under this head with each exhibit. Constant watch should be kept on the patterns, and too much metal should not be removed.

The work of the superintendent of manufacture is the most important of all the work in the factory and requires constant and careful attention because of his control of every

productive man in the house. He should know that each individual is producing work of the very best quality in the minimum time in which such work should be done. In order to facilitate the movement of the work, he must assist in ways and means of stopping any unimportant job in order to get through a rush job unless he should see fit to make it in the special department.

The screw-machine department foreman should know thoroughly how to set up and start any automatic lathe, just as well as he knows how to do a piece of work in any machine that is not automatic. He should also know when all machines are running to their full efficiency.

The very nature of the work of the superintendent of manufacture will make it necessary that he be thoroughly familiar with every item in the toolroom. He has full power to handle both the foreman and the men, and as this entire department is one of expense, careful attention should be given to see that every man is economically producing work of the right character.

Painting should receive careful attention,

both as to economy and quality. Changes of paints or methods should not be permitted. In making notes of things to be done the superintendent of manufacture will encounter a number that make it necessary to consult the office; others will require a conference with the drawing room, and still others, the pattern shops and toolroom. Such items should be grouped so that when a visit to the office is made all the items may be covered. As chief of the fire department the instructions of the superintendent of manufacture include not less than one fire drill each month. He should take notes through the week so that at weekly meetings such things as need discussion may be brought up.

IX

Routing Department

THE greatest drawback to rapid movement of work through any shop is the absence of an A1 man to think over the job and the best way to do it. This should be done by the foreman of the department in which the job is placed. In the absence of a foreman with these qualifications, the production superintendent should think for him.

The main object of a routing department (which in some shops is called a planning department) is to think for the foreman and production superintendent. In starting any job through the shop this department establishes the time it should take. If only a few pieces are to be made, say six or less, it allows as many minutes to set up or prepare to do the work as in its judgment will be consumed. When larger numbers of pieces are to go through, this time allowance may be neglected.

Example: If only one piece is wanted and chucks, follower rests, taper attachment, rear tool rests, diameter or length stops, or special chasing tools, bent chasing, turning or planing tools are necessary, such as special dogs, clamps, etc., the time allowance must be made, say from 10 to 30 minutes. If 30 pieces are to be made, only one minute each need be allowed, and this time may be decreased as the number of pieces increases.

The production superintendent should be consulted on items where the department is uncertain. The department must be well informed as to time in cutting off, also whether casting cleaning is done on tonnage or time allowance per piece.

All standard work is so well known in the cost department that shop orders are made out for it without its touching the routing department except when changes have been made; therefore, only specials and new work on which time allowances have never been made come to this department, in order that this class of work may go to the cost department for shop orders to be issued.

The production superintendent should keep

close track every day on work that is changing from special to routine, and change the allowance either on that ground or on the altered methods of doing the work and because of the larger quantities in which it is done. He should also take away the setting-up allowance as soon as the number of pieces for which it is made are exceeded. Lack of care in this department on the part of its manager may cost the company and men thousands of dollars. This involves all foremen, the production superintendent, the manager and his assistant.

X

Chief Clerk

IT is the duty of the chief clerk to keep a machine record ledger showing a record of every machine from the time built to disposal and shipping. To keep a card record of all equipment of the plant, both machines and fixtures; these cards to give all data as to purchasing, cost and inventory value. To keep a card record of all repairs to equipment, both purchases and work done by ourselves. To keep a card record of the jig equipment, and in connection with this the inspection of all finished jigs at the time of completion, together with the cost.

He is further required to keep a record of the inspection of all fire equipment, valves, etc., making a weekly report. To keep a ledger for goods in process, showing the lots in process in the shop, the cost thereof and on what orders used. He must compile a monthly

statement showing the cost of all sales, repairs and gratis items, and render a report to the cashier, relieving and debiting the different accounts.

Keeping an individual record showing the cost of each machine and attachment, also on what order sold, is another of his duties. He is required to compile a monthly statement of specials sold at a loss. Re-check all prices on orders after they have been entered in the order book. Re-check the distribution on all incoming bills as to the proper account to charge. He must dispose of any parts returned, compiling the cost thereof, relieving and debiting the proper accounts.

He is invested with all work connected with inventory taking, figuring, balancing the cashier's books and the final tabulating, also all preparatory work during the year, compiling reports and statements on such special data as may be requested by the president or vice-president. Tabulating and compiling prices for new price lists when needed, and compiling the cost of all attachments over the standard equipment of the lathe and comparing them with the selling price, are among his duties.

He should pay off all foremen and shop men, paying the foremen separately. He also has the custody of all agents' contracts.

In making prices on special work or special attachments our experience once showed that the prices estimated were too low and that in very many cases we sustained a loss because the work did not go through in the estimated time. The plan adopted recently is to refer to our costs of similar articles and upon which we lost money before, when making the price on the new work. We have adopted the method of keeping records of specials by photographing them and writing on the reverse of the photograph the cost, the selling price, to whom sold, and any remarks necessary. This record aids greatly in quoting prices on special appliances without much danger of loss. We also keep an additional copy of this record for the use of the chief clerk for inventory purposes.

It is the duty of the forman in the assembly department to note on his shop order ticket any change whatever that is a departure from the standard. This is then made use of in the cost and drawing departments.

XI

Cost and Time-keeping Department

THE duties of this department are to engage all factory hands and keep their records. After hiring, the applicant is given a time register number and all necessary information relative to starting work. An employee's record card is made out and placed on file for rate. When a vacancy occurs the man responsible for hiring is notified of the rate of the previous employee and his average premium earnings per week. At the end of two weeks this employee's premium earnings are figured and a statement of his premium with that of the man holding the position previously is given to the man responsible for hiring.

The production department receives information from the assistant manager in the form of a requisition issued by the storekeeper, for parts required to complete lots as per the delivery sheet. Shop orders are made out in triplicate form. The original is retained as a

cost-department record; the first copy is sent to the drawing room, and the second copy goes to the superintendent's office. The drawing room provides the bill of material or parts list, from which are issued the traveler or shop tag, the premium and time ticket and tracer ticket. The traveler is sent to the material clerk for raw material, the premium ticket goes to the department foreman, and the tracer coupon to the tracing table.

All lots are figured from reports of finished products given to this department by a chief clerk (main office) currently. Material is figured from weight tags handed in by the material clerk. Labor cost is taken from monthly entries in the goods-in-process ledger showing wage and burden cost. All lots of components and parts are figured upon receipt of the order copy from the tracing department, showing the lot as being completed and received by the storekeeper.

The accounting department in the main office is supplied with a summary of the payroll for each month. This shows the division of the payroll and from it the burden total is calculated. The production rate and bur-

den are figured by the accounting department.

The time is automatically compiled by 13 "International" time recorders distributed in various places throughout the shop. The workman secures his time ticket from the foreman or clerk in charge and rings in both time and traveler ticket when starting an operation, and, upon completion of the operation rings out these tickets and immediately rings in tickets for his next job. These time tickets are gathered by a boy every morning and delivered to the punch clerk, who transcribes the data onto punched cards. At the end of each week these cards are balanced with the shop payroll. The balance must be absolutely correct to within a cent.

The punch clerk also transcribes the premium onto the punched cards; these cards are also balanced with the shop payroll to within a cent. The cards are then assorted into productive and nonproductive groups; the productive being filed for use in making up a monthly recapitulation to be entered in the goods-in-process ledger, after which they are filed according to their respective shop-order

numbers. The nonproductive are filed for use in making up the summary of the payroll at the end of each month, and then filed according to their respective department numbers.

The workman's premium is figured and paid each week, the premium tickets being handed over to the premium clerk by the punch clerk after all data have been transcribed onto punched cards and balanced with the payroll. The foreman's premium statements are made up each week, but are not paid until the last Saturday of the month or the first Saturday of the following month. A list of late-comers is handed to the superintendent's office each morning. This list is made up from the time clock in the time-keeping department.

