AN IMPROVISED MULTI-PURPOSE MECHANICAL GADGET

A MODEL

A Master's Thesis

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of the Requirements for the Degree

Master of Technician Education

ARMANDO L. PAGLI-AWAN

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A P P R O V A L S H E E T

In partial fulfillment of the requirements for the degree, Master in Technician Education (MTE), this thesis entitled "AN IMPROVISED MULTI-PURPOSE MECHANICAL GADGET: A MODEL" has been prepared and submitted by Armando L. Pagli-awan, who having passed the comprehensive examination is hereby recommended for oral examination.

JOSE B. ORTIZ Jr.
Adviser

- -

Approved by the Committee on Oral Examination with a rating of PASSED.

SENECIO D. AYONG,DPA/Ed.D.
Chairman

EMILIO C. ALBOS Jr.,MTE
Member

ALEJANDRO E. CANANUA,M.A.Ed.
Member

TERSITO A. ALIPOSA,Ph.D./Ed.D.
Member

- -

Accepted in partial fulfillment of the requirements for the degree, Master in Technician Education (MTE), major in Mechanical Technology.

SENECIO D. AYONG,DPA/Ed.D.
Dean, Graduate School

Date of Oral Examination:

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MANDZ

DEDICATION

To my dearest kids

J-M and Sansan,

and to my loving wife

Alicia Laboc Pagli-awan

For their prayers, love

understanding and inspiration,

I dedicate this humble work.

MANDZ

ABSTRACT

This study entitled, "An Improvised Multi-Purpose Mechanical Gadget: A Model", was undertaken to design, construct, test and revise an instructional gadget that will facilitate and effectively deliver to the students the basic theories and principles in the operation of various machines in the Mechanical Technology Department. This gadget is made out of locally available materials. It is intended to help the students and the teacher facilitate effective teaching-learning processes and demonstrate the actual acceptable skills needed in the modern industries. With the aid of the related literature and studies, the improvised multi-purpose mechanical gadget was conceived. The design was finally made including the list of supplies and materials, tools and equipment and the detailed illustrations of the different assemblies. All defects and weaknesses were checked after the final testing and revised for smooth functioning. The result of the study showed that the improvised gadget could perform as well as the commercially-made machines of the same functions. The cost of production for a single unit of the gadget including labor cost, overhead cost and operating cost amounted to 5, 659.50.

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CHAPTER I

THE PROBLEM

Introduction

For the past decades, the Philippines has been facing a very serious economic problem which could not be solved even to the present times. The government, in its effort to thwart the economic slump in its midst, has launched several programs that would promote growth and development.

Esteban (1984), in a speech delivered, stressed that the primary concern of our government today is the development of special skills, technical knowledge and related information. Yet, these sounds impossible as problems on economic recovery have tremendously reached higher proportions. It is imperative, therefore,for every Filipino to be aware of the prevailing issues that confront progress and development in the country and help and contribute in any way he can for the improvement of their lot.

Morris (1990) states that, while the Philippines is considered to be more comparatively advanced in terms of its literacy rate and educational outputs with similar developing countries, the nation continues to experience a sluggish growth. Lately, it became worse when it suffered precarious decline in its economy because of sudden

increase in prices of fuel and other petroleum products due to the Persian Gulf crisis. Hopefully, according to government estimates, the economy might reach a favorable and healthy balance after a period of 5 to 10 years.

Aquino (1985:19) reflected his views on the current recovery program because the telling experiences of the recent past do not seem to erase doubts of erratic and undependable conditions that will provide a new order of thriving economic pursuits considering the country's dependence on foreign loans and donations of equipment and machineries.

He said, fresh in the minds of Filipinos is the near collapse and development debacle of the country in the early eighties. This might awaken the people into full force, turn again the wheels of progress, and eventually bring about prosperity. This could be made possible by tapping all resources: material, natural and manpower. This may lead to the development of specific skills, technical knowledge and related information especially to the in-school youth, who serve as the hope of the future.

However, like any other state colleges and universities in the country today, Samar State Polytechnic College (SSPC) is confronted with the problem of inadequate physical facilities for the development of the student.

Larson (1969:34) pointed out the importance of ade-

quate physical facilities for the development of the students in vocational-technical field to wit:

> Facilities for technical education must provide the environment which will inspire and challenge the youths and adult to communicate to all the urgency of work, coupled with great opportunity in technological field, facilities as well as the essential equipment for learning and teaching.

Trying to develop the manipulative skills of the students is a very tedious task to vocational teachers and instructors because it requires physical facilities to support the teaching-learning processes. This problem posses a great challenge to the teachers and instructors of Samar State Polytechnic College, especially those who are teaching Mechanical Technology and are directly involved in the transfer of knowledge and skills to students in order to become useful and fruitful molders of a productive society today.

Because of this challenge given to teachers and instructors, SSPC President Basilio S. Frincillo encouraged all the faculty members especially the trade technical teachers equipped with technical skills and teaching experiences to look for ways and means to improvise teaching-learning apparatuses utilizing primarily locally available material for shop instruction. These apparatuses may not compete in quality with commercial products but as long as they can be used for

shop instruction and purposes, they could be utilized to augment the basic teaching-learning processes.

The very basic reason of constructing this multi-purpose mechanical gadget stems from the fact that the province of Samar especially the municipality of Catbalogan, suffers electrical power crisis from time to time. This power crisis often destroys old and new machineries, delays completion of student's projects and further delays gaining appropriate skills.

Training in Machine Shop is very expensive because of the acquisition, maintenance and replenishment of expensive tools and equipment needed by the students in the development of skills, according to Esteban (1984). Thus Machine Shop Technology could not be offered by many vocational-technical institutions because of insufficient instructional facilities required for high quality program of instruction. This is aggravated by the very stringent fiscal support extended by the national government for the equipment outlay of vocational-technical schools especially those located in the provinces. This is a major problem because no efficient and effective teaching-learning situations can take place in the absence of these facilities. There are many schools with Machine Shop laboratory but they have very limited equipment.

In Samar State Polytechnic College, there are new expensive and complicated machineries in the different

shops. However, their work efficiency cannot be sacrificed by exposing them to students who are just learning basic skills and operations. They might commit error in manipulating these machines and meet accidents or destroy them. Besides, these electrically powered machines do not function during brown outs. All these hinder the laboratory work of the students, who tend to go to other laboratory shops to work on their projects to meet deadlines, hence, this improvised multi-purpose instructional gadget.

Theoretical Framework

The theoretical base for the conduct of this study is taken from the theory of Faires (1988), saying:

> The actual practice of designing is applying a combination of scientific principles and a knowing judgment based on experience. A new machine is born because there is a real or imagined need for it. It evolves from someone's conception of a device with which to accomplish a particular purpose. From the conception, follows a study of the arrangements of the parts, the location and lengths of links, the places for gears, bolts, bearings and other elements of machines. With several solutions may be and usually are found, the seemingly best one being chosen.

Corpuz (1981 in his memorandum reiterated by saying:

> There is a possibility for you to improve necessary handtools and machineries... to lead the way to stimulating inventions that would save labor and money... and again, this is the challenge for you to be active... if we are to

insure for our country a fulfilling and inspiring future.

Along this line, Albarracin (1982) in his remarks found it important by saying, "The teacher should have initiative, imagination, skill and know-how in the improvisation of the needed equipment in the laboratory". This idea underscores the need of improvised gadgets. The understanding and learning of concepts and principles in Machine Shop course can be made effective with actual performance of various technical skills. The difficulty in meeting the problems lies in the prohibitive cost of equipment which are mostly imported.

Conceptual Framework

Figure 1 presents the schema of the conceptual framework with the accompanying discussion on the input, the throughput and the output.

The conceptual framework is based on Faires theory and Corpuz' challenge in his memorandum fielded to the technical-vocational schools which states that "The teacher/instructors should be initiative and creative enough in the improvisation of gadgets".

The researcher made an improvised gadget out of locally available supplies and materials with the aid of various related studies and literature. He designed the instructional gadget and constructed it during laboratory

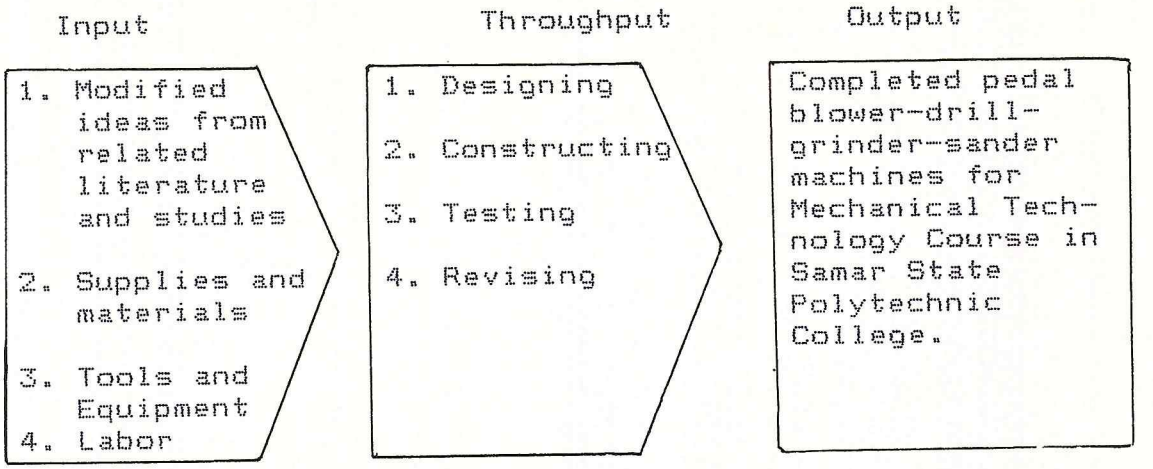


Figure 1. Schema of the conceptual model based on Faires theory and Corpuz' memorandum fielded to technical-vocational schools showing the input throughput-output approach for policy redirections towards the ultimate goal of the study.

periods with the help of the students. After fabricating, welding, machining and assembling all the spare parts of the completed drill-grinder-blower-sander machine, each system was tested to check its functionality and efficiency. All the defects and weaknesses were corrected to fit fine functioning.

Assumptions

The study aimed to justify the following assumptions:

1. The gadget can save fuel and therefore lessen the expenses in the demonstration of basic skills training in Machine Shop Technology.

2. The gadget, when used sometimes in lieu of the expensive electrically powered machines, can prevent their early destruction or inefficiency due to wear and tear.

Statement of the Problem

This study is an attempt to devise an improvised multi-purpose mechanical gadget powered by either foot pedal or a 1/2 horsepower motor for use in Machine Shop Technology. Specifically, the study aims to answer the following questions:

1. What multi-purpose mechanical gadget can be fashioned out of locally available materials in response to the theoretical framework ?

2. What basic skills and operations can be performed this multi-purpose mechanical gadget ?

3. What are the machines, tools supplies and materials needed in its construction ?

4. How is the gadget constructed and operated ?

5. What are the economic advantages of this mechanical gadget ?

Significance of the Study

This study hopes to enlighten the teachers and instructors in Machine Shop Technology on the economy and practicality of the use of the improvised multi-purpose mechanical gadget in teaching Machine Shop skills and principles specifically in drilling, grinding blowing and sanding operations.

Hopefully, this study will help the teacher or instructor in Machine Shop courses to simplify and

facilitate demonstrations of basic skills, proper care and maintenance and safety precautions on the use of the gadget.

This study may serve as an immediate answer to both the instructor and the student's need for an efficient and functional teaching-learning device in the teaching-learning processes, specifically on the basic skills in Mechanical Technology.

This gadget may lead the way to a more lively interaction between the instructor and students in Machine Shop. The gadget can awaken students interest in applying basic skills in drilling, grinding, blowing and sanding operations in Machine Shop Technology. The students taught using the unit may learn more effectively the concepts, principles and safety precautions in the use of drill, grinder, blower and sander machines respectively.

Weaver (1960:2) declared that primary problem in vocational education is the teaching of an occupation consisting of many manual skills. He said that instructors are good in transferring concrete facts, theory and information but in most cases, lack the mastery of skills in various trade and technical areas. He further emphasized that if education is the transfer of man's accumulated knowledge through the years and from generation to generation, then it is the particular study of the trade technical teacher to transfer these

handskills.

The construction of this unit is within the capacity and financial capability of the college, instructor and the students. Spare parts and materials can be found in school and the local market. This gadget can be constructed by the students in Machine Shop Technology as projects and could be brought to their respective homes and places. The unit can be used with electricity or brown outs, so it can be used even in rural communities where there is no electrical power.

Indeed, the construction of this pedal and motor operated multi-purpose mechanical gadget shall be one of the visual learning and teaching aid in Mechanical Technology courses in Samar State Polytechnic College. This is in anticipation for future requirements of the institutionalized Three-Year Diploma of Technician Curriculum (DT). To augment the basic teaching equipment that are presently found in the Mechanical Technology shop of the Samar State Polytechnic College, this technical feasibility study was conceived and made.

Finally, the construction of this gadget may result in the economy of time, fuel or electricity, effort materials and machines used in the teaching-learning process.

Objectives of the Study

The objectives of the study are:

1. To design, construct, use, test and revise the functionality of an improvised multi-purpose mechanical gadget powered by either foot pedal or a 1/2 horsepower motor.

2. To provide a portable gadget readily available for the demonstration of basic skills in Machine Shop.

3. To aid in the preservation of life and maximum accuracy, utility and effectiveness of new machineries now installed in the laboratory shops.

4. To demonstrate to the industrial world of the capacity and capability of shop teachers to design, construct and develop machines that would supplement laboratory instruction.

Scope and Delimitation of the Study

The study is focused on the improvisation of a multi-purpose mechanical gadget. It included the following: designing, constructing, testing, revising, specifying of materials used, the cost of production, operation manual of the gadget. It includes the proper care, maintenance and safety precautions. The gadget used local and some discarded materials such as old bicycle parts, pipes, pillow blocks, electrodes, sheetmetal, bearings and discarded automobile spare parts.

The gadget will be used only as a device to demonstrate basic skills in drilling, grinding, blowing, and sanding operations to make the theory more meaningful.

Definition of Terms

In order to provide a common frame of reference for the researcher and the readers, the following terms are defined as applied to this study:

Constructing. This is the fabrication, machining and assembling of the machine.

Demonstrating. It is subjecting the machine to the actual job it is intended to accomplish.

Designing. It refers to the derivation of data needed in the preparation of the master plan and the detailed plan of each part.

Discarded materials. These are the materials found in dumping places which are not used and have no value at all.

Drilling. Anderson (1977:150) defined drilling as an operation of piercing or producing a hole in a solid material by means of a cutting tool called a drill.

Gadget. It refers to a small instructional device that could be used and installed in any place.

Grinding. Tatro (1977:381) defined grinding as a process of shaping metals by grinding with the use of abrasive wheels to form material to shape and size within

the required size tolerance and surface finish requirements.

Ideas. It refers to technical information, knowledge and expertise in order to design a gadget that will enhance instruction.

