

Pittsburg State University

## Pittsburg State University Digital Commons

---

Electronic Theses & Dissertations

---

7-1953

### JIGS AND FIXTURES IN THE WOOD SHOP

James R'Leigh Bell

*Kansas State Teachers College of Pittsburg*

Follow this and additional works at: <https://digitalcommons.pittstate.edu/etd>



Part of the [Vocational Education Commons](#)

---

#### Recommended Citation

Bell, James R'Leigh, "JIGS AND FIXTURES IN THE WOOD SHOP" (1953). *Electronic Theses & Dissertations*. 297.

<https://digitalcommons.pittstate.edu/etd/297>

This Thesis is brought to you for free and open access by Pittsburg State University Digital Commons. It has been accepted for inclusion in Electronic Theses & Dissertations by an authorized administrator of Pittsburg State University Digital Commons. For more information, please contact [digitalcommons@pittstate.edu](mailto:digitalcommons@pittstate.edu).

JIGS AND FIXTURES IN THE WOOD SHOP

A Thesis Submitted to the Graduate Division in Partial  
Fulfillment of the Requirements for the  
Degree of Master of Science

MA 07 '87

PORTER LIBRARY

By

James R'Leigh Bell

140

KANSAS STATE TEACHERS COLLEGE

Pittsburg, Kansas

July, 1953

WITHDRAWN

#### ACKNOWLEDGMENTS

The writer wishes to express his deep appreciation to Dr. O. A. Hankammer, Dr. Jack W. Morgan, and Dr. J. D. Haggard for helpful suggestions and constructive criticisms which were offered. For sketches of devices submitted sincere thanks are due Mr. A. B. Culbertson, Mr. George Koons, Mr. Ted Kistler, and Mr. Walter L. Allton. The writer also owes a debt of gratitude to his wife for encouragement, understanding and inspiration given during this study.



## TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION .....	1
Introduction .....	1
Purpose and Scope .....	1
Limitations of the Study .....	2
Need for the Study .....	3
Hypothesis and Methods of Approach .....	3
II. DEFINITIONS AND BACKGROUND .....	6
Definitions .....	6
A Brief History .....	12
III. CLASSIFICATION OF JIGS AND FIXTURES FOR SCHOOL SHOP .....	15
Overview .....	15
Measuring Devices, Group I .....	16
Storage Devices, Group II .....	16
Jigs and Fixtures for Holding Tools While the Tools are Being Worked On, Group III .....	20
Jigs and Fixtures Which Hold the Tool While the Tool Works, Group IV .....	20
Jigs and Fixtures Which, Themselves, Do Work, Group V .....	20
Devices Which Hold and Direct Work in a Particular Manner for Hand Tools, Group VI .....	25
Devices Which Hold and Direct Work in a Particular Manner for Power Machinery, Group VII .....	25
Special Devices, Group VIII .....	43
IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS .	44
Summary .....	44
Conclusions .....	45
Recommendations .....	46
BIBLIOGRAPHY .....	48
APPENDIX .....	51



## LIST OF FIGURES

FIGURE	PAGE
1. Wall Angle Gauge .....	17
2. Bar Clamp Rack .....	18
3. Hand Clamp Rack .....	19
4. Clamp for Circle Saw .....	21
5. Hand Saw Jointer .....	22
6. Pistol Grip File Handle .....	23
7. Fixture to Make Grooves in Dowels .....	24
8. Picture Frame Clamp .....	27
9. Jig to Hold Bar Clamps Upright .....	28
10. Miter Bench Hook .....	29
11. Jig Used in Cutting Spline Joints on Circle Saw .....	30
12. Sample of Joint .....	30
13. Tenoning Jig for Circle Saw .....	31
14. Jig Used in Cutting Spline in Miter .....	32
15. Sample of Joint .....	32
16. Taper Jig for Circle Saw .....	33
17. Fixture Used in Sawing Circles on Band Saw .....	34
18. Fixture Used in Cutting Concaves on Circle Saw .....	35
19. Jig Used in Cutting Spline in a Miter Joint .....	36
20. Feather Board .....	37



## LIST OF TABLES

FIGURE	PAGE
21. Circle Saw Push Stick .....	38
22. Jig Used in Cutting Dowels, to Length, on Band Saw .....	39
23. Push Stick for Flat Pieces on the Circle Saw or Jointer .....	40
24. Jointer Push Stick .....	41
25. Sander Table for Wood Lathe .....	42



## ABSTRACT

This thesis is a study of jigs and fixtures and a classification of typical examples collected from the school wood shops. A definition of the terms, jig and fixture, as they apply to the school wood shop is offered.

The chief sources of information were: Interviews with school and college wood shop instructors and with furniture factory superintendents. Visitations were made to school and college wood shops and to furniture factories. Letters were sent to the outstanding shop instructors of this vicinity. The available literature was analyzed.

Letters asking for sketches of the jigs or fixtures used in the shop were sent to forty wood shop teachers in this area. The poor response made it necessary to rely on personal interviews and analysis of the literature to a greater degree.

It was found from examination of jigs and fixtures studied that jig or fixture development arises first from the need to do a particular job. Second, that jigs and fixtures should be as simple to make and use as is consistent with the job they are to do. Third, that they should be quick and easy to operate. Fourth, in the school shop they should provide a means of teaching productive methods to the student.



## CHAPTER I

### INTRODUCTION

#### Introduction to the Problem

A study of jigs and fixtures in the wood working fields would be difficult to begin without branching off first into the metal industries. Here, they have attained a place of great importance. According to Colvin and Hass: "Jigs and fixtures have become such a necessary part of modern manufacturing that an understanding of the principles involved, as well as examples of those which have proved successful, is a necessity in every shop."<sup>1</sup>

Jigs and fixtures in the wood shop are quite important also, though not in the same sense as in metal working. Parts in the metal industries have to be machined and finished to much closer tolerances. Duplicate parts need not be as exact in a woodworking industry, although they do need to build parts rapidly and as nearly alike as conveniently possible in order to meet or beat the competitive market.

#### Purpose and Scope

The purposes of this study are to: (1) recognize jigs and fixtures as an important part of the woodworking fields;

---

<sup>1</sup>Fred H. Colvin and Lucian L. Hass, Jigs and Fixtures (New York: McGraw-Hill Book Company, Inc., 1948), p. 5.



(2) to show that the school shops make frequent use of these important devices but often do not recognize them as important; (3) to show that there is a difference between jigs and fixtures in the woodworking fields and those commonly defined in the metal working industries; and, (4) to define jigs and fixtures for the school woodworking shops.

### Limitations of the Study

Jigs and fixtures are a prominent part of all of the modern building industries. In this case "building industries" refer to those which build or make or manufacture anything. In fact, jigs and fixtures are the very basis upon which modern mass production is built. In spite of this, however, comparatively little has been written about jigs and fixtures, when considered from the stand point of background or history. Most of the literature in this field is written for the practical man - the mechanic in the shop. The poor response to letters sent to school shops in the area make it necessary to depend more on analyzing what has been published in books and periodicals, limited as it is.

It has been impossible to visit as many shops as would have been desirable for a study of this nature. This study has been, voluntarily, limited to a study of jigs and fixtures of the non-commercial variety. This means those which are made and used in the shop and are not made as a marketable product.



### Need for the Study

From interviews, letters sent to school shops in the area, visitations made to furniture factories and school and college woodworking shops, from the literature available, and from personal experience it seems that most school woodworking shops could make more and better use of jigs and fixtures than they now do. In the woodworking fields, as in all industrial arts, schools need to be teaching more of the ways of industry. It is felt that there is no better way to bring the class room more into the atmosphere of industry than to introduce jigs and fixtures into it. If a better understanding of industry is gained through a study of one of the mainstays of mass production, jigs and fixtures, then an important need has been met.

In their book, Wood and Smith tell how jigs may be used in the school shop. Jigs and "kinks" are explained by twenty illustrations and with these words:

There are many ways of shortening the time and simplifying the operations on wood working projects, provided an operation is duplicated a sufficient number of times to make it worth while to construct jigs for holding, guiding, or controlling the laying out or cutting of materials.<sup>2</sup>

### Hypothesis and Methods of Approach

There has been too little written about jigs and fixtures

---

<sup>2</sup> Harry E. Wood and James H. Smith, Prevocational and Industrial Arts (Chicago: Atkinson, Mentzer & Company, 1919), pp. 154-157.



in the woodworking fields. This is especially true from the purely academic point of view. There is a difference between jigs and fixtures in the metal and woodworking fields. Jigs and fixtures are a practical part of the woodworking fields, and therefore should be defined for these fields.

The basic methods used in this study were interviews with woodworking teachers in the secondary schools and colleges, interviews with furniture factory superintendents, visitations to furniture factories and school shops, letters to school wood shop teachers, and a review of the literature on the subject.

Thirty-seven personal letters, individually typed, were sent to wood shop teachers who had previously agreed in writing to cooperate in this study. The letters asked for sketches of those devices which had been used by the individual in his shop.<sup>3</sup> The number of responses was disappointing. Only a few answered the letter; of these answers four sent sixteen sketches. Seven of the sketches sent were used in the study. One of these seven was found in a book and the credit for it was given to the authors of the book. One was a commercial device and therefore not used. Two were very similar to other devices used in the study. Six were considered unsuitable for the study.

From interviews with people to whom the letters were

---

<sup>3</sup> A copy of the letter may be found in the appendix, p. 51.



sent it was discovered that many did not have time to answer, some were using jigs and fixtures which were in previously published materials, one felt that he would loose the patent rights of his inventions by sending sketches and granting permission to record it. Five of the devices used were obtained from personal interviews. The remainder of the devices were taken from published articles or were discovered in personal experience.



## CHAPTER II

### DEFINITIONS AND BACKGROUND

#### Definitions

It is necessary in this study to set up definitions as they apply to this study. Jigs and fixtures in the metal industries are fairly well established and it seems best to quote directly from the good authority of Colvin and Hass:

Broadly speaking, a jig or fixture is any device that guides drills or other tools so as to produce work that is interchangeable within the tolerances set by manufacturing requirements. The same terms are also used for devices or frames that hold pieces in their proper position while being welded or otherwise joined together. We are, however, most interested in devices for holding work during various machining operations, and jigs and fixtures of this class will receive the greatest attention.

A distinguishing definition for jigs and fixtures that seems to be generally accepted is about as follows: A jig is a work-holding device which is not fastened to the machine on which it is used. A fixture is also a work-holding device but one that is bolted or otherwise fastened to the machine. The jig, for example may be moved around on the table of a drill press to bring each bushing under the drill spindle. A fixture, on the other hand, is fastened to the table or base of a machine, and either the tool is moved to the point of operation, as in the case of a radial drill; or the table is moved under the cutting tools, as in a milling machine. This definition, however, has not been officially standardized.<sup>1</sup>

In order to make a point clear that the authorities in the field do not entirely agree as to the exact defini-

---

<sup>1</sup>Fred H. Colvin and Lucian L. Hass, Jigs and Fixtures (New York: McGraw-Hill Book Company, Inc., 1948), p. 7.



tions for the words "jigs" and "fixtures" it will be necessary to quote from other authorities. In 1943 Donaldson and LeCain used this:

A jig is a device for insuring that a hole to be drilled, tapped, or reamed in a machine part will be machined in the proper place..... The term "jig" should be used only for devices to be used while drilling, reaming, or tapping holes, as defined above. If the operation includes machining operations like milling, planing, shaping, and so on, the term fixture should be used.<sup>2</sup>

Girardot and Karosh, co-chairmen in writing in Tool Engineers Handbook on the subject supply this definition: "Jigs physically limit and control (guide) the path of a cutting tool. Fixtures do not guide the tool but allow it to find its own path."<sup>3</sup>

The New "Standard" Dictionary (1952) defines fixture as "Any device, constituting an essential element of a machine, which holds in position either the work or the tool acting on the work. A fixture in serving its purpose is generally dependent upon the action of the machine of which it is a part, while the jig is not."<sup>4</sup>

Webster's New International Dictionary, 2nd Edition Unabridged, (1952) defines: "Jig; A contrivance fastened to or enclosing a piece of work, and having hard steel surfaces

<sup>2</sup> Cyril Donaldson and George H. LeCane, Tool Design, (New York: Harper and Brothers, 1943), p. 253.

