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Scope of Study: As a background material, this study presents the history and philosophy of industrial arts. The development of industrial arts is traced from early existence in Europe to the present position in America. This study also includes the history and development of five of the most frequently used hand woodworking tools found in all industrial arts wood working shops. The hand tools included in the study are: (a) hammer, (b) saw, (c) wood boring devices, (d) bit brace, and (e) plane.

The material for this study was obtained from books and information provided by numerous hand tool manufacturing and supply companies.

Summary: The development of hand woodworking tools has been a long and gradual process. Man's first hand tools were stones formed by nature. From this primitive form hand tools have progressed through the various metal stages until today tools are made of the finest steel especially developed for the tool making industry.

Conclusion: The teaching of related subject matter is often neglected by industrial arts teachers. It would not seem possible to meet the objectives of industrial arts by teaching only the information needed to perform the manipulative activities required in the construction of projects.

This study is an attempt to present the development of five woodworking tools in a non-technical manner, with the hope that it may be of benefit for instruction as indirectly related information.

ADVISOR'S APPROVAL: L. H. Bengtson

THE HISTORICAL DEVELOPMENT
OF FIVE HAND WOODWORKING TOOLS

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OF FIVE HAND WOODWORKING TOOLS

By

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CHAPTER I

INTRODUCTION

Many industrial arts instructors seriously neglect that important phase of teaching referred to as related subject matter. It is often more difficult to present related information than to teach the basic skills required for making projects. Wilber states: "It is difficult to see, however, how an industrial arts course can be justified on the basis of the manipulative activities alone." (14, page 96)

The tools used by the carpenter and other woodworkers are familiar to almost every youngster, however, little or no thought is given to the origin and development of these tools. The writer believes that the knowledge of the origin and development of the hand woodworking tools most frequently used in the industrial arts shop should be included in the instruction as indirectly related information.

<u>Origin of the Study</u>. This study of the development of five major woodworking tools was undertaken to provide information, of an indirectly related type, to be presented in conjuction with the units on the care and use of woodworking tools. This instruction should follow Wilber's recommendation of the proper manner in which related information should be presented. In his book <u>Industrial Arts in General</u>

Education, Wilber states: "There is a need for a central core or theme around which all such information can be related". (14, page 98)

Need for the Study. There is definitely a scarcity of information pertaining to the history and development of tools. Many of the tool manufacturers have no such information on hand. This study is an attempt to assemble the historical development of five hand woodworking tools.

Method of Investigation. Letters were sent to a number of the leading hand tool manufacturing companies requesting their assistance in securing information that would be of aid in this study. A list of these manufacturers can be found in Appendix B. Most of the companies responded with information. Those which were unable to provide helpful information submitted suggestions of where the needed information could possibly be obtained.

A diligent search was made through the Oklahoma Agricultural and Mechanical College library, the East Central State College library, and the University of Oklahoma library in an effort to obtain helpful literature. Only a small amount of material was found which could be of use in this report.

Available Literature. There are very few books, in the libraries visted, which pertain to this subject. These books are widely scattered and mention, only briefly, information that is of value to this study. Many of the hand tool manufacturing companies have available booklets and pamphlets which would be helpful in a study of this type.

Definition of Terms. To assist in the understanding of the material, a glossary of terms is included.

1. Manual Training. That phase of industrial training originated to emphasize the importance of making "good workmen" as well as "educated intellects". (1, page 361)

2. Manual Arts. A change in views to emphasize the art side of manual training. (2, page 441)

3. Industrial Arts. Those phases of general education which deal with industry - its organization, materials, occupations, processes, and products - and with the problems resulting from the industrial and technological nature of society. (14, page 3)

4. General Education. Summarized as to transmit a way of life, to improve and reconstruct that way of life, and to meet the needs of individuals. (14, page 3)

5. Directly Related Information. Includes all the information which is actually required to carry on successfully the desired manipulative processes. (14, page 96)

6. Indirectly Related Information. Includes a great body of information which cannot be connected directly to any given process or project and yet is important in an understanding of our industrial society. (14, page 97)

7. Hammer. An instrument for driving nails, beating metal and the like, consisting of a head usually of steel fixed crosswise to a handle. (13, page 373)

8. Claw Hammer. A hammer with a forked end (claw) for drawing nails. (13, page 153)

9. Saw. A cutting tool or instrument, with a thin flat blade having a continuous series of teeth on the edge. (13, page 752)

10. Crosscut Saw. Cut transversely, esp. across the grain. (13, page 199)

11. Rip Saw. A saw with coarse teeth, used for cutting wood in the direction of the grain. (13, page 731)

    Rip Saw. Used for ripping or cutting with the grain along a straight line. (5, page 9)

12. Bradawl. A straight awl with chisel edge used to make holes for brads, screws, etc. (13, page 101)

13. Gimlet Bit. A small tool with a screw point, grooved shank, and cross handle for boring holes. (13, page 350)

14. Auger. A carpenter's tool for boring holes larger than those bored by a gimlet; hence any of the various auger-like instruments or devices. (13, page 58)

15. Bit Brace. A curved instrument or handle for rotating a bit. (13, page 101)

16. Plane. A tool for smoothing wood, forming moldings, etc. (13, page 645)

    Plane. A smoothing tool, having its cutter protruding from a throat in a stock. (6, page 687)

In Chapter II the writer presents the history and philosophy of industrial arts. Chapter III relates the history of five hand woodworking tools: (a) hammer, (b) saw, (c) wood boring devices, (d) bit brace, and (e) plane. An attempt has been made by the writer to present the history of these tools in their chronological order. In Chapter IV recommendations and conclusions are presented.

CHAPTER II

HISTORY AND PHILOSOPHY OF INDUSTRIAL ARTS

Man is constantly attempting to improve his environment. This has been true since the beginning of time. The savage was driven by need to devise better means of procuring food and providing shelter. There were no schools to teach this newly gained knowledge. The people learned by unconscious imitation.

Part A

Development of Industrial Arts in Europe

As civilization progressed man's desire for improving conditions increased. Learning by imitation gave way to instruction by either the parent or the existing church of that country.

Early History. The ancient Jews, Babylonians, and Greeks placed value on the crafts of that time. Records show the teaching of these crafts and trades was left to the parents.

The Jews' motive for education was religious. Instruction in Law was held in highest esteem. Next to this was instruction in a trade or other vocation. The instruction of that time closely resembles the modern part-time school.

The boy attended school in the morning, where he received instruction from the Rabbis, and in the afternoon he remained at home learning the trade of his father. The Jews believed that to fail to train a boy in a useful trade was to prepare him to be a social parasite.

