Reduction of Set-up Time with the Concept of Single Minute Exchange of Dies (SMED)

A Project Report P-1667

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PROJECT / INPLANT TRAINING / INTERNSHIP CERTIFICATE

This is to certify that Mr. / ~~Ms.~~ R. VENKATESH BE(MECHANICAL) IV year student of KUMARAGURU COLLEGE OF TECHNOLOGY has done / u~~ndergone~~ / a Project / ~~Inplant train~~ing / ~~Internship~~ o SETUP TIME REDUCTION IN SEYI PRESS WITH THE CONCEPT OF SI MINUTE EXCHANGE OF DIES (SMED) in our ROOTS INDUSTRIES LIMITED durin the period from JAN - 2006 to APR - 2006

During this period his / ~~her~~ conduct was GOOD

(KAVIDASAN)
GENERAL MANAGER - CORPORATE HRD.

ABSTRACT

Inventory stocks are high cost. Behind this often heard statement, is increasing market request for more customized products, abundant offers, reduced life cycles because of never ending innovations. An order not fulfilled immediately, is more and more lost to a faster responding competitor. Stocked goods become obsolete very quickly. For manufacturers, lot size reduction and the need for flexibility, make mastering quick changeover a must.

Our project focuses on reduction of setup time in SEYI Press with the concept of SMED. SMED is a method of systematic seeking for setup time reduction, according to quantified target. **S**ingle **M**inute **E**xchange of **D**ie is Exchange of dies in less than 10 minutes. Single Minute means necessary setup time is counted on a single digit..SEYI Press is a 250 ton capacity, hydraulically operated press used in manufacturing of horn components.

Primarily we started analyzing tools and their set up operation. Centering the Die and feeding the coiler takes considerable amount of time during the set up arrangements. Main objective of our project is to convert internal setup to external setup in decoiler. Five conceptual designs have been proposed to obtain this objective and an optimal design for centering the die.

The sequential process of the project includes detailed time study of each setup task, study of existing equipment and its dies, spotting the possible modification of existing design and evaluation of the new design. This wholesome process eventually ends in the combination of existing activities into one thereby it results to the achievement of considerable reduction in setup time.

ACKNOWLEDGEMENT

At this pleasing moment of having successfully completed our project, we extend our earnest and sincere thanks to our guide **Mr.A.RAJESH,** Lecturer, Department of Mechanical engineering for his kind guidance and encouragement during this project. We are also grateful to the Head of department, **Dr. T.P. MANI** for his constructive suggestions & encouragement during our project.

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CHAPTER - 1

INTRODUCTION

It's April 2006, and the period of nostalgia in the industrial sector, particularly in the automobile industry is over. Even as the steel prices are soaring, there doesn't seem to be any slackness in the blooming of the ever increasing varieties of automobiles and the need for their accessories. The international trade barriers are off and with the relatively new concepts like outsourcing are pushing these industries into a productivity increase spree.

This obviously has chain triggered the same atmosphere among the accessories manufacturing industries. ROOTS INDUSTRIES LIMITED (RIL) is one such industry manufacturing horns for various types of vehicles being manufactured all over the world. The global standards of quality and productivity that would be maintained by RIL must be very much evident from the fact that it is a global supplier for more than a decade.

The changing world economy has caused an increase in the use of Just-in-Time manufacturing which results in a trend toward short-run, multiple-product manufacturing. The frequent product changeover makes it imperative to improve set-up operations and shorten line changeover times. Setups are vital because they determine downtime, capacity, product quality and some extent cost. Errors in setups lead to incorrect components requiring manual diagnosis and rework. Long setup times increase inventory levels, reduce capacity time when lines are idle during setup and affect direct labor. Though operators performing the setups are busy, downstream operations must wait for completion of a setup to begin production.

Single Minute Exchange of Dies (SMED) makes it possible to respond quickly to fluctuations in demand, and it creates the necessary conditions for lead time reductions. The more formal the job, the less drifts to check. Doing this the most ahead will guaranty the setup against omissions and mistakes. SMED is basically a methodology for systematic and radical reduction of setup times, with documented cases reductions from hours to less than ten minutes ("single [digit] minutes").The SMED methodology consists of two phases. In the first phase, a distinction is made between internal and external setup tasks. In the second phase of SMED, all aspects of the setup, both internal and external, are streamlined to make them more efficient. Internal setup efficiency results in labor savings and less downtime machine capacity. External efficiency does not directly improve downtime, but gives better utilization of labor.

The process of reduction of setup time in "SEYI Press" includes a detailed layout study of press and its unique features, a detailed time study of each setup task, spotting the stages which consume the most time, narrowing down the scope to major activities in the setup task, analyzing the various alternate proposals, arriving at a solution (design) for time crimping, conceptual design of the proposed models and concluded with an estimated reduction of setup time on implementation of proposed solution.

This results in a consistent reduction in time which by other means appears an increase in the idle time of the machine operator. As we surf through the project, we could find how this limitation is used to the benefit of the labor ergonomics

CHAPTER - 2

SMED

2.1. SMED: SINGLE MINUTE EXCHANGE OF DIES

SMED, stands for Single-Minute Exchange of Die, is a theory and techniques for performing setup operations in under ten minutes, i.e., in a number of minutes expressed in a single digit. The SMED method was revolutionized by Mr.Shigeo Shingo since 1950 in Japan. The concepts and techniques became available to other countries started around 1974 in West Germany and Switzerland and in 1976 in Europe and United States. However, not until 1980s, the SMED technique getting acceptance to companies outside Japan. SMED was developed over nineteen years as a result of closely investigating the theoretical and practical aspects of setup improvement. It is a scientific approach to setup time and reduction that can be applied in any factory to any machine. It was implemented into the Toyota Production System, and has helped them to become the leading production system.

The heart of JIT is quick changeover methods. Dr. Shingo Shigeo, as part of JIT, pioneered the concept of Single Minute Exchange of Dies. Typically when the last product of a run has been made the equipment is shut down and locked out, the line is cleaned, tooling is removed or adjusted, new tooling may be installed to accommodate the next scheduled product. Adjustments are made, critical values are met (die temperature, accumulators filled, hoppers loaded, etc.) and eventually the startup process begins – running product while performing adjustments and bringing the quality and speed up to standard. This process takes time, time that can be reduced through SMED. SMED was developed in order to reduce the fixed cost associated with the setup and changeover of dies. The basic elements driving the SMED concept are to reduce the setup time of dies, which directly result in smaller batch sizes for parts. A smaller batch size translates as lower costs associated with work in process inventory storage. This concept is especially beneficial as it allows the manufacturing system to quickly adjust to engineering design changes with very little costs. In addition, SMED allows for higher machine utilization and in turn results in higher productivity.

SMED is basically a methodology for systematic and radical reduction of setup times, with documented cases reductions from hours to less than ten minutes ("single [digit] minutes").The SMED methodology consists of two phases. In the first phase, a distinction is made between internal and external setup tasks. Internal setup operations are those that must be performed when the machine is stopped. These operations occur on-line to the machine. External operations are those that can be performed while the machine is in operation. It is more efficient to perform these tasks off-line from the machine. Once the operations are classified as either external or internal, the external operations can be moved off-line to reduce machine downtime. In the second phase of SMED, all aspects of the setup, both internal and external, are streamlined to make them more efficient. Internal setup efficiency results in labor savings and less downtime machine capacity. External efficiency does not directly improve downtime, but gives better utilization of labor.

SMED (Single Minute Exchange of Dies), Set-up or changeover reduction has been an important element of lean thinking for a number of years.

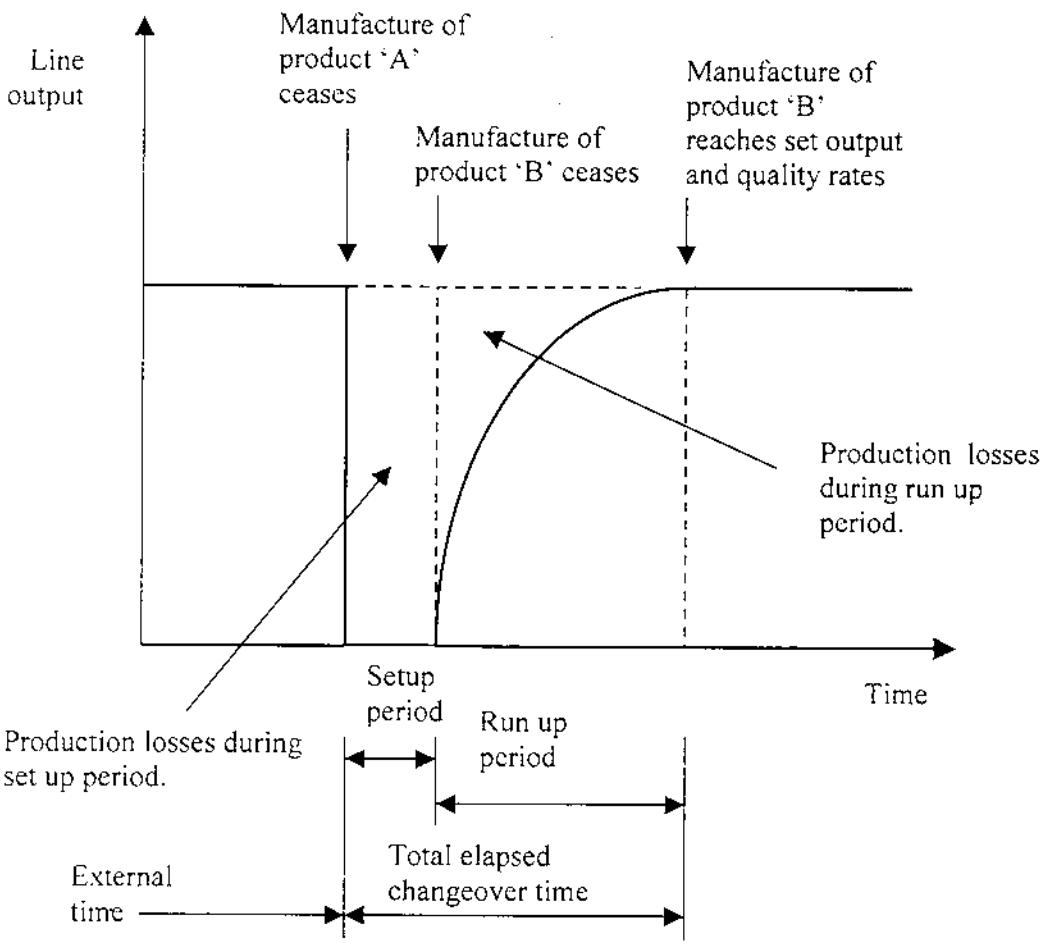

FIG 2.1. SETUP PERIOD AND CHANGEOVER PERIOD

2.2. TERMS AND DEFINITIONS

- Changeover : the total process of changing a production line from running one product to another
- Changeover time: elapsed time between the last good previous product, and the first good next product at the right speed.
- Setup time : the time to adjust or replace machine parts to accommodate the new product
- Startup time : the time to bring the process up to the right speed and quality
- Changeover time = Setup time + Startup time

SMED is often used interchangeably with "quick changeover". SMED and quick changeover are the practice of reducing the time it takes to change a line or machine from running one product to the next. However Changeover and Setup are actually different things, Changeover is the time between good product and good product at the right speed, this includes Set-up time and Run-up time. Set-up time refers to the time taken to physically make the changes to the line in order to run the new product, Run-up time is the time taken to make adjustments to the line in order to produce products of the specified quality at the specified production speed. SMED / Changeover reduction simply refers to attempts to reduce the time taken to carry out the changeover process.

2.3. NEED FOR SET-UP TIME REDUCTION

SMED is just one technique used to help reduce changeover time. The effects of SMED consist of more than just reduced setup times and improved work rates.The successful implementation of SMED and quick changeover is the key to a competitive advantage for any manufacturer that produces, prepares, processes or packages a variety of products on a single machine, line or cell. SMED and quick changeover allows manufacturers to keep fewer inventories while supporting customer demand for products with even slight variations. It also allows manufacturers to keep expensive equipment running because it can produce a variety of products. The need for SMED and quick changeover programs is more popular now than ever due to increased demand for product variability, reduced product life cycles and the need to significantly reduce inventories. There are a number of potential advantages to reducing the time taken to changeover a production line. These include:

- Increased efficiency
- Reduced stock requirement
- Increased capacity
- Reduced work in progress
- Increased flexibility.

2.4. IMPACT OF SETUP-TIME REDUCTION

Setup reduction brings the following impacts to the shop floor:

- Lot-size can be reduced.
- Help to reduce inventory.
- Reduce the cost of setup labor.
- Increase the capacity on bottleneck equipment.
- Help to eliminate the setup scrap.
- Reduce the potential Quality problems and obsolescence.

Some other beneficial effects of SMED are that machine work rates and productive capacity is increased. There is an elimination of setup errors and the elimination of trial runs lowers the occurrence of defects. Quality and safety are both improved. Standardization reduces the number of tools required and those that are still needed are organized more functionally. Tool changes are quick and simple, eliminating the need for skilled workers; therefore SMED lowers the skill level requirements for a process. SMED increases the manufacturing flexibility because of quick changeovers; therefore a company can increase their production flexibility because it will be able to respond rapidly to changes in demand. SMED can also have effects on the attitudes within the company. SMED welcomes employee involvement toward continuous improvement.

CHAPTER - 3

SMED PROCESS

3.1. STEPS FOR SMED

- Stage 1 : Separating internal and external setup as it is Existing
- Stage 2 : Converting internal to external setup
- Stage 3: Streamlining all aspects of the setup operation.

