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Scope of Study: Shop teachers and administrators need information pertaining to the selection of tools and equipment and their cost. This information is needed to plan new shops or to add new equipment to old ones. It was with this thought in mind that this study was made. A short history of the development of tools from the stone age to the present is contained within this report. Chapter III of tool selection along with tables containing a suggested list of tools and equipment and the estimated price of each.

Findings and

Conclusions: The writer found the school woodwork shop to be one of the most expensive departments to equip properly and the most difficult problem that a person will face is that of making proper selection of equipment for the shop.

It is the opinion of the writer that the person responsible for purchasing school shop equipment should be familiar with the objectives of the school and should make himself familiar with all available criteria for the selection of tools and equipment.

Advisor's Approval

C. R. Hill

THE COST OF SCHOOL SHOP  
WOODWORKING EQUIPMENT

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WOODWORKING EQUIPMENT

By

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C.C.C.

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## CHAPTER I

### INTRODUCTION

It is the aim of the writer to organize and compile lists and cost of tools and equipment used in the woodworking shop that will be useful to the industrial arts teacher. A teacher of industrial arts should have some knowledge of the history of woodworking tools, therefore the writer will start this report with the early and present development of woodworking tools and machines.

Need for the Study. A problem that faces every instructor of industrial arts is the one involving the selection and purchasing of equipment for his shop.

Every industrial arts teacher will, sooner or later, be faced with the problem of equipping a new shop, replacing old or worn out equipment, or adding new equipment to the present shop.

It is the responsibility of most industrial arts teachers to make requisition or order sheets when making a request for equipment he needs in his shop. This is not an easy task since the instructor must have the price of every item on his list. Catalogs, furnished by the manufacturer often does not include the price of their tools fully equipped and ready for operation. There are times when it may be necessary to contact the manufacturer in order to get the total cost of some piece of equipment.

School administrators and students alike are interested in the cost of woodworking equipment. The school administration is interested in securing the best equipment at the lowest cost to the school and more likely is interested in staying within a budget set up to operate the school. The student may be interested in starting a home shop and needs to know the cost of equipment suitable for his purpose.

Method of Investigation. The method of research used in this report includes a review of a report made on a similar study, articles that have appeared in periodicals, catalogs from various manufacturing companies, and books found in the Oklahoma State University Library.

Review of a Similar Study. A review of a previous study was made in preparation for this report. Darrell F. Stiles completed his report for his Master of Science degree in 1950. His report is titled "School Shop Woodworking Equipment".

In his report, Stiles gives a brief history of hand tools and wood working machines. Chapter III, of that report, is devoted to the early educational leaders and their philosophies which helped to bring about the teaching of woodwork in public schools. Chapter IV contains the criteria for tool selection. Also contained in this chapter are suggested lists of tools for woodworking in grades one through twelve. (5)

Definition of Terms. To assure the reader of this report a clear understanding of the contents, the definition of the following terms used in this report are given.

Equipment. Stationary or movable device, not usually power driven, to aid in handling, securing, or servicing the work.

Hand Tools. Small tools manipulated by hand for the purpose of cutting and shaping wood into useful products.

Machines. A term used for power driven tools either stationary or portable for cutting and shaping wood into useful products.

Power Tools. Tools powered by means other than hand but may be manipulated by hand in cutting and shaping wood and wood products.

Shop. A term used in this report rather loosely to refer to study or instruction in laboratory skills and procedures in wood and also to refer to the laboratory and equipment used.

School Shop. A shop in connection with the school system where students work with tools and materials under the supervision of a teacher.

Plan of the Report. The brief history of woodworking tools and their development from early stone age to the present time is presented in Chapter II. The chapter is divided into four parts. Part A is the early development of hand tools and the contributions made by the Egyptians and Romans. Part B is the early history of man's efforts at making machine tools and the men who contributed to their development. Part C is the development of machine tools in America, and Part D is the current trend in machine tools. Chapter III is divided into two parts. Part A is the criteria for tool selection and Part B contains a suggested list of tools and equipment for a woodworking class of 24 students along with the estimated current retail price of each item. Chapter IV contains the conclusions and recommendations of the writer concerning the findings of this report.

## CHAPTER II

### THE DEVELOPMENT OF WOODWORKING EQUIPMENT

From the earliest civilization up to the beginning of the nineteenth century, wood was fashioned and joined by hand. During these centuries methods and tools changed very little. Tools for hand woodworking and the processes involved are substantially the same even at present. This apparent slow growth, also found in machine tools, is not so much due to the lack of progressiveness or initiative on the part of man but rather to the limitations of the wood which cannot be transformed, improved or converted like other raw materials.

#### PART A

##### Early Development of Hand Tools

From the beginning of time man has endeavored to improve his use of materials provided by nature. As man developed he learned he could devise tools with which to change other natural materials into a more useful product. Man at first used sticks, stones and bones of animals for his tools. He made improvements by combining stick and stones. Tools and methods developed very slowly, until the discovery of metals. With this discovery tools and methods put on a new meaning. With this new material man became more specialized. His tools became more useful and he was able to do more in providing luxuries of living in a changing world.

The New Stone Age. The Neolithic Age was the period of basic and permanent change in human affairs. People began to modify nature and skills were developed. During this time specialization had its beginning.

Many ways were devised for providing tools with handles. They were more efficient and durable. With them it was possible to produce products that were required in a changing way of life.

