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The Peterson Clutch-Coupling Division.

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THESIS
The Peterson Clutch-Coupling Division

by
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DEDICATION

This thesis is dedicated to the memory of Harriet F. Lee. Without her encouragement and devotion throughout all these years, this goal would never have been realized. It is more specifically dedicated towards furthering the knowledge of the recent college graduate in order to enable him to choose more effectively the area of employment for which he is best suited.
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I. Introduction

A. Reason for Study

"A factory is any place in which the factors of production, land, labor, capital, and enterprise are brought together for the creation of a good or service."

This is a brief description of a factory, but there are many underlying problems and undercurrents in business that the man on the outside normally fails to come into contact with. Personality differences, financial difficulties, product selections and many other areas create untold challenges and often unsurmountable problems, the likes of which have spurred American production to great goals in the last century since the industrial revolution. The industrialist of today is confronted with these innumerable problems and difficulties. While no man can always arrive at the optimum solution, those who come up with the most feasible answers are generally the ones who may eventually become successful. Although a man may possess many good qualities of leadership, he is never guaranteed of a successful career, for no one has ever been able to list the necessary qualities and characteristics that a man in the management area must possess to be successful.

This is an indication of the challenge that a young man entering the business world today, either working for another or for himself, is confronted with. For one of

#6, p. 3
ambition and personal pride this world offers a stimulating atmosphere with rewards of not only monetary nature, but of deep personal satisfaction.

This thesis sets forth this environment, describing not only the people that make it work, but their general activities and how they fit into an organization as a whole. It describes the process of setting up and running a small business and the process of developing and marketing a product of value to the industrial world.

This thesis is particularly dedicated to the young man about to receive his college degree and to enter the business world. A major question often asked by the student about to embark on his career is, "Where will I fit in best and what type of work am I most interested in and best suited for?"

It is one thing to determine what one wants, but often more difficult to know where to find it. It is the writer's goal to set forth the many advantages as well as disadvantages to the student to be employed by a small, closely held family organization. It will indicate the areas available to the potential executive and indicate how a more diversified training may be obtained in a small corporation as compared with a large one. It should be remembered that the optimum working environment is rarely found—even in the most efficient and best run factories.

# small corporation defined as 500 or less employees.
A good way to demonstrate and pass on information is by using the case study. Here an actual situation is shown, with all the day to day problems encountered by the young man searching for his place in the industrial world.

B. Scope

The scope will be broad, encompassing the three main areas of manufacturing: Sales, Production, and Finance. While these will be covered, particular attention will be paid to the personnel problems in each category and in particular to those within the production area. Although one of the three areas is no more important than the other, many management and personnel difficulties center around production with its many branches. Technical problems regarding the product itself are also to be found in this area.

In view of this fact, the Sales Department should not be slighted, for it is clearly understood that without sales, there would be no finance and production.* Management recognizes the importance of the sales force and is generally willing to reward a man for a job well done and for the many nights that are often spent away from home while travelling.

The Comptroller and his Finance Department should not be overlooked for without them there would be no standards of performance or efficiency, as well as budgets, allocation of capital, etc.**

* 32
** 30
C. Problem

The problem will be set forth in a realistic manner to bring out the authenticity of the material and at the same time not dwell in too great detail on any one area. A paper could easily be presented on any one of the above mentioned areas, but that is not the aim. The broad overall picture will be developed to demonstrate how the many segments are fitted together to produce the complete workable organization.

D. Method of Approach

A good method of setting forth an idea is by drawing the reader into the unfamiliar by means of the familiar. In this particular problem, the unfamiliar is the many intricacies of modern business. The familiar will be an actual case study of a small business in a medium sized city. This city possesses a great deal of heavy manufacturing, closely allied with the machine tool and metal-working segments of the economy.

A brief background of local environment will be given as a setting for the case study. This work will then be further broken down into the four areas of Management, Sales, Production, and Finance, with a final section devoted to conclusions and recommendations.
II. The Smith Company

A. General

1. Introduction to Geographical Area

The problem of setting up a new business or division within an existing organization has always been an interesting and challenging task. It generally requires men who are willing to work long, hard hours, those who do not get unduly discouraged when setbacks and difficulties arrive, and those who are able to develop an inspiring leadership element of a forceful and progressive nature. They must often be willing to forsake immediate monetary rewards, must have the best interests of the business at heart, and must expect to give much more than is received until the new venture is on a paying basis and on the road to success. After this point, they must be continually on the alert for signs of stagnation within the organization, both in product and personnel, and they must continually strive to keep ahead of competitors—price-wise, quality-wise, and service-wise.

This is a tremendous challenge for the average man and an ideal place for the young man recently out of college to start at the bottom of a small organization and materially contribute to its future growth and prosperity. He will have the opportunity to obtain a diversified knowledge of many phases of an operation, as opposed to the young man who starts on his first job with a large corporation doing a routine job, such as making time studies, for several years.
The following case deals with a small organization wishing to expand its facilities and includes many of the personnel and technical difficulties that have been encountered over the more recent years.

In order to understand the nature of this company and of the people which it employs, it might be best to briefly describe the geographical and economic climate within which it exists. The study takes place in New England and, in particular, in a leading manufacturing city in Massachusetts.

New England was one of the original manufacturing areas of the nation. In the last half of the 19th century and the first half of the 20th century, textiles, shoes, machine tools, and many other diversified industries thrived and flourished here. At one time this area was the center of the first two, but as time has progressed, many companies have moved to the South and other more favorable areas of the country. There are many reasons for this migration, such as higher labor costs, greater demands by labor unions, high state taxes. These reasons, along with the fact that old mill construction buildings were becoming run down and in need of new and better machinery, caused many manufacturers to move to what they considered a more favorable economic climate. Unemployment in cities such as Fall River, New Bedford, and many smaller towns reached a high level with a large surplus labor supply of semi-skilled and skilled laborers available.
From the above, one could conclude that New England had lost most of its manufacturing, and all those determined to remain should find employment in a different occupation. This, however, is very far from the true picture, for several new industries have moved in to replace the ones that have left. Because of the many colleges and universities (especially in the Boston area) with their highly trained staffs producing an abundant supply of well-trained technicians and engineers, a new field has recently arisen. Electronics and electro-mechanical development and production are now firmly established here. Along with these firms, many high grade consulting agencies, such as A.D. Little, have grown to fill the specific needs of these new manufacturers.

Due to the abundant labor supply, the plastics manufacturers have found New England to be a favorable area in which to produce. Such companies as Foster-Grant, Monsanto, etc. have virtually arisen over night.

All in all, however, the north-east area of the country is possibly reaching a mature stage of economic growth, since it cannot be compared with the rapidly expanding areas such as Florida, the Southwest, and the West Coast.

The city in which the Smith Company is located is very characteristic of the New England picture. The population has not grown to any extent since World War II and, although still a highly industrialized area, it has only a few
large producers, such as Norton's, Healds, American Steel and Wire, and Wyman-Gordon. Most enterprises are small family owned factories producing for the machinery and machine tool segments of the economy. People have stated that the city is highly diversified, but this diversification is noticeable only within the segments of the economy which deal with machine tools and metal working, which, in itself, is only a small portion of the economy as a whole.

Outside industry has received little if any encouragement to move to this area, and it has been said that several of the influential leaders from the larger concerns have even gone so far as to discourage new industry in order to maintain a surplus labor supply with a resulting lower wage scale and a minimum of pressure from the labor unions.

The machine tool and metal working segments of the economy either operate at an extremely fast or slow pace, according to the business cycle. In clarification—when times are good and general business conditions are improving, this area shows a strong business activity. On the other hand, when economic conditions are poor, machine tool activity is at a lower level than the rest of the economy. For this reason it is difficult to manage a company and maintain good employee relations, for in good times most workers are putting in many hours of overtime which yield them an excellent week's pay. As opposed to this, when business is slow, many are laid off and many of the remaining are working a thirty hour week.
During this recent 1957-1958 recession, the area has had a severe slowdown, and January of 1959 showed the highest figure of unemployment for any January since the depression days of the 1930's.* The city was designated a class "D" rating which indicates a substantial labor surplus and is one of the lowest of six federal ratings. What is worse, the area was hit earlier and harder than national and state averages, so it will be a longer and harder climb back because of both nationwide and local factors.**

It is interesting to note that in general families are not in as severe a financial situation as one might expect. Major stabilizing factors which account for this are: the public assistance programs in operation with social security, unemployment compensation, and relief operations pumping over $5,500,000 a month into the area.***

One bright spot is the Norton Company. In spite of the fact that their machine tool business was off 50 percent in 1958 from 1957, they have gone ahead with their $19,500,000 expansion program. This should be complete within six months.

The big question in most companies' recovery scheme is, "How well will the 59's sell?" In other words, will the anticipated sales in 1959 justify the capital expenditures of the past year?

* 21, p. 23
** 21, p. 1
*** 21, p. 43
This briefly has described the setting for the case study. It should be born in mind that while New England has been criticized for its high tax structure, its conservatism, etc., one should not overlook the many desirable aspects of the area, such as the high concentration of industry with its many diversified markets, its high level of cultural activities, etc.

2. Introduction to Case

The Smith Company in 1955 decided to expand its existing facilities and to set up the Peterson Clutch-Coupling Division. The parent company was originated at the end of the last century by the original designer of magnetic chucks, and the company today is the country's largest exclusive manufacturer in this very specialized area of magnetic chucks and related products. In these last fifty years it has grown to the point where it employs slightly over 100 employees in good times with an annual net sales volume of slightly under 2 million dollars.

A magnetic chuck is a device used in the machine tool industry. By electrical and permanent magnets, iron base metallic parts are firmly held in position during various machining operations such as milling, grinding, and lathe turning. The company has always followed the policy

# The Smith Company and the Peterson Clutch-Coupling Division are fictitious names substituted for the existing company and division in order to protect all parties involved.
of producing the Cadillac of magnetic chucks and has never been willing to forfeit quality in order to lower its selling price and obtain a larger sales volume. The result is that it has remained basically a job order shop without the necessary volume to invest in the automatic devices required of mass production techniques.

Problems relating to the newer, more progressive Peterson Division will be emphasized while describing its relationship to the parent company. They are physically at the same location but function separately insofar as the administrative and technical aspects are concerned. The manufacturing of both, while in the same building, occupies separate floor space.

3. History

The Peterson Clutch-Couplings were invented and developed at Worcester Polytechnic Institute, which was founded in 1865 as Worcester County Free Institute of Industrial Science. Here a new idea of teaching shop work in addition to science was developed and became known as the "Worcester Plan", which has since been adopted by many schools, including Stevens Institute, Georgia Tech, Carnegie Tech, and others. The "Worcester Plan" was carried on in the Washburn Shops of Worcester Polytechnic Institute (as it was later to become known) and in 1869 its first products were drawing stands and drafting tables.

Smith worked for the Washburn Shops in the 1890's
and invented a machine for grinding twist drills which is still manufactured today. In 1896 when Milton P. Higgins, Superintendent of the Washburn Shops, resigned to found the Norton Company, Smith went with him and in 1900 invented the magnetic chuck. As a result of a disagreement with the Norton Company, he left and founded the parent company of the Peterson Clutch-Coupling Division—the Smith Company.

Backtracking again to the Washburn Shops, in 1926 they bought out the makers of the Westland Clutch. These clutches were manually operated and of the single friction disc type used to engage or disengage two line shafts or countershafts.

Many inquiries about couplings were received from various industries, and it was obvious that an automatic coupling was needed to connect parallel shafts together without the necessity of manual operation. It was also realized that the manually operated clutches or couplings then in use caused a huge surge of electric current through the motor when they were suddenly engaged. This not only damaged the motor and considerably shortened its life, but also increased the overall power cost to the company through higher power rates. For these various reasons, attempts were made to develop an automatic coupling.

The first attempt was to incorporate something similar to a flyball governor into the Westland Clutch by having thrust transmitted to the friction plate. The
horsepower that could be transmitted by this coupling was so small that it was not practical. Springs were also tried in order to press the friction discs together, but they too failed.

The next attempt was to use a hollow rubber ring containing water and arranged so that centrifugal force caused the water to expand the rubber, which in turn engaged the friction discs. It proved impractical for it took a ring a foot in diameter to transmit three horsepower at a normal motor speed, and about three feet in diameter for ten horsepower.

Later the friction material was put on the outside periphery of the ring instead of the sides in order to take full advantage of centrifugal force. Mercury was substituted for the water, and this proved to be a workable unit. The mercury, however, was very expensive and the rubber rings had a doubtful life.

In 1930 the double centrifugal clutch was invented and patent rights secured. This was very similar to the present clutch with the exception of several minor design changes and improved materials. The couplings were immediately put into production, working very satisfactorily and causing demand to increase rapidly in spite of the fact that these were years during the middle of the depression.

Centrifugal force is that which results from the tendency of a rotating weight to fly outward from a center of rotation.
In 1933 the Falk Corporation of Milwaukee was licensed to manufacture and sell the coupling. With a few alterations in design, large scale production methods were applied to the manufacture of the coupling, and they attempted to sell the unit at a low price. Since they had failed to standardize the engineering end of it, it was soon found out that the cost to engineer each separate application was prohibitive, and after three years they gave up the item. The work then came back to the Washburn Shops.