Shop orders for all jigs and tools made in the shop are issued by this office in duplicate; the original is sent to the toolroom, and the duplicate retained in this office. When a jig is finished, the original comes back to the office and the cost is figured upon the duplicate, which is then handed to the chief clerk (main office) for inventory purposes. The superintendent is also supplied with a book record of all jigs and tools made in the shop.

All routing is supervised by the routing clerk in the superintendent's office. This applies principally to alterations of previous routing and also the routing of any new parts. An accurate record of through routing is kept in the cost department; also a record of the premium limits. A record of all work spoiled in the shop is kept by this office. A record of all accidents is kept and the necessary reports issued to the insurance company.

The entire shop payroll is made up by this office and handed over to the cashier on Saturday morning, complete, ready to have the money placed in the envelopes. A Metal-Trades quarterly report is made out every three months. A record is kept of each employee's check number, name, hourly rate, wage and premium earned per month, in such shape that comparisons can be made by the assistant manager at any time, showing the employee's increase in rate, increase in hourly attendance per month and his premium-earning capacity. This form is compiled so that a six months' tabulation of each man appears on the one sheet.

XII

Operation of Premium Plan

THIS plan divides the saving equally, namely, for every two hours saved the workman receives one hour extra pay at his hourly rate of wages. The company on its side furnishes him with ample facilities in power, tool steel, belts, special appliances, helpers and a sufficient number of pieces to make the earning of 50 per cent. over his daily wage an easy matter.

The method of establishing the time allowance is as follows: An expert machinist first does the work, recommending to the tool department the special appliances needed for the job and the best tools and methods. When these are made and ready, the workman is shown how to do the work and the time required. Fifty per cent. is added to this time allowance and the work started, with the understanding that if he fails to do the work in the time allowed on the second

piece he must report to the foreman, who points out why he failed. In about eight cases out of ten when this is done the operator succeeds.

When work is started on this plan the time allowance is never changed. Many men have continued without any change in ten years, and these old employees have averaged 50 per cent. over their daily wage during that time. An allowance of 30 minutes for setting-up time is made on all jobs where the number of pieces is six or less. When a larger number is wanted, no allowance is made because in ten pieces only three minutes are used on each piece, while in 100 pieces the 30 minutes are absorbed by requiring only 1/3 minute per piece. Automatic machines are seldom set up for as small a number as six, the work being done in the ordinary way.

A decided effort is made in all departments on routine work to prevent premium workers from losing time and going on day work. This is accomplished by means of a clerk in each department, where the department is big enough to employ one, whose duty it is to deliver new work before the last job is finished, assist

the man with his premium tickets, get appliances, reamers, drawings, etc., ready for him and take finished work to the inspection department.

The foreman is always ready with a helping hand. Courteous treatment of the men by foremen is always insisted upon. All machine tools are gone over once a month to see that they are accurate and capable of doing work with the greatest nicety. The foreman supplies an ample amount of well dressed cutting tools and good facilities for grinding them. Men are paid every Saturday for all work finished Thursday night.

XIII

Superintendent of Assembly

THIS department should be supervised by a man who is an all-round machinist, one who thoroughly understands good planing, lathe work, grinding, milling, gear-cutting and especially good vise work. He should have executive ability to a marked degree. In order that his department may give the best results, he must have every item necessary to complete the assembly of the entire machine ready to assemble before he gives any of it to the group assemblers.

He must have sufficient force to insist upon and compel this. This means that he must see the work and insist that unless all items needed are delivered, he cannot carry out his instructions. If the man in charge of moving the work fails to get these items to him, then to be forceful he must keep a book record of every

case (giving articles and dates) where his department has fallen down.

He must be broad enough to help the man in charge of delivering the work to the first operation department by making suggestions to him as to the cause of delay and the remedy as he sees it. He should have sufficient ability to set not only every sub-foreman right but also to show such sub-foreman where every man under him is lame, either in quality or quantity, and correct both the man and the work. He should also be able to keep full control of both sub-foremen and their help.

He should give notice every morning to the stores department as to his needs for the day, and then if anything is reported not on hand, at once notify the man in charge that these missing parts will interfere with his promises. He should then enter the item and the date in his book, in order to show the man in charge of moving the work that he is on his job. He should thoroughly know, and instruct the cranemen and truckmen in their duties in his department.

He should know every time allowance for

every man and every job. Not one piece of assembly should be made in his entire department that he is not thoroughly posted on, both as to quality and time. He should keep strict watch of machines while being run off to see whether the customer, either agent or user, can find any fault with the paint or finish, but particularly as to smoothness of operation and accuracy.

He should keep strict watch on the general assembling to see that no work is slighted, that nothing defective is passed and that no time is wasted through bad work from other departments. On receiving weekly production reports from the man in charge of moving the work, he should check them over carefully and investigate whether the machines specified will be finished. If not, notice must be given at once, so that the customer can be advised of the delay, thereby obviating unnecessary correspondence.

He should consult the assistant manager regarding the building of split lots, and also with the superintendent of manufacture on methods of doing work, tools and fixtures. All overtime work in his department should be

eliminated if possible; at least kept down to as low a point as possible.

He must look daily over the absent report and send a boy for men when urgently needed; also look up late-comers, and if they cannot be corrected, replace them. Get out and give to the assistant manager a monthly production report specifying the finishing date and then see that it is rigidly carried out. All overtime work must be avoided if possible and especial care and attention given to hiring men. Let the first questions be: For whom did you work last? How long? (If time has been short at last place, then the questioning should be) Whom did you work for before, and how long? If the man is being hired for lathe work ask him how many years' experience he had, and with whom.

All the time these questions are being asked and answered, look carefully at the man's face and if he does not impress you as straightforward and truthful, do not engage him.

It is highly important that the superintendent of assembly shall keep in harmony with the superintendent of manufacture, and if at any time a change is planned that may upset

the latter's first planning, it must not be made without first consulting him. If routine operations must be disturbed by reason of an exceptionally large sale of any one size, this department, the manufacturing department, and the assistant manager, must decide promptly what is best for the company and regulate work in accordance with their decision.

Whenever a piece is changed or canceled, the drawing department must notify the cost department in written form, to be filed with the corresponding parts list; and the cost department in turn must notify the tracing department to recall both the ticket and premium tickets. The pieces with the ticket attached are to be delivered to the storeroom, and the premium tickets to the cost department. Foremen must examine the work coming into their departments and see that it corresponds to the material called for on the attached shop-order ticket.

A premium ticket should, wherever possible, remain with the work until the inspector has O.K'd the quality of the work. These tickets are to be signed by the inspector and turned in to the cost department. No changes are

to be made on any premium ticket without consulting the cost department. No premium will be paid on any ticket where this rule has been violated. Eliminate wherever possible the use of continuation and helper's tickets.

XIV

Handling Complaints

WHEN a claim is made that a lathe does not bore straight, a good level should be used and exceeding care taken in leveling the lathe crosswise near the head, then about the middle, then at the other end. A variation of 1/32 in. in the location of the bubble will make all the difference in the world because it indicates that the weight of the lathe is not properly distributed on the feet. Out of 5,000 cases there has never been one where this did not correct the difficulty.

When a claim is made that a lathe does not turn straight, use the same leveling operation and then carefully test to see that the centers match up with each other. It should always be borne in mind that if a long piece is being turned between centers without a steady or follower rest support, the work will spring away from the tool to some extent. With

this exception there will be no question about the lathe not turning straight.

When the lathe chatters, in nine cases out of ten careful crosswise leveling will correct the trouble. It is just possible that through some special strain on a lathe, caused by bolting heavy work to it, that the wings of the carriage may spring slightly. After the lathe is level, release the carriage from the apron and gibs, take off the tool rest, turn the carriage over and paint very lightly with red lead, then rub on the ways and turn over again.