Improvise. This is the fabrication of a device that is already found in the vicinity and modifying it for immediate use and economical purposes.

Local materials. It refers to the materials found in the locality and can be acquired at a very reasonable price.

Mechanical gadget. This is a device that is used to demonstrate various skills and operations in Machine Shop.

Multi-purpose. It refers to a device that could perform various range of operations.

Revising. It refers to the possible adjustments of parts that are not properly secured in the machine.

Skill. Silvius (1956) said, it means anything that the individual has learned to do with ease and precision either physical or mental performance.

Skilled Worker. It refers to a worker who can manage his work alone and produce quality products without any supervision.

Technician. Woolf (1981:367) defined technician as the person skilled or highly specialized in the method or practice of a particular trade with the use of technique.

Technology. It refers to the systematic, scientific study of technique applied to various fields of work.

Testing. It refers to subjecting the gadget to test the various intended operations to insure safety and accomplish correct functions.

CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter covers the review of related studies and literature and present some of the brief/summary of several unpublished seminar papers, periodicals, speeches, books and other reading materials which are relevant informations to this feasibility study. The review of this aforementioned materials, however, did not reveal any technical feasibility study conducted by anyone during the 1990's in Region VIII, that would in any way, be similar to this technical feasibility study.

LITERATURE

It is a fact that foreign reading materials provide broader field of information to this particular study so that the researcher decided to include these literature.

Doughties (1981:15) concluded that design is a culmination of an engineering education. Without design, industry would halt in its production; basic information resulting from research would halt. However, with the present trend of our educational program, design is no longer limited to engineers, as ordinary shop teachers and instructors or even students may also do the job.

Machine design is already integrated in some

vocational courses and students are encouraged to make simple design in their respective classes. This trend will result in the development of young engineers in their respective fields of specialization, especially if the program is augmented with sufficient exposure and practice.

Toffler (1984:31) states that the technology of tomorrow,especially in Machine Shops, requires men who can make critical judgments, who can weave their way through noble environment, and who are quick to spot new relationships in the rapidly changing reality.

Producing this new breed of people to cater to the new trends and demands of a fast accelerating technology and society would also necessitate a new kind of education. Technician teachers are aware of the inadequacy of the facilities for instructions as well as the economic crisis we are facing now. Vocational and technical courses are designed to provide the youth with knowledge, skills and attitudes that will enable them to enter occupation.

Strainer (1975:89) underscores the need for this kind of training due to the technical or technological changes, and new discoveries and inventions in various fields of industries.

One of the systems of the gadget is a blower. According to Feiler, (1987:287) air is available every where. It can be used for various work in industry, laboratory shops or at home when properly treated because it

has a comparatively high flow speed in the piping and valves that can be used for blowing.

Anderson (1977:143) emphasized the important use of the drill press machine in Mechanical Technology to wit: drill press machine is a built driven general purpose tool used to produce a range of small size holes. These drill presses are made in pedestal or floor models, bench models and multiple spindle units. These machines do not have an automatic feed mechanism so the cutting tools must be fed by hand using the hand-feed lever. The range of spindle speeds varies according to the speed of the motor, the size ratio of the pulleys and the number of steps on the pulleys.

Ostwald (1988:613) underscored the essential use of grinding machine in Mechanical Technology. He said that grind means to abrade, to wear away by friction, to sharpen, to shape or finish surfaces of metals with a rotating abrasive wheel. The wheel action is similar to a milling cutter. The cutting wheel is composed of many small grains bonded together, each one acting as a miniature cutting point.

This gadget uses foot pedal to accelerate motion to its systems. James (1988:85) emphasized the importance of motion to wit: The acceleration of the moving part is becoming more important. The inertia forces produced by the acceleration of the links in a machine may be of a

high magnitude and, in some cases, may be higher than the forces produced by the working medium at a certain position. The obtaining of the acceleration of points in the links of the machine is a prerequisite to the making of inertia forces analysis of the machine.

Doughties (1988:346) said that chains are frequently used as connectors between parallel axes to transmit acceleration and for conveying and hoisting machinery and for similar purposes. The wheels over which chains run are called sprockets and have their surfaces shaped to conform to the type of the chain used. The speed ratio of shafts connected by chains depends upon the number of teeth on the sprockets.

Anderson (1977:505) revealed the importance of sanding or quality surface finish of various products. He said that the smoothness of a machined surface has always been of concern to the machinist, the technician and the engineers. Serious consideration is given to surface smoothness wherever two machined surfaces come in contact with each other.

Faires (1988:407) states that bevel gears are used to connect intersecting shafts usually but not necessarily at 90 degrees. Its teeth are subjected to much the same action as spur gear and helical teeth; the total maximum load on a tooth is compounded by the transmitted load and a dynamic increment arising from profile and tooth spacing

inaccuracies. The maximum compressive stress is the principal criterion of wear resistance. Since bevel gears are inherently not interchangeable, they are designed in pairs.

Reinhard (1988:309) underscored that inspite of good lubrication on slide bearings, pin and bearing surfaces come into contact for a short time. Therefore to reduce wear and to avoid galling of bearing surfaces, certain requirements are specified upon the material used for bearing bushes and bearing shells. The pin is made of steel; its surface is often hardened. Bearing materials should be wear and corrosion resistant and pressure proof. It should have only little expansion in heating and should carry off the heat well. In addition to this, they should also adapt themselves to the pin form during initial run.

The relevance of the aforementioned literature to the model undertaken by the researcher enlightened him to engage in a research study that led to the construction and design of a pedal or motor operated multi-purpose mechanical gadget that will be used in Mechanical Technology for instructional purposes, for helping the students gain the basic skills in drilling, grinding, blowing and sanding operations and aid in lengthening the life of the electrically powered machines now installed in the laboratory shops. The literature included in this study helped the researcher in designing, constructing,

machining, fitting, assembling and testing the functionality of the model. The theories and principles adapted by the researcher from the different authorities finally shaped up this study.

STUDIES

Prior to the formulation of this study, a thorough research was made to find out if there has already been studies on this pedal and motor powered drill-grinder-blower-sander machine. The research showed that educators and researchers attempted to design and fabricate innovations but those are solely powered by electricity.

At this point of fuel difficulty, not only in the country but throughout the world, improvisation of gadget is an economical and feasible undertaking. The following are some of the improvisations:

Cabilogan (1984), in his seminar paper entitled, "Power Train Mock-Up: A Technical Feasibility Study", was concerned with the design, construction use and functionality of an automotive power train mock-up as an instructional aid in Automotive Technology in Samar State Polytechnic College. This instructional mock-up was constructed to show and demonstrate the basic theories and principles of the automotive power train that is generating from the engine down to the driving wheels.

Cuna (1984), in his study entitled "An Instructional

Saw-Sander Machine" said, economy-wise, improvisation is feasible. The researcher concluded that an improvised saw-sander machine can be constructed and is effective in performing sawing and sanding operations in the Civil Technology class in Samar State Polytechnic College.

In the teacher's desire to impart to his students the necessary skills for employment, there comes about a need for machineries to augment shop instructions. Sad to say, even the cost of commercially made wood lathe machine is about 35,000.00 pesos.

In this connection, Germones (1982), in his seminar paper entitled, "An Improvised Wood Lathe Machine", constructed and improvised a wood lathe machine as effective as the commercially made wood lathe machine. The cost of one unit of the improvised wood lathe machine is 2,019.00 pesos which is very much lower as compared to the cost of the commercially made one.

It is common knowledge that technological innovations are implemented and adapted through a series of phases. Some first have an idea. If it is good, the idea goes to a technical problem-solving stage later advancing to design and development. Finally, it fills a significant social need.

Ativo (1980), in his study, designed and constructed a portable hand shaper machine. The construction of this machine led to the solution of the foremost problems met

by the students in Machine Shop Technology at Sorsogon College of Arts and Trades.

In a Terminal Report on Industrial Arts Teachers Education (1964) conducted by the Bureau of Public Schools at the Stanford University, Manila, it was concluded that the scarcity of equipment, both in terms of machineries and handtools, is a problem of the first magnitude of the schools in developing countries. In most cases these cannot be purchased, but are frequently possible to design and build with simple tools and devices which can be used to increase production to aid home industries and improve the shop program.

According to Rodolfo Simpson (1982:115),improvisation is possible. Simple and locally made apparatuses will enable the students to understand the basic principles applied to everyday life. Apparatuses need not be highly sophisticated to illustrate the concept of science.

Gil Barredo (1988:15) in his published handout said that improvisation of gadget can help solve the economic crisis of our country. He revealed that his invention, The Instant Water Heater, which was aproduct of continued research and ingenuity, could help in the world crisis on energy conservation.

Another invention made by Carlos Cabuatan (1988:44), revealed that a cocking stove could be made into a multi-fueled stove at a very low cost. Charcoal, firewood or

saw dust can be used to make the construction more economical.

In a related study conducted by Geronimo Santos (1984:21) entitled, "An Improvised Heat Treatment Furnace" he concluded that the prototype model instructional materials could be mass produced on a commercial basis because the mechanism is so simple that it could be made by the students. The college has the facilities, manpower and materials needed which are locally available.

In a feasibility study conducted by Guzman (1984:250) entitled, "Improvised Screw Driver Non-Cast Mechanical Press Machine: A Technical Feasibility Study", he proposed to design, construct, test and revise an improvised non-cast mechanical press machine in order to provide the Nueva Viscaya's State Polytechnic College Machine Shop Course an instructional gadget for the students.

In his study, the following were concluded:

a. The gadget could perform similar operations as the electrically operated mechanical press machine.

b. The gadget can be constructed by a machine shop instructor with common, simple and available tools.

c. The production cost of the project is only 9,267. 00 as compared to the very expensive commercially produced machines.

Based on the conclusions of his study, he recommended the following:

a. School administrators should encourage their faculty members to develop their own instructional gadgets based on the needs of the students, teachers and administrators.

b. Further study should be conducted to improve the design and efficiency of the machine.

In the seminar paper of Vertido (1984:28) entitled "Instructional Multi-Purpose Band Saw Machine: A Technical Feasibility Study", he sought to design, construct and test an instructional gadget made of locally available materials, mostly from wood.

Based on the findings, the following conclusions are drawn:

a. The construction of the gadget can be done in a short span of time only.

b. The construction cost of the gadget is only 9,000.00 which is about three times lower compared to some commercially produced machines.

c. The machine could perform almost as equally well as the commercially made machines.

a. Machine Shop and Civil Technology instructors should coordinate in the improvisation of the gadget.

b. The students may construct this project under the supervision of the teachers concerned.

c. Technical-vocational schools may produce this model in quantity for commercial use.

In a related study conducted by Ernesto Longasa (1985:21) entitled, "A Brake Shoe Grinder Machine: A Technical Feasibility Study", he designed, constructed, tried out and revised a brake shoe grinder machine in Automotive Technology in Samar State Polytechnic College.

In his study, the following were concludedz;

a. The improvised machine can perform similar operations as the commercially developed one.

b. The machine can be produced by shop teachers or students because the machine's mechanisms are very simple.

c. The construction cost of the machine is only amounting to 6,843.90, lower than the cost of commercially produced machines.

It has been recommended that:

a. Support should be extended to teachers and instructors who posses technical skills and initiative and inventive minds in developing gadgets.

b. Administrators should encourage the inmstructors to further research and design gadget to attain maximum usability of the device.

c. The gadget should be mass-produced for commercial use.

In a seminar paper made by Lopez (1985:31) entitled "Improvised Automotive Electrical Multi-Purpose Tester: A Technical Feasibility Study", was conducted to design, construct, use and test the functionality of an automotive

electrical multi-purpose tester for instructional purposes in Automotive Technology at the Bicol College of Arts and Trades.

The findings of this study drew the following conclusions:

a. The improvised tester operates effectively and efficiently similar to commercially produced testers.

b. The gadget could be designed and constructed by the shop teachers and the syudents single handedly.

c. The production cost of one unit of the machine is only 2,529.60.

Based on the findings of this study, the researcher recommends the following:

a. School Superintendents and administrators should encourage the teachers and instructors to develop their own instructional gadgets.

b. The teachers and instructors in vocational schools should encourage and teach the students to produce worthwhile projects like the automotive electrical multi-purpose gadget.

Biñas (1983) in his seminar paper entitled, "Improvised Power Hacksaw: A Technical Feasibility Study", was concerned with the design, construction and testing of the efficiency and effectiveness of the machine in Mechanical Technology.

Specifically, this study attempted to:

a. Design and construct an improvised power hacksaw.

b. Test the effectiveness of the machine.

c. Find out its functionality and rigidity.

The significant findings of this study shows that:

a. The gadget is capable of cutting 12-14 mm. metal.

b. The gadget can be constructed by the students in Machine Shop using available common shop tools with the supervision of the teachers or instructors.

c. The gadget could perform similar operations as the commercial machines.

d. The improvised machine costs lower than the commercially made machine of the same type.

From the significant findings of this study, the researcher recommends that:

a. Vocational School Administrators should try to encourage the faculty members to design and construct more instructional gadgets to facilitate learning.

b. Teachers and instructors should modify and improve the gadget to maximize its utility.

c. Improvised power hacksaw can be mass produced for instructional and commercial use.

Cardoso (1986:23), in his study entitled "Integrated Electronics Trainer: A Technical Feasibility Study", sought to design, construct and test the functionality of an integrated electronics trainer in Electronics Technology in Samar State Polytechnic College.

The primary objective of the study was to develop an improvised electronics training aid to cater to the needs of the students of the college to partially solved the insufficiency of laboratory training aids.

On the basis of his findings, the following conclusions were drawn:

a. Designing and constructing of gadget is feasible with the use of locally available materials and supplies.

b. The trainer performed effectively in demonstrating the basic principles covered by the machine.

c. The electronics trainer can be constructed by the shop teachers or the instructors and the students.

On the basis of the findings and conclusion, it is recommended that:

a. The college should support the teachers and instructors who posses technical skills and innovative minds.

b. Administrators should encourage the instructors to further research and design gadgets worthwhile for shop instructions.

c. The gadget could be mass-produced forcommercial use.

Francisco (1985:20) in his seminar paper entitled "Instructional Model of an Emergency Ligthing: A Technical Feasibility Study", was concerned with the design, construction, use and test the functionality of the gadget

in emergency lighting as instructional aid. The purpose of the study was to provide adequate facilties to effect learning process.

The significant findings of this study reveals that it is technically feasible to design and construct an instructional emergency lighting out of cheap local supplies and materials.

The production cost of the gadget is approximately 1,800.00 pesos as compared to one unit of commercially produced machines of the same type that costs about 13,000.00.

Therefore, improvisations of the gadgets enhance much savings for the school and the government in general.

Based on the findings of this study, the following recommendations are drawn:

a. Instructors should coordinate with the Automotive Shop Instructors for the development of the instructional model of the gadget for their classroom use.

b. Automotive and electrical instructors can design other prototypes and experiments to improve the gadget.

c. The gadget can be modified and improved by changing the incandescent lamp to a flourescent lamp.

Out of the conclusions and findings of this study, the researcher recommended that the need for further study be made to find more improvement on the gadget.