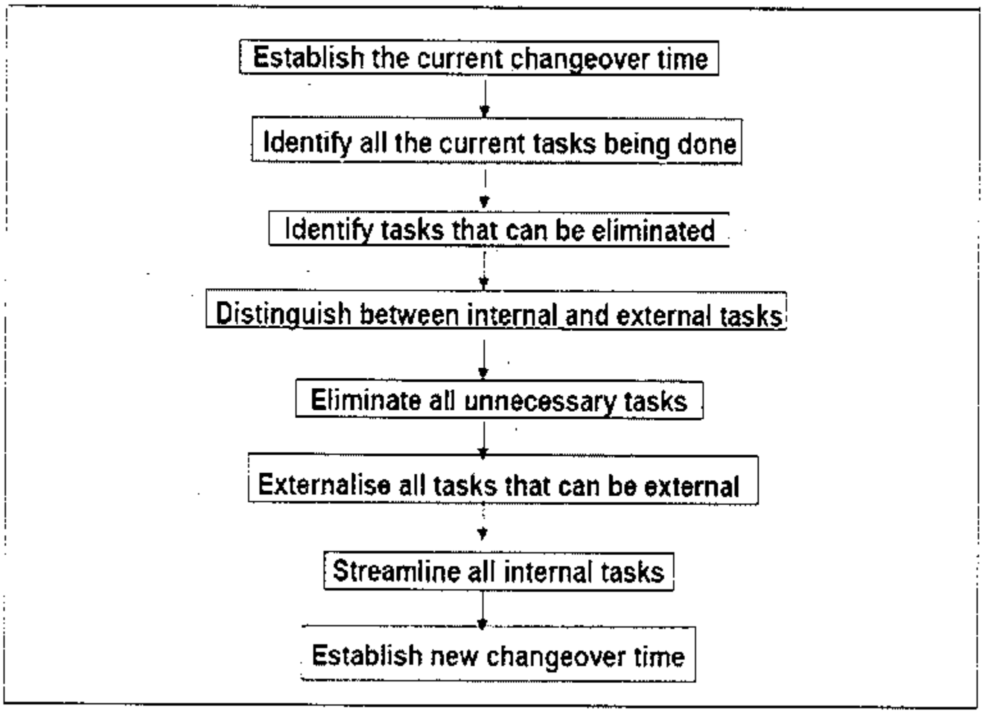

FIG 3.1. SMED PROCESS

3.2. NECESSITY OF TECHNIQUES FOR SETUP TIME REDUCTION

The operation of changing over the by product being produced-the setup operation – will occur for any line not dedicated to a specific product.Thus, thinking generally setup time will be required, and if a variety of product are produced in small lots, equipment utilization ratio should fall to that extent, and the amount of operating time available should decrease. In this context, one might expect that there is one optimum production quantity that would result in an economic balance between the equipment utilization ration and the quantity produced in a lot. This is the concept of economic lot size, which considers setup cost in a mass production situation. This concept of economic lot size is similar to that of economic order quantity and can be found by the following formula:

$$Qe = \sqrt{2RC/Pi}$$

Qe=economic lot size

Where

R= estimated amount of demand during scheduling period

C= setup cost

P= purchasing unit price

i=inventory cost factor

However at the time the general formula was applied in mass production situations and became established as common sense, the late Shigeo Shingo of Japan proposed a way of thinking that totally overturned that common sense. His innovative concept focused on separating internal and external setup. According to this concept, when the setup time and cost are large enough, the formula for economic lot size can be applied, but when those factors are relatively small, an economic lot size does not really exist, and lots can be made as small as desired. Based on this new thinking, Shingo developed an original production technique that later became the foundation on which the late Taiichi Ohno built the Toyota production system as a production system for small-volume production of a variety of products and for cell type "one piece flow" .

3.3. ADVANCEMENT AND DEVELOPMENT OF SETUP IMPROVEMENT TECHNIQUE

With the broad adoption of the Toyota production system, the technique of single setup , which had initially been used with industrial press equipment, was gradually applied to all kinds of equipment that use molds, such as injection molding, forging, and casting equipment. It spread from the auto industry to every other industry including consumer electronics and home appliances, semiconductors, heavy electrical construction, sales and distribution. food service and the like. Furthermore, Shingo selected this name, single setup, to indicate a high level of achievement, comparing the reduction of setup time to a single digit(i.e. less than 10 minutes) to a single-digit golf handicap. Activity in the field of setup improvement, which became famous through the popularity of single setup, has continued to make progress.

The concept of setup improvement, which really got its start from the innovative idea of "considering internal setup and external setup separately". Gained attention not only from Japan's leading manufacturers but also from companies around the world, and in just a short time it became widely accepted.

Technically, production activity may be thought of as a matrix of process steps and tasks or operations. It is important to recognize that work can be accomplished while separating the progression of process functions (forming, changing the material, assembling, breaking down) from human operations (setup, main operations, spare time) as depicted . In other words, if preparation tasks and follow-up tasks (i.e. the setup operation) can be done in a way that does not hamper the progress of the production process and can be completed while equipment is actually operating, the amount of time lost to stoppages of product production or to equipment downtime can be remarkably reduced. If this separation is made, the setup tasks for which the equipment must absolutely be stopped are actually very few. This results in a significant reduction of internal setup and further breakthroughs become possible.

- Abolishing unnecessary operations
- Converting internal setup activities to external setup
- Shorting the essential internal setup operations-standardizing molds and connectors (including functional standardization), controlling adjustments, converting the final locks-in step to a one-touch clamping.
- Reducing external setup

3.4. BASIC STEPS FOR SETUP TIME REDUCTION

Basic procedures for setup time reduction which can be viewed as the basic steps to single setup, are outlined in the figure. The following sections briefly describe these basic procedures in sequence.

Practical step 1: Analyze the setup operation.

Often the importance of a setup operation is not recognized, or if recognized, technical difficulties are encountered and improvement efforts are abandoned. For such reasons, in cases where the existing setup operation takes more than a few hours, it frequently happens that no one has clearly understood what tasks are being, done, and in what order. There may be some differences depending on the equipment used or the way operations are performed but the typical time scheduled for all tasks in the setup operation, prior to improvement, can generally be summarized by the following breakdown.

- Preparation and cleanup of materials, cutting tools, jigs, and checking heir funcionali-30 percent.
- Installation and removal of cutting and similar tools-5 percent
- Centering and setting of dimensions and other parameters-15 percent
- Trial run, adjustments-50 percent

Practical step 2: Identify the targets for improvement.

The second practical step to focus on is the potential for improvement. First, referring to the times measured in the practical step 1for each task based on the observations on the factory floor, improvement oriented questions should be asked:" Why must this task be done?" or " Why cant this task be made part of external setup?" . Here, it may be helpful to use improvement idea to checklist or some of the many reference materials that are available. In a Basic orientation for Achieving Single Setup, the most effective methods to improvement ideas in this setup are organized and presented as idea steps. These idea steps can be roughly organized into five classes. Generating ideas need not follow a system, but a systematic process for idea generation may be very effective when working to reduce setup time. It enables those involved to keep organization in their minds which idea at what idea is being considered at any moment, and in that way energy can be focused where the priorities lie. The subsequent sections summarize the five idea steps.

Step 1: Eliminate losses in setup operations

Meaningless tasks within the setup operation are often done simply by habit. without a clear purpose. Thus, the first ides step is to pursue the function of each task, asking why that task is performed. If any tasks are found that have no particular meaning or are simply a waste of time, they should immediately be eliminated from the setup operation.

Step 2: Separate internal and external setup work

Next, it is necessary to identify those setup tasks that can be done only if the equipment is stopped(internal setup) and separate them from tasks that can be done without stopping the equipment(external setup).Without this distinction, all setup tasks may be treated like internal setup tasks and the equipment may be stopped much longer than is necessary. In this step the rule that "equipment may be stopped for setup only if the specific setup task cannot be done without stopping the equipment" is enforced. Many tasks can be accomplished without having to stop the equipment, including preparation of cutting tools, molds, jigs, fixtures and certain follow-up tasks.Thus, simply by differentiating between internal and external setup, setup time requiring equipment stoppage can be reduced by 30 to 50 percent.

Step 3: Convert internal setup steps to external steps

In this step setup tasks that currently must be done while the equipment is stopped are changed and improved so that they can be done while the equipment is in operation. For the case of tool-centering operation, it is done only with the equipment stopped. But it was found that presetting could be done with the equipment operating. Likewise, another procedure required that the equipment be stopped after setup until the quality of newly produced products could be verified. However, by increasing the reproducibility of manufacturing conditions for non defective products, it was possible to restart the equipment immediately(without a trial run) with full expectation of quality products. In this way, it is often possible through creative thinking to change setup tasks presently done as internal setup to external setup.

Step 4: Shorten internal setup steps

At this point, the internal setup tasks still remaining must be thoroughly analyzed and improved. It is important to approach this effort motivated by a strong determination that "We will achieve single setup in any way possible!" Those individuals involved, based on examples of past successes. must change their viewpoints and way of thinking in the effort to contribute innovative ideas.

Step 5: Shorten external setup steps

At present, the equipment operator must in many cases do setups along with his regular tasks and it is becoming less common for someone other than the operator(a supervisor for example) to take care of external setup tasks. Therefore, total improvement of the setup operation generally cannot be achieved without significant reduction of external setup tasks as well. To accomplish this, it is necessary to look closely at all the things which change as part of the setup operation and seek to eliminate or reduce them.

In following these idea steps, it is not necessary that each one be used in the course of a single time study. After the improvement ideas have been organized, selected and implemented, one can return to an idea step that could not be used in the first round and come up with improvement ideas in that category, which can then be implemented. Improvement through this kind of a repetitive process is very effective. After one round of Idea Steps-from (i1) to (i5), return to Practical Steps. Practical Step 3 is next in the procedure sequence

Practical step 3 : Finalize the improvement plan

After a multitude of improvement ideas have been submitted for each task in the setup operation, the relevant ideas should be assigned to one of four levels: easy to implement, requires a small investment, requires a medium investment or is too idealistic. Next, mark with a large black dot the tags with improvement ideas that are selected for adoption. It is important to address as many tasks of the setup operation as possible and adopt as many ideas as possible.

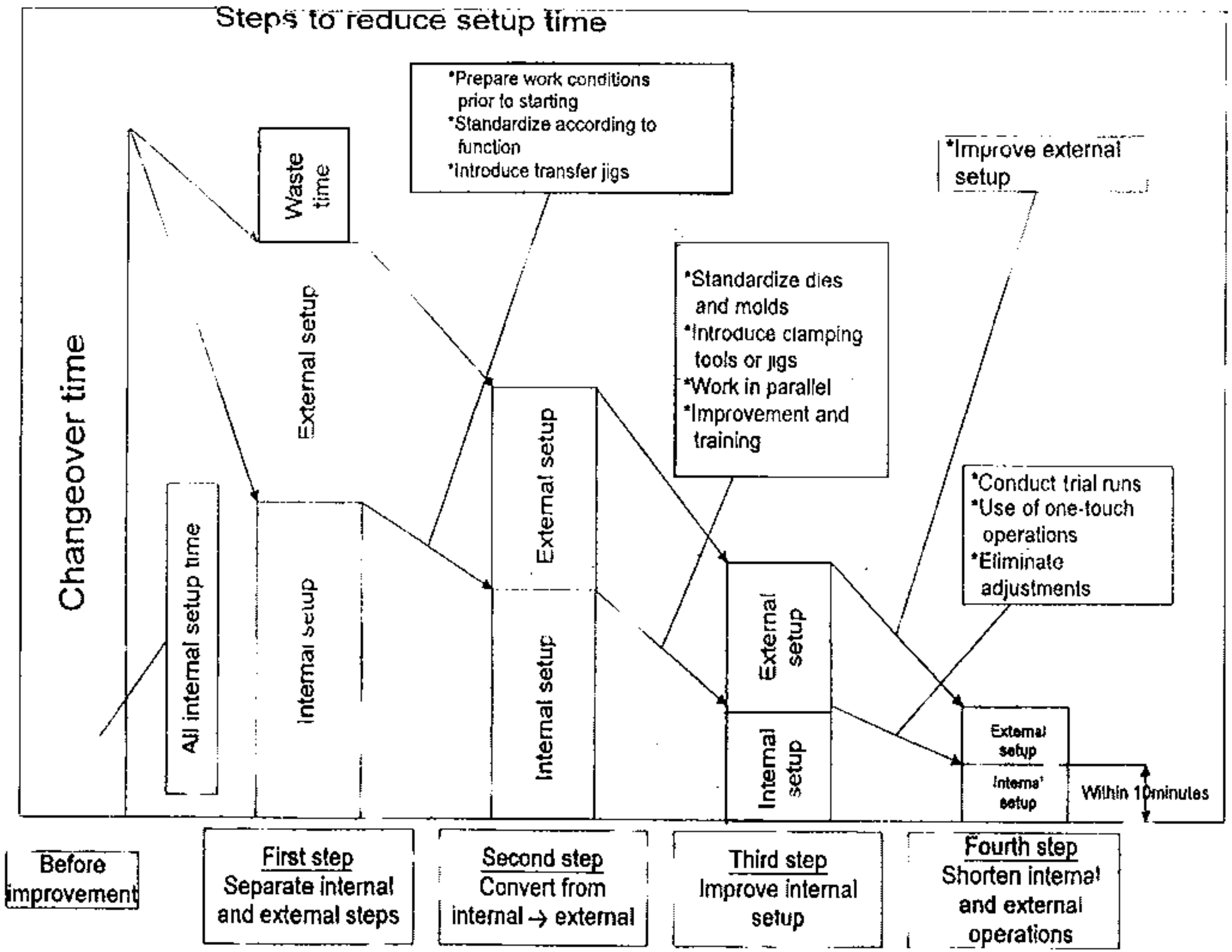

FIG 3.2. IMPROVEMENT PROCESS FOR SETUP TIME REDUCTION

Practical step 4 : Estimate post improvement setup time

On a time improvement analysis sheet, for each task in the setup operation, calculate and display the total reduction in time that will be possible through the adopted improvement ideas. Then for each setup task, this time reduction is subtracted from the current time (as observed and measured in the time study) and an estimate of the time for the setup operation after improvement is calculated. If there are setups tasks whose time values are still large even after improvement, more improvement ideas must be generated and further reductions attempted.

Practical step 5 : Study and evaluate the improvement plans

Using a setup improvement-idea evaluation form, the ideas that were classified into the four levels described in Practical Step 3 are reviewed and the determination as to whether each idea will be adopted is made and recorded. Preparations should be started immediately for ideas assigned to the "easy to implement" level. In some cases an idea from the "requires a small investment" or "requires a medium investment" level will have been given a high priority for adoption. If it duplicates (solves the same problem) as an easy to implement idea, then no preparatory work should be done on the latter idea because it would shortly be replaced anyway. Each of the improvement ideas classified at the levels of small investment, medium investment, or idealistic is evaluated as to whether it should be adopted. In conducting this evaluation, the required investment should not be the only criterion, but rather the expected effect and the cost performance of the idea should be considered. Moreover, since the initially estimated investment cost is only a tentative number, it may be possible, with a little creativity or innovation, to come up with a much less expensive solution that will produce the same effect. For this reason, improvement ideas should not be rejected only because the investment cost may be large.

Practical step 6 : Arrange the actual implementation

For each improvement idea adopted in Practical Step 5,a request must be made for the required hardware changes. To facilitate this, a form is generally used that outlines the arrangements needed for rebuilding the hardware to achieve the planned improvement and contains realistic estimates of the expected cost of the improvement idea and the required time. For each adopted idea, a person must be placed in charge and preparations for implementation are then begun.