Tools developed during this period were boring flint, gauge, scraper, chisel and saw. With these tools products could be fashioned with mortise and tenon joints and assembled. Abrasives were used for stone cutting and drilling. (7, pagell)

The Bronze Age. Bronze made possible tools of refined design. They were sharper and had a more durable cutting edge and they could be sharpened repeatedly. This was a great advantage over stone and flint tools.

During this period the Egyptians developed tools of production such as the vertical and horizontal levels, and the cubit stock. These tools made possible construction never before known. (7, page 13.)

The Iron Age. With the coming of iron tools came greater advances in skills and crafts. During this period the first spikes were developed. The plane came into use and the first saw with set teeth. Other tools developed during the iron age were socket chisels, augers and brace, draw knife, and turning saw.

The advantages of these tools and all they might have accomplished lay dormant, because of human slavery. The tools

and inventions, which the Romans and Greeks developed were to become the embryos for further advancement centuries later. (7, page 15.)

## PART B

### Early History of Machine Tools

The earliest woodworking machines date back as far as the fifteenth and sixteenth centuries, and were found in only a few places in Germany, Holland, Sweden, and England. These machines were very crude. The frames were made of heavy timbers and only the cutters and bearings were made of metal. They were powered by man, animal, wind, or water.

Circular Saw. The first circular saw was invented in Holland. This saw was never a success because of the difficulty in making saw blades and bearings. Later a saw of similar design was set up in England in 1777. It was patented by Samuel Miller, a sailmaker of Southampton. (4, page 1)

Planing Machine. A planing machine was patented in England in 1776 by Hatton, but it never had any practical value. It consisted of a series of cutting irons which were dragged over a board by the use of a series of pulleys. The transverse planing machine was invented in 1802 by Joseph Bramah. It resembled the machine used for planing metal. The board to be planed was fastened to a carriage which moved under a cutter revolving in a horizontal plane. (4, page 7)

Rotary Cutting Tools. The prison system in England was reformed and modernized about 1790 through the efforts of Sir Jeremy Bentham. Woodwork shops were established but the

majority of the prisoners were unskilled in the use of hand tools. A number of years was required, in those days, to become a skilled craftsman with hand tools. Faced with this problem, Sir Jeremy Bentham called on his younger brother, Samuel Bentham, for help in solving this serious problem. Samuel Bentham had a thorough practical and technical knowledge of ship building and the woodwork trade. At one time he acted as manager and commandant of shipyards and glass, cordage, and woodworking factories.

Samuel Bentham, who had other inventions to his credit, did not disappoint his older brother, but made the most ingenious series of inventions, which changed woodworking from a handcraft to an industry. The most important of these was the principal of rotary cutting which is used in all modern planers, jointers, shapers, molders, and matchers. He also invented veneer cutting machinery, segmented circular saws, tenon cutters, boring machines, and sharpening machines. He even suggested tilting the table saw and described fences for ripping and crosscutting. Samuel Bentham may therefore, rightfully be called "the father of woodworking machinery". (4, page 3)

With the inventions of Samuel Bentham the unskilled prisoners were able to plane, saw, or bore as well or better than a skilled woodworker with hand tools. These machines proved even more useful and efficient in the hands of skilled woodworkers in the dockyards. (4, page 4)

The Band Saw. The band saw was patented in 1808. It was known as the Newberry saw and was invented by William Newberry. It was not put into use until about 50 years later, when the French perfected the manufacture of saw blades. (4, page 5)

## PART C

Development in America

England remained the leader in woodworking machine inventions until the beginning of the nineteenth century but from this point on England seemed to lag and the leadership passed to the United States. This country was just getting its start in the East. The West was still unknown and unexplored. The country had an apparent inexhaustible supply of timber. Small shops were set up to take care of carriage work, cooperage, carpentry, and cabinet work. These shops usually consisted of one room adjoining the house of the owner and were operated by only one man or with one or two helpers. Shops of this kind could be established with very little capital, because they had no machines except a lathe. (4, page 6)

The Lathe. The lathe is probably the oldest woodworking machine known to man. The Egyptians invented a bow lathe about 740 B.C. The stock was rotated by means of a bow whose string was wound around the stock. Both hands and feet were used in the operation of the bow lathe. This type of lathe is still being used in many parts of Asia and Africa. The pole lathe was operated on the same principal as the bow lathe. It was mounted on a wooden frame. A string was attached to an overhead pole then wound around the stock and then to a pedal operated by footpower. A wheel was added later to revolve the stock in a continuous direction. In some places where labor was cheap, lathes were rotated by means of a six foot wheel fastened to the floor some distance from the lathe and a rope



was used as a belt to turn the lathe. The large wheel was turned by one and sometimes two men. (4, page 8)

During the sixteenth and seventeenth century many kings and princes, and even queens and ladies of high rank, practiced woodturning as a hobby. They used small lathes made of richly inlaid wood and took great pride in their craftsmanship. Examples of this royal handiwork are found in many European museums. (4, page 11)

The forerunner of the automatic lathe or turning machine was invented by Thomas Blanchard of Philadelphia in 1819. In this lathe a model of the shape to be turned was used for the first time as a guide for the cutters. (4, page 11)

Circular Saw. Benjamin Cummings of Schenectady, New York, is credited with making the first circular saw in his own blacksmith shop. A patent on an improved circular saw was granted Robert Eastman of Brunswick, Maine, in 1824. (4, page 11)

Planing Machine. William Woodworth, a carpenter living in Poughkeepsie, New York, succeeded in inventing the first planing machine using feed rollers in connection with a rotary cutter. He was granted a patent on his machine in 1828.

