AN IMPROVISED MULTI-SCALE TRACER:
A TECHNICAL STUDY

A Thesis

Presented to the

Graduate Studies Department

SAMAR STATE POLYTECHNIC COLLEGE

Catbalogan, Samar

In Partial Fulfillment

of the Requirements of the Degree in

Master in Technician Education (MTE)

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February, 1995

APPROVAL SHEET

This thesis, entitled "AN IMPROVISED MULTI-SCALE TRACER: A TECHNICAL STUDY" has been prepared and submitted by AMADOR L. VELASCO, who, having passed the comprehensive examination, is hereby recommended for oral examination.

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ACKNOWLEDGMENT

Writing this technical study and making the Improvised Multi-Scale Tracer has been a fruitful experience and a big trial to the researcher. Aside from it's tremendous work as a teacher, it allowed him to discover so much of his friends' inspirations and encouragement to finish the final step to be an MTE graduate. His friends who give challenges to him -- add up to his strenght to strive harder in order to meet the challenge. With God's blessings, he was able to take the final step, with more particularly through His precious gift of persons who have shared their invaluable time and effort in the completion of this study. For these, the researcher gave thanks to Him and to:

Dr. Dominador Q. Cabanganan, College President, for his leadership support on continuing the SSPC Faculty Development Program and approving his thesis aid.

Dr. Bernardo S. Oliva, Vice President for Academic Affairs, the researcher's adviser, for his encouragement, guidance, unselfish assistance and for his valuable suggestions for the refinement of the manuscript.

The Dean of Graduate and Post Graduate Studies, and the Chairman of the Committee on Oral Examination,

Dr. Rizalina M. Urbiztondo for her professional, yet motherly advice for the improvement of the manuscript.

Dr. Simon P. Babalcon, Jr., Dean of Student Affairs, and member of the panel for oral examination, for sharing his precious time, expertise and constructive criticism.

Dr. Emilio C. Albos, Jr., Head, Tech-Voc Department and member of the panel on oral examination, for being approachable, and for his encouragement and valuable suggestions for the good of the study.

Professor Ciriaco R. Abalos, Jr., member of the panel for oral examination, for sharing his expertise and skills in the completion of the gadget.

Mrs. Imelda O. Velasco, the researcher's wife for the computerization of the manuscript.

The ever loyal friends, Gina and Larry, Nora and Delfin, Collette and Eddie, for their support and assistance through thick and thin and whose expression of confidence did a lot to boost his morale.

Wannie and Philip the researcher's supportive friends for their never-ending help and suggestions in the making of the gadget.

Mano Simon and Mana Linda Babalcon, Emilio and Mana Impa Albos, Mano Ebyo and Mana Nene Pacolor, Mano Puden and Mana Izan, Flor and Dayday, Madz Violy, Madz Inah, Paking and Jojie, Cacoy and Marife, Mano Tito and Mana Belen, Jun and Remy, Mally, Assy and Yheng, Mando Pagliawan, Mano Alger, Mano Intoy, Mano Moling, Tony and Faus, Gorgonio, Dando, Ernie and Ernesto for their moral support, invaluable help and cheer.

His Parents-in-law, Mr. and Mrs. Antonio Oliva, brothers-in-law, and sisters-in-law for their wholehearted prayer and financial support.

His parents, Mr. and Mrs. Dionesio Velasco, his brothers and sisters for their love and concern.

Last but not least, Imelda, his loving and considerate wife who has served as his inspiration in finishing the study.

LAPS

Dedication

This humble work
is dedicated to all I have owed
so much in finishing this study. . .
my father & father-in law,
DIONING *and* TONY,
my mother and mother-in law,
TOYAY *and* AMPANG,
for their never ending love
and spiritual support
and guidance. . . ,
my very best friend,
WANNIE
for his endless
cooperation;
my friend
TOTO
for his
advice and assistance,
and to the most person who
shaped and changed my life,
my wife
IMELDA

LAPS

ABSTRACT

This study is an attempt to device and improvise a multi-scale tracer, and to determine its feasibility and effectiveness. This gadget is ideally suited for the accurate transferring, reducing and enlarging of drawings, lot plans, patterns templates, pictures, trade signs and drawings without scales. It also has its particular advantages in terms of quickness because of its extraordinary simple design and easy handling. It is operated by just pushing forward, downward and sidewards using the transmission ratios, pole at end and pole in middle in order to come out the desired size of the design. This gadget is made out of locally discarded materials mostly aluminum and small parts of staedtler barrel and iron materials which can be found anywhere in the locality or in any automotive shops. Based on the testing and demonstrating of the completed gadget, the researcher found out that the students acquired more knowledge and skills in drawing/drafting techniques with the use of the improvised multi-scale tracer as a working model for an efficient and functional teaching and learning process on the basic skills in drawing/drafting laboratory. The use of the improvised multi-scale tracer remedies the difficulties of the students especially in making their project in drawing/drafting and enables them to submit their projects on time.

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Chapter 1

THE PROBLEM: IT'S BACKGROUND

Introduction

Researchers believe that societies with a high degree of technological development are becoming richer. In fact, according to Angeles S. Santos (1991), societies that have not developed technologically have remained poor. However, the technological means of providing men with their needs are available and will increase. Society must now learn how these technology can best be used.

Educators believe that the school should help students grow and learn all that they can for their own benefit. Some believe that the main purpose of education is to give the students an understanding of the country they live in and encourage them to work towards solving the country's problem.

The Samar State Polytechnic College (SSPC), through its mission statement is in conformity with this belief, although it is meeting some local problems -- one of these problems is financial.

Due to financial constraints, the SSPC especially the drawing/drafting technology department under the technical vocational program of the college, were

confronted with problems on the inadequacies of instructional facilities like books, tools, drawing instruments and equipment for instructional purposes in order to keep the students well-informed with the advancement of trends.

The researcher, having been a Drawing and Drafting Technology teacher for the past eight years, was beset with complaints from the students with regard to drawing and drafting facilities. Some would not participate and some could not submit their work on time due to lack of interest as well as lack of drawing instruments. On the part of the students, they cannot afford to buy tools and equipment in drawing/drafting due to high cost of prices. So, this prompted the researcher to dig deeper into the problem.

To the researchers' analysis and understanding, the solution of the problem is vested on the need of tools and equipment to support the teaching and learning techniques, for it would be very boring and wearisome on the part of the students and instructors if nothing can be seen or turn into shape the words they are hearing.

According to French and Vierck (1975: 115), "the best way to learn to read a drawing is to learn how to make

one". Based on this maxim, the students certainly cannot perform splendidly and ingeniously on their task if nothing is seen or is taking place. Consequently, if our objective as teachers in the drawing/drafting department of the Samar State Polytechnic College is to mould the students to become serviceable and productive in the society today and for the future, then, this should become a challenge to us, teachers, to pursue improvisation of machines or gadgets to help alleviate the ever-growing problem of inadequacy and inavailability of tools and equipment.

One of the biggest problems is how to get equipment for instruction. In order to solve this problem, there is a need to improvise equipment utilizing local and inexpensive materials that will facilitate effective instruction.

As cited by Pagli-awan (1987), Santos (1964) states that:

> We are now ready to construct very much improved and accurately planned, and carefully improvised gadgets aimed at better teaching of science and classroom and workshop laboratory with your help, your sympathetic attitude plus the effort of scientist and science lover. We will make the teaching of science as modern, as effective as practical and as functional as it ought to be for a young country like ours. Discovery method, critical thinking, do-it-yourself method, self activity, all

> these are reinforcements of old teaching principles suplied in our laboratory classes. First, the leader take full advantage of the adequate apparatus improvised and constructed out of inexpensive materials. . . . a boast to effective teaching.

Although, there are new expensive and sophisticated machineries that are found in some of the shops/laboratories in the Samar State Polytechnic College, the drawing/drafting technology department, has a dearth of these equipment.

This demand gives challenge to the researcher to look for ways and means to overcome the problem arising in the drawing/drafting department affecting the students. To contribute to the solution of the problem, the researcher made this study of constructing an improvised multi-scale tracer that would partly solve the problem of lack of instructional devices and would help the students especially those who cannot afford to buy a complete set of drawing/drafting instruments.

Larzon (1959: 34), pointed out the vital role of the teacher in upgrading shop facilities for the development of students in the technical field. He further stressed that facilities for technical education must provide an environment which will inspire and challenge the youth and adults to meet the urgent needs of workers and

opportunities in the technological field as well as the essential equipment for teaching and learning process.

Along this line, this improvised gadget could somehow augment the new trend in industries in which T-square, triangles, protractor for scaling and graphing are commonly used. The development of improvised multi-scale tracer would not only help students in scaling and graphing but it could also help in the accurate transferring and enlarging of drawings, lot plans, patterns, templates, pictures, trade signs, and drawing without scales, without using the necessary tools like T-square, triangular scale triangles and protractor.

This gadget can minimize also the problems encountered in giving instruction specially in practical demonstration and operation because it is quite impossible for instructors, particularly in a vocational institution using words alone to convey their ideas in the teaching and learning process without giving them something that could somehow give interest on the part of the students. However, as a result of this study, or with this improvised multi-scale tracer, the problems and needs of the teachers in drawing/drafting department, and students, probably, may now be answered hence this improvisation.

Objectives of the Study

This study is aimed at attaining the following:

1. To develop, design and construct an improvised multi-scale tracer out of locally available materials using tracer lens, melted aluminum wire, aluminum scrap, and cast iron.

2. To test and demonstrate the functionality of the improvised multi-scale tracer.

3. To provide a portable gadget readily available for instruction.

4. To enhance savings by producing improvised drawing/drafting gadget instead of purchasing expensive one in laboratory works and instructions.

5. To contribute to the policy of the national government of promoting self-reliance.

Theoretical Framework

Based on some studies, instructors should not limit their source of study materials to textbooks alone, but to use other means such as designing and constructing instructional gadget to facilitate the teaching and learning process. This was also anchored on the theory enunciated by Albarracin (1974: 69), which states that teachers should have the initiative, imagination, skill

and know-how in the improvisation of the needed equipment to augment what are already found in the laboratory.

It was also underscored by Belen (1952: 60), that the importance of educational device that will augment shop or laboratory instruction is a project that will develop skills in the use, upkeep, and repair of this equipment.

In this regard, Secretary of Education and Culture, Juan L. Manuel (1970), when he was still Director of Public Schools said:

> In the field of education, we seem to be quite conservative in our approaches, in our ways of accomplishing our objectives... And so, if educators and educationists will solve the mounting problems of education, steps that are as creative, as inventive, as innovative as those that are now being used in agriculture, industry, medicine, and other lines of human endeavor should be taken.

In effect, this means that we cannot make any change without the support of research and that any form of educational innovation or thrust should be conceived of not just for the sake of change, but rather for the sake of solving problems and of improving the total educational program.

As enunciated and fielded also by the former Minister of Education, Culture and Sports, Minister Onofre D. Corpuz in his Memorandum (1982), which states:

> Vocational Teachers and Instructors and Professors, initiative and creativity in the improvisation of needed machineries and equipment in the laboratory are of paramount importance in making classroom instruction more effective and efficient.

This idea underscores the need of improvised gadgets. The understanding and learning of concepts and principles in Drawing/Drafting Technology can be made effective with actual performance of various technical skills. The difficulty in meeting the problem lies in the prohibitive cost of equipment which are mostly imported.

Conceptual Framework

Guided by the authorities aforementioned, this study was undertaken in order to come out with a working model of a project that will cater to the needs of drawing/drafting technology students of the Samar State Polytechnic College at a minimal cost. Utlimately, this will motivate also, anybody especially those who have no interest in drawing/drafting from simple to complicated designs of drawings to appreciate the operation. They will be highly enthusiastic with the game-like operation that they will be encouraged to seek out new levels of achievement in related areas which they may have earlier thought of as impossible.

The conceptual framework which guided this study is shown below:

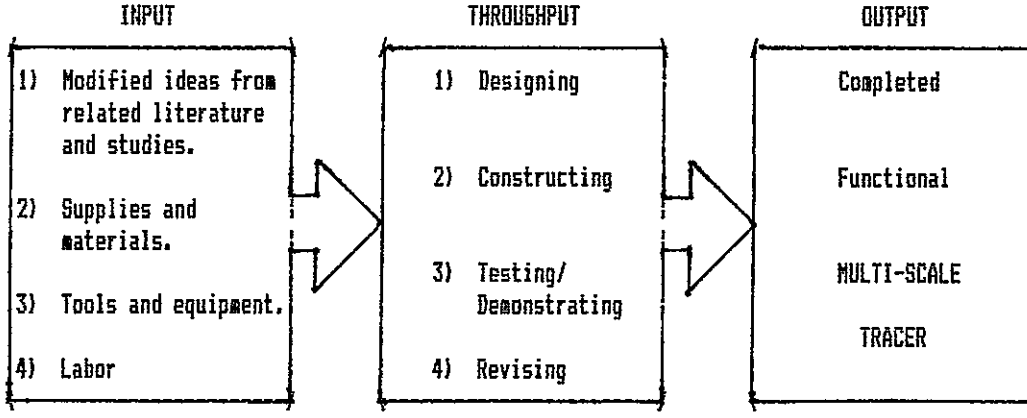

Figure 1. Schema showing the input, throughput output approach attaining the ultimate goal of the study.

