ECONOMY IN FOUNDRY

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In my profession, I have often had ocassions to analyze a small and medium-sized foundry business on a management consulting basis.

My management consultation has been aimed at contributing toward the development of foundry business by discovering and calling attention to both the merits and demerits of a foundry shop under review from the standpoint of production technology.

As a business enterprise, a foundry shop is necessarily concerned with making a profit from the sale of castings it produces, My discussion here centers on what should be done about the production technique of a foundry shop in order to increase its earning capacity. The present-day foundry production is carried out by a combination of individual technical know-how and general control technique; the former consisting of melting, sand handling and molding, and the latter consisting of production, quality and handling controls. It is natural, then, that such modern production at a foundry shop should be carried out most economically. The essence of my discussion today is based on my own personal experience in this field.

Three Elements

In analyzing a foundry plant on a consultant basis, I always investigate the conditions of the plant from the following three angles:

1). Price of product

Prices here are meant to be the unit prices of products sold on market such as ¥75,000 per ton or ¥90,000 per ton. Special attention is directed to any product with price considered to be noticeably higher because of its specially clean surface, greater dimensional accuracy, or the greater degree of control to which the product was subjected in the process.

2). Yield of Product

A yield is determined by the relationship of the quantity of final products cast to the total quantity of materials melted. The portion of the total melt not cast into end products consists of melting loss, sprue, gate and rejects. To minimize this particular uncast portion is to improve the yied. Therefore, any study of yield performance should begin with finding out the ratio of each composite part of total loss.

For instance, a foundry plant with 70% yield may be the plant with 4% of melting loss, 20% of sprue, runner and gate combined, and 6% of rejects, or the plant with 3% of melting losses, 18% of sprue, runner and gate combined and 9% of rejects.

In this instance, the general improvement of yield performance can be tremendously aided by efforts to reduce melting loss, make the respective size of sprue and gate smaller and cut down the rate of rejects.

In a country where the ratio of material cost against total foundry production cost is relatively large like Japan, the question of yield performance possesses special significance.

In America, the ratio of material cost against total casting costs is about 20%, in Germany about 40% and in Japan as high as 60%. Consequently, the effective utilization of materials in conjunction with foundry technology exerts a vitally important influence upon the existence or extinction of a foundry business. The importance of yield as such becomes a matter for extroardinary concern. The matter of yield, however, should be approached with due prodence, since any attempt to raise a yield is liable to cause difficulty in connection with productivity increase and quality control which will be discussed in detail later.

3). Productivity

There are many ways to measure and express productivity, but the productivity for this discussion's sake is

measured in terms of the length of labor time required to produce one ton of foundry products. For example, at a plant with 50 employees below a president, its total monthly labor hour is, say, 10,000 man hours, as each man works 200 hours per month. Its monthly production tonnage is 100 tons. From these statistics, it is then figured out that 100 hours are required to produce one ton of castings at this foundry plant.

In America, inasmuch as material cost shares as much as 60% of total casting costs, production is highly mechanized, resulting in a marked increase in productivity. For this reason, quite a number of foundry businesses in America are striving very hard through various devices to increase their productivity even at the sacrifice of yield (in order to facilitate mechanized operation, the sizes of sprue and gate are enlarged). This is one feature about the foundry business in America. Taking an example, in Japan, of product like sawing machine parts which can be manufactured with relative easiness and virtually on a mass production basis, its price per ton is ¥65,000, yield 70% and productivity about 120 hours.

A metal processing machine is a jobbing item with the specified quality of its material difficult to get. Its unit price is ¥90,000, yield 65% and productivity about 150 hours. For a malleable iron joint which can be easily mass produced, the unit price is ¥150,000, yield 45% and productivity 80 hours.

Thus, these three elements are correlated and form a foundation which supports a foundry business. That is to say, an attempt to sell at cheap prices foundry products which are difficult to make would only destroy a business. Any endeavour to increase earning capacity out of the existing operations of a business should be preceded by consideration of what should be done about each of the three elements mentioned on the basis of the results of accurate cost accounting. In this way, a solution to the problem is almost guaranteed.

Capital investment is of course a matter for separate consideration. My discussion today is purely from the

viewpoint of production technique.

Melting

The quality of foundry product demanded must be first fully understood, and it is in accordance with such full understanding that materials should be melted. Together with the importance of strength and hardness, to prepare the molten iron which is readily cast into a desired foundry product is equally an essential condition.