When World War II arrived, demand became so great that the productive capacity at the college could not nearly satisfy the demand. The only solution was to license outside manufacturers, the largest of which was the Syncro Machine Company, which later formed the Centric Clutch Company to exploit the Peterson Coupling. They were given a non-exclusive license agreement with the college, which was terminated in 1954 as a result of poor performance. Despite this and the fact that the original patents had expired, Centric has continued to manufacture the clutch.

The outstanding wartime application of the Peterson Clutch-Coupling was on helicopters, and even today's Sikorsky ships have a modified unit for their main drive.

In 1955 Worcester Polytechnic Institute decided to terminate all commercial operations at the school because of extensive outside pressure. The school was beginning to show large yearly profits which was not considered proper
for an educational institution, and it was believed that the interests of making a profit through commercial enterprise would conflict with the interests of educating young engineers.

In 1956 the coupling, drawings, records, special tooling, and several excellent machine tools were sold to the Smith Company for the exceedingly low price of $25,000.

This brings us to the beginning of the case study, which deals with the testing and developing of new and improved materials and of standardizing a product to make it a commercially profitable item suitable for large scale mass production.*

4. Product

The main part of the Smith Company is devoted to the manufacture of permanent and electrically accentuated magnetic chucks, as previously mentioned. Since this product caters directly to the machine tool industry with its characteristic ups and downs, the company decided in the early 1950's to expand into another area in an attempt to even out these cyclical fluctuations.

After negotiations with Worcester Polytechnic Institute, the Peterson Clutch-Coupling was purchased outright and in 1956 was brought to the Smith Company.** Along with the physical and intangible assets came the following

* 24
** 31
personnel: (1) an application engineer who had been functioning as superintendent of the Washburn Shops, with an excellent knowledge of the technical aspects of the item (2) a shop superintendent with a complete knowledge of all applicable machinery operations (3) a consultant engineer who served as special advisor for the more technical and scientific problems. These two full time employees handling a sales volume of approximately $5,000 per month have expanded into a division of ten men with a net sales of $20,000 per month.

In order to better understand the operation of the clutch, the following technical definitions are listed before the product is described.*

1. Clutch- a unit which slowly and smoothly engages a motive force (electric motor, steam turbine, gasoline engine, etc.) to a driven load (washing machine drum, air compressor, refrigerating unit, etc.). This is an indirect type of drive through the use of "V" belts and cast iron sheaves.

2. Centrifugal Force- a force directly outward, caused by a weight rotating about a given center.

3. Centrifugal Clutch- a clutch that is accentuated by centrifugal force.

4. Coupling- a unit that directly couples a motive force to a driven load as in No. 2.

* 27
5. Centrifugal Coupling- a coupling that is operated by centrifugal force.

6. Centrifugal Clutch-Coupling- a unit that is a combination of Nos. 3 and 5.

The Peterson Clutch-Coupling Division is the only manufacturer of Peterson Clutches and Clutch-Couplings, and although several attempts have been made to copy them, the would be producer was confronted with many patents covering the technical aspects of the design. On page 113 of the appendix is a picture of a Peterson Type A Clutch-Coupling. This is a unit that directly connects the motive force and the driven load, i.e. the axis of the two shafts is common. The hub that can be seen facing you is slipped onto the motor shaft and securely fastened, while the hub of the driven member is attached to the shaft of the driven load.

On page 115 can be found the Peterson Type B Clutch. This unit indirectly connects the motor to the load by means of "V" belts passing over two sheaves. Here the axes are parallel to each other. The motor would be situated to the left side of the unit with the shaft fitting inside of the bore which is shown emerging from the right side.

# Type A (direct drive) and Type B (indirect drive) are the two main categories of units. Type A is called a Clutch-Coupling, as it acts as a clutch and a coupling, while Type B is called a clutch, for it serves only that function. These are the two main types of units and all variations are developed from them.
These clutches and couplings will be described and it will be shown that a simple mechanism such as this can do an extremely effective job. On page 114 in the appendix you will find the Type A unit disassembled. The following main components are shown: (1) Driven member or driven drum on the left (2) Driver or driving member on the right (3) shoe segments—in darker color—fitting into the pockets formed by the "spider".

To assemble the unit, the driven member on the left is turned upside down and dropped over the driver half on the right. Both parts are independent of each other.

As the motor starts up, the shoe segments are thrown directly outward against the inside of the driven drum and as these shoes slip over the surface, their friction gradually causes it to reach the motor speed. It is the smooth gradual start that is effective, similar to the smoothness produced by a shock absorber in an automobile. When both halves have reached the same speed, the load and motor are locked together and there is no slippage.

The action is identical to the old style fluid coupling found in the Dodge automobile during the early 1940's, with the main difference being that the fluid coupling uses a rotating fluid (oil) instead of metallic shoe segments. Because of this, there is always slippage which

# Terms particular to the power transmission field and the Peterson Clutch-Coupling.
amounts to a 5-10 per cent power loss at normal speed. This unit is known as "Free Engagement" because the shoes are free to fly outward as soon as the motor starts up, with no restraining force. On page 116 the "Delayed Engagement" style of shoe is shown. The couplings are identical, except that flat springs are bolted to the back of each shoe and spring slots are cut into the driver to retain them. These are used in gasoline and diesel engines where there must be a warming-up period with no load, similar to that in starting an automobile while in neutral. The springs hold the shoes back against the centrifugal force until a predetermined speed is reached. At this point the outward force of the shoe bends the spring far enough so that engagement with the driven drum takes place.

Both free engagement and delayed engagement shoes are found in the Type A (direct) and Type B (indirect) drives. These couplings carry horsepower from a fraction all the way up to 2 thousand or more. For a given speed, the capacity of the clutch can be varied in two ways—by changing the amount of weight in the shoes or by varying the distance they rotate from the center. For this reason, the fractional HP unit is only three inches in diameter and weighs less than ten pounds, while the one for 2,000 HP is two feet in diameter and weighs 1,500 pounds (3/4 ton). With this range of capacity these units are used on the lightest of commercial products, such as lawn mowers, as well as the heaviest of industrial equipment, such as large diesel engines.
Although they are very simple in design, many metallurgical and design problems had to be solved before they could be mass produced at a profit.* The greatest problem that confronted the Peterson Division was the shoe segment. When the product first came from Worcester Polytechnic Institute, the shoes were made of standard automobile brake lining, hammered and bent into shape and backed with lead weights, which were secured with brass rivets. They were completely hand made, with each job being separately engineered. The result was that almost every coupling had a different weight of shoe, with no semblance of standardization. The lining was not of an adequate material to stand up under the higher temperatures, but at that time no better material was commercially available. Upon starting, the sliding friction between shoes and drum developed tremendous heat. This is an important function of the product, for in order to bring a certain mass up to a certain speed, electrical or chemical energy must be converted to mechanical energy, resulting in a fixed amount of heat being generated. Without the use of couplings, all this heat would go into the motor, overheating it and shortening its life by many times. The coupling takes a substantial portion of this heat from the motor and absorbs it into its own metallic parts.**

* 27
** 26
As the lining heated up, "break fade" took place, which means that at elevated temperatures the lining breaks down and does not adequately perform its function.* The lining also acted as an insulator, leaving 90 per cent of the heat to be absorbed by the drum. This rapid rate of heat influx followed by fairly fast cooling set up tremendous stresses in the cast iron drum, and over a period of years, cracks would form and the metal would fail. The problem was to get a material that could absorb a large amount of this heat but still not break down. Many materials were tested and finally a bronze was developed which solved many of the problems, for this metal absorbed two-thirds of the heat, leaving only one-third for the drum to absorb. Bronze, however, was extremely expensive and its surface would melt at high temperatures—over 1500°F.

During 1958 much time and money was spent on experimenting with the cheaper irons in order to eliminate this melting problem. Iron does not melt until it reaches a temperature of 2700°F, while bronze will melt at 1700°F. The greatest difficulty was to prevent the harder iron shoes from wearing into the drum which is also cast iron. If a softer iron was used so as not to wear the drum, it would not absorb enough heat and the drum cracking effect (heat checking) would still exist.** On the other hand, a hard iron absorbs more heat but rapidly wears the drum.

* 13, p. 26
** 12, p. 15
Finally a cast iron was chosen which was a good compromise between the two. It gave better overall performance and, at the same time, was only one-fourth the cost of bronze or organic lining. Presently all stock of bronze shoes is being used up and all new orders will be of the cast iron metal.

With the use of metal shoes came the necessity to standardize certain weights for each size of coupling. Tables were set up to eliminate the necessity for calculating many complicated formulae for each application, and now the unit can be picked out of a standard table in the catalog. This was the greatest single factor which made the item commercially feasible, for during the 1930's one of the reasons that the Falk Corporation failed in their project was due to the very difficult task of accomplishing this goal.

The Detroit automobile industry has been spending millions of dollars in an attempt to develop a metallic shoe and have tried many combinations of sintered metals.* Sintered metals were tried by the Peterson Division but failed to meet the heavy duty requirements. Because of the high stresses and temperatures, the material would crack and then split in half.

It should not be, though, that the Peterson Division succeeded where General Motors and Ford have not. Upon starting and stopping, the shoes used in Peterson Couplings

* 18, p. 242
produce a high, squealing noise. While this is not detrimental in heavy industrial equipment where there is considerable noise from other sources, it could not be tolerated in the automotive industry. A commercial automobile is a quietly running mechanism, and a similar amount of noise on the brake drums would be unacceptable from a consumer standpoint, which is of primary importance.

However, the new iron base shoes are not the ultimate, for higher speeds and higher horsepowers are becoming more and more popular in steam and gas turbines. Higher speeds and horsepower mean higher heat input to the coupling, which in turn means greater metallurgical problems. These will not be solved overnight, as was discovered in the aircraft industry when high speed jets and rockets were developed. The problems are similar and are good examples of further improvement in a product having to wait for the basic research of a large corporation or an ingenious inventor to catch up.

The answer may be in plastics which are becoming very diversified in their usage.* Recently, a great deal of work has also been done by the Bendix Aviation Corporation in the area of metal-ceramic friction materials.** This material is reported to have excellent wear characteristics and to afford good protection against heat checking,

* 16, p. 27
** 15, p. 152
but presently the experimental work is a very closely guarded secret, with only a smattering of information being made known to the Peterson Coupling Division.

The second area of general improvement was with the Type B (indirect drive) clutch. In this unit the clutch is fastened together as a unit with bronze bushings guiding the two parts. These bronze bushings were made of heavy pieces of metal and were continually breaking down and causing much trouble. After considerable experimentation a thin, 3/32" steel-backed bronze bushing was substituted. This has diamond indentations with graphite baked into it to reduce wear, and has proven to be very effective. This same type of clutch, as shown on page 115 in the appendix, must have a "V" belt sheave attached to take power from the clutch to the load. Previously the sheave was cast as a part of the driven member with thousands of combinations available. Because of this, each unit had to have special castings made to order.

The new design has no integral sheave but merely a tapered hub. The customer now buys a commercially manufactured sheave to his liking and assembles it to the clutch. This appears to be a simple problem to solve, but only a small number of the available sizes could fit on to each size clutch and the most popular sizes had to be chosen. Previously, nearly all of the Type B's were specials, but now 90 per cent are standard "off the shelf" items.
Much machining time was cut down and many operations completely eliminated by the new foundry practice of shell molding. With this process an iron or bronze casting can be molded to an accuracy of .003 of an inch for each inch of length. At present, however, the equipment is only large enough to handle a coupling 8" in diameter, which excludes the shell process for units in the 10" to 24" range.

As the shop superintendent said, "Without these major improvements we never could have handled this new volume of production without a large expansion program."* And on the same subject the comptroller said, "The new modernization program has changed a non-profit item to a product making from 40 to 70 per cent profit on the manufacturing cost."** Although this is a rare situation, and although the Peterson Clutches and Couplings are competitively priced, it seems as if the only way to get the high volume required for mass production is by lowering prices in order to take existing accounts away from competitors. This would reduce the profit margin on each unit, but the anticipated volume of sales could greatly pyramid the overall profit picture of the organization.

These clutches and couplings have an almost limitless number of applications, ranging in size from small washing machine drives to helicopters and huge diesel engines.

* 28
** 30
Listed are nine major reasons why people buy and have used Peterson Clutches and Couplings for nearly thirty years.

1. for overload safety protection
2. for high inertia\# loads
3. to eliminate expensive starting equipment
4. for a smooth soft start
5. for dual drive applications
6. for engine warm-up periods
7. for high starting torque
8. to limit current and heat to the motor
9. for reversing ease

In order to show some of these many applications, pictures have been included in the appendix on pages 119 through 131, with a short description of the motive sources, clutch sizes and types, and driven loads. These pictures not only show actual uses, but show how the clutch or coupling is mounted between motor and load.

B. Management

1. Organization of the Smith Company

Good management concerns itself with the development of people as well as direction of things. Proper selection, training, and upgrading form the very basis of morale building, and morale can either make or break an

\# inertia is an engineering term used to express the weight and size of a given object.
organization.* This morale is a state of faith—faith in the organization, in its leadership, in its objectives, in the achievement of these objectives.**

One of the important things that a prospective employee should attempt to find out about a company during the interview period is the state of morale. This can be surmised in many ways. The first and most accurate method is by personally speaking to people that have worked for the particular company or that know of people presently employed. If such individuals are not available, then much can be gained by carefully observing the attitudes of the working man in the shop as well as his apparent efficiency on the job. The organization should be a smooth running operation with the majority of workers not only satisfied with their salaries, but also content in their working environment.