Woodworth received \$5,000 for his patent in 1848. The patent was sold to John Gibson, Samuel Schenck, and Samuel Pitts. These men succeeded in establishing a monopoly which lasted for 28 years.

The first Whitney planer was manufactured in 1860. (4, page 11)

Mortising and Tenoning Machine. The footpower mortising machine was invented in 1843 by George Page of Keene, New Hampshire. The same year J. A. Fay invented a tenoning machine.

These two men joined forces under the name of Page and Company. Mr. Fay can be given credit for improving the demand for more and better machines in this country. The first hollow chisel mortiser was invented by the Greenlee Brothers in 1876.

(4, page 12)

Power. Probably the greatest advance in machines has been made in the method of supplying power. The first machines were driven by water, wind, or animal power. Although the steam engine was invented in 1769, it was not until the nineteenth century that one was built that was practical and economical for general use in industrial plants. The engine was placed at one end of the plant with an overhead shaft extending the full length of the building. Machines were operated by open belts extending down from this main shaft. This method of operation remained unchanged until after 1900. At this time machines were being introduced that were driven by individual motors. (4, page 14)

Many advances have been made in the design and construction of machines. Improved high speed electric motors with ball bearings have replaced the overhead shaft with its open belts. The machines are now well guarded with the safety of the operator in mind. The square cutter heads of the early rotary cutters have been replaced with round heads which have greatly reduced vibration of the machinery. Steel alloys are now used that will withstand high speed and shock. Lubricants are now used to reduce friction which was a major factor in the failure of early day machines.

## PART D

### Current Trends

With the discovery in the use of electricity, improved metals, and alloys, modern machines are a far cry from those early machines with their large bulky wooden frames and unguarded working parts. Although we may think of our machines as being modern they are only improvements of those which were invented many years ago.

The early machines could only be used in one place and could only perform one operation. In recent years machines have been made smaller. They are economical, safe to operate, and are capable of performing many different operations.

One of the first portable power tools was a router produced in 1909 by the Kelley Electric Machine Company of Buffalo, New York. The portable jointer was produced in 1918 by J. D. Wallace of Chicago, Illinois. Portable power tools have become so versatile they can now perform operations that formerly were restricted to hand tools. The portable savor saw has replaced the coping and turning saw. The electric router, with its many attachments can do the jobs formerly done with chisels, hand router, and universal plane. Electric hand drills, electric belt sanders and vibrators sanders, and electric planes, all of these have done away with much of the laborious hand method of woodworking. When installed in production shops, they are a great time and labor saving device. These tools have completely revolutionized the carpentry trade. Today the carpenter carries his light weight power tools

from job to job as easily or easier than the early day carpenter carried his hand tools.

It is not unusual to find a well equipped hobby shop in the home of today. The small electric portable tools require very little space and can be plugged into any 110 volt electrical outlet in the home.

These improvements and refinements in the design and manufacture of woodworking have been made at a time when the increased use of steel has replaced wood in many industries.

In the schools the modern trend is to place more emphasis on the practical side of education. Every boy should have some experience in shopwork and learn to use both hand tools and machines. The number and size of these machines vary greatly according to the community, the type of school, and the age level of the students. A well equipped woodworking shop of the senior high school usually has the following machines: a circular saw, a band saw, a planer, a jointer, a wood trimmer, a mortiser, a sander, a grinder, a portable router with attachments and two or more lathes. Along with these machines a good supply of hand tools are needed. Hand tools like machine tools should be of the very best quality in material, workmanship and design.

The criteria for the selection of tools will be discussed in the following chapter. There are tables containing lists of tools and equipment needed to equip a high school shop of 24 students. Included will be the price of each item and the number needed.

## CHAPTER III

### SELECTION OF WOODWORKING EQUIPMENT AND ITS COST

During the past years many new school buildings were planned, built, and equipped with little thought for shop facilities. All too often, when a new high school was built, the shop got the short end of the educational stick. Because many administrators are academically minded, the new building was planned and well equipped for all areas except shop. Industrial Arts got only four bare walls. What about equipment? This question is often answered with, let the shop teacher order the equipment after he arrives on the job. He could even build his own benches and cabinets.

By the time the school is dedicated, the community has usually run out of money and there is nothing left for the shop equipment. Then it is suggested that the shop teacher get along with the equipment they used in the old shop. Usually one or two areas stand idle because of the lack of equipment while other areas are equipped with obsolete benches, tools, and machines.

How can we make sure the shops built in the future will be architecturally and educationally correct and the new shops will have equipment that will be an integral part of each? The following suggestions may be of some help in solving this problem.

1. The members of the profession should work closely with school architects in order that they will be acquainted with the needs of this area of education.
2. Administrators and architects should be convinced that shops must be completely equipped with tools, machines, benches and cabinets. The shop teacher should not be expected to set up benches and install equipment.
3. Superintendents should be convinced that the shop teacher is hired to teach, not to build the shop equipment.
4. Every state should have available a consultant service at the state level so that small and medium sized schools may obtain expert advice as to the kinds and types of shops that best suit their particular communities.
5. The job of planning industrial arts facilities should be the responsibility of the industrial arts teacher or teachers. Since the basic offerings of industrial arts are the same regardless of geographic location, every state should have available suggested floor plans that may be used by those who design new school buildings.
6. Teachers should seek the advice of commercial concerns in selecting benches and equipment but

should not turn the job of school shop planning over to any single company. They should use standard brand, high quality benches, cabinets, machines, and equipment and should buy from companies that are interested in education. The idea of buying off brand items for which replacement parts and services are difficult to get should be discontinued.