Albos (1986:19) in his study entitled, "A Multi-Purpose Grinder and Drill Press Machine: A Technical Feasibility Study", was primarily concerned to design, construct, test and revise a multi-purpose grinder and drill press machine for Mechanical Technology in Samar State Polytechnic College. The primary objective of the study is to teach basic skills and principles of grinding and drilling to DIT students of the Samar State Polytechnic College in preparation for future employment.

Based on the findings of this study, the researcher drew the following conclusions:

a. The gadget performs effectively and accurately in grinding and drilling metals similarly to commercially made drill press and grinding machines.

b. The gadget can be mass-produced by the students with the supervision of the Machine Shop teacher.

c. The school can generate savings from the fabrication of said gadget because of lower production cost that amounted to 5,759.00 pesos per unit as of May, 1985.

d. The students will earn at the same time learn the skills in the construction of the multi-purpose grinder and drill press machines.

Based on the findings and conclusions of this study, the researcher recommended the following:

a. Vocational school administrators should encourage

their teachers and instructors to improvise useful gadgets for instructional purposes to improve instruction in the shop.

b. Vocational schools can make use of this study as a basis for the design and construction of their own improvised gadgets.

c. The materials used in the construction of this study may re-designed or modified to ensure longer and better performance.

d. Further study on the feasibility study should be be made for purposes of commercial use.

e. The design should be patented by the college or its school administrators.

The studies made by Cabilogan, Cuna, Germones, Ativo, Simpson, Barredo, Cabuatan, Santos, Guzman, Vertido, Longasa, Lopez, Biñas, Cardoso, Francisco, and Albos are similar to the present study in the sense that their studies focused on the development of skills of the students in the use and invention of gadgets in order to enable them to get immediate employment after finishing the course. The foregoing studies show that invention and improvisation are the key factors in overcoming the inadequacy of teaching materials and equipment for home and school use. It is in this context that the researcher thought of the idea of designing and constructing a combination of foot pedal or motor-powered blower-drill-

grinder-sander machine incorporated into one unit for the use of Machine Shop Technology students in Samar State Polytechnic College.

CHAPTER III

MATERIALS AND METHODOLOGY

Description of the Gadget

This gadget stands 110 centimeters high supported by two pipes of one-inch diameter pipes. These pipes serve as legs or stand. The top of the pipe is welded with a flat bar where two pillow blocks are rested and bolted. The pillow blocks hold the main shaft, the end of which accommodates the grinding stone, the blower and the fly-wheel which is at the same time will be used as a sander.

The main shaft is bolted with a smaller bicycle sprocket, a two step pulley and bigger miter gear in between the pillow blocks. This smaller bicycle sprocket at the main shaft serves as the driver of the gadget. It iis connected to a bigger bicycle sprocket below with a chain. The bigger sprocket is welded to a bicycle hob with another small bicycle sprocket attached to the other end of the hob. This smaller sprocket is directly connected to the foot pedal where another bigger sprocket is welded 50 centimeters from the ground. The two step pulley is connected to the 1/2 Hp motor through a V-belt. The bevel gear meshed with the smaller bevel gear below that holds the drill chuck. It is detachable when not in use to minimize too much load on the foot pedal. The

gadget operates by moving the foot pedal forward similar to running of a bicycle. All systems will work except the drilling machine when detached.

Table I

SUPPLIES AND MATERIALS

Quantity	Unit	Name and Description
1	pc.	Electric motor 1/2 Hp. 220 volts
1	pc.	Pipe 1" dia. 300 cm. long
1	pc.	Round bar, 1" dia. 100 cm. long
2	pcs.	Pillow blocks, 2.54 cm. dia.
2	pcs.	Sprockets, 7.5 cm. dia.
2	pcs.	Sprockets, 20.32 cm. dia.
1	pc.	G.I. Pipe, 1/2" x 200 cm. long
1	pc.	Drill chuck No. 21-32 mm.
1	pc.	Bevel gear, 50.80 mm. dia.
1	pc.	Bevel gear, 30. mm. diameter
2	pcs.	Bicycle hobs, Standard
1	pc.	Step pulley
1	kg.	Welding rod, .635 cm. E-6010.
2	pcs.	Roller bearings No. 6001 NSK
12	pcs.	Bolts, 1.27 cm x 3.81 cm.
1	pc.	Spur gear, 5.08 cm. diameter
5	pcs.	Sanvik hacksaw blades
2	rls.	Bicycle chains (Standard)
1	pc.	V-belt
2	pcs.	Steel plate, 1.27 x 20 x 12.70 cm.
5	pcs.	Sandpaper (waterproof)

Tools and Equipment

Table 2 shows the tools and equipment needed in the gadget construction and their uses respectively.

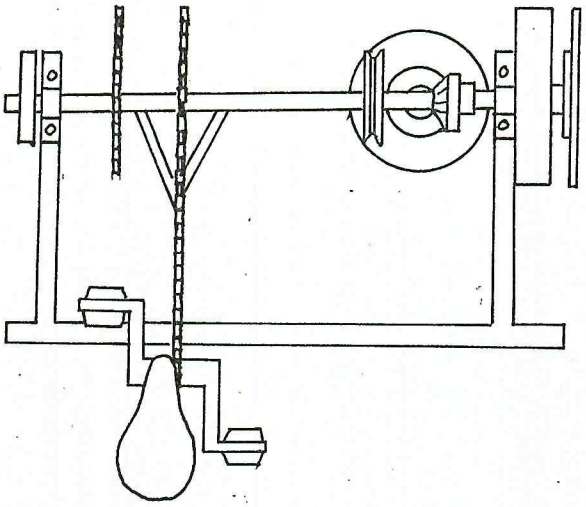
Table 2

TOOLS AND EQUIPMENT AND THEIR USES

Tools and Equipment	:	U s e s
1. Foot rule	:	Take correct measurements in the designing and assembling.
2. Try square	:	Takes correct level & angle.
3. Hacksaw	:	Cuts pipe and metals to sizes.
4. Adjustable wrench	:	Tighten, loosen bolts and nuts
5. Vernier caliper	:	Takes precise shaft measurement
6. Allen wrench	:	Tighten and loosen allen screws
7. Tinner snips	:	Cuts sheetmetal into shapes.
8. Files	:	Removes sharp edges of metals.
9. Drill bits	:	Make holes on metals and parts.
10. Lathe machine	:	Cut and shape shafting to accommodate pulleys and gears.
11. Milling machine	:	Cut keyways and slots of shaft.
12. Grinding machine	:	Removes unwanted and protruding parts of the gadget.
13. Welding machine	:	Join cut metal parts firmly.
14. Roller machine	:	Shapes metal cover of blower.

Construction of the Gadget

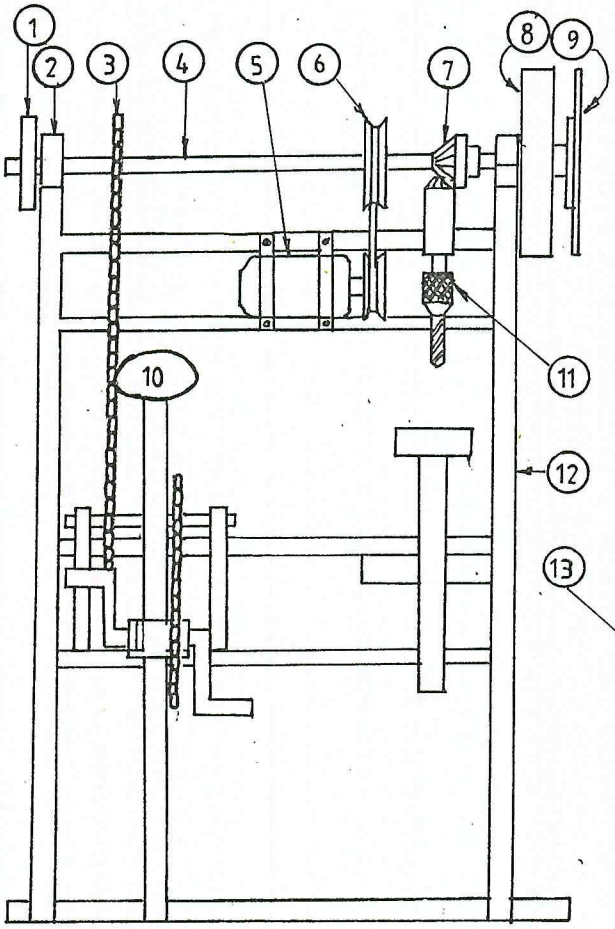
Figure 2 shows the pictorial view of the multi-



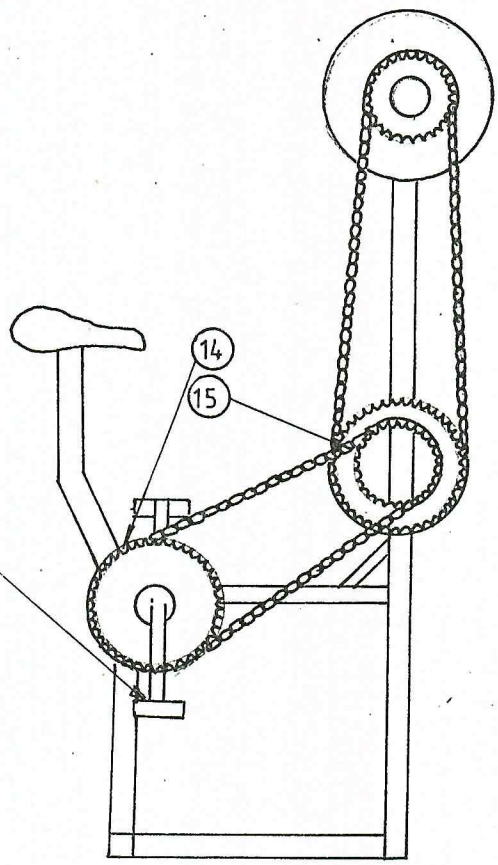
TOP VIEW

FIGURE 2. THE DIFFERENT PARTS OF THE MODEL

1 GRINDER
2 PILLOW BLOCK
3 BYCICLE CHAIN
4 MAIN SHAFT
5 1/2 Hp. MOTOR
6 V- BELT
7 MESHING BEVEL GEARS
8 BLOWER MECHANISM
9 DISC SANDER
10 ADJUSTING SEAT
11 DRILLING MECHANISM
12 PIPE STAND
13 FOOT PEDAL
14 DRIVER SPROCKET
15 DRIVER SPROCKET



FRONT VIEW



LEFT SIDE VIEW

purpose mechanical gadget. It illustrates the dimensions of the gadget including the drilling, grinding, blowing and sanding mechanisms.

The improvised multi-purpose mechanical gadget under study is composed of four basic mechanical functions namely drilling, grinding, blowing and sanding operations. It is constructed and designed to work by foot pedal in case there is no electricity to run the gadget. However, if there is power, the operator may opt to use it for ease and comfort. To start constructing the gadget, the following basic steps are to be followed to minimize waste of time in assembling the major and minor parts.

1. Make a sketch of the gadget and its accessories.
2. Design plan of the gadget and its mechanism.
3. Determine the type, size and cost of materials for the construction of the gadget.
4. Secure the supplies and materials needed.
5. Measure and cut the pipestand, seat and braces into their correct length.
6. Weld pipe braces to the sand and seat properly.
7. Level the top precisely, then weld a piece of flat bar drilled with 1/2" holes on both sides.
8. Attach pillow blocks on the top and tighten them with bolts and screws.
9. Cut threads and finish, turn the shaft into its proper shape and dimension using the lathe machine

10. Assemble, fit and align the grinding stone, pulley bevel gear, blower, flywheel and the sprockets on the shafting and tighten them with bolts and nuts.
11. Align the foot pedal to the hob and the sprocket attached to the shaft, then attach the chains.
12. Mesh the miter gear of te drill spindle to the miter gear on the shaft, then bolt them securely.
13. Cut rack and spur gear for the table feeding mechanism of the drill press system.
14. Align and attach the working table of the drill mechanism with hand-feed lever.
15. Attach a wooden seat to the seat stand.
16. Cover the blower tightly with a sheetmetal.
17. Glue the circular emery cloth on the surface of the flywheel.
18. Remove metal burrs from the sharp edges of the joints then polish them with sand paper.
19. Tighten the pillow blocks' allen screws holding the shafting of the gadget.
20. Paint the polished gadget with a primer paint, then finish coat it with lacquer paint.
21. Take a photograph of the improvised gadget.
22. Test the functionality of the gadget's mechanisms
23. Observe and look for the defective parts.
24. Determine appropriate remedies and revisions for the weaknesses and defects of the gadget.

25. Revise defective parts and mount them back into place.
26. Administer final test to the revised gadget by requesting the students to run the gadget.
27. Prepare the gadget for actual demonstration in class instruction.

Try-out and Revision

This topic shows the initial and final try-outs of the gadget. It was found out that there were defects during the initial try-outs and therefore remedies and revisions were made to check proper functioning. Table 3 shows the defects found and revisions made.

Table 3

DEFECTS FOUND AND REVISIONS MADE

Defects	Revisions
1. Frame stand too high	: Frame height shortened by 10 cm
2. Drill chuck too close to pipestand.	: Drill assembly moved 10 cm. away from the pipestand.
3. Drill spindle wobbling	: Spindle changed with a new one.
4. Grinder too far to the operator.	: Seat was made movable.

Construction Time Frame

This portion shows briefly the schedule of work, and the corresponding time allotment for every activity.

1. Frame Assembly
   a. Prepare a solid round bar measuring 22.2 mm. dia. x 1,000 mm. long for main shafting.
   b. Measure the angular bar into specified dimensions cut, then weld them to form a base of the gadget.
   c. Measure and cut the pipestand, seat and braces into their correct length and weld them to base.
   d. Level the top of the pipestand precisely, then weld a piece of angular bar on the top of it with two 1/2" holes for the pillow blocks.
   e. Measure and cut flatbars provided with slots for the foot pedal brace and weld them to pipestand at the lower portion.
   f. Measure, cut and attach a 13 mm. x 306 mm. pipe on the lower base for the driven bigger sprocket.
   g. Prepare and attach a pipe handle for the operator, extending from one pipestand to the other.
   h. Attach two 22.2 mm. pillow blocks at the top of the pipes then insert the machined and threaded main shaft to the pillow blocks.
2. Grinding Machine Assembly
   a. Prepare a 15.8 mm. x 50 mm. bushing drilled and tapped with 20 NF thread.