<sup>3</sup> E. H. Girardot and J. I. Karash, "Jigs and Fixtures", Tool Engineers Handbook (New York: McGraw-Hill Book Company, Inc., 1949), p. 1541.

<sup>4</sup> Funk & Wagnalls New Standard Dictionary, (New York: Funk and Wagnalls Co., 1952).



to guide a tool, as a drill, or to form a shield or template to work to, as in filing."<sup>5</sup> Webster's New International also has this to say about fixture: "(a) A device for supporting the work, during machining, without guiding the cutting tools. (b) A similar device, for holding parts in correct position during assembly or testing."<sup>6</sup>

In the book, Jig and Fixture Design, Witzel and others, explain the difference between the two as follows:

A jig is a special device which holds, or supports, or is placed on a part to be machined. It is a production tool so made that it not only locates and holds the workpiece, but it also guides the cutting tool as the operation is performed. Jigs are usually fitted with hardened steel bushings for guiding drills or other cutting tools.

A fixture is a production tool used to locate accurately and to hold securely one or more workpieces so that the required machining operations can be performed. A fixture should be securely fastened to the table or the machine upon which the work is done. Though used largely on milling machines, fixtures are also designed and used to hold work for various operations on most of the standard machine tools. The main purpose of a fixture is to locate the work quickly and accurately, support it properly, and hold it securely.<sup>7</sup>

From the definitions quoted above it can be seen that they all apply directly to the metal working industries. In so far as the literature available is concerned nothing

---

<sup>5</sup> Webster's New International Dictionary, 2nd Edition Unabridged, (Springfield, Mass: G. & C. Merriam Company, 1952).

<sup>6</sup> Ibid.

<sup>7</sup> Ewald L. Witzel and others, Jig and Fixture Design (Albany, N. Y.: Delmar Publishers, Inc., 1947), p. 6.



seems to have been written in an attempt to define or clarify what is meant by either of the words "jig" or "fixture" as they are used in woodworking literature. It seems appropriate, therefore, to examine the way in which the terms are used and try to evolve a definition therefrom.

In some instances the words are used interchangeably as if they had the same meaning. A case in point may be found in Gunerman's book, How to Operate your Power Tools. In explaining how to sand the edges of circles and curves on a disk sander with the aid of a fixture. Such a jig is shown in figure....". He goes on to show how such a device can be made. A part of this device is clamped to the table and another part is made to slip through a slot in the clamped part.<sup>8</sup> In that respect it becomes stationary or firmly attached and it does guide and direct the work of the sander on the stock.

Again Gunerman refers to a device used for keeping stock square on a belt sander and in this case it is clamped to the fence. It is called a "fixture."<sup>9</sup> In another place Gunerman explains how to plane an octagonal or hexagonal shape on a device which is called a "jig." In this case it is securely clamped to the table of the machine.<sup>10</sup>

---

<sup>8</sup> Milton Gunerman, How to Operate Your Power Tools (New York: The Home Craftsman Publishing Corp., 1950), p. 116.

<sup>9</sup> Ibid., p. 119.

<sup>10</sup> Ibid., p. 95.



The illustration and explanation of a device used in cutting a slow curve on a circle saw. It does not move, is clamped securely to the saw fence, and is called a "jig" in Amateur Craftsman's Cyclopedia.<sup>11</sup> Another device is shown which makes it possible to do accurate drill press mortising without doing any lay out marking on the work.<sup>12</sup> This device is bolted to the drill press table, it does not guide or control the cutting tool in any way, and it is called a "jig".

A simple device for holding jointer or planer knives while grinding them is described by Hjorth which is made of two close grain pieces of hard wood. The device moves to direct the action of the grinder and is called a "jig" for grinding knives on an oil stone.<sup>13</sup>

Smith describes and illustrates what he calls a jig for holding turned pieces and how to set and use a hollow chisel mortiser. "In cases where the mortise cannot be cut while the piece is in rectangular form, a suitable device or jig, may be used to hold the work rigidly while the mortise is being cut."<sup>14</sup>

---

<sup>11</sup>Amateur Craftsman's Cyclopedia (New York: Popular Science Publishing Company, Inc., 1939), p. 261.

<sup>12</sup>Ibid., p. 257.

<sup>13</sup>Herman Hjorth, Principles of Woodworking (Milwaukee, Wisconsin: The Bruce Publishing Company, 1946), p. 130.

<sup>14</sup>Robert E. Smith, Machine Woodworking (Bloomington, Ill: McKnight & McKnight, Publishers, 1948), p. 128.



It would seem to indicate from what has been said up to this point that the words "jig" and "fixture" are applicable only to devices for use on and with power tools. This appears to be largely the case in the metal industries. In most of the definitions quoted above the machine is mentioned directly and, therefore, leaves no doubt in mind that a jig or a fixture is a power tool device.

Unlike the devices used in the metal industries the term "jig" in the woodworking shop is often used to refer to an aid for a hand tool. Figure 5, p. 22, is an example. Finsterbach explains how an improved coping-saw jig may be made. It is a hold-down device for stock that may be cut with a coping saw.<sup>15</sup>

In the literature it is possible to find jigs for working on tools with hand tools. A device for setting a circle saw is illustrated and explained by Watkins. The purpose of this jig is to hold the circle saw and at the same time provide an anvil to set the teeth on with a hammer or punch.<sup>16</sup>

The definitions given above for the metal industries do not express the idea completely and adequately for the terms, "jigs" and "fixtures," as they are frequently used in woodworking. On the other hand there is a notable inconsistency in the use of these terms by those who choose to use them

---

<sup>15</sup>Fred Finsterbach, "Improved Coping-Saw Jig," Industrial Arts and Vocational Education, XXXVIII (January, 1949), 32-33.

<sup>16</sup>David L. Watkins, "Circle Saw Setting Jig," Industrial Arts and Vocational Education, XLI (October, 1952), 289-290.



when writing about the wood working industries.

As used hereafter when referring to the woodworking fields or the school wood shop the word "jig" will be understood to mean a device which is used to hold, guide, or direct the work, or the tool, for a hand or power machine. It is not fastened to the bench, the machine table, or fence, but may move and act with the operative part of the tool or machine.

A fixture may also hold, guide or direct the work or tool. The fixture is fixed or fastened or held to the bench, the machine table, fence or stationary part.

Either jigs or fixtures make it possible to do a given job better, faster, more economically or safer. A jig or fixture is not a complete tool in itself but only becomes a part of a tool when it is performing one or more of the specified objectives stated herein.

#### A Brief History

"A jig is a device that holds the work and guides the tool...." while a "fixture simply holds the part as it is being worked....."<sup>17</sup>

If Mr. Zozzora's definition were to be accepted as the general meaning of these two words; and it is logical and meaningful; then their history would date back many thousands

---

<sup>17</sup>Frank Zozzora, Engineering Drawing (New York: McGraw-Hill Book Company, Inc., 1953), p. 102.



of years. The hand which guides the knife to cut a T-bone steak is a jig while the fork is a fixture. Many examples of similar nature could be called to mind and the history of jigs and fixtures could be pushed back as far as one would care to go.

Very little is available, however, about the actual written historical record. Colvin mentions jigs in this manner: "The nearest approach to a jig or fixture in the shop (Wheelock Engine Company, 1892) was a few manila-paper templates for making flange bolt holes."<sup>18</sup>

In their little book Jig and Fixture Kinks, Colvin and Stanley tell how to make use of ideas in the shop. This book was compiled in 1907 from material previously published in "American Machinist".<sup>19</sup> No attempt is made to define the terms or tell anything of their origin.

Randel wrote an article in 1917 in which he tells about a project in production work in a school shop for making about fifty chairs. It was necessary to make jigs and put the job on a production basis. No mention was made of fixtures.<sup>20</sup>

---

<sup>18</sup>Fred H. Colvin, 60 Years with Men and Machines (New York: McGraw-Hill Book Company, Inc., 1947), p. 51.

<sup>19</sup>F. H. Colvin and F. A. Stanley, Jig and Fixture Kinks (New York: McGraw-Hill Book Company, Inc., 1908), p. 24.

<sup>20</sup>Victor Randel, "A Problem in Furniture Construction," Industrial Arts Magazine, IV (June, 1917), 258.



In history jigs and fixtures are very old but in use they are very new. They have come to mean the newest thing of the wonderful machine age of this day.



### CHAPTER III

#### CLASSIFICATION OF JIGS AND FIXTURES FOR SCHOOL SHOP

##### Overview

Jigs and fixtures in the wood shop range through every phase of the woodworking industries. There are jigs invented and contrived for almost every imaginable job. Some are made to make it easier to do a given job. Some are invented when it is necessary to speed up a job. There are others which were figured out to make the work safer, while some jobs might not have been possible without the aid of some insignificant appearing device. There are still others whose purpose it is to cut the cost of a particular job. All of these inventions cannot be called either jigs or fixtures but they all sprang from the depths of some ingenious mind, which had a problem to solve. A good many of them come under the definitions laid down in this study for either a "jig" or a "fixture".

It is impossible to give an illustration or description of all jigs and fixtures used in the school shops because they are being made and discarded every day. It is likely that in some cases good ideas may be lost to society in this way. In many instances, it seems logical to assume, that the maker of a jig or fixture may have felt that his idea was insignificant and not worth much, so was discarded.



In this chapter an effort has been made to record at least one representative example for each classification group.

### Measuring Devices, Group I

In the first group it seems natural to place the measuring devices. The wall angle gauge, Figure 1, p. 17, is a device for measuring or taking a pattern for un-square or odd shaped pieces in tight places.<sup>1</sup>

### Storage Devices, Group II

The devices which are used for tool racks or cases are placed in this group. The question arises as to whether they should be classed as jigs or not. When thinking of the tools themselves as the material to be stored, the tools in this case are acted on by the storage devices, and therefore, may be considered as jigs or fixtures. They would, likely, be called "fixtures" if they were fastened stationary but when placed on glides or casters so that they may be moved around to the work they come under the definition of "jigs".

This group includes the bar clamp rack and the hand clamp rack, Figures 2, p. 18, and 3, p. 19.<sup>2</sup>

---

<sup>1</sup> B. W. Pelton, Furniture Making and Cabinet Work (New York: D. Van Nostrand Company, Inc., 1949), p. 247.

<sup>2</sup> Ideas for these drawings supplied the writer by Ted Kistler, Springfield, Missouri, January 8, 1953.



## Wall Angle Gauge

It is convenient to use this jig in measuring accurately the size and shape of a board for a closet shelf, a piece of floor covering, or something of like nature. In making it the dimensions should vary according to the individual needs.

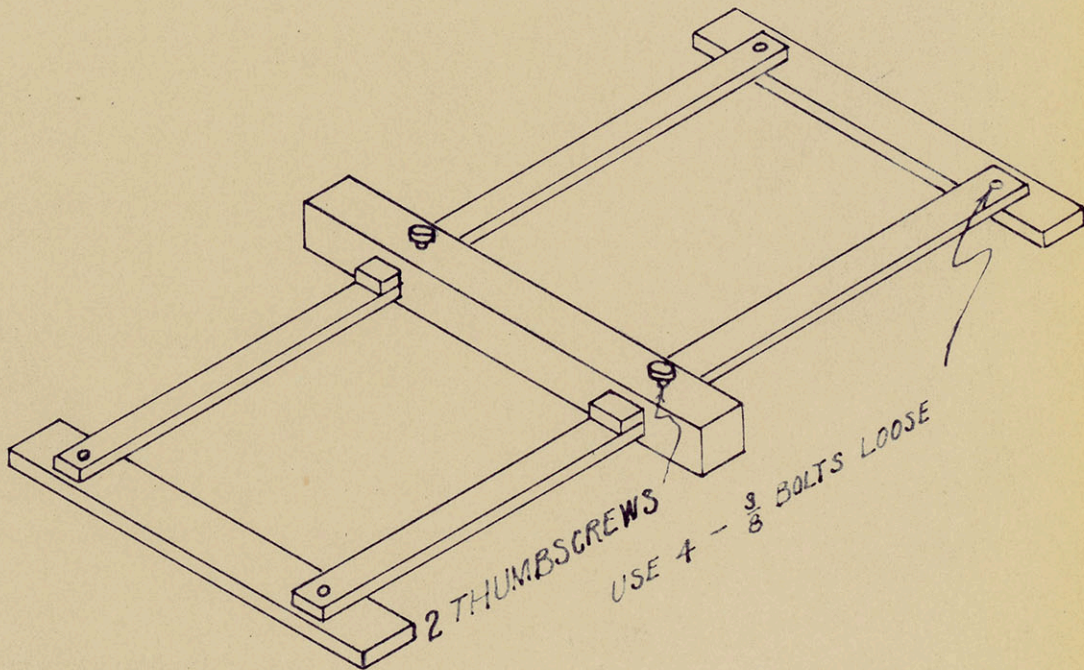


Figure 1, Wall Angle Gauge



## Bar Clamp Rack

The rack shown should be reinforced at the joints as much as is needed. It is very convenient when placed on heavy glides or casters.