The apprenticeship method of instruction was used by the Babylonians. Under this method of instruction the apprentice was provided with food, shelter, and instruction in the particular trade of the master. The Babylonian Code of Hammurabi (2240 B.C.) contains the following:

> If an artisan take a son for adoption and teach him his handicraft, one may not bring claim against him. If he do not teach him his handicraft that adopted son may return to his father's house. (1, page 14)

This relationship between master and the apprentice existed until the development of machines, and the factory system took manufacturing away from the home.

Handicraftsmen in Greece during the Homeric age held a place of honor. In later years the use of slaves or hired labor caused the craftsmen to lose this position. Anyone, except those in agriculture or cattle raising, that used his hands to earn a living was not highly respected. Socrates (470-399 B.C.) stated the following reason for the attitude of contempt toward mechanical arts:

> The so-called banausic arts have a bad name, and are in ill repute in the city-states. For they ruin the bodies of those who work at them and those who oversee them. They compel these men to remain seated and to work in gloomy places, and even to spend entire days before a fire. While their bodies are being enervated, their souls, too

> are becoming much enfeebled. More especially, also, the banausic arts offer men no leisure to devote to their friends or to the state, so that such men become base in relation to their friends and poor defenders of their fatherland. And so in some of the cities, especially in those which are considered to be strong in war, no citizen is permitted to work at any banausic craft. (1, page 15)

Since this attitude prevailed the Greek youth of the upper classes had no manual training. However the lower classes continued the apprenticeship method of instruction handed down from earlier times.

During the early 15th Century, new education philosophies and new methods of teaching appeared. These new ideas were brought about by the invention of the printing press, revival of classical learning, and the Protestant Reformation. Two fundamental ideas appeared upon which modern instruction in industrial arts has been built. The first is that sense impressions are the basis of thought. The second is the related idea of "learning by doing". These new philosophies led to the placing of handicraft in the 15th Century schools.

Middle Ages. Johann Heinrich Pestalozzi was one of the first men to successfully put these new theories into use. Although he was heavily in debt from his venture in farming, Pestalozzi brought about twenty poor children to his farm. These children worked in the fields and around the house. There was very little time devoted to actual lessons, but the children were taught while working. Pestalozzi gave them constant practice in conversation from subjects taken from their every day life. Educationally his experiment was a complete success. Pestalozzi is often referred to as the "father of manual training".

The educational system at Hofwyl was established by Phillip Emanuel von Fellenburg. Fellenburg combined parts of Pestalozzi's principles with his own. His school, Hofwyl, claimed world wide interest during the first half of the nineteenth century.

The methods of learning by doing were not accepted by everyone. Many industrial and educational leaders thought the apprenticeship method to be a better means of training for industrial employment. After the factory system became well established, the true value of the industrial school became evident. The apprenticeship method of instruction could no longer meet the needs for the increased labor requirements. The decline of the apprentice system gave added importance to the teaching of manual training in the schools.

Sloyd Movement. In the Scandinavian countries the winter evenings were long and dark. It became a custom for the people to spend their evenings in some form of useful handiwork. The men and boys would make articles needed for use around the farm. The women and girls would spin, weave cloth, and make clothes. This form of handiwork in Scandinavia was referred to as sloyd.

When the rural people learned to sell or trade some of their surplus projects the home sloyd developed into domestic industry. Many villages became famous for their work and every boy became active in this form of industry.

The invention of power machines, the factory system, and the spread of the manufacture and use of alcoholic drinks, all contributed to the downfall of the home sloyd. This breaking down of skill and character was a cause of much concern among the Scandinavian leaders. As a solution to these problems, sloyd schools were established. By 1844, sloyd schools were numerous throughout Norway and Sweden.

In 1668 a sloyd school was established by Abrahamson. Four years later Otto Salomon, nephew of Abrahamson, became assistant at the school. Otto Salomon had attended the Technical School of Stockholm and the Ultuna Agriculture Institute and was a firm believer in the sloyd system.

In the year 1872 the sloyd schools received official recognition and the Chamber of Deputies alloted money to stimulate instruction in sloyd. In this year an industrial school was founded at Naas. This school was intended for boys who had completed the work in the folk school. Included in the instruction were carpentry, carving, turning, smith's work, basket making, saddlery, stone cutting, fretwork, and painting. Other subjects of more educational value, such as drawing, mechanics, mathematics, and physics, were also taught. Special sloyd teachers were also given instruction at this school.

Russian Movement. A school of Trades and Industries was established in Moscow. This school, which later became the Imperial Technical school, was established to train civil engineers, mechanical engineers, draftsmen, and chemists. Classes in both theoretical instruction and shop work were conducted. The plan cannot be considered a complete success because the students learned their shop work by imitative methods from workmen engaged in construction contracted from private individuals.

Victor Della Vos and his instructors soon realized the limitations of their plan. A new system of shop instruction was worked out whereby the "construction" and "instruction" shops were separated.

Many of the modern concepts of industrial arts were developed from the Russian. They were: unit shops, work stations with individual tools, use of models according to increasing difficulty, models made from drawings made by students in drawing class, and the idea that every teacher have more knowledge of his speciality than is necessary to perform the exercise of instruction.

The Imperial Technical School sent exhibitions to all the expositions of that day and exerted a profound influence on the schools of Europe and America. The exhibit presented in 1876 at the Centennial Exposition in Philadelphia was the cause of the School of Mechanic Arts being opened at Massachusetts Institute of Technology, and the St. Louis Manual Training School in America.

Part B

Development of Industrial Arts in America

The development of industrial arts, as well as many of the social traditions, was greatly influenced by the changes as they took place in Europe. The idea of free education which prevailed in the colonies afforded a better opportunity for the education of all social classes.

Colonial. The industrial training before colonization was of the same type carried on in the monastic schools of Europe. Schools were in operation in what is now New Mexico, California, and Florida, as early as 1630. These schools were started by Catholic missionaries. Instruction in tailoring, shoemaking, carpentry, carving, blacksmithing, brick making, and some cutting, was given. The instruction was taken over by the natives as they became skilled. In addition to the crafts taught for men there was instruction for the girls.

The apprenticeship method of instruction carried on in the English colonies was much the same as that practiced in England. Since the apprenticeship was under the control of town and colony authorities, and because there were no guilds, it developed more as an educational institution. Legislation was passed by most of the colonies for the benefit of the apprentice. There were faults in the American apprenticeships' instruction just as there were in Europe. Even though many of the masters were indeed artisans they could neither read nor write. This led to the establishment of the first elementary school in America.