1. Abrasive Wheel Nut
2. Washer
3. Abrasive Wheel
4. Pillow Block
5. 13 Thread per inch thread
6. Main Shaft
7. Pillow Block
8. Blower

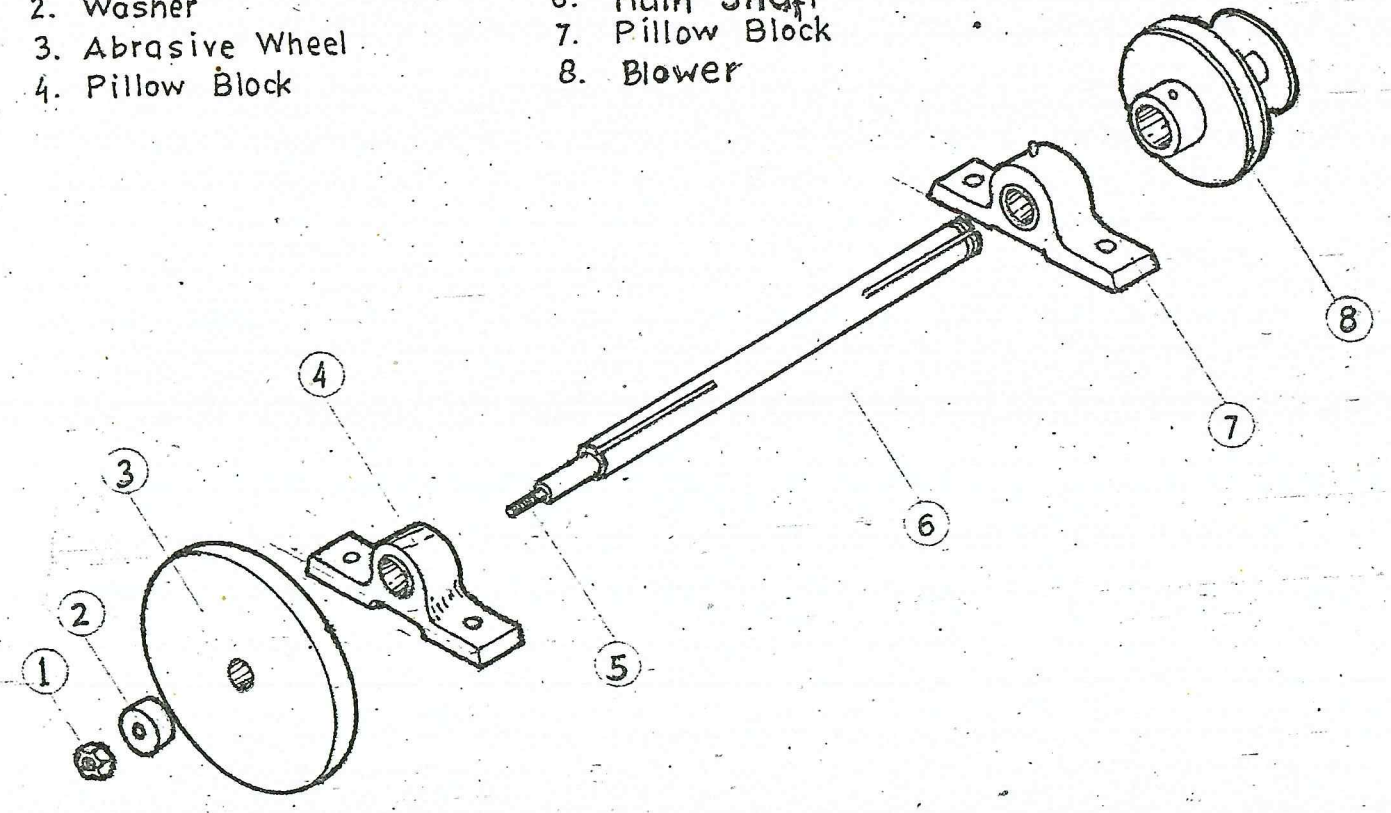
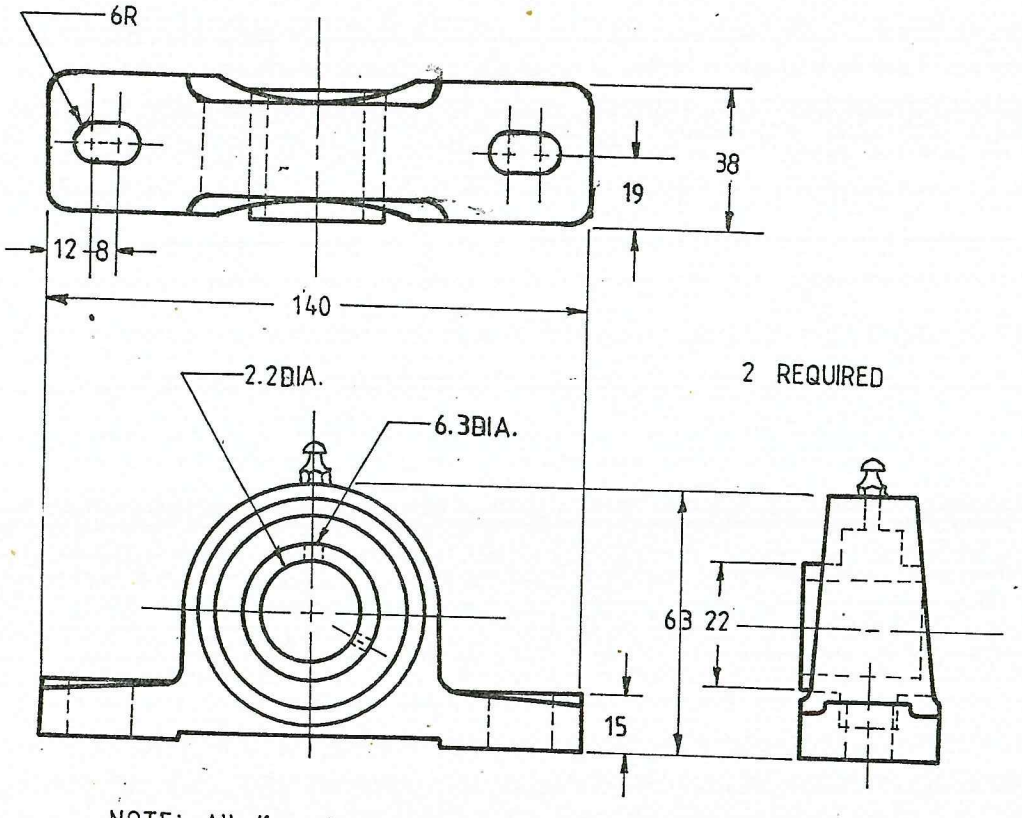
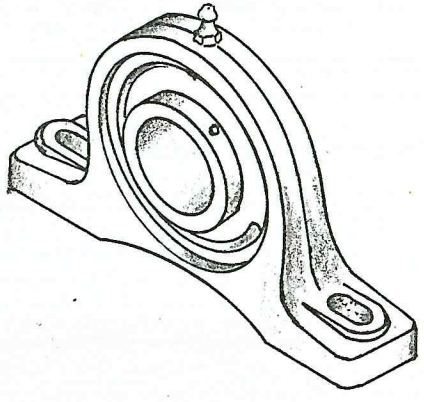


FIGURE 3.. GRINDER ASSEMBLY

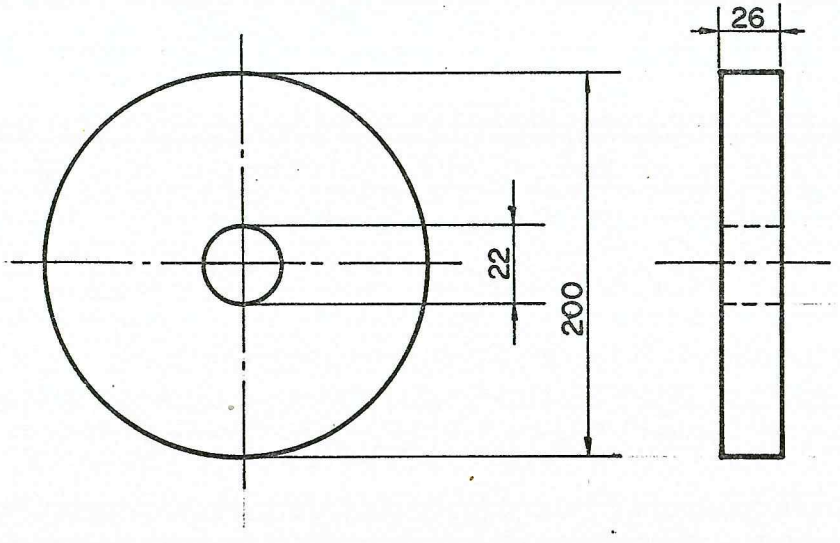


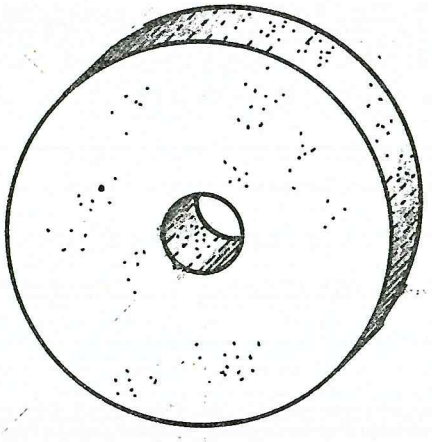
NOTE: All dimension are in millimeters



PILLOW BLOCK

FIGURE:4 THE PILLOW BLOCK





PICTORIAL VIEW

Figure:5 THE ABRASIVE WHEEL

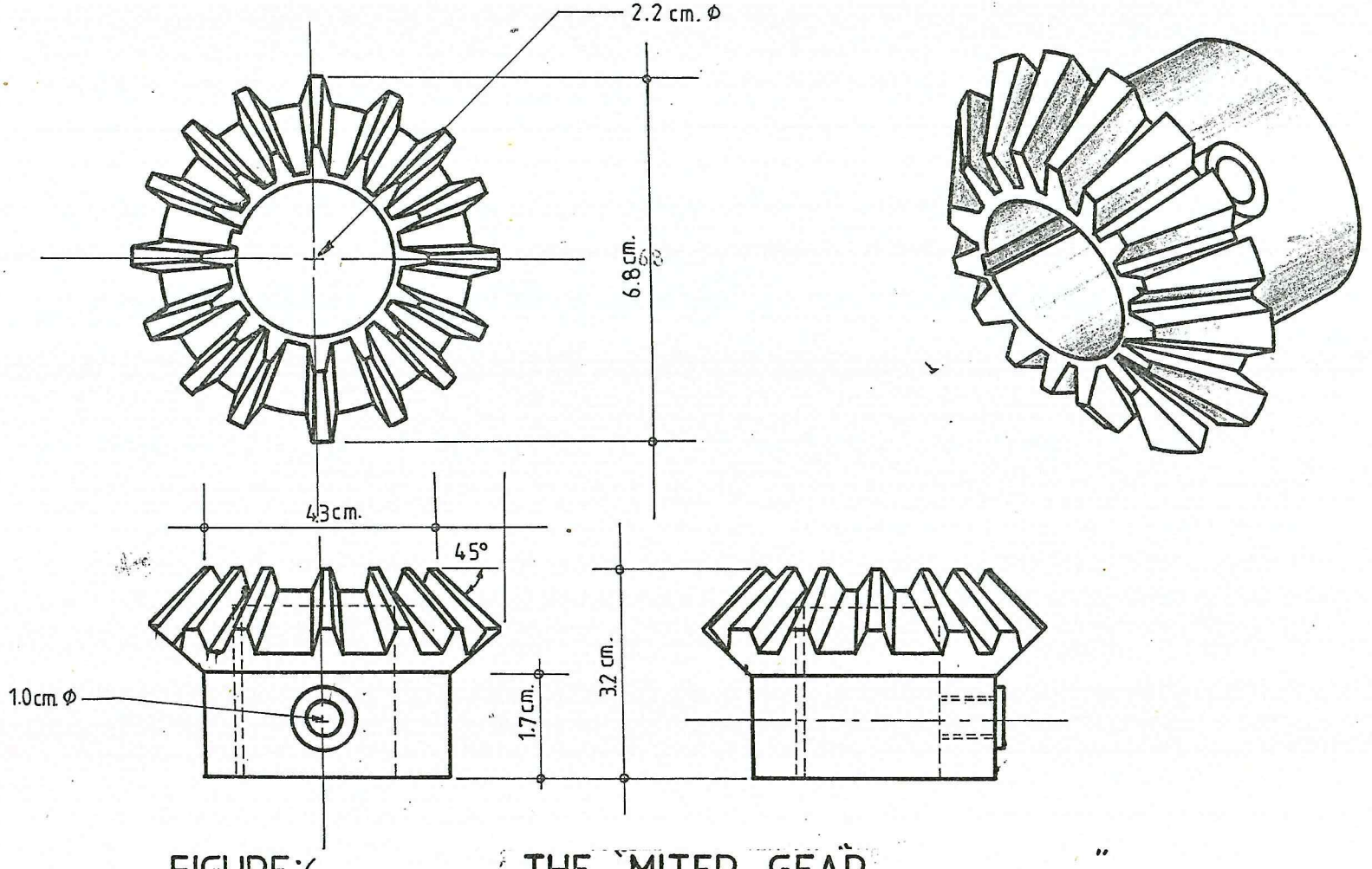


FIGURE:6 THE MITER GEAR

b. Prepare a washer and a 5/8" nut.

c. Prepare a 175 mm. dia. abrasive wheel, assemble, and tighten the bolts and nuts securely.

3. Drill Press Machine AAssembly

a. Prepare a 22.2 mm. x 155 mm. round bar, machine it

b. Prepare two pieces 22.2 mm dia. pillow blocks.

c. Attach 50 mm. miter gear to the main shaft.

d. Connect another 35 mm. miter gear below.

e. Attach and align the pillow blocks to it and insert the drill spindle.

f. Prepare and insert a drill chuck at the lower end of the drill spindle.

g. Insert a re-bored 38 mm. x 76 mm. table holder, drilled and tapped with 20 NF thread.

h. Prepare and machine the drill working table precisely.

i. Cut rack and spur gear for the drilling mechanism.

j. Weld and attach them to the table holder correctly

k. Provide lock screws to the working table for swiveling of the table to different directions.