The selection of a cupola should be made on the basis of the type of heat desired, ton-per-hour melting capacity and the time required for one charge.

For instance, at a plant producing 50 tons per month, assuming its operation is on a 25-day-per-month basis and its yield is 70%, its daily tonnage for melting would be about 2.4 tons. In this case, if the product cast is a mass production item like a manhole, mechanical ramming by a conveyor system is convenient. On this assumption, a cupola would be a 0.5 ton furnace and operates about six hours a day. Although it is convenient to use a water-cool type cupola for six-hour-per-day operations, water cooling for a small size cupola is very difficult, and hence, water cooling had better be given up. The result would be that one ton cupola will melt three hours a day. For a 1.5 ton cupola, 20 hours operation per day is sufficient.

Since the shorter the tapping time, the longer the mold ramming time, and therefore, it helps raise productivity. However, since this means that pouring should be done in a short time, care must be taken of handling control so that no confusion is caused in operations. This, in turn, necessitates investment of sizable capitals into buildings and equipment, and causes a reduction in yield. The advantage of short pouring time is that it causes less work fatigue and danger. These considerations stand from the result of application of the aforementioned three elements to this particular case.

Molding Sand

The product value of casting rises by means of making a foundry product with smooth surface and close tolerance, to which the quality of molding sand is directly related. Greater attention should be paid to the preparation of molding sand to the maximum possible degree of economy.

Since the cause of casting rejects lies in the preparation of molding sand, to exercise serious vigilance over the selection and handling of foundry sands and binders so as to make good molding sand means that a yield will be improved at the same time.

Even if one or two percent extra was incurred on improved molding sand, it would be still fully effective if it helps to reduce the rejects rate from the previous 8% to 5%.

Next, if there is enough demand for easily moldable and highly productive molding sand with sufficient fluidity, strength and aeration, and if it is certain that a business's profit will go up with the supply of such sand, then steps should be taken to immediately go into such a new direction. This kind of thinking should underline a basic attitude for synthetic sand.

Thus, it is quite necessary to determine the attitude toward molding sand from the viewpoint of economical production.

Molding

In making a certain cast product, it often happens that a drawing is first made without a definite plan, and a wood pattern is made from this drawing accordingly, from which work proceeds more or less aimlessly to molding. However, a new molding technique calls for the development and application of general production methods by which the property of molten iron to be cast is first considered prior to the making of a wood pattern (or a metal pattern) and a study is made of necessary measures to be taken to assure the suitable characteristics and effective use of molding sand as a means of most efficient molding

and casting.

Melting iron is akin to growing rice plant; a paddy field is like foundry sand, and planting is like molding. Once a rice plant and a paddy field are there on a consistent basis, the method of rice planting will be automatically decided. This fact of inter-relationship should be solidly understood.

Furthermore, adequate measures should be undertaken to produce foundry goods with accurate dimension so that their product value may not be reduced, prevent rejects and enhance productivity. In this regard, the question of whether productivity should be more stressed at the sacrifice of yield making the sizes of gate and sprue larger or the reverse is better should be solved on a case by case basis from the standpoint of cost considerations.

Decision in regard to adoption of mechanical vs. manual ramming, and to the necessity, type and extent of mechanization should be made by carefully weighting one's ability to do so and the ultimate advantage expected to arise therefrom. Mere copying of an advanced, mechanized method is meaningless.

The same thinking holds true of finishing and handling. New methods will be effective only when it is assured that higher profit will result therefrom.

It is the earnest desire of engineers like ourselves to produce castings precisely as specified with beautiful appearance, accurate dimension and no defect.

Such production should, however, be economical and pay off. And for the purpose of assuring further development of the foundry business the improvement of its productivity, unit price and yield should be seriously reviewed.

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FACTORY MANAGEMENT OF FOUNDRY

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By: Dr. Ryojiro Kono
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1. INTRODUCTION

When we discuse the principles of management, it is often quoted that "any enterprise should, not only be operated but be developed in terms of GOING CONCERNS".
The foundries, by no means, can be exempted from this. They must, therefore, do every effort to secure profit which is indispensable for running machines, improving facilities, disbursing pay-roles and purchasing materials, and so forth.
The profit, in other words, should be regarded as driving energy for enterprises, as none of them can continue operations without earning profit consecutively.

For any foundry, this may not always be easy, because keen competitions brought about by the recent industrial evolution often cause to create various intricated problems of management. In response to such conditions, management science made a remarkable progress providing us with a variety of sophisticated techniques.