In 1647, an order was given by the General Court of Massachusetts for every town of fifty families to select a teacher to be paid by the inhabitants. Industrial arts was not mentioned, but because of the puritan distate for idleness this training was probably given in the home. The most important outcome of this court order was the establishment of the first "free" schools in America.

In 1685, a plan for public education was proposed by Thomas Budd for Pennsylvania and New Jersey. This plan called for compulsory education for all children, the rich, the poor, and even the Indians. Budd proposed to teach each child that "art, mystery, or trade that he or she most delighteth in". (1, page 621) There is no evidence that this plan was ever put into practice, but it may have had some influence on education of that day.

One of the most notable schools established during the eighteenth century was the De la Howe School at Abbeville, South Carolina, founded in 1787. Both girls and boys attended. The boys were primarily engaged in farming and gardening, while the girls practiced the household arts.

The Nineteenth Century. In 1862, the Morrill Act was signed by President Lincoln. This act was primarily for the establishment of agricultural schools, and became the most important legislation for higher education ever adopted by any nation. The act provided for 30,000 acres of public land, for each senator and representative in Congress, to be used in establishing colleges of agriculture and mechanic arts.

Calvin M. Woodward, Washington University of St. Louis, observed that the students could not visualize certain problems being taught in applied mechanics. He asked the students to make these forms in wood. Much to his surprise the students knew nothing of using the simplest types of woodworking tools.

In 1871, a supplementary catalog was published containing the following announcements:

> There will be fitted up a work shop containing an elegant lathe made expressly for the University by the Fitchburg Machine Co., of Massachusetts, for turning wood and iron; a work bench and full set of carpenter's tools. The engineering students will be able here to acquire some dexterity in the use of tools which, though slight, will be of great value to them in the subsequent work of their profession (i.e. this experience will make them better judges of workmanship). (2, page 319)

John Runkle, Massachusetts Institute of Technology, was confronted with the same problem. He found that students without shop experience had difficulty entering professional work after graduation. The Russian exhibition at Philadelphia in 1876 solved the problem, and shop work was started at the Institute the following year.

The first manual training high school was established at Washington University. This type of instruction in the secondary schools had long been a dream of Calvin M. Woodward, the champion of industrial arts in America. In the establishing ordinance dated January 6, 1879, the purpose of the school was stated thus:

> Its object shall be instruction in mathematics, drawing, and English branches of a high-school course, and instruction and practice in the use of tools. The tool instruction, as at present contemplated shall include carpentry, wood turning, pattern making, iron chipping and filing, forge work, brazing and soldering, and the use of machine shop tools, and such other instruction of a similar character as may be deemed advisable to add to the foregoing, from time to time.
>
> The students will divide their working hours, as nearly as possible, equally between mental and manual labor.
>
> They shall be admitted, on examination, at not less than fourteen years of age, and the course shall continue three years. (2, page 347)

The manual training school was the object of great controversy and heated discussion from 1880 to 1890. Even though this type of school filled a need long recognized as essential, not only in America but throughout the world, many of the conservative educators feared it would lower academic standards. Ridicule, by some educators, was used in an effort to stop the movement that seemed destined to become a part of all the public schools. A speech by A.P. Marble, superintendent of public schools, at Worchester, Massachusetts, contained the following: "There is no information stored up in the plow, hoe handle, steam engine, but there _is_ information stored up in books". (2, page 361)

Even though there was much opposition by 1893 manual training had been introduced into public high schools of more than fifty cities in the United States.

Industrial Arts Since 1900. In 1904 Charles R. Richards suggested the adoption of the term "industrial arts" to replace the name of manual training. He said that manual training in its strictest forms was outmoded and "now we are beginning to see that the scope of this work is nothing short of the elements of the industries fundamental to modern civilization." (2, page 453)

Teacher education institutions naturally kept pace with the changes in industrial education. The increasing demand that all teachers have at least a bachelor's degree had induced universities to introduce professional courses in the field of industrial arts education. The first university to offer these courses was Columbia. Stout Institute and Bradley Polytechnic Institute were among the first privately endowed institutions to offer professional courses.

There has been much progress since 1917, but perhaps the most notable has been the development of the professional spirit among industrial arts teachers. This has been accomplished largely through professional associations organized for cooperation and advancement of the profession.

Part C

Philosophy of Industrial Arts

The teacher plays an important role in the development of youngsters. This is especially true of industrial arts teachers. In the industrial arts class students have the opportunity to explore the various industries to attain knowledge about and experiences in many of the work activities found in industry.

There seems to be no better way to express a philosophy for industrial arts than in terms of objectives and desired behavior changes. In his book, Industrial Arts in General Education, Wilber suggest the following objectives and desired behavior changes:

> Objective: To explore industry and American industrial civilization in terms of its organization, raw materials, processes and operations, products, and occupations.
>
> Expected Behavior Changes From Students:
>
> 1. They will be familiar with the organization of industry and relate the personel organization of the industrial arts shop to similar systems in industry. Their cooperation in the personnel system will increase.
> 2. They will read more intelligently about industry and industrial products. The choice of their reading will be affected.
> 3. They will recognize industrial methods and will attempt to apply them in the school shop.
> 4. They will visit industries wherever possible to learn about methods, products, etc.
> 5. They will recognize various raw materials and talk about their sources, transportation, and processing with the class.
> 6. They will read and talk about the various occupations within an industry. A tentative choice of an occupation may be made.
> 7. They will discuss occupations with the teacher, friends, and parents.
> 8. They will choose materials wisely because they are acquainted with their uses by industry.

9. They will read about and interpret the problems of management and labor more intelligently.

10. They will seek information about new developments in industry.

Objective: To develope recreational and avocational activities.

Expected Behavior Changes From Students:

1. They will read such magazines as Popular Science, Home Craftsman, and Popular Mechanics.

2. They will ask advice on how to carry on constructive activities out of school.

3. They will becom interested in, and will engage in, one or more constructional hobbies.

4. They will spend spare time in the shop either in school or at home.

5. They will ask questions and talk about their hobbies.

6. They will consult catalogs for information about their hobbies.

7. They will contribute to class discussions and information gained from reading along lines of their interests.

8. They will take the initiative in visiting industries along the lines of their interests.

9. They will make the acquaintance of, and form friendships with, others of similar interests.

10. They will develop home workshops.

11. They will suggest and work on projects related to their hobby interests.

Objective: To increase an appreciation for good craftsmanship and design, both in the products of modern industry and in artifacts from the material cultures of the past.