Practical step 7 : Create a temporary procedures manual for the improved setup method

Once the hardware changes have been made on a test basis according to the improvement idea and the effectiveness of the improvement verified, a tentative procedures manual for the improved setup operation is developed. In addition to outlining revised operating procedures, the temporary procedures manual for the setup operation lists the estimated time for each setup task. In this way the total setup time before and after improvement can be verified. If at this late stage, it is found that the time improvement is small, it may be worth going back to earlier steps and seeking further improvement ideas.

Practical step 8 : Officially launch the improved setup method

To recognize the efforts of everyone involved, it is desirable to launch the new, improved setup operation with "fanfare" inviting upper management and key people from outside the company. Such an opening ceremony, enables everyone to see the results of the improvement, and also sends a strong message as to the importance of ongoing setup improvement activity. Announcing the "grand opening" date well in advance has the advantage of also providing a stimulus for the people engaged in setup improvement to complete their work on time and this may unleash a level of effort not usually seen. In addition, putting improvement activities in the limelight can provide big impetus to further activity of this type.

Practical step 9 : Implement a "sideways expansion" of single setup

If single setup is achieved in one part of the factory, it is beneficial to publicize the achievement and recognize the good results. Moreover, the accomplishments should not be allowed to end there, but similar improvements should be immediately applied to similar process and equipment throughout the factory. This "sideways expansion" of the adopted improvement ideas might occur by applying them just as they are to the other lines or equipment that were examined in Practical Step 1 during selection of the model line for improvement. For other types of equipment, the setup improvement methodology can be applied to seek similar benefits.

Considering the results of setup improvement activity, simply reducing setup time for one piece of equipment will not have that large an impact because only the labor-hours needed for setup have been reduced. Besides, if setup operation tasks have merely been changed to external setup tasks, the total labor-hours will not have been reduced at all. Therefore, when a single setup has been successfully achieved, it is essential to think in terms of sideways expansion so that the single setups can be achieved throughout the entire line producing the product, and other lines as well. If the improvement process described previously is viewed as a progression of setup time reductions, it will appear as shown in the fig. This can be easily understood as a process of gradually "digging deeper", through use of the idea steps, while repeating the practical steps. That is, while repeating the practical steps over and over, the idea steps are gradually applied more intensely. Of course, since these are idea steps, in practice it is quite acceptable to develop ideas that span these four steps.

3.5. PROCEDURES FOR SETUP REDUCTION:

SMED can be conducted according to the following steps:

1. Form the setup reduction team.
2. Conduct training and education.
3. Study the setup process (e.g., use video tape).
4. Classify setup operations into waste, internal setups , and external setups
    - Waste - Operation which do not add values to the setup.
    - Internal Setups - Operations that can only be performed while the machine is shut down.
    - External Setups - Operations that can be performed without shutting down the machine.
5. Eliminate the waste.
6. Convert as many internal setups as possible to external setups.
    - Use standard insert module.
7. Improve internal setups (include adjustment).
    - Use specially designed cart to organize tools.
    - Use quick-release fasteners instead of bolts and nuts.
    - Use stoppers to quickly position the jigs.

- Use rolling bolsters instead of cranes.
- Use overhang mechanisms to handle heavy jigs.
- Use locating pins and holes (socket) to eliminate the adjustment.
- Use standardized die height.

8. Improve external setups.
    - Apply visual control principles.
    - Use checklist to avoid omission.
    - Use specially designed cart to help organize tools.
    - Organize workplace (5S) to reduce search.
9. Develop the standard operating procedure (SOP).
10. Evaluate the performance of setup reduction.
11. Prepare for the next setup reduction project.

CHAPTER - 4

ROOTS INDUSTRIES

4.1. INTRODUCTION

The name "ROOTS" spells difference. A name that is all set to take on the industry segment through quality and innovation. Roots Group of Companies, a multi-faceted industrial conglomerate in this part of the country with a tradition of three-decades excellence in automobile parts, industrial products and engineering, that values and believes in the power of the people much more than technology. A company that is built on the principles of ethics and human values on a solid footing. Its commitment to quality systems and society could be seen in the NO.1 position it ranked in getting ISO,VDA6.1, ISO/TS 16949 and ISO 14001 in the regional, national and international levels. Roots is on the look-out for dynamics and competent workforce for its various units.

Roots is a leading original equipment similar and specializes in the manufacture of a wide range and line-up of automobile horns to major vehicle manufactures like Mercedez Benz, Mitsubishi, Mahindra & Mahindra, Toyota, Fiat, Telco, Tvs, Kinetic, etc. The technical collaboration with Robert Bosch S.A. of spain starting from 1995 has strengthened the R&D activities and increased Roots technical competence to international standards. Roots Industries Limited places a premium on original technology and innovation. Its technical collaboration with Robert Bosch of Spain in 1995 has helped it to further strengthen its R&D activities and technical competence. This collaboration along with Roots indigenous talent has kicked off a spree of growth unmatched in the history of automobile OE manufacture.

Team building, relationship management abilities, a passion to overcome challenges and achieve goals are required for all the following positions.

Roots multi clean Ltd. (RMCL) is a joint venture with Hako Werke Gmbh & co., Germany , one of the largest cleaning machine manufacture with global operations. RMCL is the sole representative in India and SAARC countries for Hako Werke's entire range of cleaning equipment. The quality of RMCL products is so well established that Hako buys back a major portion for their global market.

RMCL also represents several global manufacture of cleaning products and is gearing itself up to provide customized, total cleaning solutions.

COMPANY/INSTITUTION	PRODUCTS MADE
1.Roots Industries Limited	Electric horns
2.Roots Auto Products Private Limited	Air horns, switches, and controllers
3.Roots multi-clean Limited	Cleaning machines
4.Roots cast private Limited	Aluminum and zinc pressure die cast
5.Roots precision products	Dies, tools, jigs, and fixtures
6.Roots digital engineering services private limited	Digital engineering services
7.Roots metrology laboratory	Instrument calibration, quality systems, consultancy
8.Roots polycraft	Plasic components
9.R.K. nature cure home	Nature cure therapy, yoga and massages
10.Satchidananda Jothi Nikethan	International school
11.crystal clean care	Range of modern cleaning techniques

TABLE 4.1. ROOTS GROUP OF COMPANIES

4.2.THE ROOTS INDUSTRIES LTD

Roots Industries Ltd. Is a leading manufacturer of HORNS in India and the 11th largest manufacturing company in the Coimbatore in India. Roots has been a dominant player in the manufacturer of horns and other products like casting and industrial cleaning machines.

Since its establishment in 1970. Roots has had a vision and commitment to produce and deliver quality products adhering to international standards.

With a strong innovative base and commitment to quality, Roots industries Ltd. has occupied a key position in both international and domestic market has suppliers to leading OEMS and after market. Similar to products, Roots has leading edge over competitors on strong quality system base. Now, RIL is the 1st Indian company and 1st horn manufacturing company in the world to get ISO/TS 16949 certification based on effective implementation of QS 9000 and VDA 6.1 system requirement earlier RIL has entered into technical collaboration with Robert Bosch, SA to further enhance technical competence. Roots vision is to become a world class company manufacturing world class products, excelling in human relation.

4.3. ROOTS VISION

We will stand technologically ahead of others to deliver world-class innovative products useful to our customers. We will rather lose our business than our customer's satisfaction. It is our aim that the customers should get the best value for his money.

Every member of our company will have decent living standards. We care deeply for our families, for our environment and our society. We promise to pay back in full measure to the society by way of selfless and unstinted service.

4.4. QUALITY POLICY:

We are committed to provide world-class products and services with due concern for the environment and safety of the society.

This will be achieved through total employee involvement, technology upgradation, cost reduction and continual improvement in,

- Quality of the product and services.
- Quality Management systems.
- Compliance to QMS requirements.

Quality will reflect in everything we do and think,

- Quality in behaviour.
- Quality in governance.
- Quality in human relation.

4.5. QUALITY – AN ALL PERVASIVE ENTITY

Roots is committed to manufacture customer-centric and technology-driven products on par with international quality standards. For example, the horns manufactured undergo a rigorous life-cycle test and are subjected to an endurance of over 200000 cycles of performance while the industry norm requires only 100000.

What's more, Roots believes in a quality culture that goes beyond just products. Equal emphasis is given to quality in human relation and quality in service. Roots in it's journey towards Total Quality Management and has reached important milestones: ISO 9001, QS 9000, VDA 6.1, ISO/TS 16949 and ISO 14001 Certification, presently in the process of obtaining NABL accreditation for our Metrology labs. The Group's TQM policy has a well-integrated Quality Circle Movement with active employee participation at various levels .

4.6. MILESTONES ACHIEVED BY ROOTS GROUP OF COMPANIES

- 1970- Promotes American Auto Service for manufacture of Electric Horns.

- 1972- First to manufacture Servo Brakes for Light Motor Vehicles.

- 1984- Roots Auto Product Pvt Ltd was established to manufacture Air Horns. Die Casting Unit commences commercial operations.

- 1988- Polycraft, a unit for plastic Injection Moulding was established.

- 1990- Roots Industries Pvt Ltd takes over Electric Horn Business.

- 1992- RMCL enters into Techno- Financial collaboration with M/s. Hako Werke Gmbh, Germany.

- 1992- Roots Industries Pvt Ltd obtains National Certification- ISI mark of quality.

- 1994- Production of floor cleaning equipment commences. Roots Industries Pvt Ltd wins American International Quality Award.

- 1999- Becomes the first horn manufacturer in Asia to obtain QS 9000.

- 2000- Becomes the first horn manufacturer in Asia to obtain VDA 6.1and the first in the world to win ISO/TS 16949.

- 2000- Floats Roots Digital Engineering Services Private Limited to offer CAD/CAM Services.

- 2000- The first to introduce digitally controlled air horns and low frequency, low decibel irritation free Jumbo Air Horns.

CHAPTER - 5

5.1. INTRODUCTION

SEYI Press is popular equipment in Press shop of the manufacturing firm. It is the pride of the industry for making this press available in their Press shop as it enables quicker production of horn components. ROOTS Industry Ltd. made this Press available in their operation unit right from January 2005 and it's the unique one available in the state of Tamil Nadu.

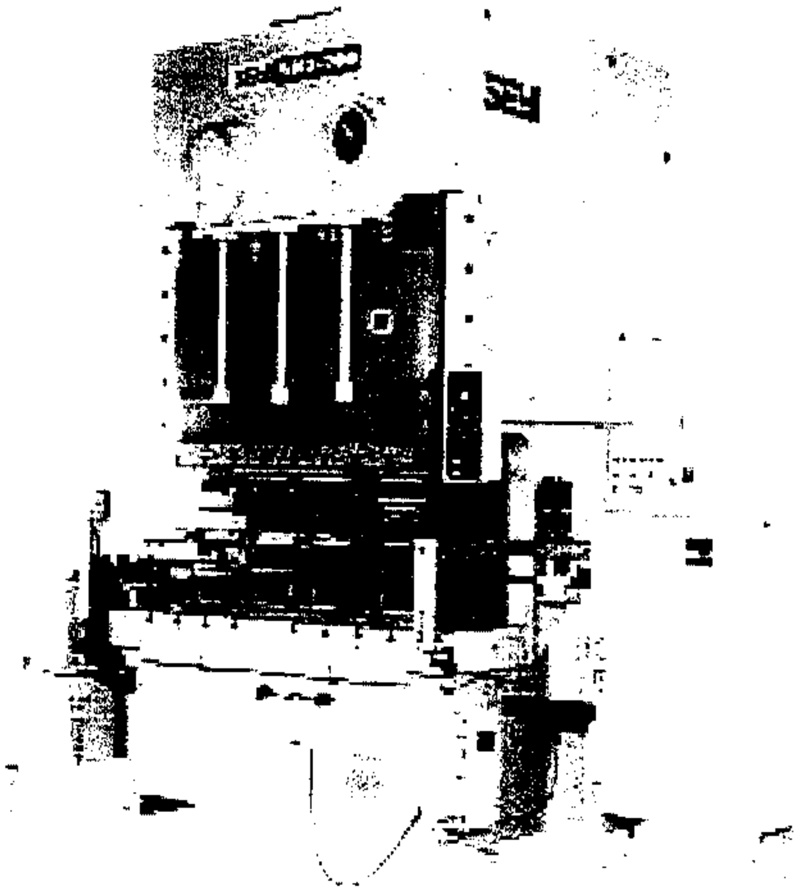

FIG 5.1.SEYI PRESS

Make: SHIEH YIH MACHINERY INDUSTRY LTD., TAIWAN.

SNO	FEATURES	SPECIFICATION
1.	Model	SLS2-200
2.	Serial no.	SLS2-200-013
3.	Date	January 2005
4.	Capacity	200 tons
5.	Stroke Length	230 mm.
6.	Strokes/min.	25 – 45 spm.
7.	Die Height	500 mm.
8.	Slide Adjustment	100 mm.
9.	Slide Area	1850 x 750 mm^2.
10.	Bolster Area	2200 x 840 mm^2.
11.	Air Pressure	5 kg./cm^2
12.	Main motor	25 x 4 hp x p
13.	Power source	440 V 50 Hz 30 KVA

TABLE 5.1.SPECIFICATIONS OF THE SEYI PRESS:

5.2.FEATURES OF SEYI PRESS

SEYI Press, on which the project undertaken is of model type SLS2-200.It, is of 200 tons capacity occupying a slide area of 1850 x 750 mm^2.Air pressure employed is of about 5 kg./cm^2 with a stroke length of 230 mm. Strokes per minute is in the range of 25 – 45 spm. Die that has to be placed in the machine bed occupies a height of 500 mm. Power source requirement for operation of SEYI press is 440 V, 50 Hz and 30 KVA.Unique features of the press are:

- High torque, low noise, wet clutch and brake.
- Rigid frame with less deflection.
- Many protective devices ensure operation safety.
- User-friendly design and all-function electric control system provide high automation compatibility.

5.3.APPLICATION

SEYI Press have been made available for the medium type of single and progressive die application in blanking component, piercing and bending process thereby enabling effective production of horn components.

5.4.DIES USED:

In SEYI Press, seven different kinds of progressive dies are employed. Each die has its own unique features and favours production of quality products. These dies have been made in the ROOTS Industries Ltd. for the production of horn components. The following table shows the details of various dies with its number of progressive stages in it that enables the production of end product.

SNO	DIE/TOOL	STAGES
1.	W 75 Housing Tool	7
2.	Smart one Tool	9
3.	FC4 Housing Tool	8
4.	Thunder Bird Housing Tool	7
5.	Vibro mini Grill Tool	7
6.	W75 Keeper ring Tool	7
7.	R 3 Grill (Vibro sonic)	7

TABLE 5.2.DETAILS OF THE DIES

5.5. DIE SPECIFICATIONS:

The table given below gives the detailed specification of each dies employed for the production of components.