(3, page 35)

## PART A

### Criteria for Tool Selection

One of the most difficult jobs that a woodworking teacher will face is that of selecting tools for a shop. Before a shop teacher makes any selection he should visit other schools that have had similar problems. No person should sit down and write out, from memory or imagination, what he considers an ideal list of tools and equipment.

Survey Equipment Needs. Probably no school could be found that would serve as a complete example for any other, but a study of the tools and equipment could be made to determine whether or not the tools and equipment have served the purpose for which they were purchased. Such a visit should not be made to copy or surpass other schools but to avoid errors made by others in their selection of woodworking equipment.

Satisfy Objectives. The objectives of the shop course should be a guiding principle when selecting tools and

equipment for the shop. Each piece of equipment should be considered on the basis of the objective it is to satisfy or attain. All machines should be selected with the pupils' interest and the use the pupil will have for such a tool or equipment.

New designs of more suitable tools and equipment, for school use, are constantly manufactured and offered for sale. Schools that were equipped one or two years ago may not have the latest equipment. This is not meant to imply that the latest is always the best.

Investigate Before Making a Selection. A variety of manufacturers should be contacted for catalogues of their tools and equipment. Advertizing pages of professional and trade magazines have addresses of firms specializing in school shop equipment. The fact that a certain firm had the best machines five years ago does not prove that the same firm holds that position today. (2, page 313)

Selection of Tools and Equipment. In the selection of tools and equipment, it is the duty of the person selecting these to acquaint himself with four governing factors.

1. The nature of the course.
2. The maturity of the pupils.
3. The size and location of the room.
4. The probable amount of money available.

(5, page 34)

With the first three factors as a basis, an ideal list of equipment should be planned without regard to the fourth factor.



By starting with a complete picture of the ideal tools and equipment, eliminations can be made without the probability of overlooking some essential need.

A good definition of ideal equipment is:

One that enables each student to have access, without delay or loss of time, to the necessary tools for the performance of the work in hand.  
(8, page 298)

Standard Brand Tools. Standard brand machines and equipment should be the first choice on any list. Manufacturers in most lines of tools and equipment have adopted trade names to identify their products. The selection of nationally known brand tools and equipment will undoubtedly give better service, stay sharp longer, contain high quality steel, parts and repair service may be more easily and conveniently obtained, and help in making the student more conscious of quality tools. Some examples of standard brand woodworking machines are:

- |                   |                     |
|-------------------|---------------------|
| 1. Boice Crane    | 5. Oliver           |
| 2. Yates American | 6. Black and Decker |
| 3. Delta          | 7. Stanley          |
| 4. Walker Turner  | 8. Porter Cable     |

Some examples of standard brand woodworking handtools and equipment are:

- |                     |               |
|---------------------|---------------|
| 1. Stanley          | 7. Plumb      |
| 2. Disston          | 8. Atkins     |
| 3. Miller Falls     | 9. Wilton     |
| 4. Irwin            | 10. Columbian |
| 5. Russell Jennings | 11. Hargrave  |
| 6. Greenlee         | 12. Jorgensen |

Manufacturers of these tools also produce tools and equipment of the home shop variety. Because of the exceptionally hard years of service and many students using them, tools and equipment of this type should be avoided for school use.

Check List for Tool Selection. It will be well for the person selecting machines for the shop to keep the following points in mind:

1. Have proper materials been selected for the various parts and has enough material been used for strength and rigidity?
2. Is the machine well guarded so there is no likelihood that a pupil will be injured by moving parts?
3. Are repair parts easily obtainable at reasonable prices?
4. Can broken or worn parts be easily removed and replaced?
5. Can repairs or adjustments be easily made without taking the whole machine down?
6. Can bearings and parts needing oiling be easily and properly lubricated?
7. Are bearings and other moving parts protected from dust and other injurious material?
8. Are belt connections simply or awkwardly made?
9. Are gear trains awkward and difficult to reach?
10. Is the machine finished and pleasing in appearance?
11. Is excessive vibration eliminated by good engineering or using an unduly heavy frame?

(5, page 34)

Use of Equipment. Other items that definitely require consideration in selecting tools and equipment are: will the tool be of general usefulness; is equipment for instructional

use; how often will it be used; and where will it be put?

Equipment should be purchased for use of students, not for the pleasure and experimentation of the instructor. In many cases equipment is included that appeals to the instructor but has no practical use for students. This practice is a common cause of over-equipping.

How many hours a day or week or month will the equipment be used? The answer to this question should enter into the final decision regarding the purchase of any piece of equipment. Occasionally, pieces of equipment are added for the purpose of getting out stock for class use. This type of machine may be justifiable, but the factor of use must not be overlooked.

Where will it be located? This is a question which should be answered before the purchase of any large piece of equipment is made. It is not sufficient to attempt to visualize in a general way the location of a proposed machine. Planning in advance the exact location will be a good basis for intelligent selection. Exact locations must be determined through scaled drawings. Pieces of cardboard should be cut out to scale, representing each piece of equipment, and then manipulated in various positions for a complete picture of the best possible layout. Manufacturers will usually furnish layouts and templates upon request. (2, page 316)

## PART B

### Woodworking Tools and Equipment and Their Cost

The following tables contain information that will be very helpful to anyone interested in purchasing additional

tools or planning a complete school woodwork shop. Since most school administrators will be interested in the cost of the equipment, an approximate price for each item is included. The prices were determined by using an average of the current-selling price as quoted by reputable concerns manufacturing similar equipment and will appear in the table as round numbers for machine tools. The number of tools needed to equip a shop for 24 students is a suggested number and may be increased or decreased to meet the need or budget of individual schools. The specifications on the tables are brief and general in nature. Additional specifications would aid the buyer in acquiring the specific tool desired.