Expected Behavior Changes From Students:

1. They will recognize good design and apply such knowledge in the construction of projects.

2. They will appreciate good design in artifacts and will show such appreciation in speech and actions.

3. They will recognize and appreciate period pieces.

4. They will recognize the place of "streamlining" in design and will apply it correctly in developing projects.

5. They will re-design projects to improve their appearance and utility.

6. They will select or develop projects which are suitable to the material being used.

7. They will recognize and avoid poor design and "over decoration".

Objective: To increase consumer knowledges to a point where students can select, buy, use, and maintain the products of industry intelligently.

Expected Behavior Changes From Students:

1. They will examine articles carefully and judge their value before buying.

2. They will look for constructional features in judging the worth of an article.

3. They will learn about materials and will apply their knowledge in making purchases.

4. They will become acquainted with trade names and will look for proven brands when buying.

5. They will maintain and use manufactured articles in such a way as to prolong their life and usefulness.

6. They will recognize quality and will buy accordingly.

7. They will buy on the basis of their needs, rather than entirely on the basis of price.

Objective: To provide information about, and — in so far as possible — experiences in, the basic processes of many industries, in order that students may be more competent to choose a future vocation.

Expected Behavior Changes From Students:

1. They will read and talk about various occupations.

2. They will make tentative choices of a vocation.

3. They will decide that they are not fitted for, or are not interested in, certain vocations.

4. They will know and be able to explain the entrance requirements, training, working conditions, and wages of many occupations.

5. They will talk with representatives of many occupations concerning the work in which they are engaged.

6. They will visit industries and observe the various workmen under normal working conditions.

7. They will watch with interest motion pictures showing workmen at various occupations.

8. They will choose elective courses which provide additional information about occupations.

Objective: To encourage creative expression in terms of industrial materials.

Expected Behavior Changes From Students:

1. They will design and make new projects.

2. They will think through the correct procedure for making a project and will then follow their plan.

3. They will experiment with new ways of solving construction problems and will make improvements on the basis of their experiences.

4. They will develope skill and facility in the use of many materials.

5. They will appreciate or criticize constructively design in the work of others.

6. They will choose materials which are best suited for a given project or use.

7. They will take ideas from different sources and create new designs.

8. They will increasingly attempt to solve their own problems.

Objective: To develope desirable social relationship, and tact.

Expected Behavior Changes From Students:

1. They will develope a group spirit and loyalty.

2. They will cooperate with others in promoting a group program.

3. They will assume and discharge leadership responsibilities in connection with the personnel organization.

4. They will organize or participate in club activities.

5. They will accept leadership responsibilities in club organizations.

6. They will give help and advice willingly.

7. They will accept assignments given them by leaders in the personnel organization and will recognize the leadership of others.

8. They will work willingly with individuals who may be of a different race, creed, or color.

Objective: To develop safe working practices.

Expected Behavior Changes From Students:

1. They will perform tool processes with an increasing degree of accuracy.

2. The quality of workmanship in their projects will be improved.

3. They will develop pride in their craftsmanship.

4. Their self-assurance will increase and will be indicated by a willingness to attempt more difficult projects.

5. They will practice difficult operations in order to perfect the skills. (14, pages 47-54)

With the history and philosophy of industrial arts as a background, attention is now directed to the development of five of the most frequently used hand woodworking tools found in all industrial arts shops.

CHAPTER III

THE EVOLUTION OF FIVE HAND WOODWORKING TOOLS

Thousands of years ago man had no tools but his bare hands. With his hands he caught his food, built his home, and killed his enemies. Only man's own strength stood between him and death. Thus the man with the strongest hands owned the best tools.

It is thought that the hammer was the first tool to be used by man. Some primitive man, probably not the strongest member of his tribe, conceived the idea of attaching a stick to a stone. This was the first hand tool to be developed by man. Since that time there have been developed hand tools to be used in every trade or work.

The hand tools included in this study are those used by the carpenter, the cabinet maker, and an untold number of home craftsmen and repair men.

Part A

Hammer

The hammer has made its own important contributions to civilization. From its earliest existence as a means of aiding primitive man in his food quest, the hammer has developed into a versatile and diversified hand tool. There is hardly an industry existing in which the hammer does not play an important part. There are numerous types of hammers manufactured and used throughout the world in our present age. This study deals primarily with the type used by carpenters and woodworkers, commonly called the claw hammer.

Primitive Hammer. The first hammers were mere rocks that primitive man found in the river or brook beds. These rocks were used to break open nuts, bones, and mussels, in the quest for food. They were later used to break and shape other stones to form weapons or other tools.

The handleless pounding instruments are referred to by archaeologists as hammer stones. The term hammer is used to refer to implements with handles. The first true hammers are thought to be stones formed to permit the lashing of handles. Unshaped stones that once may have been made into hammers cannot be identified as such since time has destroyed the handles and fastenings. In every part of the world stone hammer heads have been found with grooves, intentionally shaped by man, around them to make possible a firmer lashing of the handle. The handle was usually bent in a U-shape around the head and lashed with thongs. Many of the primitive races could drill stone, but rarely has a stone hammer been found with a handle hole bored through the head.

The ancient Egyptians never developed a handled hammer of any type, even though they did develop the mallet. Driving and pounding unsuited for the mallet was done with a hammer stone. A few bronze hammers have been found, but the stone hammer seems to have been the most widely used.

Inhabitants from many parts of the world, where copper and bronze were used extensively, never developed a metal hammer. Even though the Greeks generally used stone hammers, a few small iron specimens, about the size of a tack hammer, have been found.

Medieval Hammer. The Romans were thought to be the first to specialize the hammer for different purposes. The earliest Roman hammers were blow striking instruments as much like weapons as they were tools. The Romans also developed an iron hammer with nail pulling claws and an oval eye for the handle. This iron hammer closely resembles the modern tool. Several have been found in old Roman camp sites and are now prized possessions of museums, one of which is the Swiss Museum. These hammers are too heavy for horseshoeing and must have been used for carpentering.

These old claw hammers of the Romans had plain shallow handle-eyes that are similar to those of a generation ago. The handles must have been held in by the aid of a pair of iron straps that went through the eye as a part of the handle which strengthened it. One of this type was found in the ruins of Fort Ticonderoga, New York.

The Encyclopedia Britannica shows a claw hammer that has side plates between which the handle was riveted. It was called the "Canterbury Hammer". This eyeless hammer had plates similar to those on the hammer found at Ticonderoga, except that they were part of the head. A picture made in the sixteenth-century, "Melancholia", by Albrecht Durer, shows one of these Canterbury Hammers.

Modern Claw Hammer. David Maydole, in his blacksmith shop at Lebanon, New York, in the 1830's made the first improvement of the claw hammer. It was distinctly different from all earlier hammers; it had a deep or adz-type eye that held the handle strongly and securely. Maydole, whose satisfactory, but apparently simple improvement, soon was made head of a great factory which has been making hammers for the world ever since.