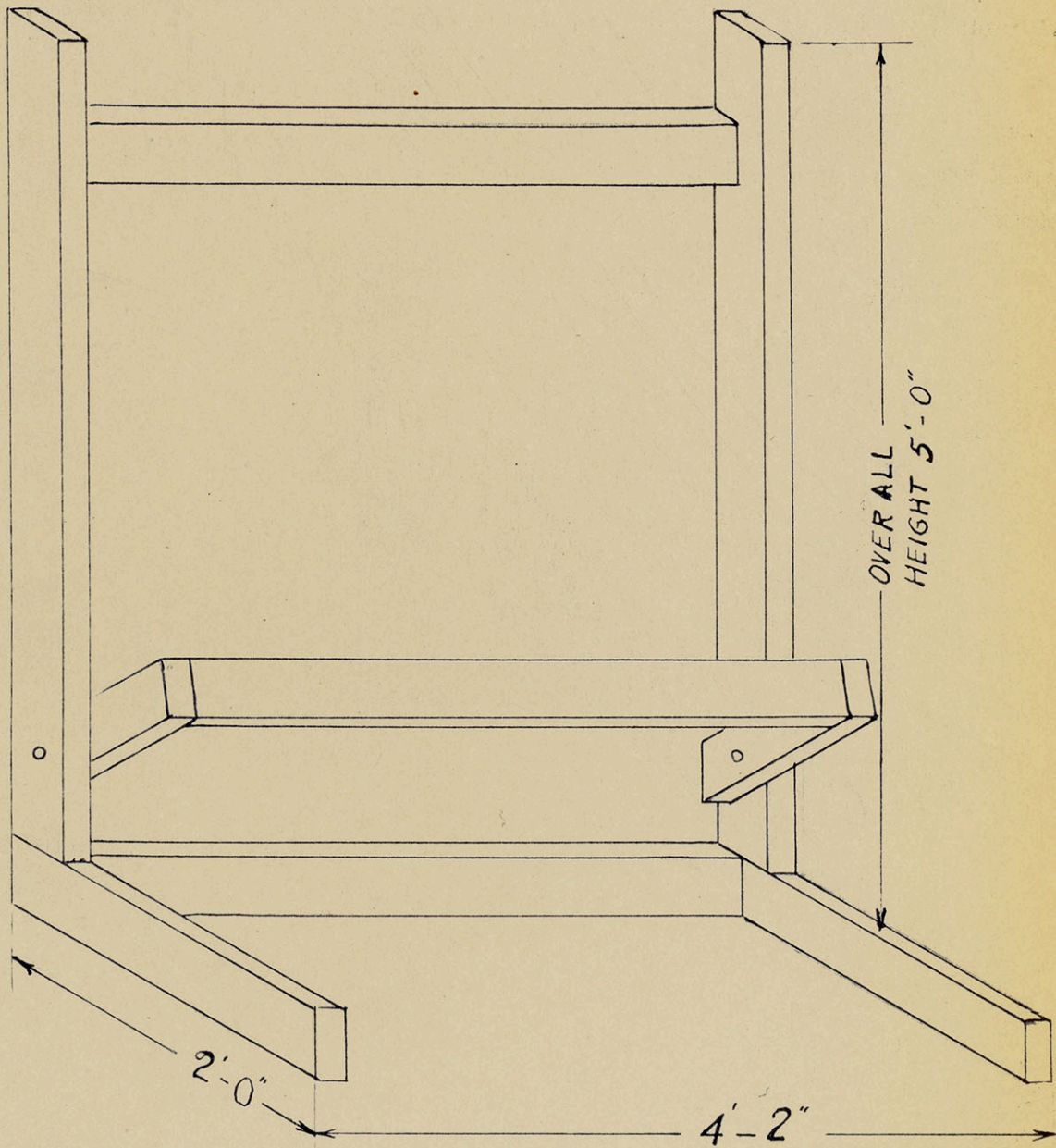


Figure 2, Bar Clamp Rack



### Hand Clamp Rack

The size of this device should vary according to needs and desires of the shop where it will serve.

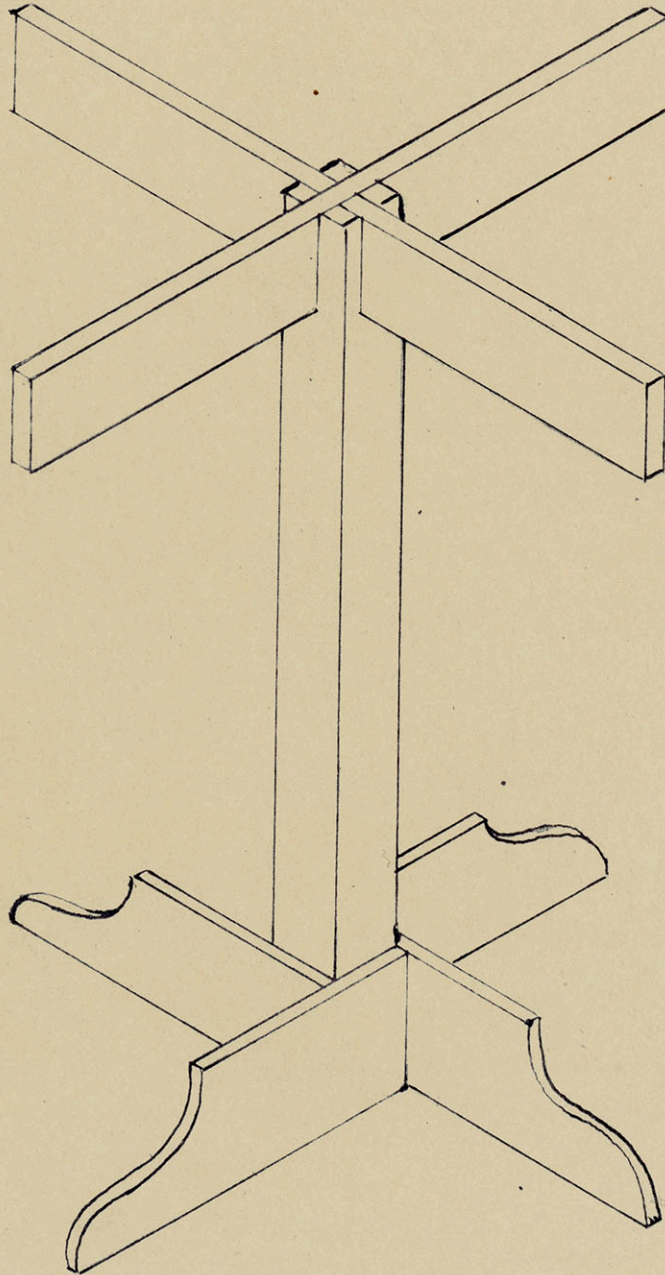


Figure 3, Hand Clamp Rack



Jigs and Fixtures for Holding Tools While the  
Tools are Being Worked On, Group III

The third group of jigs and fixtures includes those which are used to hold or support tools while the tools are being worked on. The circle saw clamp to hold the saw while it is being filed is a good example of this type, Figure 4, p. 21. One other good example of this type of device is explained by Watkins.<sup>3</sup>

Jigs and Fixtures Which Hold the Tool While  
the Tool Works, Group IV

The fourth group of jigs and fixtures refer to those which hold, guide, or direct a tool while the tool is doing work. The representative examples from this group, are a hand saw jointer,<sup>4</sup> Figure 5, p. 22, and a pistol grip file handle,<sup>5</sup> Figure 6, p. 23.

Jigs and Fixtures Which, Themselves, Do Work, Group V

Group five includes those devices which actually perform an operation on the material or stock. A fixture to make grooves in dowels is illustrated, Figure 7, p. 24, as the device for this group. This type of device may be classi-

<sup>3</sup>Supra, p. 21.

<sup>4</sup>L. J. Smith, "The Art of Saw Filing Hand Saws," Home-Craft and the Home Owner, XXIII (January-February, 1953), 148.

<sup>5</sup>Idea for drawing supplied the writer by Professor Ed Davis, Fort Hays Kansas State College, Hays, Kansas, March 28, 1953.



## Clamp for Circle Saw

This device is used when it is necessary to hold a circle saw for filing. It should be made to the desired dimensions.

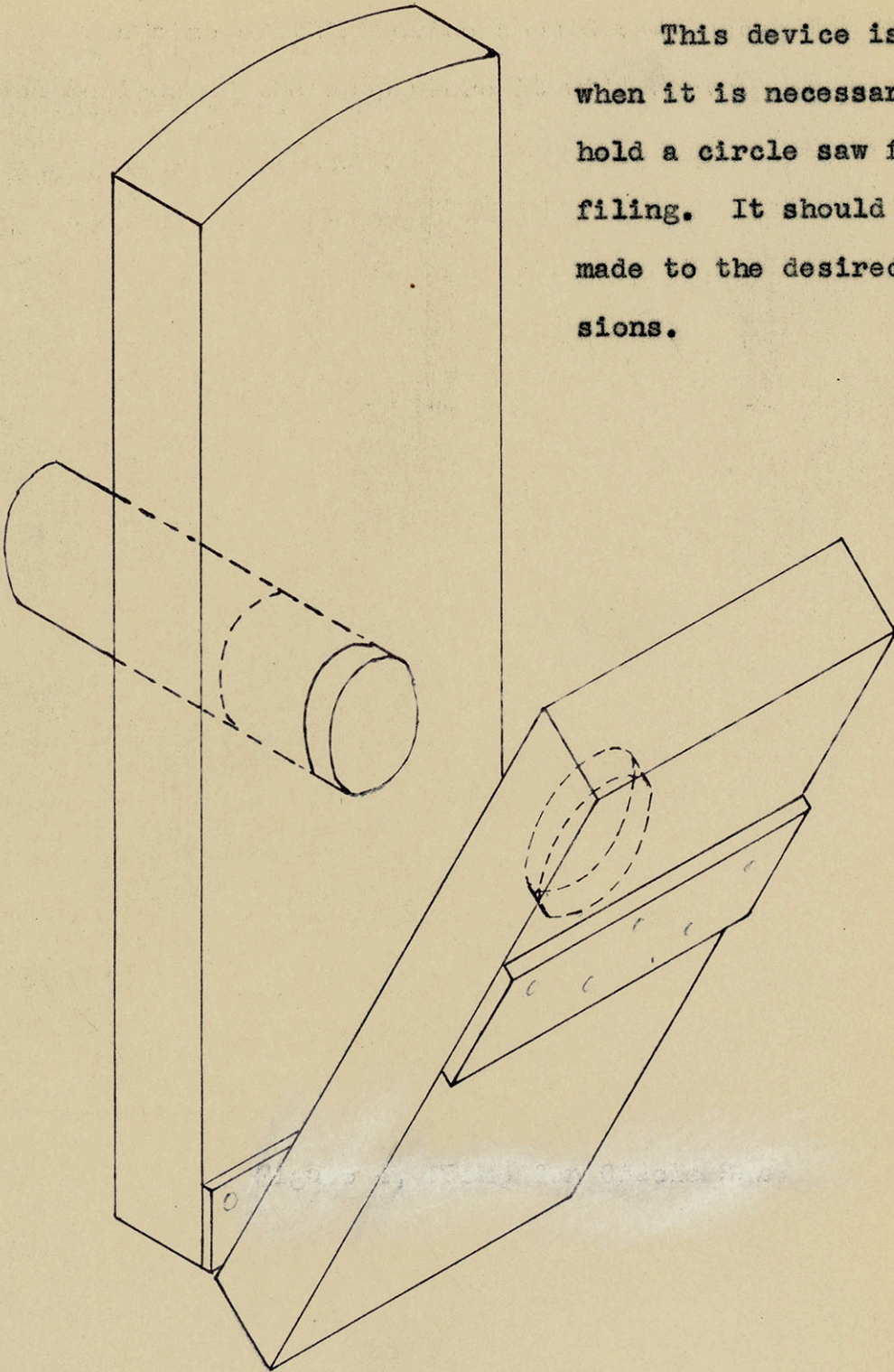


Figure 4, Clamp for Circle Saw



## Hand Saw Jointer

This Jig should be made of hard wood with the inserted piece slightly tapered so that when the file is in place and the inserted piece pushed in it will hold the file snugly.