NO	DIE/TOOL	LENGTH mm.	WIDTH mm.	HEIGHT mm.
1.	W 75 Housing Tool	1320	530	510
2.	Smart one tool	1485	520	530
3.	FC4 Housing Tool	1480	530	520
4.	Thunder Bird Housing tool	1300	530	520
5.	Vibro mini Grill Tool	1270	530	520
6.	W75 Keeper ring tool	720	460	425
7.	R 3 Grill (Vibro sonic)	1460	580	500

TABLE 5.3. SPECIFICATION OF TOOLS

CHAPTER - 6

PROBLEMS FACED

6.1. INTRODUCTION

SEYI Press is a 250 ton capacity, hydraulically operated press used in manufacturing of horn components. Starting our project, we made study on properties, method of operation and unique features of the SEYI Press. As a part of it, we made a thorough analysis of various types of dies and its unique specifications employed for the production of components. Then, time taken for change of each dies has been recorded out with a detailed description of various activities involved in the set up process.

6.2.CAUSE AND EFFECT DIAGRAM

On analyzing the various activities, we framed out here the 'Cause and Effect diagram' which by other means called as 'Fishbone diagram' highlighting the important causes that lead to the effect of longer setup time.

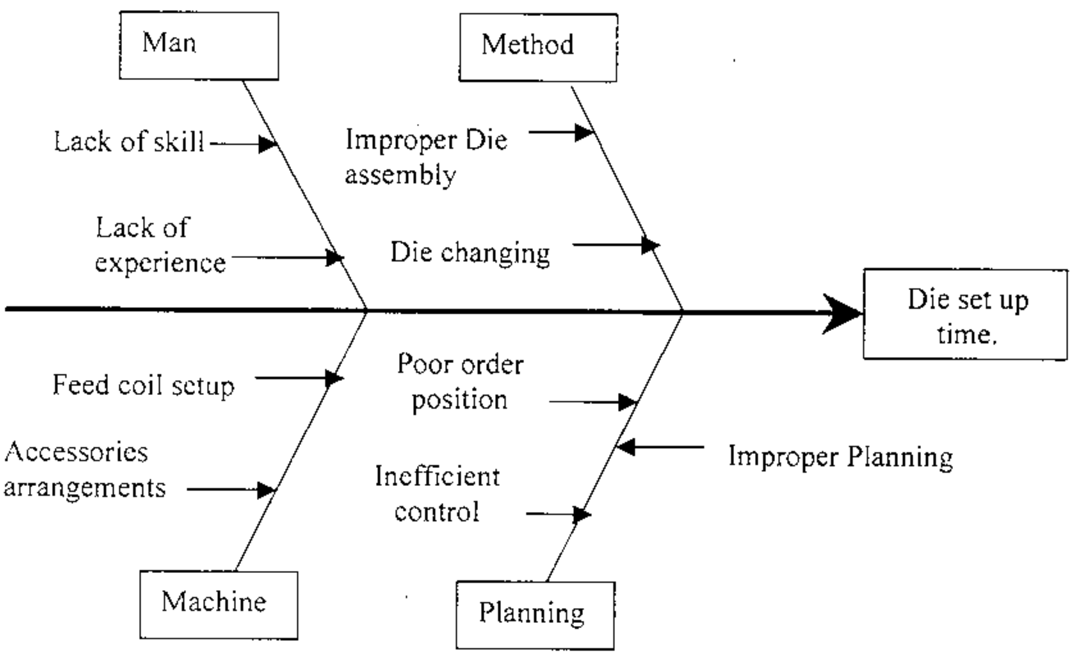

FIG 6.1.CAUSE AND EFFECT DIAGRAM

From the above 'Cause and Effect diagram', it has been found out that the following were the major cause that lead to higher set up time in the press:

- Man
- Machine
- Method
- Planning

Each of the above factors has certain activities that lead to time consumption in the process.

6.2.1.Man

The operator employed in the press should have exposure in the field of setup process. They must be trained and should have thoroughly studied the features of machine before getting into the operation process. The need for reduction of setup time in the machine must be made to understand by the operators well before starting of the process in the press The major part of the operator for their cause to setup delay is their:

- Lack of skill in the process of die change
- Lack of experience in area of press shop

Further, lack of coordination among the operators working in the machine and with their engineers tend to contribute a consistent level in the time delay of die changing process. Operator fatigue due to continuous work in the machine also remains a main cause for delay in the setup tasks. These were the reasons for the worker as a main cause for the time delay of die changing process.

6.2.2 Machine

SEYI Press provides high torque, low noise and has wet clutch and brake with a rigid frame which gives less deflection. In spite of various unique features of the press, it has been found out that certain activities which are the part of setup tasks contribute a major part in the delay of setup operation. It is necessary to identify and distinguish the various activities in the setup process as internal and external task. Internal setup operations are those that can only be carried out when the machine is stopped. These operations occur off-line to the machine. External operations are those that can be performed while the machine is in operation. It is more efficient to perform these tasks on-line from the machine. Once the operations are classified as either external or internal, the internal operations can be moved off-line to reduce machine downtime. Looking on to the machine side, the major events to be taken into consideration during the setup process are:

- Feed coil setup process
- Accessories arrangements

Activities involved in these processes consumes considerable amount of time which has to be reduced in order to achieve quicker set up. It is necessary here to convert the activities of internal setup task to external setup task as much as possible so that the required objective of considerable amount of reduction in setup time can thus be achieved.

6.2.3. Method

Third major cause leading to more time consumption in setup activities is the method of various operations occurring in the press. More important activities observed from the activities occurring in the press that affect the die change time are:

- Die centering process
- Tool changing activities

The critical alignment of any press is the parallelism of the upper and lower rams to each other and the squareness to the way (gib). Every time there is tool changeover, the die and punch need to be aligned for both centre and angle. Centering dies in the machine bed has been currently carried out manually in SEYI press. As a result, based on the experience and skill of the worker in this field makes the centering process to end in the effective manner. Also tool changing activities has been carried out by means of trolley arrangement leading to more time in setting it in machine bed. This kind of traditional method of activities must be taken into consideration and must be changed to alternate method of operation to achieve the target of quick changeover of dies.

6.2.4. Planning

A system of effecting way of optimizing the available resources must be planned and to be skillfully implemented so that more tangible gains can be achieved. Planning the method to be applied and allocating the resources according to the priority of requirements plays a vital role in the productivity of the firm. The following activities occurring in the press shop affects the flow line of die setup process :

- Poor order position
- Inefficient control over the activities
- Improper planning of method

These activities by the operators and the engineers lead to disturbance in the production line and thus affect the productivity. Major activities should always be under the control of team members so that the smooth flow of processes can be maintained. Also orders of production should be prioritized and must be maintained consistently that ultimately leads to effective control of all other activities. Improper planning of processing methods and inefficient control over it affects succeeding activities thereby leading to more time delay in setup activities. These factors must be taken care of by all means to get quick change over of dies.

CHAPTER - 7

SETUP TASKS INVOLVED

7.1. SET UP TIME:

Setup time does not refer to only the time for changing molds or other tooling and parts, but rather to the entire time from stopping production of the previous product until the production of non defective units of the next product has been confirmed. Set up time is thus defined as "all the work and time involved between making the last good product of tool 'A' to the next good product of tool 'B'.

7.1.1. Internal setup time

Internal setup operations are those that can only be carried out when the machine is stopped. These operations occur off-line to the machine. Time involved in activities which are found as internal setup tasks are referred as internal setup time.

7.1.2. External setup time

External operations are those that can be performed while the machine is in operation. It is more efficient to perform these tasks on-line from the machine. Time taken in carrying out such external activities in the set up process is called external setup time.

7.2. SETUP TASK IN DIE CHANGE PROCESS

Various internal and external setup activities during die change process have been listed out. Setup process involved has been classified into four major parts:

- Tool changing activities
- Die centering process
- Press feeder arrangements
- Accessories arrangements

NO.	ACTIVITIES	TIME INVOLVED (In min.)	REASONS FOR DELAY
TOOL CHANGING			
1	Coolant spray	1	Manual operation
2	Removal of conveyor arrangements	1	Manual operation
3	Removing the tool 'A' from bed	2	Trolley arrangement
4	Carrying the tool 'B' from Store	4	Absence of space for placing tool
CENTERING ARRANGEMENTS			
5	Placing the tool at the machine bed	2	Trolley arrangement
6	Aligning with the X-axis	5	Manual operation
7	Aligning with the Y-axis	5	Manual operation
8	Positioning and clamping the tool at the centered position	4	Manual operation

NO.	ACTIVITIES	TIME INVOLVED (In min.)	REASONS FOR DELAY
PRESS FEEDER ARRANGEMENTS			
9	Unclamping the decoiler	1.5	Removal of bolts
10	Lifting the roll with crane	2	Operating the crane consumes time
11	Placing the feed roll in the de-coiler	3	Manual operation
12	Clamping the decoiler	1.5	Fitting the bolts
13	Adjusting the feed in the straightener	4	Internal setup
ACCESSORIES ARRANGEMENTS			
14	Sensor setting	2	Manual operation
15	Re inspection	2	Manual operation
16	Conveyor arrangement	2	Manual operation
17	Production of first component	4	Controlling feed and stroke
	TOTAL	46	

TABLE 7.1.OBSERVED SET-UP TIME

Looking on to various activities concerned with the setup task, activities involved in

- Automatic Press Feeder
- Die- Centering

consumes a major part of the set up time. The Pie diagram shown below depicts the percentage contribution of various activities in the set up process.

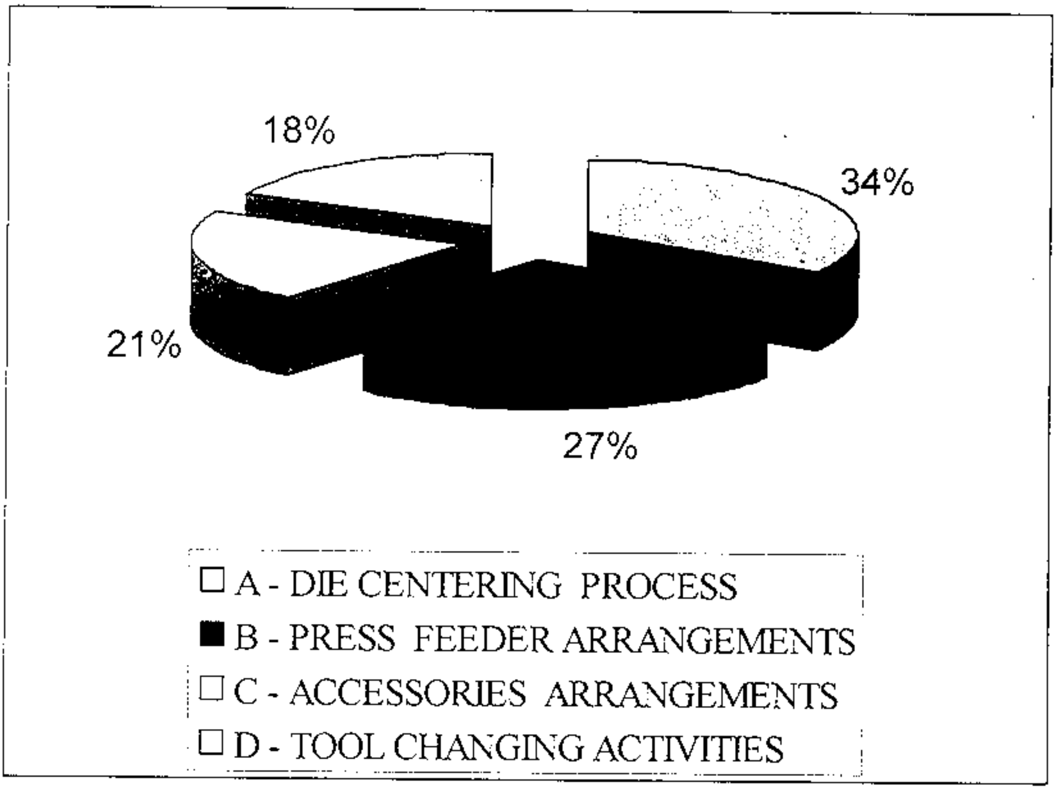

FIG 7.1.PERCENTAGE DISTRIBUTION OF SET-UP TASKS

CHAPTER - 8

DIE CENTERING

8.1.NEED FOR CENTERING

Die centering is an important aspect of set up task. For the effective production of components, centering of dies is very much essential. Die centering forms the part of internal set up task and hence the machine is stopped for placing the dies. Die centering involves aligning of center axes of the dies with the axes of the machine bed. The center point of dies must exactly coincide with the center of machine bed. This enables effective utilization of the stroke thereby resulting in the reduced vibration of the machine during the process. Further, centering of tool at the machine bed results in the production of non defective products as the center axes being exactly coincides.

8.2. EXISTING METHOD

Among the various set up tasks in SEYI Press, Die centering consumes major amount of time as the process has been carried out manually. The die that has to be used is carried from the store by means of trolley arrangement. The heavy weight of dies delays the centering process as it has to be handled by means of trolley. Various activities involved during the centering process have been listed out below.

NO.	ACTIVITIES	TIME INVOLVED (in min.)
1.	Placing the tool at the machine bed	2
2.	Aligning with the X-axis	5
3.	Aligning with the Y-axis	5
4.	Positioning and clamping the tool at the centered position	4
	Total	16

TABLE 8.1. TIME TAKEN FOR DIE CENTERING

As soon as the tool is placed in the machine bed, its position is checked by means of vernier. Its exact location is sketched out both in X and Y axis. The vernier measurements are noted at various points from the machine bed by the operator and position of the tool is analyzed. As the position has been finalized from the vernier measurements, necessary changes from the current position of the tool have been planned so that the center axes of the tool exactly coincides with the machine bed axes. The tool at the machine bed is adjusted from its current position to the required point in both directions so as to meet the requirement of the centered position. Again the new position of tool is checked by means of vernier and the required changes from the center position are pointed out and the tool is adjusted accordingly. The process is repeated until the centre point of the tool coincides with the centre of machine bed. At the centered position, the tool is clamped with the machine bed. The total time involved in the centering process is around 16 minutes.

8.3. PROJECT PROPOSAL

Centering process forms the part of internal set up task and also it can never be made as an external setup. To reduce the time involved during the centering of dies, we propose here the 'CENTERING BLOCK' arrangements in the machine bed indicating the position for placing the tool so that the centered position is achieved in few minutes.