Material as well as shape has improved the modern claw hammer. The iron hammer, either cast or wrought, has been replaced by steel especially selected for hammer manufacture. This steel is skillfully hardened so that it will neither yield nor break. Now, the hammer is expected to be well polished and to have that essential quality of balance as well as the quality of steel. Unlisted research engineers whose combined efforts give the woodworker of today a tool for one dollar that a fortune could not have purchased a hundred years ago.

Part B

Saw

The saw is one of the most ancient tools known to man. It antedates civilization. Its use dates back to the Neolithic or later stone age, before the discovery of metals, when only the crudest of implements were constructed. It is generally conceded that nature provided the examples which inspired the invention of saws. Some investigators claim the saw-fish as the first type; others, the wasp with the saw-like action of its serrated sting.

A great Grecian fable describing the origin of the saw relates how Talus (or Perdis), having found the jawbone of a fish (according to some authorities a serpent), produced an imitation by cutting teeth in iron. While the Grecian claim to discovery is unbacked by historical authority, such an origin seems probable.

A few specimens of prehistoric saws existing in the museums of Europe and America enable us to judge the character and method of use of the primitive types. The saws of the bronze age, of which a number of typical specimens have been found, more nearly approach the form of the stone saws of the earlier period which were determined largely by accident. Bronze permitted manipulation into desired shapes, and its introduction marked a distinct improvement in form. As the ancients' knowledge of metals increased, iron was used in tool construction, especially in that of saws. More modern forms were developed as the iron age succeeded the bronze age, and some saws of iron that date to Biblical times and beyond might, but for their inferior material and workmanship, be taken as models for more modern implements. This period may be considered the genesis of modern saw making.

Indisputable evidence that bronze saws with jeweled teeth were used by the ancient Egyptian for cutting the hardest stone was discovered by the eminent Egyptologist, Professor W.M. Flinders Petrie. Sir Austen Henry Layard, the assyriologist, found at Nimround near Nineveh, a two-handled iron saw three feet and eight inches long by four and five-eighths inches wide (demensions similar to those of the present day saw). Saws are mentioned in the Bible. It is said that Christain martyrs in the days of persecution were "sawn asunder". I Kings 7:9 refers to: "costly stones, according to the measures of hewed stones, sawed with saws, within and without, even from the foundation into the coping, and so on the outside toward the great court." II Samuel 12:31 refers to execution with iron saws: "And he brought forth the people that were therein, and put them under saws,..." Grecian carpenters used saws similar to those of today.

Ancient Saws. The earliest prehistoric saws were simply small flakes of flint, notched by chipping. Rarely more than three inches long, with irregular teeth of doubtful sharpness and held between thumb and finger, these saws had very limited cutting power. They were used chiefly in the manufacture of ornaments from bone and soft stones. Excellent specimens found in the north of England are shown in many museums.

Flint saws have been discovered in the caves of the "reindeer period" in France, in the Kjokken-moddings(ancient stone heaps) of Denmark and Sweden, in the lake dwellings of

Switzerland and northern Italy, and practically throughout Europe. The smallest discovered is one and one-half inches in length and none has been found longer than nine and one-half inches. In Scandinavia, where flint is found in large blocks, the primitive saws were larger and half-moon shaped. The teeth were on the straight edge, which is from four to seven inches long.

The stone-age man's ingenuity increased with his needs, and he discovered that by mounting his serrated flint chips in a groove formed in a stock of wood he obtained a more serviceable tool. The finest specimen of this type was found in the prehistoric region of Polada, in northern Italy. Four separate flint flakes are cemented into the wooden casing with asphalt. Swiss archaeologists declare the shape of the handles indicates that this was made for the use of a left-handed man. A similar saw was found in a lake dwelling at Vinelz, Switzerland. Mounted specimens of prehistoric man's handiwork are rare because of the impermanence of wood.

Early Saws. During the middle ages, the woodworker knew only the saws of the frame type. The Romans developed the bow saw, buck saw, and the rectangular saw which was used for a thousand years by European cabinetmakers as a ripsaw, and the frame saw was used by the lumber sawyer. In handsawing lumber, two types of saws were used; pit saws, the framed and the open. The oldest form, the framed pit saw, was not practical because the frame had to be taken apart whenever the blade could not be backed out of the kerf. However, the blade was slender and fast cutting. The open pit saw was limber, but easier to operate. Two workmen were required to operate both types which had handles at either end. The log that was being sawed had to be rolled over a deep pit and supported on cross timbers. Then the laborious job of working the pit saw up and down began with one man above the pit and another man in the pit.

The frame type saw was used until the sixteenth and seventeenth centuries. The turn saw was then developed making it possible to saw either crosswise or lengthwise, using the same saw frame. The wide blade saw, the forerunner of the modern saw, came into use in the sixteenth century. A picture dating from 1718 shows the handsaw with a handle that might have belonged to a dueling pistol of that time.

Beginnings of the Modern Saw. The modern handle was not made until about 1750, and was not universally used until saws began to be factory-made, about 1840. Saw making was no longer an occassional job for the blacksmith, but was a factory enterprise; a lifework. Though the factory has not materially altered the form of the saw, it has improved its quality by research into the most suitable steel, the best means of tempering the blades, and how to give it the most attractive and sale-producing finish. Steel is the only metal which could withstand the manipulation and strains in the manufacture and use of saws, and its employment is largely responsible for the development in the saw-making art.

Part C

Wood Boring Devices

The story of boring tools spanned the entire known history of the human race. From the dawn of creation, man is found posessed with certain tools for making holes. There has been a large variety of boring tools that man has experimented with from savagery to civilization, but only the more outstanding methods are dealt with in this study of wood boring devices.

Ancient Boring Devices. Ancient materials of stone, bone, teeth, and ivory, have been found with holes bored in them. These perforations were accomplished by the ancients in one manner or another. McGuire reports in his paper:

> When we see bones or stones which have been perforated and cut, it is reasonable to insist that wood was cut and bored also. In the caves of the world, in the rock shelters, in the gravel beds, and in the older shell-heaps, with rare exceptions, all articles of wood would be destroyed in comparatively few years; yet we have evidence from which it may be agreed that wood was worked as well as harder materials. In bogs and clays of sufficient numbers to demonstrate that early in the bronze if not the stone period man was an experienced worker of wood.
> (7, page 628)

From McGuire's reports, the assumption may be made that the implements with which primitive races have made holes in substances by any artificial means would include wood as well as other materials.