In order to put these ideas into a practical situation, the organization of the Smith Company as well as a description of its key personnel and of their individual characteristics is discussed in this chapter. The management personnel are the ones that either set a good or bad example, and upon them goes the direct responsibility of maintaining worker morale.

The organization of the Smith Company is shown on the following page. While no formalized chart as this exists

* l, p. 5
** l, p. 1616-1626
CHART I

ORGANIZATION OF THE SMITH COMPANY

PRESIDENT

VICE PRESIDENT

PETE RSON
DIVISION MANAGER

SALES

ENGINEERING

COMPTROLLER

SALES

PRODUCTION

ENGINEERING

SUPERINTENDENT

LATHE DEPARTMENT

MILLING DEPARTMENT

GRINDING + WELDING DEPARTMENT

DRILLING DEPARTMENT

SAW DEPARTMENT

SHIPPING DEPARTMENT

DEMAGNETIZER

PERMANENT CHUCK

SHOE DEPARTMENT

SOURCE: INTERVIEW WITH THE PETE RSON DIVISION MANAGER
within the company, it is small enough so that everyone is aware of his responsibilities for the most part, with only occasional problems arising from lack of knowledge on an individual's part.

The president, Mr. Sands, is a man in his mid-forties whose family recently obtained a controlling interest in the company. Previously he was in the management of a larger company, also controlled by the same family, which is one of the most well-established manufacturers of cutting tools for the metalworking industry. The items include drills, taps, reamers, and other related products. It was believed that a younger, more vigorous personality such as his would go a long way towards building up the sales volume of this well-established business, and in 1955 he resumed his present activities as President. Mr. Sands keenly is interested in the research and development phase of the business and formed a new department exclusively devoted to the electronic and electric phases relating to demagnitizers.

A demagnitizer is a unit that in a minute interval of time removes any residual magnetism from an object such as a ball bearing. During various machining operations they are held down by magnetic chucks and pick up some of its magnetism. If left in that condition they would attract any free iron dust or filings, and in a short time would be destroyed. This, by the way, was the manner in which much sabotage was carried on during World War II—by placing iron
filings in the lubrication systems of machinery. This type of unit requires large currents of a specialized nature and therefore an elaborate system of electrical components.

This president has since been instrumental in buying the Peterson Coupling from Worcester Polytechnic Institute, as well as buying out a controlling interest in a similar magnetic chuck manufacturing company in Holland. He spends considerable time visiting this company as well as making goodwill tours to the more important sales personnel in the field and to the original equipment manufacturers.

Within the organization Mr. Sands spends more of his time on the higher level management decisions, such as hiring of key personnel, sales policies, production policies and personnel relations. Mr. Sands appears to be a thinking and dynamic individual and is proving to be the motivating force behind a more progressive company with a younger, more energetic management group behind him.

Mr. Sands' assistant is the vice president, Mr. Roberts. He is a man in his middle sixties, who started at the bottom as shop worker and has worked his way to the top. He will reach the retirement age within three years. Mr. Roberts came with the Smith Company fifteen years ago as shop superintendent and later moved up to his present position of vice president. Being responsible for the day to day operations of the factory, as well as keeping the
president informed on all important matters, is one of the important functions of this man. Upon his shoulders rests, too, the challenge of putting a product on the market as efficiently as possible with as good a quality rating as possible.

Mr. Roberts believes that in order to efficiently perform his job, he must be aware of all details of the shop's operation.* He therefore follows the policy of having all orders and correspondence cross his desk before entering normal distribution. The new orders for magnetic chucks are priced by him and written up prior to processing by the clerks.

He is personally responsible for all activities pertaining to the Peterson Division. Under the vice president are found these three staff offices: Sales, Engineering, and Comptroller.

Mr. Jones is in charge of all sales relating to the parent company, but not of the Peterson Division. With his one assistant, the two of them cover the entire United States. Consumer or user accounts are handled through manufacturer representatives and local distributors, while the more lucrative original equipment manufacturers are handled directly. The schedule of the two men consists of two or three weeks on the road and one in the home office. While in the factory, they work very closely with the development

* 31
engineers on new products and non-standard items requested by the customer. Considerable time is also spent on setting prices on these items, as well as establishing delivery dates on current and potential orders.

One of the main responsibilities which these men have is bringing customer opinions and reactions concerning Smith products back to the factory. As Mr. Jones stated, "We are the eyes and ears of our company, and in addition to our selling function, we endeavor to bring back all the information to the company that we can concerning our products."

The sales force of a company is probably the most important of the three areas of sales, production, and engineering, for without sales there would be no requirement for the other two. For the student looking for his first job, this aspect of manufacturing concern offers good possibilities of not only monetary rewards, but also the feeling of personal accomplishment. The salesman is generally his own boss, and his success is dependent upon his own energies and ability to get along with people. It is often thought that the salesman is a man who goes from door to door trying to get his foot over the threshold before it is slammed in his face. Industrial sales of a well patented item is very different. There is very little "wining and dining" for you are dealing with people that are as interested in

*34
finding improved products that will save them money as you are interested in selling to them.

The Engineering Department is the second staff agency coming under the jurisdiction of the vice president. Mr. Anderson, who has been with the Smith Company for many years, is in charge, and has grown up with magnetic chucks. He is a man in his fifties who possesses a superior knowledge of the many facets in the design and development of standard and specialized chucks and related products. Working for him are three design engineers, one of which has a college education, the other two having learned the trade through the years of practical experience. This department is responsible for the design, development, and testing of new products as well as variations to existing ones. One of their major achievements is the perfection of a new line of magnetic chucks utilizing small non-metallic permanent magnets in each unit as opposed to a lesser number of electric coils in previous models. This new type is extremely powerful and removes the necessity of specialized electrical equipment to obtain the direct current required in previous units. This unit now represents sixty to seventy per cent of the entire business.

Their latest development has been an entirely new line of Vacuum Chucks. Aluminum and magnesium parts, predominantly used in the aircraft industry, are non-metallic. In order to securely hold them to a table, the idea was
conceived to use an air vacuum in place of magnetism. This has proved satisfactory and last year several $70,000-$80,000 specialized units were sold to the government to use as a holding device for large wing sections of the large jet bombers.

Mr. Anderson is also responsible for the processing of proposed drawings and price quotations on inquiries sent in from the field by the Sales Department. Pricing is developed from complete historical records of previous orders combined with the many years of experience in the manufacture of similar items.

A small sub-department in the same area is that of reproduction. All blue-prints and copies of letters are made here, requiring the use of a great deal of one draftsman's time. The reproduction equipment is quite old and inefficient, whereas with the newer type of machines, more labor hours would be available for the draftsman to devote to productive drafting time.

For the student with a technical background looking for his first job, this area offers an excellent opportunity to learn a product and the workings of production. Once this knowledge is acquired, experience in the sales and finance aspects can be gained as the employee reaches toward the ultimate goal of top management.

The engineering aspect of a factory offers a challenge to the man who enjoys the more detailed type of work
and who wishes to see tangible day to day accomplishments. The designer who originates a piece of machinery and sees it constructed in a relatively short period of time can derive a great feeling of pride and self accomplishment. On the other hand, administrative or management personnel who enact new policy procedures may not see the results for a considerable period of time, and then they may be intangible at best.

There are the many areas of a business where one may find the most interesting work of his choice, and no one can positively state that one area is more desirable for all employees than another. Many factory workers would not accept an administrative desk job, even if it meant a considerable increase in salary and greater security.

The Office of the Comptroller is where the financial and administrative functions of the Smith Company are performed. In charge of this department is the treasurer, Miss Bond. Miss Bond is a middle-aged woman in her late fifties who will retire this year after having worked for the company for thirty years. Mr. Long, her assistant, is expected to take over her duties later this year. He is a young man, twenty-nine years of age, and a graduate of the Wharton School of Business of the University of Pennsylvania. After spending three years as an officer in the United States Navy, he began his career in the advertising area. Shortly afterward he entered the employment of the Smith Company and has held his present position ever since.
Including three clerk-stenographers, the total number of employees in this department is five. The responsibility for administrative procedures pertaining to all personnel actions lies in this department. When an employee is hired or fired, numerous forms must be completed for record keeping purposes. Records for weekly pay computations, as well as Federal and State withholding taxes and social security benefits, must also be maintained. The company has liberal fringe benefits for its employees which include: a retirement plan, a life insurance policy and Blue Cross-Blue Shield, which also must be administered by this department.

The responsibility for keeping all production cost records and a running inventory for the main division belongs to Mr. Long. Each order that enters the shop is given a number, and all production time reported under that number is added together. Mr. Long combines this with the material and overhead costs to get the cost of goods manufactured. From this information and with the aid of accumulated historical records, the efficiency of the shop can be measured, as well as the profitability of an applicable order.*

All internal accounting such as budgets and monthly profit and loss statements are also maintained by Mr. Long. The purchasing function was assigned to this area, but the workload became too great and it was transferred to the office of the superintendent.

* administrative employees of the Peterson Division are in a separate office.
All clerical and stenographic activities of the main division of the Smith Company are concentrated in this office, including those of the office of the president and vice president.

For the student seeking employment who is not interested in the technical aspects of engineering or sales, this area offers the opportunity for an extremely diversified education. The Comptroller's Office is the eyes and ears of the organization, and works closely with top management, offering a good avenue for advancement. The responsibility is available for one willing to work conscientiously in this area.

The above three departments—Sales, Engineering, and Comptroller—comprise the staff functions of the main division of the Smith Company. In the chain of command, the line function goes from the vice president to the office of the superintendent and assistant superintendent.

The superintendent, Mr. King, is a man in his middle fifties, with many years of experience in the textile and machine tool industries. He has under his name approximately twenty patents for items which he has developed over the years. He was originally hired by the Smith Company in 1957 as a design engineer, working in the engineering department under Mr. Anderson. His first job was to design and supervise the construction of the first large vacuum chamber ordered by the Army Ordnance at Redstone Arsenal. In
the latter part of 1958, after the project was completed and after the recession had decreased the annual sales to a large extent, the management decided it was necessary to reduce the administrative overhead. The first phase of the program was to reduce the salaries of the more highly paid administrative employees by 10 per cent. In addition to this, many employees would be placed on a twenty-eight or thirty-two hour week and the remainder placed on the already increasing list of unemployed. Mr. King was one of those given his two weeks' notice.

At this same time difficulties arose between the existing superintendent, Mr. Jones, and the vice president, Mr. Roberts. The result of the differences in personalities was that Mr. Roberts was transferred to the field as head of the sales department. His assistant, who had only recently been elevated from the position of lathe department foreman, was returned to his previous job. With this renovation, the production at the Smith Company was left without direct supervision.

After considerable thought and one week before Mr. King was to leave, the Smith Company management requested that he accept the job of superintendent. "This was quite a surprise to me, for instead of being laid off, I've been given the excellent opportunity to take over as superintendent," stated Mr. King.*

* 28
Three men were available for the position of assistant superintendent—the foreman of the shipping department, the shoe department foreman, and the permanent chuck department's foreman. After considerable thought and with the consent of the vice president, the shipping department foreman was chosen, for he was the only man who had a fairly comprehensive knowledge of all the aspects of production. His assistant moved up to take charge of the shipping room.

These two men are directly responsible for maintaining a harmonious and efficiently operating shop. This has been an extremely difficult task over the past year for, at one time the workers were only putting in a twenty-eight hour week. The natural reaction was to reduce their output in an effort to increase their number of working hours per week by not getting the work completed according to existing schedules.

With the aid of staff production engineers, delivery dates were scheduled and from then on, it was the responsibility of the superintendent to see that these dates were met. To achieve this end, they must see that the work flows smoothly and without interruption through the shop. Since there is no formal scheduling of orders, they must at any time be able to know where each lot is and in what stage of production the particular item is. Also to achieve this end, a production board has been established which visibly shows delivery dates, but not production routine. This is a
considerable improvement over attempting to remember each one of the many items.

Mr. King must also see that employees are properly paid for the work being done, with as few inequities arising as possible. He must have a good working knowledge of all the machinery in the shop in order to insure that the most work possible is derived from each machine. This may be accomplished through the use of improved methods, the use of jigs and fixtures to eliminate as much hand work as possible, improved cutting tools and many intangible factors such as the proper lighting, cleanliness, maintenance, etc.

It can be seen that the superintendent must be a machinist, a time and motion study engineer, a production engineer, a wage setter and a personnel expert. His is one of the more difficult jobs in the factory requiring a vast knowledge of many details and might be compared with the position of master sargent in the army. The master sargent is the backbone of the army, for he is the man who is directly responsible for carrying out the orders of his superior officers.

Mr. King has nine operating divisions beneath him as shown on the organization chart. The lathe department is composed of seven to ten men working on small engine lathes as well as large Warner-Swasey fully automatic machines. The department is diversified to the extent that it can handle one time shortrun items or large lot sizes approximating the full automation of mass production.
The milling department consists of from five to seven men operating varied milling machines which also are used in metal cutting operations.