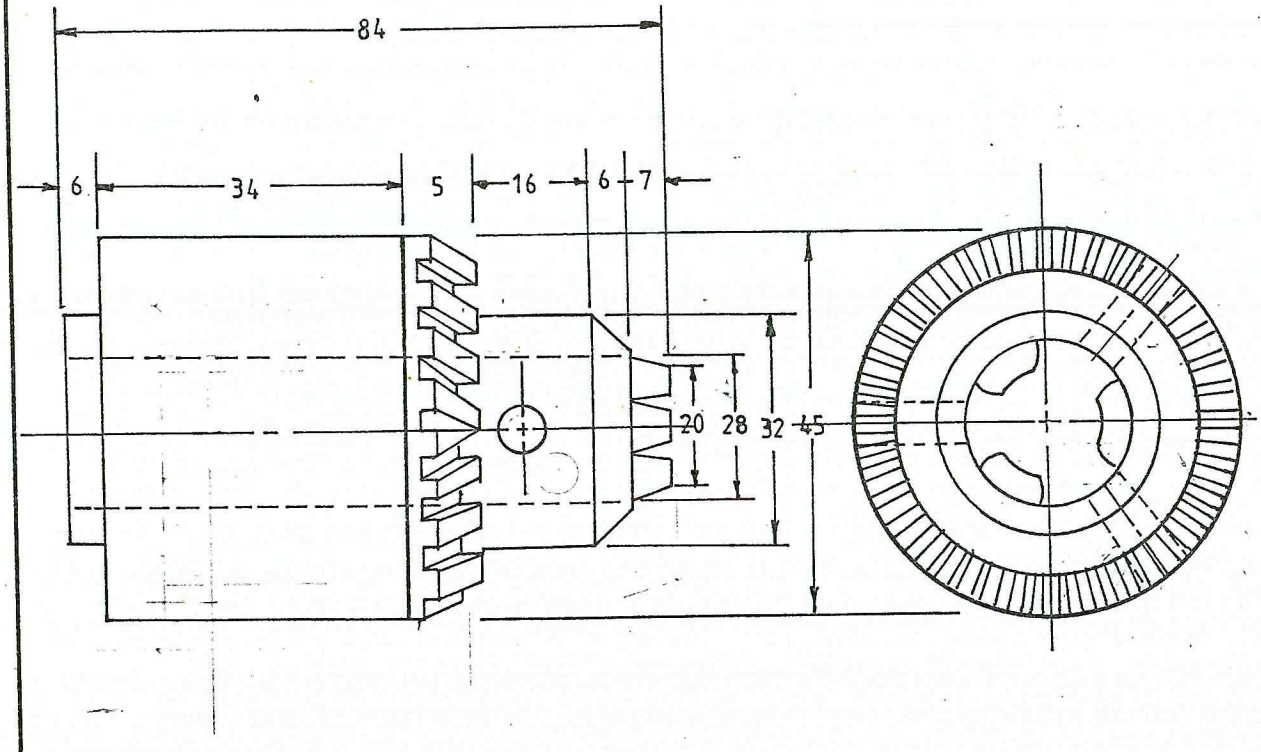
l. Mount a table vise on the working table.

4. Blower Assembly

a. Prepare a 200 mm. x 28 mm. fan wheel, drilled for bushing and tapped with 28 NF thread.

b. Prepare fan cover sheetmetal/aluminum for the blower provided with air inlet and outlet.

DRILL CHUCK



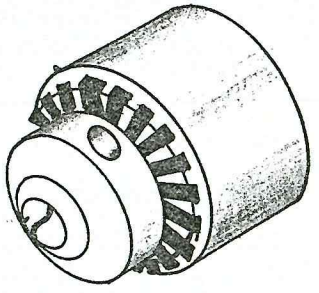


FIGURE: 7 THE DRILL CHUCK

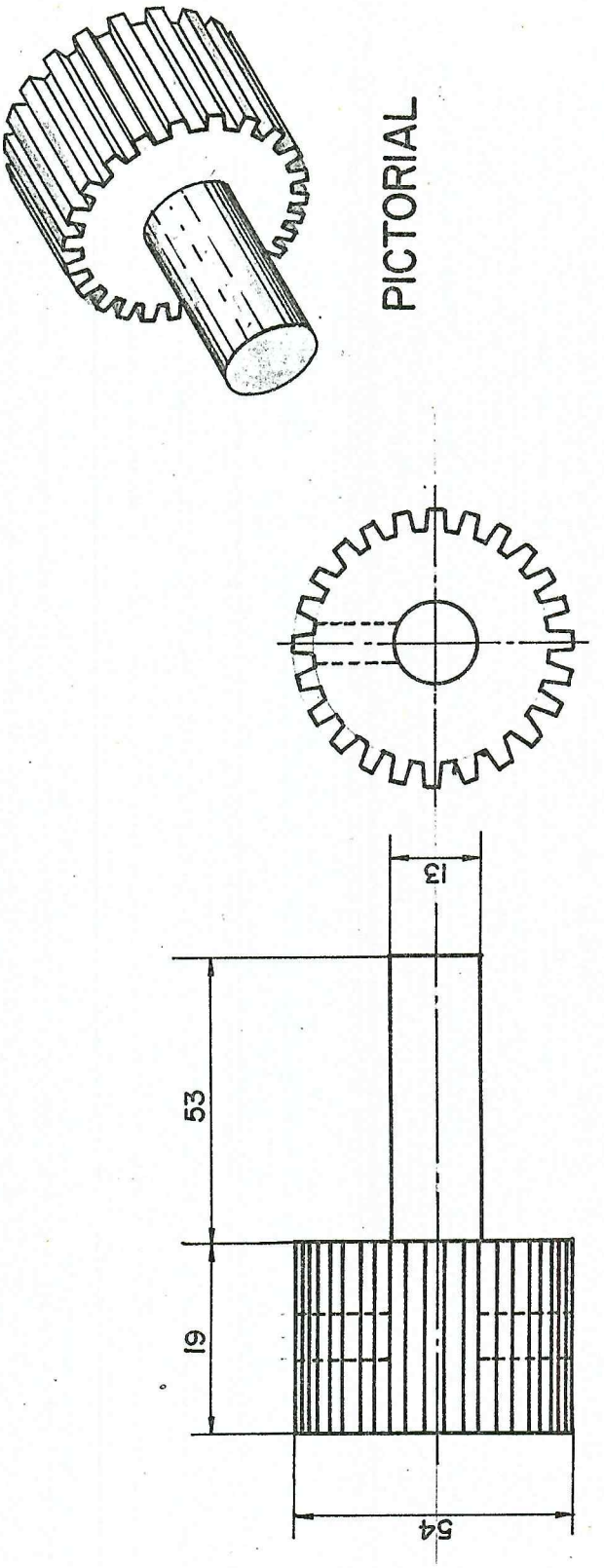


Figure:8 THE DRILL PRESS SPUR GEAR

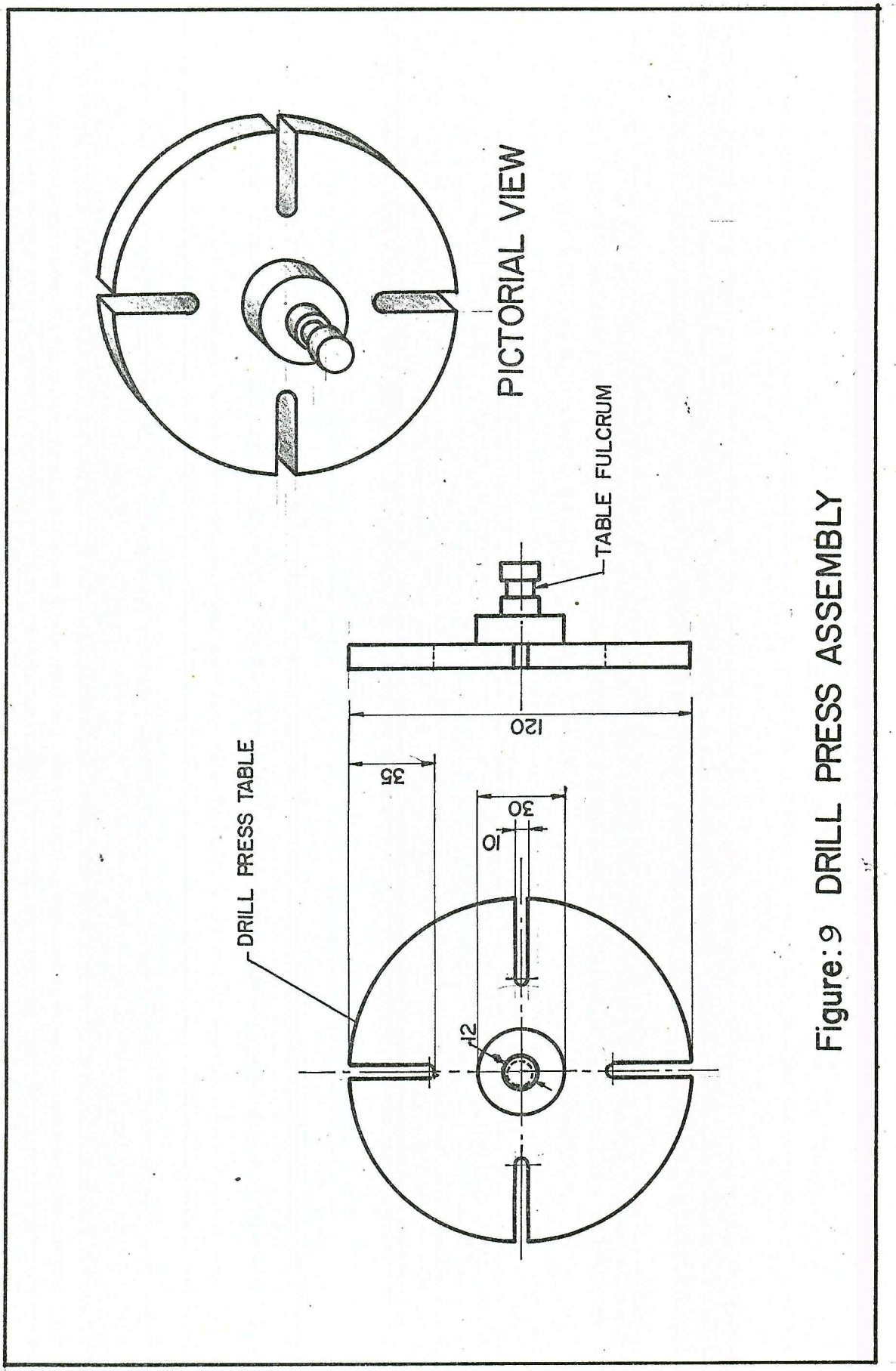
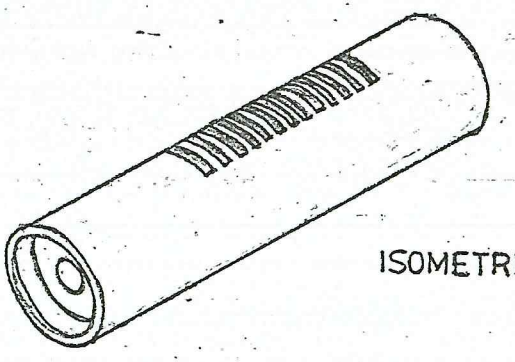
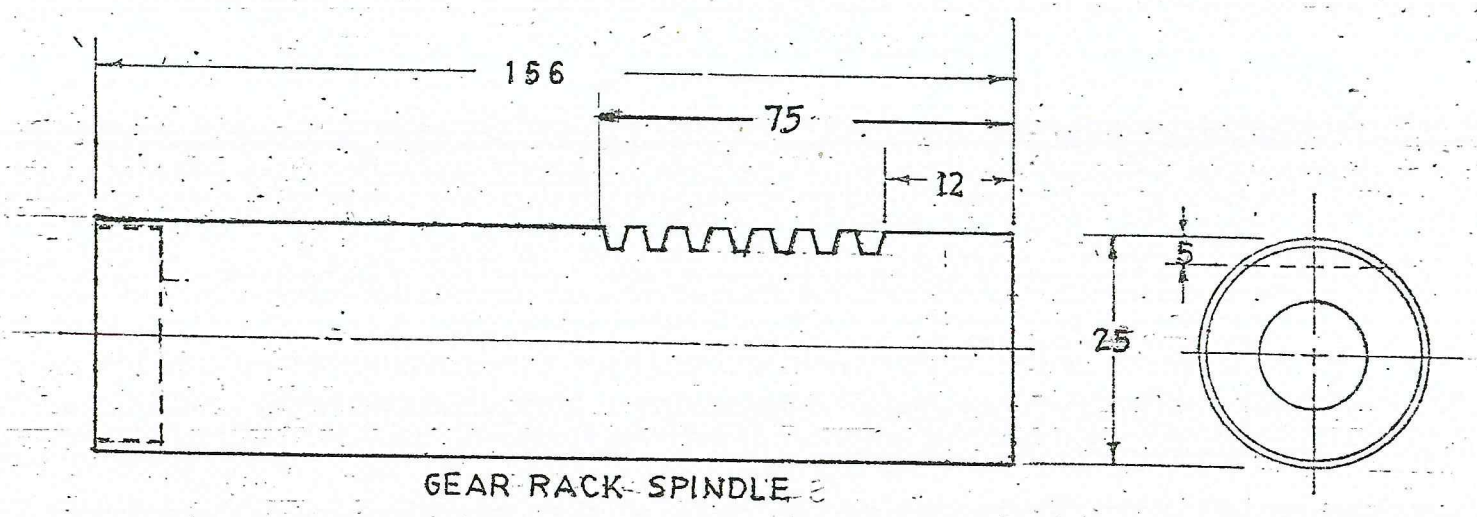


Figure: 9 DRILL PRESS ASSEMBLY

NOTE : All dimensions are in millimeters unless otherwise specified.