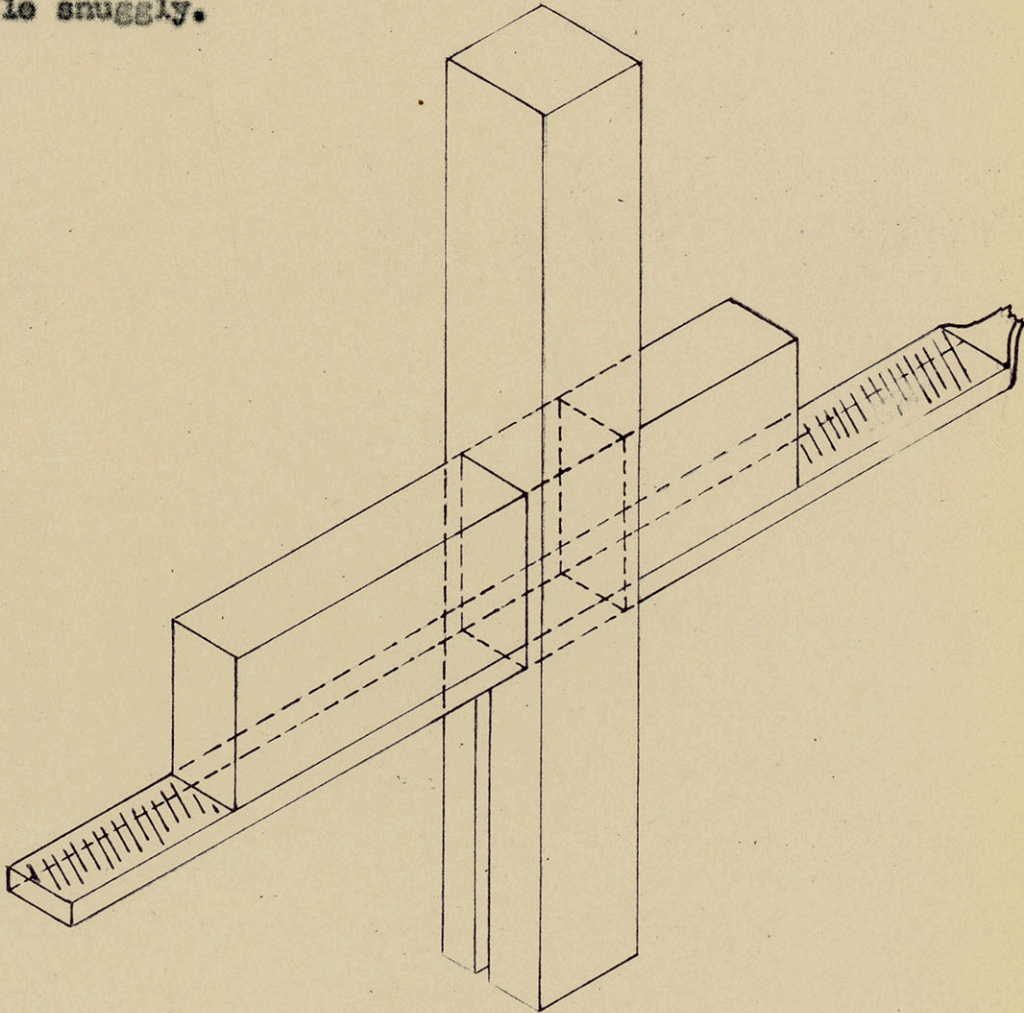


Figure 5, Hand Saw Jointer



### Pistol Grip File Handle

The idea behind this jig is to make it easy to hold the saw file and to get the same angle of cut on each tooth. There should be a small hole drilled in the center of the small end so that when the file handle is forced into it, it will make a hexagonal shaped hole to hold the file in the position desired. When necessary to file a cross cut saw the file should be held in the position shown at "a",

Hexagonal hole

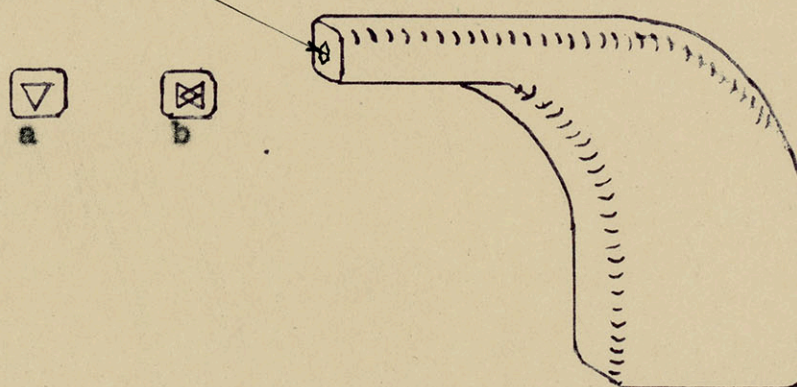


Figure 6, Pistol Grip File Handle

Figure 6 In filing a rip saw the file will need to be placed in the position shown at "b" for one side of the saw and turned to the other position shown at "b" for the opposite side.



### Fixture to Make Grooves in Dowels

The holes may vary in size according to the needs of the shop. The screws should be filed to a sharp point and extend into the holes approximately one sixteenth inch. This device may be fastened to a wall or a bench permanently, or clamped in a vice while in use.

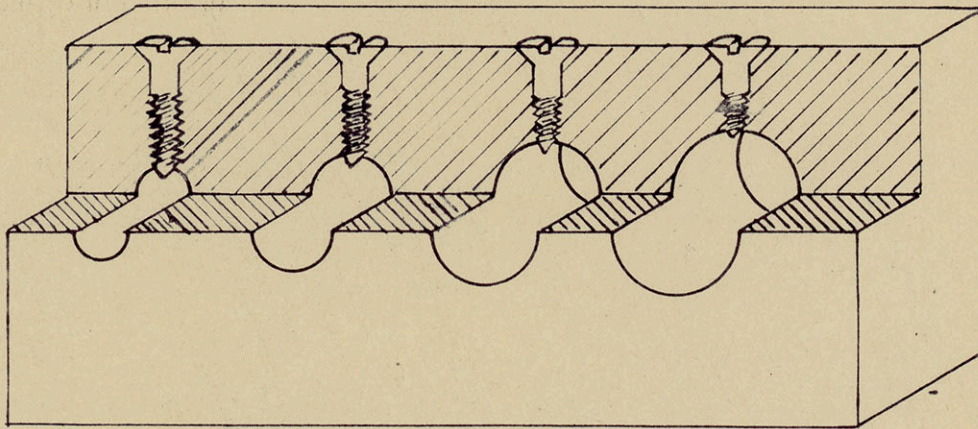


Figure 7, Fixture to Make Grooves in Dowels



fied as a tool in some cases.<sup>6</sup>

Devices Which Hold and Direct Work in a Particular  
Manner for Hand Tools, Group VI

The picture frame clamp,<sup>7</sup> the jig to hold bar clamps upright, and the miter bench hook<sup>8</sup> are all splendid examples of the jigs included in group six, Figures 8, p. 27, 9, p. 28, and 10, p. 29, respectively.

Devices Which Hold and Direct Work in a Particular  
Manner for Power Machinery, Group VII

The devices which hold, guide or direct the tools or work in a particular manner for the power machines have been placed in this group. Because of the nature of jigs and fixtures those which are used with the power machinery constitute a large group. It will be remembered that in metal the terms "jig" and "fixture" are generally considered to be connected with power machinery and usually with production work on a volume basis. If this is true in metal it is also true in wood, though, to a somewhat lesser degree.

---

<sup>6</sup>Idea for drawing supplied the writer by Harold J. Campbell, Ventura, California. July 10, 1952.

<sup>7</sup>Harry E. Wood and James H. Smith, Prevocational and Industrial Arts (Chicago: Atkinson, Mentzer & Company, 1919), pp. 154-157.

<sup>8</sup>Idea for drawing supplied to writer by A. B. Culbertson, Riverton, Kansas. January 6, 1953.



The contrivances for the circle saw, Figures 11, p. 30, 13, p. 31, and 14, p. 32, were devised by the writer for use in a wood shop. Figure 17, p. 34, illustrates a fixture for sawing circles on a band saw.<sup>9</sup> The fixtures to cut concaves on a circle saw illustrated in, Figure 18, p. 35, is a little more refined than a board clamped to the saw table.<sup>10</sup> A jig for cutting a spline in a miter joint on the circle saw is shown in, Figure 19, p. 36.<sup>11</sup>

The clamp for the circle saw, Figure 4, p. 20; the device to hold glue clamps upright, Figure 9, p. 27; the taper jig for the circle saw, Figure 16, p. 32; the feather board, Figure 20, p. 36, and the various push sticks, Figures 21, 23, and 24; pp. 38, 40, and 41, respectively, are all devices which are common knowledge to most shop men. They are all very important jigs and fixtures, however, in almost any organized school wood shop.

It has always been considered a dangerous operation to cut dowels on a band saw but a jig for this purpose, Figure 22, p. 39, has changed that somewhat.<sup>12</sup> A fixture of another type, Figure 25, p. 42, in this group is the sander table illustrated.<sup>13</sup>

---

<sup>9</sup>Idea for drawing supplied the writer by Robert Wilkins, Turner, Kansas.

<sup>10</sup>Culbertson, Loc. cit.

<sup>11</sup>Frank Hegemeyer, "Woodworkers' Information Department," Homecraft and the Home Owner, XXIII (May-June, 1953), 298.

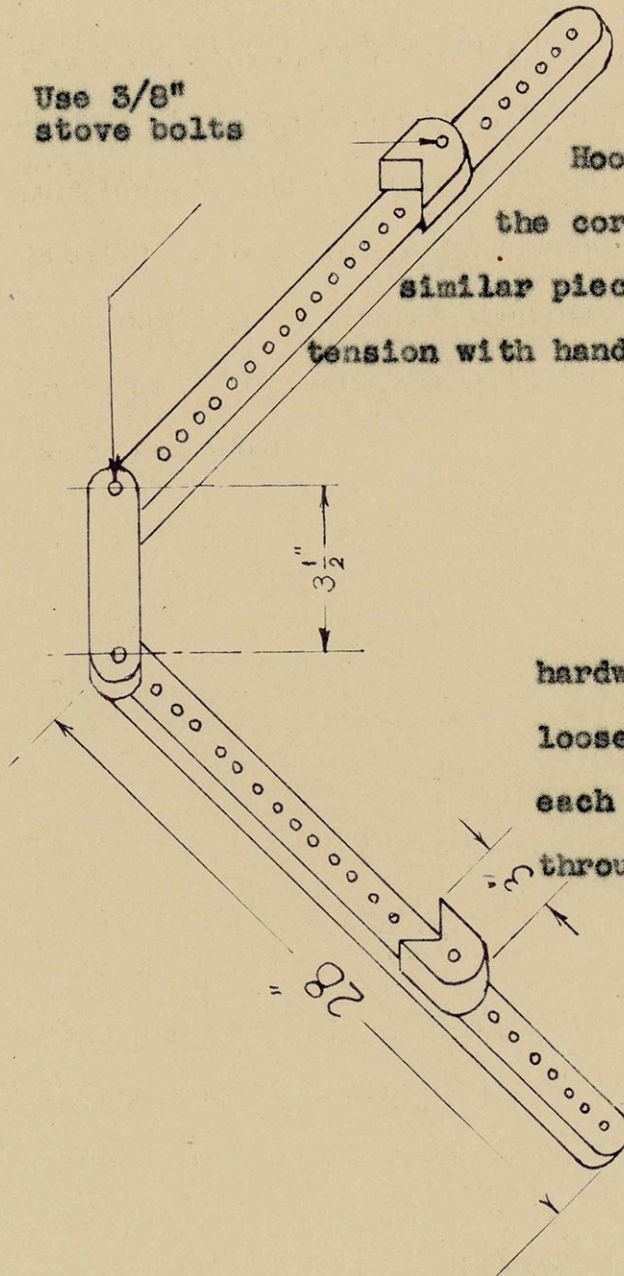
<sup>12</sup>Campbell, Loc. cit.