The paradigm shown has three major frames which represent the flow of the study.

The first frame contains the input variables which are the varied ideas encountered through reading of related references from which the researcher was able to derive the idea of improvising a drawing gadget. Also in this first frame are the necessary supplies and materials for the construction of the gadget including labor.

The second frame indicates the throughput variables which are designing and constructing the physical features of the gadget. It also included testing and demonstrating the gadget after the construction, and revising the parts that do not operate accordingly to its specified function.

The third frame is the completed functional multi-scale tracer successfully attaining the ultimate goal of the study.

Statement of the Problem

This study is an attempt to device and improvise a multi-scale tracer, and to determine its feasibility and effectiveness. Specifically, it seeks answer to the following questions:

1) What are the machines, tools, supplies and materials needed in its construction?
2) How is the gadget constructed and operated?
3) What are the functions of the improvised multi-scale tracer?
4) What are the advantages of the improvised multi-scale tracer?
5) What basic operations can be performed by this improvised multi-scale tracer?

Assumptions

This study justifies the following assumptions:

1) The students can acquire more knowledge and skills in drawing/drafting course.
2) The students can make their own gadget before or after graduation for their own use based on what they will observe on the construction of the gadget.
3) Instruction can be more effective, efficient and economical with the use of the gadget.

Significance of the Study

The improvisation of the multi-scale tracer will give benefits to students, teachers/ instructors, parents, school administrators, and others especially those who enjoy sketching & tracing, and other artful creations.

To the students. The improvised multi-scale tracer can enhance the interest and understanding as well as remedy the difficulties of the students especially in making their projects in drawing/drafting. The students will be able to submit their projects on time with enthusiasm for the succeeding projects to start immediately. They can make their own gadget for

their own use and purpose and it could be brought to their respective homes, because it is handy. So it can be used even in the rural communities where there are no electrical powers.

To the teachers/instructors. This improvised multi-scale tracer can serve as an immediate answer for an efficient and functional teaching-learning device in the teaching and learning process specifically on the basic skills in drawing/drafting laboratory.

To the parents. This will help them reduce their budget in buying drawing instruments for their children for it has the functions of a T-square, protractor, triangles and triangular scale.

To the school administrators. This will answer the problem of inadequate instructional materials for instructional purposes. This gadget will also serve as an income generating project for it is within the financial capabilities of the school to finance the project by mass producing and selling it to the public or to the students at a lesser price affordable to them.

This multi-scale tracer, has a multi-function, hence it is ideally suited for the accurate transferring, reducing and enlarging of drawings, plans, patterns, templates, pictures, trade signs and drawings without scales.

This study will cater not only to the drawing/drafting students of the college but also to surveying offices, for civil and mechanical engineers, for designers, architects, commercial and advertising artists and most especially for technical schools.

It has also its particular advantages like: 1) Quick and accurate working because of a simple design and easy handling; 2) Little resistance to motion, absolutely uniform in all directions; 3) No need for the working surface to be especially level or even; 4) Very little space required; and 5) Could be set up in one minute only.

Hopefully, this project will be able to help the vocational instructors especially in the drawing/drafting department to simplify and facilitate demonstrations of basic skills on the use of this gadget.

Scope and Delimitation of the Study

This study concerns mainly on the improvisation of a multi-scale tracer. It includes the following: designing, constructing, testing/demonstrating, revising, specifying of materials used, the cost of production, and procedure of improvised gadget.

This gadget utilized local and discarded materials such as lens, melted aluminum wire, aluminum scrap and cast iron. The function of this multi-scale tracer is only limited to transferring, reducing and enlarging of drawings, lot plans, patterns, templates, pictures, trade signs and drawings without scales.

Definition of Terms

In order to establish a common frame of reference for the researcher and the readers, the following terms are defined operationally as used in this study.

Annular Marks. Is a center point of the tracer lens that traces marks and lines from the original drawing.

Artful. This term refers to a person exhibiting art or skill, fondness of art, or artistic.

Bars. A flat and long pieces of metal that forms a parallelogram.

Chamfer. A flat surface made by cutting of the square edge of a metal about 45^{o}.

Drafting Machine. The machine consist of a mounting bracket an upper arm, a lower arm and a head that includes a handle for positioning the machine.

Drawing Board. A flat soft wood usually made of white pine to prevent warping which is used to provide a smooth surface in making a drawing.

Drawing Head. Is used for marking of transferred lines points and arcs from original drawing.

Enlarge. To reproduce on a larger form of lines, pictures, trade signs, and etc.

Knurl. A small ridge as one of the series on the edge of a metal coin.

Lead. A thin cylinder or stick of marking substance (as graphite) in or for a pencil.

Mold. A hollow form for giving a certain shape.

Multi-Scale Tracer. It is an instrument composed of several flat pieces of metal joined in such a way as to form a parallelogram which is used for reducing or enlarging drawing in any proportion.

Orientation Lens. Used to magnify small marks, points, etc.

Parallax-free. Free to an apparent change in the direction of an object, caused by a change in observational position that provides a new line of sight.

Pen. A device used in writing or drawing with ink.

Pin. A needle like which fasten the pole weight.

Pole Weight. Is a stationary or pivot that holds the four bars in moving upward, downward and sideward.

Protractors. It is an instrument used for laying off or measuring the degrees of an arc. It is commonly semi-circular, made of plastic or metal and is usually graduated to half degrees. The graduations are numbered from each side up to 180^{o}.

Reduce. To lessen the size or scale.

Rivet. A metal bolt used to fasten parts together.

Scale. A series of marks along a line in measuring. It is usually made of plastic and sometimes of boxwood or metal. This scale has six edges on which various scales are engraved or stamped.

Spring. A device as a coil or wire that returns to its original form after being forced out of shape.

Templates. Is made of paper, cardboard, metal, and plastic with opening in them shaped to represent the outline of various symbols and fixtures.

Thread. Is a uniform section in the form of a helix on the external or internal surface of a cylinder or cone.

Tracer Arms. Arms forming parallelogram and has a pilot which follow and guide the heads.

Tracer Head. Is used for tracing lines, points, arcs from original drawing.

Tracer Lens. A lens that traces lines, points or marks.

Transfer. To convey from one surface to another.

Triangles. Are flat pieces of plastic, triangular in shape, first type is known as the 45^{o} triangle. The second type is known as the 30^{o} & 60^{o} and is sometimes called 30 x 60 triangle.

T-square. is an instrument used to draw parallel lines. It is made up of a head and a blade and angles to each other, forming a t-shape for which it is named.

Turn. To cause to move around in order to achieve a desired result.

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter covers the review of related literature and studies and specified some of the brief summary of several unpublished seminar papers, periodicals, speeches, books and other sources of information relevant to this study. The ideas, concepts, and principles cited in this review will support the idea that improvisation of gadget or machine is very effective in solving problem of inadequacy and inavailability of tools, machineries and equipments.

RELATED LITERATURE

A study of the history of civilization will show that science and technology enabled mankind to advance rapidly especially after the advent of the industrial revolution. The invention of the steam engine marks the beginning of the series of achievement which is self explanatory.

In the early 40's and 50's, a notable reproduction and invention began. One of these inventions was the drawing board. This drawing board is made of soft wood such as basswood or pinewood in which thumbtacks is used

to fasten drawing paper. Drawing board is usually made with a cross strip on each end of the board to prevent warping and splitting. The edges must be straight, smooth and square to provide a working edge for the T-square.

According to Newkirk (1967:5), this drawing board which was improvised to drafting machine, eliminates the basswood or softwood for thumbtacks purposes and not necessarily made with a cross strip on each side or end to prevent warping and splitting. This machine is made from aluminum and plastic materials. (See Figure 2)

Simpson (1972: 2), also added that improvisation is feasible. Simple locally made apparatus will enable the students to understand the basic principles more easily and make the students aware of those scientific principles applied to everyday life. He further stressed that apparatus need not be highly sophisticated in order to illustrate the concept of science.

On the other hand, Seymour (1966: 20), stressed that the human skills and the capacity to acquire it have been fundamental throughout the progress of mankind. Skills are not innate but their acquisition is one feature that characterizes living things as opposed to non-living one in their capacity to learn. He added that men is a tool

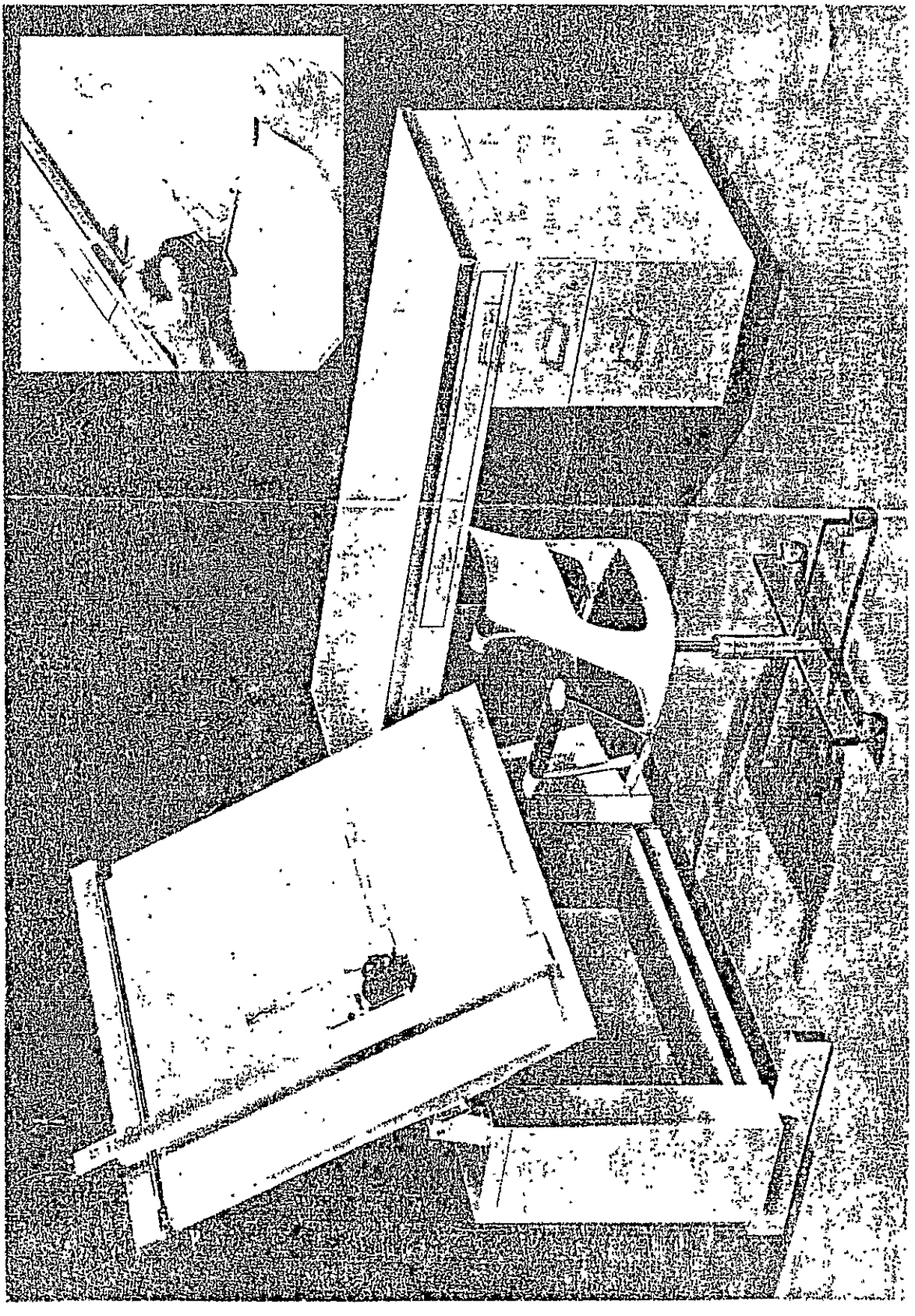

Figure 2. DRAFTING MACHINE

making animal. The manifestation of skill among primitive men was recorded in the products they left behind, and which were uncovered by archeologists. Thus, the discovery of simple tools in burial places leads to the conclusion that they had the capacity to make use of tools which were found.

However, Toffler (1984: 31), states that the technology of tomorrow, 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 instruction as well as the economic crisis we are facing now. Vocational and technical courses are designed to provide the youths with knowledge, skills and attitudes that will enable them to enter occupation.

Meanwhile, Weaver (1960: 2), declared that the primary problem in vocational education is the teaching of an occupation, consisting of many manual skills. He

further 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 from generation to generation, then it is the particular study of the trade technical teacher to transfer these hand skills.

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

In the field of vocational education, the upgrading of technology education is being done through scholarship program at all levels of specialization. Basic scientific equipment for schools are being developed to promote interest in technological aspect and to make teaching more meaningful to our youth.

In relation to this, Rotmans (1950: 1), stressed that decades ago, most manufacturing was done by hand. Wool was spun and cloth was woven by hand-operated devices in the homes. Implements of metal were forged by hand. As population increased, the demand for wool cloth was

greater and men begun experimenting with machines for spinning and weaving. The first machine for weaving cloth were made of wood but these were not durable and wore out quickly. Machines and metal, mostly iron, were then built because they resisted wear and lasted longer.'