Before making this trial be sure that the lathe spindle fits the bearings properly and that there is no looseness of the bearings where it fits the headstock. Chatter will also occur if the work extends too far from the chuck, or if there is too great a distance between centers without support. An ill-fitting, home-made chuck plate will sometimes cause chatter. Ill-fitting centers are also a cause of this trouble.

In chuck work, care should be taken to see that there is no end play of the spindle. If the above does not correct the trouble

carefully note the fit of the cross-slide on the carriage, and if defective, correct. Having the cutting edge of the tool below center will cause chatter, either in the chuck or between centers. The spindle may need adjusting by drawing down the cap, also taking up end play, especially in chuck work. Bolts which hold the chuck to the chuck plate must be tight; this is very important.

See that the screws that hold the headstock to the bed are drawn down tight, and that the gibs on the compound rest and cross-slide are properly adjusted, always leaving free movement, especially when using the taper attachment. See that the lathe is level and resting firmly on all feet. Always use straight packing, not iron taper wedges, packing underneath legs for leveling; use cardboard if possible. See that the centers are a perfect fit. By holding the finger on the V's of the bed close up to the ends of the wings on the carriage you can readily detect if the carriage does not lie solid on the shears. To detect any vibration this must be tried when the lathe is running with a cut on. Pounding with the hand on the extreme ends of the carriage wings will also dis-

close any defect such as the carriage being sprung.

When using tool holders, especially when using cutting or parting tools, see that vibration does not occur from the clamping screws which hold these small tools. The lathe may be out of balance caused by adding chucking fixtures to the face plate; or work may be of an irregular shape or weight, which will cause the lathe to chatter. A lathe speeded up too high on some classes of work will cause chatter.

If the gears are noisy there is some fault in the adjustment of the eccentric shaft upon which the back gear is mounted. If this is corrected the gears will run quietly. Gears should not mesh so deeply that they touch the bottom of the teeth. In patent head lathes there is a possibility of twisting one eccentric out of line with the other if the bearing should be allowed to run dry. In that case see that there is no twist in the connecting shaft between the two eccentrics.

The claim occasionally made that a lathe does not face straight, never applies to a Lodge & Shipley lathe unless it has been in use longer than five years, and in that case the remedy is

to scrape the dovetail upon which the tool slide moves until it lines up perfectly. In all these matters leveling crosswise is of the utmost importance. It may be well to examine the carriage to see that it has a correct bearing on the bed.

The claim that the lathe cuts a drunken thread occurs only when the faces of the outer ends of the journal bearings receiving the resistance from the lead screw are not true with the bore. Inspection should make this a certainty. To make sure, however, remove these bearings; take a bar of steel as large as the outer diameter of the journal, turn one end of it to fit the bore, squaring the shoulder nicely, and test with red lead to determine whether it has a perfect bearing against the end of the bearing, remembering that in the Lodge & Shipley lathe the pull is against the outer end of the bearing whether chasing right or left hand.

XV

Pattern Shop

IT is very essential to have good machines in the pattern shop in order to eliminate hand work. To produce good patterns at a low cost, the following machines are required: One 36-in. band saw, one 20-in. hand planer, one 24-in. thickness planer, one ripsaw, one 30-in. full universal double disk sander, two 6-in. pony hand planers, one large wood-turning lathe, two small wood-turning lathes, one band saw filer, one full universal oilstone tool grinder, one 6-in. Fox bench trimmer to every two men, two electric drills, one electric glue heater holding two 1-quart glue pots and 12 benches.

With 12 hands employed to the superintendent of this shop should have three first-class journeymen, one medium hand, one pattern recorder, five boys at the bench, one boy to cut up, plane and glue up lumber, fillet, sand

and finish patterns and core boxes, one boy to varnish patterns, sweep the shop and oil machines.

On large patterns use as many boys as possible to help the journeymen; have journeymen rough up patterns and core boxes and boys finish them. In this way you not only cut the cost to less than half but it teaches the apprentices how to build patterns and core boxes, to read drawings and finish work properly. See that the varnish boy is bright and willing so that when you are ready to advance boys he is capable of taking the next boy's place. If he has no varnishing to do have him turn up stock core prints and get accustomed to the machines. Keep in touch with applicants and when men show restlessness add a new man or men; if you have a disturber get rid of him. Try, by all means, to keep your old force together.

When you instruct your men to make a good or cheap pattern see that they do it. This is very important, as time can be wasted on jig and one-casting patterns. Good patterns, if not properly made, that is not nailed, screwed, glued, etc., and generally constructed

so as to be molded properly, will not last one-tenth the time they should. In measuring up patterns you cannot be too strict; call the men's attention to any fault you find, both in measurements and construction; keep at them until you get what you want.

This is *the* way to avoid scraps and trouble in the shop. Use good judgment with your boys, don't dog them, treat them as you would your own children or brother; be their friend always remembering they are learning and are not supposed to know it all. Do not make the patterns for them, instruct them how patterns are to be made, give them necessary information on drawings, etc., but don't have them running after you; teach them to use their own judgment and find their own way. This will relieve you of a good deal of bother, save time in the end, and make better pattern makers of your boys.

Keep your eye on the lumber pile, remembering that dollars can be wasted easily; instruct your sweeper how to separate waste lumber; have the men use up small pieces. Use good lumber on standard patterns; common lumber where it is not injurious, such as

for battens, lagging, etc., and on jig and one-casting patterns. The sweeper should be cautioned, also, not to sweep up leather filleting, sandpaper or any other material that may be mixed in shavings.

See that the men use the machines to the best advantage, for the man who can do his work with the smallest number of tools is generally the speediest and best pattern maker. Keep after your pattern recorder and see that his records are correct; have him order his castings promptly, put the patterns in the proper place and keep a good supply of material.

In order to see the results of patterns, you should visit the casting shed, yard and shop. Inspect all castings; if defects are found call up the foundry superintendent, find out if the defects are caused by the pattern or molding and have the trouble corrected. Visit the foundry occasionally; see how your work is being made; work with the foundrymen; make patterns to suit them if you want them to produce good castings. Visit the different foremen in the shop and see if you are allowing finish to suit them; if you are putting on the

necessary lugs, etc., for clamping or chucking castings. Be willing to make any change they may desire in order to better their conditions.

XVI

Tool-making Room

A DRAFTSMAN should be kept right in this department. Endeavor to keep the equipment thoroughly up to its requirements. And add other equipment to meet shop needs. The leading hands on lathe work, planing, milling, grinding, horizontal and vertical boring mills, vises, etc., should all be A1 men in their line. All expensive measuring tools require special care. If necessary, a safe should be provided for them.

The chucking lathe is sufficiently important to employ a good man, one who is thorough and whose work will leave the chucking lathe without fault. His kit of tools should at all times be in good order and his machine clean and orderly. This tool is considered capable of doing more boring than any two engine lathes in the department.

Considerable attention should be given to

an examination of what tools are ordered made as to whether they will serve the purpose for which they are made and whether we are likely to have to change the designs to improve them, which sometimes means making them twice—a very costly lack of care.

Tool steels are mostly kept in this department as are all small tools. Therefore, very little running to the auxiliary toolrooms is necessary. All auxiliary toolrooms should either be under the general charge of the toolroom foreman or should receive the special attention of the general manager, who, in any event, should issue instructions to all auxiliaries—six in all—as to their relation to the general toolroom. Lists should be kept by the auxiliaries, of micrometers and other expensive tools that might be and sometimes are, carried off, and a report made to the assistant manager when any are missing.

XVII

Forge Department

Instructions on Heat Treatment

PACK in case hardening compound or bone dust. For surface case hardening in small boxes, heat to 1650°. Keep at this heat 4 hours and plunge in water. For heavy articles continue the 1650° of heat 8 to 12 hours, according to weight.

When case hardening is needed to penetrate deeper, do not cool in water but in the air while in the box. Then re-heat to 1425° (without case hardening compound or bone dust) and plunge in water. This second treatment should give a depth of about 1/32.