Archaeologists have found stones sharpened to a point and suggest that if these stones were held between the palms of the hands and rotated back and forth they could be used to bore a hole in softer material. Archaeologists have also found cores from bored holes which suggest that hollow bone or shallow wood shaft, using sand and water and revolving, might have been used to bore holes.

The use of the drill of some form or another to which rotary motion in alternate directions was communicated by means of a cord, is of great antiquity. Drills used in this fashion would have some sort of support on the top of the drill. This support, in the shape of a plate, could be held in the hand and a downward pressure exerted giving a faster cutting action to the drill. A tool of this design would require two people to operate, one to pull the cord and one to hold the plate. By attaching the cord to a bow one person could operate this drill by holding the plate in one hand and manipulating the bow with the other. The cutting edge of these drills has been different materials including stones, bones, woods, and metals.

Early Metal Boring Tools. Round holes have been made in wood by carpenters for more than two thousand years. The early Anglo-American workmen sometimes burned square holes with a red hot iron, but the carpenters of western Europe and America made holes one hundred years ago by means of another ancient class of master tool, which worked either by: (a) squeezing through and pushing aside the fibers without removing them; (b) boring, by paring the wood away into shavings; (c) drilling, scraping into dust at the bottom and sides of the hole as the tool penetrated the wood.

The first method can be illustrated by the bradawl. The first boring tool may be assumed to have been an awl of some kind. The blade of the awl is a thin rod, never over one-eighth of an inch in diameter, with a chisel shaped point, mounted on a wooden handle and twisted back and forth, so as to perforate the wood. Carpenters often employed it, years ago, to prepuncture oak or hard wood into which the wrought nails would not drive without bending. This little instrument was not satisfactory for making holes larger than one-eighth inch in diameter, because it formed the hole by squeezing aside the grain, without producing any shavings or dust.

The second type of hole formed by boring a larger hole than that made by the bradawl was by using a gimlet bit. The gimlet bit was a very ancient invention. According to Knight, "Pliny states the Daedalus invented the gimlet, - 1240 B.C." (6, page 184) The gimlet used by the Romans was a small auger turned by one hand instead of two. Unlike the awl it does not squeeze, but cuts a round hole through the wood and therefore made shavings. The modern gimlet has a pivot starting screw. The sides which do the cutting are sharpened. The spiral carries away the shavings. Only small holes may be bored with this instrument.

A larger hole may be bored by the auger. The auger is far better known than other types of boring instruments. Archaeologist have not decided whether the auger was known to the Egyptians, but they are certain the Romans used the auger centuries ago. Early augers were hand forged from iron into various shapes, and were made to cut circular holes by hand-twisting in one direction (left to right). The auger had a wooden cross-handle. Some of the early European augers were equipped with a breast pad to increase downward pressure. This breast auger is pre-eighteenth-century. A photo-engraving from an English illuminated manuscript dated earlier than the fifteenth c entury shows Noah boring one of the planks of the ark with a pod-auger. The instrument had a cross handle which Noah twisted in the usual fashion. Downward pressure was applied by leaning on a revolving circular breast plate attached to the end of the drill shank above the handles.

The early augers, because of their design, would only cut shallow holes in soft woods. To overcome this, and make the tool more workable in deeper holes, an iron shank extending into blades was developed. These augers may be roughly divided into two classes; those which cut downward and those which cut sideways.

The simplest bit that cuts downward is typified by the gouge bit. The gouge bit resembled a carpenter's gouge, but it was sharpened not only on the bottom but on its parallel sides. This instrument would cut in either direction. It simply cut a deep circular incision, thereby releasing a full-sized central plug or core. The tool removed no shavings and had to be pulled out of the hole to allow the shavings to be released. The plug cutter of today is an adaptation of this principle.

Another bit of similar design was the spoon bit. This bit was constructed in the same way as the gouge bit, except the bottom of the cylinder was spoon shaped, and therefore would pull out some of the shavings. The spoon bit was probably developed in northern Europe, but the earliest specimens were found in old Roman army camps. As late as 1768, the spoon bit was found among the tools of the carpenters and the wheelwrights.

The first auger to indicate a twist to the shank was the twisted cylinder or pump auger. Its origin is lost in antiquity. The pump auger was an elongated open cylinder with sides, one of which was sharpened as a blade, somewhat twisted as it tapered downward to end in a screw point that cut diagonally downward, enlarging the hole until the full diameter of the tool was reached. It engaged the wood much more firmly than the un-twisted auger, though much less than the spiral auger described later in this study. Nevertheless, the pump auger did not grasp the wood sufficiently to enable it to penetrate without constant pressure being exerted by the operator, and hence, would not, like the spiral auger, work freely on a crank. Because the pump auger could bore a long hole it was preferred in elongated accurate borings by colonial pump makers for wooden pump trees. This bottom-twist of the cylinder was helpful in holding the shavings as the clogged blade was continually pulled out of the hole to discharge them.

Still another auger used by early coopers is the taper auger. It is wide at the top and tapers to a point on which is a screw. The coopers used it to cut bung or spigot holes in casks, and the cabinet-makers for socketing chair legs.

The wheelwright's burning iron is another type of instrument used to form holes. It had a long, tapering, rectangular, wrought iron point set through a wooden cross handle like an auger. The iron was heated and pressed through a piece of wood producing a square hole to receive the upper square shank of a carriage bolt. One disadvantage of burning holes was that the wood adjacent to the hole was charred and therefore weakened.

All the augers described up to this point failed to discharge their cuttings, hence they interrupted the workman, who had to continually stop, remove the bit, and clean the hole. This brough about a differently constructed and far more effective form of auger which came into general use in the United States and England approximately one hundred years ago; namely, the spiral bit. The spiral auger had a horizontal revolving knife which cuts downward at the full diameter of the hole, but produces an upward lift and continuously discharges the cutting from the hole. This novel method of discharging the cuttings at once revolutionized the auger bit.

The first spiral auger seems to have been that invented by Phineas Cook of England in 1770. The cutting blade differs from the horizontal blade, but is shaped like the pod auger, where it cuts on the sharpened down-twist of its bottom flanges. The spiral is twisted from a flat piece of strap iron and the head and shank formed on each end.