It is my opinion that foundries today should never hesitate to introduce such approaches to help modernize themselves, but the significance of production technology should be estimated none the less. Management, being my subject assigned, is too broad for me to cover within several hours discussions. What I intend to do, therefore, is to pick up several important fascets of management in the light of foundry modernization.

2. EXISTING CONDITIONS OF FOUNDRIES IN JAPAN

Prior to take up the subject, we should command a bird's-eye-view of the foundry industry in Japan, which summarized as followings:

a. Foundries have been too much production-centered.

b. They have been d epending too much upon emprical intuitions in making decisions.

c. Under sub-contracting relations, they are liable to loose managerial independence.

2.1. Production-centered Attitude

Since many of the foundry entrepreneurs are from the casting specialists, it would be natural that they usually have excellent command of production techniques. As a result, developing production-centered attitude, they apt to loose sight of the other management functions. This might have been justifiable in the past, but it is rather doubtful if they can continue to be so from now on. Because, competitions tends to average the gaps of technical levels of each foundry, permitting no individual to maintain more margin than the other.

This fact clearly indicates that they must work out some measures in order to survive.

2.2. Drifting Management

Being endorsed by many years experiences, intuitions of foundry entrepreneurs can never be under-estimated. This is particularly true when the factory is small in size and simple in administrative functions.

But nowadays, it is very common that a factory grows so fast that it easily arrives at such status as exceeds the abilities of any individual to control by himself through his emprical intuitions.

2.3. Foundries as sub-contractors, and problem of managerial independence.

As any mass-production system prerequisits supply of tremendous amount of parts, large factories must organize their purchasing planning carefully, and must coordinate the deliveries of the parts ordered to the outsiders (sub-contractors). Many of the foundries come under such parent factories supplying them with semi-processed parts, of which items usually diversified, and quantity mostly limited.

For the sake of the production planning of parent factory, in most of the cases, the terms of contracts (including prices) are decided unilaterally.

Such sub-contracting relations may have raison d'etre of their own, but I am not in favour of the situation in which most of the foundries are accepting unconditionally that their managerial independence is almost being ignored.

Now, reviewing the discussions so far, we will be lead to the conclusion that there are three main problems to be solved for modernizing the foundries, namely:

a. To adjust production-centered attitude.

b. To overcome drifting management.

c. To restore independence of management.

3. INTRODUCTION TO MODERN MANAGEMENT TECHNIQUES

I will restrict my discussion in this chapter within those which are closely related with the problems of foundry modernization. They are:

a. Marketing

b. Cost control

c. Personnel administration

Processing quantitative data through logical analysis, each of these three methods are modern in concepts and scientific in approaches. These three are indispensably needed for modernization, because:

Firstly, any foundry must sell its products under preferable terms before it earns profit. This involves the problems of marketing.

Secondly, since profit is determined by deducting production cost from sales volume, we have either to reduce production cost or to increase sales volume for earning more profit. Cost control is one of the most effective tools for controling production cost.

Thirdly, no enterprise can attain its organizational objectives without personnel who are productive as well as cooperative. In spite of this, there are many foundry entre-preneurs who are not fully cognizant of the significance of personnel administration.

4. MARKETING

Most of the old-fashioned foundry entrepreneurs are sensitive enough to the problems of production, but are reluctant to those of selling. But now, foundry industry can no longer remain indifferent to marketing on account of the following reasons:

Firstly, materials which are substitutive for iron and steel have been steadily extending their utility through trespassing upon the area of casting. Among those plastics, aluminum and powder-metallurgy are the most influential upon the foundry industry.

For example, cups of industrial machines have been completely replaced by plastics. Beds and columns of industrial machines will sooner or later be substituted also by plastics.

Secondly, such production processes that can compete with casting, are also infiltrating into our area by expelling casting and replacing with themselves. For example, automotive brake-shoes had been made by casting, but are now processed through steel-plate punching; and diesel-engine columns, from casting to steel plate welding.

Thirdly, parent factories' mass-production systems, which are being automated year after year, inevitably make purchasing requirements more strict as ever, especially in stability of product quality, exactness of sizes, and in finess of casting surfaces.

It is indeed high time for the foundry industry to take some effective measures for protecting themselves. Originally, castings are known to have many excellent characteristics in the following properties; durability, vibration-corrosion-, and heat-resistance. Foundries should try to develop new utilities of castings taking full advantage of the foregoing characteristics. For example, it has been studying to change production process from forging to casting for making crank-shafts of automobiles.