Another manual skill was proven by Faires (1980: 407), who states that bevel gears are used to connect intersecting shafts, usually but not necessarily at 90 degrees. Its teeth are subjected to match 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 the 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.

James (1988: 85), on the hand, emphasized the importance of motion to that the acceleration of the moving part is becoming more important. According to him, the inertia forces produced by the acceleration of the links in a machine maybe of a high magnitude and in some cases, at a certain position, maybe higher than the forces produced by the working medium. The obtaining of the

acceleration of parts in the links of the machine is pre-requisite to the making of inertia force analysis of the machine.

It was during the 22nd SEAMEC Conference, when Minister Pehin Datu Abdul Rahman Taib of Brunei Darussalam in his address at the first plenary session (1987), noted that because of the continued impact of a world recession, limited resources had to be directed to high priority projects which could meet the regions emerging needs for skills upgrading. A balance would have to be struck between "striving for accomplishments beyond financial constraints on the one hand, and of being slumped into static ineffectiveness because of the gloomy prospects of economic recovery, on the other hand."

In addition, Townsend (1947: 1), emphasized that the principal reasons for the development of man through the ages to the point where he became able to make use of the forces of nature for his own benefit is the ability, which he and only he among living things possesses of inventing, making and using tools. He further stressed that the invention of steel square those times to make different parts of the work true and square will fit together properly for easier work for the carpenter, as well as the

slide rule for the engineers; hand books of rules and tables for the officeman; and T-square for the draftsman.

On the other hand, Hepler (1971: 137), added that the function of T-square is of two scales; one which performs parallel slide in drawing horizontal lines and the other scale is the vertical scale which performs the function of a triangle in drawing vertical lines.

In a terminal report on Industrial Arts Teachers Education in Iloilo School of Arts and Trades (1964), conducted by the Bureau of Public Schools at the Stanford University, it 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 simple tools and devices that can be used to increase production to aid home industries and improve the shop program.

Also, during the convention on Youth Participation in Improving the Quality of Life, Dr. Quintin L. Quintanar (1982), stated that, "Man using his God-given intellect, has always strived for the improvement of the quality of his life". It is this same intellectual capacity that has provided him the means towards this end through science

and technology. Science enables him to use these principles and harness them for his own purposes.

It is in the relevance of these related literatures that the researcher thought of the idea to make a design and construct an improvised multi-scale tracer that gives multi-purpose function in transferring, tracing drawing in full size as well as enlarging and reducing drawings, plans, pictures, patterns, templates, trade signs, and drawings without scales to make instruction real and the solution to the teaching-learning problem in the drawing/drafting technology.

The theories and principles adapted by the researcher from the different authorities finally shape-up this technical study.

RELATED STUDIES

Prior to the formulation of this study, a thorough research has been made to find out if there has been already an existing study about this improvised multi-scale tracer which is the same function as in pantograph machine, a commercially made machine. The research showed that there was one circulating in the market with limited functions. It is then that the researcher is atempting

to design, to enable to understand and further enhance the importance of this gadget.

It cannot be denied that at this time of inadequacy and inavailability of tools and equipment, vocational school teachers are encouraged to improvise machines or gadgets as the best solution to facilitate the teaching and learning process which is feasible and economical. Several educators or researchers have ventured into some improvisation in the past decade. Such is the study of Ativo (1984), entitled "Portable Hand Shaper: A Technical Feasibility Study", which was concerned with the design, construction, use, and function of a working model -- a portable hand shaper to partially solve the problems met in machine shop.

Another improvisation was made by Cabilogan (1984), in his study 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.

It is a common knowledge that technical innovations are implemented and adapted through a series of phases. First, some have an idea that it is good, then the idea goes to a technical problem-solving stage in advancing to design and development. Finally, its completion fills a significant social need.

Meanwhile, the seminar paper of Cuna (1984), entitled, "An Instructional Saw-Sander Machine", was constructed and found to be effective in performing sawing and sanding operations in the civil technology classes in Samar State Polytechnic College.

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

However, Orale (1985), in his technical feasibility study entitled, "Multi-Purpose Wood Working Machine", was concerned with the design and construction use and functionality out of locally available materials using wood and metal parts. The significant findings of this

study is that, the machine can perform operations similar to those performed by commercial and imported machines found in industries. This will also help solve the problem of inadequacy of instructional machines in civil technology at the Samar State Polytechnic College.

Another gadget was improvised by Cardoso (1986), entitled "Integrated Electronic 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 solve the insufficiency of laboratory training aids.

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

a) Designing and constructing of the 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 shop teachers or instructors, and the students.

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

a) The college should support the teachers and instructors who possess 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 for commercial use.

Several researchers have tried themselves to conduct studies on this field. 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 the product of continued research and ingenuity, could help in the world crisis on energy conservation.

Yet, another invention was made by Cabuatan (1988: 44), a cooking stove that could be made into a multi-fueled stove at a very low cost. Charcoal, firewood, or sawdust can be used to make the construction more economical.

Still, Lara (1992), in his seminar paper conducted, designed and constructed "An Improvised Swing Saw Machine: A Technical Study". The development of this machine contributed to a better teaching in the civil technology class in Eastern Samar State College.

Pagliawan (1992), in his study, "An Improvised Multi-Purpose Mechanical Gadget: A Proposed Model", was primarily concerned to design, construct, use and test the functionality of an improvised multi-purpose mechanical gadget powered by a foot pedal or 0.50 H.P. motor. The following conclusions were made:

a) The gadget could help the teacher and instructors in Machine Shop Courses facilitate demonstration on basic skills, proper care, maintenance and safety precaution on the use of the machine.

b) The gadget can be mass-produced by the students with the supervision of the machine shop teacher or instructor.

c) The students could earn at the same time learn the skills in the construction of an improvised multi-purpose mechanical gadgets.

d) The construction cost of the gadgets is only amounting to P5,659.50 which the school can generate

savings from the fabrication of this machine because of the lower production cost.

Based on the aforecited conclusion, it is recommended that:

a) State College Presidents, Technical and Vocational School Administrators should encourage their vocational teachers, instructors and professors to improvise useful gadgets for instruction purposes to improve instruction in the shop.

b) State Colleges, Technical and Vocational Schools can make use of this study as a basis for the design and construction of their own improvised machine.

c) The material used in the construction of this study may be redesigned or modified to ensure longer and better performance.

d) The design should be patented at the Bureau of Patent in Manila, under the expenses of the school administrators or of the researcher himself.

Another study was conducted by Abalos (1987), that of improvisation of a "Rotary-Type Copier Printing Machine", which aims at solving some of the problem of inadequacy in white printing and facilitating the reproduction of original civil work plans.

The studies made by Ativo, Cabilogan, Cuna, Santos, Orale, Cardoso, Barredo, Cabuatan Lara , Pagliawan and Abalos are similar to the present study for the reason that their studies focused on the development of skills of the students through the use and invention of gadgets in order to enable them to get immediate employment after finishing the course. The foregoing studies show that inventions and improvisations are the key factors in overcoming the inadequacy of teaching materials and equipment for home and school use. The researcher therefore thought of the idea of designing and constructing a Multi-Purpose Tracer to meet the complaints and inavailability of tools and equipments in the drawing/drafting technology department of the Samar State Polytechnic College.

Chapter 3

METHODS OF CONSTRUCTION

This chapter provides an overview of the description of the gadget, supplies and materials, tools and equipment and construction of the gadget.

Description of the Gadget

This gadget consists of different parts such as bars or arms with a maximum length of 50 cm. long and a minimum length of 45 cm. long using aluminum with graduations in metric measurements that can reduce, enlarge and transfer plans, patterns, templates, pictures, trade signs and drawings without scales using table for setting various transmission ratios as shown in Appedix A. At the top left, pole weight is attached that serves as the pivot in the operation. At the end of the right arm or bar, tracer lens is inserted, and the bottom arm, drawing head is attached. The drawing head and the tracer are threaded for easy insertion and interchange as required for reducing, enlarging and transfering of drawings. This gadget operates by adjusting the joints by light thumb pressure towards the checking level and automatically fixed when releasing the pressure. A tracer lens bearing

a small annular mark with bright visual field and inclined eyepiece affords an exact and absolutely parallax-free tracing.

This gadget is composed of three functions, namely: (1) transferring; (2) reducing; and (3) enlarging of original drawing such as plans, patterns, templates, pictures and trade signs. It operates by moving or pushing the tracer or the drawing head forward, backward and sideward looking at the original drawing or plan to be traced.

Bill and Cost of Materials

Table 1 shows the quantity, unit, name and description, unit cost and total cost needed in the construction of the gadget.

The total cost incurred for the construction of the gadget as reflected in the list of materials and cost is P188.00. These materials are available in hardware stores, except the aluminum shaft that was used in the making of tracer head, drawing head and slide thumb press assembly were the discarded materials found in the machine shops here in Catbalogan, Samar.

Table 1

BILL AND COST OF MATERIALS

QTY.	UNIT	NAME AND DESCRIPTION	UNIT COST	TOTAL COST
2	kls.	Junk Aluminum	P 15.00	P 30.00
4	pcs.	10mm x 500mm long aluminum flat bars	5.00	20.00
2	tubes	Mighty bond	35.00	70.00
1	pc.	Hacksaw blade	10.00	10.00
1	pc.	Sand paper #400	8.00	8.00
1	pc.	Magnifying lens	50.00	50.00
		T o t a l		P188.00

Tools and Equipment

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

Table 2

TOOLS AND EQUIPMENT AND THEIR USES

Tools and Equipment	Uses
1. Pull Push Rule and Foot Rule	Takes correct measurements in the designing and assembling of parts.
2. Try Square	Takes correct level and angle.
3. Hack Saw	Cuts pipe and metal to sizes.

(Table 2 Cont'd.)

Tools and Equipment	Uses
4. Vernier Height Gauge	Measure height accurately.
5. Drill bits	Make holes on metals and parts.
6. Lathe Machine	Cut and shape shafting and threading rounded parts specified diameter.
7. Vernier Caliper	Checking inside and outside dimensions of a cylindrical stock.
8. C-clamp	Holding a piece of metal stock while cutting and filing.
9. Drill Press	Drilling large and small holes in a workplace.
10. Letter Punch	A tool used to punch letters.
11. Acetylene	Melts and molds discarded aluminum.
12. Jack Plane	Dressing rough lumber into finish stock.
13. Hammer	Driving and pulling nails.

Construction of the Gadget

The pictorial drawing of the improvised multi-scale tracer is shown in Figure 3. It illustrate and emphasize the dimensions, views, and details of all important parts of the gadget to be more tangible to the reader.

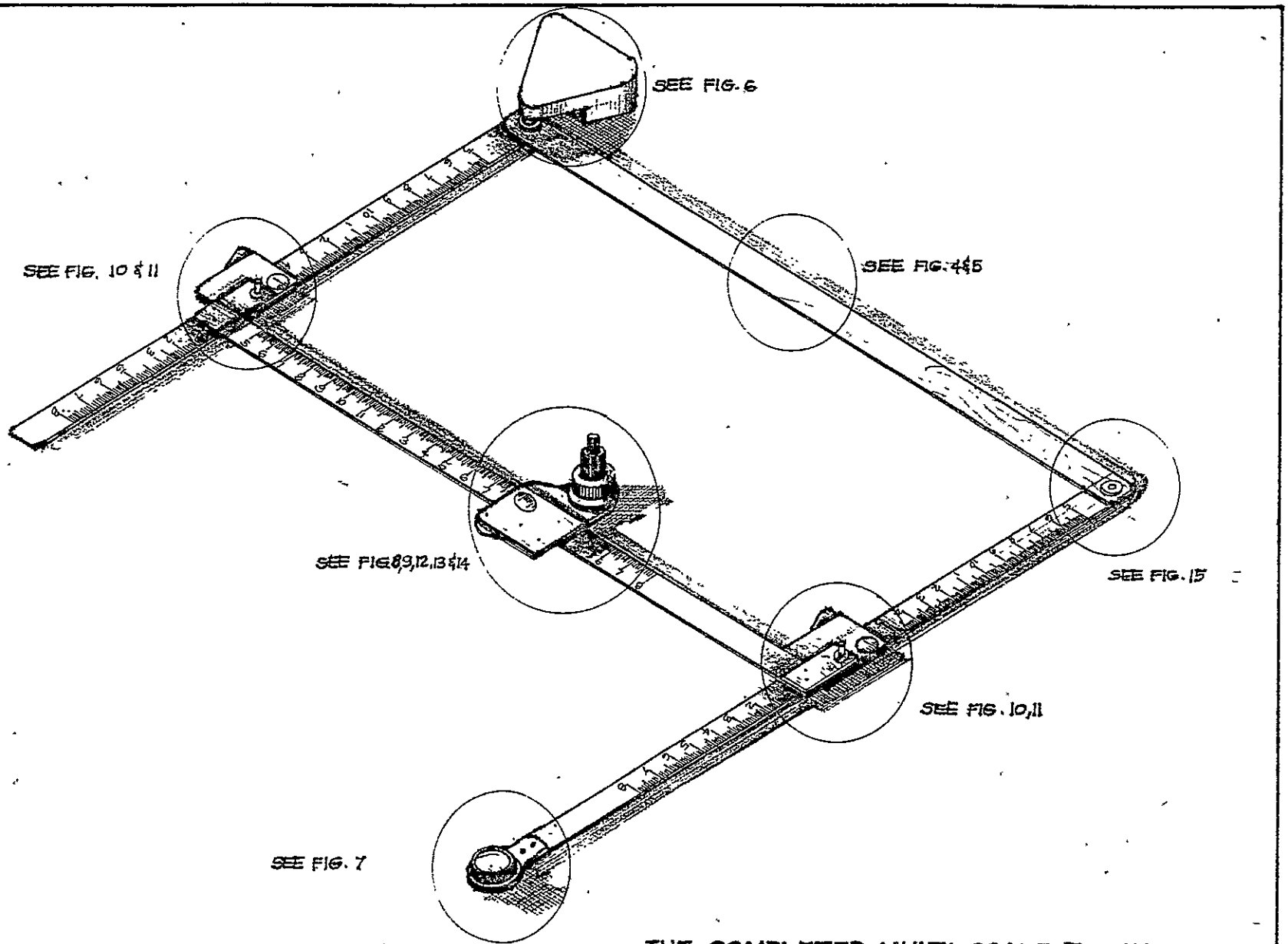

Figure 3. THE COMPLETED MULTI-SCALE TRACER

To start constructing the gadget, there are basic steps to be followed to minimize waste of time and materials in assembling the major and minor parts of the gadget. The basic steps are the following:

1. Make a rough sketch of the gadget and its accessories.
2. Check and redraw the revised plan.
3. Make the final drawing of plan and all details.
4. Prepare estimate of the bill of materials.
5. Canvass and purchase the supplies and materials according to estimate.
6. Prepare the materials needed and cut to dimension as stated in the plan.
7. Melt the junk aluminum and form to its specified measurements and diameter using vernier caliper.
8. Mark and draw lines for the graduation of the millimeter.
9. Cut and measure the graduation in millimeter level and parallel to vernier height gauge.
10. Prepare the punch for numbering.
11. Cut threads and turn the shaft to finish its proper shape and dimension using lathe machine.
12. Bore holes for the drawing head and the tracer from its specified diameter.

13. Knurl the parts of drawing head and tracer for easy handling.

14. Assemble bars or arms to its position.

15. Assemble thumb pressure to the bars or arms.

16. Attach pole weight, drawing head and tracer.

17. Check and test the feasibility of the gadget.

Construction Time Frame

Table 3 briefly describes the schedule of work and the time allotment for every activity.

Table 3

WORK ACTIVITIES AND TIME ALLOTMENT

WORK ACTIVITIES	TIME ALLOTMENT
1. Bars or arms assembling	2 days
2. Pole weight assembling.	2 days
3. Melting and shaping	1 day
4. Tracer head assembling	3 days
5. Drawing head assembling	2 days
6. Machining and threading	2 days
7. Slide thumb press assembling. . .	2 days
8. Socket assembling	1 day
9. Try-out	2 days
Total number of days. .	17 days

1. Bars or Arms Assembly. (Fig. 4 & 5)

Steps:

a. Prepare an aluminum flat bar measuring 50 cm. and 45 cm. long.

b. Mark and draw lines for the graduation in millimeter.

c. Cut and measure the graduation in millimeter, level and parallel to vernier height gauge.

d. Start the punch for numbering.

e. Drill a 9mm hole to the three bars.

f. Attached the three bars into a 9mm eyelit or socket.

2. Pole Weight Assembly (Fig. 6)

Steps:

a. Prepare a 0.10 x 0.2.54 cm. iron and cut into its specified design.

b. Draw a .05 cm. line and cut one half of its thickness.

c. Drill a 7mm hole for every side of the pole weight.

d. Insert the 7mm x 25.4mm bushing with pin into the three holes.