Modern Metal Boring Tools. The really modern bit dates from the beginning of the nineteenth century. Knight states in his dictionary: "Lilly and Gurley, both of Connecticut, invented the auger bit about 1800, but the first patents were to Hoxie (1804 and Hale (1807)." (6, page 184)

One of the first large American manufacturers of this auger bit, twisted from a flat piece of iron, was the Russell Jennings Manufacturing Company of Deep River, Connecticut. The plant was organized in the year 1840 by Russell Jennings, a Baptist minister, and his brother, Stephen Jennings. The first tools manufactured were gimlets. From this product they expanded into the manufacture of the common type auger bits. In the early 1860's they moved to their present location at Chester, Connecticut, and started a program of expansion. They added new buildings from time to time, and acquired other plants in the neighborhood. The year 1855 was a memorable year for Russell Jennings, as the orginal patents for the "extensive lip" type auger bits were issued at that time. The patents were re-issued in 1869 for twenty-one years. This type bit proved so superior that its popularity grew in leaps and bounds, and its superiority, together with the high quality of the Russell Jennings product, resulted in world-wide distribution and acceptance.

In 1885 the Irwin Auger Bit Company was organized and bit manufacturing was begun. Many small changes have taken place in the design of the auger bit during the past sixty-five years. These changes were made mostly by trial and error and from suggestions from workers in the factory. Many angles of incline were tried on the helica twist before the correct angle was determined which would efficiently carry the chips away. However, the basic design had not been altered.

The history of the auger bit began with the cave man and his primitive methods of drilling. Each era in history has contributed to the gradual change in design of this tool until today the modern auger bit is an efficient wood boring device.

Part D

The Bit Brace

The auger bits are useless without a brace. From the beginning of time man has had to have another tool to hold his drilling device. The primitive man used a wrapping of skin for his hand and a shaft of reed to twirl his drill of stone between his palms. Our present day brace goes back to the primitive methods of holding used by the Stone Age man.

Primitive Brace. The cord-operated drill, replacing the hand-rotated drill, developed in two forms; the strap drill, operated by a strap drawn tight and alternated right and left to rotate the drill point, and the bow drill developed about the same time in most parts of the world. The Egyptians illustrated in their carved pictures, a strap drill as a two-man or three-man tool. The "Iliad", by Homer, tells of boring "with a drill while his fellows below spin it with a strap, which they hold at either end."(15, page 31)

In the two- or three-man form of a strap drill, a man pulls at each end and either one of them or a third steadies the tool. The bow drill survived in Europe throughout the Middle Ages. Its use had continued even to the present, and the strap drill is to be found in use in Alaska among the Eskimos.

Medieval Brace. Woodworkers had to have a better holding tool when the shaving-cutting bit came into use. More force was needed to turn the bit, thus the first cross auger handle was invented. The cross handle now serves to rotate the tool, but in more ancient tools this handle had to serve also as a means of pressing the tool into the wood. An old fourteenth-century picture shows Noah building the Ark, using an auger equipped with a wood breastpiece. An ancient Egyptian picture clearly shows a bit brace being used. Several ancient Roman bits have been found, but not the braces. In a Brussels gallery is a fourteenth-century picture showing St. Joseph boring holes with a wooden brace which seems to have been the customary kind in use throughout the Middle Ages.

Modern Brace. In 1760, a brace appeared with an iron bit that fit into a wood shank; and the wood shank slipped through a square hole in the brace. Bits with the modern metal square tang probably were first used on blacksmith bit braces, since the blacksmith had access to metal. Also, the blacksmith's brace had an efficient device for locking and releasing bits. An old French encyclopedia published 1769 illustrates one of the oldest metal braces(1767). Another seventeenth-century metal bit brace is now in the Cleveland Art Museum. These old relics had a ball in the center of the brace which is an answer to why the sweep handle, or center of the brace, is called by some writers the "ball".

The year 1850 witnessed the first factory to make bit braces in America. According to the Peck, Stow, and Wilcox Company, this tool was called a Pexto brace. This crude cast-iron brace had a rivet for the head which was replaced by a wooden head in 1865. The brace was improved at the same time by a free-turning centerhandle.

Manufacturing standards had not yet been introduced and each bit manufacturer made the tangs of his bits by his own idea of size causing the purchaser to file his new auger bit to fit his brace socket. Spofford remedied this when he patented a split socket in 1859. The split socket gripped any size and taper of bit tang by means of a thumb screw. In 1866, John S. Fray and Horace Pigg purchased the patent. This popular split socket brace has been on the market ever since Fray and Pigg popularized it. The first shell-type chuck, developed by Barber, came out in 1864. The Fray chuck followed sometime after Barber's chuck. Both types are made by all bit brace manufacturers today. The Barber chuck holds either the square or round tang bits, but the Fray chuck holds only the square type. In 1868, the first racket brace was brought out in the United States, however it is doubtful that it was popular until the eighties. The racket brace was convienent for working in tight corners. The most recent change in the brace has been the use of ball bearings; some of the braces have ball races in the center handles, under the heads, and in the chucks.

In recent years, attention has been turned to the bit brace by inventors, perhaps even more so than any other tool in the woodworker's kit.

Part E

Plane

Some tools change little from age to age, but the plane is one of evolution; it has advanced step by step from ancient times to modern civilization. The plane is not a tool of great antiquity, unless the chisel and adz are considered as planes, although the plane doubtless evolved from the chisel and adz.

Ancient Plane. The earliest plane was written about in the Bible, Book of Isaiah 44:13, "The carpenter stretcheth out his rule; he marketh it out with a line; he fitteth it with planes...". The Phoenicians, in the building of their ships, perhaps used the first plane. The Phoenician's plane was a chisel-shaped implement of stone. Among the many discovered tools of the Egyptians, no plane was found. Pictures carved by Egyptians show workmen with chisels, saws, and adzes, and smoothing their work by rubbing it with pieces of sandstone. The Romans had well developed, and very refined, planes. A Roman plane dating from 50 B.C., believed to date from the time of the Roman occupation of England.

Medieval Plane. During the Renaissance Period, the plane became a wooden bed instrument, the wedge held in place by side grooves, with a knob for the hand. "Melancholia", painted by Albrecht Durer, in 1514, pictures a newer way of holding the wedge and iron by the well made knob. The Roman had a rear hand-hold which did not appear again until it was introduced in the seventeenth century as an aid in carrying instead of planing.

The eighteenth century brought about a marked improvement in the plane by the adding of a second cap, or curling iron, that made it possible to plane against the grain. This second iron was held in place by the pressure of the wooden wedge. The curling iron was the greatest improvement in the eighteenth century.

The woodworker made his own tools until the early nineteenth century when factories began manufacturing them. Individuality was the workman's certificate of craftsmanship. This custom largely accounts for the fact that the workman's tools were made of wood, and the factory accepted this and made their tools from wood. The factory production did not change the plane. Factory type jack and jointer planes were made from 1828 to 1880 with little variation. The iron was held in place by a wooden wedge, tightened in tapered side grooves by driving with a hammer. The iron had to be reset to adjust its depth. The woodworker used several planes varying in depth of set rather than do this time consuming adjusting.