8.4. CENTERING BLOCKS

Centering blocks are brick like structure designed to meet the requirement of positioning the tool at the center point in the machine bed. Two blocks: one is of rectangular and the other is of conical shapes are designed and is placed in the machine bed surface. These blocks are designed to a width of 130 mm. making it possible to indicate the position for placing the tool. Rectangular block 'A' is placed in the right hand side and is meant for aligning the tool in the Y-axis direction. It is designed for maximum width of the tool taking into consideration of all possible cases. Conical block 'B' is placed in the left side at a distance of 740 mm. from the edge of the bed surface. This block is designed for minimum length of the tool with a view of aligning the tool in the X-axis direction. Thus the arrangement of these blocks makes centering process feasible and enables the process to end up in few minutes thereby a considerable portion of set up time is estimated to be reduced.

8.5. CENTERING PROCESS WITH BLOCK ARRANGEMENTS

Placing of blocks 'A' and 'B' in the machine bed surface at the specified distance matches with all the tools that are used in SEYI Press

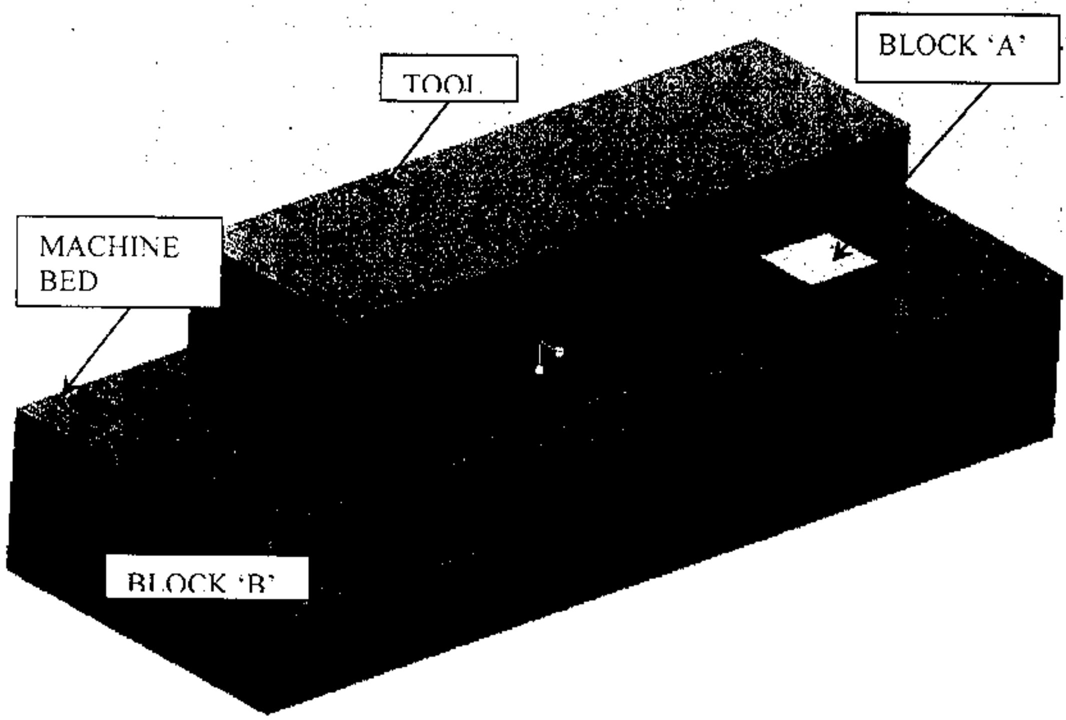

FIG 8.1. ARRANGEMENT OF CENTERING BLOCKS IN THE MACHINE BED

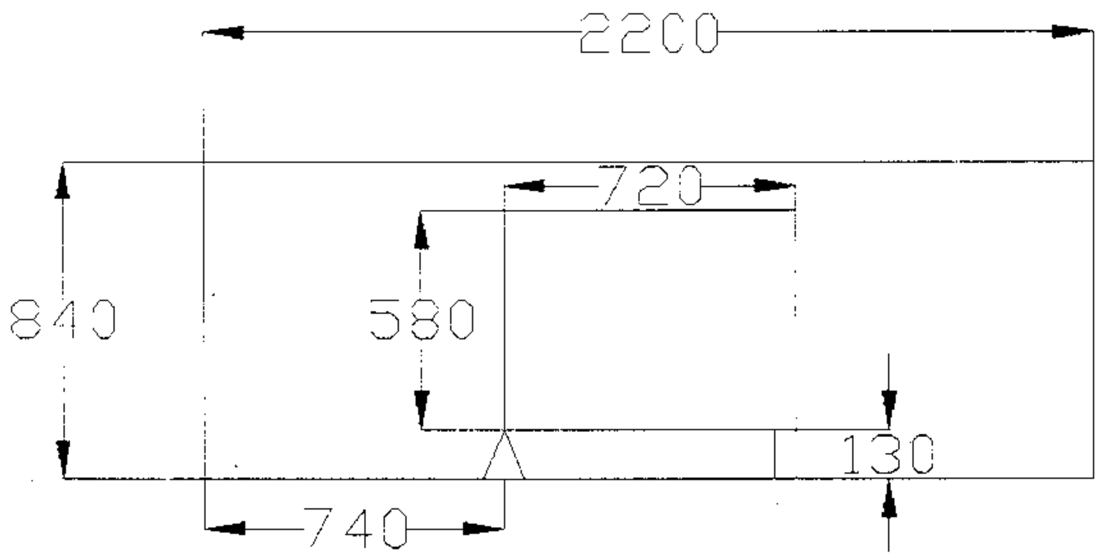

FIG 8.2. TOOL OF MINIMUM LENGTH AND MAXIMUM WIDTH

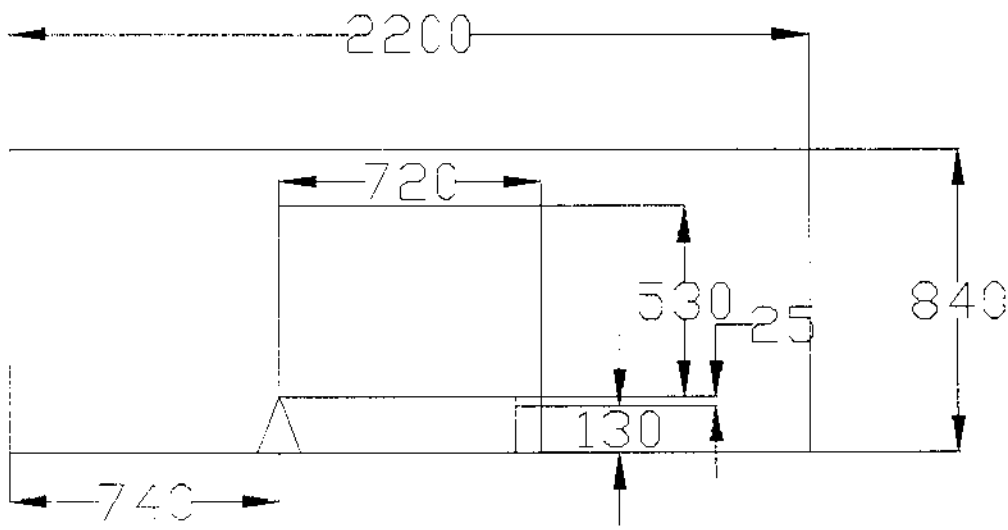

FIG 8.3. TOOL OF MINIMUM LENGTH AND MINIMUM WIDTH

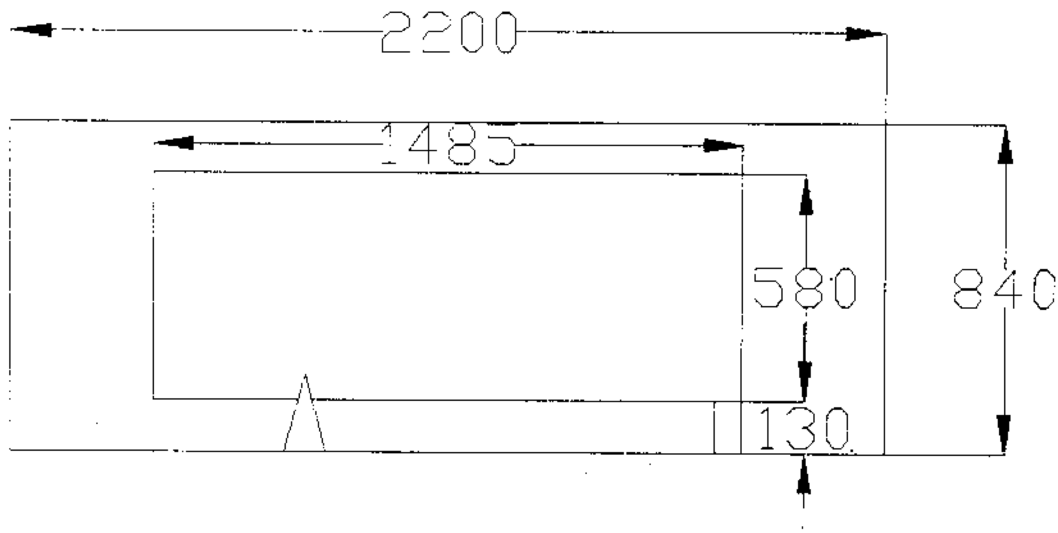

FIG 8.4. TOOL OF MAXIMUM LENGTH AND MAXIMUM WIDTH

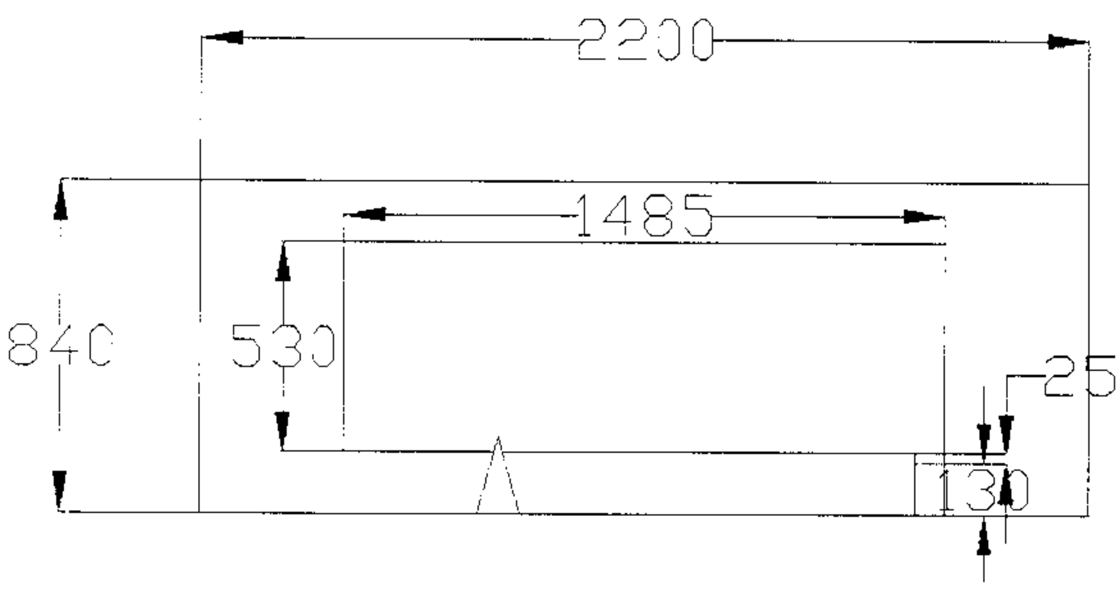

FIG 8.5. TOOL OF MAXIMUM LENGTH AND MINIMUM WIDTH

8.6. ALIGNMENT WITH X-AXIS:

The machine bed is of 2200 x 840 mm. in size with definite number of T-slots. Conical block 'B' has been designed, taken into consideration the minimum length of the tool and is meant for aligning the tool in X-axis direction. The minimum length of the tool is W75 Keeper Ring Tool and is of 720mm.To make it placed in the center position, its edge is exactly placed in the conical point and its position is thus aligned with X-axis. Smartone tool is of 1480 mm.length and it forms the maximum length among the various tools. To make it aligned in the X-axis direction, conical mark is incurved in the side surface of the tool itself so that the tool can be placed in such a way that the conical mark in the surface matches with the conical block 'B'. For all other length of the tool, similar conical mark is placed at the calculated distance in the tool itself and it is thus made to coincide with the block 'B'.Thus the alignment of tools in the X-axis direction is easily achieved.

8.7. ALIGNMENT WITH Y-AXIS:

Rectangular block 'A' is placed in the right hand side and is meant for aligning the tool in the Y-axis direction. It is designed for maximum width of the tool taking into consideration of all possible cases. R3 Grill (vibro-sonic) tool has a maximum width of 580 mm. It is placed exactly at the block head and thus it has been centered in the Y-axis direction. The minimum width is 530mm. for Thunder Bird Housing Tool. For placing such tool, a small block like arrangement to a width of 25mm. is attached with the tool itself in order to meet the rectangular block 'A' of 130 mm. and thus the tool is aligned with the Y-axis direction. For all other tools, similar arrangement of required dimensions_is made in the tool itself so that it exactly touches with the head of rectangular block 'A' and thus the center position is achieved.

CHAPTER - 9

AUTOMATIC PRESS FEEDER

9.1. INTRODUCTION

Automatic press feeder is the device used for uploading the coiler and feeding the coiler to the seyi press. This automatic press feeder is also called as the straightner or decoiler. This decoiler will feed the coil in definite interval according to the input given by the operator. In this automatic press feeder only one decoiler setup is there so the operator can feed only one coil at a time. These types of feeders are also used for the straightening the coil and so these feeders are named as straightner. The coil car is used to pre-stage a coil and then load a coil on the uncoiler. An automatic coil centering feature by job recipe is provided to assure proper coil positioning. The delinker unit is used to provide an upward bend on the leading edge of the coil so it can be properly threaded through the line.

This automatic press feeder consumes time when loading the coil to the feeder and for clamping the coil. Following the straightener, the coil stock is directed into a looping pit that is designed for proper material storage so the line can operate at speeds up to 230 FPM. Full radiused catenary sections are provided at each end of the looping pit to support the material and prevent coil set from being re-induced into the strip. The high speed servo feed unit on this line is designed with 7.0" diameter feed rolls that are backed up to prevent deflection and prevent marking of the coil strip. The servo feed is driven by a high performance AC servo motor and the drivetrain consists of precision gearing running in an oil-filled sealed bath.