Table I is a suggested list of equipment and storage facilities to be used in a woodwork class.

In the modern school shop more emphasis is being placed on power tools than ever before. Industry is using power tools in most of its production. Therefore it is reasonable to assume the school shop should be equipped with a good selection of power tools used by industry regardless of whether the shop is to be used to train students for an occupation or to be used for exploratory classes. Table II is a suggested list of power tools.

Although hand tools are being replaced, to some degree, by power tools, there is still a definite need for these tools in the woodworking shop and will remain an essential item until a power tool can be devised to perform the same operation equally well. Table III is a suggested list of hand tools.

The quantity of each item in Tables I, II, and III is a suggested number to be used in a school woodworking shop of 24 students. The prices on Table I and II are rounded to the nearest dollar. The prices on Table I, II, and III are those obtained from 1961 catalogues of manufacturers and distributors and are those of first quality tools and equipment. The tables of equipment follow, beginning on the next page.

TABLE I  
EQUIPMENT AND STORAGE

| Quantity | Name of Equipment        | Description   | Price    | Total      |
|----------|--------------------------|---|----------|------------|
|          | Benches                  |   |          |            |
| 12       | a. Woodworking           | Two station 2 $\frac{1}{4}$ " laminated maple tops equipped with two rapid acting vises<br>Metal base with lockers. | \$119.00 | \$1,428.00 |
| 1        | b. Teacher Demonstration | Single station 2 $\frac{1}{4}$ " laminated maple top equipped with one rapid acting vise<br>Metal base for storage  | 105.00   | 105.00     |
| 1        | c. Glue                  | Metal top with base to provide for storing glue equipment and supplies  | 38.00    | 38.00      |
| 1        | Bulletin Board           | $\frac{1}{4}$ " x 4' x 8' cork  | 30.00    | 30.00      |
| 1        | Chalk Board              | Portable  | 35.00    | 35.00      |
|          | Cabinets                 |   |          |            |
| 1        | a. Stain and Finish      | All steel for storage of flammable liquids  | 120.00   | 120.00     |
| 1        | b. Filing                | 4 drawers for class records, instruction sheets, drawings, and tests  | 55.00    | 55.00      |

TABLE I (Continued)  
EQUIPMENT AND STORAGE

| Quantity | Name of Equipment   | Description   | Price    | Total      |
|----------|---------------------|---|----------|------------|
| 1        | c. Storage          | All purpose for storage of miscellaneous supplies   | \$ 60.00 | \$ 60.00   |
| 1        | d. Tool Cabinet     | Large enough to accommodate all small tools not kept at work stations. Base to provide storage of hardware. | 550.00   | 550.00     |
|          | Cases               |   |          |            |
| 1        | a. Book             | Glass Front. Completely enclosed.   | 60.00    | 60.00      |
|          | Desks               |   |          |            |
| 1        | a. Teacher          | Knee hole type. 30" x 60" top and chair.  | 110.00   | 110.00     |
| 1        | b. Student Planning | Equipped with 4 drawing areas with 4 stools.  | 140.00   | 140.00     |
| 1        | Lumber Rack         | Lumber storage up to 14' in length.   | 240.00   | 240.00     |
| TOTAL    |                     |   |          | \$2,971.00 |

TABLE II  
POWER TOOLS

| Quantity | Name of Equipment      | Description  | Price    | Total     |
|----------|------------------------|--|----------|-----------|
|          | Drills                 |  |          |           |
| 1        | a. Drill Press         | Floor model 15" equipped with mortising attachment, motor, switch, and guards  | \$216.00 | \$ 216.00 |
| 1        | b. Drill Press         | Floor model 14" standard equipment motor, switch and guards  | 170.00   | 170.00    |
| 2        | c. Electric Hand Drill | $\frac{1}{4}$ " capacity gear type chuck   | 30.00    | 30.00     |
| 1        | Tool Grinder           | 7" pedestal type equipped with guards one fine grit and one coarse grit wheel. Plane iron grinding attachment.   | 180.00   | 180.00    |
| 1        | Jointer                | 8" long bed fitted for rabbiting, safety cylinder type equipped with guards.   | 445.00   | 445.00    |
| 4        | Lathes                 | Motor in head multi-speed to take 24, 36, 48, 60 inches between centers. Each complete with cup center, drive center, face plate, tool rests, and tools. | 580.00   | 2,750.00  |



TABLE II (Continued)

## POWER TOOLS

| Quantity | Name of Equipment | Description  | Price      | Total      |
|----------|-------------------|--|------------|------------|
| 1        | Planer            | 24" single surface planer.<br>Safety head cylinder 4 knife<br>type.                          | \$2,750.00 | \$2,750.00 |
|          | Sanders           |  |            |            |
| 1        | a. Belt and Disk  | Belt and disk combination<br>6" x 48" belt, 10" disk.<br>Mounted on stand motor<br>included. | 240.00     | 240.00     |
| 1        | b. Portable Belt  | Hand plane type 4" belt.<br>Equipped with dust bag.  | 130.00     | 130.00     |
|          | Saws              |  |            |            |
| 1        | a. Band           | 20" motor drive, completely<br>guarded, brake, rip fence, and<br>mitre gauge.                | 740.00     | 740.00     |
| 1        | b. Cutoff         | Radial arm 10" completely<br>guarded fitted with safety<br>return attachment.                | 420.00     | 420.00     |
| 1        | c. Scroll         | 24" Belt drive with motor.<br>Assortment of blades   | 210.00     | 210.00     |
| 1        | d. Table          | 10" motor drive, tilting<br>arbor, completely guarded  | 450.00     | 450.00     |