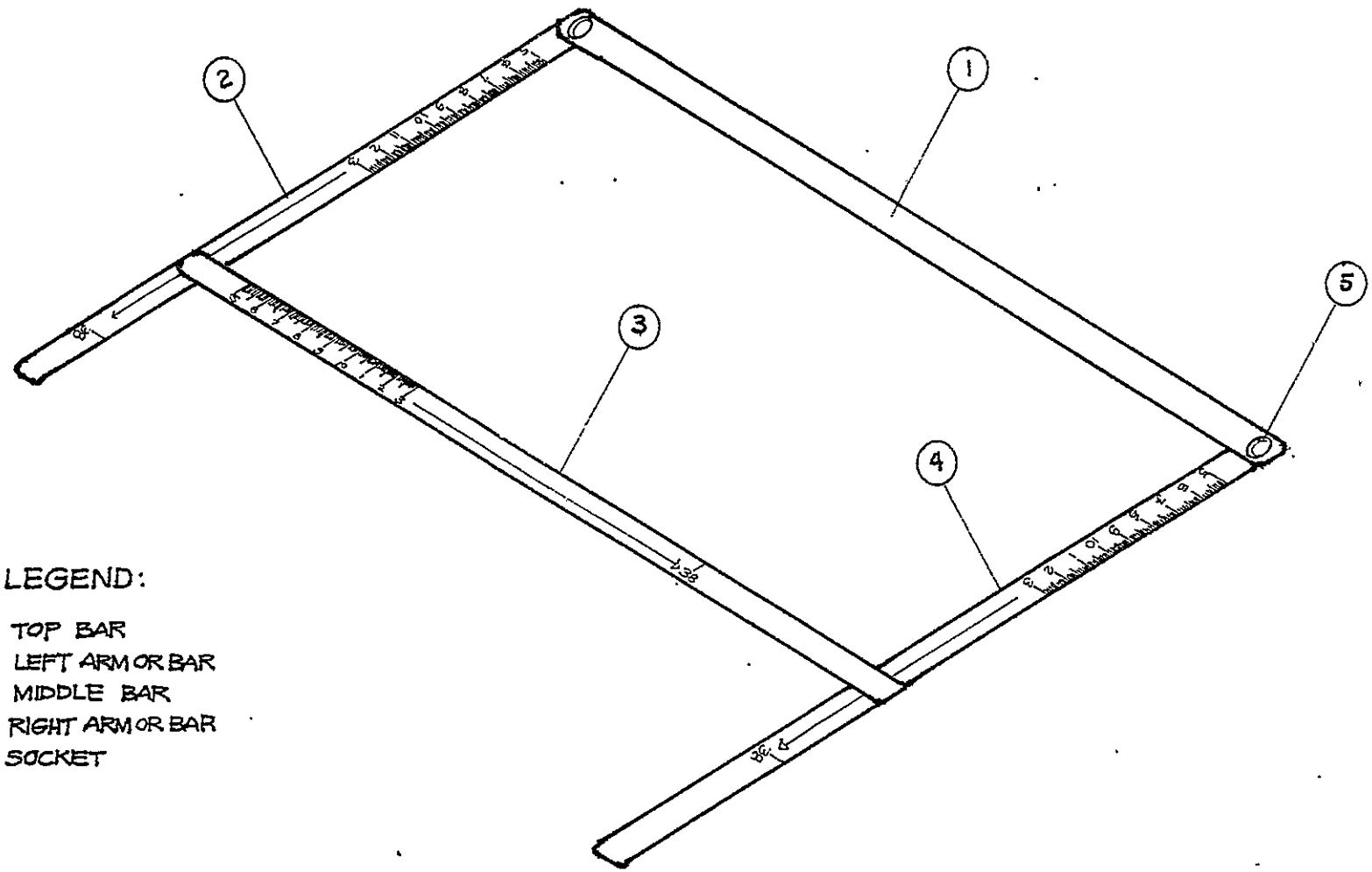

Figure 4. BARS OR ARMS-ASSEMBLY

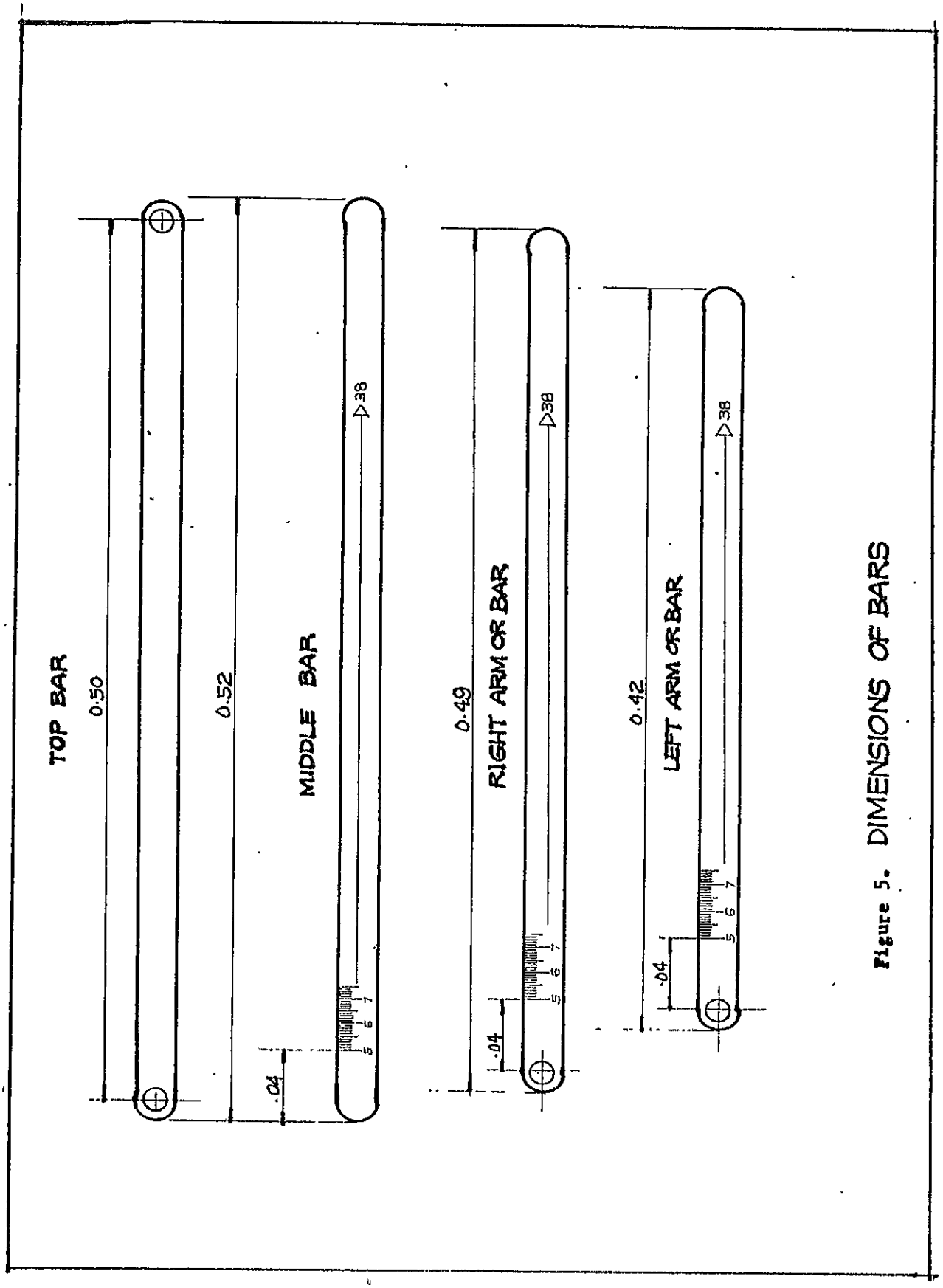

Figure 5. DIMENSIONS OF BARS

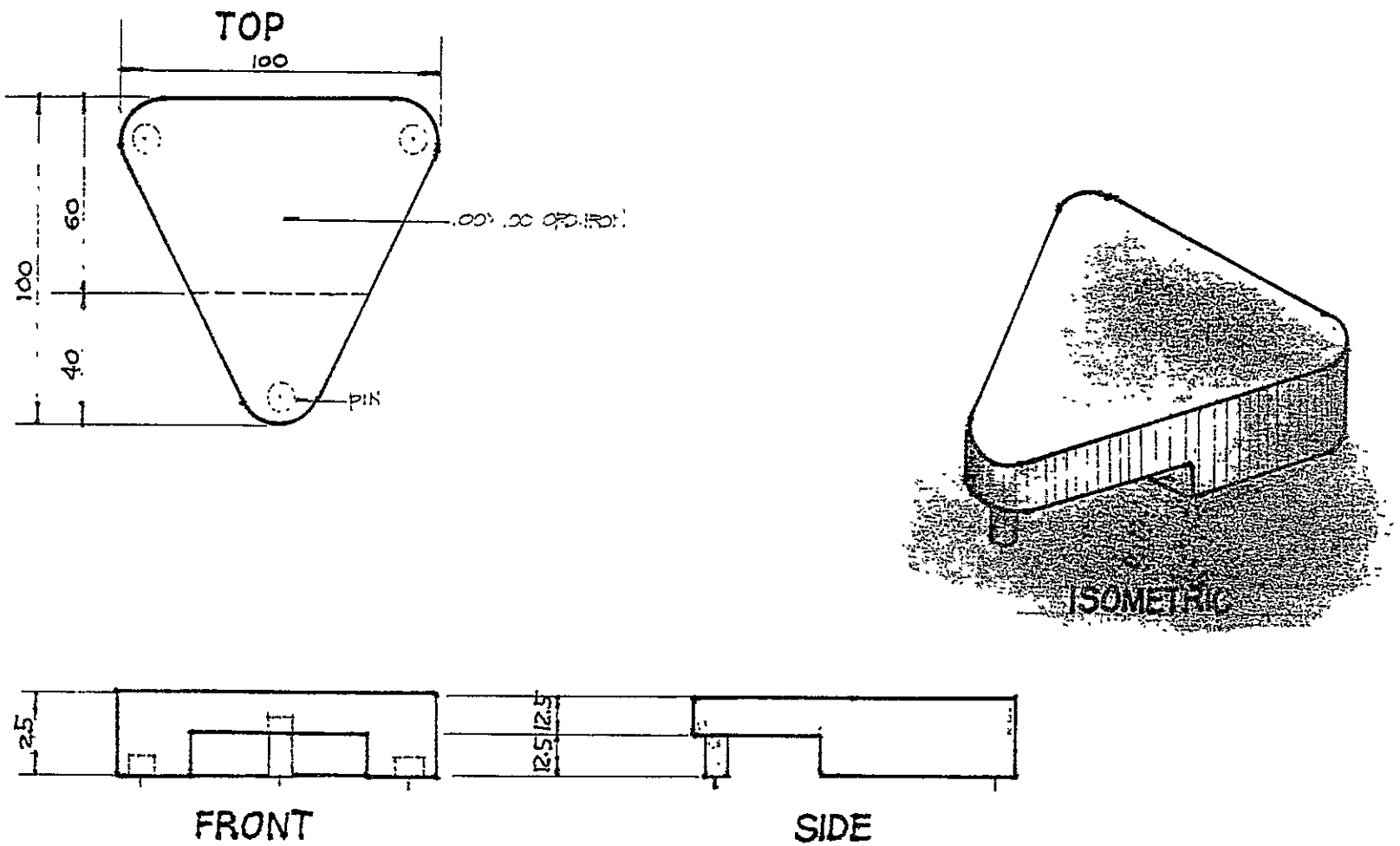

Figure 6. POLE WEIGHT ASSEMBLY

3. Tracer Head Assembly (Fig. 7)

Steps:

a. Prepare a 35mm x 20mm aluminum shaft.

b. Make an external thread on a 7mm distance from the edge of the tracer using 24 threads per inch (special thread).

c. Drill a 20mm hole and insert 20mm lens.

d. Drill a 30mm hole and insert 30mm lens.

4. Drawing Head & Doting Device Assembly (Fig. 8 & 9)

Steps:

a. Prepare a 35mm x 12mm aluminum shaft.

b. Make external thread on a 7mm distance from the edge of the drawing head using 24 threads per inch (special thread).

c. Drill a 2mm hole with a depth of 8mm.

d. Cut a 8mm long steadler cap and insert into a 12mm hole of the drawing head.

5. Slide Thumb Press & Base Plate Cover at Middle & Tracer Bar/Arm Assembly (Fig. 10, 11, 12, 13 & 14)

Steps:

a. Prepare a 0.55mm x 75mm x 3mm aluminum base plate and drill 30mm hole.

b. Prepare a 0.55mm x 55mm aluminum sheet and drill 15mm hole.