9.1.1. On the microfeeder

An important feature in this automatic press feeder is the coil end electronic servo micro feeder. It's motor driven and adjustable to telescope through the press column opening and into the bed area. A total travel of 42" is provided to allow feeding of the coil tail strip as close to the die as possible. The microfeeder rolls are manually operated by a jog button to locate the coil stock in the die. This unique equipment has helped KLP reduce coil scrap and improve efficiency. Instead of wasting from 10' to 20' of expensive Galvineal stock during changeover, waste is greatly minimized to sometimes only 24".

According to the survey and research taken by cecil it is estimated that the microfeeder saves them thousands of dollars in reduced scrap annually. "If we were running three shifts or more it might be higher." Changeover time is also reduced with the microfeeder. Cecil adds, "while the last short bit of coil strip is being fed through the microfeeder, we have the capability to go to the uncoiler and load our next job. The microfeeder gives us time savings and definitely cost savings. It cuts our coil change time by 50%. I would think that anyone that is feeding progressive dies, especially with small feed parts, should have a microfeeder, even if it is just for the scrap savings on the strip."

The coil hold down, threading assist assembly, dekinker, hydraulic crop shear, straightener, threading table, and servo feed prepare the coil stock for feeding into the press. Cecil says they use the threading assist and dekinker equipment because of the different steels that they have .They have steel that is 0.125 thick that is tough to thread through the equipment and it needs to be dekinked. The company is having such a wide variance of product that they run through, and we do use the dekinker on several parts, so they need it.

9.1.2. Set-up operation enhanced

To keep the press uptime high, fast setup is essential. The equipment has an Automatic Set-up Through Data Entry feature that allows fast setup. The operators don't have to hand crank wheels to set the material widths, feed lengths, pilot release windows, feed angles, straightening roll depth settings, coil centering position, passline height, or micro-feeder positioning. All functions are motorized and setup done automatically as data is downloaded by job recipe

The line functions are PLC controlled and three (3) color-coded proface touch screens are used as the primary operator interfaces. One operator said that if the screens are all in a green mode you know that you can proceed with the stamping process. If the screens have yellow or a blinking light or something other than all green, the line has a problem.

In order to meet tin product market demands for higher quality and to be globally competitive, a new automatic press feeder was selected to roll various products with good surface appearances, close thickness and flatness. The latest advanced control technologies and mechanical equipment are applied for fulfilling the quantitative and qualitative requirements as well as for minimizing the operator's intervention.

9.2. SHEET METAL COIL PROCESSING

9.2.1. Objective

After watching the video and reviewing this printed material, the viewer will be aware of the essentials of sheet metal coil processing and the equipment involved.

- Coil stock production and handling is shown
- Slitting line systems are explained
- Blanking and shearing processes are explored
- Basic components of a coil processing line are depicted

9.2.2. Coiled sheet metal processing

Sheet metal stock is produced in varying widths and material thicknesses. This stock is typically coiled for efficient handling, transport and further processing. Coiled sheet metal is processed in several ways:

- It can be slit into a number of individual coils of reduced width
- It may be sheared into rectangular or irregularly shaped blanks for further processing.
- It may be fed directly into a stamping press or other machinery for parts Production

9.2.3. Coil Slitting

Slitting is a shearing process in which the width of an original, or master, coil is reduced into multiple narrower coils. A wide range of materials and thicknesses can be slit, ranging from thin foils to thick plate. Normally, the outside edges of the master coil are trimmed. This creates an accurate register cut, providing a reference point from which the other cuts can be made. Slitting is performed on slitting lines which consist of four basic devices:

- The uncoiler, or pay-off reel, which tightly grips the master coil on its inside diameter using an expandable mandrel. The coil is fed into the slitter by either rotating or jogging the mandrel.

- The slitter, which consists of two parallel arbors mounted with rotary cutting knives. These knives partially penetrate the coil stock causing a crack or fracture on both sides of the stock, separating the material.

- A tensioning device, which is placed between the slitter and the subsequent recoiler. A tensioning device is needed because the master coil is crowned or larger in diameter in the center of its width than at the edges. Without a tensioning device the slit material from the center of the master coil would take up more quickly while the outboard strips would hang loosely.

- The recoiler, which takes up the slit coils on a driven, expandable mandrel. The recoiler mandrel is fitted with separator discs which prevent interleaving of the narrower coil widths.

Other slitting line equipment can include:

- Scrap disposal machinery
- Edge conditioning equipment
- Packaging devices

There are two basic types of slitting lines:

- The pull-through slitting line
- The loop slitting line

On pull-through slitting lines the recoiler provides the power to pull the coil material off the uncoiler reel, through the slitter, and recoil the processed strips. In loop slitting lines, a pit is incorporated into the line. The processed coil strips are looped into the pit which assists in absorbing the strip length differential within the slit coils. The slitter typically provides the power to both uncoil and slit the material, while the recoiler provides the power to rewind the material.

9.2.4. Coil Blanking

Medium to large size sheet metal parts are produced from stacked blanks fed into a stamping press. These blanks are generated from coiled stock using either cut to- length shearing lines or blanking presses. Critical to subsequent processing is the need to flatten the naturally occurring curvature, or set of the master coil stock. To achieve this, the coiled material is fed through a straightener or leveler. As the sheet metal material moves

through the straightener or leveler, it gets flexed between opposing, adjustable rollers. This flexing results in flattening of the material. Straighteners only remove coil set, but levelers, in addition to removing coil set, also improve flatness by correcting some common defects found in coiled sheet metal stock,

including: Wavy edges, where the outer strip edges are longer than the center and Center buckling, or oil-canning, where the center of the strip is longer than the edges after straightening and leveling the blanks are sheared to size. This is most commonly accomplished using either the stationary-shear, or loop-type cut-tolength line or the flying-shear cut-to-length line. The primary difference between the two cut-to-length lines is that the coil is momentarily stopped during shearing on the stationary-shear line, while the shear travels and cuts the continuously moving coil material on the flying-shear line. While regularly shaped blanks are produced by direct shearing operation, more complex and irregular shapes are produced with blanking presses. Such presses may be either high speed eccentric or hydraulic types presses having a maximum of 80 strokes per minute. Holes and slots may also be produced during the basic blanking operation.

9.2.5. Coil Processing Lines

Coil processing significantly improves the efficiency of sheet metal stamping operations as well as other processing lines, such as roll-forming and duct work manufacturing. Because the coil is fed continuously through the system, production is uninterrupted. In addition, coil processing lines can eliminate the need for separate blanking presses and reduce storage and handling requirements.

The basic components of a coil processing line include:

- Pay-off reels, upon which the coil is loaded with a variety of coil handling equipment. For coils of thicker material and where surface finish is not critical, coil cradles may be used.

- straightening or leveling equipment to insure the coil stock is flat.

- Automatic coil stock feed mechanisms, such as slide, roll, or gripper feed systems to move the coil stock.

Coil stock feed systems can be press driven or independently driven. The most popular and versatile feed system employs independently powered feel rolls driven by digitally controlled servomotors.

All coil production will generate an amount of scrap. In some cases scrap processing can be a function of the stamping die itself. Most often scrap is processed by separate mechanisms which may be press actuated or independently powered.

For high production coil operations, a continuous and uninterrupted flow of coil stock is needed. For this purpose coil-to-coil welding stations are placed so that the leading edge of the new coil can be welded to the trailing edge of the previous coil, eliminating the need to thread a new coil into the line. To facilitate the welding, a coil or strip accumulator is used to hold enough coil to keep the line running while the weld is taking place.

9.3.COIL UNWINDERS

Once the decision is made to use coiled material, the exact type of coil feeding equipment needed depends largely on the particular stamping operation. The most commonly used methods for unwinding coils include centering reels, pallet decoiler, and coil cradles. Each has its advantages and disadvantages, and all three are available in a wide variety of configurations. Regardless of the method chosen, unwinding equipment needs to meet the application's payoff speed and acceleration/deceleration time requirements. Material thickness, width, coil weight, and payoff speed determine the best type of unwinding equipment for each application.

The centering reel is the most common coil feed unwinding method. The coil is held by its center via an expanding arbor assembly, which grips the coil's inside diameter.

Centering reels come in both powered and non-powered versions. Powered reels are motorized, and can be used with or without pull-through straightener and/or feeders. Because payoff speed varies as coil diameter changes (as material is used and coil diameter decreases, reel speed must increase proportionately to maintain a constant payoff rate), rotational speed (rpm) must be calculated for the minimum coil diameter.

Non-powered centering reels, also known as "pull off" reels, rely on either pinch rolls or a power straightener to pull off material. Typically, a small fixed-speed threading drive is used for initial coil threading. In virtually all cases, a drag-tensioning device is employed to maintain back tensioning on the material, which in turn, prevents slack from developing between the coil and pull-off device during deceleration and stopping. It also prevents the coil from "clock springing." Drag-tensioning device types include disk-type air brakes and AC motor back-tensioning drives.

The most common configurations for centering reels are either single- or double-ended mandrels. In the single-ended mandrel, a single arbor assembly is used for unwinding. Stationary or traveling variations are available. A stationary setup means the coil must be precisely positioned on the mandrel's centerline to ensure proper alignment with the rest of the feed line. In a traveling configuration, the coil is typically placed against the backplate and centerline, and can be quickly adjusted in the event of misalignment.

Double-ended centering reels feature two mandrels facing in opposite directions, coupled to a rotating head. A two-mandrel system allows one mandrel to be loaded with the next coil to be processed, while the other is feeding the machine. When the latter coil has been used, the head is rotated into position to feed the other coil. This configuration works well in applications requiring quick coil changes.

Pallet decoilers improve run time and reloading. They require a minimal amount of floor space, and have fairly low acquisition costs. Range and material thickness are limited, as the material strip must make a transition from vertical to horizontal as it is unwound.

As the name implies, coil cradles use a box or framework into which the coil is placed. The coil's outside diameter rests on nest rolls, which provide feed movement for the coil. Coil cradles work well in medium- and heavy-gage applications, or when material marking is not a consideration. As such, they are not as well suited for applications in which coil rewinding/rebanding or material finish is a factor.

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There are three basic coil cradle configurations. The first is the combo style. It integrates both cradle and straightener into one package. The coil is unwound from the top and pays off through a powered straightener into a horizontal loop. The second type is called inline. This type unwinds the coil from the bottom and into a vertical or overhead loop. The inline style saves space because the loop area doesn't require substantial floor space, although vertical height requirements must be considered. The third type is the cradle/straightener/feeder combination. This type unwinds, straightens, and feeds directly into the press without requiring a slack loop, making it a compact and self-contained system

9.4. PRESS FEEDS

Press feeds or feeders feed material into the die. There are three criteria to consider when specifying a press feed. First, it must be flexible in terms of setup. Second, it must deliver material to the die with sufficient precision and speed. Finally, it must be able to synchronize its timing to the press itself.

There are two basic feed types: roll feeds and grip feeds. Roll feeds, as the name implies, use rollers to move material into the tool. Grip feeds employ gripping clamps and linear motion to move material. Both types can be employed with pull-through straighteners, although this combination is seen more frequently with grip feeds. Each type can be self-powered or use the press' power.

Press-driven feeds, such as rack and pinion or cam types, are always synchronized to press rotation. These feeds always begin their motion at some predetermined point in the press cycle and finish at another predetermined point, regardless of press speed or die pilot pin engagement. Although index speed must increase or decrease to keep pace with the press, the feed can draw as much power as it needs from the press to accomplish this, within the limitations of the mechanical coupling to the press.

This synchronization feature makes press-driven feeds ideal for high-speed indexing, feeding in-die transfers, or for use with unloaders and other applications that require feed motion be tied to press rotation in order to avoid collisions. When the press stops, feed motion stops as well. Conversely, due to lack of adjustment in timing with most press-driven feeds, feed motion for all dies cannot begin until after a point in the stroke at which the deepest draw die disengages. This limits flexibility, as the feed window is limited to worst-case scenario.

Press-driven feeds exhibit a smooth motion, called S-curve move profile, as opposed to the trapezoidal move profile used by most other feeds. An S-curve motion profile means that the acceleration rate varies throughout the index, eliminating sharp transitions in velocity, which can cause slippage with trapezoidal feed profiles. Most self-powered feeds go from a stationary condition directly into a fixed acceleration rate, resulting in a sharp velocity transition called a "jerk" point. These jerk points occur at the beginning, middle, and end of each move. On the other hand, a press-driven feed makes gradual transitions in velocity, with high acceleration and deceleration in the interim. This eliminates jerk points, while retaining the ability to make very high-speed indexes with good accuracy.

The drawback to most press-driven feeds lies in adjustment difficulties, feed length limitations, lack of inching capability, and lack of controls interface. Most require gear sets, rollers, or mechanical linkages be changed or adjusted to modify feed length. They are also somewhat limited in their range of feed-length adjustment and, since they are coupled directly to press rotation, they lack the ability to jog the strip for threading. Additionally, because there is no electrical or electronic interface, mechanical feeds cannot accept setup information from, or provide feedback to, press control or automation systems.

Self-powered units differ from press-powered units in two ways. First, they derive their power not from the press itself, but from a source independent of the press (although not necessarily independent of the feed line). Second, they begin their motion in response to a signal from the press but have a finite. minimum amount of time in which they are capable of indexing based on the amount of power available and load encountered. The result is, the point at which it finishes varies with press speed. The faster the press runs, the later in the stroke a self-powered unit will finish, as opposed to press-driven units, which always start and finish at the same point in the stroke regardless of press speed. Also, unlike press-powered feeders, self-powered feeds operate independent of the press and can be adjusted for each application to begin feeding as soon as the die opens.

Servo-driven roll feeds have been used in press feeding for a many years. Nearly every manufacturer of press feeding equipment now has an offering in this area. The concept involves the use of a closed-loop positioning drive, usually a servo (but sometimes a stepper) to control feed roll index position.

Servo-driven roll feeds share many advantages with the press-driven variety, such as minimal space requirement, low maintenance, and high speeds. However, servo feeds' unlimited feed-length capability and the fact they use a microprocessor-based control gives them added flexibility. Features include programmable move patterns, self-diagnostics, auto correction, and the ability to communicate with automation.

Servo-drive technology has matured, making these drives more reliable and less expensive than in the past. The number of domestic and foreign servo-drive suppliers has increased dramatically in the past few years. Increased reliability, modularity, and self-diagnostic features of servo systems have eased the fears that existed earlier, although it may still require a considerable degree of technical expertise to troubleshoot them.

Servo-driven roll feeds are available in a wide variety of configurations, including conventional two- and four-roll units, feeder/straighteners, unwinder/feeder/straighteners, and zig-zag units. Feed control packages range in sophistication from simple-to-use, single setup controls with thumbwheels or keypads, to systems that allow programming elaborate multi-axis move patterns, control of auxiliary functions and devices, as well as offering varying levels of memory and communications capability.