TABLE II (Continued)

## POWER TOOLS

| Quantity | Name of Equipment     | Description  | Price    | Total      |
|----------|-----------------------|--|----------|------------|
| 1        | Shapers<br>a. Spindle | One piece invertible double spindle fitted with fence, hold downs, and assorted cutters. | \$450.00 | \$ 450.00  |
| 1        | b. Router             | Portable with assortment of cutters and routing attachments.                             | 100.00   | 100.00     |
| 1        | Compressor            | Equipped for spray painting and cleaning equipment.                                      | 400.00   | 400.00     |
| TOTAL    |                       |  |          | \$9,251.00 |

TABLE III

## HAND TOOLS

| Quantity | Name of Equipment       | Description   | Price   | Total   |
|----------|-------------------------|---|---------|---------|
| 6        | Awls<br>a. Brad         | Assorted sizes  | \$ 1.00 | \$ 6.00 |
| 2        | Bevels<br>a. Protractor | Large size  | 7.75    | 15.50   |
| 6        | b. Sliding T            | 8" blade  | 3.25    | 19.50   |
| 13       | Bits<br>a. Auger        | 1/4" - 1" x 1/16" inclusive (Set)                               | 17.20   | 17.20   |
| 5        | b. Auger                | 1/4" - 1/2 x 1/16" inclusive<br>(Set)                           | 5.40    | 5.40    |
| 15       | c. Drill                | 1/16 - 1/2 x 1/32 inclusive with<br>index                       | 15.65   | 15.65   |
| 2        | d. Countersink          | Rose head pattern for wood                                      | 1.20    | 2.40    |
| 1        | e. Expansive            | 7/8" - 1 1/2"   | 3.25    | 3.25    |
| 1        | f. Expansive            | 7/8" - 3"   | 3.85    | 3.85    |
| 3        | g. Screw driver         | Square shank 1/4", 5/16",<br>3/8" regular                       | .80     | 2.40    |
| 3        | h. Screw driver         | Square shank, point size, 1, 2,<br>3, for Phillips head screws. | .90     | 2.70    |
| 2        | i. Bit stops            |   | 1.25    | 2.50    |
| 4        | Brace<br>a. Ratchet     | 10" sweep   | 7.95    | 31.80   |

TABLE III (Continued)

## HAND TOOLS

| Quantity      | Name of Equipment            | Description                                 | Price   | Total   |
|---------------|------------------------------|---|---------|---------|
| Brushes       |                              |   |         |         |
| 6             | a. Bench                     | 10"   | \$ 1.55 | \$ 9.30 |
| 3             | b. Glue                      | Round 1/2" and 3/4" and 1"                  | 1.00    | 3.00    |
| 4             | c. Varnish                   | High quality 2" and 2 1/2"                  | 2.85    | 11.40   |
| 2             | d. Wire                      |   | .60     | 1.20    |
| 2             | Burnishers                   | Round or Oval                               | 1.50    | 3.00    |
| Cans          |                              |   |         |         |
| 1             | a. Oil Waste                 | For storing oily rags. Must be covered.     | 9.20    | 9.20    |
| 1             | b. Oil                       | Pump type with straight nozzle              | 2.70    | 2.70    |
| 1             | c. Oil                       | Pump type with flexible nozzle              | 3.25    | 3.25    |
| Carving Tools |                              |   |         |         |
| 1             | a. Wood Carving              | Set of 6 tools                              | 9.60    | 9.60    |
| 1             | b. Wood Carving              | Set of 12 tools                             | 18.35   | 18.35   |
| Chisels       |                              |   |         |         |
| 1             | a. Cold, mechanists          | 3/8" and 1/2"                               | .55     | 1.10    |
|               | b. Mortising chisel and bits | 1/4" - 1/2" by 1/16 for drill press         |         | 58.00   |
| Set           | c. Socket firmer             | Beveled edge 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2 | 19.35   | 19.35   |
| Set           | d. Tang Butt                 | Beveled edge 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2 | 18.75   | 18.75   |

TABLE III (Continued)

## HAND TOOLS

| Quantity | Name of Equipment                | Description                                      | Price   | Total    |
|----------|----------------------------------|--|---------|----------|
| Clamps   |                                  |  |         |          |
| 6        | a. Bar                           | I Bar 24"  | \$ 5.50 | \$ 33.00 |
| 6        | b. Bar                           | I Bar 36"  | 6.05    | 36.30    |
| 6        | c. Bar                           | I Bar 48"  | 6.60    | 39.60    |
| 6        | d. Bar                           | I Bar 60"  | 7.15    | 42.90    |
| 4        | e. Hand Screw                    | 4"   | 2.65    | 10.60    |
| 4        | f. Hand Screw                    | 5"   | 2.80    | 11.20    |
| 4        | g. Hand Screw                    | 6"   | 3.15    | 12.60    |
| 4        | h. Hand Screw                    | 7"   | 3.40    | 13.60    |
| 4        | i. Hand Screw                    | 8"   | 3.80    | 15.20    |
| 4        | j. Hand Screw                    | 10"  | 4.30    | 17.20    |
| 4        | k. Hand Screw                    | 12"  | 5.00    | 20.00    |
| 4        | l. Hand Screw                    | 14"  | 6.00    | 24.00    |
| 4        | m. Carriage                      | Malleable iron 6"                                | 3.15    | 12.60    |
| 4        | n. Carriage                      | Malleable iron 8"                                | 4.60    | 18.40    |
| 4        | o. Carriage                      | Malleable iron 10"                               | 6.35    | 25.40    |
| 1        | p. Miter Frame                   | 24" x 24" capacity                               | 13.65   | 13.65    |
| Dividers |                                  |  |         |          |
| 2        | a. Wing                          | 6"   | 2.80    | 5.60     |
| 2        | b. Wing                          | 10"  | 3.50    | 7.00     |
| 1        | Dowel and Rod<br>Turning Machine | With cutters 1/2", 1/4", 3/8",<br>5/8", and 3/4" | 44.00   | 44.00    |
| 2        | Doweling Jig                     | With guides 3/16" - 1/2" x<br>1/16               | 6.35    | 6.35     |