For the treatment of higher grade steel, proceed as described above, making sure that about 1 in. of bone dust is packed all around each piece, and after re-heating and plunging in water, heat in crude oil up to 450° to draw to the proper degree of thickness and temper.

Any furnace may be used, heated either by gas, oil or coal, providing a suitable pyrometer is used to register the heat.

The parts should then be put under a sand blast, and if gears, smooth off the teeth at equal distances in diameter, and test with the scleroscope.

When hardening forming tools, taps and cutters, where a fine edge must be preserved and when they are made of high-speed steel, they should be packed in pulverized charcoal in a box in the same manner as for case hardening, heated to 1900° F., and then cooled in crude oil. When hardening high-speed cutting tools, heat them in gas burners to 2150° F. and cool in crude oil. Test the pyrometer occasionally by placing some common salt in a box, putting it on the fire until it melts; the melting point will be 1441° F.; then place the point of the pyrometer in the molten salt, and if the pyrometer, reading on dials, registers 1441°, the pyrometer will be correct.

XVIII

Lathe Department

THE foreman of this department, which embraces the engine, turret, and automatic lathes, should keep every lathe clean, well oiled, supplied with a decent tool board or cabinet and a complete set of tools suitable for the class of work assigned to it. He should look the tools over every day to see that they are in first-class condition, and correct them if correction is needed.

The space upon which lathes stand should be kept free from dirt, scrap, mandrels, or anything not strictly belonging to the work in hand. The lathe hand must not lose time because the mandrel press or other needed appliances are not within his reach. Suitable tools such as calipers, hammer, center punch, micrometers, rules, and soft hammer to drive mandrels in and out, also an oil can, should be provided for him. Chucks, steady-rest,

wrenches, etc., should be examined by the foreman periodically.

He should have the work for every man in his charge ready in advance of the time he needs it, together with all tools, drawings, mandrels, reamers, etc., and then give him a clear explanation of the work and be sure that he understands just what is wanted before leaving the work with him.

On all premium work a man should be started right, if he is not familiar with the job. The foreman should insist that if the operator does not perform the work within the limit set, he tell him when the second piece is done, and then set him right. He must train every one to tell him instantly when a piece is spoiled or broken, also if there is any uncertainty as to whether or not the work is being done right.

If the foreman loses confidence in a man and cannot regain it, or if the man is untruthful or has a bad disposition, he should see the superintendent of manufacture and ask to have him replaced. If the man is careless or reckless with expensive tools "call him down" hard. If he does bad work or is indifferent

and cannot be corrected, replace him. The foreman should know a man's value in one week, and should study him, particularly the first week he works in that department.

When men deliberately refuse to earn premium, they cannot be replaced too soon. The foreman should act quicker on this than if a man is slow or dull; there is hope for the latter if his disposition is right. But for the man who will not embrace an opportunity when offered there is little hope. The foreman should have no end of patience with men who find it hard to learn how to keep time right; he should nurse them, tell them again and again. They must be told good humoredly, with a smile that will make them feel he is trying to help them. They make good men when they get to know.

Among his other duties the foreman should carefully teach all men and boys the use of taps and reamers, telling them how readily taps break and how to avoid breakage, how reamers will act in machine steel, in tool steel, in vanadium steel. Tell them how cutters will act, also how a cutter may be fed through a cored hole in cast iron 1/16 in. to a revolution, while

in solid steel 1/64 in. is most too fast. Tell them that high-speed steel reamers will cling badly if used to ream nickel steel and that only carbon-steel reamers should be used.

He should teach them that reamers if held rigidly in a turret must be so held only when the turret hole is strictly in line, but that the reamer will act well if held carefully against a center mounted in the turret. Show them, however, how it must be kept from jumping into the work. The foreman should not make fun, get impatient or swear. He should be just and command the respect of his men. Daily kind treatment of men will do them more good than sermons. The foreman is the man they copy. If he blusters, swears, or acts improperly, they will copy him and later speak disrespectfully of him. The foreman should make short work of men or boys, who, under kind treatment show a bad disposition. This shop is no place for such men, and probably when they have lost a number of places because of their failure to respond to decent treatment, they may see the error of their ways.

XIX

Grinding Department

LET it be remembered that good cylindrical grinding cannot be done on the very best grinding machines known, unless the wheel itself is true and in thoroughly good balance. The live and dead centers for all grinding machines should be ground to an angle of 60 degrees. An operator should never be permitted to adjust a wheel arbor. This should be done by a toolroom man assigned to this work. Cylindrical gages should be used at all times to set micrometer sizes. On work from 3/8 in. to 5/8 in. in diameter and more than 7 in. long, steady-rests should be used. Beginning at 1 in. in diameter and 14 in. long, and all longer lengths, steady-rests should also be used.

All work, where the wheel comes against a shoulder of larger diameter than the part being ground, should be delivered to a lathe and

necked down at the shoulders at 0.005 in. below the finished diameter, in order to permit the wheel to run out without striking the shoulder. The travel of the wheel should be within 1/4 in. of the width of the wheel being used. When grinding small diameters, and where it is desirable to pass the wheel entirely over the work, a square center driver with a little extra pressure when mounting in the machine will admit of this, if care is taken in handling the work to be ground. This, of course, can be done only where both live and dead center drives for the machines are furnished. On pieces where positive clutches are machined and hardened, a driving center, cut to fit the same clutch, makes a good driver and admits of entire outer diameters being ground. This hold good either for clutches on solid stock or clutches cut on bored stock.

When grinding the holes in hardened gears, mount in an independent chuck, true up the diameter and sides, and test them by the hole itself. Short bushings with standard holes should be ground on the plug arbor mounted in the driving spindle, and using either the keyway, the oil groove, or if neither of these

is present, a roller pin arbor. When grinding pieces that have been bored, and in order to avoid driving in mandrels, it is advisable that the outer end of the bore be turned and reamed to 60 degrees and made to revolve on pipe centers that are stationary.

When a piece of work to be ground has a hole tapped in the end, the end should be reamed to 60 degrees, and the piece revolved on centers. This secures much better work than to attempt grinding it on a plug arbor having a thread to fit the tapped hole. In internal grinding limit plug gages should be used for sizing.

The foreman or leading man of the department should see that all machines are kept well cleaned and thoroughly lubricated, and not allowed to be used unless in the pink of condition. A copy of these grinding instructions should either be in the hands of each operator, or mounted on a board and hung in the department. When composition lubricant with soda or water is being used for grinding, it will injure the paint on the machine and make it necessary, in order to have the department look well, to repaint each machine at least

once every six months. Polished work on machines should be kept bright.

The foreman of the department should see to it that each man's work is delivered with an allowance on outer diameters of not less than 0.008 to 0.015 in. according to diameter. All centers should be lubricated with white lead, not oil. No greater allowance in diameter than 0.015 in. and from that down to 0.008 in. should be allowed by the lathe for the grinding department when the work is soft; about double this amount should be allowed if the work is hardened.

In internal grinding, the allowance should be 0.0095 to 0.01 in. below size. All wheels should have a surface speed of 5,000 ft. and all work a surface speed of 20 to 25 ft. per min., either for internal or external grinding, where obtainable. For cast iron, the grain and grade of the wheel should be: Grain 36 or 40, grade P. For soft steel, grain 36 or 40, grade L. M. or N. For hard steel (use soft wheel) grain 40, grade K. Where the length of the piece justifies it, the operator should be supplied with two dogs, so that one piece may be dogged while the other is being ground.

XX

Drilling Department

THE foreman of this department should be a well posted machinist who can read drawings and who knows the importance of smooth, straight and round holes, and who also has a good knowledge of the setting and holding of work for doing rapid drilling with absolute truth.

All jigs in the department should be kept with guide bushings fitting the tools and without being the least bit loose. Tools must be ground and replaced in the jigs and be ready for service when wanted. Drill chucks must be in such excellent order for use that no makeshifts of any kind will ever be necessary. When drilling through jigs be sure that the guide bushings are central with the drill spindle.