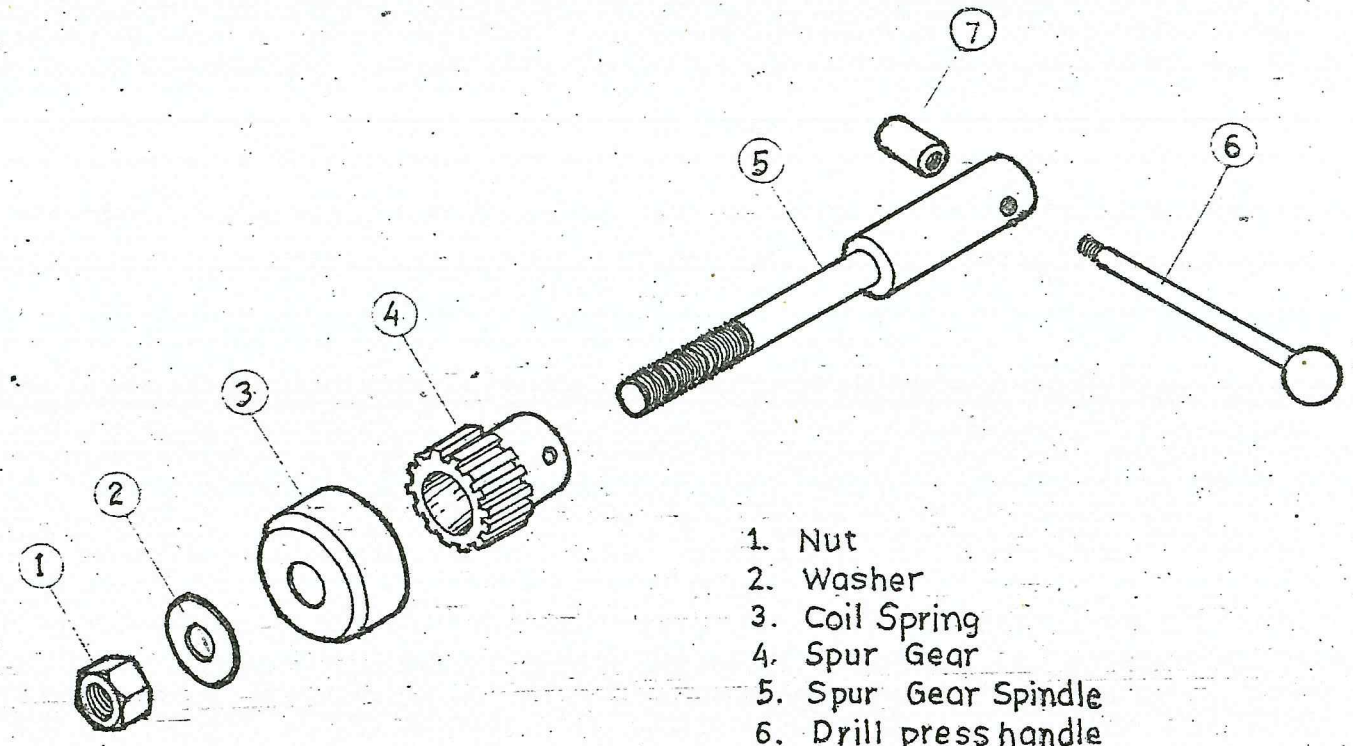


ISOMETRIC



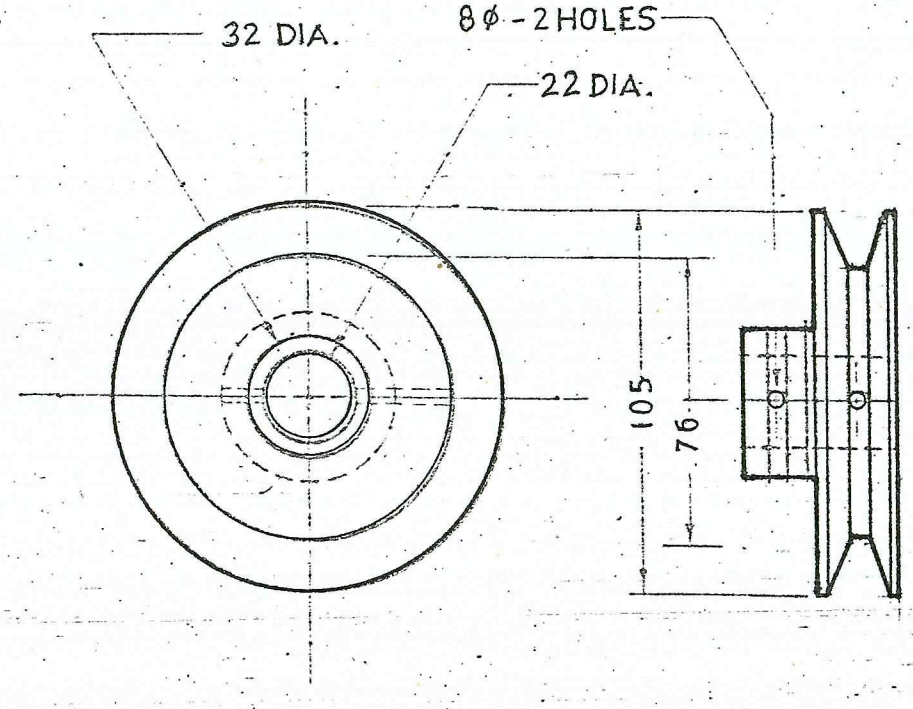
GEAR RACK SPINDLE

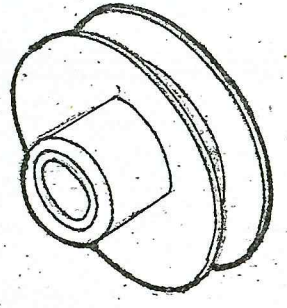
FIGURE 10 : SHOWS DETAIL OF THE GEAR RACK SPINDLE



1. Nut
2. Washer
3. Coil Spring
4. Spur Gear
5. Spur Gear Spindle
6. Drill press handle
7. Nut

FIGURE 11 The drill hand drive assembly





STEP PULLEY

NOTE : All dimensions are in millimeters.

FIGURE 12 THE STEP PULLEY

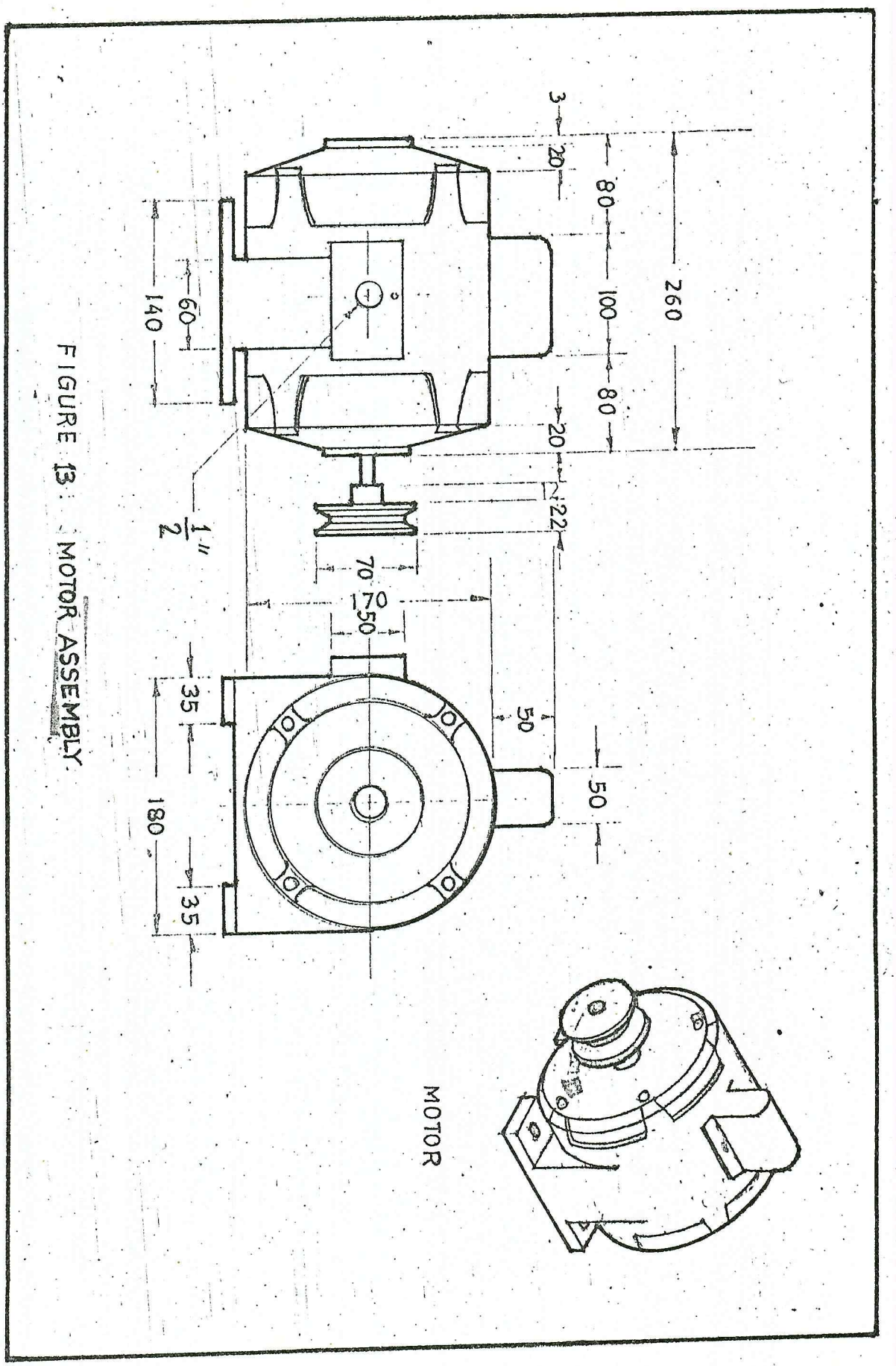


FIGURE 13: MOTOR ASSEMBLY.

c. Prepare 10 pieces 3/16" stove bolts.

d. Assemble and attach the blower cover to the shaft opposite the grinding machine assembly.

5. Disc Sander Assembly

a. Prepare a 2 mm. x 180 mm. dia. sheetmetal disc.

b. Attach a 22.2 mm. x 25 mm. bushing at the center of the disc provided with a 28 NF tap.

c. Attach the thin piece of wood on the disc.

d. Glue the 7" dia. emery cloth or sander on the wood

e. Insert the bushing at the end-most of the main shaft near the blower assembly, then tighten it.

6. Foot Pedal Assembly

a. Prepare a 50 mm. x 75 mm . pipe, schedule 40.

b. Align and weld this pipe 200 mm. from the surface of the base to the pipe seat stand.

c. Prepare a used bicycle foot pedal assembly and aasemble them properly.

d. Tighten the bolts and nuts correctly.

7. Driving Mechanism Assembly

a. Prepare a used bicycle hob provided with a free-wheeling small driver sprocket at one end and a bigger driven sprocket at the other end.

b. Attach a small driven sprocket at the main shaft and align this to the bigger sprocket below.

c. Prepare two pieces of bicycle chains. Connect these to the foot pedal driver sprocket, then to

the main shaft.

d. Align the chains properly then tighten securely.

e. Cover the uppermost sprocket with a sheetmetal.

Table 4

WORK ACTIVITIES AND TIME ALLOTMENT

Work Activities	Time Amt.
1. Frame assembling	: 3 days
2. Machining and threading main shafting	: 4 days
3. Machining grinder, blower, sander parts	: 2 days
4. Machining drill press machine parts	: 5 days
5. Milling rack and spur gear	: 3 days
6. Machining drill press column, table assembly	: 2 days
7. Preparing blower assembly and sander	: 2 days
8. Preparing and aligning driving mechanism	: 2 days
9. Polishing ang painting	: 1 day
Total number of days	: 24 days

Cost of Supplies and Materials

Table 5 shows the quantity, unit name, and description and cost of supplies and materials needed in the construction of the gadget.

The cost of supplies and materials was based during the time when the gadget was constructed in 1990. It is common knowledge that construction of an improvised gadget

requires much time, money and effort before coming into perfection. Some parts are to be revised and replaced with new spare parts if necessary to keep the gadget working, thus requiring additional budget.

Table 5

BILL OF SUPPLIES AND MATERIALS

Quantity	Unit	Name and Description	Cost
1	pc.	G.I. Pipe 1" x 300 cm. long	10.00
1	pc.	Round bar, 1 x 100 cm.	100.00
4	pcs.	Pillow blocks, 22.2 mm. dia.	720.00
2	pcs.	Sprockets, 7.5 mm. dia.	90.00
2	pcs.	Sprockets, 20.32 mm. dia.	150.00
1	pc.	G.I. Pipe, 1/2" x 200 mm.	50.00
1	pc.	Drill chuck, 1-13 mm. dia.	390.00
2	pcs.	Miter gears, 35-50 mm. dia.	100.00
2	pcs.	Bicycle hobs, Standard	300.00
2	kgs.	Welding rod, 6.33 mm. dia.	40.00
10	pcs.	Stove bolts, 3/16" dia.	10.00
12	pcs	Bolts and nuts, 1/2" dia.	24.00
1	pc.	Spur gear, 50 mm. dia.	10.00
1	pc.	Rack gear, 22.0 mm. x 150mm.	18.00
2	rls.	Bicycle chains, D.I.D.	90.00
5	pcs.	Sandvik, Hacksaw blades	180.00
1	pc.	Abrasive stone, 175 mm. dia.	80.00
1	pc.	Sander (emery cloth)	35.00
5	pcs.	Sand paper (waterproof)	50.00
1	set	Bicycle foot pedal	145.00
1	qt.	Green enamel paint	75.00
1	pc.	Steel plate 1.27 cm x 20 cm.	36.00
		Grand Total	2793.00

Table 6 shows labor estimate. Computing the labor cost in Catbalogan, where an ordinary lathe machine operator, welder and milling machine worker charges ninety

eight pesos per day (98.00), the construction of the frame, machining of shafting, and milling rack and spur gear requiring twenty-four working days, will cost about 2, 352.00 for labor alone. (See Table 6).

Table 6

LABOR COST

Quantity	Description	Rate/day	No. days	Cost
1	Milling opr.	98.00	3	294.00
1	Machinist	98.00	13	1,274.00
1	Welder	98.00	3	294.00
1	Assembling/ Finishing	98.00	5	490.00
			Total	2,352.00

Table 7 shows the outlay of the gadget. Combining the cost of supplies and materials with labor cost, it will come up to 5,145.00. Adding 10% (514.50) to it for the use of machine and electricity, production cost will reach 5,659.50 per finished gadget.

It is expected that after completion of the gadget under study, the approximate production cost may go beyond the production cost shown in Table 7.

Table 7

SOURCES OF COST AND COST PER SOURCE

S o u r c e s	: C o s t
1. Supplies and Materials	: 2,793.00
2. Labor	: 2,352.00
3. Overhead Cost (10%)	: 514.50
Total Cost	: 5,659.50

This gadget is entirely different from various machines of the same type commercially sold because aside from its unique design, it can either be used with or without electricity in urban or rural communities, in school or at home for varied activities. Besides, the gadget is constructed with different functions in only one unit.

CHAPTER IV

DESCRIPTION OF THE COMPLETED PROJECT

This portion briefly describes the completed improvised gadget in terms of its structures and processes.

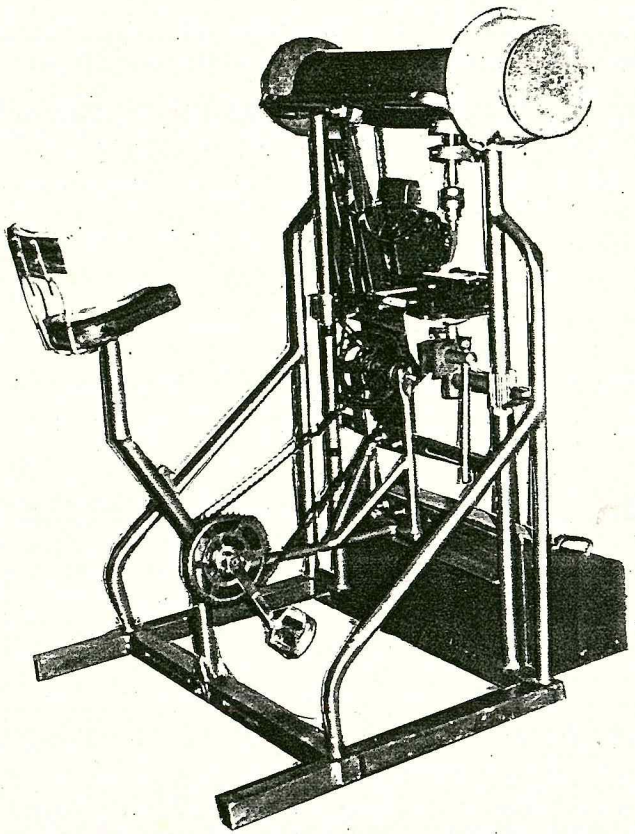
It is expected that with the completion of this gadget, the students will be able to continue working on their projects during every laboratory period especially drilling, grinding, sanding and blowing operations with or even without electricity. Although the completed gadget is limited to light operations or work capacity, it is essential in simplifying and facilitating demonstrations on basic skills, proper care and maintenance and safety precautions on the use of drill press, grinder, blower and sander machines respectively.