TABLE III (Continued)

## HAND TOOLS

| Quantity | Name of Equipment | Description                           | Price   | Total    |
|----------|-------------------|---------------------------------------|---------|----------|
|          | Drill             |                                       |         |          |
| 4        | a. Hand           | 1/4 Chuck                             | \$ 7.50 | \$ 30.00 |
|          | Files             |                                       |         |          |
| 4        | a. Auger Bit      | Assorted 6"                           | .65     | 2.60     |
| 2        | b. Cabinet        | 8" half round wood file               | 1.65    | 3.30     |
| 2        | c. Cabinet        | 10" half round wood file              | 2.25    | 4.50     |
| 2        | d. Card and Brush | for cleaning files                    | 1.80    | 3.60     |
| 4        | e. Flat           | 12" wood, bastard cut                 | 1.60    | 6.40     |
| 4        | f. Half Round     | 12" bastard cut                       | 1.95    | 7.80     |
| 2        | g. Mill           | 10" wood bastard cut                  | .75     | 1.50     |
| 4        | h. Round          | 12" wood bastard cut                  | 1.25    | 5.00     |
| 2        | i. Taper          | Three corner 7" smooth cut            | .55     | 1.10     |
|          | Gauge             |                                       |         |          |
| 10       | a. Marking        | Boxwood with metal face plate on head | 3.10    | 31.00    |
| 1        | Glass Cutter      | For General Glass Cutting             | .50     | .50      |
|          | Gouges            |                                       |         |          |
| 5        | a. Handled Firmer | Outside ground 1/2" to 1 1/2" by 1/4" | 19.55   | 19.55    |
| 5        | b. Handled Firmer | Inside ground 1/2" to 1 1/2" by 1/4"  | 29.80   | 29.80    |

TABLE III (Continued)

## HAND TOOLS

| Quantity  | Name of Equipment | Description                                   | Price   | Total   |
|-----------|-------------------|---|---------|---------|
| Hammers   |                   |   |         |         |
| 2         | a. Ball Pen       | 16 oz.  | \$ 2.70 | \$ 5.40 |
| 6         | b. Claw           | Curved Claw 13 oz.<br>Steel handle            | 4.80    | 28.80   |
| 6         | c. Claw           | Ripping Claw 16 oz.<br>Steel handle           | 4.80    | 28.80   |
| Handles   |                   |   |         |         |
| 24        | a. File           | For 10 - 12" files _ _ _ _ _ @12              | 2.65    | 5.30    |
| Knives    |                   |   |         |         |
| 2         | a. Putty          | For general use 1 1/4" wide blade             | .20     | .40     |
| 4         | b. Sloyd          | 3 1/8" blade                                  | 1.15    | 4.60    |
| Level     |                   |   |         |         |
| 1         | a. Wood           | 24" horizontal & vertical                     | 6.05    | 6.05    |
| Mallets   |                   |   |         |         |
| 6         | a. Hickory        | 3" x 5" head                                  | 1.60    | 9.60    |
| 2         | b. Rubber         | 24"   | 1.35    | 2.70    |
| Oilstones |                   |   |         |         |
| 2         | a. India          | 1" x 2" x 8" fine one side<br>medium 2nd side | 2.45    | 5.30    |
| 1         | b. Gouge slip     | 6" x 2" x 1" x 1/2" x 3/8"<br>medium grit     | 2.45    | 2.45    |

TABLE III (Continued)