The equipment for each drill press should include bolts and clamps, and suitable stands

to receive at least six different kinds or sizes of chucks or drills should be located by each drill press that is regularly in use and the man who runs the press be held responsible for their good order and their constant presence at his machine. The foreman must at all times be on the alert with men and work, instructing the men when the jig holding the work may be free on the table or when it must be clamped to the table. Quick change chucks should be used for all drills $\frac{1}{2}''$ and over and below $\frac{1}{2}''$ regular drill chucks with the end of the shank holding the chuck and the end of the shank of the drill each cut away $\frac{1}{2}''$ or $\frac{5}{8}''$ of their length at the end, so as to prevent their turning in the chucks. This end receives but a slight pressure because the chuck will usually drive the drill but it will prevent the marring of the shanks, by preventing their turning in the chuck.

Foreman must deliver the tools and jigs with the job; see that everything is complete and when a new jig is being tried out for the first time, call the foreman of the tool room and the inspector so that we may be assured the jig is right for every-day use.

Every man on a drill press should be able to call his own, his oil can, his center punch, hammer, monkey-wrench and suitable drift.

The operator should not be allowed to grind either the drills or the countersinks that belong with jigs. This grinding should be done by the man in the Auxiliary Tool Room.

The foreman should be well posted on speeds and feeds for all sizes of drills and see that every part of every drill press be kept well oiled and very clean, never allowing belts to run crooked or twisted and use only high speed machines for small work.

The foreman should insist upon delivery into his department of all lots without one piece missing and as nearly as possible in proper sequence for the size of machines upon which he may be working.

XXI

Planer Department

NO planer should ever be at work without having its next job put down beside it one hour in advance and with the job the drawing, templates, chucking devices, clamps, bolts, resting blocks for the clamps and full and clear instructions about the job from the foreman. The foreman must, of course, inform himself on the number of jobs, and special devices that may be needed. These should be ready. Some work may need a little drilling to receive clamps; this should be done. He should post the operator as to speed, feed, how many cuts, etc. He should at all times see that the tools are right and ready for all work assigned and before the work gets to the operator.

He should see the beginning of every job and avoid planer stoppage, so that the machine is kept cutting as many hours and minutes

during each day as possible. He should never lose sight of proper oiling, and never permit any planer to look dirty, or untidy, with clamps, bolts, scrap, cuttings or dirt, lying around it.

Many routine jobs should have two sets of chucking devices so that while one job is being planed another may be chucked, thus keeping the planer cutting most of the time now consumed in chucking. All planer countershafts should receive as careful attention in adjustment, in cleanliness, in oiling, in efficiency and tautness of belts, etc., as the planer itself. This applies to motors also, when machines are motor driven.

It is bad practice to permit men to ride on planer tables or to use stools, as their time can be much better used in cleaning up, in getting tools, templates, chucks, etc., ready for the new job. All this also applies to shapers. Any planer or shaper used occasionally only should be oiled before using, and cleaned before leaving. Foremen should see that such machines have a full kit of cutting tools and keep them locked up, well dressed and ground ready for use. If work is delayed in delivery to a de-

partment, or the sweeper and helper are delaying work through absence when wanted, see the assistant manager on this or any other requirement at once.

XXII

Milling Department

THIS department is handled by one foreman whose duty it is to deliver the work to the machines with full information as to what is to be done. He should also deliver special mandrels with gang cutters mounted, and special chucking devices for holding the work, when it is known that they are in the tool storage. Wrenches and auxiliary tools should not be allowed to remain on the floor but should be placed in the cabinet or in the tool storage, whichever is their accustomed place. The space surrounding the machine should always be kept thoroughly clean. No gang of milling cutters mounted and true, should be removed from the mandrel without consulting the foreman of the department.

Whenever cutters become dull, when mandrels are not true, when collars are not correct or there is any difficulty with the dividing

head, the foreman should be notified at once so that the trouble may be corrected without loss of time. If the operator knows that the work he is engaged upon is taking much more time than it should, by reason of the absence of proper appliances, he should at once notify the foreman asking him to correct the trouble. If possible the foreman should confine all single or small number piece jobs to one machine so that the routine machines may be continually working to advantage.

A complete set of wrenches and special tools for each machine should always be kept in good order. Foreman should be notified without loss of time should they be otherwise. Each operative should have his own oil can, hammer and suitable wrenches. Should these be missing the foreman should at once supply them. Foreman should also keep close watch on the quality of the work being turned out so that never more than one piece of a batch is likely to be spoiled.

XXIII

Gear Cutting Department

THIS department is handled by a working foreman, necessary operators and an inspector whose duty it is to see that each pair of gears is properly tested. This inspection should cover smoothness of cut, absence of tearing of metal as the cutter leaves the work, and smooth revolution when the teeth are in mesh so as to touch on all sides. The equipment for the tests should consist of mandrels and bushings that admit of the least possible side play—not to exceed 0.001 in. Should the gears need any correction, the foreman of the department should be notified.

If the foreman of the department cannot get quick action when new bushings or mandrels are needed, the superintendent of manufacture should be appealed to at once, and the work stopped until the proper appliances are in hand. The foreman of the department

should insist that all cutters, either rotary or for the gear shaper, should be ground before being hung up. If this is not done for any reason a report should be made to the superintendent of manufacture. This applies also to new cutters, mandrels, and bushings. If the equipment for the department is not sufficient to produce the work called for, the foreman should consult the superintendent of manufacture.

No gears, mandrels or other articles not strictly pertaining to the work in hand should be allowed to remain on the floor, or on or under the benches. All superfluous mandrels or bushes belonging to the testing machine should be placed in the tool storage department. If on Saturday, when the machine cleaners are through with their work, this should prove unsatisfactory, the foreman should report the fault to the superintendent of assembly.

Advance information should be obtained as to the cutters wanted on any new work before the work comes into the department so that the cutters may be on hand when the work arrives. Every machine and every coun-

tershaft should be kept thoroughly oiled. All the appliances used in this department and dealing with the accuracy of the work should be kept within easy reach and in first-class condition. Should the fit of the slides or the fit of the dividing gearing show any inaccuracy, this should be reported at once to the superintendent of manufacture. Should the foreman be in any doubt as to appliances for gear that are difficult to cut, he should also see the superintendent of manufacture.

XXIV

Special Manufacturing Department

THIS department is officered by one lathe foreman and one vise foreman. The vise foreman has an assistant for drilling machines who runs a drill on most important work. The foreman has general charge of the department covering drilling machines, millers, shapers, grinders, vise men, and planers.

The work of the department consists of all work that has not been established as routine work, all special work wanted by the shop, all work the insufficient quantity of which precludes it as routine work, all special fixtures that go with lathes sold on guarantee of production, in fact all work not routine, including helping out the toolroom when that department is crowded beyond its capacity.

The man in charge shall look to the tracing department for all material needed to complete

work as per drawings, and report to the assistant manager if this is not forthcoming when needed. The routing department will furnish drawings with routing and order tickets attached giving full information on all work done by this department.

Precedence is to be accorded work on the order of the superintendent of assembly. The superintendent of manufacture has strict jurisdiction over the quality and the methods of doing work. Any additional equipment for this department must be referred by the superintendent of manufacture to the assistant manager for order to purchase. No work shall be done in the department except on regular order, because every hour must be accounted for to the cost department. The chief inspector will detail a man as inspector whose decision, when referred to the chief inspector, shall be final.

This department has generally been looked upon as a losing proposition. Good men and efficient work are required. There are times when this department is slack. At such times, routine work that may be late on its journey to the storerooms shall be done here. Pre-

mium work shall be used when deemed wise by the superintendent of manufacture who may place any work on this basis when it has reached a routine stage.

XXV

Inspecting Department

THE man in charge of this department should post each man in detail as to just what he must inspect and how to proceed. He must lay out the amount of work one man can comfortably get through with; see that the proper measuring tools are in his hands and show him how to get limit gages, drawings, etc., also what part of his work must be very accurate and what other part does not require too much of his time.