Being closely related with the world economy, current market of foundries is subject to dynamic evolution. It is the responsibility of the foundry entrepreneurs to be always on the alert in catching the informations within their market so as to make their products cope with the advancement of industries.

5. COST CONTROL

It is almost imperative for any foundry to make their production cost as low as possible in order to maintain pertinent profit, because keen competitions prevent foundries from raising prices of their products, while the cost of materials has been going up quite rapidly. In some cases, prices of certain castings have even been reduced.

There are, in my opinion, two approaches for making production cost down: Firstly, to make the best use of the present system, facilities and equipment. Secondly, to modernize both system and physical facilities on the basis of exact computation of engineering economy. In this process forecast of sales volume, and capital-recovery ratio will be the most important factors.

There are not few entrepreneurs who have the miscomprehension that once their physical facilities are modernized, then all other problems will be solved automatically.

In this session, therefore, I will only discuss on the first approach.
First of all, for controlling production cost, we must establish cost accounting system, through which behaviour of the cost can be comprehensively analysed. Cost accounting starts from setting cost items which represent every conceivable expenses within factory, for example, materials, labor, and so on. Those items should further be broken down according to each production process, such as; molding, core making, pouring, shake-out, finishing and melting, etc.

Only through this system, we can find answers for the following questions:

"What production items are the most expensive?"
"What department cost is conspicously higher than others?"
"What production items are the most problematic, and what problems are involved therein?"

We can work our measures for cost-down only after those answers are given, and that they are analysed carefully.

Now, let me quote some of the actual data for the cost items. Cost composition in average in Japan is reported:

materials 40%, labor 20%, others 40%. In U.S.A.: materials 20%, labor 60%, others 20%.

Coarse as they are, we can get a clue for controlling production cost.

Taking a look at these figures, we are easily aware of that in U.S.A. labor is the main portion of cost, while in Japan materials being the major.

Also in your countries, cost of materials will be top-ranked among other items. Therefore, I would like to show you several measures for controlling material cost.

a. Eliminate rejects and errors through stabilizing quality of materials purchased, improving casting-plan, and production methods in each process and through other possible means. Usually, rejects and errors are the main causes for high production cost.

b. Check current specification from the view-point of product-designing. Changes in specification often enable us to decrease the weight of raw-materials per product tonnage.

c. Apply value-analysis to find such materials as are substitutive for others with lower prices.

I am sure that foregoing measures will enough to control material cost if they are put into practice effectively.

6. PERSONNEL ADMINISTRATION

But for personnel, no other management resources would be meaningless, and even modern management techniques will loose its significance. But, how capable the employees might have been, without effective administration, productive workforce would not be available.

I would like to discuss on personnel administration in the following two points:

Firstly, significance of the working environment and conditions. Speaking about environment, foundry shops is far from being comfortable, when it is compared to that of other industries. In such processes as melting molding, and shake-out,

employees have to work under comparatively high temperature. Furthermore, foundry-shops are, as a whole, very dusty because of the various types of sands used. These factors are apparently detrimental to the health of the foundry workers. Factory should, therefore, take some measures to protect employees by installing ventilation system and dust-collectors.

Most of the foundries in Japan have been, more or less, anachlomatic regarding personnel policies. This has been positively infuluential upon the morale as well as mental stability of workers. As one of the counter-measures, foundry should review their policies to stipulate regulations as a basis for sound personnel adminstration. Provisions for such regulations should cover followings: terms of routine performances, wage system, duties and responsibilities in relation to position descriptions, and so on.

Secondly, necessity for developing workers' knowledge and skills to keep abrest of the evolutional times.

Recentry, foundries are imperatively demanded to modernize their physical facilities in relation to the improvement in casting-plans. This will enevitably cause to create new operational requirements within foundry shops, eventually leading to establish entirely new jobs or positions. For instance, in modern foundry, there must be a new job of which responsibility is primarily the maintenance of various machines and equipment, which are often very costly, and are required to be operated in maximum conditions at any time.

In accordance with the advancement of production techniques, and with the improvements of product quality, factory must demand workers more than ever for higher potentiality as well as capacity. Although this is not so easy to attain, foundry should organize the plans for employee development as a long-range program in order to meet this latent requirement.

7. SUMMARY

Throughout my discussion, I intended to bring several up-to-date problems to your attention. Though most of you seem to belong to the technical field, I would be very happy if I could help you realize the significance of management as counter-

part of technology, which are both important for the sake of the prosperity of your company.