## HAND TOOLS

| Quantity | Name of Equipment       | Description   | Price   | Total   |
|----------|-------------------------|---|---------|---------|
|          | c. Gauge Slip           | 6" x 2" x 1" x 1/2" x 3/8"<br>fine grit                         | \$ 2.45 | \$ 2.45 |
|          | Planes                  |   |         |         |
| 12       | a. Block                | All steel adjustable 6"   | 6.60    | 79.20   |
| 25       | b. Jack                 | 14" Bed 2" cutter   | 11.95   | 298.75  |
| 2        | c. Router               | 3 cutters   | 11.20   | 22.40   |
|          | Rules                   |   |         |         |
| 25       | a. Bench                | 2 ft. maple metal tips  | 2.20    | 55.00   |
| 6        | b. Push Pull            | 10ft. white blade   | 1.70    | 10.20   |
| 4        | c. Yard stick           | 3 ft. maple metal tips  | 1.95    | 7.80    |
|          | Saws                    |   |         |         |
| 12       | a. Back                 | 12" 14 points   | 6.10    | 73.20   |
| 2        | b. Compass              | 12" Reversible blade  | 2.40    | 4.80    |
| 6        | c. Coping frames        | For 6 1/2" blade adjustable                                     | .85     | 5.10    |
| 12       | d. Coping blades        | 6 1/2" pin end  | .35     | .35     |
| 2        | e. Crosscut             | 26" 8 points  | 7.65    | 15.30   |
| 1        | f. Hack Frame           | 10" - 12" adjustable  | 2.65    | 2.65    |
| 6        | g. Hack Blade           | 24 teeth 12 "   | .20     | 1.20    |
| 2        | h. Rip                  | 26", 5 1/2 point  | 7.65    | 15.30   |
| 1        | i. Meter box<br>and saw | capacity 10 1/2" at right angle<br>7 1/2" at meter saw 24" x 4" | 63.00   | 63.00   |
|          | Scrapers                |   |         |         |
| 6        | a. Cabinet              | Malleable iron  | 3.50    | 21.00   |
| 6        | b. Hand                 | 3" x 5"   | .45     | 2.70    |



TABLE III (Continued)

## HAND TOOLS

| Quantity      | Name of Equipment | Description                           | Price   | Total   |
|---------------|-------------------|---------------------------------------|---------|---------|
| Screw Drivers |                   |                                       |         |         |
| 2             | a. Cabinetmaker   | 4" regular tip                        | \$ 1.15 | \$ 2.30 |
| 2             | b. Cabinetmaker   | 6" regular tip                        | 1.45    | 2.90    |
| 2             | c. Cabinetmaker   | 8" regular tip                        | 1.80    | 3.60    |
| 2             | d. Cabinetmaker   | 10" regular tip                       | 2.20    | 4.40    |
| 2             | e. Phillips       | No. 1 point                           | .55     | 1.10    |
| 2             | f. Phillips       | No. 2 point                           | .65     | 1.30    |
| 2             | g. Phillips       | No. 3 point                           | .80     | 1.60    |
| 1             | h. Quick Return   | Spiral Ratchet 3 blades               | 8.30    | 8.30    |
| Sets          |                   |                                       |         |         |
| 2             | a. Nail           | 1/32                                  | .45     | .90     |
| 2             | b. Nail           | 2/32                                  | .45     | .90     |
| 2             | c. Nail           | 3/32                                  | .45     | .90     |
| 1             | d. Saw            | For saws 14 points to an inch or less | 5.75    | 5.75    |
| Snips         |                   |                                       |         |         |
| 1             | a. Tinnors        | Torged steel 2 1/2" cut               | 4.80    | 4.80    |
| Squares       |                   |                                       |         |         |
| 4             | a. Combination    | 12" blade grooved                     | 3.40    | 13.60   |
| 25            | b. Try            | 8" blade steel handle                 | 2.85    | 71.25   |
| 4             | c. Steel framing  | 16" x 24" with board measures         | 4.30    | 17.20   |
| 2             | d. Steel          | 8" x 12"                              | 2.70    | 5.40    |
| Set           | Trammel Points    | Adjustable steel points               | 2.85    | 2.85    |

TABLE III (Continued)

## HAND TOOLS

| Quantity | Name of Equipment       | Description          | Price   | Total      |
|----------|-------------------------|----------------------|---------|------------|
|          | Wrenches                |                      |         |            |
| 1        | a. Adjustable           | 8"                   | \$ 2.20 | \$ 2.20    |
| 1        | b. Adjustable           | 10"                  | 2.70    | 2.70       |
| 1        | c. Adjustable           | 12"                  | 4.05    | 4.05       |
| Set      | d. Boxed End            | 3/8" - 3/4" openings | 8.50    | 8.50       |
| Set      | e. Open End             | 1/4" - 1" openings   | 8.00    | 8.00       |
| Set      | f. Headless<br>Setscrew | Allen hex keys       | 2.00    | 2.00       |
|          | g. Pipe                 | 10"                  | 3.30    | 3.30       |
|          | h. Pipe                 | 14"                  | 4.45    | 4.45       |
| TOTAL    |                         |                      |         | \$1,831.85 |

The total cost of the suggested tools and equipment in Tables I, II, and III is \$14,038.25. The greatest expense in equipping a school shop was found to be that of power tools.

The equipment for any shop should be purchased with a planned program in mind. The equipment should be of best quality in materials, workmanship, safety, and design. When this type of equipment is used in the shop, students learn to work and care for the best and also learn to take great pride in their work.

A summary of this report and a prediction of the writer are in the following chapter.

## CHAPTER IV

### CONCLUSION

In summarizing this report it has been learned that man has made slow progress in developing tools, for processing wood, since the first stone age tools were used. The most rapid advancement has come about since the discovery of the principle of rotary cutting by Samuel Bentham of England in 1790. Since that time machines have replaced hand tools at a very rapid pace. Since Mr. Stiles made his report in 1950, a few hand tools listed in his report cannot be found in catalogues for 1961 and more are being discontinued as this report is written.

A Prediction. It is the opinion of this writer that in the next fifty years a very limited number of hand tools will be available in catalogues to equip the school shop. This opinion is supported by the number of light weight electrical tools being designed and manufactured to perform tasks formerly restricted to hand tools. These tools do better and faster work than most hand tools with a minimum of sacrifice to craftsmanship.

Recommendation. It is recommended, by the writer, that a similar study be made on other major industrial arts fields. It is further recommended that a study be made pertaining to the increase in power tools being manufactured and the effect it has on the production of hand tools.

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