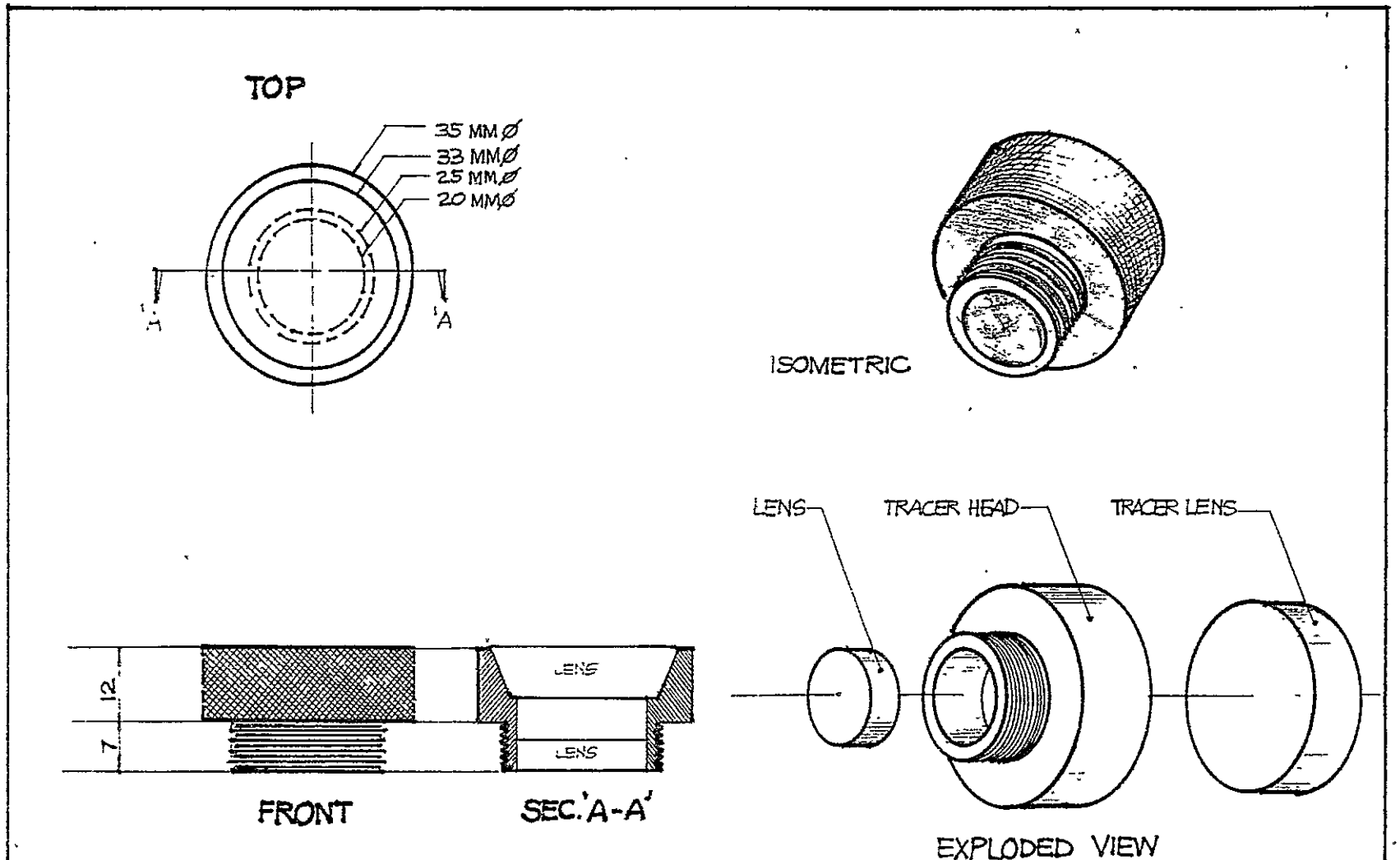

Figure 7. TRACER HEAD ASSEMBLY

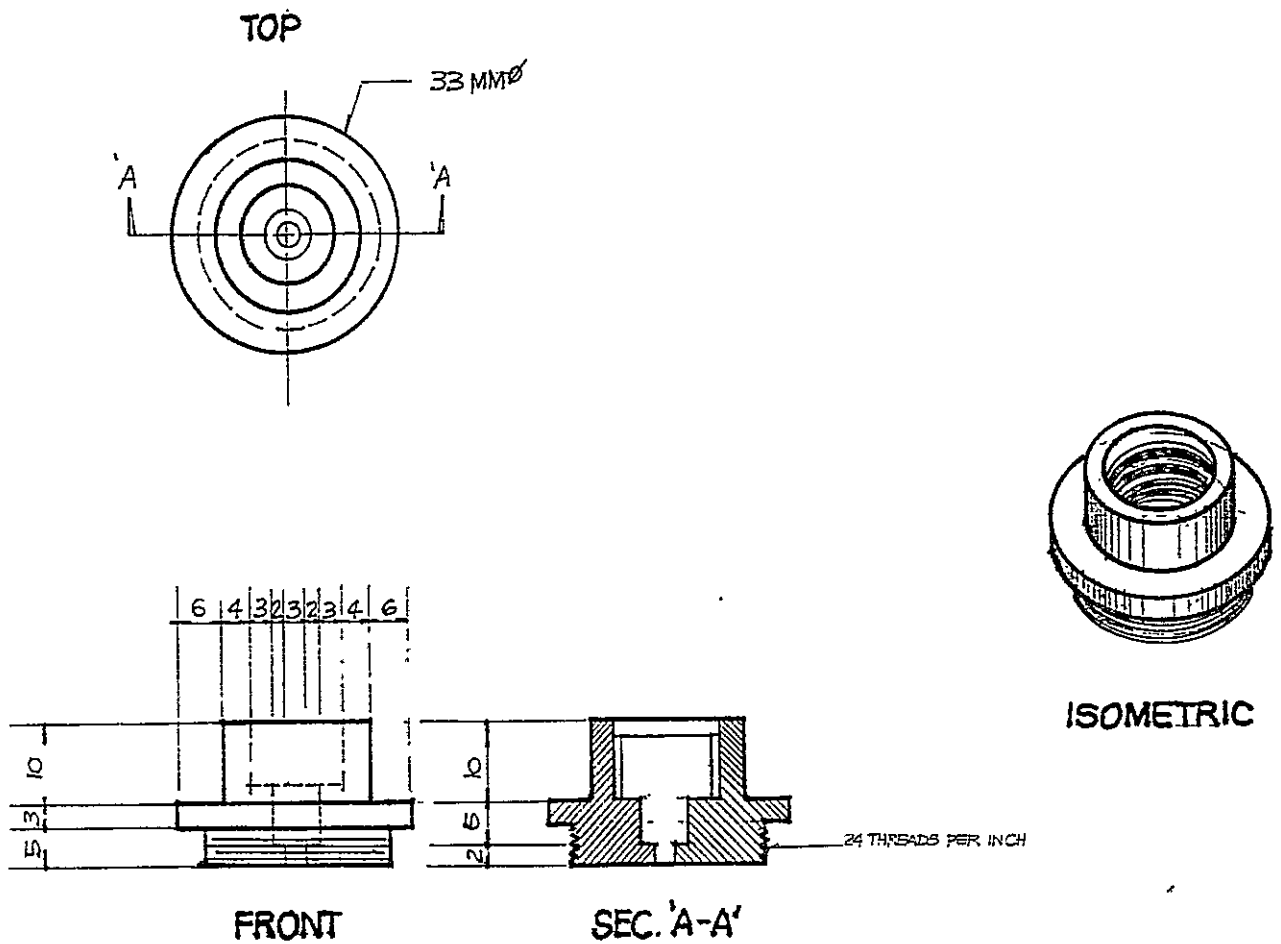

Figure 8 . DRAWING HEAD ASSEMBLY

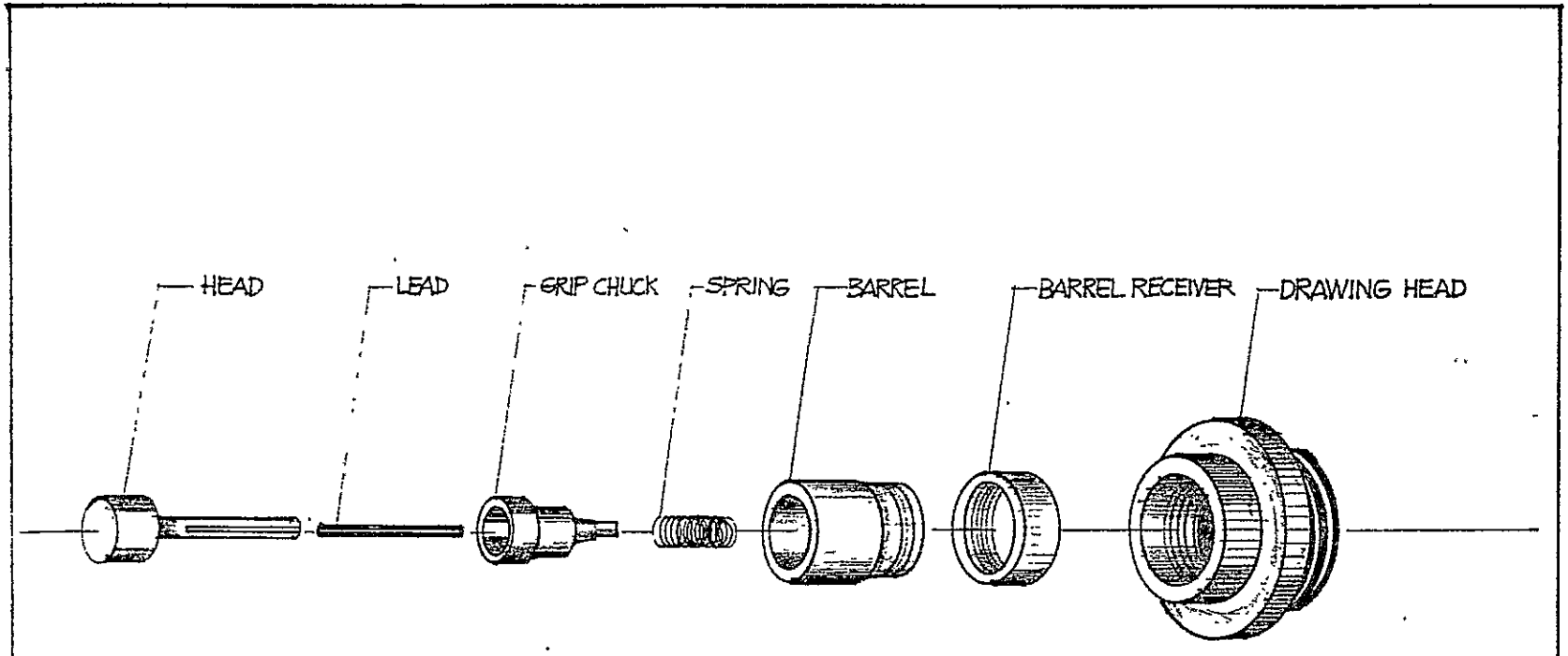

Figure 9. EXPLODED VIEW OF DOTTING DEVICE @ DRAWING HEAD ASSEMBLY

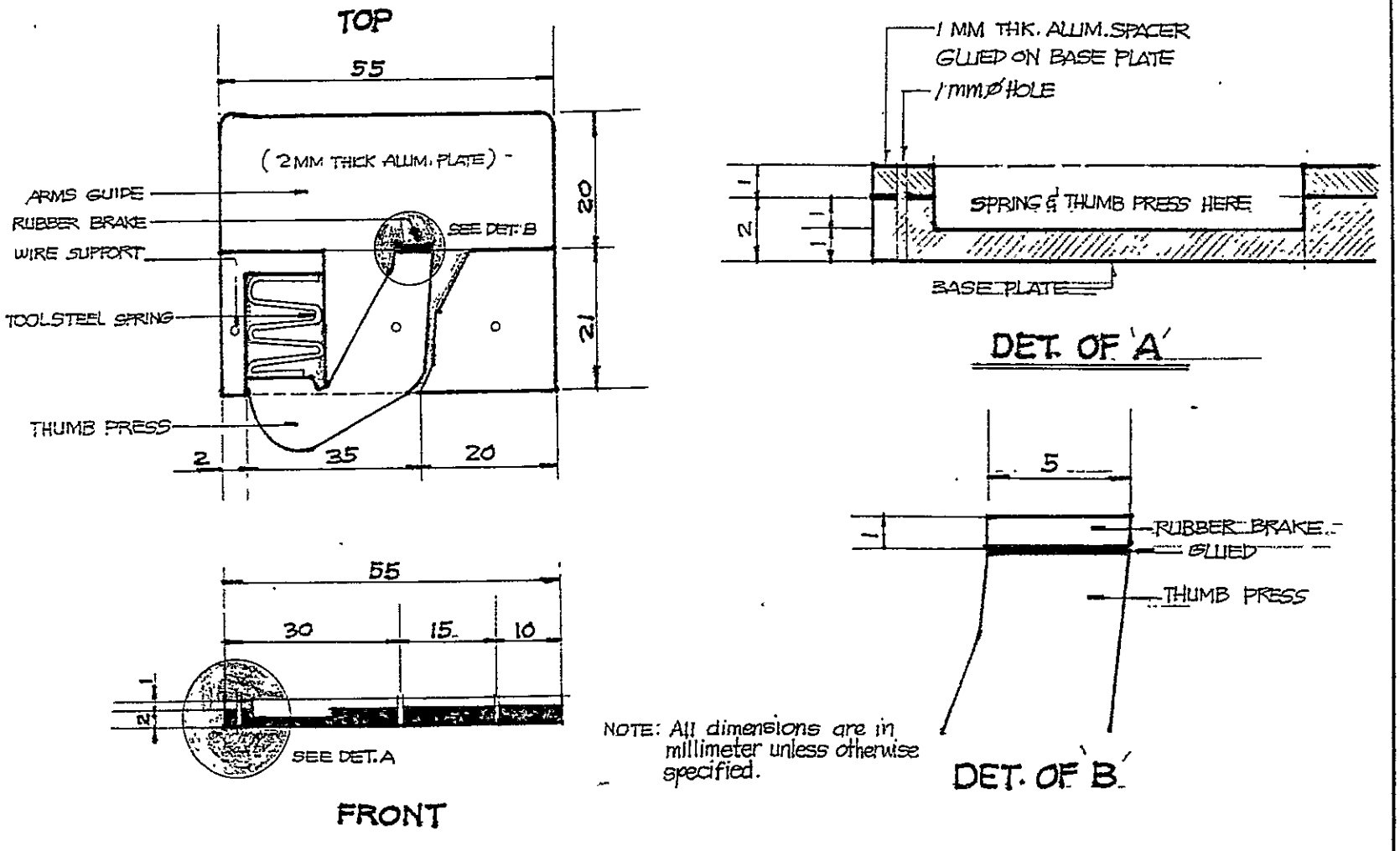

Figure 10. TYP. DET. OF SLIDE THUMB PRESS @TRACER ARM

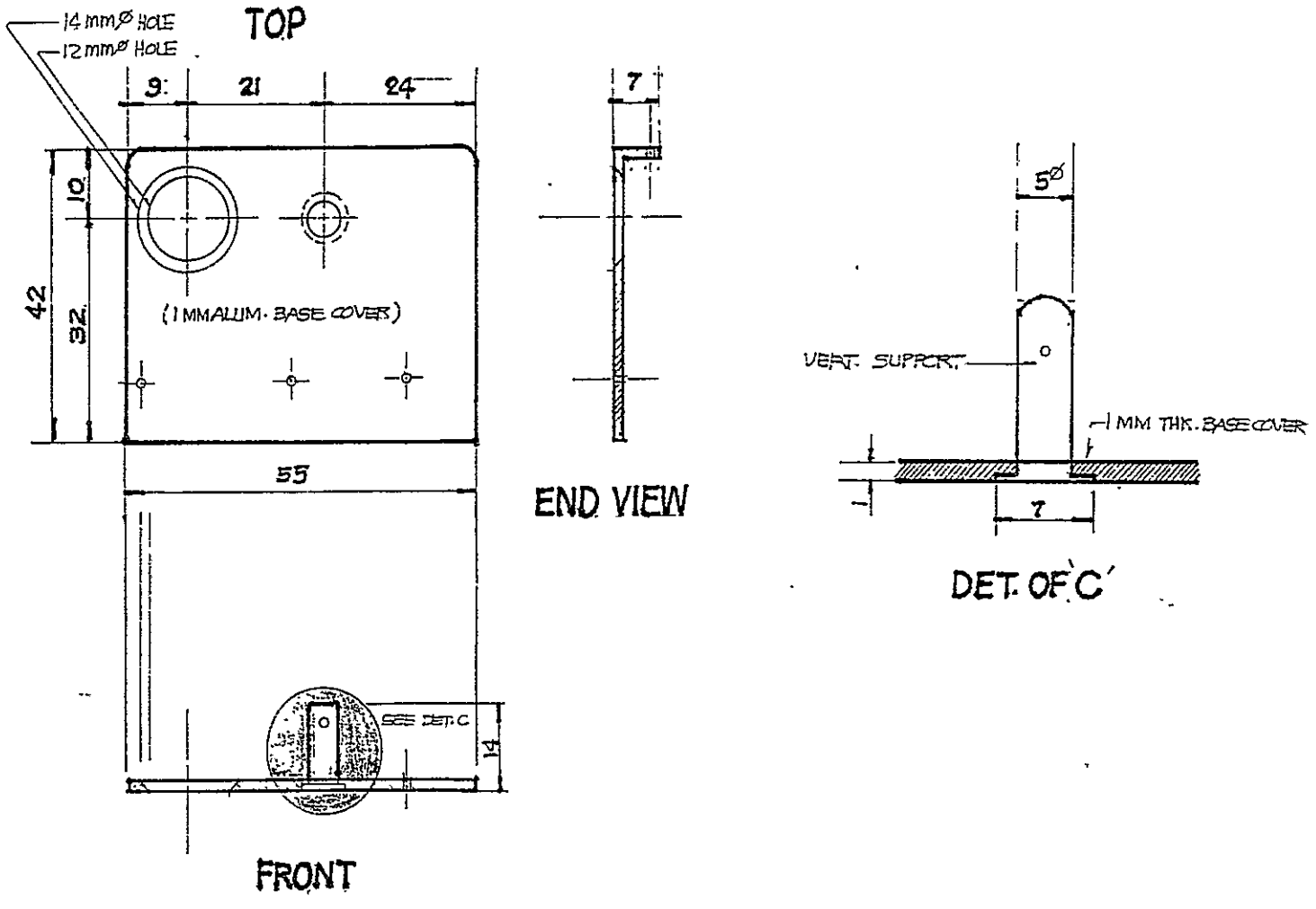

Figure 11. DETAIL OF SLIDE THUMB PRESS COVER @ TRACER ARM

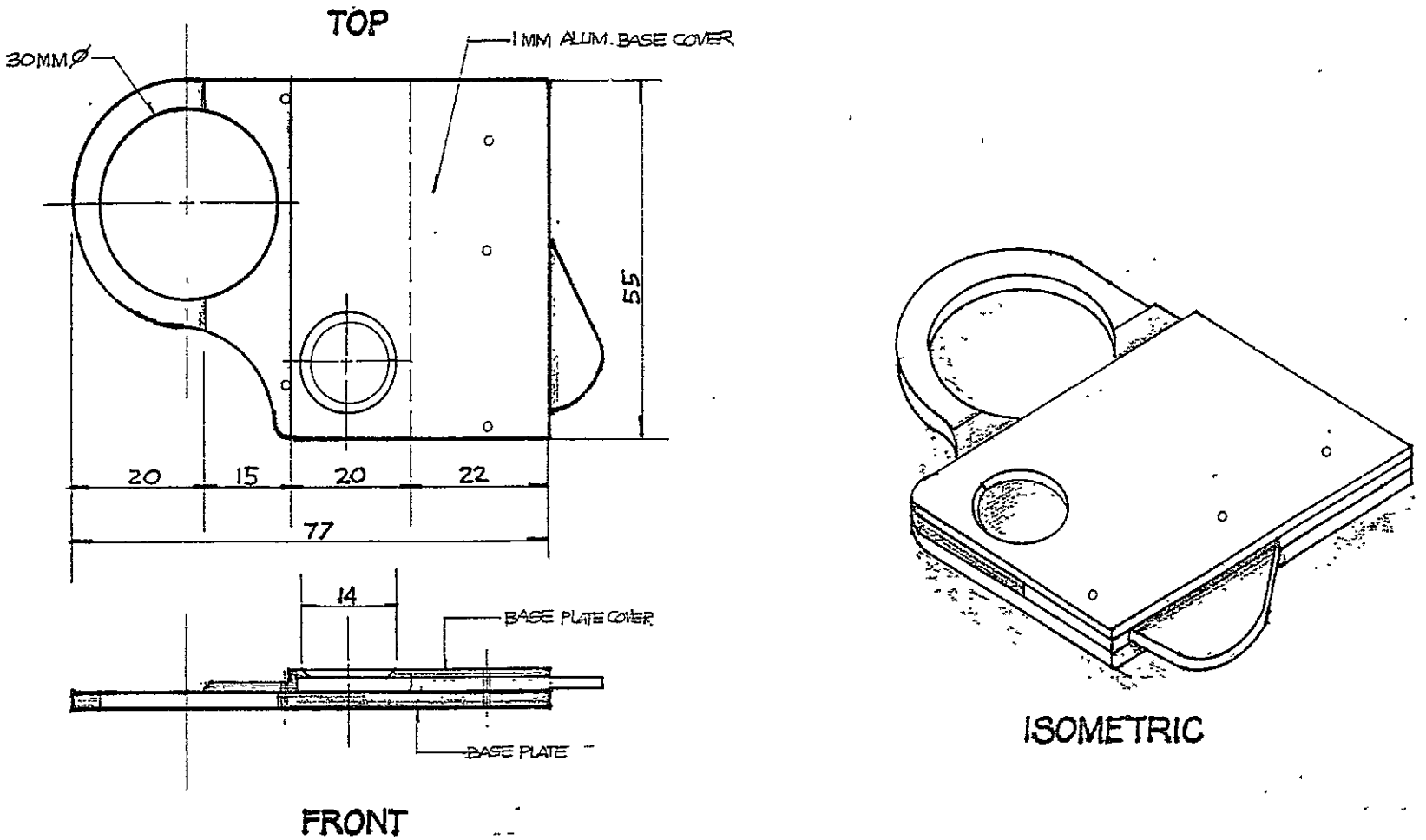

Figure 12. BASE PLATE COVER @ MIDDLE BAR

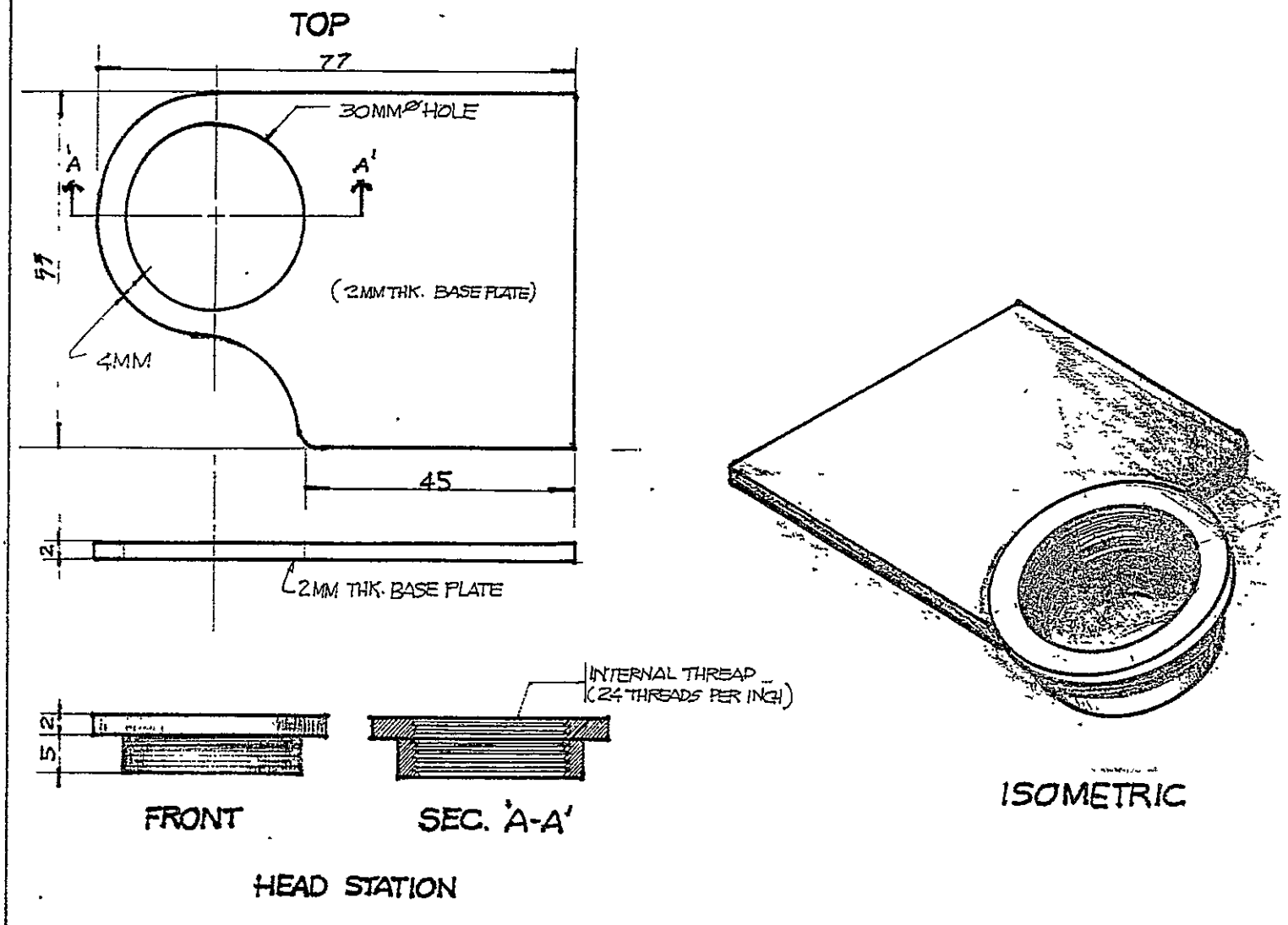

Figure 13. DETAIL OF BASE PLATE & HEAD STATION @ MIDDLE BAR

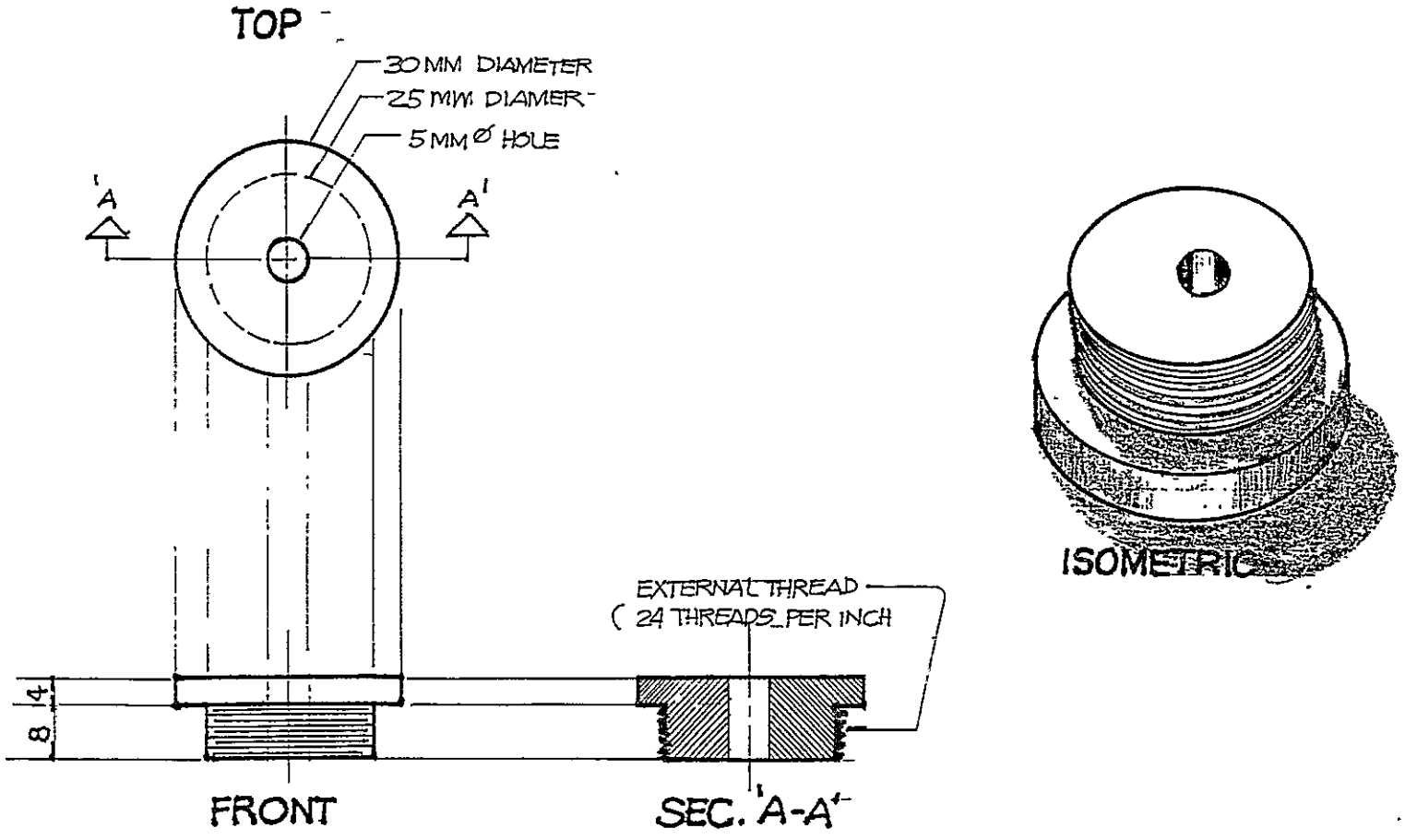

Figure 14. PIN SHAFT GUIDE @ MIDDLE BAR

c. Bend 2mm width from the aluminum base plate cover forming "zee" and drill 1mm hole and insert aluminum wire for bonding.

d. Cut 2mm x 20mm tool steel and form a spring.

6. Socket Assembly (Fig. 15)

Steps:

a. Prepare a 0.20mm aluminum shaft.

b. Cut and turn into its specified shape and drill 6mm hole (male) and 9.5mm hole (female).

c. Attached the socket to the tracer arms or bars.

Table 4 shows the layout of the gadget combining the cost of materials which is One Hundred Eighty Eight (P188.00) Pesos plus the melting, threading, and shaping costing P300.00 making a total of P488.00 Pesos only adding the 10% overhead by using machine and electricity making a total of P536.80 for the finished project.

Table 4

TOTAL PROJECT COST

SOURCES	COST
1. Cost of Materials	P 188.00
2. Labor	300.00
3. Overhead Cost 10%.	48.80
TOTAL	P 536.80

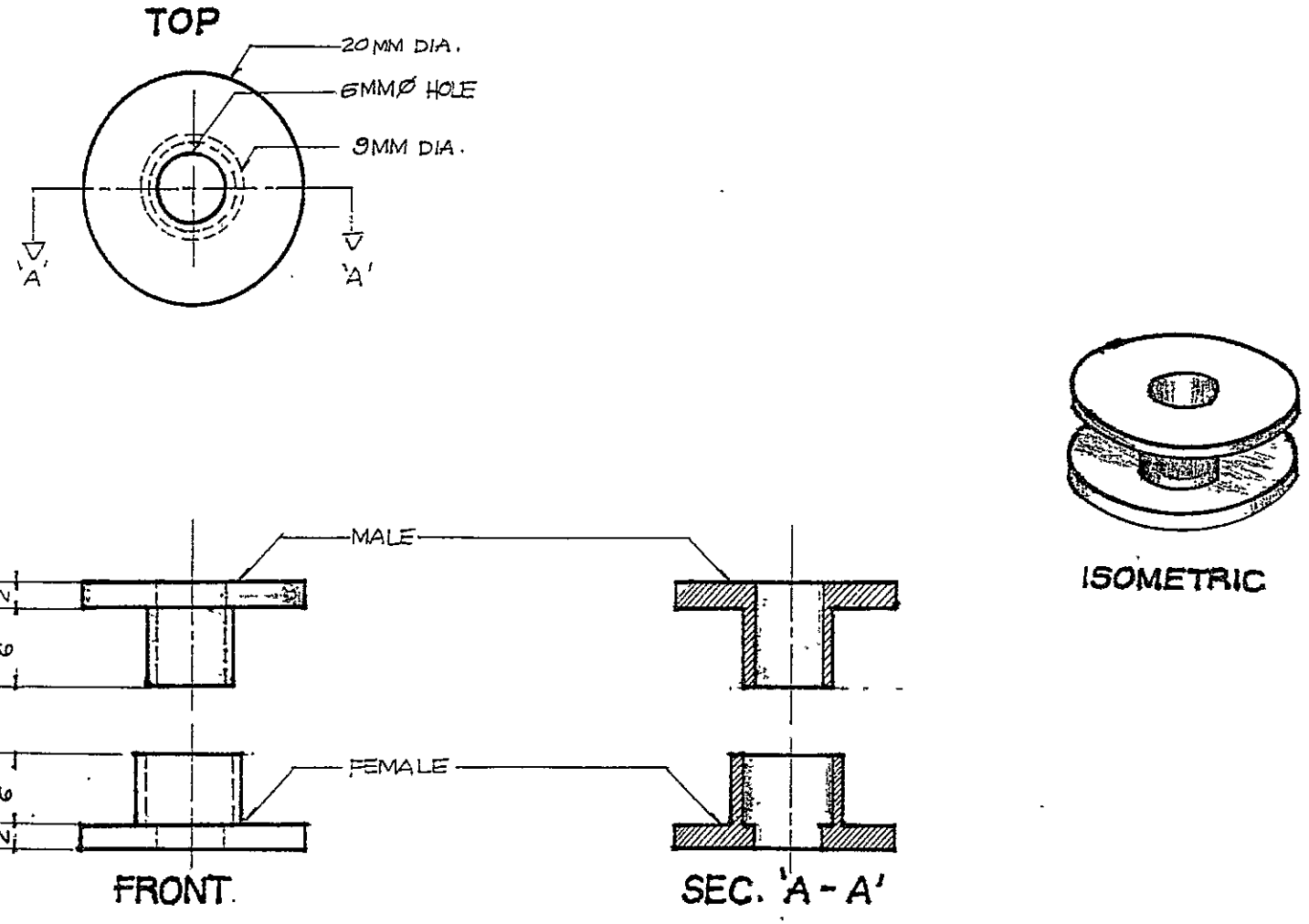

Figure 15. DETAIL OF SOCKET

This gadget is obviously different from the existing gadget found in the market, offices and shops because the existing gadget is made of wood without the specific drawing scale to be used.

The improvised multi-scale tracer can perform easily and rapidly in tracing, transferring, reducing and enlarging the drawing.

Chapter 4

DESCRIPTION OF THE COMPLETED PROJECT

This chapter briefly describes the completed Multi-Scale Tracer in terms of its structures, and processess by following the formula for reducing and enlarging drawing.

It is expected that with the completion of this gadget, it will enhance the interest and understanding as well as remedy the difficulties of the students especially in making their projects in drawing/drafting. That they will be able to submit their projects on time with enthusiasm for the succeeding projects to start immediately.

Furthermore, it will answer the problems of the teachers/instructors in the drawing/drafting department of Samar State Polytechnic College, for an efficient and functional teaching and learning process on the basic skills in drawing/drafting laboratory.

Although this gadget is limited only for transferring, enlarging and reducing the size of the original drawing, this gadget is also essential to the ones' who are too willing to practice on their own, but cannot because they lack skills.

Structure

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

1. Parts and Functions

Table 5 shows the different parts and functions of the completed improvised multi-scale tracer.