The grinding and welding department consists of from five to seven men with no machinery except portable hand tools. When large iron and steel castings enter the shop they must be ground reasonably smooth when they are not machined. This is accomplished here with the aid of portable grinders. All welding, soldering, and brazing is also done in the department.

The drilling and saw departments each have from four to six men and handle all drilling, tapping, and countersinking operations, and all sawing of metal parts and wood parts.

The shipping department is maintained by four men. Production items are painted and then packaged here in specially constructed, heavy duty boxes. The paperwork is then processed and the chuck or coupling shipped via truck, rail, or airplane. A reasonable amount of responsibility lies within this department, for without a continual vigilance, orders could easily be shipped to the wrong place or improper material shipped in error. The shipping department chooses the routing, except in special rush cases or where the customer specifies the common carrier which should be utilized. In shipments for overseas, there are several separate procedures that must be followed in order to obtain
clearance through customs and to allow for any existing tariffs.

The demagnitizer department is slightly over one year old and seems to have great potential. It produces demagnetizing units which remove any residual magnetism that may exist in an iron base metal. This department presently employs four men and is largely engaged in the experimental and developmental phase of the product. The president, Mr. Sands, spends considerable time with his electronics engineer on such projects as these, for he believes that here exists excellent potential, especially among the ball bearing manufacturers.

The permanent chuck department is the largest of the nine. It employs from ten to fifteen men and is devoted entirely to the manufacture of the newer line of permanent magnetic chucks. The market only recently seems to have switched from electric to permanent magnetic chucks. Because of a recent development of a ceramic magnet many times more powerful than its predecessor, the desired strength from this type of unit can now be obtained. It removes the necessity of expensive electrical equipment required by the conventional electric type. At the present time, however, they have a physical limitation of two feet in length, whereas the electric ones are made from one foot to twenty or thirty feet long.

Because of this new demand, the personnel of this
department are presently working a fifty-eight hour week, and the future for this product seems to be very bright.

The shoe department consists of three men and is entirely devoted to the manufacture of brake shoes for the Peterson Clutch-Coupling. Although directly under the superintendent, it works very closely with the engineering staff of the Peterson Division, as there have been many engineering changes and trial and error developments which have made this a necessity. Presently, as the product is fairly well standardized, this coordination is not required, and the department is entirely under the office of the superintendent. This area will be discussed in more detail in future sections under the description of the Peterson Division.

2. **Organization of the Peterson Division**

Backtracking a bit, the Peterson organization chart shows that the Peterson Division is apart from the main division of the Smith Company insofar as the engineering production, and sales functions are concerned. The office of the comptroller provides a staff assistance in the areas of finance, budgeting, and factory costs, and exercises no command function over the division. It also handles the weekly payroll and other matters pertaining to personnel records, but all hiring and firing is the responsibility of the division manager, subject to the approval of Mr. Roberts, the vice president.
The monthly profit and loss statements are compiled by Mr. Long and submitted to the vice president. No formal budgets exist, but periodic checks are made on inventory levels in order to insure a proper inventory turnover. Since the Peterson Division has prospects of highly increased sales in the future, the management is quite lenient in this area and only requests a two to three time turnover per year, as opposed to a figure of four to five if the sales were in a more stabilized position. Under these conditions, it would be easier to predict the raw material requirements and thereby lower inventory levels considerably.

All orders sent down to the shop have a "cost schedule" completed by the division production engineer. All raw material requirements are listed with space provided for labor hours, labor dollars, and overhead rates to be inserted. The dollar costs are filled in by Mr. Long and totaled to get the complete manufacturing and operating costs for the order. These are then compared with the net amount received through the sale of the item and the profitability is determined. These figures are kept on file and used as a basis for periodic changes in the selling prices and future quotations.

The division manager, Mr. Marshall, reports directly to the vice president and is responsible to him for all decisions made. Mr. Marshall is a man in his middle
fifties, who obtained his engineering degree at the University of Michigan. He spent the next seventeen years heading up the New Devices Committee of General Motors before going out on his own. Having more than twenty inventions registered with the U.S. Patent Office, he then proceeded to develop an encapsulating machine that automatically produces vitamin and other pills in very large quantities. After this venture, he developed the Steel-O-Tex mattress material which combines a steel netting within molded foam rubber.

In 1956, when the coupling was purchased from Worcester Polytechnic Institute, Mr. Henderson, the present applications engineer, was the only one possessing a knowledge of the technical aspect of its construction. It was soon evident that he would need assistance in the difficult task of unravelling the complications that existed in the present coupling. In a few months an outside man was brought in as manager of the newly formed division. Little is known about him except that in approximately six months he left and was replaced by Mr. Marshall, the present division manager.

The problems and difficulties related to the sales and production areas were numerous and will be discussed in a later chapter. There were, however, many problems on the management level to be solved.

Just before Mr. Marshall arrived, a new, two-story wing was added to the existing building. The ground
floor was given to the permanent chuck department for their production, while the top floor was given to the Peterson Division for use as their office space. The area was the most pleasant and desirable in the factory. Previous to this, the new division was looked upon as the step-child and under the new conditions there was a further resentment. As is often the case in a well established business, a drastic change is often met with considerable resistance. This was one of those cases. In the processing of orders through the shop, Peterson would always be handled after Smith orders were completed, resulting in a delivery date of two or three months for a standard item. Only through hard work and an uphill battle all the way, has this generally negative attitude been changed so that the clutches and couplings are now on a par with the magnetic chucks.

Under the division manager are the three departments: Sales, Production, and Engineering. The chain of command follows down through production to the superintendent, Mr. King. This will also be described in greater detail in a later chapter.

3. Management Policies and Areas for Improvement

"Sound personnel administration means so organizing and treating people at work that they utilize their maximum individual capacities, thereby rendering their maximum service to the enterprise of which they are a part."*

* I, p. 1539
Morale is not as high as it could be at the Smith Company due to many factors, but most important, the low volume of incoming business with its resulting thirty-five hour work week. The situation can best be brought out by analyzing Alford's Principles of Manufacturing Management.* These principles are as follows:

1. Organization and leadership
2. Specialization and standardization
3. Production planning and control
4. Materials control and handling
5. Product inspection and quality control
6. Individual productivity
7. Wages and wage payment
8. Safety and maintenance

The products of the Smith Company are superior to those of their competitors in the same field, and through the years a great deal of time and money has been spent to develop this line to its present status. The first and major necessity for an efficient and smooth running organization with proper delegation of authority is an organization chart so that each man knows where he stands in the company, who he is responsible to, and what he is responsible for. This is one essential factor in a smooth-running organization. As the foreman of the Peterson lathe department said,

* 1, pp. 1385-92
"How can I do an effective job when I have several bosses telling me to do different things, and I really don't know how much authority I have and who comes under my direct supervision."

This is the type of statement that one runs into when speaking to the average hourly-paid employee in the Smith Company. There should be a firmer leadership with a more definite chain of command.

The second principle is Specialization and Standardization. The company has succeeded in doing a good job in both areas. There are only a handful of related products and the Peterson Division has completely standardized on 99 per cent of its business. In 1956 the opposite was true--99 per cent was non-standard.

There were no standard selection tables from which an existing or potential customer could choose a clutch or coupling. All orders would come into the Smith Company with specifications for each application, requiring separate engineering calculations. With the present and anticipated volume of orders this would require a large engineering staff which would cause the overhead to be so high that the product would become unprofitable. There were no standard weights for the brake shoes which meant that a stock of finished goods items could not be kept on hand.
Many housings were of a varied design which required special castings to be ordered from the foundry. This prolonged the delivery date to the point where customers would go to another supplier who could afford them a few days' service. The shop was also manufacturing by rough hand sketches without standard drawings and specifications.

All of this has changed and presently the company is producing a standard item which can be manufactured in large lot sizes. This makes use of the efficiencies derived by utilizing more elaborate machine setups and expense jigs and fixtures.

These many changes did not occur without much effort on the part of Peterson Division personnel. To complicate matters, the old time employees were not extremely imbued with the policy of spending one dollar to save two, and with the clutches and couplings being the "step-child", resistance was even more intense.

Despite these difficulties, the division manager overcame the problems one by one, until today the product has become a commercially recognized and readily marketable item. Only through his creative imagination and an unusual desire to achieve this goal was all this made possible.*

The third principle, Production Planning and Control, is an important one. The shop is not large enough to have a complete scheduling of each machine, so an overall

* 26
daily schedule has to be sufficient. This is based on an educated guess as to what the shop can produce from day to day, and there are no specifically arrived at times to base this scheduling on. There is also no definite routing through the shop and this aspect of production control is left entirely to the superintendent and his assistant—a most difficult task.

Materials Control and Handling, the fourth principle, is on an informal basis at the Smith Company. Five men generally do the raw material ordering when they deem it necessary for their particular area of production, subject frequently to the supervision of the comptroller. The physical handling of the material is quite efficient as there are a large number of overhead cranes and booms situated in a position so as to service all machines working on bulky production items.

The fifth principle, Product Inspection and Quality Control until recently had been non-existant. An attempt had been made to make production personnel inspect their own work, but this proved very unsatisfactory for, as one foreman said,

"If I'm inspecting my own work and find defective material not meeting drawing specifications, but I know it will operate satisfactorily, do you really think I'll reject my own work and put myself in a bad light?"*
This is only logical and the man cannot really be blamed for his natural instinct to protect himself.

Since this proved unsatisfactory, a new system has only recently been put into operation. Three out of the original fourteen copies of the invoice form are routed to the shop—the packing list, the shipping notice, and the shop order. The shipping notice, before leaving the office, is marked "Inspected By" and "Date". Two people in the shop are assigned the function of final acceptance inspection and each shipping notice has to be initialed and dated by one or the other prior to shipment.

Before this system was instituted, at least one improper order would leave the shop each week. This was very undesirable for several reasons. Customer relations suffered considerably, the sales force was at a loss for explanations as to the errors, and a considerable expenditure of money was necessary to clear up each situation. Phone calls, telegrams, and freight bills began to eat into profits to the point where this change became necessary.

Since the change two months ago, only one improper shipment has left the Smith Company and that was due to an administrative error. Since the problem has been solved, all the production personnel are producing work of a higher quality and morale is greatly improved.

This inspection is presently one hundred per cent, but as larger numbers of identical items are shipped on the
same order, a system of statistical quality control sampling will be put into effect. At the present time, however, it would cost far more to institute and administer the system than it would to continue on the 100 per cent inspection program.

Individual Productivity, the sixth principle, is an important factor. The efficiencies of mass production can not be realized in a job order shop, but there is still room for a margin of improvement. On those items that are standardized, larger lot sizes of ten, twenty-five, or more pieces could be run instead of three to five at a time. This would eliminate much of the setup time and indirect labor required to move only a few pieces at a time from station to station.

Individuals move from station to station at a slow pace and are accustomed to operating their machines at an equally slow pace. This is being changed by management's present view, that it is necessary to lower costs and ensuing selling prices in order to meet the increasing competition and lower prices of their competitors. A company may have the best quality product, but may lose a good percentage of the available market if they are not competitively priced.

The seventh principle, Wages and Wage Payment, is always a very sore spot in companies. Many people habitually feel that they should be getting paid a higher rate
than they are receiving. This feeling is intensified in times of a recession, when the worker is not only deprived of his overtime, but also cut below the standard forty-hour week. This situation exists to some extent at the Smith Company. There are several solutions however—some long range, others short range.

Primarily there should be one man responsible for seeing that the overall wage scale is on a par with other similar industries in the same area. Secondly, he should attempt to eliminate as much inequity as possible from man to man within the work force. It was recently observed that a lead man was supervising three men, all of whom were commanding a higher hourly pay rate than himself. When this was learned, it created much dissention and a general feeling that the company was not treating its employees fairly. The situation was alleviated by raising the pay of the lead man, but a small incident as this is often carried in the back of a man's mind for a considerable period of time.

At times one department may be working a fifty or fifty-five hour week while another is on a thirty-five hour week. This creates much dissention and jealousy, and if the situation could be remedied, morale and productivity would increase. Although the situation is not always easy to remedy, a better flow pattern and more even influx of orders from the field could go a long way towards reaching the desired goal of all men working an equal number of hours per week.
The eighth principle, Safety and Maintenance, is only partially adhered to. Goggles are provided for all machine operators, but the continued use of them is not always enforced. Although there is no formalized safety campaign, accidents are kept to a minimum, as most of the men are well acquainted with the different types of machinery within the shop.

Mr. McCaully in his book Management Controls for Foremen and Supervisors set forth ninety basic principles of operation which an organization should generally follow in order to be considered a smooth-running, efficient company.* Many apply to the Smith Company, but only those will be discussed that serve to demonstrate possible areas of improvement within the company.

A company should have non-overlapping lines of authority, set forth on an organization chart with one and only one person to be responsible for the decisions. This could be accomplished with the aid of the proper type of organization chart and the cooperation of all parties concerned. The result would be to fix responsibility and avoid the shirking of duties, thereby increasing the efficiency of the entire operation.