<sup>13</sup>Kistler, Loc. cit.



## Picture Frame Clamp

Use 3/8"  
stove bolts



This jig should be  
made and used in pairs.

Hook the corner pieces over  
the corners of a picture frame or  
similar piece and pull to the desired  
tension with hand screws.

All lumber should be of 1-1/8"  
hardwood. All joints should remain  
loose so that they will pivot on  
each other. All holes 3/8" clear  
through. Two pieces required.

Figure 8, Picture Frame Clamp



### Jig to Hold Bar Clamps Upright

This little jig can be very handy and useful around a school woodworking shop.

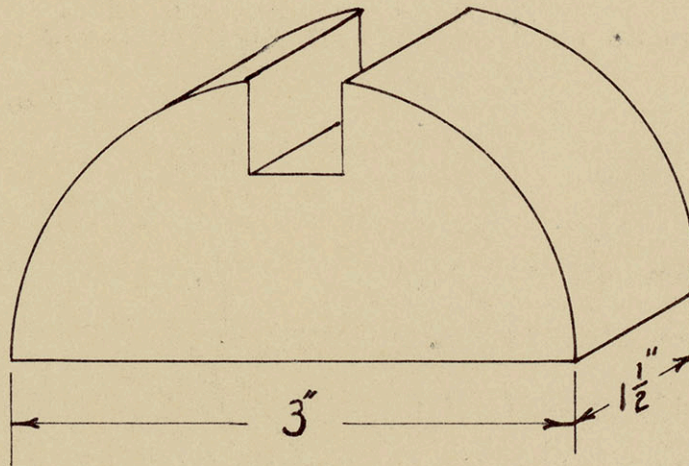


Figure 9, Jig to hold Bar Clamps Upright



## Miter Bench Hook

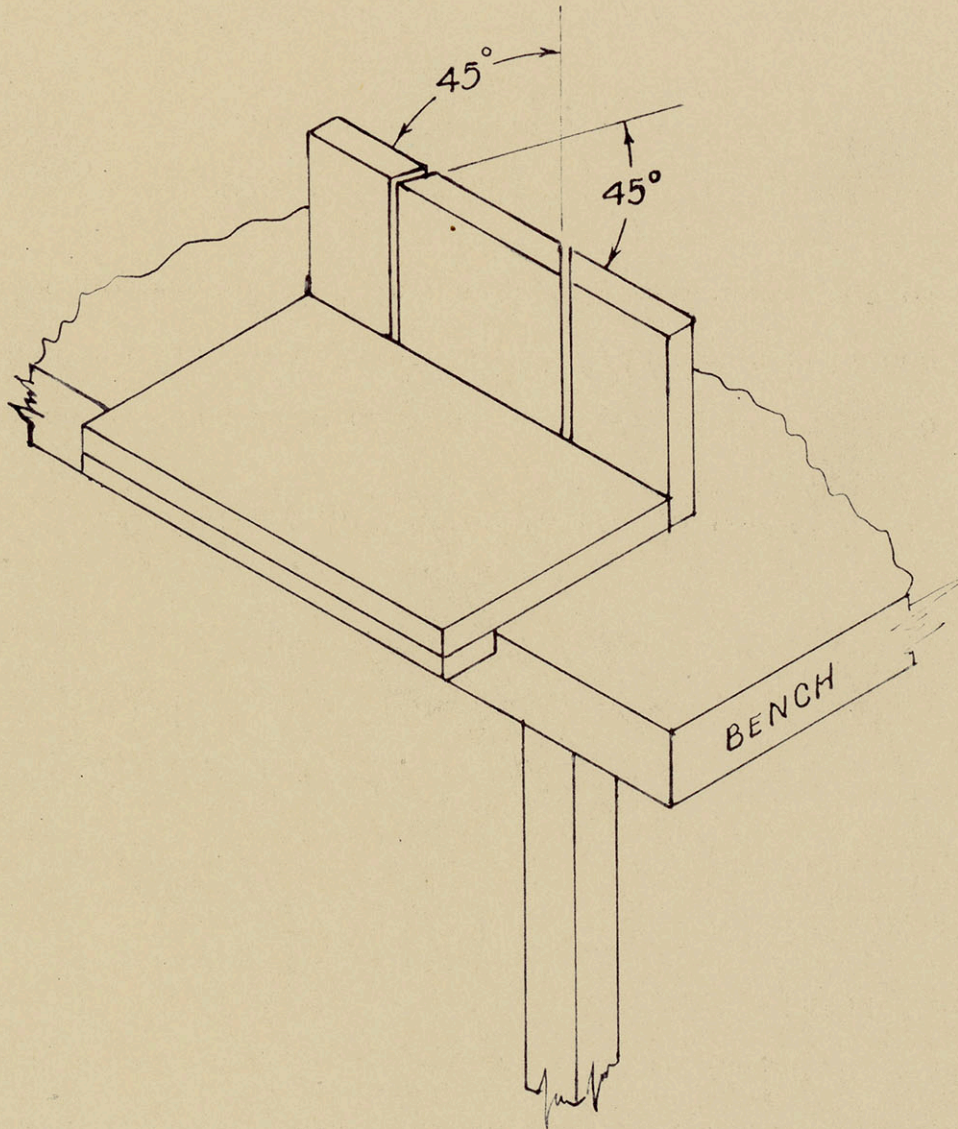


Figure 10, Miter Bench Hook



### Jig Used in Cutting Spline Joints on Circle Saw

This simple Jig should be used by clamping stock into the rabbet of the Jig with a small C - clamp.

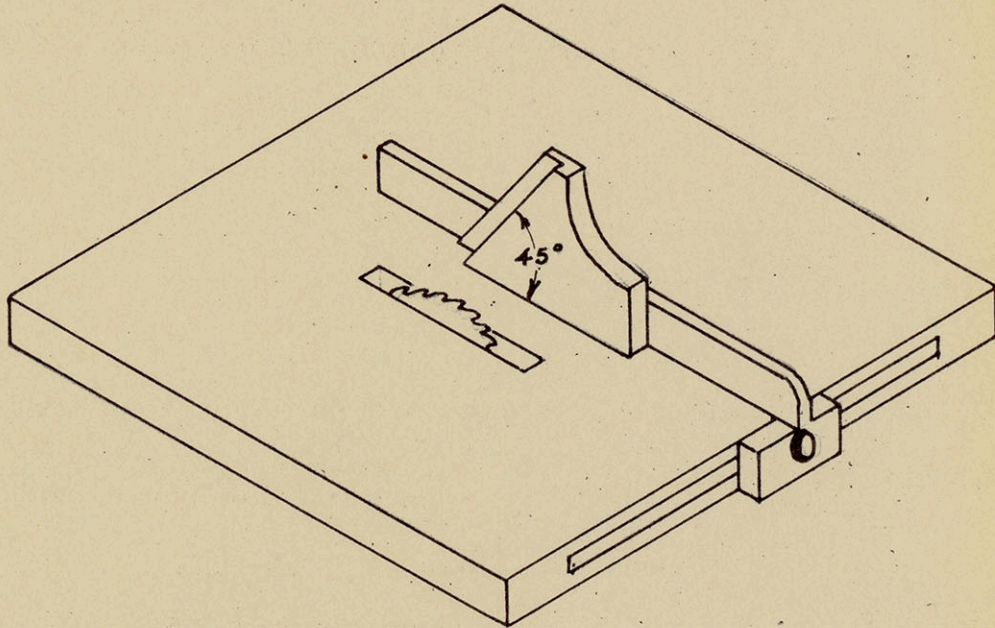


Figure 11, Jig Used in Cutting Spline Joints on Circle Saw

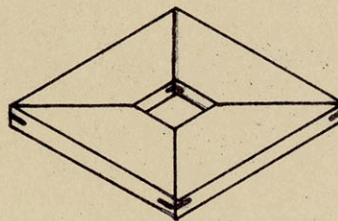


Figure 12, Sample of Joint



## Tenoning Jig for Circle Saw

Jig is used by clamping stock into the rabbet of the

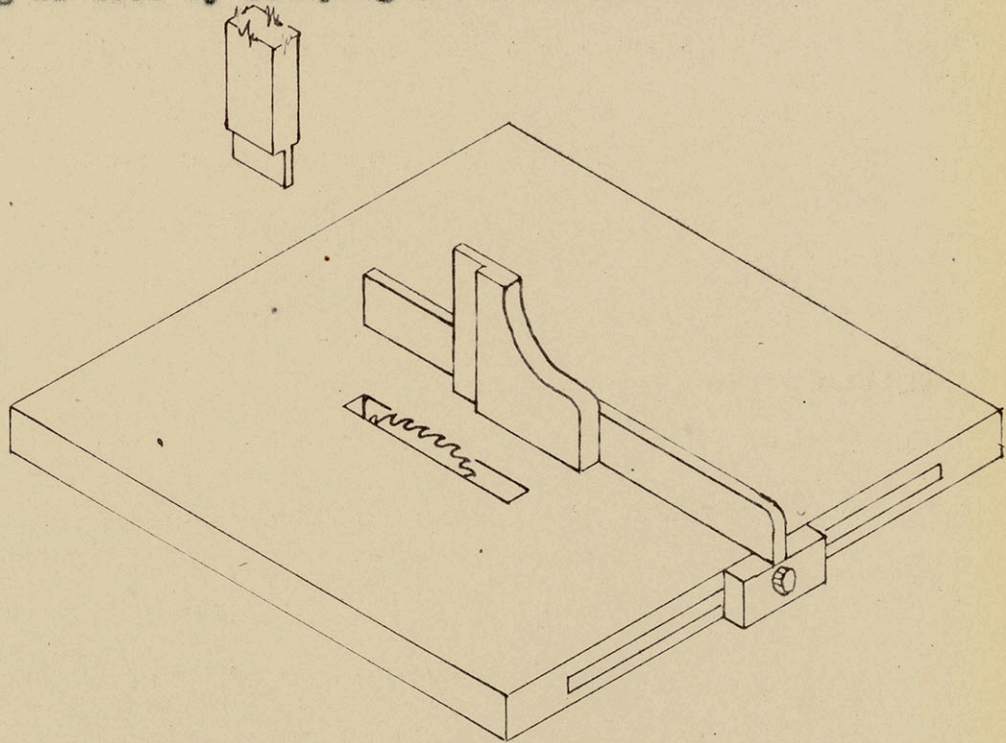


Figure 13, Tenoning Jig for Circle Saw

jig with a small C-clamp. The piece marked "a" shows a tenon, but a through mortise can be cut just as easily.



### Jig Used in Cutting Spline in Miter

This Jig is made of four pieces which may be fastened together with screws or glue or both. The stock should be clamped to the foremost piece with a small C-clamp when in use.