A. Structure

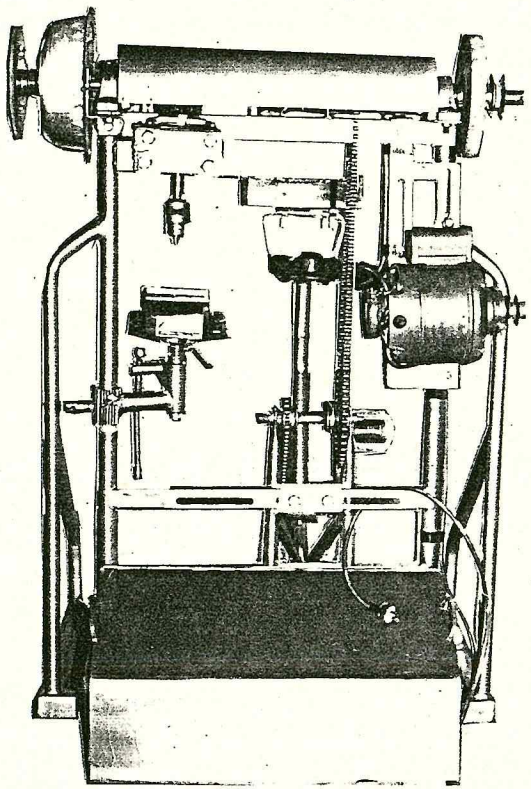
The structure of the gadget includes the parts, their functions and interrelationships, capabilities and limitations.

1. Parts and functions.

This portion shows the different parts and functions of the completed improvised multi-purpose mechanical gadget.

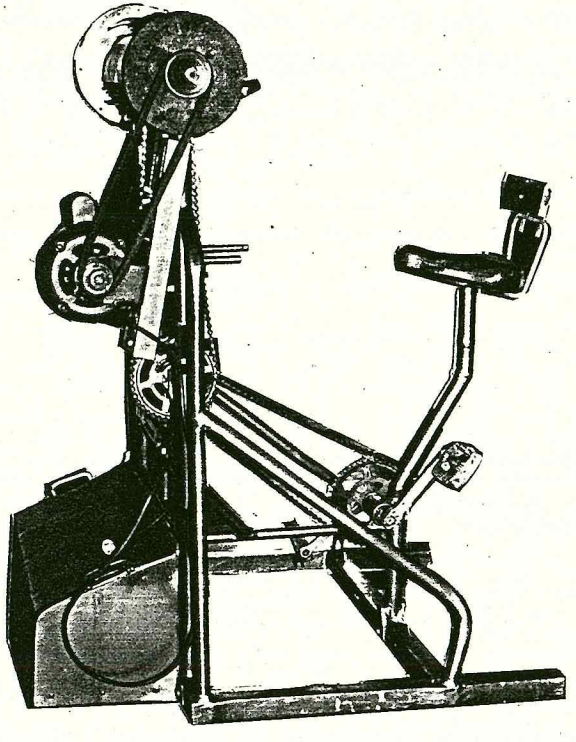


LEFT SIDE VIEW

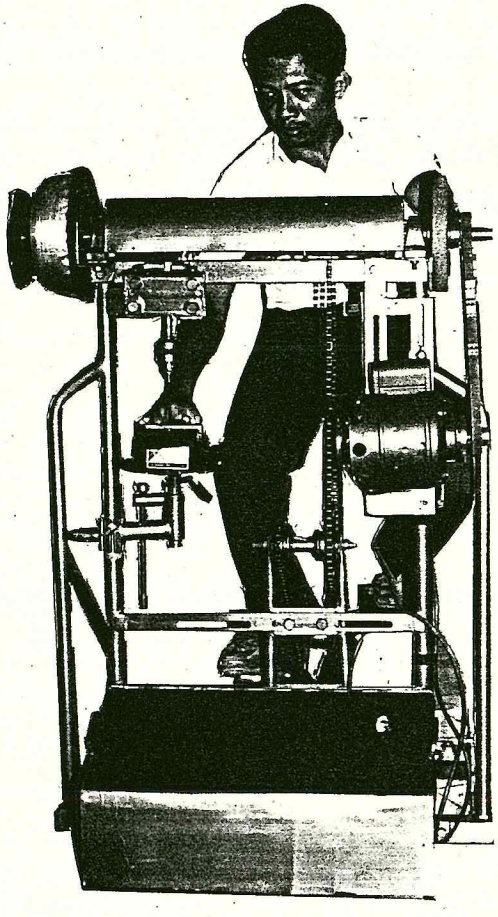


FRONT VIEW

Figure 15. Shows the left side view and front view of the improvised gadget.



RIGHT SIDE VIEW



The researcher, Mr. Armamdo Pagli-awan demonstrates the use and function of the gadget.

Figure 16. Shows the right side view and the researcher during the demonstration of the use and function of the improvised gadget.

Table 8

PARTS AND FUNCTIONS OF THE COMPLETED PROJECT

Parts	Functions
1. Frame	: Serves as the base and stand of the improvised gadget.
2. Grinding Machine	: Serves as the flywheel, grinds various surfaces and sharpens cutting tools.
3. Blower Machine	: Blows air out for various uses.
4. Sander Machine	: Serves as the polisher and straight surface sander.
5. Drill Press Machine	: Drills various sizes of holes ranging from 1/32" to 1/2" or 1 to 13 millimeters diameter.
6. Foot Pedal Assembly	: Serves as the source of power for the gadget during brown-outs or when economizing use of electric power.

2. Interrelationship.

The improvised multi-purpose mechanical gadget is composed of different parts playing vital roles in the effective operation and manipulation of the gadget. Figure 14 shows the paradigm of interrelationship of different parts and how a particular part works and interrelates its motion to other parts of the gadget when put into action. The gadget is powered by either motor or foot pedal. Presently, the instructor and the students are using the

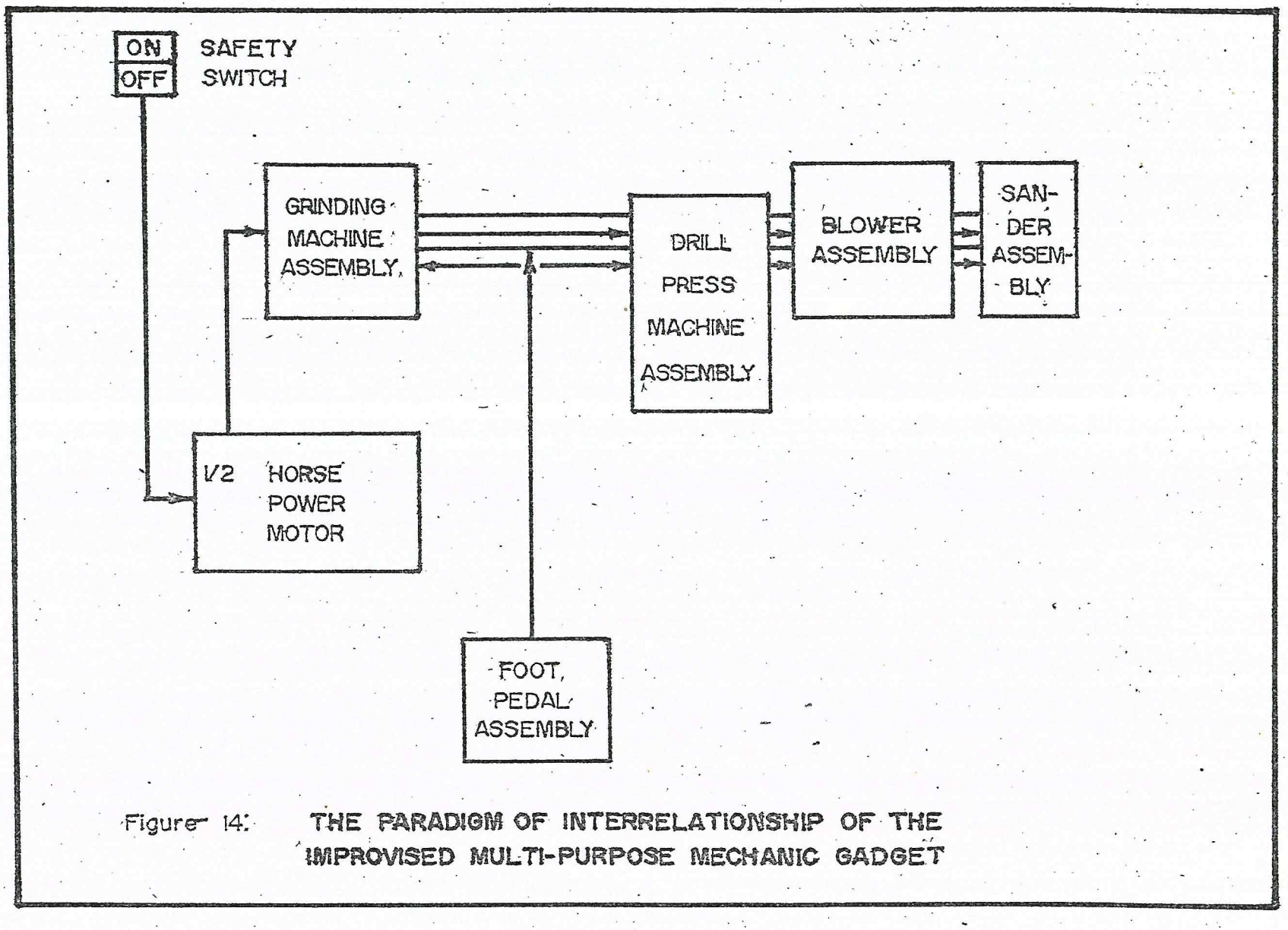


Figure 14: THE PARADIGM OF INTERRELATIONSHIP OF THE IMPROVISED MULTI-PURPOSE MECHANIC GADGET

gadget with the use of the foot pedal. The foot pedal consists of the driver and the driven sprockets connected by two rolls of bicycle chains. These sprockets are attached to the hobs bolted at both ends of the axle firmly. When the foot pedal is moved forward, the sprockets rotate and drive the chains connected to the main shaft. At the left side of the operator facing the gadget is the grinder machine that consists of an abrasive wheel rigidly gripped by a threaded nut and a stopper lock bolted at the other side of the pillow block to prevent shaft from slipping. The abrasive wheel moves forward with the foot pedal at a ratio of 1:6 revolution. This means that for every complete turn of the foot pedal turns the abrasive wheel 6 times. At ordinary speed, the foot pedal drives 75 to 80 turns per minute. Multiplying it by 6, it would approximately give 450-480 rpm. However if higher rpm is desired, the gadget can be run faster up to the maximum speed of 145 to 150 foot pedal turns. This would give 870 to 900 rpm on the main shaft. The small driven sprocket rigidly bolted to the main shaft is essential for the transmission of power from the foot pedal up to the different mechanisms of the gadget.

At the right side of the machine is the blower mechanism with a fan blower in it, covered with a sheetmetal and aluminum provided with air inlet and outlet that is attached to the pillow blocks. The outlet is

provided with a plastic pipe where a hose can be connected for blowing dust, metal chips, maintain flames on a furnace during annealing, cooling off heated metals and blowing metal sparks away from the operator when grinding or sanding operations.

At the right end-most of the shaft is the sander machine. This mechanism is just an addendum to utilize the idle space of the gadget. The operator cannot use it while running the gadget unless somebody does the job of sanding processes. However, sanding cannot disrupt the operator's work on drilling, grinding and blowing as sanding for polishing uses a very light load only. This attachment is made up of a thin metal frame disc, covered with a thin piece of plywood where the sand paper or emery cloth is glued. The frame is riveted to a bushing and is bolted to the main shaft with a groove.

About 10 centimeters away from the blower rests a big miter or bevel gear bolted to the main shaft. The gear is connected down to another smaller miter gear held by 2 pillow blocks perpendicular to it. This smaller gear holds the drill chuck spindle bolted firmly and accurately. When the main shaft turns, the bigger gear goes with it transmitting motion to the smaller gear at a ratio of 1:3. Therefore, from the foot pedal up to the drill spindle it transmits motion at a ratio of 1:9. Bringing the total rpm from a minimum of 675-720 to a

maximum of 1,305-1,350. The drill spindle is directly connected to the drill chuck attached to the lower end of the spindle. The spindle is held by two self-aligning pillow blocks bolted to the frame of the gadget to check the proper alignment of the drill bit to the working table below it. The capacity of the drill chuck to hold the drill bits ranges from 1/32" to 1/2" or 1 mm. to 13 mm. diameter. The drill spindle is fixed to the pillow blocks to maintain its rigidity. Therefore, the drill chuck cannot be moved up and down for drilling operations. It is the working table provided by a vise that brings the workpiece up and down when drilling. The working table is provided with a spur gear and rack gear mechanism meshed exactly inside a casing. The spur gear is held by a shaft extending out from the casing and is drilled with a hole for a one foot long drill lever handle. This lever handle is made parallel to the legs of the gadget when the working table rests on the gear casing. When the lever handle is pushed downward, the spur gear raises the working table two to three inches upward, much higher than the maximum capacity of the drill press gadget of 1/4" or 6 mm. thick of metals to be drilled. The sliding table holder can be adjusted up and down or as desired on the legs of the gadget depending upon the thickness of the workpiece mounted on the working vise bolted on the working table.

The gadget is provided with a safety drive handle in front of the operator for ease and comfort. The main shaft mechanism in front is securely covered with a sheetmetal properly shaped to protect operators from touching moving gears and sprockets.

Fifty centimeters in between the gadget's legs is the seat stand that houses the foot pedal and the operator's seat. It helps support the legs of the gadget through pipe braces connected below the foot pedal hob and is bolted on the braces of two legs. This seat stand is bolted on the frame below so when the operator finds it hard to work efficiently and accurately it can be moved to any desired distance to the left for ease and comfort in grinding operations. The top of the seat stand can be adjusted up and down at the convenience of the operator. It is purposely made movable so the operator can get in and out of the gadget easily when using it. It tilts at a slight angle so that the operator can rest his back on the seat support, welded and bolted with a piece of wood at the back. After tightening all bolts, nuts and screws, the gadget is then ready for any desired operation mentioned before. This gadget can be used with all the mechanisms functioning simultaneously. However, to avoid so much work load or pressure on the foot pedal, other mechanisms not in use can be disengaged or remove when so desired.

3. Capabilities. This gadget has been constructed strictly observing three factors of design namely: functionality, rigidity, and efficiency according to Virgil Moring Faires in his book Design of Machine Elements. However, the frame of this gadget cannot be compared to the strength and rigidity of any commercially made machines as it is only made out of ordinary G.I. pipes. Its design suits only light work and demonstrations of the very basic skills and operations in drilling, grinding, blowing and sanding operations. This gadget can withstand daily work depending upon the stamina of the operator to run the machine without electricity.