Modern Plane. In 1827, a cast-iron bed plane was patented by H. Knowles, marking the beginning of the modern plane. The factory era brought about this change from a wooden tool of a thousand years. A screw adjustment was invented by T. Stanford in 1844. This screw discontinued the use of a hammer to adjust the bit; the bit could be adjusted longitudinally or vertically. Leonard Bailey and G.A. Warren later improved on the screw adjustment. Bailey also invented the lever cap that was so superior to the wedge; he fastened the curling iron and bit together with a screw; Bailey connected the knob and handle to the bed by bolts; he invented the bend in the lower end of the curling iron; and he introduced the adjustable frog that permits the operator to control the width of the shaving throat. G.A. Warren's contributions to the plane modernized its present pleasing lines, balance, and convenient arrangement of parts.

The Gage plane, now made by Stanley Plant, was being manufactured by the Gage Company at the same time the bed-rock plane was developed by the Stanley Rule and Level Plant in 1895. They are now in close competition with the Bailey.

There was no limit to the many special planes a wood-worker had for making dadoes, rabbets, tongue and grooves, rounds, hollows, reeding and complete moldings, but now they are of little use. Now with machinery and the many assorted cutters the need for most special planes are filled.

The story of the plane has a great evolution, however the changes of the past one hundred years have been the most radical, but the two thousand-year-old basic idea of a chisel held in a depth-controlling gouge has not been changed. There will probably always be a place for the hand plane where a simple tool is needed and preferred over a machine.

CHAPTER IV

RECOMMENDATIONS AND CONCLUSION

Man's position of superiority over the other creatures of the earth is due largely to his ability to take simple objects of nature and convert them into simple tools. As man's needs and desires developed so developed the hand tools. In the study of history the means by which man conquered the obstacles in his climb to civilization is seldom mentioned. History so often relates only the strife and conflict of man. Wyatt states in his book:

> More truthfully the significant history of man reads like this: By conquest of the club, the stone hammer was conquered; by conquest of the hammer, the drill was conquered; by conquest of the drill, the wheel was conquered; by conquest of the wheel, the lathe was conquered; by conquest of the lathe, the steam engine was conquered; by conquest of the engine, the electrical age was achieved; all because primitive man learned that he could strike harder with a club than with his fist. (15, page 3)

Recommendations for Further Study. The following is a list of suggestions for additional studies:

1. The history and development of other hand woodworking tools.
2. A study of the development of hand tools used in other industrial arts subjects.
3. The history and development of power saws.
4. A study of the development of power drilling devices.

5. The development of the jointer and surfacer.

6. The care of woodworking tools and machines.

It would seem advisable to include more than one of these topics in a single report, since there is definitely a limited amount of material available.

Conclusion. The hand tool has made great contributions to the development of civilization. Man learned to control his environment through the manufacture and use of hand tools. There is hardly a business, trade, or industry in which hand tools do not play an important role. Hand tools are used extensively in construction, repair, and maintenance. The invention of the power tools has not affected the importance of the hand tool.

APPENDICES

A. A Selected Bibliography

B. Respondents to Inquiry

C. Letter of Inquiry

Appendix A

A SELECTED BIBLIOGRAPHY

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Appendix B

RESPONDENTS TO INQUIRY

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2. Connecticut Valley Manufacturing Company, Chester, Connecticut.

3. E.C. Atkins and Company, 402 South Illinois Street, Indianapolis, Indiana.

4. Fayette R. Plum Inc., Philadelphia, Pennsylvania.

5. Foley Manufacturing Company, 3318 Northeast 5th Street, Minneapolis, Minnesota.

6. Greenlee Tool Company, 2023 Twelfth Street, Rockford, Illinois.

7. Henry Diston Saw and File Company, Philadelphia, Pennsylvania.

8. Herman A. Schildt Company, 323 - 327 East Market Street, Louisville, Kentucky.

9. Irwin Auger Bit Company, Willmington, Ohio.

10. Millers Falls Company, Greenfield, Massachusetts.

11. Russell Jennings Auger Bit Company, Chester, Connecticut.

12. Simonds Saw and Steel Company, Fitzburg, Massachusetts.

13. Stanley Tool Company, 473 Elm Street, New Britain, Connecticut.

14. The Kindt-Collins Company 12653 Elmwood Avenue, Cleveland 11, Ohio.

15. The S.L. Garrett Company, Athol, Massachusetts.

16. The Wilkie Foundation, Des Plains, Illinois

17. Utica Drop Forge and Tool Company, Utica, New York.

Appendix C

Joe M. Floyd
124 West Maple
Stillwater, Oklahoma

Dear Sirs:

At the present time, I am enrolled in the Graduate School of Oklahoma Agricultural and Mechanical College pursuing work toward a master of science degree in Industrial Arts Education.

A thesis is required as partial fulfillment for the requirements of this advanced degree. The title of my thesis is "The Historical Development of Five Hand Woodworking Tools". There is very little information available in the library pertaining to this subject.

Your company has been selected from a list of nationally known tool and supply companies with the hope that you may be able to provide some information including drawings, pictures and diagrams on this subject.

The tools included in this study are: (a) hammer, (b) saw, (c) wood boring devices, (d) bit brace, and (e) plane.

Sincerely,

Approved:

Leroy H. Bengtson, Advisor

VITA

Joe Mac Floyd

Candidate for the Degree of

Master of Science

Report: THE HISTORICAL DEVELOPMENT OF FIVE HAND WOODWORKING TOOLS

Major Field: Industrial Arts

Biographical:

Personal data: Born at Ada, Oklahoma, December 6, 1932, the son of Furman and Estelle Floyd.

Education: Attended Irving Grade School, Ada Junior High School, and was graduated from Ada Senior High School in 1950; received the Bachelor of Science degree from East Central State College with a major in industrial arts education in July, 1955. Completed requirements for the Master of Science degree in August, 1956.

Professional experiences: Entered United States Army, Infantry, in September, 1950; served in Japan and Korea; received disability retirement in August, 1952.

REPORT TITLE: THE HISTORICAL DEVELOPMENT OF FIVE HAND WOODWORKING TOOLS

AUTHOR: Joe Mac Floyd

REPORT ADVISOR: Leroy H. Bengtson

The content and form have been checked and approved by the author and report advisor. The Graduate School Office assumes no responsibility for errors either in form or content. The copies are sent to the bindery just as they are approved by the author and faculty advisor.

TYPIST: LaVerne Floyd