Better cooperation between all divisions and all people within a division could be developed by having periodic meetings which would give employees the feeling of

* 4, pp. 201-209
belonging to a team. Each employee should always be given the opportunity to express his views, be it criticism or praise of any conditions which exist in his surroundings.

Every person in a position of responsibility should be able to organize his workload and that of his subordinates. He should not try to get by with a minimum of work, but should expend more energy than his subordinates if necessary to get the job done. He should always remember that his enthusiasm, drive, efficiency, firmness, honesty, fairness, consideration, tact, courtesy, and general deportment will be an example to his entire personnel. The executive sets the pace.

Efficiency and quality in the Smith Company must be raised to as high a level as possible. Standards of performance must be set with an emphasis on greater productivity, and at the same time with an increased quality level. All personnel should be thoroughly acquainted with the principles of cost consciousness, for large savings can be realized with only a small amount of effort on everyone's part. Periodically the procedures of the company should be checked to insure as high a level of efficiency as possible.

Morale building will be an important factor in the future of the company. Employees must be shown that they exist not to be exploited by their management, and they must be made to feel a part of the organization. As often as possible they must be assured that advantage is not being
taken of them and that they are an indispensable part of the working body.

The last, and one of the most important areas, is that of planning for the future. A great man once said something to the effect that big thoughts eventually produce a big person. This is sometimes quite true, for the man who does not think ahead and plan for the future will not be prepared when that time arrives. More progressive thinking on the part of all management personnel will go a long way towards expanding the business from its present small scale employment to a considerably larger scale of employment.

Growth has been slow within the Smith Company over the past fifty years, but with the proper management personnel, the company could rapidly expand its new Peterson Division to a unit several times the size of the existing factory.

From the above facts, it can be observed that this is a company with a good product, but that it has some room for improvement in its operating efficiency. Because of its small size, it does not hire specialized executive personnel to help the company attain this goal. Because it has not dropped its prices and given better service to the customer, its sales volume has not pyramided, and because of this its profits do not increase to a very large extent. As can be seen, it is a cause and effect creature with the animal continually running in circles trying to catch its tail, but never quite reaching it. One way to break out of the
circle would be to hire specialized management personnel with progressive ideas to bring a revitalizing surge to the company. An organization soon degenerates under routinized operation and must be revamped at intervals to prevent stagnation and stunted growth.*
III. The Peterson Clutch-Coupling Division

A. Sales

1. Personnel

"A successful company is one which is founded on principles from which it derives a consistent logical pattern of behavior, making for good relations with the customers on the outside and effective interrelationships among departments on the inside. The sales department accepts the responsibility for being the eyes and ears of a company as well as its voice. It tells a company what the customer wants and what the competitors offer; and that the other departments of the company must align themselves with the planning of the sales department."

To say that the sales department is important to an organization is an understatement. Without an effective sales force, the production and finance departments would not be of much use.

In 1956 when the Peterson Clutch-Coupling came from Worcester Polytechnic Institute, it had only a handful of relatively inactive distributors in the northeast part of the country, and only a small number of incoming orders. There were two alternatives for the Smith Company—(1) to

* 3, p. 106
set up their own sales force with company paid sales engineers throughout the country or (2) license an exclusive sales agent to handle the line. Since it would require from $150,000 to $200,000 to develop the item and make it commercially feasible from an engineering and production standpoint, the company was too small to consider hiring company paid salesmen and to spend money on a national sales program. With this sort of program, the company might have, out of necessity, ended up spending $500,000 before any real profits could have been realized.

Under these conditions, the only salvation would be to obtain the services of a sales agent with an existing nationwide sales setup. The dangers involved here are that you must obtain an agent with a progressive and technically trained sales force with your own interests as well as their own at heart.

During the summer of 1957 at the Design Equipment Show in Detroit, the Brown Company occupied a demonstration booth next to the Smith Company's. From this chance meeting negotiations began and in January 1958, the existing sales agreement between the two companies was signed. The Brown Company would furnish all necessary sales and field engineering personnel and bear the expense of all advertising. The Smith Company would retain all patent rights and be responsible for all manufacturing and engineering services required by the sales force.

# fictitious name for the existing company
This seemed to be a good working agreement for both parties and it appeared that this was the first time since its inception in 1930 that the Peterson Coupling might have the sales force to put it across.

Chart II on the following page shows the organization of the Brown Company's Sales Department. The president of the Brown Company, Mr. Bates, is a man in his early fifties. He is a graduate of the engineering school of the University of Michigan, and had worked for many years with the Reliance Motor Company. His last position was as sales manager of one of their large districts. Upon deciding to go into business for himself, he spent several years before coming across the Brown Company.

Approximately ten years ago he bought a controlling interest in the company and took over as president. Since that time he has built the company from almost nothing to a $3,000,000 a year enterprise. To say that he is a capable and progressive executive would be an understatement, as his achievements have spoken for themselves.

Directly beneath him and acting as his assistant is Mr. Grimes, a man in his early forties. Mr. Grimes had been an active salesman for the Square D Company, and was contacted by Mr. Bates shortly after coming with the Brown Company. Mr. Bates made him an excellent offer and he joined the company as vice president and sales manager. He has since taken complete charge of all sales activities.
CHART II
ORGANIZATION OF THE BROWN SALES DEPARTMENT

PETERSON DIVISION MANAGER

PRESIDENT

VICE PRESIDENT and
SALES MANAGER

ASSISTANT SALES
MANAGER

DISTRICT MANAGERS
SALES ENGINEERS
MANUFACTURERS AGENTS

DISTRIBUTORS

SOURCE: INTERVIEW WITH THE PETERSON DIVISION MANAGER
of both Brown and Smith. Last year he attended a six-month course in management at Harvard Business School. Mr. Bates believes that this further education will better equip Mr. Grimes for eventually taking over the responsibilities of president of the Brown Company.

It is his function to keep a close contact with Mr. Marshall of the Peterson Division and to work out all engineering and sales programs pertaining to the clutches and couplings.

In January of 1958, a young engineer was designated to serve as assistant sales manager with duties mainly connected with Peterson sales. The first major task was to construct a catalog which would set forth the product in a clear, concise manner in order to enable the sales engineers themselves to accomplish the basic engineering function of ordering a standard "off the shelf" item. This would take some of the routine engineering work off the shoulders of the Peterson Division personnel and enable them to spend more time on the more difficult applications and further development.

Before this project was to be completed, the indirect drive clutches were still to be standardized—a process which had been the biggest obstacle towards reaching the goal of a complete line of standard units commercially saleable. After two months of coordinated effort between Brown and Smith personnel, this goal was attained.
After an intensive three months of hard work and many trips and phone calls between Worcester and Detroit, the catalog was finally completed. It not only possessed a complete engineering description of the product, but also contained sales appeal, which is so important today even in industrial sales.

You will see on the following table* that the United States is broken up into eleven district sales offices.


2. **South Atlantic States**: Virginia, North Carolina, South Carolina.

3. **South Central States**: Florida, Georgia, Alabama, Tennessee, Mississippi, Eastern Arkansas.

4. **East Central States**: Western New York, Western Pennsylvania, West Virginia, Eastern Ohio.

5. **Middle Central States**: Michigan, Western Ohio, Eastern Indiana, Kentucky.

6. **Midwestern States**: Illinois, Wisconsin, Northwestern Indiana, Minnesota, Missouri, Iowa.

7. **West North Central States**: North Dakota, South Dakota, Nebraska, Kansas, Iowa, Minnesota.

* 27
8. **Middle Atlantic States**: Metropolitan New York, New Jersey, Delaware, Maryland, Eastern Pennsylvania, District of Columbia.

9. **West South Central States**: Texas, Oklahoma, Louisiana, Western Arkansas, New Mexico.

10. **Pacific Coast**: Washington, Oregon, California, Arizona


At present, areas 2, 3, 8, 9, and 11 are not covered by personnel employed by Brown, as the company does not feel that the potential business in those areas is enough to warrant hiring additional employees. Areas 3 and 9 are covered by licensed manufacturers' agents who carry several other lines and in turn also license local distributors.

The remaining areas are assigned to Brown District Managers. These men are graduate engineers who have a thorough knowledge of the many technical aspects in the power transmission field. Because of the continued growth, four out of six of these districts have hired sales engineers to help carry the workload. These men are also graduate engineers. When first joining a District Manager, they work quite closely with him, but as time progresses and they become more acquainted with the product, they are given a portion of the territory for which they are responsible.

It is the general practice that when District Managers leave
Brown employment, they are replaced with the sales engineers.

These sales personnel have a two-fold responsibility: (1) They must license and educate local distributors for the sale of their products to the consumer trade. These distributors are mainly in the larger cities and carry from twenty-five to thirty-five other lines. It is the responsibility of the district manager to see that his product is not neglected by these people. (2) He must locate, sell to, and service all original equipment manufacturers, which accounts for two-thirds to three-quarters of all sales.

It can be seen that these sales personnel are the key to the success or failure of the products of the Brown and Smith Companies and can contribute a great deal towards furthering common goals.

In March of 1958, a sales meeting was called for all district sales personnel and the executive staffs of both companies. The new item was formally introduced to the salesmen with a comprehensive three day schooling program, including as much technical information as possible. The men left with their minds stimulated to the new task of setting up an entirely new distribution setup as rapidly as possible.

By the middle of 1958, it was evident that personal differences had arisen between the assistant sales manager of Brown and Mr. Marshall of Peterson. The engineer was given a sales territory and was replaced by an older, more experienced salesman, Mr. Connelly.
Relations have since improved considerably between the two, with less friction on both sides of the picture.

By the end of 1958, over thirty distributors were licensed to sell the clutches and couplings in most of the major cities in the country and shortly afterwards an additional sales agreement was signed giving Brown exclusive rights over the entire world.

2. **Competition**

The Original Equipment Market consists of establishments which design and develop engineered products for resale. The products range in size from tiny mechanisms to battleships and locomotives, and other items include watches, automobiles, aircraft, all types of appliances, machines, instruments, and industrial equipment. Any product which calls for the skill of an engineer may be considered a part of this vast market. The Original Equipment Manufacturers' encompass a tremendous market. The products manufactured number into the thousands, and the parts, components, and materials which go into their manufacture are measured in the hundreds, thousands, and even millions of units.

Industry's increasing investment in research, more people with dollars to spend, and a growing need for the tools of mass production, have combined to sky-rocket the demand for engineered products. By definition of the

# From this point on referred to as O.E.M.
<table>
<thead>
<tr>
<th></th>
<th>Table I: Geographical Location of the Original Equipment Market</th>
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<tbody>
<tr>
<td>2.</td>
<td>Illinois</td>
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<td>4.</td>
<td>Ohio</td>
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<tr>
<td>7.</td>
<td>New Jersey</td>
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<td>8.</td>
<td>Massachusetts</td>
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<td>9.</td>
<td>Wisconsin</td>
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<td>10.</td>
<td>Indiana</td>
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<td>12.</td>
<td>Texas</td>
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<td>13.</td>
<td>Missouri</td>
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<td>15.</td>
<td>Maryland</td>
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<td>16.</td>
<td>Iowa</td>
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<td>17.</td>
<td>Washington</td>
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<td>18.</td>
<td>Oregon</td>
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<td>19.</td>
<td>Tennessee</td>
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<td>20.</td>
<td>Oklahoma</td>
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<td>21.</td>
<td>Rhode Island</td>
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<td>22.</td>
<td>Georgia</td>
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<td>23.</td>
<td>Kentucky</td>
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<td>24.</td>
<td>Kansas</td>
</tr>
<tr>
<td>25.</td>
<td>Virginia</td>
</tr>
</tbody>
</table>

**Source:** Machine Design, geographical analysis of the Original Equipment Market, September, 1955, Cleveland, Penton

# States are in decreasing order of importance
The Original Equipment Market represents a major market for clutches and brakes, and are important components of many different types of engineered products. The various types of manufacturers using this equipment are: machinery, industrial equipment, appliances, electrical equipment, transportation equipment, instruments, and other miscellaneous manufacturers. Twenty-eight and eight tenths per cent of all O.E.M. are now using clutches and/or brakes.*

Whenever there is a transmission of power there exists a possible application for some type of flexible coupling. In addition to the 28.8 per cent of O.E.M. now using clutches and/or brakes, another 44 per cent presently use flexible couplings in quantities of 300,000 per year on light equipment. Both outlets are potential Peterson customers.**

These above mentioned units go on motors ranging from sizes of fractional horsepower up through the largest of electric motor, steam, and gas turbines, and all diesel engines. A tabulation of the number of various sizes of flexible couplings sold in a given year is shown on the table on the following page.