4. Limitations. This gadget is limited to the following operations:

a. Sanding rough and finished surfaces of metal.

b. Blow air to maintain flames on furnace, blow dust, metal chips and sparks away from the operator.

c. Perform light drilling operations to non-ferrous metals like aluminum, brass, etc and ferrous metals like steel plate, cold rolled steel, galvanized iron, round, flat, angular, and square bars at a limited sizes, with a minimum drill hole of mm. to 13 mm. dia.

d. Grind rusty and rough surfaces of metals, sharpens cutting tools, knives, nippers,

kitchen utensils, and fabrication of keys.

5. Process.

The processes include the operating procedures, maintenance, safety and control measures.

a. Operating Procedures. To operate the gadget, the operator will simply sit on the operator's seat and start moving the the foot pedal forward like that of driving a bike and follow the recommended processes:

1.) In the use of the Grinding Machine.

a. Check the bicycle chains on the sprockets.

b. Adjust bolts on seat stand if necessary.

c. Move the pedal assembly to a convenient place.

d. Align the upper chain to the sprocket below.

e. Tighten the bolts and nuts of the assembly.

f. Test the foot pedal and make final alignment.

g. Run the gadget and start grinding operations.

h. When motor is used to run the gadget, detached the chain from the sprocket on the main shaft before running the gadget.

2.) In Using the Blower.

a. Insert the fan blower bushing to the end portion of the main shaft and tighten the screw.

b. Cover the fan blower with a sheetmetal or aluminum and tighten the screws.

c. Attach the hose to the plastic pipe outlet and position the nozzle of the hose to a specific place of use.

3.) In Using Sander.

a. Insert the bushing of the sander disc frame to the main shaft of the gadget at the right end of it.

b. Tighten the screw of the bushing to the shaft.

c. Tighten the sander guide bar and start sanding.

d. Position the blower nozzle at a convenient place to blow dust and dirt away from the operator.

4.) In Using the Drill Press.

a. Check and fit the big miter gear to the smaller miter gear below and tighten it.

b. Insert the desired size of drill in the drill chuck and tighten it correctly with chuck key

c. Mount the workpiece on the working vise attached to the working table up about 1/4" or 6 mm. to the tip of the drill bit.

e. Adjust the workpiece work center to the tip of the drill bit and tighten the vise.

f. Pull the feed lever handle down applying very light pressure as the gadget runs, until hole is properly done.

g. Determine the approximate speed needed

according to the size of the drill bit and type of material.

h. Remove the drill bit on the chuck after use.

i. Always clean the gadget and oil it after use.

Drilling metals require some factors for consideration. These factors are: cutting speed, revolution per minute, size of the drill bit and type of metal to be drilled.

Cutting speed is the distance traveled by the cutting tool in terms of feet per minute (fpm). This can be calculated by using the following formula.

If the rpm is given, the following cutting speed formula can best be applied:

$$\text{Cutting Speed} = 1/4 \times \text{drill diameter} \times \text{rpm}$$

$$= \frac{3.1416 \times d \times \text{rpm}}{12}$$

Example:

To calculate the cutting speed of a 1/4 inch drill that revolves at 400 rpm, multiply 1/4 inch by 3.1416 then divide this by 12, thus:

$$\text{Cutting Speed} = \frac{1/4 \times 3.1416 \times 400}{12}$$

$$= \frac{.25 \times 1{,}256.64}{12}$$

$$= \frac{314.16}{12}$$

= 26 feet per minute (fpm)

To calculate for the rpm, the following formula can best be applied:

$$RPM = \frac{\text{Cutting Speed} \times 4}{\text{Drill dia.}}$$

Example:

To calculate the rpm of a 1/4 inch drill bit that rotates at 50 fpm, multiply 4, the constant, with the cutting speed of 50 and divide this by the drill diameter of 1/4, thus:

$$RPM = \frac{50 \times 4}{1/4}$$

$$= \frac{200}{.25}$$

= 800 revolution per minute

b. Maintenance. This is the proper care, maintenance and lubrication of the gadget to lengthen its life span, improve the functions, productivity, and efficiency in the teaching-learning processes.

The following steps are suggested:

1.) Check all attachments and accessories in their proper positions before using the gadget.

2.) Make the necessary adjustment and alignment of parts before starting to work.

3.) Clean and lubricate the bearings, sprockets,

chains, and gears often.

4.) Prohibit students from playing with the gadget.

5.) Detach the foot pedal chain after use.

6.) Keep all tools and accessories in safe place.

c. Safety Precautions.

To insure safety and minimize accidents, the following steps are suggested in the operation of the gadget:

1.) Disaligned chains and sprockets should be checked before use.

2.) Unfit gears, loose bolts, nuts and joints must be properly checked and tightened.

3.) Meshing gears and sprockets should be covered when using the gadget.

4.) Goggles and nose cover should be worn during sanding and grinding operations.

5.) Apply light pressure on the feed lever handle when drilling to avoid drill damage, waste of materials and possible injury to the operator.

6.) Avoid using the gadget with loose long hair, loose clothing and jewelry on hands and fingers. These may be caught by the moving parts of the gadget and cause serious injury

7.) When drilling, see to it that workpiece is clamp firmly or held in a vise correctly before use.

8.) Remove unnecessary tools, materials and objects around the working area.

9.) Avoid talking to the operator while working.

10.) Return all tools and accessories after work.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents the summary, conclusions and recommendations of the study.

A. Summary

This study sought to design, construct, test and revise the improvised multi-purpose mechanical gadget for the demonstration of basic skills in Mechanical Technology. Construction of said gadget will help the preservation of life span and maximum accuracy, utility and effectiveness of new and expensive machineries now found in the laboratory shops. It also demonstrates to the industrial world the capacity and capabilities of the shop teachers to design, construct and develop machines that would supplement laboratory instruction in Samar State Polytechnic College for the benefit of the students, teachers, administrators and the College as a whole. The gadget is fabricated out of locally available materials, mostly metals and small pieces of wood. It could be run by either an electric motor of at least 1/2 horsepower or by foot pedal. The gadget can be operated using all the mechanism simultaneously without so much difficulty on the operator provided the belt connected to the motor from the main shaft is disengaged.

The findings of this study showed that the improvised multi-purpose mechanical gadget can perform similar operations as that of the commercial machines of the same type or functions. The advantage of this gadget over commercially made machines is that, it is very much cheaper and economical in use because it can be operated without spending a lot of fuel. Besides, one unit of the gadget provides four functions and operations that save time, money effort and shop room space during class instruction. Aside from that, the gadget can be constructed by the students in Mechanical Technology with the supervision of the shop teacher or instructor concerned, using common machines found in the Mechanical Technology laboratory shop like lathe machine, welding, drill press, grinding machine and milling machine. The cost of production of a single unit as of December, 1991 is 5,659.50.

B. Conclusion.

The result of this study clearly shows that the improvised gadget can be used effectively and accurately in drilling, grinding, blowing and sanding operations. This gadget can be mass-produced by the college using the students in Mechanical Technology under the Income Generating Project (IGP) of the college with the supervision and guidance of the teacher. Students can be given a share or income out of their work at the same time

learn various skills in the fabrication purposes. This could be beneficial to their chosen field of vocation.

C. Recommendations.

As a result of the findings of this study, the following are recommended:

a. Vocational school administrators should continue encouraging their teachers and instructors to improvise more useful gadgets for instructional purposes to improve teaching-learning processes in the laboratory shops.

b. Technical-vocational schools can make use of this model as a basis for the design and fabrication of their own improvised gadget appropriate to their needs.

c. The materials used and the design of the fabrication of this gadget may be re-designed, modified or improved to ensure better performance.

d. The college should help in patenting the gadget to ensure the college of the royalty of the original design.

e. The gadget should be mass-produced by the college for other technical-vocational schools who are in need it to avail of.

f. Further research and study should be made on the model or study for additional function, use and marketability.

B I B L I O G R A P H Y

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D. SPEECH

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APPENDIX "B"

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

December 11, 1990

The President
Samar State Polytechnic College
Catbalogan, Samar

S I R :

In my desire to finish writing my thesis proposal leading to the degree of Master of Technician Education (MTE), in Samar State Polytechnic College, I would like to request from your good office that I be granted study leave with pay, as stated in Section 18 under Leave Privileges of the College Code, next school year 1991-1992 starting from the first semester of June 1991.

I hope this request will merit your favorable consideration.

Very truly yours,

(SGD.) ARMANDO L. PAGLI-AWAN

NOTED:

(SGD.) SIMON P. BABALCON JR.
Head, TECH-VOC.

RECOMMENDING APPROVAL:

(SGD.) SENECIO D. AYONG,DPA./Ed.D.
Dean of Instruction and
Related Services

(SGD.) BERNARDO S. OLIVA,Ed.D.
College Dean

APPROVED:

(SGD.) BASILIO S. FRINCILLO
President

CURRICULUM VITAE

NAME	: ARMANDO L. PAGLI-AWAN
ADDRESS	: 7th St. Patag, Catbalogan, Samar
PLACE OF BIRTH	: Camarubo-an, Jiabong, Samar
DATE OF BIRTH	: August 14, 1959
PRESENT POSITION	: Instructor III
STATION	: Samar State Polytechnic College

EDUCATIONAL BACKGROUND

Elementary	East Catbalogan, Elementary School (Now Catbalogan III)
	Camarubo-an Elementary School,1971.
Secondary	Samar National Agricultural School Gandara, Samar 1975-1978.
College	Samar State Polytechnic College Catbalogan, Samar. 1980-1983.
Curriculum Pursued	Master of Technician Education
Major	Mechanical Technology

CIVIL SERVICE ELIGIBILITY

Professional Board Examination for Teachers, Tacloban City November 27, 1983.

Professional Career Examinations, Catbalogan, Samar, July 7, 1983.

HONORS AND AWARDS RECEIVED

Valedictorian	Camarubo-an Elementary School Jiabong, Samar. 1971.
Valedictorian	Samar National Agricultural School, Gandara, Samar. 1978.
Gerry Roxas Leadership Award	Samar National Agricultural School, Gandara, Samar. 1978.
Insular Life Gold Eagle Medal	Samar National Agricultural School, Gandara, Samar. 1978.
Farmer of the Year	Samar National Agricultural School, Gandara, Samar. 1978.
Parliamentarian of the Year	Samar National Agricultural School, Gandara, Samar. 1978.
Boy Athlete of the Year	Samar National Agricultural School, Gandara, Samar. 1978.
Battalion Commander CAT-I	Samar National Agricultural School, Gandara, Samar. 1978.
FFP Regional Farmer	FFP Regional Organization MECS Region 08. 1978.
Machinist of the Year	Samar State Polytechnic College Catbalogan, Samar. 1983.
Certificate of Recognition	Active FFP Adviser, Samar State Polytechnic College, Catbalogan Samar. 1984.
Certificate of Appreciation	Regional FFP Trainor in Parliamentary Procedure Contest, CJAC Can-avid, E. Samar. 1984.
Certificate of Appreciation	First Runner-Up Coach in Track and Field, SCUAA Meet Tacloban City, 1986.
Certificate of Appreciation	Active FFP Chapter Adviser, Samar State Polytechnic College, Catbalogan,Samar.1985.

Certificate of Recognition	For maintaining the Good Standing of the FFP Organization in SSPC, DECS, Bureau of Technical and Vocational Education, Manila. 1987.
Certificate of Appreciation	Back-Up Official, National SCUAA Meet '88,Leyte Institute of Technology, Tacloban City. 1988.

CO-CURRICULAR ACTIVITIES

President	Senior Class Organization, Samar National Agricultural School, Gandara, Samar. 1978.
President	Future Farmers of the Philippines, Samar National Agricultural School, Gandara, Samar. 1978.
Secretary	FFP Regional Organization, Region VIII. 1977.
Athlete	Samar Track and Field Team, Catbalogan, Samar. 1975-1982.
President	Senior Class Organization, Samar State Polytechnic College Catbalogan, Samar. 1983.
Delegate	FFP Annual Regional Work Conference, Samar National Agricultural School, Gandara, Samar. 1975-1978.
Trainor	SSPC Parliamentary Procedure Contest, Samar State Polytechnic College, Catbalogan, Samar. 1980.
Participant	Regional/National Screening for exchange students to Canada YSTAPHIL, Manila, Sta. Maria and San Miguel Bulacan. 1981.
Delegate	FFP National Convention, CVAC, Lal-lo, Cagayan Valley. 1978.

Participant	Regional FVLP Convention,INAVS Isabel, Leyte. 1982.
Adviser	Future Farmers of the Philippines, Samar State Polytechnic College, Catbalogan, Samar. 1983-1991.
Trainor	SSPC Ati-atihan Dance Group, Samar State Polytechnic College, Catbalogan, Samar. 1984-1987.
Coach	SSPC Track and Field (Men), Samar State Polytechnic College Catbalogan, Samar. 1986-1991.

SCHOLARSHIP GRANT

Rp-Canada World Youth Exchange Program
Carman, Manitoba, Canada and Rizal, Pontevedra, Capiz, Philippines. 1981.

Summer Teacher's Upgrading Course, MIST,MTI,TUP, Manila 1984.

Summer Teacher's Upgrading Course in Welding and Fabrication, TVEP/NMYC, University of Southwestern Philippines, Obrero Campus, Davao City. 1985.

Summer Teacher's Upgrading Course in Mechanical Technology Syllabus Making, Cebu State College of Science and Technology, Main Campus, Cebu City. 1986.

POSITIONS HELD

Secondary School Teacher	Samar State Polytechnic College Catbalogan, Samar. 1983-1985.
Instructor I	Samar State Polytechnic College, Catbalogan, Samar. 1986.
Instructor III	Samar State Polytechnic College Catbalogan, Samar. 1987-1992.

SEMINARS ATTENDED

FFP Regional Work Conference, Alang alang Agro-Industrial School, Alang alang, Leyte. 1975.

Youth Leadership Training Seminar, Sudlon Agricultural School, Lahug, Cebu City. 1977.

FFP Regional Work Conference, Southern Samar Agricultural College, Salcedo, Eastern Samar. 1977.

FFP Regional Work Conference, Bontoc National Agro-Fishery School, Bontoc, Southern Leyte. 1978.

Youth National Leadership Training Seminar, Cagayan Valley Agricultural College, Lal-lo, Cagayan Valley. 1978.

VLP-FFP-FAHP Leadership Training Seminar, Samar State Polytechnic College, Catbalogan, Samar. 1981.

Seminar on Student Travel Clubs for Leyte and Samar, Leyte State College House, LSC, Tacloban City. 1982.

FFP Regional Work Conference, Can-avid Junior College, Can-avid, Eastern Samar. 1984.

FFP Regional Work Conference, Leyte National Agricultural College, Villaba, Leyte. 1986.

Regional SCUAA Meet Consultative Seminar, University of Eastern Philippines, Catarman, Northern Samar. 1987.

FFP Regional Work Conference, Isabel National Agricultural Vocational School, Isabel, Leyte. 1987.

FFP Regional Work Conference, Visayas State College of Agriculture, VISCA,Bayabay, Leyte. 1988.

FFP Regional Work Conference, Carigara School of Fisheries, Carigara, Leyte. 1990.

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