Most servo feeds manufactured today use a trapezoidal move profile with four distinct jerk points that can cause slippage. Some, however, are available with controls that execute s-curve move profiles like the press-driven units. Systems electronically synchronized to press rotation are also available. These synchronized units require a special controls package and a feedback device (either a resolver or encoder) attached to the press crankshaft to track press rotation. Their top speeds are still limited by the available drive power, as opposed to press-driven feeds, which can run as fast as the press and tooling.

9.5.GETTING A GRIP ON IT

Gripper feeds employ linear motion to move the strip as opposed to the rotary action of roll feeds. They are available in a wide variety of sizes from very simple, compact, low-cost, press-mounted units to large cabinet-mounted models, which include pull-through straighteners. Gripper feeds use a pair of clamps: one stationary, called the retainer, and the other moving in feed and return strokes called the gripper. During the feed stroke, the retainer releases the strip as the gripper clamps and moves it forward through the top half of the press cycle while the tool is open. On the return stroke, the gripper releases the strip and the retainer holds it while the gripper retracts away from the press through the bottom half of the press cycle while the tool is closed. Since it usually takes about as much time for the return stroke as it does for the feed stroke, gripper feeds are limited to a 180-degree feed window at maximum operating speed.

Gripper and retainer clamps can be cylinders, air or hydraulic powered, or they can be one-way roller mechanisms that hold the strip in one direction, but allow it to roll freely past in the opposite direction. With cylinder-powered clamps, clamp and release timing is critical to accurate feeding and can be a limiting factor in terms of speed. If timing is not correct, the strip can be free to fall back, resulting in short feeds. Clamping is actuated by solenoid valves or air logic valves. Timing can be controlled either electrically or through valve porting.

An air or hydraulic cylinder, hydraulic motor, servo motor, or the press can provide gripper pulling force. The gripper is usually supported by guide bars or rails and is driven by cylinder rods, chain and sprockets, ball screws, or a mechanical linkage to the press. With air- or hydraulic-powered units, feed length is adjusted by setting a positive stop. The gripper moves between the adjustable stop and a stationary stop, and employs a cushion of some sort to soften the blow at the end of each stroke. Feed-length adjustment may require using tools and often involves some trial and error.

Gripper feeds are limited to a specific maximum feed length based on the model used. The longest feed length requirement must be anticipated at the time of purchase. A disadvantage is that each additional increment of length costs more money, and the longer feed length capability dictates that the machine itself become longer and, therefore, requires more floor space. The tendency is to buy the shortest machine that will fill the need. If there is ever a need to run a feed length that is longer than the machine was designed for, then it must perform multiple cycles on each press stroke, commonly referred to as "multi-stroking." This capability requires an optional and more expensive controls package. Because of the time required for the return stroke, the press usually must be operated in the single-cycle mode when multi-stroking.

Air-powered grip feeds are generally inexpensive and are commonly used in conjunction with pull-through straighteners to provide a cost effective alternative to roll feeds with powered straighteners. This is applicable to jobs requiring low to moderate speeds and limited feed lengths. Their low purchase price will be offset in time by higher setup and maintenance costs, and the high cost of energy to operate them. Compressed air is often an expensive energy medium with losses due to leaks, pressure drops, and contamination. Because of the many moving parts and wear components, maintenance costs can be quite high. These machines require timely maintenance to sustain good accuracy and performance.

9.6. EXISTING AUTOMATIC PRESS FEEDER

In roots industries the automatic press feeder used is from shuang wei enterprises. This automatic roller feeder is having only one decoiler setup and it is comprised of the electronic servo micro feeder. A total travel of 42" is provided to allow feeding of the coil tail strip as close to the die as possible. The microfeeder rolls are manually operated by a jog button to locate the coil stock in the die. This unique equipment has helped KLP reduce coil scrap and improve efficiency. Instead of wasting from 10' to 20' of expensive Galvineal stock during changeover, waste is greatly minimized to sometimes only 24".

After coiling, the strip is transported to the exit side V-type walking beam. Along the carriage way, the coils are banded, weighed, and marked. The coils are removed to the intermediate storage yard before they are transferred to the coil preparation and inspection line by an automatic coil transfer car. The strip head end is recoiled and the coil is transported to the single head pay off roll using an operator.

The pay off roll rotates the coil in anti clockwise direction to the threading position from the bottom. This strip head end falls down to the magnetic conveyor that transports the strip to the entry side bridle roll. By interacting of pay-off reel and bridle roll unit, the strip head end is threaded to the rolling press stands. The anti-crimping roll at the entry side is approached at the same time so as to touch the strip to prevent longitudinal waves and vertical vibrations during rolling. Two roll polishing devices are provided at the entry side of the press stands to prevent surface defects like dull marks.

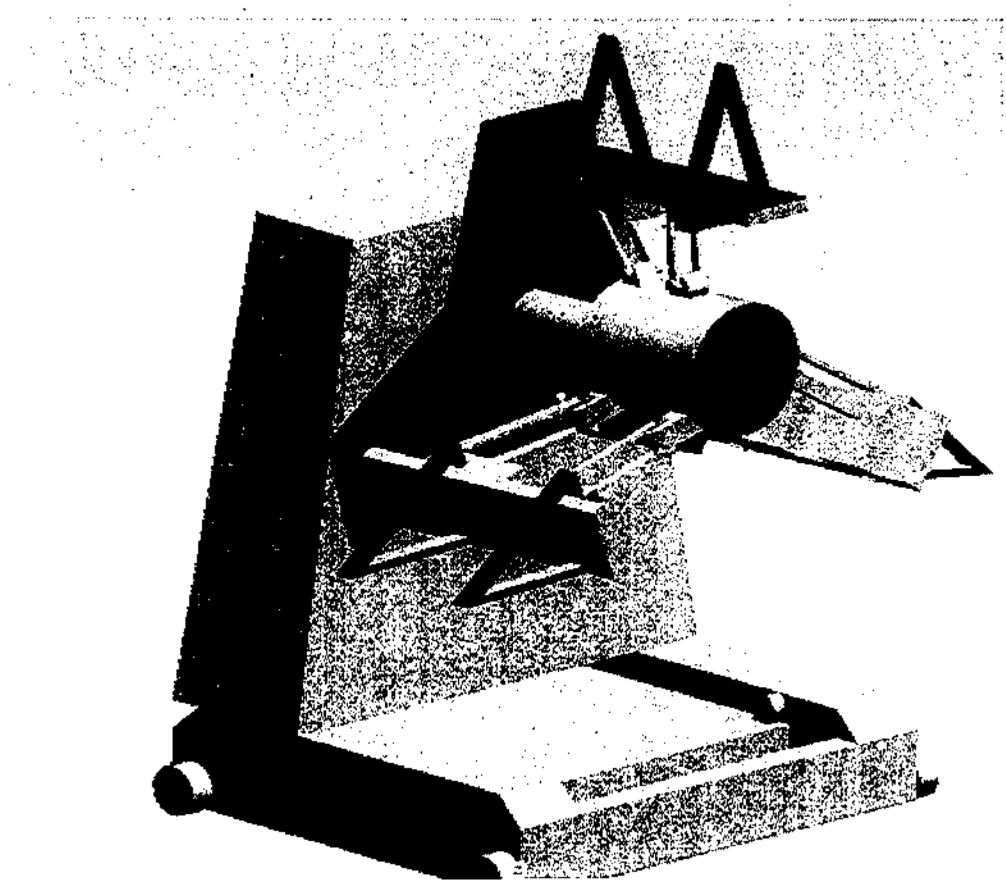

FIG 9.1. EXISITING MODEL

For the reduction mode, the first stand is equipped with a separate lubrication and cooling system to change the lubricant concentration rapidly and thereby to control roll thermal crowns efficiently. To buildup the preset tension, two bridle roll units are arranged at the entry and exit sides of the press. After passing both stands, the strip head is transported to the tension reel. The strip is fed to the tension reel from bottom via the exit bridle roll unit and a magnetic conveyor at threading speed.

9.6.1. Operations done on the decoiler

This automatic press feeder consumes around 13 minutes for loading the coil, clamping, unclamping, fitting and centering the coil into the feeder or decoiler. Here an EOT is used for the transfer of the coil from ground to the decoiler. This EOT consists of a closed chain supported on a roller this enables the rotary motion of the chain. One end of the chain is tied with the coil and the chain is made to rotate, this rolling action lifts the coil in the upward direction thus facilitating the operator to fit the coil easily into the decoiler. Then comes the centering operation which involves the manual effort, here the operator adjusts the coil up to the exact center axis of the decoiler. Then the operator grips the coil tightly into the decoiler and then he starts clamping the coil plate with the decoiler so that the slippage can be avoided.

The coil is then pulled into the roller feeder for straightening the coil and then it is pulled to the micro feeder where the coil is very much straightened before going to the blanking operation. In this microfeeder the feed at which the coil should be sent to the blanking press is given as the input. The micro feeder according to the input given by the operator feeds the coil to the seyi press. This automates the complete operation in the press feeder until the coil gets completed. As soon as the coil gets completed, the above all operations should be repeated for replacing the coil with another coil.

NO.	ACTIVITIES	TIME INVOLVED (In min.)	REASONS FOR DELAY
1	Unclamping the decoiler	1.5	Removal of bolts
2	Lifting the roll with crane	2	Operating the crane consumes time
3	Placing the feed roll in the de-coiler	3	Manual operation
4	Clamping the decoiler	1.5	Fitting the bolts
5.	Adjusting the feed in the straightener	4	Internal setup
	Total	12	

TABLE 9.1. SET UP TASKS IN AUTOMATIC PRESS FEEDER

9.6.2. Limitations

- The first and foremost limitation is this press feeder is having only one decoiler which accommodates only one coil at a time.
- In this press feeder it is not possible to the external setup time to internal setup time.
- It requires large number of equipments for loading and unloading the coil in the decoiler.

CHAPTER - 10

CONCEPTUAL DESIGN OF PRESS FEEDER

10.1. DESIGN- I : DOUBLE HEADED TYPE PRESS FEEDER

To suppress the limitation of the existing press feeder, we designed this Double headed type press feeder. In this Double headed type press feeder there are two decoilers parallel to each other as shown in the fig 10.1. These two decoilers connected to the common head with two different frictionless shafts. This head is designed such that it can be rotated in z axis. The central beam supports the weight of the coil and thus enabling coil to rotate without any vibration i.e. with considerable gripping.

In this the coil is first loaded in the decoiler 2.while the coil in the decoiler 1.is under operation (without shutting down the machine). As soon as the coil in the decoiler 1.gets completed just rotate the head of the double headed type press feeder and feed the coil of the decoiler2.which is already loaded. Thus this double headed type decoiler enables the easy loading of the coil in the decoiler. Here the internal setup time can be completely converted into the external setup time. So the time consumed by the existing press feeder i.e. around 13 minutes is completely reduced or saved.

Here again an EOT is used for the transfer of the coil from ground to the decoiler. This EOT consists of a closed chain supported on a roller this enables the rotary motion of the chain. One end of the chain is tied with the coil and the chain is made to rotate, this rolling action lifts the coil in the upward direction thus facilitating the operator to fit the coil easily into the decoiler. The centering, clamping, unclamping and gripping the coil is same as that of the above described process.

The coil is then pulled into the roller feeder for straightening the coil and then it is pulled to the micro feeder where the coil is very much straightened before going to the blanking operation. In this microfeeder the feed at which the coil should be sent to the blanking press is given as the input. The micro feeder function is as described in the process of existing press feeder (refer the part on micro feeder above).

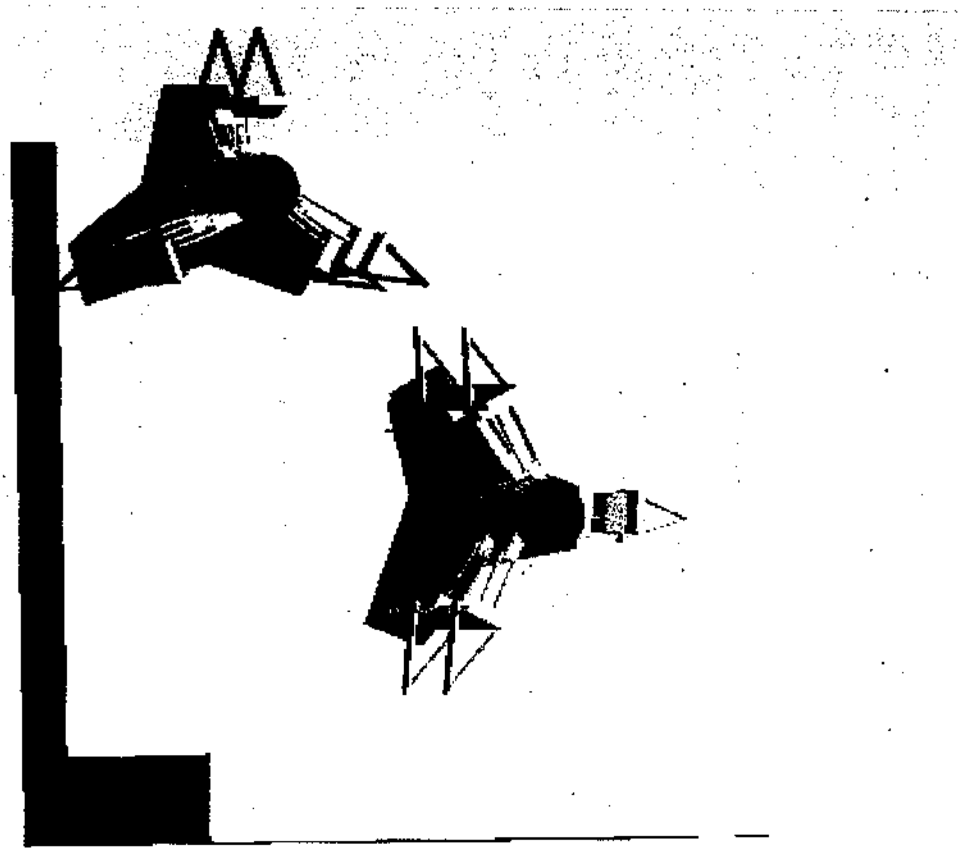

FIG 10.1. DOUBLE HEADED TYPE PRESS FEEDER -I

10.2. DESIGN II: DOUBLE HEADED TYPE PRESS FEEDER

This is other type of double headed press feeder where instead of single beam; a rigid frame is designed to accommodate two decoilers. In this Double headed type press feeder two decoilers are placed on the same side of the rigid frame as shown in the fig10.2. Here also the objective is to convert the internal setup time to external setup time so that the manufacturing can be increased. This double headed type decoiler also consists of two decoilers such as decoiler1.and decoiler2. Here these two coilers are not connected in parallel as in the previous case.