* 7, p. 3  
** 9, p. 1
TABLE II
YEARNLY SALE OF FLEXIBLE COUPLINGS

<table>
<thead>
<tr>
<th>NUMBER USED</th>
<th>HP RATING</th>
</tr>
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<tbody>
<tr>
<td>2,702,341</td>
<td>Fractional</td>
</tr>
<tr>
<td>830,671</td>
<td>1-10</td>
</tr>
<tr>
<td>559,596</td>
<td>Over 10</td>
</tr>
<tr>
<td>4,092,608</td>
<td>TOTAL</td>
</tr>
</tbody>
</table>


As can be seen on the foregoing table, the total number sold is 4,092,608 per year, and that is only for couplings—not clutches. Since 28.8 per cent O.E.M.'s use clutches and 44 per cent use flexible couplings, we can assume that two thirds as many use clutches as couplings. This would yield roughly 2,500,000 and a total market for clutches and couplings of 6,500,000 million. Most of these are in the fractional horsepower range where the prices are low and competition is keen. Following are two tables showing coupling and clutch competitors in decreasing order of importance.
### TABLE III
COMPETITORS IN THE COUPLING FIELD

1. Falk Corporation  
2. Lovejoy Flexible Coupling Company  
3. Morse Chain Company  
4. Hoppers Company, Incorporated  
5. Boston Gear Works  
6. Link-Belt Company  
7. John Walton Corporation

**SOURCE:** Recognition of Manufacturers of Flexible Couplings, Market Research Department, Machine Design, Cleveland, Penton, 1955.

### TABLE IV
COMPETITORS IN THE CLUTCH FIELD

1. Twin Disc Clutch Company  
2. Warner Electric Brake and Clutch Co.  
3. Borg-Warner  
4. Dodge Manufacturing Corporation  
5. Hilliard Corporation  
6. Carlyle-Johnson Machine Company  
7. Farwic Airflex Division  
8. Conway Clutch Company

**SOURCE:** Recognition of Manufacturers of Clutches and Brakes, Market Research Department, Machine Design, Cleveland, Penton, 1955.
These tables represent the names of many well known large manufacturers, which is just an indication of the competition and the difficulties encountered in the field. It is unfortunate that in 1930, when the Peterson product was originally conceived, it was not properly merchandised, for at that time it was many years ahead of all competitors in engineering design. The situation is not as bad as it might appear however. Most of these companies manufacture the smaller capacity clutches with a low markup and a higher volume, while staying away from the higher capacity-lower volume units. These involve many technical problems, most of which have to be separately engineered. Because of this, they do not readily lend themselves to the mass production which these other manufacturers are mainly interested in. Under these conditions the Smith Company can effectively compete with these much larger manufacturers both in price, quality of product, and engineering know how.

Peterson has never manufactured for the fractional horsepower range, but it has been recently established that it is easier for a sales engineer to get in the front door of a company by selling a small inexpensive unit to start with.* The average purchasing agent is not willing to spend a large sum of money on a relatively unheard of and untried coupling, but will often be willing to gamble ten to fifteen dollars on a small unit out of curiosity.

* 33
Although competition is keen, everyone concerned seems certain that Peterson is a superior and more durable unit than anything presently on the market. When it receives national recognition, it is a surity that the product will become a high volume item.*

3. Volume

The sales volume can be seen on Graph III on the preceding page. Here, volume of orders and shipments, in thousands of dollars, are plotted against the applicable month or quarter.** The curves start at the time the coupling was moved from Worcester Polytechnic Institute to the Smith Company. Throughout 1956, sales moved slightly upward until the third quarter. At the end of the year Brown was contracted with and several dealers that were exclusive in their areas had to be terminated. The next three months was an educational period for the sales engineers and a period of catalog revision and reprinting.

By the middle of 1958, sales had again risen to a level of approximately 300 per cent of the pre-Brown era and the future looked inviting. But then it happened. In September sales started to drop off sharply. Everyone felt that it was only a bad month, but since then sales have continued to drop and in January 1959, reached a low of $9,000. After three weeks of business in February, it looks as if

* 33
** 26
the sales volume will drop to an even lower level of five or six thousand dollars, and this, it can be observed, is even lower than when Brown took over the sales function.

Morale is very low and the future looks uninviting. As the division manager says, "It is hard to conceive of such an excellent product failing to be successful after so many years and so many successful applications." Several reasons might be set forth for these situations—none of which can be definitely ascertained. The recession could be the cause, but it seems improbable that at the low spot of the recession sales were the highest and now as business is picking up, Peterson sales again drop to a low level.

There have been a number of personality conflicts between various Brown Company field personnel and the Peterson Division Manager. The Smith Company has hesitated to spend the money to enlarge their engineering staff to handle inquiries of special non-standard couplings. The large O.E.M. accounts expect and require the clutches and couplings to be designed to fit their specifications, as opposed to designing their units around the Peterson Coupling and they feel that they have the right to expect a better and non-standard product at a lower price. Because of their large volume of orders, they not only expect, but receive such service—if not from Peterson then from Dodge or Twin Disc. The division manager has inadvertently

* 27
discouraged this business because of lack of engineering personnel, and this has in turn possibly discouraged the sales personnel. It is a forgone conclusion that the majority of business is of a special design nature for the O.E.M. market.

At about the same time as sales started to fall, the new sales manager at the Brown Company took over. This also might be a factor.

Whatever the reason or combination of reasons, one thing is certain. The Peterson Clutch-Coupling will either have a number of policy and/or personnel changes in the very near future, or the product will have to be given up. The Smith Company will probably not be willing to support a non-profit organization for any period of time.

D. Production

1. Plant

The Smith Company occupies a building containing 40,000 square feet of floor space of which thirty thousand of these were part of the original company, dating back to the early 1900's. It is a wood construction building, three quarters of which is on one floor because of the high overhead cranes required to lift larger units, and the other quarter which is situated on the second floor. In 1956 when the Peterson Division was formed and when the main division entered the production area of Permanent Magnetic Chucks, a new addition of 10,000 square feet was constructed. This also is on two floors, but is of cinderblock construction.
Presently most companies favor one story buildings along with straight line production flow.* A new building also is more desirable and may be more economical in the long run, not because it is cheaper, but because it permits operating at lower costs.** Much of the material used on the second floor has to be brought up by a small elevator one foot wide by three feet long. All larger pieces must be brought up a retractable ramp over the stairs with three or four men pulling on the end of a long rope.

The shipping and receiving room is at one end of the building, and all items have to go to the other end of the shop for processing. Sometimes they go up and down the ramp many times before coming back to their original starting place. It can be seen that much time is expended on materials handling, and time is money.

The Peterson Division office occupies the second floor of the new addition. It is the best office space in the shop, having fluorescent lighting and large windows, both of which create a pleasant working atmosphere. The main disadvantage is that there are no separate offices for individuals. The floor is of bare wood construction, and the cinder block walls have been painted. The bottom floor is occupied by shop personnel and the noise of the machinery and foreign odors rise directly upward. The heating system

* 1, p. 730
** 6, p. 12
could also be improved, but everything considered, this remains the most desirable area in the shop.

2. **Equipment**

"As accuracy of work can be no better than the accuracy of the tool that produces it, so the efficiency of a plant can be no better than the caliber of its machine layout. Proper machines must be provided to handle the volume of work expected, and their arrangements must be such that the work will flow smoothly from operation to operation without excessive delay."

The Smith Company's machinery is mostly of the post World War II type and in excellent operating condition. There are approximately fifty pieces of equipment ranging in size from automatic hacksaws to planers twenty or thirty feet long and a large lathe that will turn a workpiece of at least six feet in diameter. As can be seen, the company has not spared the dollar when it comes to purchasing the proper equipment, for they believe that to produce an item, a machine must have the required capacity and the ability to produce to the desired tolerances. No formal studies are made when replacement of a machine is contemplated in order to determine if it is economically justified. The people seem to have the ability to know when to make replacements and with what type of machine. This knowledge

* 1, p. 745
has been developed during the many years of experience that the management has had in the machine tool area.*

A factory layout can be either product or process.** If a product is mass produced over a relatively long period of time, the product type of layout will prove economically feasible. Because of the great expense required for special tooling and setup, these costs can only be effectively prorated over a large volume of production so that the unit overhead is not overly prohibitive. Most industries outside of the automotive, aircraft, and others of this type cannot economically justify the expenditure for such a setup.

On the other hand, the process arrangement is usually found in most small and medium sized factories and even in many large ones. It is mandatory that this exists when there are many different items going through a shop at one time—no one of which has the required volume to have a separate mass production line for itself.

The Smith Company is set up under the latter category. The nature of its products and the volume of sales do not warrant lot sizes of over twenty to fifty pieces. The larger, more specialized units are manufactured to order, and there are seldom any more than five pieces run through at a time.

* 1, pp. 829-35
** 1, pp. 758-65
The picture on page 117 in the appendix shows four driven halves of the largest size of Type A coupling.

Even if the sales volume permitted, the cost to set up these large units on a mass production line would be enormous due to the very large and specialized type of equipment required.

Materials handling in the average factory results in 22 per cent of the cost of manufacturing.* Because of the large size of many items going through the Smith Company and the long time required to set them up in the machine tools, this 22 per cent figure probably is nearer 30 per cent. Due to the nature of the product, the company was required to install an elaborate system of travelling overhead cranes and smaller boom cranes to service the individual machines. One of these smaller chain hoists can also be seen in the picture on page 117 in the appendix.

Many factories have tool cribs which supply all of the items required by the worker.** The Smith Company has always followed this policy of having each worker purchase his own tools except for any specialized tooling required for a particular job. Expendable items such as drills, milling cutters, and turning tools are supplied by the shop. The company feels that they save many man hours of time that would be required for the men to walk from one end of the shop to the other in order to get a screwdriver.

# Two feet in diameter weighing 1,500 pounds
* 1, p. 769
** 1, p. 875-99
or a wrench. They also save the cost of a man to take care of and issue tools from the crib. This seems to be a satisfactory arrangement and there have been no outstanding complaints from the workers.

A separate shed is provided for the Peterson Division to carry on dangerous experimental work and to store raw material. One of these test setups is shown on page 118 of the appendix. Here again the size of the item and also the equipment can be realized by the fact that an average sized man can barely see over the top of the coupling. A test here was being conducted on a new type of spring controlled bronze shoe. This coupling ultimately was to be placed on the end of a 2,000 horsepower diesel, used to power a large dredge barge operating in the East River of the New York City area.

It is interesting to note that although the company could be more progressive in its personnel policies, it is quite liberal in allocating funds for experimental and development work, much of which never shows any tangible results.

Working conditions are of the primary importance in maintaining worker morale.* Heating and ventilating, air conditioning, lighting, and general housekeeping come under this category. Heating at the Smith Company is inadequate and on very cold winter days the shop personnel have

* 1, pp. 802-23
to wear sweaters and overcoats. This not only cuts down their efficiency, but loose clothing is also a safety hazard. Ventilating systems are inadequate and foreign odors of a disagreeable nature often permeate parts of the shop and offices. Air conditioning does not exist, and during the hot summer months efficiency in the shop as well as in the office drops off sharply. Many careless mistakes have been made because people are hot and uncomfortable, and reach the point of irritability and laxness.

Lighting is adequate but could stand improvement in some remote areas, but housekeeping is generally good, as each man is responsible for his own machine and neighboring area. At the end of each work day, a half hour is devoted to cleaning up, and at the end of the work week, one full hour is devoted to a thorough cleaning and preventive maintenance of all machinery.

If all factories were examined, as far as working conditions are concerned, the Smith Company could be considered below average, but for an old shop with a wooden floor construction, it might not be too severely criticized.

3. Personnel

"No manufacturing firm can progress any faster today than the quality of its foremen and supervisors will allow. For these are the men who control the front line operations and make it possible, through direction from management,
for a company to operate successfully. A plant cannot attain sound objectives or achieve adequate results if its leaders are deficient in ethics, abilities, or volition."

The production of the Peterson Division cannot be broken apart from the Smith Company's operations since they are performed under the same roof and supervised by the one superintendent, Mr. King. This phase of the organization is shown on Chart I.

Directly beneath Mr. Marshall are the three staff functions: Sales, Production, and Engineering. Sales has been discussed in the previous section so shall not be described further. In charge of the engineering function is an applications engineer, Mr. Henderson. He is a graduate mechanical engineer from Worcester Polytechnic Institute, and was acting as superintendent of their shops when they closed them in 1955. When the Peterson Clutch-Coupling was sold to the Smith Company, he came along with the product as acting manager, but has since been expending his energies on the technical aspect.

He is responsible for acting on and giving recommendations for all non-standard units when inquiries arrive from the field. This involves complex engineering calculations to determine the proper size coupling with the proper size brake shoes. After this is determined, an engineering

* 1, p. 6
assembly drawing must be produced and sent to the field for approval. Upon approval an engineering drawing showing all details of parts to be constructed must be drawn and a cost estimate run to determine the selling price.

A prototype is then constructed and sent to the field for testing. If it proves to be satisfactory, it then enters the category of a standard production item but is still under the control of this department.

Mr. Henderson is also responsible for the purchasing and record keeping of all items under his jurisdiction. In charge of production is the production engineer, Mr. Raymond. He is a man in his late twenties, having completed his engineering work at Cornell University and graduate work in business administration at Boston University. All standard production items come under the jurisdiction of this department, including maintaining perpetual inventories of raw material, work in process and finished goods inventory. Appropriate inventory levels must also be determined for all standard items. He is also responsible for office procedures pertaining to processing orders to the shop and keeping accurate engineering specifications and drawings on every coupling sent to the field.

Whenever tests or experiments have to be accomplished within the factory, they are done under the supervision of Mr. Raymond. For example, presently tests are being undertaken to determine the feasibility of replacing
brass bronze bushings with ball bearings. This involves an elaborate setup and a considerable expenditure of money, but positive results should be obtained.