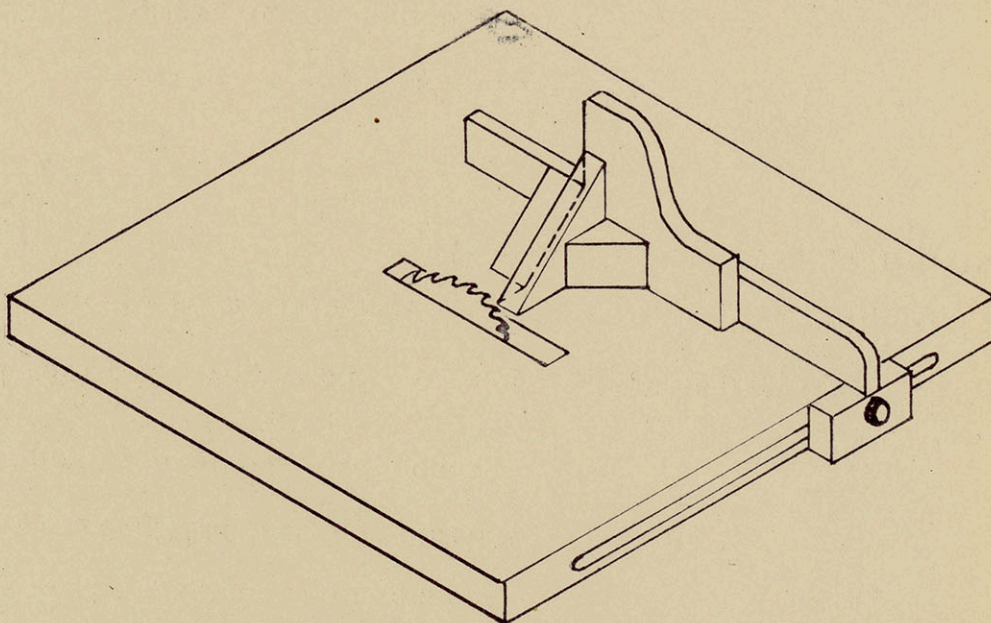


Figure 14, Jig Used in Cutting Spline in Miter

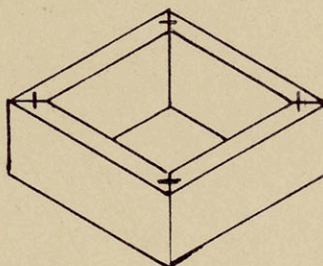


Figure 15, Sample of Joint



## Taper Jig for Circle Saw

To determine the various positions in which the arm must be held for the tapers desired, proceed as follows:

First, fasten strap iron *HINGE* to long piece. (see Fig. 16)

Second, measure two feet from point.

where the two pieces touch. Third

spread the arms six inches at the

two foot mark. Fourth, locate the

point for the thumb screw. This is

the position for tapers of three

inches to the foot. Fifth, pro-

ceed as above for any desired

tapers according to the table

below.

5" apart for taper  $2\frac{1}{2}$ " to 1"

4" apart " " 2" " 1"

3" " " "  $1\frac{1}{2}$ " " 1"

2" " " " 1" " 1"

POINTS IN-  
DICATE POSI-  
TION FOR  
THUMBSCREW  
FOR OTHER  
TAPERS

1" apart for taper  $\frac{1}{2}$ " to 1"

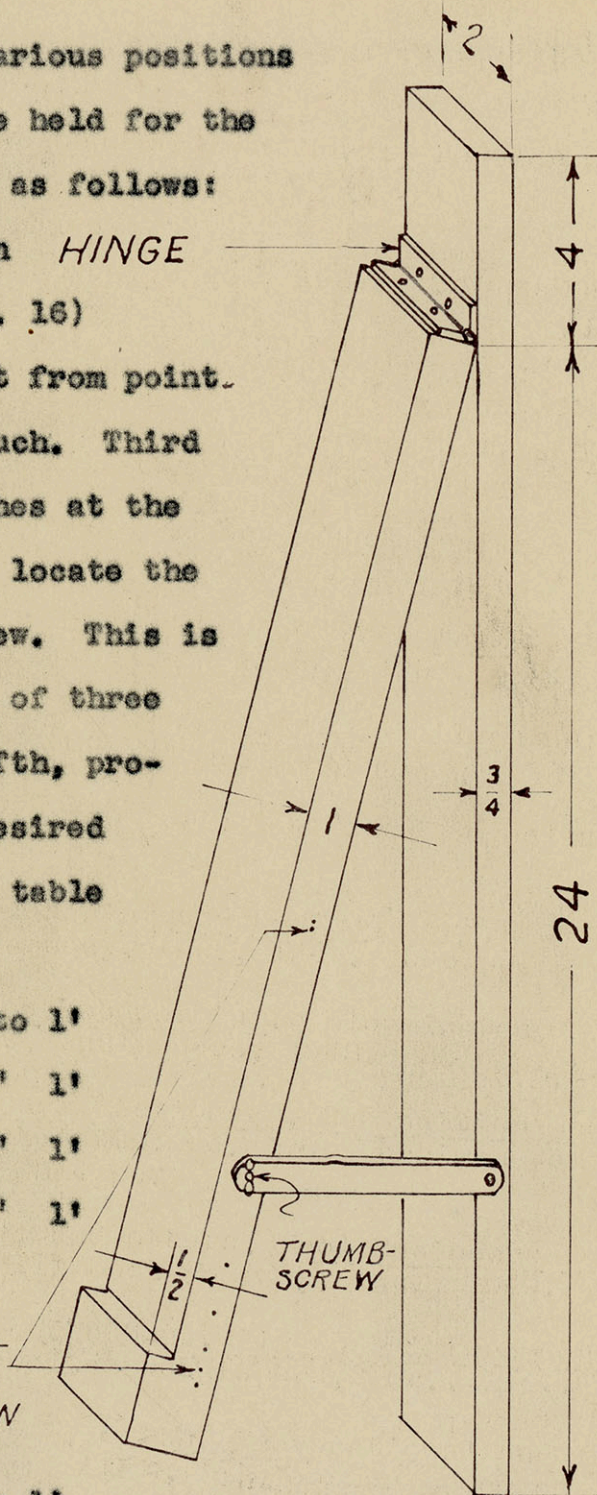


Figure 16, Taper Jig for Circle Saw



### Fixture Used in Sawing Circles on Band Saw

The point of the screw should extend through the board one eighth inch and should be filed sharp. The screw should be so placed that the point will be located along the center line of the slot left for the saw blade. When this fixture is clamped onto the saw table the clamps should be placed at the points marked A and B on the figure. This fixture should

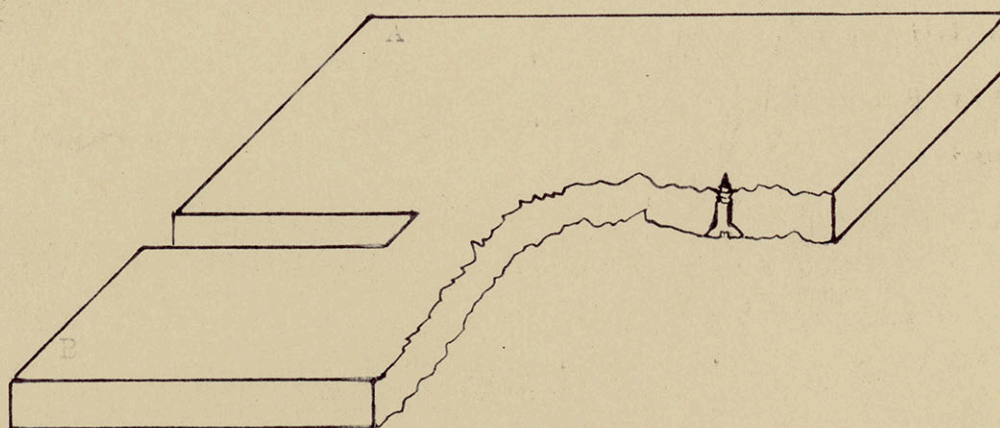


Figure 17, Fixture Used in Sawing Circles on Band Saw

be clamped onto the so that the point of the screw will be on a line perpendicular to the saw blade at the cutting edge and at a distance equal to the radius of the desired circle.



### Fixture Used in Cutting Concaves on Circle Saw

To use this fixture by sure saw is sharp and has plenty of set. Clamp fixture to saw fence. Set fixture to desired angle and set saw about one eighth inch above saw table for