Here these two decoilers are designed in such away that it should occupy very less space. These two decoilers facilitate the operator the easy loading and unloading of the coil in the decoiler. Here again an EOT is used for the transfer of the coil from ground to the decoiler. This EOT consists of a closed chain supported on a roller this enables the rotary motion of the chain. One end of the chain is tied with the coil and the chain is made to rotate, this rolling action lifts the coil in the upward direction thus facilitating the operator to fit the coil easily into the decoiler. The centering, clamping, unclamping and gripping the coil is same as that of the above described process.

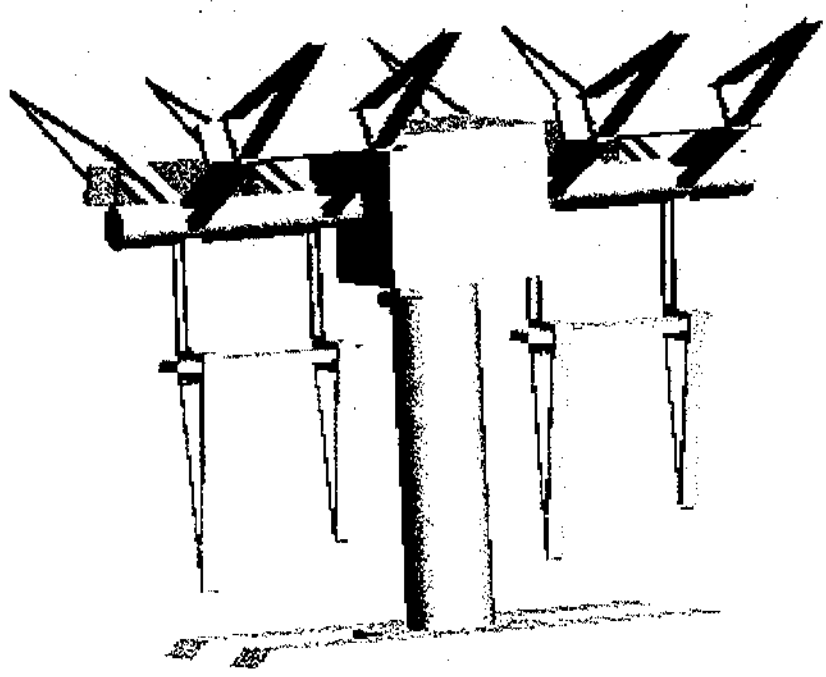

FIG 10.2. DOUBLE HEADED TYPE PRESS FEEDER- II

After coiling, the strip is transported to the exit side V-type walking beam. Along the carriage way, the coils are banded, weighed, and marked. The coils are removed to the intermediate storage yard before they are transferred to the coil preparation and inspection line by an automatic coil transfer car. The strip head end is recoiled and the coil is transported to the single head pay off roll using an operator. After this the coil is pulled on to the micro feeder and the feed of coil according to the requirement is set by the operator

Thus this double headed type press feeder enables the conversion of the internal setup into external setup time. This makes the setup time to reach the optimal time which increases the manufacturing rate.

10.3.DESIGN III: MULTI HEADED TYPE PRESS FEEDER

In this type of press feeder there is multi decoiler setup which can accommodate three decoilers at a time. These three decoilers are arranged in series with each other on a single rigid frame as shown in the **fig 6.** Here the rigid frame is designed in such a manner that it should withstand the weight of three decoilers. These three decoilers are separated with minimum distance so that the entire space occupied by the press feeder will be optimum. In this decoiler setup also the internal setup time can be completely converted into the external setup time i.e. the coil can loaded on the decoiler without shutting down the machine. The total time reduced here also the same as that in the previous cases. This multi headed type decoiler occupies more space when compared to the above two designs.

In this multi headed type decoilers the coil is first loaded in decoiler2.while the decoiler1.is in working condition. After decoiler2.is loaded, the decoiler3.should be loaded with the coil while the decoiler1.is in operating condition. Thus this multi headed type decoiler facilitates the operator to work in easy environment. This multi headed type decoiler clamping, unclamping, centering the coil and gripping the coil will be done as mentioned before.

Here again an EOT is used for the transfer of the coil from ground to the decoiler. This EOT consists of a closed chain supported on a roller this enables the rotary motion of the chain. One end of the chain is tied with the coil and the chain is made to rotate, this rolling action lifts the coil in the upward direction thus facilitating the operator to fit the coil easily into the decoiler. The centering, clamping, unclamping and gripping the coil is same as that of the above described process.

Thus this multi headed type decoiler converges the setup time and expands the rate of manufacturing within the industries giving less weightage to the workers, becoming efficient than the existing press feeder.

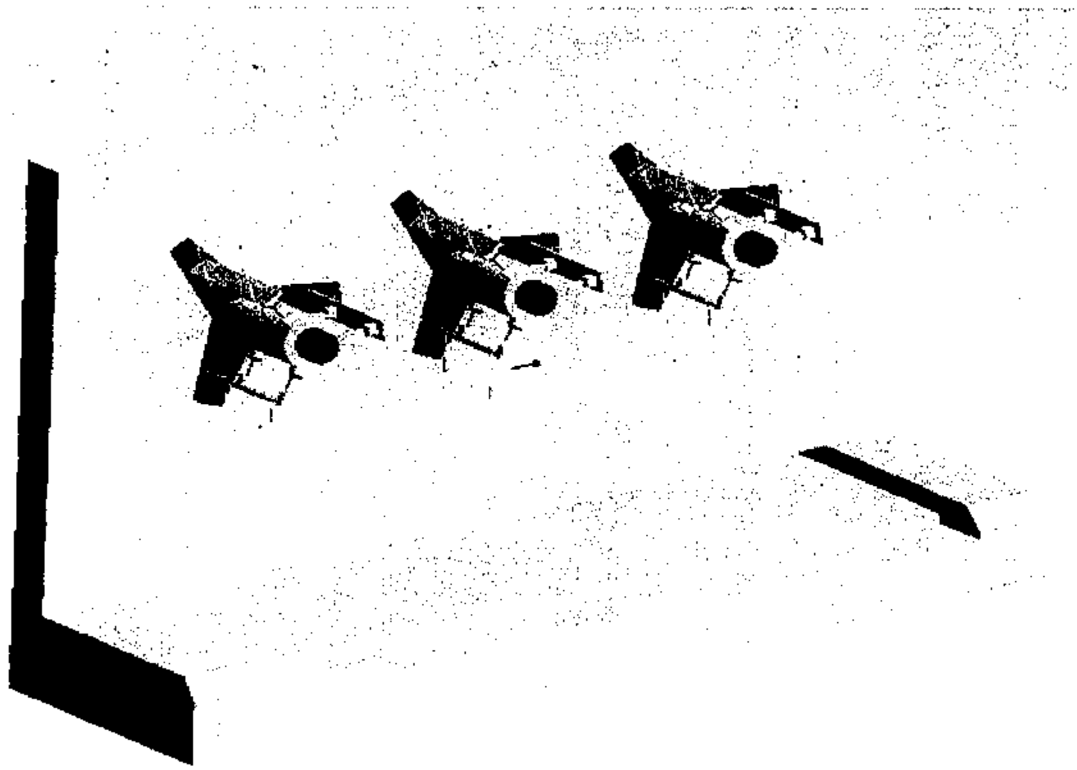

FIG.10.3.MULTI HEADED TYPE PRESS FEEDER

10.4.DESIGN IV: FLEXIBLE TYPE PRESS FEEDER

This flexible type press feeder is having only one decoiler setup; it is designed completely with different objective. Here the objective is to reduce the setup time in loading the coiler using the EOT whereas in the previous cases the setup time is reduced in the decoiler setup. Here the internal setup time cannot be converted into the external setup time whereas in the previous cases the primary objective is to convert the internal setup time into external setup time. In this flexible type press feeder internal setup can be reduced to the reasonable extent.

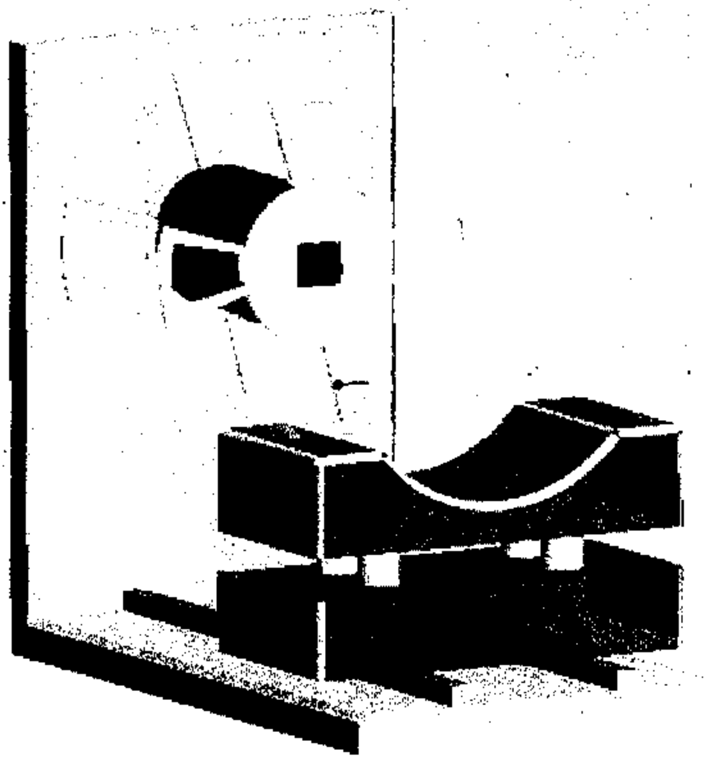

FIG 10.4.FLEXIBLE TYPE PRESS FEEDER

This flexible type press feeder consists of guide rails in front of the decoiler at a calculated height (this calculated height should be an average of all the coilers used in the roots industries) and should occupy optimal space. The coil is placed on the platform provided on the guide rails while the machine is in operating condition as soon as the coil in the decoiler gets over the machine is stopped and this platform is pushed towards the decoiler setup and centered. Then comes the centering operation which involves the manual effort, here the operator adjusts the coil up to the exact center axis of the decoiler. Then the operator grips the coil tightly into the decoiler and then he starts clamping the coil plate with the decoiler so that the slippage can be avoided. After this, clamp the coil with the suitable clamping devices and start the machine after the coil is pulled into the micro feeder.

The coil is then pulled into the roller feeder for straightening the coil and then it is pulled to the micro feeder where the coil is very much straightened before going to the blanking operation. In this microfeeder the feed at which the coil should be sent to the blanking press is given as the input. The micro feeder function is as described in the process of existing press feeder (refer the part on micro feeder above)

Thus it is observed that the setup time gets the declining path using this flexible type press feeder when compared to the existing press feeder's setup time.

CHAPTER - 11

ESTIMATED REDUCTION IN SET UP TIME

NO.	ACTIVITIES	TIME INVOLVED (In min.)	REASONS FOR DELAY	ESTIMATED TIME AFTER THE PROPOSED MODIFICATION (In min.)	ESTIMATED TIME SAVE (In min.)
TOOL CHANGING					
1	Coolant spray	1	Manual operation	**Alternative solutions are being implemented**	
2	Removal of conveyor arrangements	1	Manual operation		
3	Removing the tool 'A' from bed	2	Trolley arrangement		
4	Carrying the tool 'B' from Store	4	Absence of space for placing tool		
CENTERING ARRANGEMENTS					
5	Placing the tool at the machine bed	2	Trolley arrangement	2	0
6	Aligning with the X-axis	5	Manual operation	0	5
7	Aligning with the Y-axis	5	Manual operation	0	5
8	Positioning and clamping the tool at the centered position	4	Manual operation	4	0

NO.	ACTIVITIES	TIME INVOLVED (In min.)	REASONS FOR DELAY	ESTIMATED TIME AFTER THE PROPOSED MODIFICATION (In min.)	ESTIMATED TIME SAVE (In min.)
PRESS FEEDER ARRANGEMENTS					
9	Unclamping the decoiler	1.5	Removal of bolts	x	1.5
10	Lifting the roll with crane	2	Operating the crane consumes time	x	2
11	Placing the feed roll in the de-coiler	3	Manual operation	x	3
12	Clamping the decoiler	1.5	Fitting the bolts	x	1.5
13	Adjusting the feed in the straightener	4	Internal setup	4	0
ACCESSORIES ARRANGEMENTS					
14	Sensor setting	2	Manual operation	0	2
15	Re inspection	2	Manual operation	0	2
16	Conveyor arrangement	2	Manual operation	0	2
17	Production of first component	4	Controlling feed and stroke	0	4
	TOTAL	46		18	28

TABLE 11.1. ESTIMATED SETUP TIME REDUCTION

11.1. ESTIMATED RELATIVE PRODUCTIVITY IMPROVEMENT

Time Estimated to be saved from the proposed modification

- Die centering = 10 minutes
- Automatic press feeder = 8 minutes

Strokes/min = 35

DIE CENTERING

Products that can be produced in the Estimated time

Of Centering Process / die change per day = 10 x 35

= 350 components

AUTOMATIC PRESS FEEDER

Products that can be produced in the

Estimated time / Roll change = 8 x 35

= 280 components

Roll change / day = 10

Product that can be produced in the

Estimated time / day = 10 x 280

= 2800 components

Total number of components Estimated to be produced = 2800 + 350

= 3150 component / day

Average production rate per day = 10000 components

Productivity improvement from the proposed modification = **31.5%**

CHAPTER - 12

CONCLUSION

CONCLUSION

Setup time reduction is a key factor in the successful implementation of JIT production. The approach to setup time reduction described here started with traditional SMED re-engineering. By applying the principles of SMED to Automatic Press Feeder, we were able to reduce setup time by removing all activities that could be done off-line. In addition to reducing line downtime for setups, the new methods substantially change the off-line setup activities (while the line is running). The net effect of these changes was to reduce the incremental setup time per feed from 12 minutes to 4 minutes in the press feeder and from 16 minutes to 6 minutes in the die centering process . We view these results as support for the hypothesis that taking a "dynamic approach" to production, i.e. improving the core production processes by deliberate improvement efforts, that can have very high payoffs.The effects of these changes fall into three categories. The magnitude and economic value of some of these effects are hard to measure, but they are all potentially significant.

- Reduced line downtime.
- Reduced labor content and elapsed time in both on-line and off-line (feeder preparation) setup. This reduces labor cost and increases production flexibility.
- Reduced errors from incorrect components, requiring less rework

Thus SMED has been a good tool for reducing the set-up time but it requires people with team working skills and structures to obtain the optimal set-up time.

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