Practice of modern management is no more than applying PLAN-DO-CHECK principle repetitively, but in regard to its implementation, like any other techniques, being developed constantly both in concepts and approaches. Approaches in management can hardly be standardized in any pattern, but they should rather be flexible enough to be able to adjust themselves according to the economical as well as inter-national situation of your country.

Before closing my discussion, let me introduce you an old French proverb "Gouver c'evoir", meaning "to govern is to forcast". If this is interpreted in our sense, it will be "Successful management starts from forcasting the future, then organize plans and control activities accordingly".

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SAFETY MEASURES AND ACCIDENT PREVENTION IN FOUNDRIES

SAFETY MEASURES AND ACCIDENT PREVENTION IN FOUNDRIES

By: Mr. Tetsuro Hoshizawa
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1. BASIC CONCEPTS IN SAFETY

1.1. Definition of the Term "Safety"

The term "safety" is defined as one of the management functions to protect workers from the humanitarian point-of-view through taking all the possible measures to prevent accidents that may occur in production processes in which machines and facilities are operated by workers.

1.2. The Significance of Accident Prevention

Accident must be prevented from the two main reasons, bumanity and economy. An individual may take up this problem from the former, while the company from the latter.

1.3. The Causes of Accidents

1.3.1. Direct causes

They are classified into:

* Natural cause 2 %
* Unsafe conditions 10 %
* Unsafe acts 88 %

1.3.2. In-direct causes

They are either from the unsafe personnel conditions or from administrative and supervisory failures.

2. ENFORCING THE SAFETY PROGRAMS

2.1. Safety Conciousness

Safety conciousness is meant by the workers mental attitude that their attentions are constantly paid to safety.
The more successful are the safety training programs conducted by the supervisors, the more safety concious will

become the workers. For developing such attitude, there must be something that appeals to the minds of workers, such as:

(1) Sense of self-preservation
(2) Feeling of shame or responsibilities
(3) Competitive spirit
(4) Reasons

It is the responsibilities of the supervisors to promote safety conciousness in each of their shops so that safety measure will be implemented both in facilities and in personnel.

2.2. Housekeeping

To maintain good housekeeping within shops is one of the most important duties for the supervisors. For maintaining good housekeeping PLAN-DO-CHECK principle should be applied.

2.2.1. Basic requirements for good housekeeping

* Workers must be well-informed of its significance.
* Assign specific individuals with duties and responsibilities for housekeeping.
* Train workers in methods and procedures for housekeeping.

2.2.2. Requirements for making the practice ever-standing

* Plan the program precisely as well as practically. Put the program into practice through cooperation of workers.
* Check results

2.3. Safety Inspection

The purpose of the safety inspection lies in finding the causes of accidents, whether apparent or latent, that may lead to casualities in physical facilities or in personnel, and thus enables us to take preventative measures.

2.3.1. Inspection of physical facilities

Machines would be inspected thoroughly. Only by proper inspection we can assure their conditions as proved.

Emphasis should be placed more in preventative maintenance than in posterior repairing.

2.3.2. Inspection of workers

Clothes, behaviours and acts or workers must be checked occasionally by supervisors. It must be noted that even the most careful worker may cause an accident through unbelievable acts which are affected by his emotions. Safety campaigns or safety patrol is considered effective for contrrolling unsafe acts.

2.3.3. Main check-points for inspection

* Where and how the materials are placed.
  (The way they are piled up, and trapped on walls.)
* Aisles, floors and passage-ways
* Operations of materials handling
* Electrical equipment and circuits
* hand tools

2.4. Safety confirmation

Many accidents are ascribable to the neglegence of safety confirmations. For the sake of workers themselves, training should be provided so intensively as safety confirmation would eventually form a part of their working habits. In case of the work orders which is either new or expedizing, it is indispensably required to intensify coordination and to confirm safety precautions.

2.5. Operation Standards

2.5.1. The significance of standardizing operations considering that many accidents have been caused from unsafe acts of employees, operations must be standardized to secure the uniformity regardless who does the operations.