If the inspector's work can be handled on a bench he should be taught to keep his quarters clean, free from litter and from work, either finished or in prospect. He should also be required to lock up valuable tools every night and report to the department head if his work does not come to him in ample time.

Should a man's work require him to visit several places in a department, he should be

taught to work in detail and day by day until he is thoroughly familiar with it. If his work is vise work the importance of key fits should be explained. If his work covers sliding keys, the necessity of the key being fitted very firmly and tightly in its keyway should be demonstrated. On no account should this depend on peening for a tight fit, nor should more than 0.001 in. freedom on top for sliding be allowed if the key fit is stationary; the key should fit snugly sidewise and *tight* on top.

The superintendent of this department must never permit any running shaft to pass if the least bit out of line, one journal with another, and must never pass any running journals unless ample provision is made for oil. He should insist that all screws have a good thread; the same is true of holes. Pieces that will not paint well and smoothly must not be passed; this also applies to places where one part is bolted to another if seats do not match up.

All gears must run smoothly and mesh well with the least possible freedom. No running part must pass if it runs out of true or does not turn with perfect freedom in its place.

No part that looks the least bit sloppy or untidy should be passed. The merchant requires nice paint and nice polish when he shows parts to a customer and will complain if machines are faulty in this respect. The user not only wants all this but he will reject a lathe if he finds any fault with its accuracy or smooth operation, or encounters difficulty in handling.

Special care is needed in packing. All parts should be in the box containing loose pieces, which should be checked with the card containing the names of the pieces the box contains. This card is to be packed in the box and signed by the packer with his own name. A duplicate of this should be kept. Some of these machines travel thousands of miles and great care should be given to see that they are securely fastened when packed.

XXVI

Specific Instructions for Painting Lathes

1. The first coat is to be steel blue paint both inside and outside and to be applied to the castings as soon as possible after they are received.

2. The second coat to be dark filler put on with the brush.

3. The irregularities in the castings that cannot be corrected by chipping are to be filled with the smallest amount of filler that can be applied with the knife.

4. We then apply another coat of filler with the brush.

5. After thoroughly drying they are sanded down until the iron shows through.

6. We then apply a coat of intermediate surfacer and touch up with filler.

7. Sand down and apply a coat of surface black.

8. The foregoing refers both to heads, beds and smaller parts and after all have been assembled the paint work is rubbed all over with what is known as a "hair rub."

9. After drying, the machine is to be given a coat of blue paint.

10. No machine must be touched by the finishers until every piece belonging to it is fitted in place.

11. No painting must be attempted while machines are being finished.

12. The machine shall not be delivered to the painters until the finishers are entirely through; after painting, no machine shall be touched for delivery until the day after the finishing coat of paint has been applied.

13. The man in charge of the finishing shall act as final inspector when the machines are finished painting.

14. All work will be delivered to the paint room in its proper order by the trucking department. Hold assembly superintendent for this.

XXVII

Sales Manager

A SALES MANAGER must know the business because otherwise he cannot judge what the customer needs.

He must see that merit and not lowest price *governs* but that merit and nearly the same price "knocks the persimmons."

He must not sell machines to perform stunts not offered, listed or described by the manufacturer.

He must not give attachments that he thinks do not cost much; the maker, not he, knows best.

When the house assumes the credit, the house must pass upon the same before the sale may be completed.

No mechanical performance must be promised without consent of the Mechanical Department.

In handling subordinates, no amount of care in posting them should be considered too much

trouble. They are not *expected* to know as much as the sales manager. They do not pull down his salary.

Should the sales manager pass upon expenses of either subordinates or demonstrators, he should do so after careful investigation and knowledge of all the conditions.

A live, dignified, financially able and well-located line of agencies are the best means of disposing of the shop's product. Their geographical position is of the utmost importance; care being taken when selection is made to see that they are close to good live markets.

We should insist that their salesmen should possess fair technical knowledge and should be allowed a reasonable time in the L. & S. Shops for training in actual work such as time estimates and the handling of machines and setting of diameter and shoulder stops, ball stops, rear rests, the handling of crankshaft work, taper attachments, turret equipment, motor drives, belt drives, feeds, speeds, apron control, etc.

Advertising comes next in importance for getting business, after agencies. To make advertising effective, every issue should con-

tain emphatic presentation of some of the 100 features contained in our product not contained in others and frequent mention should be made when these features are patented or when patents have been applied for. Special engravings of these should accompany advertisements with clear descriptions. Stress should be laid on simplicity, power, ease of handling, weight, features that are hardened, packing, facts such as only one complaint of lack of accuracy out of 5000 machines supplied and this due to accident in transit.

The next important business getter is a well-trained corps of demonstrators. These men must be experts and able to receive a drawing in any shop and make work both correctly and with dispatch. They must be modest, have tact, know every detail of the machine they demonstrate, show finish to grind and also finish to file. They must never contradict the customer unless allowed to prove their statements. They must remember that any bad impression left injures the company, and that they are actually carrying the same responsibility that any officer of the company carries.

They should be able to see at once in any shop as they observe how the work is being done, approximately how much time would be saved if that work could be done on L. & S. machines and recommend the size of machine that would do the work to the best advantage. They must never show anger, no matter how the other fellow may treat them; such men will admire their patience and tact and become their good friends. Never leave anything undone that needs fixing because the customer will complain to headquarters, saying the men should have fixed it and did not.

Keep the country well covered by dealers in territories which are not *too large*. Have as representatives live men who are on the job themselves. Branch houses as a rule are unsatisfactory and do not work a territory like a house who must rise or fall by the business secured from that particular territory.

Develop young men who are well educated so as to make salesmen of them for our agents. A young man educated by us on our lathes will bring back greater returns than one who has only a superficial knowledge.

Develop trade all over the world. Get into the world's field early. Foreign business is a great balance and helps fill the shop with orders when business at home is dull.

XXVIII

Shipping Clerk

IT shall be the duty of the shipping clerk to see that all orders for stock machines are shipped within 24 hours. This can be done by having the inspector and boss laborer on hand as soon as the tag comes from the drawing room.

He shall, each evening, look over the machines on the finishing floor and determine how many teams he will need the following day and about at what time. He should not cause the teamsters to waste time in getting his load by having the wagon come along before the machine is ready, as this eventually means an increase in the cost of hauling.

When the bill of lading has been signed by the railroad he should see that the proper rate has been inserted for the proper classifications. He must keep in close touch with traffic solicitors, as they frequently exercise

more influence with the yard crew in moving a car than the agent himself.

He is required to keep in touch with the agent also, and make a round of the freight houses to look up incoming material. Frequently it is allowed to remain in the freight house for a couple of days when it is badly needed by the shop. The incoming shipments are more important than the outgoing, and should be given the best attention. When an agent or customer notifies us that he is sending a motor or lathe chuck to apply on some order, the shipping agent should see that he is supplied with tags with his and our order numbers plainly written thereon, and request him to attach them to the articles to be forwarded to us. He should also request him to furnish a bill of lading when the shipment has been made. This will save a good deal of time and the shop will also benefit.

The shipping clerk will get from the purchasing department each morning all bills of lading for incoming material, and if invoices have been received without a bill of lading, write for them. He must keep persistently after the railroad until material is received. If the case is urgent

and the shipment is overdue, he must not hesitate to go the highest official of the railroad that can be reached, and also use the aid of the Receivers and Shippers Association.

He should study the regulations of the parcel post and use it in preference to express where it shows a saving in time and cost. See that a packing list goes with each lathe shipped and file a copy of it for reference against claims for shortage. Study the crating and boxing of machines. See what others are doing in this respect and if improvement is possible he should make it. We want our machines to be in A-1 condition on their arrival at destination.