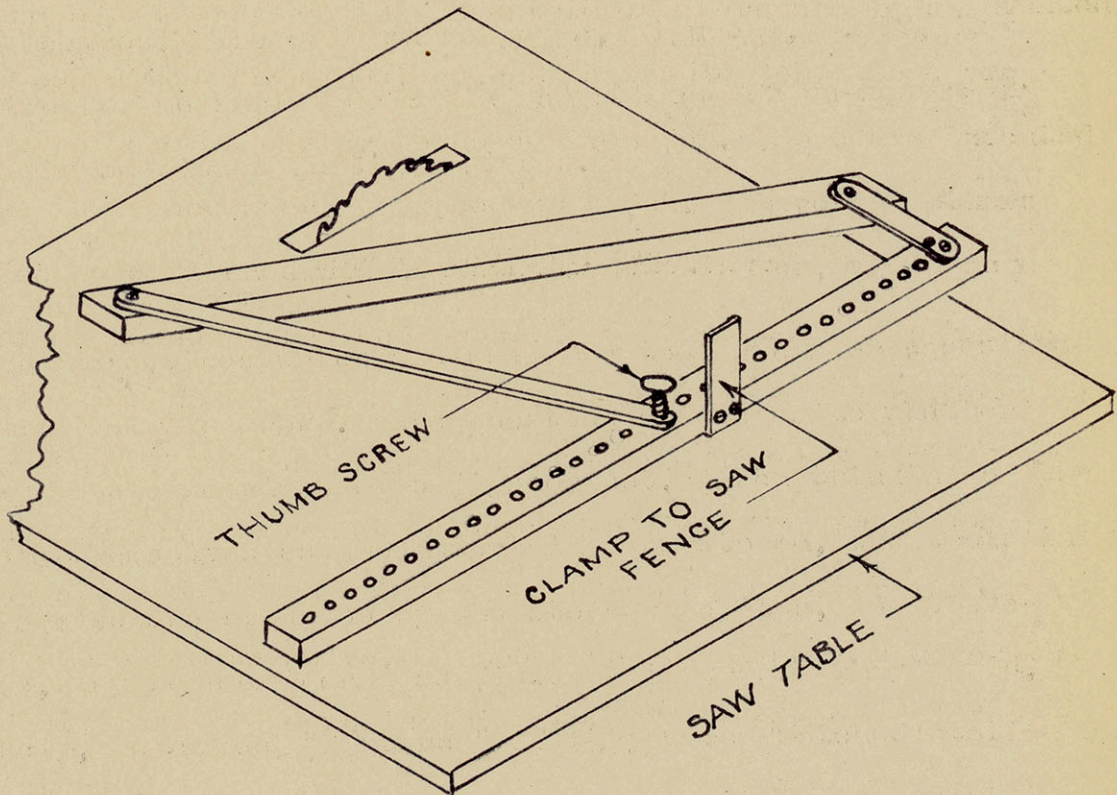


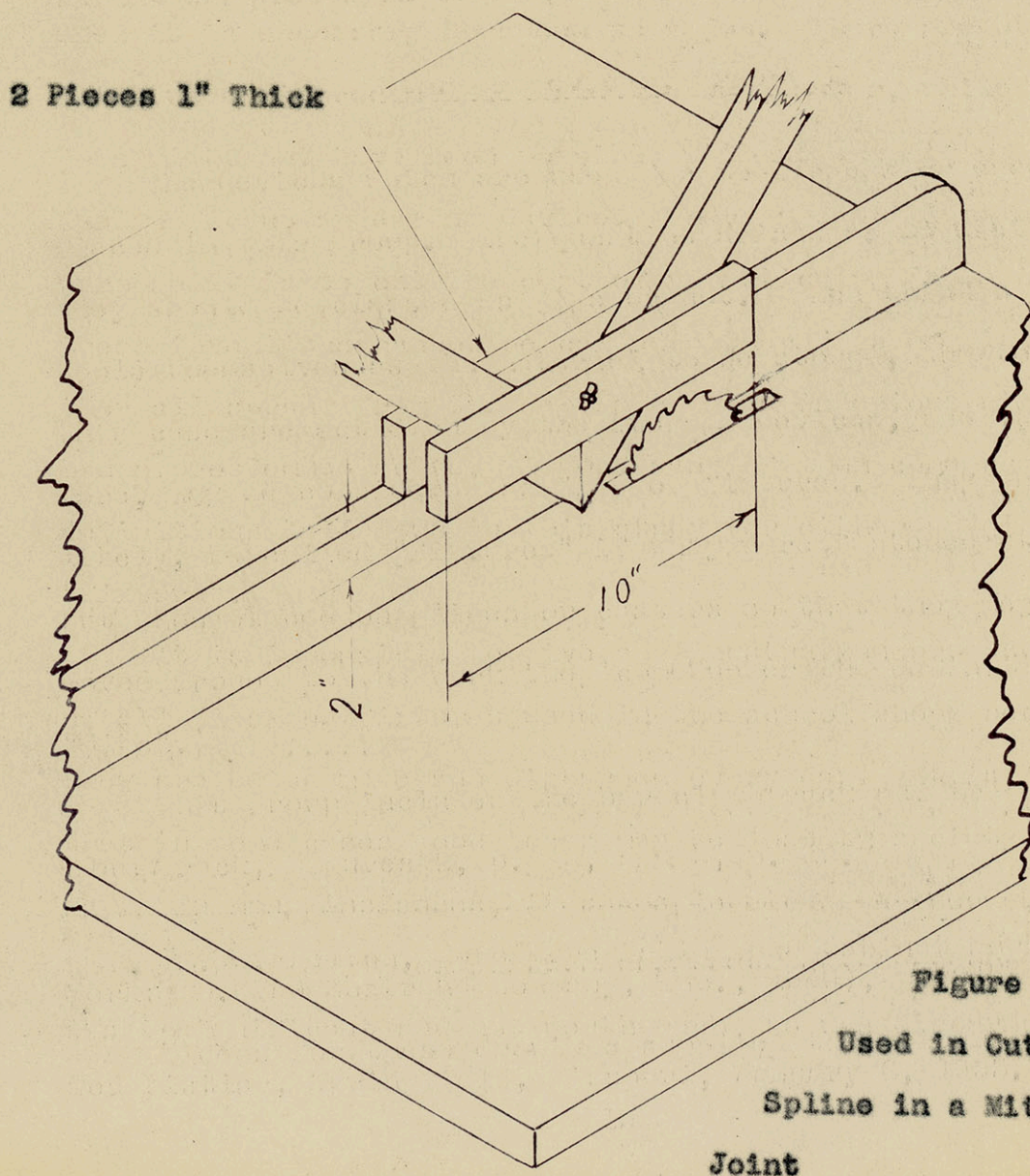
Figure 18, Fixture Used in Cutting Concaves on Circle Saw

first cut. Proceed by setting saw approximately one eighth inch deeper after each cut until the desired depth of concave is reached.



### Jig Used in Cutting Spline in a Miter Joint

This jig is useful when cutting though splines for such places as window screen frames.





## Feather Board

This device is useful on various power machines for holding and guiding the work as it is fed into the circle saw, jointer, or shaper. It may be possible to use this device as a jig but most of the time it will be a fixture.

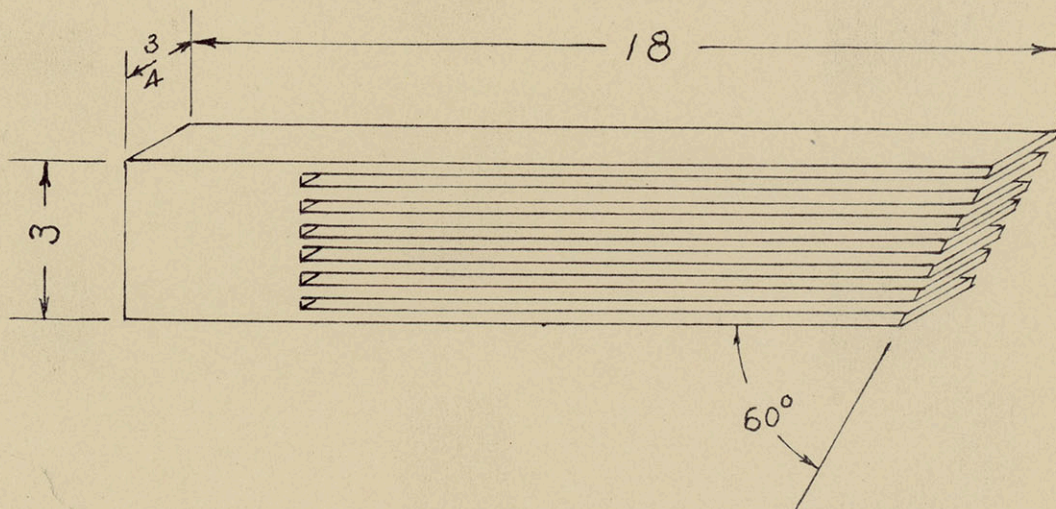
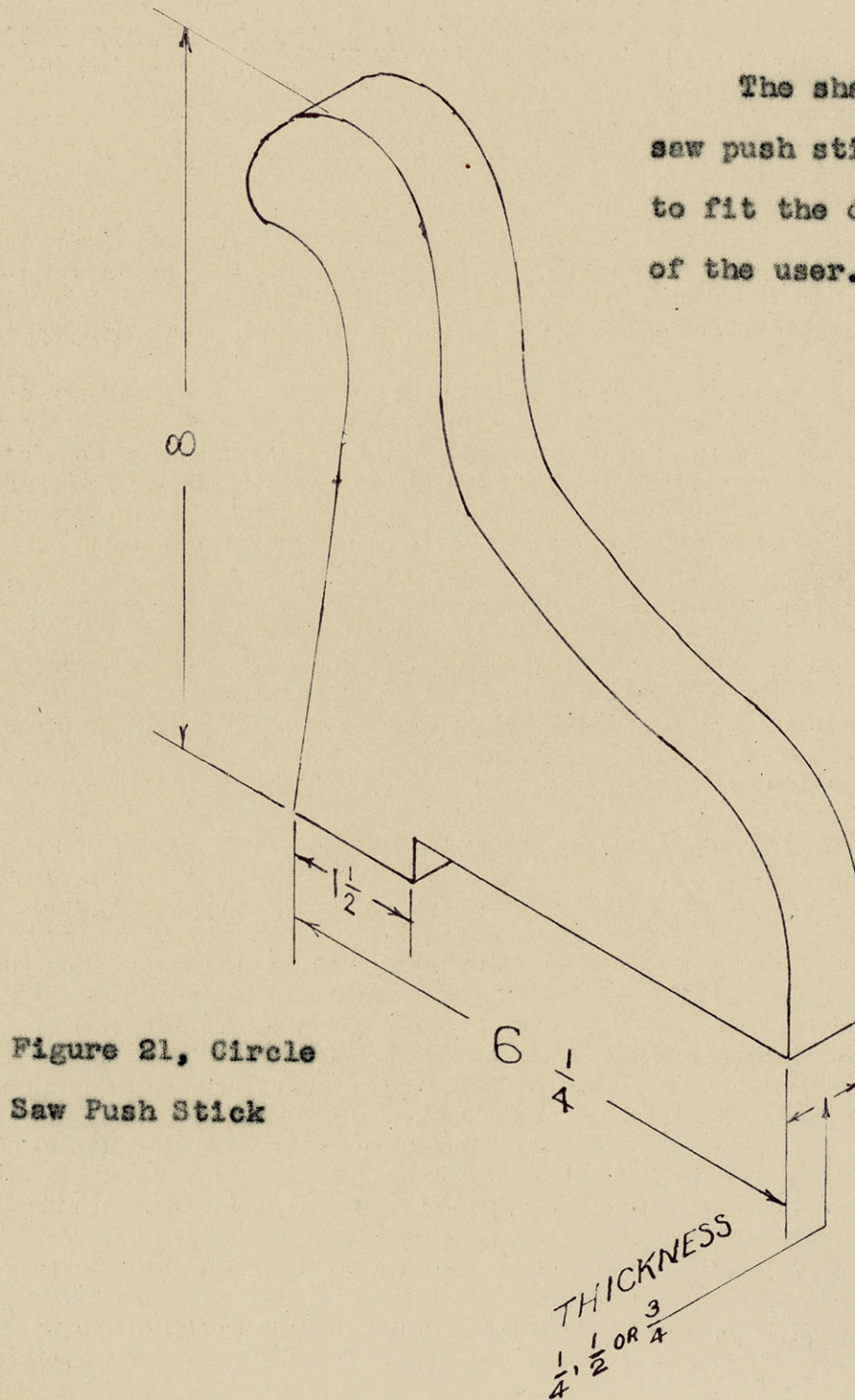


Figure 20, Feather Board



## Circle Saw Push Stick

The shape of this circle saw push stick may be changed to fit the desires and needs of the user.





### Jig Used in Cutting Dowels to Length on Band Saw

Sand paper may be glued along one side of the vee in place of the sharpened brad, as shown, if so desired. The jig, as shown, is made to be used with a miter gauge. In case

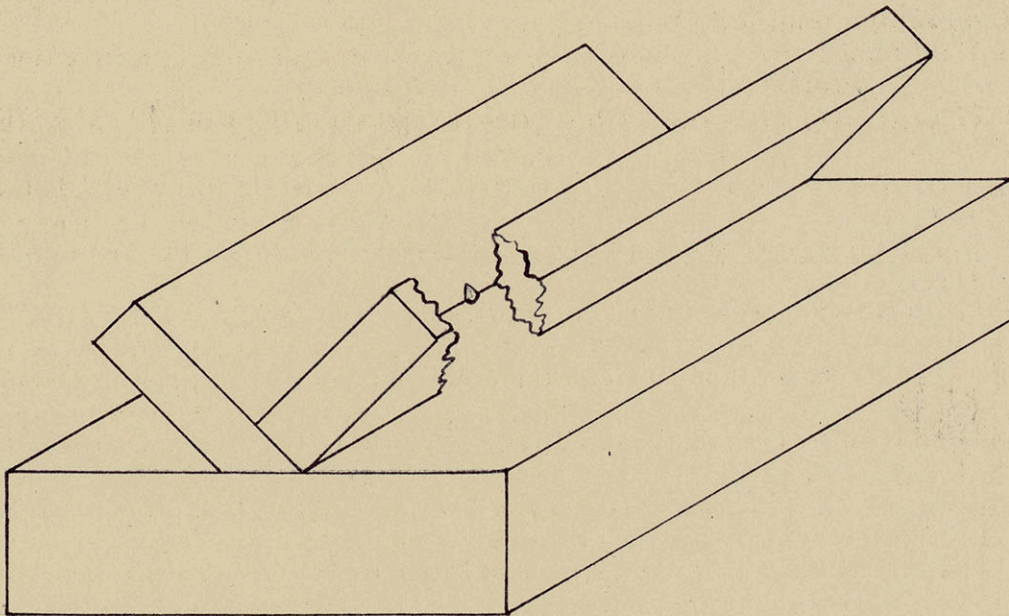


Figure 22, Jig Used in Cutting Dowels to Length on  
Band Saw

the band saw does not have this equipment nor a groove in the table top, the jig should be made as long as the distance between the saw blade and the edge of the table, and a cleat attached to the end in such a way that it will drop down below the table top to guide the jig squarely through the saw.



Push Stick for Flat Pieces on the Circle Saw or  
Jointer

The handle should be attached with screws countersunk  
safely below the surface.

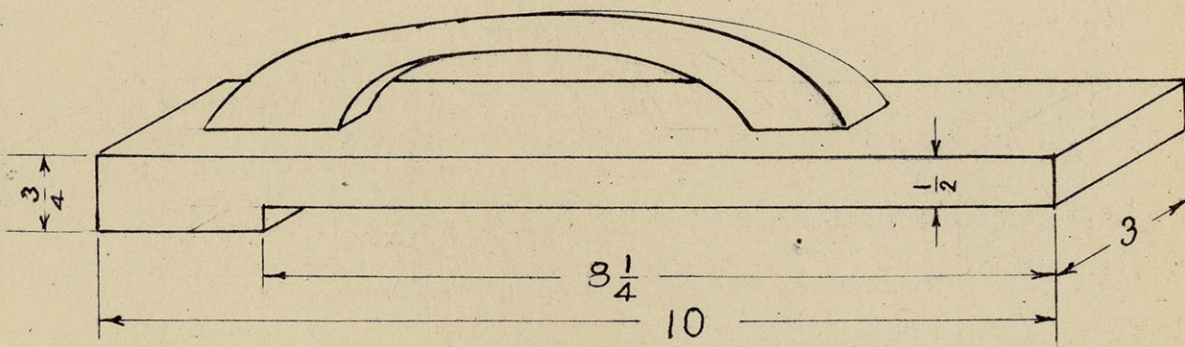


Figure 23, Push Stick for Flat Pieces on the  
Circle Saw or Jointer



### Jointer Push Stick

This push stick should be made of heavy material approximately  $1\frac{1}{4}$  inches thick and from eighteen inches to two feet long. These dimensions may vary according to the needs of the shop in which it will be used. The main use for this device is when surfacing heavy flat pieces on the jointer.