Table 5

PARTS AND FUNCTIONS OF THE COMPLETED PROJECT

PARTS		FUNCTIONS
1. Bars or Arms	-	Measures the length, height and width of the original drawing by transferring, enlarging and reducing.
2. Pole Weight	-	Serves as stationary that holds the four bars in moving upward, downward, and sidewards.
3. Needles	-	Holds the poleweight from moving.
4. Socket	-	Serves as the station of poleweight.
5. Drawing Head	-	Follows the movement of the tracer head.
6. Tracer Head	-	Traces all lines, points from the original drawing.
7. Dotting Device	-	Marks lines and points from the original drawing.
8. Thumb Press	-	Using the thumb to press to slide the sliding device.

2. Capabilities

This gadget has been made to augment and facilitate to the needs of the teachers and students in the drawing/drafting department in Samar State Polytechnic College to simplify and facilitate demonstrations of basic skills. It is capable to reduce, enlarge, transfer designs and drawings.

This multi-scale tracer is unique in nature in the sense that all accessories in the making of tracer head, drawing head, slide thumb press, socket and others, are made out of discarded aluminum materials which can be found anywhere in the locality or in any machine shop. Because it is made of aluminum, it has also its qualities, like being handy, durable, unbreakable and resistant to corrosions.

3. Limitations

The function of this gadget is definetely limited for transferring, enlarging, reducing of original drawing to 350 setting which is equivalent to a transmission ratio of 1:700 to 1:1000 reduce scale to 1:1000 to 1:100 enlarge scale set at pole at end and pole in middle.

4. Process

The process includes the operating procedures, reducing, enlarging, maintenance and safety precaution of the gadget.

A. Operating Procedure

POLE AT END

Reducing Original Drawing:

Steps:

a. Insert lead or dotting device (drawing head) in the middle.

b. Insert tracer head (lens) at the end of the tracer arm.

c. Compute the required scale for setting.

d. Sight at right angle or perpendicular to the annular mark in following the points or mark from the original drawing.

e. Press the dotting pen as soon as the target is hit by the annular mark in the tracer lens.

f. Follow until everything is finished.

FORMULA:

$$x = 500 \frac{m}{M}$$

SAMPLE PROBLEM:

Original Scale: 1:100
Reproduce : 1:200

$$x = 500 \frac{m}{M}$$

$$= 500 \frac{100}{200}$$

$$= 500 \ (0.5)$$

$$x = 250 \text{ setting}$$

LEGEND:

M - large figure of ratio

m - small figure of ratio

x - setting of the bars

500 - length of tracer bar

Enlarging Original Drawing:

Steps:

a. Insert tracer lens in the middle.

b. Insert lead or dotting device(drawing head) at the end of the tracer arm.

c. Compute the required scale for setting.

d. Sight at right angle or perpendicular to the annular mark in following the points or mark from the original drawing.

e. Press the dotting pen as soon as the target is hit by the annular mark in the tracer lens.

f. Follow until everything is finished.

SAMPLE PROBLEM:

Original Scale: 1:200
Reproduce : 1:100

$$x = 500 \frac{M}{m}$$

$$= 500 \frac{200}{100}$$

$$= \frac{500}{2}$$

$$x = 250 \text{ setting}$$

POLE IN MIDDLE

Reducing Original Drawing:

Steps:

a. Transfer the poleweight at the middle.

b. Insert the dotting pen at top left where the pole weight stationed.

c. Insert the tracer lens at the end of the tracer arm.

d. Compute the required scale for setting.

e. Sight at right angle or perpendicular to the annular mark by following the points or marks from the original drawing.

f. Press the dotting pen as soon as the target is hit by the annular mark in the tracer lens.

g. Follow until everything is finished.

SAMPLE PROBLEM:

Original Scale: 1:600
Reproduce : 1:800

$$x = 500 \frac{M}{M + m}$$

$$= 500 \frac{,600}{800 + 600}$$

$$= 500 \frac{6}{14}$$

$$= 500 \ (0.4285)$$

$$x = 214.3 \text{ setting}$$

Enlarging Original Drawing:

Steps:

a. Transfer the poleweight at the middle.

b. Insert the dotting pen at top left where the pole weight stationed.

c. Insert the tracer lens at the end of the tracer arm.

d. Compute the required scale for setting.

e. Sight at right angle or perpendicular to the annular mark by following the points or marks from the original drawing.

f. Press the dotting pen as soon as the target is hit by the annular mark in the tracer lens.

g. Follow until everything is finished.

SAMPLE PROBLEM:

Original Scale: 1:600
Reproduce : 1:400

$$x = 500 \frac{M}{M + m}$$

$$= 500 \frac{600}{600 + 400}$$

$$= 500 \ \frac{6}{6 + 4}$$

$$= 500 \ \frac{6}{10}$$

$$= 500 \ (0.6)$$

$$x = 300 \text{ setting}$$

TRANSFERRING:

Steps:

a. Use pole in middle.

b. Use any number at right pole in middle.

c. Locate the cross point of the two lines.

d. Render the figure for setting the adjustable joints and the middle slide thumb press.

B. Maintenance and Safety Precaution

This Multi-Scale Tracer is made of aluminum materials, so inorder to preserve its appearance and prolong its life, the following instructions should be observed:

a. Avoid sliding and pressing the thumb press when not in use to prevent loosening of spring.

b. Do not place the pole weight on an unlikely position to prevent the needle from breaking and dulling.

c. Wipe with a damp cloth and dry with a soft one.

d. Place it in the box when not in use to avoid corrosion.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

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

Summary

Based on the problems of students during his teaching, the researcher sought to design, construct, and test the Improvised Multi-Scale Tracer in simplifying and facilitating demonstrations of basic skills for use during instructions in the drawing/drafting class in answer for an efficient and functional teaching & learning process. It would come out as a working model of a project that could somehow give benefits to those who are engaged in sketching and tracing. This will also cater not only to the drawing and drafting students of this college but also to surveying offices, for civil and mechanical engineers, for designers, architects, commercial and advertising artists and most specifically for technical schools.

This gadget is ideally suited for the accurate transferring, reducing and enlarging of drawings, lot plans, patterns, templates, pictures, trade signs and drawings without scales.

It has also its particular advantages in terms of quickness because of its extra ordinary simple design and easy handling. It is operated by just pushing forward, downward and sidewards using the transmission ratios, pole at end and pole in middle in order to come out the desired size of the design.

This gadget is made out of locally discarded materials mostly aluminum and small parts of steadler barrel and iron materials which can be found anywhere in the locality or in any automotive shop.

Conclusions

Based on the testing and demonstrating of the completed gadget, the researcher found out that the students acquired more knowledge and skills in drawing/drafting techniques with the use of the improvised multi-scale tracer as a working model for an efficient and functional teaching and learning process on the basic skills in drawing/drafting laboratory.

The use of the improvised multi-scale tracer remedies the difficulties of the students especially in making their projects in drawing/drafting and enables them to submit their project on time.

Recommendations

Based on the foregoing conclusions, the following recommendations were made:

1. Students should be exposed to an actual learning instruction using the multi-scale tracer and in them be developed the feeling of enthusiasm, independence and self-confidence knowing that they possess skills in the drawing and drafting designs.

2. This gadget should be re-designed, modified or improved to enhance better performance.

3. Further study should be undertaken for additional function or use of the gadget.

4. Financial support to teachers and instructors who possess ingenuity in developing instructional gadgets should be extended.

5. The gadget should be mass produced by the College for other vocational schools who are in need of gadgets for instructional purposes.

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A P P E N D I C E S

APPENDIX A

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

July 20, 1992

Dr. Dominador Q. Cabanganan
Dean, Graduate & Post Graduate Dept.
Samar State Polytechnic College
Catbalogan, Samar

S i r :

In my desire to start writing my thesis proposal, I have the honor to submit for your approval one of the following research problems, preferably Problem No. 1:

1. AN IMPROVISED MULTI-SCALE TRACER:
   A TECHNICAL STUDY

2. A MULTI-PURPOSE THREE-IN-ONE DRAFTER

3. AN IMPROVISED PANTOGRAPH

I hope for your early and favorable action on this matter.

Very truly yours,

(SGD) AMADOR L. VELASCO
Researcher

Recommending Approval:

(SGD) COSETTE C. OLIVA, Ph.D.
Head, Research Development

Approved:

(SGD) DOMINADOR Q. CABANGANAN, Ed.D.
Dean, Graduate & Post Graduate Studies

APPENDIX B

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

SCHOOL OF GRADUATE STUDIES

APPLICATION FOR ASSIGNMENT OF ADVISER

NAME: VELASCO, AMADOR L.

CANDIDATE FOR DEGREE: Master in Technician Education (MTE)

AREA OF SPECIALIZATION: Drafting Technology

TITLE OF PROPOSED THESIS/DISSERTATION: "An Improvised Multi-Scale Tracer: A Technical Study"

(SGD) AMADOR L. VELASCO
Applicant

BERNARDO S. OLIVA, Ph.D.
Name of Designated Adviser

CONFORME:

(SGD) BERNARDO S. OLIVA, Ph.D.
Adviser

APPROVED:

(SGD) RIZALINA M. URBIZTONDO, Ed.D.
Dean, Graduate & Post Graduate Studies

APPENDIX C

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

September 17, 1994

Dr. Rizaline M. Urbiztondo
Dean, Graduate & Post Graduate Studies
Samar State Polytechnic College
Catbalogan, Samar

M a d a m :

I hereby respectfully request that I be scheduled for a pre-oral defense of my thesis proposal entitled "AN IMPROVISED MULTI-SCALE TRACER: A TECHNICAL STUDY", on the 18th day of September, 1994.

I hope for your kind and favorable action on this matter.

Very truly yours,

(SGD) AMADOR L. VELASCO
MTE Student

Recommending Approval:

(SGD) BERNARDO S. OLIVA, Ph.D.
Adviser

Approved:

(SGD) RIZALINA M. URBIZTONDO, Ed.D.
Dean, Graduate & Post Graduate Studies

APPENDIX D

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

February 15, 1995

The Dean
Graduate School
Samar State Polytechnic College
Catbalogan, Samar

Madam:

I have the honor to apply for Final Oral Defense of my Thesis entitled "AN IMPROVISED MULTI-SCALE TRACER: A TECHNICAL STUDY" on the date convenient for your Office.

Very truly yours,

(SGD) AMADOR L. VELASCO
MTE Student

Recommending Approval:

(SGD) BERNARDO S. OLIVA, Ph.D.
Adviser

Approved:

(SGD) RIZALINA M. URBIZTONDO, Ed.D.
Dean, Graduate & Post Graduate Studies

Date: February 18, 1995
Time: 2:00 P.M.

APPENDIX E

SCALE FOR SETTING

Proportion -->	1	2	3	4	5	6	7	8	9	10	<-- Proportion
	250	333.3	375	-	-	-	-	-	-	-	1
	166.6	250	300	333.3	357.1	375	-	-	-	-	2
1	-	200	250	285.7	312.5	333.3	350	-	-	-	3
2	250	166.6	214.3	250	277.8	300	318.2	333.3	-	-	4
3	166.7	333.3	187.5	222.2	250	272.7	291.7	307.7	321.4	-	5
4	125	250	375	200	227.3	250	269.2	285.7	300	312.5	6
5	100	200	300	181.8	208.3	230.8	250	266.7	281.2	294.1	7
6	83.3	166.7	250	333.3	192.3	214.3	233.3	250	264.7	277.8	8
7	71.4	142.9	214.3	285.7	357.1	200	218.7	235.3	250	263.2	9
8	62.5	125	187.5	250	312.5	375	205.9	222.2	236.8	250	10
9	55.5	111.1	166.7	222.2	277.8	333.3	-	-	-	-	
10	50	100	150	200	250	300	350	-	-	-	

POLE @ END

POLE IN MIDDLE

CURRICULUM VITAE

NAME	:	AMADOR LOMENTIGAR VELASCO
ADDRESS	:	Purok 9, Brgy. Canlapwas, Catb.
PLACE OF BIRTH	:	Catbalogan, Samar
DATE OF BIRTH	:	May 22, 1959
CIVIL STATUS	:	Married
WIFE	:	Imelda Oliva Velasco
PRESENT POSITION	:	Instructor I
STATION	:	Samar State Polytechnic College

EDUCATIONAL BACKGROUND

ELEMENTARY	:	Catbalogan II Central Elem. Sch. Catbalogan, Samar 1966-1972
SECONDARY	:	Samar School of Arts and Trades Catbalogan, Samar 1972-1976
COLLEGE	:	Samar State Polytechnic College Catbalogan, Samar 1980-1984
DEGREE OBTAINED	:	B. S. in Industrial Education
MAJOR	:	Drafting Technology
CURRICULUM PURSUED	:	Master in Technician Education

CIVIL SERVICE ELIGIBILITY

Professional Board Examination for Teachers (PBET), August 5, 1986, Tacloban, City.

MEMBERSHIP IN ORGANIZATION

SSPC-Personnel Association (SSPC-PA)

SSPC-Primary Multi-Purpose Cooperative, Inc. (SSPC-PPMPCI)

POSITION HELD

Draftsman	:	Samar State Polytechnic College April 1984
Secondary School Teacher: (Teacher I)		Samar State Polytechnic College SY 1984 - Sept. 20, 1994
Instructor I	:	Samar State Polytechnic College September 21, 1994 to date

LIST OF FIGURES AND TABLES

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