2.5.2. Steps in setting standards

* Select the operations that need analysis
* Analyse the motions of the operations.
* Set standards
* Put them into practice

2.6. Safety Training

2.6.1. Safety training as a part of orienting new employees as a pre-assignment training, new employees should be informed of the basic concepts and rules :

* The purpose of safety campaign
* The significance of accident prevention
* Key-points in preventing accidents

2.6.2. Safety training as a part of job-induction

The content of the program should be composed of:

* Possible dangers involved in the operations
* Types and use of protectors, and safe-guarding appliances.
* Safety precautions

2.6.3. Safety conference at each workshop

* When have the conference ?
  # Regularly
  # Special conference in case of an accident.
* Purpose of the conference
  # To inform workers of pertinent informations
  # To ask for their ideas
  # To make them cooperate
* Duties of the conference leader
  # Use questions as a tool for thinking
  # Give everybody opportunities to talk
  # Summarize discussions in the end

3. ACCIDENT PREVENTION

3.1. When Unsafe Acts Discovered

Upon discovering unsafe acts, supervisor should lose no time for correcting them on-the-spot. If he is too vacillating to take corrective means timely, he will be placed in an embarrassing situation in the future.

3.2. Examples of unsafe acts

(1) Operate machines without license
(2) Perform something prohibited
(3) Disregard instructions
(4) Operate machines without observing the signals
(5) Any other acts that neglect safety precautions

3.3. Correcting Unsafe Conditions

Casualties brought about by unsafe conditions are reported statistically no more than 10%, but they are mostly fatal when occurred. Supervisors should be on the alert to find such unsafe conditions and eliminate them before they turn up to be accidents. At the same time, he should lead the workers to pay more attentions to unsafe conditions, and to cooperate in erradicating them.

3.4. Examples of Unsafe Conditions

(1) Poor maintenance of physical facilities
(2) Operations with no safeguarding appliances
(3) Operations with poor safeguarding appliances
(4) Poor housekeeping
(5) Unsafe working conditions

4. DISPOSAL OF ACCIDENTS THAT OCCURRED

4.1. Report Should be Immediate

No matter how minor the accident might have been, it should be reported quickly in order

(1) to help supervisors take proper counter measures
(2) to minimize the economical as well as personal casualties to the possible extent.
(3) to eliminate the main causes to prevent accidents from recurring.

4.2. Investigation

Every accident has its own causes. So far as those accident causes remain unnoticed within the shop, recurrences of another accidents would be unavoidable in the long run.

Through investigation we are able to find those hidden causes.

4.3. The Steps of Investigation

(1) Take actions as soon as possible when an accident is reported.
(2) Get as many informations as possible.
(3) Get informations relating to both physical and personnel factors.
(4) Check all the facts relating production, such as, facilities, processes and operations.
(5) Don't jump into the predetermined conclusion.
(6) The report should be prepared on the basis of the facts alone.

4.4. Preventative Measures and Their Evaluation

One of the most effective approaches for planning preventative measures is to have conferences with the subordinates. But, followings must be kept in mind:

(1) Dogmatism will never be allowed.
(2) The conclusion should be practical as well as feasible.

5. RESPONSIBILITIES OF CASUALTY CONTROL

In each organizational echelon, lie those responsibilities.

(1) The management is responsible for providing workers with the physical facilities, working areas and tools which are well equipped and safeguarded.

(2) The supervisors are responsible for keeping the workers always observe the safety rules and precautions.

(3) Workers are responsible for doing their jobs in accordance with the safety rules.

Safety of a factory can be successfully maintained only through integrated efforts of all the personnel in each organizational echelons.

6. EXAMPLES OF SAFETY MEASURES (SINTOKOGIO K. K.)

6. 1. Our Accomplishment

The construction of our foundry was started in 1943. Since then we have been known as one of the most renowned foundries in Japan. Particularly we are proud of our supremacy in such products as; steel ingots, casting moulds, roles, cast steel, cast iron and pipes. The number of employees is 1, 800.
At the time when our plant started, the accident rate was high. Through various measures, we have been reducing this rate year after year, and finally, in 1966, it was 1. 11 (Ref. the table)

The measures we adopted are shown below:

* Improving safety organization
* Conducting safety training for skilled workers
* Standardizing operations
* Organizing pertinent regulations
* Promoting safety campaigns within each shop

In addition to those, our foundry was honoured by the prize of the Minister of Labor in 1960. We also established the record for accident-free-hours by 3, 250, 000 hours in June 1966.