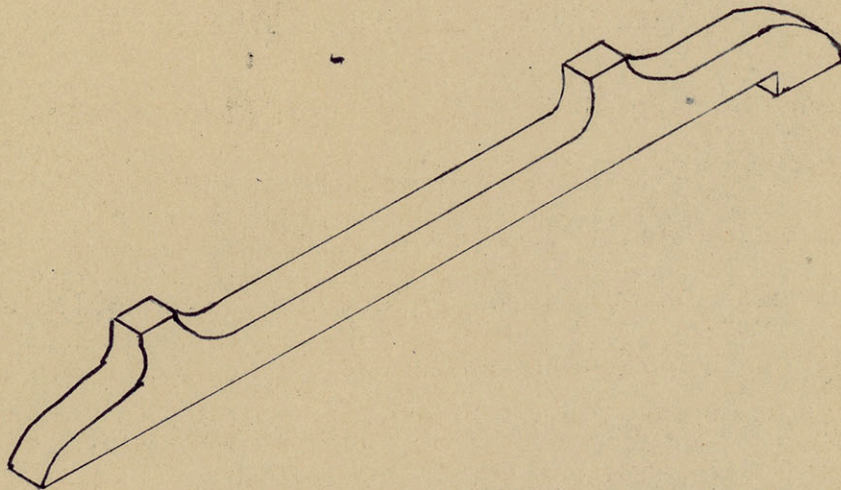


Figure 24, Jointer Push Stick



## Sander Table for Wood Lathe

The size of the table and post may vary according to individual needs.

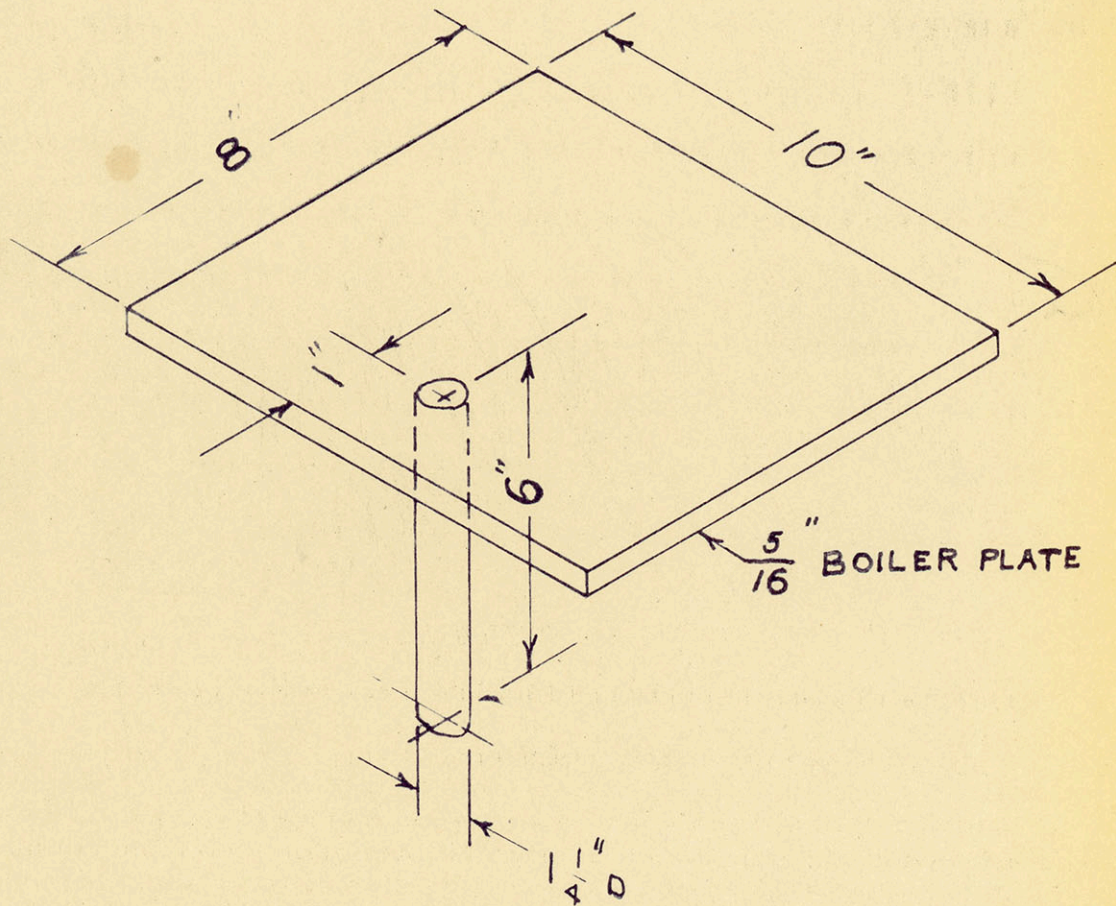


Figure 25, Sander Table for Wood Lathe



Special Devices, Group VIII

Group eight, or "special devices" are not illustrated. This group would include all those devices which are made for a special job on a given project. For example, it might be necessary to assemble twenty chairs and it was found that by making a special framing jig they could be assembled much faster and easier. This would be one example of the jigs of this group.

This type of device constitutes the major part of the jigs and fixtures used in industry where speed of production and low cost per unit are required.

In the school shop, however, where the objective is to teach all that is possible to the student the emphasis is not on quantity of production but rather on safety, analyzing quality, but recognizing that speed is important too.



## CHAPTER IV

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### Summary

"Jigs" and "fixtures" have been defined for the school wood shops on the basis of the meaning of the terms in the metal industries, their uses in the literature on woodwork, and their application in the shops. The brief history in this report is inadequate though suggestive of a rich source of information. More study should be devoted to the historical aspects.

Jigs and fixtures have been classified into eight groups and an explanation given of each group. It is believed that all school shop jigs and fixtures can be classified in one of these groups. It is recognized that there are many very useful jigs and fixtures which are not mentioned. It was discovered that there is much more study needed on this topic. Devices have been presented which may be useful to some teacher or shopman. Many of the devices are so old and so much used that it is impossible to determine, even approximately, where they originated. Many of the devices sent in were also found in other sources. No school shop was discovered which did not make use of jigs or fixtures to some extent. This is not conclusive, however, as too few shops were visited. It is believed that all modern, well run,



efficiently operated school shops will make and use many jigs and fixtures over a period of a year.

### Conclusions

An examination of the devices presented will show that they all were originally an idea in someone's mind. The idea was born of a need to accomplish a particular purpose.

In some of them the job could have been done with a simpler device. For example, Figure 18, page 35, is designed to cut concaves on a circle saw and when handled properly it will accomplish its purpose. The same job could be done by merely clamping a straight board diagonally across the saw table. The results could be the same and in many instances it would be better to use the simpler fixture. However, if it is necessary to cut concaves frequently in a particular shop and of various sizes the more refined fixture may save time and effort in the long run.

Another important point is illustrated by the example above, that a jig or fixture should be as simple to make and use as is consistent with the job it is to do, and the time it is expected to last. All of these shown in this study are intended to be used over and over for many years. There are many jigs and fixtures which are intended only for one job. That may be for ten or a hundred projects but when finished the jig is dismantled or discarded. These are the ones which should be included in group eight.



For the production shop it is important that jigs and fixtures be easy to operate and quick to assemble and disassemble. In the school shop this is desirable but not as essential as in business.

#### Recommendations

Jigs and fixtures are an important part of the industrial arts wood shop, since one of the objectives of industrial arts is to teach the ways of industry. An effective way to do this, then, is to set up a production shop, in the shop, as near like the factory as is practical. This, of course, would include as many jigs and fixtures as could be conveniently and economically worked into the shop program. This does not mean that all or even a major part of the work done should be on this level, but that perhaps one project a year be a production project. This method would not only present the ways of industry first hand but students would learn about jigs and fixtures, their importance to modern production methods, and something about constructing them.



## BIBLIOGRAPHY



## BIBLIOGRAPHY

### Books

- Amature Craftsman's Cyclopedia. New York: Popular Science Publishing Company, Inc., 1939. 338 pp.
- Colvin, Fred H., 60 Years with Men and Machines. New York: McGraw-Hill Book Company, Inc., 1947. 297 pp.
- Colvin, Fred H., and L. L. Hass, Jigs and Fixtures. New York: McGraw-Hill Book Company, Inc., 1948. 241 pp.
- Colvin, Fred H., and F. A. Stanley, Jig and Fixture Kinks. New York: McGraw-Hill Book Company, Inc., 1908. 106 pp.
- Donaldson, Cyril and George H. LeCane, Tool Design. New York: Harper and Brothers, 1943. 443 pp.
- Gunnerman, Milton, How to Operate Your Power Tools. New York: The Home Craftsman Publishing Corp., 1950. 224 pp.
- Hjorth, Herman, Principles of Woodworking. Milwaukee: The Bruce Publishing Company, 1946. 445 pp.
- New Standard Dictionary. New York: Funk and Wagnalls Company, 1952. 2815 pp.
- Pelton, B. W., Furniture Making and Cabinet Work. New York: D. Van Nostrand Company, Inc., 1949. 596 pp.
- Smith, Robert E., Machine Woodworking. Bloomington, Illinois: McKnight & McKnight, Publishers, 1948. 334 pp.
- Webster's New International Dictionary, 2nd Edition Unabridged. Springfield, Massachusetts: G. & C. Merriman Company, Publishers, 1952. 3214 pp.
- Wilson, Frank W., editor, and others, Tool Engineers Handbook. New York: McGraw-Hill Book Company, Inc., 1949. 2070 pp.
- Witzel, Ewald., editor, and others, Jig and Fixture Design. Albany, New York: Delman Publishers, Inc., 1947. 329 pp.
- Wood, Harry E., and James H. Smith, Prevocational and Industrial Arts. Chicago: Atkinson, Mentzer & Company, 1919. 266 pp.



Books

Zozzora, Frank, Engineering Drawing. New York: McGraw-Hill Book Company, Inc., 1953. 369 pp.

Periodical Articles

Finsterback, Fred, "Improved Coping-Saw Jig", Industrial Arts and Vocational Education, XXXVIII (January, 1949), 32-33.

Hegemeyer, Frank, "Woodworker's Information Department", Homecraft and the Home Owner, XXIII (May-June, 1953), 295-298.

Randel, Victor, "A Problem in Furniture Construction", Industrial Arts Magazine, IV (June, 1917), 258-259.

Smith, L. J., "The Art of Saw Filing Hand Saws", Homecraft and the Home Owner, XXIII (January-February, 1953), 148.

Watkins, David L., "Circle Saw Setting Jig", Industrial Arts and Vocational Education, XLI (October, 1952), 289-290.

Other Sources

Campbell, Harold J., Ideas for Drawing, Ventura, California, July, 1952.

Culbertson, A. B., Ideas for Drawings, Riverton, Kansas, January, 1953.

Davis, Edd, Idea for Drawing, Fort Hays Kansas State College, Hays, Kansas, March, 1952.

Kistler, Ted, Ideas for Drawings, Springfield, Missouri, January, 1953.

Wilkins, Robert, Idea for Drawing, Turner, Kansas, July, 1952.



APPENDIX

PORTER LIBRARY



202 South "D"  
Herington, Kansas

January 5, 1953

Mr. \_\_\_\_\_  
\_\_\_\_\_ High School  
\_\_\_\_\_, Kansas

Dear Mr. \_\_\_\_\_:

Under the auspices of the Industrial Education Department of Kansas State Teachers College, Pittsburg, Kansas, I am investigating non-commercial jigs, fixtures and devices used in the wood shops. I am attempting to formulate classifications, principles, and methods of jig and fixture building in the wood shop.

Will you please send me sketches of the jigs, fixtures or devices which you have in your wood shop? These may be devices which you use with your power tools, hand tools, shop maintenance, with special production jobs, or may be those used in some other capacity about the shop. May I also have your permission to record your devices or inventions? Any material used in my study will be given due recognition.

Thanks, sincerely, for this help.

R'Leigh Bell