When a shipment is made by express the shipping clerk should see that the customer does not have to pay on an unnecessary amount of lumber. Use cardboard boxes or cloth bags whenever feasible. When shipment is less than 100 lb. he should not ship by freight unless the customer has so requested. When the shop is making a special effort to get out a shipment the clerk must do what he can to boost its effort.

XXIX

Boss Laborer and Express Truckmen

Boss Laborer

THE boss laborer must see that all wagons are loaded and that machines are covered and weighed, and get the countershafts for the machines. Get the repairs that are boxed, and weigh them ready for shipment. Make ready all the countershaft skids; slush the countershafts, leg them on the skids and crate them. Take all the finished stock countershafts, slush them and store them away.

He must get out all skids for machines that are to be finished. Get in all export platforms and weigh them, also see that they have countershafts. Transfer finished machines to and from warehouse. Move machines or any other material where there is a change to be made. Stack all lumber for carpenters. Also stack the pattern lumber in the loft and take it upstairs as they need it. See that the yard is kept clean; also patch the cement floor.

He must also look after all fire extinguishers. See that the small as well as the large "Ajax" extinguishers are tested twice a year, Nov. 15 and May 15. See that all finished machines, whether they are stock machines or held on customer's order for shipping instructions, are fully covered with waterproof covering as soon as the finishing coat of paint is dry. Each afternoon he should walk through all the yard storage places. If anything untidy is found, this should be his first concern the following morning.

Express Truckmen

The express truckman must arrange for his daily trip to the city for supplies and to the factory to take or bring back patterns. All orders on his time must come through the assistant manager, if made by any other than the purchasing, receiving or pattern departments. He must keep his automobile clean and neat, and carefully go over all oilers once each week. Also see that the oiling of the Ford machine is properly done by the gate watchman.

The Ford is to be used by him and the

chief storekeeper on the week days during working hours. Under no circumstances can this machine be taken out at night or on Sunday. His regular hours are 60 per week, on a fixed salary basis. In consideration of having to put in overtime to keep the yard free from rubbish, lumber, packing boxes and ashes, a bonus of $3 per week will be paid him.

XXX

Millwright and Belt Man

Millwright

THIS man reports to the superintendent of assembly and receives orders from him. He must keep trestles, boards for the top of them, and all his tools, such as wrenches, spirit levels, lagscrews, belt clamps and ladders where they are easily accessible, even if we must provide a place to lock them up.

In the daytime, when machinery is running, neither he nor any one who may be helping him must run risks of accidents without first stopping the machinery. He must see that all ladders used are provided with sharp steel spikes to prevent slipping. No allowance over hourly rate is made for overtime.

He must keep all line shafts aligned, looking them over once a month, using the first Saturday afternoon of each month for this duty. No dead ends of shafts either auxiliary or line,

having keyways must be allowed to stick out from journal bearings more than two inches without a safety setscrew collar, pulley or coupling.

He must report to the manager anything that he cannot correct himself and which might cause an accident. This applies to setscrews or gears that might catch one's clothing, emery wheels, narrow places, bad chains, slings, belts, etc., or any point in danger of fire.

Belt Man

This man reports to the assembly department. His duty is to repair all belts, and immediately sew all belts brought to him by any man running a machine. Old belts, or parts of them must be joined by cementing when they have enough life in them to justify the time it takes. These belts may be used for countershaft drives, and should be kept on shelves and ticketed.

No new belts should be given out except on a written order of the superintendent of assembly. When belting is ordered for stock, the order must come from this official. The belt maker must keep up his other supplies

through orders to the purchasing department. His quarters must be kept neat and clean, and suitable shelves provided to receive belting, supplies and tools, all of which must be kept in good order. No extra price will be allowed for overtime. The assembly superintendent will supply bench and vise work to fill in the time not used on belts.

XXXI

Engineer, Electrician and Oiler

Steam Engineer

THE steam engineer must know the construction and operation of his engine thoroughly and must be keenly alive in having all the oiling facilities in effective constant use. He must also keep valves well fitted and set so close that no steam is wasted. Lost motion in any one of the moving parts must be constantly taken care of and if any waste of steam occurs by reason of slide valves not seating well, a man from the shop will correct this by scraping (or planing if necessary) any evening or Sunday.

Cylinder rings must always fit so close that no steam may leak through. The crosshead guides and piston rod must be kept adjusted centrally and a close fit. The connecting rod must be so nicely adjusted to pins that no knock can be heard at ends of stroke. A good

level should be used on the cylinder and guides twice a year to make sure the foundation is right.

The feed-water heater and boiler feeder must be kept in apple-pie order and all valves between boilers, engines and pumps thoroughly seated. Careful watch must be kept on the water gage so that any trouble with the feed water may be instantly detected. All tools, wrenches, gaskets, packing, oil cans, etc., must be kept neatly arranged and always in place ready for use.

The engineer must be on hand in time to get up steam before starting time in case the night watchman fails, and must know that the night watchman is capable and performs all his duties so far as they concern the engineer's department. The night watchman must be replaced if delinquent or incompetent.

Firemen are strictly in the care of the engineer and both are engaged and discharged by him when necessary. He will see that they are thoroughly up in their work in knowledge and practice. Boilers must be cleaned every other month with mechanical cleaner and tests made of oil and coals when called for by the assistant

manager. Any change of wage rate must be submitted to the assistant manager before being acted upon.

The engineer has full charge of, and is responsible for, the condition of all valves, pumps, stage of water, and paraphernalia pertaining to the sprinkling system; also all machinery and matters pertaining to the heating systems throughout the plant. The water meters, valves, etc., either for incoming or outgoing water, are also under his supervision. Any needed repairs, painting, etc., in his department must be reported to the assistant manager, and all supplies should be obtained through the purchasing department. He should see that the night watchman is posted about cold weather and Sundays, and that nothing is allowed to freeze.

Electrician

The duties of the electrician consist of the care of all electric motors throughout the plant. When these need cleaning, he must see to it that this is taken care of. All lighting, lamps, wiring, storage batteries and electrical appara-

tus of every kind must be handled by this department.

He must clean out truck batteries March 1 and Sept. 1, and also clean all electric hoists in June and December. Have flaming arc globes cleaned every two weeks during the winter months and covered during the summer. Blow out all generators and motors each Saturday afternoon. If a motor is sparking, he should give the armature and commutator proper attention at once.

He must see that all incandescent lamps are protected by wire screens. When putting up new work, he should always study the underwriter's specification for that class of work, and see that this is closely followed. Keep the fire alarm, auto call and electric clock system in good working condition. Take good care that his stockroom is at all times locked during his absence.

Night Oiler

This man reports to the assembly superintendent. His work calls for oiling all overhead work that cannot be safely taken care of during the day. The oil cans and ladders must be

assigned a suitable place, and kept for this purpose. Ladders must have sharp steel spikes to prevent slipping. Should bearings become hot and oil reaches them, he must report to the foreman, who will see to the quality of the oil. He will report to the foreman anything that seems dangerous. Where not sure that grease would do better than oil, he must tell the foreman who will decide.

XXXII

Janitors and Watchmen

Janitors

JANITORS are required to report to the assistant manager. The two men employed at this work are to keep all the main offices clean, washing the floors of main offices every Wednesday and Saturday; also keep all windows strictly clean. This work is to be done evenings and Saturday afternoon.

The rooms to be cleaned and scrubbed once a week are the drawing rooms, cost department, superintendent's office, and all office toilets and washrooms; the foremen's and workmen's washrooms, furnace room and office toilet room. They are also required to clean all office and factory entrance halls and stairways, sidewalks and crossing in front of the office, windows, paint work, heaters, etc.

All skylights and factory windows are to be kept thoroughly clean, including the paint

work in and around the offices. All waste-paper baskets and cuspidors are to be emptied by them and the waste paper baled. Small painted or varnished surfaces such as base-boards, window sills, stairways and railings are to be kept looking nice. Men are detailed by the labor boss to cut and rake the lawns.