Many other miscellaneous tasks such as compiling and assembling engineering manuals for field personnel are also originated in this department. The office of the superintendent, Mr. King, is responsible to the production engineer. All shop orders, drawings, and specifications come from the production engineer on matters concerning Peterson production. This engineer is responsible for getting proper records and schedules to the superintendent who performs the direct supervisory function. The superintendent is a man in his late fifties who has come up through the ranks, so to speak. He is well versed in the technical aspects of the design and engineering functions, extremely creative and presently has numbers of patents under his own name. This man is of the newer school, and believes in delegating authority and letting his subordinates assume full responsibility for their work. He does not believe in supervision by forcing people to work for fear of losing their jobs, and perhaps in this respect could be somewhat firmer.

Mr. King does fall short in organizing his time and workload, and is very often found rolling up his sleeves in the shop and tightening a nut or a bolt on a machine when there are more important things to be accomplished. He is very conscientious but lax to the extent that important
details are left undone, unless he is reminded of the situation several times.

"Production control is the technique of setting a plan in motion by the release of orders and of observing, inspecting, and recording progress in such a manner as to keep a continuous comparison between planned and actual results."

Although well liked by most workers in the shop, this is the area where he is weak. To help in this function, the head of the shipping department was promoted to take over as his assistant. He has been with the company for many years and has developed a fairly comprehensive knowledge of the product and its proper methods of manufacture. The more routine functions of supervision and production control were delegated to him. Although, as previously stated, he has had a comprehensive knowledge of the product, he is more of a staff than a line man, and in performing his duties he does not have the complete respect of the men that a person in his position requires. Because of this, at times careless mistakes will be made in the shop that should be avoided, and these mistakes cost the company considerable money and result in dissatisfied customers. Any dissatisfied customer is a potential customer of a competitor.

Often, improper shipments have been made to a customer through a mistake in the manufacturing process or

* 1, p. 69
an error on the part of a shipping clerk. Most of this could be avoided with a firm policy of delegation of authority, along with adequate incentives for the supervisors to eagerly accept responsibility. The keynote is—lines of authority from top to bottom and lines of response from bottom to top.*

"If the company adopted the policy of merit raises and of paying an employee for doing a better than average job, workers would develop a feeling of teamwork and would begin to produce high quality work with fewer careless mistakes,"** said Mr. King.

On the average, for every 100 direct factory workers, there are 75 additional employees.*** The Peterson Division has four administrative employees and when business was at the peak, employed eight to ten direct workers in the shop. Although this appears to be a very profitable situation, the application engineering function was only receiving the services of one man who found it difficult to effectively handle all of the sales inquiries. This resulted in many dissatisfied customers, and the district sales managers developed a feeling of hopelessness. This might have been one of the contributing factors in the decline of clutch sales.

* 1, pp. 7-9
** 28
*** 3, p. 7
At the present time the Smith Company, and in particular the Peterson Division, have very adequate production facilities. If the various personnel problems could be ironed out and morale improved, the coupling might again be placed on a paying basis.

4. Purchasing

On the average, procurement of goods through purchase, accounts for about half the money spent, but different industries range from 20 per cent to 90 per cent. It is easy to see that the procurement function is of primary importance to a company, for here a great deal of money can be saved or wasted.

Alford, in his Production Handbook, set forth the following thirteen important duties of a purchasing agent.*

1. Locating and selecting sources of supply for materials or services required.
2. Knowing in considerable detail the operations and processes carried on in the plant, the materials required in these operations, and the general plan and procedures in production control and materials control.
3. Procuring materials and services as required.
4. Placing shipping orders against purchase orders.

* L, pp. 253-4
5. Following up suppliers to make sure that shipments have been made.

6. Making sure that the quality and quantity of materials have been made.

7. Approving bills for payment.

8. Maintaining records necessary for proper operation of its function.

9. Securing adjustments on claims for shortage, poor quality, etc., in material received on purchase orders.

10. Knowing the factors governing cost of production—demand, supply, and cost of materials, and labor needed in production.

11. Knowing business law as it governs contracts and sales.

12. Assembling and analyzing data on markets, commodity supply and demand, price trends, etc.


For a person to have all this ability, he would have to be an economist, an engineer, a production specialist, a sales and market forecaster, and be able to follow almost every function in the company. Most large companies can afford to have this caliber of man, but the Smith Company is too small. The amount of money he would save the company in its comparatively small volume of purchases would not be able to cover his salary.
In the Peterson Division, purchasing is accomplished by the production engineer and the applications engineer. The production engineer handles procurement of all standard items, including castings, bronze bushings, steel stock, and other parts which go into the completed items. All non-standard items, which are not carried in stock but are ordered upon receipt of a customer purchase order, are handled by the applications engineer, for he is more acquainted with the special designs pertaining to individual items.

A running inventory is kept of all items, so that at any time the amount on hand can be obtained from the visible card index. The applications engineer handles all non-standard items which have required special design and which he is more thoroughly familiar with.

Inventories of finished goods, work in process, and raw materials are also kept by the production engineer. The situation in this area has greatly improved in a little over a year, for there used to be no running inventory. Previously no one was aware of what was in the shop without going out on the floor and making an actual count. This was a time consuming and inefficient procedure, for each item did not have a place of its own and castings of various sizes could be found almost anywhere in the shop. Since then, bins have been constructed for all standard items and shelf space provided for all finished machined stock.
Production planning and purchasing should be based on sales forecasts.* This is accomplished under optimum conditions, but very often cannot be realized. Sales fluctuate so radically from month to month that the problem is made even more difficult. In addition, purchases cannot be made in quantities as small as is desired, very often with the result that two or three times as much material of a given item must be kept on hand. Sometimes such great savings can be realized from quantity purchases that it becomes practical to keep more than the minimum amount of stock on hand.

The biggest problem associated with purchasing is the acceptance of material not meeting minimum quality standards. It has been recommended that an employee be given not only the function of final acceptance inspection, but also the duties of accepting or rejecting incoming raw material. The company has failed to do this and many times an item will be received in a defective state, processed through the shop, and sent out in this same condition. It will not be long before this type of policy begins to show up and the company receives a poor reputation for quality.

5. **Factory Costs**

The process of obtaining accurate factory costs reflecting the true manufacturing picture is an arduous task, and often only an approximation of the true situation can be determined.

*3, p. 108
Each order that goes through the shop is costed by the comptroller's office. The Peterson Division functions as an independent unit with regard to administrative procedures associated with production, but the comptroller does render the service of keeping cost records.

Each order that goes into the shop has a number assigned to it. All direct labor put into its processing is reported on time slips and after the order is completed, a cost schedule is prepared by the production engineer.

This schedule is forwarded to the comptroller who determines material costs knowing part numbers, and adds the direct labor cost from the time slips. To this figure is added the cost of overhead, which at present is figured at the rate of 200 per cent of direct labor, and the total results in the cost of goods sold. Knowing the net amount of money received from a sale, Brown discounts the 20 per cent sales commission, the difference between this figure and the cost of goods sold being the profit. Smith desires this profit figure to be in the neighborhood of 30 per cent, but recent schedules indicate an abnormally high rate of profit nearing 70 per cent on many items.

The reason for this was discussed previously, but it might be mentioned again that the improved casting process of shell molding and processing of all standard units through the shop in lot sizes of 25-50 instead of 2-3 pieces was an important factor.
Job estimating of costs is another function of the production engineer. This might be defined as the process of compiling a statement of the quantities of materials required, the amounts of time involved in production, and the procedures to be followed in putting an order through, together with the cost of the articles made or to be made where experience supplies no figure.*

There are presently no standard costs available, and when a quotation has to be submitted for a new item, the historical records are used, combined with a conference with the superintendent and the foreman of the lathe department. This is not the most desirable situation, but at this time the shop can not afford to have a system of standards installed. Sometimes on a large sized order it has been ascertained that buying the machined part from an outside source will be more economical than manufacturing it. This is often the case when all employees are working more than the forty-hour week, and it is necessary to pay overtime rates.

As can be seen, the costing system is considerably better than most in job order machine shops, but has room for improvement before approaching the complex systems of the large corporations.

* 1, p. 1031
E. **Finance**

1. **General Financial Aspects**

All internal and external auditing for the Peterson Division is handled through the office of the comptroller. Monthly profit and loss statements are presently being prepared for the division by Mr. Long in order to compare the efficiencies of the operation from a month to month basis.

All year end statements—balance sheets and profit and loss statements—are prepared and audited by an outside accounting firm.

No formal budgets have been set up for the operation of the division or the company as a whole, and expenditures are more or less left up to the discretion of the individuals responsible for a given area.

Since its inception in the early 1900's, the company has been on a firm financial foundation and never in any serious financial difficulties. When the family of Mr. Sands obtained a controlling interest in this closed corporation, additional financial backing was added. The family is quite wealthy and possesses interests in such larger companies as Union Twist Drill. With this added strength, the corporation has been able to enter such activities as the development of permanent magnetic chucks and demagnetizers. Considerable money has also been spent on the development of the Peterson Division to a point where the
product is on the verge of becoming a major item in the company.

From all appearances, the management would have little trouble obtaining capital for most ventures which they might choose to participate in.

2. Financial Reports

"In every company today there is a responsibility for gathering the financial information of incoming and outgoing reports to the owners and to the government. This line operation is the formalized side of accounting, rather rigidly prescribed in form, and audited by outside accountants. It is just as necessary to a business today as placing the first bar of steel into the processing machines or unloading the first shipment of new cars into the salesroom of a dealer."*

Outside financial reports are prepared by the auditors working in conjunction with the comptroller. The only function that the Peterson Division personnel play in this phase of the business is to obtain the year end inventory of raw material, work in process, and finished goods.

On the following pages will be found "Condensed Comparative Balance Sheets" and "Condensed Comparative Statements of Income and Surplus" for the years of 1955-1958.

* 1, p. 110
SMITH COMPANY

Condensed Comparative Balance Sheets as of Sept. 30, 1955-58
(In Thousands)

<table>
<thead>
<tr>
<th>ASSETS</th>
<th>1955</th>
<th>1956</th>
<th>1957</th>
<th>1958</th>
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<tbody>
<tr>
<td>Cash-Demand Deposits and Currency</td>
<td>114</td>
<td>190</td>
<td>102</td>
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<tr>
<td>Accounts Receivable-Customers</td>
<td>98</td>
<td>109</td>
<td>133</td>
<td>77</td>
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<tr>
<td>Inventory-Merchandise &amp; Supplies at cost</td>
<td>182</td>
<td>239</td>
<td>308</td>
<td>273</td>
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<tr>
<td>TOTAL CURRENT ASSETS</td>
<td>394</td>
<td>538</td>
<td>543</td>
<td>461</td>
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<table>
<thead>
<tr>
<th>Liabilities and Capital</th>
<th>1955</th>
<th>1956</th>
<th>1957</th>
<th>1958</th>
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</thead>
<tbody>
<tr>
<td>Accounts Payable and Accrued Expenses</td>
<td>39</td>
<td>80</td>
<td>50</td>
<td>32</td>
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<tr>
<td>Accrued Mass. Excise and Federal Income Taxes</td>
<td>70</td>
<td>85</td>
<td>49</td>
<td>4</td>
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<tr>
<td>TOTAL CURRENT LIABILITIES</td>
<td>109</td>
<td>166</td>
<td>99</td>
<td>36</td>
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<table>
<thead>
<tr>
<th>Capital Stock-Common-(Authorized 2,500 Shares Par $10 per share)</th>
<th>1955</th>
<th>1956</th>
<th>1957</th>
<th>1958</th>
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<tbody>
<tr>
<td>Issued 2,250 Shares</td>
<td>22.5</td>
<td></td>
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<tr>
<td>Less in Treasury 133 Shares</td>
<td>1.5</td>
<td>21</td>
<td>21</td>
<td>21</td>
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<tr>
<td>Retained Earnings</td>
<td>521</td>
<td>598</td>
<td>640</td>
<td>633</td>
</tr>
<tr>
<td>TOTAL LIABILITIES AND CAPITAL</td>
<td>651</td>
<td>785</td>
<td>760</td>
<td>690</td>
</tr>
</tbody>
</table>

SOURCE: Interview with the Smith Company President
# SMITH COMPANY

## Condensed Comparative Statements of Income and Surplus

For the Years Ended September 30, 1955-58

(In Thousands)