Trend in Safety

Year	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Disabling injuries	18	13	6	7	12	11	10	4	7	12	2
Frequency rate	8.82	4.91	2.59	2.66	3.84	2.99	2.63	1.11	1.72	2.70	0.64

Average Frequency Rate

Whole Industries	13. 45
Foundries	18. 99
Steel Industries	8. 23

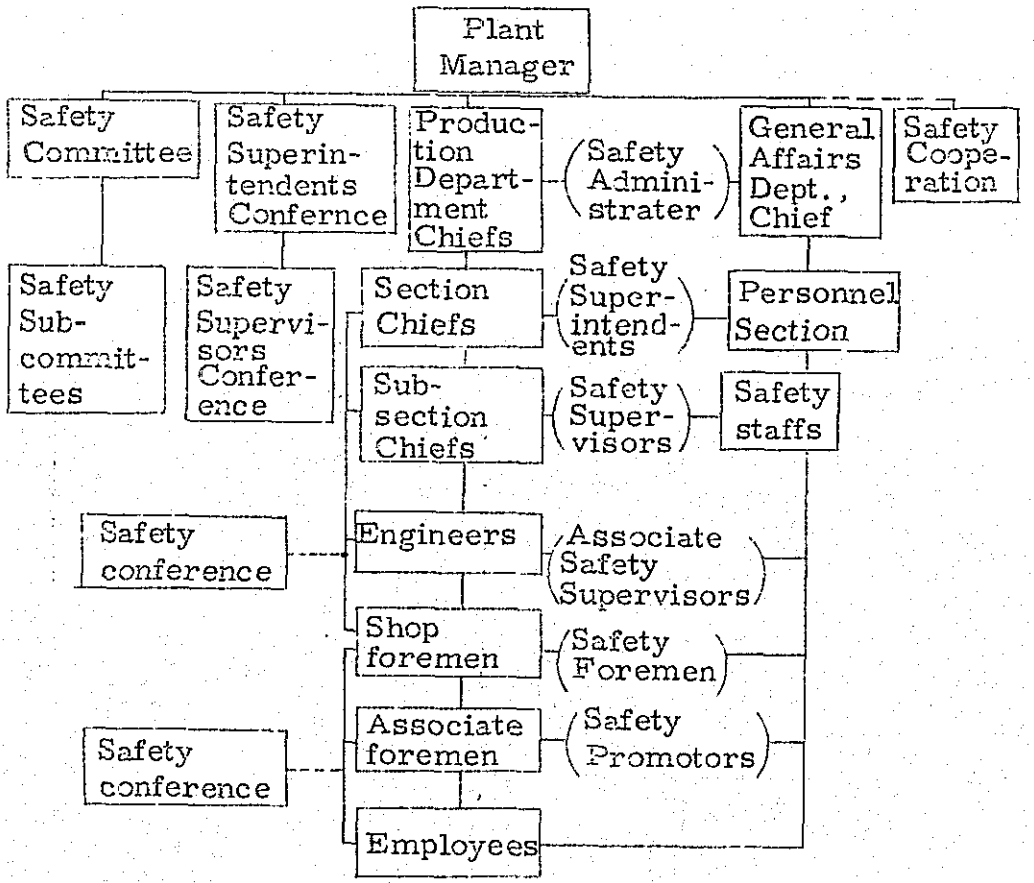
Frequency rate (Number of disabling injuries per million man-hours worked)

6.2. Safety Organization and Regulation

6.2.1. Organization

All the safety programs are administered through channels of safety organization of the company. Chief of Production Department is assigned as the Safety Administrator (KOJYO ANZEN KANRISHA) which is stipulated by the Labor Standardization Law. Each Section Chiefs are assigned as Safety Superintendents. Responsibilities and authorities of those assignments are stipulated in the provision of the safety regulation.

SAFETY ORGANIZATION



6.2.2. Regulation

The regulation covers 27 provisions that stipulate safety practice regarding the foundry operations.
As examples, some of them are listed underneath:

* Operations relating to high pressure gas
* Operations relating to handling hoisting tools
* Screening test for arc-welding technicians
* Screening test for AIZUKO (who gives signals)
* Operations relating to handling protectors and safeguarding appliances

6.3. Safety Training

Safety program consists of five courses.

6.3.1. The course in orientation program

The orientation of the company last 3 days. A safety course (3 Hrs)is one of the most important part of the program.

6.3.2. The course on-the-job

When new employees are assigned, each shop conducts apprentice courses (1 week), in which safety is taken up as an important session. For general workers, on-the-spot instructions are opportunely given through safety patrols and conferences.

6.3.3. Safety course for supervisors

Four hours course for associate foremen, and six hours course for foremen.