Gate Watchman

This man reports to the assistant manager and must be on hand at least 15 minutes before and 15 minutes after the starting and stopping whistle. He must allow no strangers or applicants for employment through his gate, but direct them to the office. Employees are not to be allowed out during working hours, except by permission of the assistant manager. He may telephone the office through the receiving department in cases where he is uncertain what to do. Report all cases of men carrying out bundles unless he knows them to be personal property. He must see to the cleaning of the Ford automobile at least three times a week. This means keeping the running gearing and body free from mud.

Night Watchman

The night watchman must have a suitable engineer's license. He must report for duty every evening including Sunday at 5:30. He is under orders of the head engineer as to the boilers, when to get up steam and in what kind of weather to keep up steam all night. Instructions as to the running of the gas engine and lights, and the charging of all storage batteries are to come from the same source.

He is required to register on all stations, notifying the Ohio Messenger Service Co. that he is on the job, and in accordance with his instructions as to the time of each round. In addition he must (while making his rounds) keep a keen lookout for fire, thieves, open windows or skylights when raining, and try all doors, gates and windows that should be kept locked.

He must write out and deliver to the engineer any information regarding leaky water pipes, water closets, urinals, steam or air, also all cocks that need repair and should make his first round in daylight or while lights are lit, so that he may move obstacles over which he

might stumble in the dark. He must watch the temperature in the winter and warm up the shop earlier on cold mornings. The temperature in the shop should be 60 degrees at 6 :30 a.m.

XXXIII

A Proposed Pension Plan[1]

IN endeavoring to present a feasible plan for a pension system, it is my desire to assist, rather than handicap, manufacturers. There is much discussion on the subject of workmen's compensation which will undoubtedly affect some of us more than others, according to the particular kind of business we are in. Some of us in the machine-making line have been in business from 20 to 40 years with perhaps only one death from accident and probably less than three cases of total disability, while the cases in which workmen have been seriously maimed will not amount to over half a dozen.

With these facts before us, is it not clear that any state tax which may be levied should not be indiscriminately laid, but should take into account the proportion of accidents in each line? Even then we might be paying for the

[1] Read before National Metal Trades Association, 1913.

carelessness of some in our own direct line. In my opinion the establishing of a life pension for such of our employees as have filled all the conditions to be set forth, is of vastly more importance to our workpeople as a whole, than is the question of workmen's compensation. It is also of more importance to our members in general, as it will help to solve some of our problems regarding the keeping of good men in our employ.

Those of us who do business in the Middle West know the restless and floating tendency of the men and the advantage of being able to keep the same set of men whom we have educated with great care and often at considerable cost. This is such a real advantage that it will pay us to adopt any reasonable plan which will secure such results. It would also tend to steady the population in our industrial centers.

Many cases may be cited where pension plans are working out successfully, imparting a comfortable feeling to the minds of the men, and, when they know that to leave their employers means the abandonment of that pension, any change is apt to be considered

very seriously. Any pension system should be based upon some plan that will pay the beneficiary not less than half the usual wage. The government pension to common soldiers and sailors is open to many criticisms on this account.

The establishment of a pension system necessitates the setting aside of a fund that will form a nucleus and finally the capital on which the pensions may be based. If, for instance, a concern employing only 100 men should decide to set apart 2 cents per hour for every operator in its employ, this would mean approximately $6,000 per annum on the basis of a 10-hour day. If any concern using the premium plan would put aside a like amount per hour, out of the hours saved, it would double this fund, which would soon reach the point of sustaining any pension payments that need be made.

XXXIV

Basis on Which a Fund Can Be Started

ANY employer who has maintained an efficient system of knowing the cost of manufacturing, realizes the tremendous change in the art of machine making which has taken place during the last 10 years. The decreased cost of production has been largely due to the advent of high-speed steel, and the designing of machine tools which could use that to the best advantage. This has been hastened by the advent of the automobile, as the demand for these has made possible the development of special machinery and the lowering of cost of production. As an example, take the four-throw crank of an automobile. A comparatively few years ago this required 10 hours to machine, while with the new and special machinery it can be turned ready for grinding in 15 minutes.

Many other cases could be cited, but I wish

to point out that, owing to the improved methods which have so materially reduced costs, we are in a position to lay aside a small portion of this saving over former costs as a basis for the pension fund. In other words, we should adopt some system that will permit the taking of a portion of the profits which have come through the adoption of more modern systems of doing business, whether these savings come from the machine shop, from the method of buying material, or in any of the many ways which are proving economical in modern business.

These are only a few of the many things to be considered, my main object being to call your attention to the desirability of making a start so that a fund may be accumulated from which pensions may eventually be paid. In case any one may decide to adopt such a plan, there are a few points connected with it which it may be well to bear in mind.

Points To Be Considered

The Retiring Age.—My suggestion would be 65 years; but this should not be arbitrarily fixed. It should be at the discretion of the

trustees handling the pension fund, as there may be cases where it is desirable to extend the limit and others where a man should be retired before reaching this age. The Pennsylvania R.R. pension plan allows retirements earlier, but not later than the age limit fixed.

Period of Service.—This should probably be at least 25 years before a man becomes eligible to receive the pension, but might also be left to the discretion of the trustees.

The Pension Fund.—This should not be handled by the firm or company, but by a board of trustees. This is on the advice of an eminent lawyer, on account of its being an obligation upon the firm or company if so handled.

Apprentices.—The need of a retiring age is clearly shown, as an apprentice, entering the shop at 15, would be only 40 at the end of 25 years' service.

Number of Pensioners.—By going over your books you can readily see how many employees have been with you 25 years. This will give you a line on the possible number of pensioners and form a basis for the probable demand on the pension fund during the next 50 years. It

must be remembered, however, that a larger percentage of employees will serve the required number of years with a pension plan in existence.

Adding to the Pension Fund.—There should be a thorough thrashing out of all methods of adding to the pension fund, and these should be decided upon and put in writing, with a request for suggestions from the various people interested. The question as to who should contribute to the fund should be carefully considered. My own idea is that this should be established entirely by the firm and that the men should have no part in its establishment.

Amount of Pension.—This varies widely. Some large corporations, including railroads, both in this country and abroad, pay 2 per cent. of the average wage earned during the 10 years preceding retirement. Others pay 1 per cent. for every year of service, based on the preceding 10 years as above. This is hardly sufficient, as it necessitates a man's serving 50 years to secure half pay.

Special Retirement.—This should be provided for in cases where the man has become incapacitated through ill health before his

25 years of service have elapsed; a certificate from a physician approved by the trustees should be required in such cases.

Further Considerations

The continuance of the pension to the family after the death of the beneficiary.

Whether the fund shall be invested in municipal, state, national or railroad bonds, or otherwise.

Whether the beneficiary may engage in business on his own account after retirement if said business would not be objectionable to the trustees.

Investing the trustees with power to suspend the pension in case of gross misconduct. Should a clause of this kind be adopted, it should be very carefully worded, so that it would be impossible for any trustees to debar a man on account of any personal differences, political or otherwise.

Ample provision to prevent any beneficiary having a sum set aside for his own pension.

A discussion as to the plan of operation of the work, in which the coöperation of the employees may be had. The adoption of

straight piecework, premium plan, or a combination of premium and bonus plans. But, regardless of the plan adopted, some portion of it should be used for the establishment of a pension fund.

The possible discontinuance of the business either through death, ill health, lack of profit, or in any other way, and the disposition to be made of the pension fund in such cases.

It should be thoroughly understood that the successful carrying out of such a plan rests with the employers alone. The whole subject is presented as a business proposition and not as a philanthropy in any way. Any company having a reliable pension system will be better able to retain its men for long periods. It will, I am sure, be a marked step in the advance of human progress if pension systems can be made more general. The general adoption of some such system, taking care to point out its advantages to the men, will lessen the restlessness and decrease the floating population, will retain the men we have taken the pains to educate, will increase the value of the business itself, and cannot help but make better citizens.