<table>
<thead>
<tr>
<th></th>
<th>'55</th>
<th>'56</th>
<th>'57</th>
<th>'58</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Sales</td>
<td>$1,190</td>
<td>$1,750</td>
<td>$1,250</td>
<td>$850</td>
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<tr>
<td>Cost of Goods Sold</td>
<td>982</td>
<td>1,443</td>
<td>1,032</td>
<td>722</td>
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<tr>
<td>Gross Profit on Sales</td>
<td>$ 208</td>
<td>$ 307</td>
<td>$ 218</td>
<td>$128</td>
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<tr>
<td>Operating Expenses</td>
<td>88</td>
<td>116</td>
<td>133</td>
<td>156</td>
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<tr>
<td>Operating Profit (Loss)</td>
<td>$ 120</td>
<td>$ 191</td>
<td>$ 85</td>
<td>$(28)</td>
</tr>
<tr>
<td>Other Income</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other Expense</td>
<td>$ 121</td>
<td>$ 191</td>
<td>$ 85</td>
<td>$(28)</td>
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<tr>
<td>Profit (Loss) for year</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>(Before Federal Income Taxes)</td>
<td>$ 121</td>
<td>$ 188</td>
<td>$ 85</td>
<td>$(30)</td>
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<tr>
<td>Federal Income Taxes or</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Refundable Taxes</td>
<td>58</td>
<td>92</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td>Net Profit (Loss) for year</td>
<td></td>
<td></td>
<td></td>
<td>$(14)</td>
</tr>
<tr>
<td>(After Federal Income Taxes)</td>
<td>$ 63</td>
<td>$ 96</td>
<td>$ 46</td>
<td>$(14)</td>
</tr>
<tr>
<td>Retained Earnings-October 1</td>
<td>$ 585</td>
<td>$ 496</td>
<td>$ 598</td>
<td>$640</td>
</tr>
<tr>
<td>Net Profit (Loss)-above</td>
<td>$ 648</td>
<td>$ 592</td>
<td>$ 644</td>
<td>$626</td>
</tr>
<tr>
<td>Additions to Net Income</td>
<td>$ 648</td>
<td>$ 602</td>
<td>$ 649</td>
<td>$639</td>
</tr>
<tr>
<td>Deductions from Net Income</td>
<td>$ 152</td>
<td>$ 4</td>
<td>$ 9</td>
<td>6</td>
</tr>
<tr>
<td>Retained Earnings-September 30</td>
<td>$ 496</td>
<td>$ 598</td>
<td>$ 640</td>
<td>$633</td>
</tr>
</tbody>
</table>

Note: figures in parenthesis indicate negative figures

**SOURCE:** Interview with the Smith Company President
Much information and many of the operating characteristics of the Smith Company can be derived from this information through the use of standard ratios. An accountant with a limited knowledge of a company can often arrive at conclusions concerning the operative characteristics that the management itself does not realize. In this way they are in a better position to give advice of not only a financial nature, but concerning company policies as well.*

The ratio of Operating Profit before Taxes to Sales for the years 1955 through 1958 are 10, 11, 7, and -3% respectively. Ten per cent is generally considered reasonable for a manufacturing concern in the metal-working industries. After the recession of 1954, the company did well, as indicated by the 10 and 11% profit figures, but in 1957 the ratio fell off sharply and in 1958 showed a -3% loss. This is a direct reflection of the recession which started in the summer of 1957, and only recently has business begun to pick up. This is another indication of the large fluctuations of business activity in this type industry.

The Turnover of Inventory can be shown by the ratio of Cost of Goods Sold or Net Sales to the Year End Inventory. Nineteen fifty-five and 1956 showed a turnover of five or six times as opposed to three times in 1957 and 1958. This is a direct measurement of the amount of dollars of sales each dollar of inventory generates. As sales decreased
in the last two years, inventories were not cut accordingly, which brought about a larger amount of assets unnecessarily tied up. These might have been invested in a more lucrative area such as advertising or experimental and development work.

The ratio of Accounts Receivable to Sales show how many sales dollars are tied up in money which is owed by customers to the company. It measures the efficiency of the department which is responsible for insuring quick, efficient payment of bills. It also is a measure of the ability of the customer to meet his payments. In 1955 and 1956 the ratio was 8% and 6% while in 1957 and 1958 it increased to 13% and then decreased to 9%. Since the increase was temporary, it could be assumed that the efficiency of the controller's office was not at all at fault, but the generally poor business conditions which prevented some customers from rendering their usually prompt payments due to lack of working capital.

Working capital, or the excess of current assets over current liabilities is a measure of the liquidity of a company. From 1953 through 1958, the figures show $285,000, $372,000, $444,000, and $425,000. These are high values for a small sized company with not over two million dollars of sales per year. It does indicate that it is on a firm footing but overly conservative. If some of this excess capital was put to work in an expansion or sales program, the company might begin to realize a steady growth pattern.
If the net sales are divided by working capital, the ratio indicates how efficiently the Brown Company is making use of their funds. This ratio decreased from four to five to three to two over the years in question, which indicates further inefficiencies over most recent years. There is no long term debt showing that the company is a very good risk, as there are more than sufficient liquid assets. This good cash position is not of complete advantage if one is looking for growth in a company, as these funds are not being effectively utilized for such goals.

The ratio of net sales to common stock plus retained earnings shows figures of 2, 3, 2, and 1 for the four years. A similar ratio of net income after taxes to common stock plus retained earnings shows figures of 12, 16, 7, and -2 per cent, which indicates that the company is over capitalized for the amount of business they are doing.

The dividend policy is low and stabilized, allowing additional funds to be placed into retained earnings. This is a further indication of conservative management.

Although the management is on the conservative side, the company does have a fair rate of return on sales. They are in a specialized area of manufacturing where competition is not severe, and they have enjoyed a position of comparative monopoly over the last fifty years through their patents. The indications are that the operation of the company is not extremely efficient; but, fortunately, not
to the point where a fair rate of return on the invested dollar is prohibited.

This sums up the financial aspect of the Smith Company. No statements for the operation of the Peterson Division have as yet been compiled, but generally speaking, the policies and problems related to this division are similar to those of the company as a whole. The financial function of a manufacturing concern is of primary importance. Without adequate financing, a company is prohibited from expanding and might even go so far as not being able to meet its current obligations. With excessive finance, funds which could be put into better use in another area lie idle.

The financial area is an interesting one for the student interested in the type of detail which is so closely allied to the accounting field. The men in this area control the activities of their company. Many times they can even put the red or green light on long range policies regarding plant expansion and general expenditures of funds. Many junior executives that have ultimately reached top management levels originally received their start in finance.
IV. Conclusion

A. Anticipated Sales and Expansion

After analyzing the case study of the Smith Company and, in particular, the Peterson Division, the reader should possess a clear picture of the manufacturing functions and the personnel problems which exist. Looking at the monthly orders on Graph III, one might skeptically regard the future of the clutches and couplings, for the trend is definitely downward.

If certain problems could be solved, the product might have a bright future, for the possible number of applications is almost limitless. The administrative function, as far as the paper work is concerned, is capable of handling a high volume of production, and the shop, with its present equipment, could handle up to $100,000 of orders per month without being overcapacitated, and when this point does arrive, it would be only a matter of expanding into a new line of more fully automatic machinery.

The Smith Company has the equipment, the factory, and the engineering know-how to put this product across and to ultimately expand into the large business category. Before they will attain this goal, however, considerable personnel and policy changes will have to be instituted. This is not an easy task for a company that has been operating under relatively fixed procedures for so many years.
B. Recommendations

It is recommended that all personnel at a supervisory level, not willing or capable of practicing the important principles of scientific management, be given a proper orientation or else be replaced by the type of men who are willing to spend their time and effort in order to change the general attitude of lethargy which is quite commonly found in the Smith Company.

The company should begin to periodically review the performance of all employees and reward them accordingly with both salary and position. If a man is paid a higher salary, he should be expected to perform at a higher rate of efficiency right down the line. This means eliminating the "deadwood" which refuse to yield to new policies.

Through these changes, the men in the shop will begin to more fully work with and for their management, and when this occurs, morale and productivity shall have reached a higher level with the resulting lower costs. As costs are lowered, selling prices may also be dropped with a higher sales volume following with greater overall profits and the end product of plant expansion with improved jobs for many.

In particular, the following changes are recommended for the Peterson Division. The division manager should develop more ability to organize the unit into an efficiently operating machine, and must firmly deal with
the Brown sales force, while at the same time command their respect and admiration. The policy that non-standard applications are not emphasized should be terminated, for it has been shown that over half of the contemplated sales are of this O.E.M. nature. The company must be willing to spend time and money to develop these profitable accounts, even to the extent of enlarging the engineering force. The sales force must be treated as a customer, not to the extent that the customer is always right, but it should be realized that the salesman is a temperamental human being who does not produce desired results if his morale is not continuously operating at as high a level as possible. The occupation of the salesman is not an easy one, and he should be made to realize that he is performing one of the most important functions. Production should always be behind him with 100 per cent backing.

Presently the policy of the division is to have hard and fast rules for every customer. If one is dissatisfied, little can be done for him. The customer should be catered to a little more than normally—at least until the Peterson Division product becomes a little better known and receives national recognition. This is not to say that the customer should be able to take advantage of the supplier, but on the other hand, Peterson is not nearly large enough to possess an independent attitude very often found in the large corporations. A compromise policy might be in line, with a little give and take on both sides of the fence.
Since the profit of each item is relatively high, the list prices could be somewhat lowered and quantity discounts could be made substantial in order to encourage the larger O.E.M. accounts. With these additional changes, sales volume might again be spurred upward.

If these and similar progressive policies are instituted, the sales force might again be restimulated, and the product again on the road to success.

It must be realized that it is very easy to put these reforms into effect on paper, but in actuality, many times it is extremely difficult. The Smith Company is small enough, however, so that with a few strategic changes these goals could be attained.
APPENDIX
Appreciation is expressed to the management of the Smith Company for their assistance in obtaining the photographs on the following pages.
1. 14 x 4 Type "A" Riley Stoker coal pulverizer-150 HP-1200 RPM motor. Purpose: Overload, high inertia & to eliminate expensive equip.

2. 10 x 3 Type "B" Strander 10 HP, 1750 RPM motor. Purpose: soft start, high inertia & to eliminate expensive equipment.
3. 7 x 2½ Type "B" Yarn Beaming Machine-10 HP, 1170 RPM motor. Purpose: soft start & to eliminate expensive equipment.

4. 10 x 3 Type "A" Pulper 60 HP, 1750 RPM motor. Purpose: overload protection.
5. 6 x 2 Type "B" Milk Filling & Closing Machine
3 HP, 1750 RPM motor.
Purpose: for soft start & jamming.

6. 7 x 2½ Type "A" Centrifuge- 5 HP, 900 RPM motor. Purpose: high inertia & to eliminate expensive equipment.
7. 16 x 5 Type "AS" Auxiliary Power Unit-200 HP 900 RPM with 450 RPM idle engine. Purpose: dual drive & engine warmup.

8. 10 x 3 Type "B" Cloth Calender- 40 HP, 1750 RPM motor. Purpose: high starting torque & to eliminate expensive equipment.
9. 8 x 3 Type "B" Printing Press- 7½ HP, 600 & 1200 RPM motor. Purpose: high starting torque & to eliminate expensive equip.

10. 8 x 3 Type "B" Air Conditioning Unit- 10 HP 1000 RPM motor. Purpose: high starting torque.
11. 24 x 8 Type "AS" Dredging Barge. 900 HP, 720 RPM motor with 50 RPM idle. Purpose: engine idle.

12. 8 x 3 Type "A" Riley Stoker coal pulverizer- 20 HP 1750 RPM motor. Purpose: overload, high inertia & to eliminate expensive equip.
13. 5 x 1½ Type "A" Circular Saw- 3 HP, 3470 RPM motor. Purpose: overload and current limiting.

14. 5 x 1½ Type "A" Buzz Planer- 5 HP, 3470 RPM motor Purpose: overload and current limiting.
15. 5 x 1½ Type "B" Engine Lathe- 2 HP, 1140 RPM motor Purpose: overload, reversing ease.

16. 10 x 3 Type "B" Sullivan Air Compressor 40 HP, 1140 RPM motor Purpose: high torque, eliminate expensive equipment.
17. 7 x 2½ Type "A" Forced Air Fan- 7½ or 4 HP- 1200 or 600 RPM motor. Purpose: Eliminate expensive equipment for downspeeding.

18. 8 x 2 Type "B" Cold Rolling Mill- 10 HP, 1200 RPM motor. Purpose: soft start.

20. 7 x 1½ Type "B" Butt Bunching Machine- 7½ HP, 1730 RPM motor. Purpose: high inertia & soft start.

22. 8 x 3 Type "B" Continuous Wire Drawing Machine- 15 HP, 1750 RPM motor. Purpose: high inertia & to eliminate expensive equip.
23. 10 x 3 Type "A" Riley Stoker Coal Pulverizer- 50 HP, 1200 RPM motor. Purpose: overload, high inertia & to eliminate expensive equip.

24. 8 x 3 Type "B" Morgan Fine Wire Wet Drawing Machine- 15 HP, 1745 RPM motor. Purpose: soft start.
25. 14 x 1 Special Type Omega Helicopter, 210 HP, 3000 RPM engine with 1500 RPM idle. Purpose: soft engagement & engine idle.
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II. Books and Pamphlets


III. Newspapers and Periodicals

BIBLIOGRAPHY (Cont.)

17. Product Engineering
18. Automobile Engineering
21. Worcester Telegram

IV. Publications of Government Agencies and Departments


V. Personal Sources of Information, Correspondence, Interviews

26. Interview with the Consulting Engineer, J.A. Holbrook.
27. Interview with the Peterson Division Manager.
28. Interview with the Shop Superintendent, Smith Company.
29. Interview with the Foreman, Lathe Department, Smith Company.
30. Interview with the Comptroller, Smith Company.
31. Interview with the Vice President, Smith Company.
32. Photographs from sales literature.
33. Sales data information from Peterson Division files.
34. Interview with Sales Manager, Smith Company.