6.3.4. Safety course for skilled workers

For those jobs which may involve dangerous operations, standard operational procedures have been established, and training is organized thereof. Skill-contests are occasionally sponsored by the company. The jobs are listed under:

* Crane operator
* Welding technician

* Boilerman
* TAMAGAKE-KO (e.g. to look the ladle etc.)
* High pressure gas operator
* Electric wiring technician

3.3.5. P.R.

Through annual campaigns, P.R. cards are distributed among workers for bringing their attentions to safety. (Example, Electrification prevention month in summer)

6.4. The Highlights

6.4.1. Safety patrol

Weekly-duty system has been practiced in order that safety patrol will be conducted spontaneously at each working shop. In addition to this, safety patrols are also conducted every day by those who are assigned as safety supervisor, safety foreman and safety promotor. In each shop, they check safety practice and recommend opportune counter measures, or provide pertinent instructions.

6.4.2. Safety day

The fifth of each month is set for the safety day in our company. On this day we have a variety of campaigns, such as lifting up the safety flag, speeches by the Section Chief, safety conference, shop inspection and prayer - meeting.

6.4.3. S.O.P. (Standard Operational Procedures) and prohibitive acts.

Prior to establish S.O.P., the company nominated qualified individuals as analysts and provided them with necessary training. Operations have been broken down by those analysts as a basis for working out S.O.P.. No less than 500 S.O.P. are established so far. In addition to those, prohibitive acts in each section are set forth through booklets which are distributed to workers.

6.4.4. Oral confirmation

Most of the unsafe acts are caused from workers' missing

some of the important operational steps or key-points because of their attentions being distracted. To avoid this, workers are requested to ascertain their safety conciousness by asking themselves a question "Am I sure?", whenever they start to work.
For specific operations, numbering as many as 100, workers are compulsorily required to have oral confirmation.

6.4.5. Shops placed under safety probation

Those shops that was suspended because of accident, or those which need more intensified control in safety practice are placed under probation for three months. The shop is discriminated by identification mark, and is given a DARUMA with blank eyes (If they succeed in overcoming the deficiencies, it is allowed to have eyes). The safety supervisor is responsible for taking special care of those shops for guidance. Usually the shops are given several points for improvement specifically requested.

7. GENERAL RULES FOR SAFETY PRACTICE

(1) Don't wear half-sleeved shirt when you work.
(2) Don't keep a cigaret in your mouth when you work.
(3) Helmet should be fastened on your head with jaw-belt.
(4) Lift up the signal when you work in pit area or in altitudes.
(5) Set stockades around pit area.
(6) Don't use a hammer with gloves in your hands.
(7) Call technician whenever the electric fuses are changed.
(8) Put up the signals for the machines which are out of conditions or being repaired.
(9) Don't put anything within one meter from the perimeter of pit area.
(10) Workers are not allowed to get on truck body while transporting materials.
(11) The clearance between stone-wheel and table of a grinding machine should be less than 3 mm.
(12) Don't try to blow dusts off your clothe using high pressure air.
(13) Don't put anything over rails.

(14) When a truck enters into factory building from the tail, it should be guided by a pilot.
(15) Don't put anything cold into molton metal.
(16) Don't use oily gloves when you handle oxygen.
(17) Never miss to apply stopper to prevent round materials from rolling off by itself.
(18) Switches for high voltage circuits should not be touched by nobody but the designated.
(19) Metal flasks should never be piled up more than 2 meter high.
(20) Fasten handle of a hammer tightly with a wedge.
(21) No wooden ladder should be used except approved types.
(22) Only designated individuals are allowed to handle L.P.G. (Liquid Propane Gas)
(23) No gas container should be placed in pit area.
(24) Don't touch the rotating part of running machines.
(25) Put on mask when shaking out used sands.
(26) Nobody but the designated can handle the laddle during pouring process.
(27) Put on both glasses and mask during pouring process.
(28) Never use water to cool the leakage of a mould.
(29) Don't peep into riser hole during pouring.
(30) TAMAGAKE operation should be performed in cooperation with two TAMAGAKEKO and one signal conductor.
(31) Signal conductor and TAMAGAKEKO should be licensed.
(32) Signal conductor should put on safety helmet marked with green cross.
(33) Bag should never be piled up, nor should it be hanged in dual for transit.
(34) Nothing should be put on a bag in transit.
(35) Square flasks should never be piled up.
(36) Conduct the signals on the floor when performing TAMAGAKE operation in pit area.
(37) Don't work under anything that suspended.

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