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An Evaluation of an Experiment in Instruction in Junior High School Beginning Woodworking

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AN EVALUATION OF AN EXPERIMENT IN INSTRUCTION IN JUNIOR HIGH SCHOOL BEGINNING WOODWORKING

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by

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APPROVED FOR THE GRADUATE FACULTY

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E. Frank Price, COMMITTEE CHAIRMAN

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Stanley A. Dudley

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Ramona Solberg

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CHAPTER I

INTRODUCTION

Living in an urban community with its growing dependency upon an ever-changing, increasingly sophisticated industry, the author felt a need to establish a junior high school beginning woodworking program which would more readily prepare the student to meet the needs of today's society. The program would strive to broaden the scope of fundamental operations experienced by all students, while maintaining presently accepted industrial arts objectives, building a foundation providing adaptability for learning needed industrial skills or for using tools and techniques in home craftsmanship.

In striving to adapt to cultural and vocational changes wrought in the greater community served by the school, educators must ever evaluate and experiment, else their goals stagnate, and lose relevancy to the demanding world of today.

I. STATEMENT OF THE PROBLEM AND IMPORTANCE OF THE PROBLEM

The purpose of this study is to measure the effectiveness, based on fundamental woodworking knowledge gained, of

a method of teaching junior high school woodworking through teacher-controlled projects.

A comparison of two beginning woodworking classes was made based only upon the stated criterion, as selected by the instructor from the 1964 Washington State Industrial Arts Guide, of fundamental information learned during one semester.

Method A, a method of instruction allowing for individual pupil-project selectivity and related skill techniques, was used with one class. Method B, a method of instruction limiting project selection and design and striving for basic skills determined by the instructor, was used in the second class.

The significance of this problem is basic to education: should goals and skills essentially be teacher designed, based upon a professional responsibility to interpret community needs, or should they be more incidental, related to student goals holding more interest or immediate meaning?

II. HYPOTHESIS

The null hypothesis will be tested to determine if there are any significant differences between the achievement of students taught by Method A and Method B.

III. LIMITATIONS

The following factors are limitations of the study:

1. The experiment was held in the Issaquah Junior High School Industrial Arts Woodshop, Issaquah, Washington during the 1965 Fall semester.
2. The experiment involved ninety 55 minute periods.
3. Woodworking, in Issaquah Junior High School, is an elective offered to any eighth or ninth grade boy or girl who has completed Drafting I.
4. The classes were scheduled by the eighth and ninth grade counselors.
5. There was no special grouping of students considered by the counselors in the scheduling of these classes--class assignments were made as registration slips were received by the counseling office. I.Q., age, sex, and sociological factors were not considered.
6. There was no control over continuity through outside, disruptive factors such as period change, class interruption, and time factors.
7. Instructional Method A was used during the first period of the day. This class consisted of ten ninth grade boys and eleven eighth grade boys.

8. Instructional Method B was used during the second period of the day. This class consisted of seven ninth grade boys and fifteen eighth grade boys.
9. Testing materials, for the purpose of this experiment, were based upon technical and related information as suggested by the 1964 Washington State Industrial Arts Guide.
10. The testing did not attempt to directly measure efficiency of skills developed, general concepts of working with wood structures, nor, aesthetic values of woodworking gleaned.

IV. DEFINITION OF TERMS

Method A

Method A is defined as a method of instruction in a junior high school beginning woodworking course allowing for individual student project selection, design and construction.

Method B

Method B is defined as a method of instruction in a junior high school beginning woodworking course allowing for limited project selection from a designated group of projects determined by the teacher, small group instruction and small group construction.

Fundamental Industrial Arts Woodworking Information

Fundamental industrial arts woodworking information was used as stated in the Washington State Industrial Arts Guide (16:25-26).

Instructional material presented in Method A and Method B was selected from the following outline in the Washington State Industrial Arts Guide:

UNITS OF INSTRUCTION	INFORMATION - TECHNICAL & RELATED
General Information	Trees and forests Production of wood products Occupations in wood products industries Care of wood products in home Grading and standard sizes of lumber System of lumber measurement Models - patterns and molds Safe Practices
Designing and Planning	Basic understanding of design process Elements of designing in woods Simple techniques of sketching Uses of best design resources Socio-economic principles related to design for industry
Hand Tools	History of hand tools Approximate cost Care and use Maintenance Relationship of machines to science

Power Equipment	Safety procedures Basic operations Sawing Jointing and planing Drilling Routing and shaping Turning Sanding
Fabrications	Fasteners Hardware Adhesives Common joints
Finishing	History of abrasives Uses of abrasives Common types of finishes Basic thinners Care and use of devices for applying finishes: Rags Rollers Dip Tanks Brushes Spray guns

CHAPTER II

REVIEW OF LITERATURE

A review of current literature in the industrial arts field indicated an increasing interest in, and a stated need for, wider experimentation with instructional methods, materials and techniques to relate classroom experiences more directly to skills used in contemporary home and industry.

There appears to be two basic methods of instruction with many variations practiced in industrial arts today. The individual-student-oriented approach is centered on student selected projects which determine basic knowledge to be applied and laboratory experiences to be practiced. The group-oriented approach relies on a teacher selected project which allows for control of basic knowledge to be applied and laboratory experiences to be practiced. Both of these methods have long been considered of value in the learning process but research shows no significant difference between the two methods of teaching. Dr. Ronald L. Koble explored this area with a select unit in industrial arts to determine whether a group-oriented learning experience or an individual-oriented learning experience enabled students to learn more content information and to develop a higher degree of perceptual motor skills. No significant

difference was found (22:52-54).

Professional educators, industry's representatives and lay public see a need to search for better techniques of teaching. In this search, Dr. Armand G. Hofer has worked with putting demonstrations in printed form. His materials "tell" and "show" how to perform an operation through a carefully sequenced set of photographs and written instruction. The program was found to produce results at least as good as demonstrations with far less time and energy on the part of the teacher. Dr. Hofer stressed that programed materials be thought of as an aid to teaching rather than completely replacing demonstrations or the teacher (15:49-51).

Since the beginning of the twentieth century, industrial arts education has not kept pace with our rapidly changing society, and particularly its industrial complex. Textbooks being used today often contain out-dated information. As this gap between school and industry widens, industry finds it increasingly necessary to provide on-the-job training and special schooling to prepare today's labor force. This rapid increase has caused, with its demands, methods of instruction, current goals and limits of industrial arts education to be out-grown. To help meet these demands, better basic education must be provided, thus

manifesting a need for continuing experimentation and evaluation. Jerry Streichler states:

> The central purpose of Industrial Arts education is the preparation of individuals for meeting the requirements of a technological culture. This area of education purports to meet the needs of all students on all levels through programs in shops, laboratories, and special classrooms: through the use of tools, machines, and materials which contribute to understandings and wholesome changes in the learner (25:16-17).

Industrial arts laboratories in their experimentation should attempt, too, to represent progressive industry and our technical society in some operational phases if the field is to meet more universally its stated objectives. Louis Bruno, State Superintendent of Public Instruction, realizing that external cultural forces today dictate curricular changes, states in his introduction to the Washington State Industrial Arts Guide that:

> If classroom instruction in the industrial arts is to be responsive to changing conditions and situations in the actual work-a-day- world, the guide must lend itself to revision (16:2).

In like manner, the American Industrial Arts Association proposes that industrial arts education must, among other things, (1) help prepare various student types for effective living in today's technological culture; (2) employ actual concrete involvement with tools, machines, and materials to reinforce the written and spoken word; and (3) provide technical skills and knowledge basic to most

occupations and professions (1:1).

John L. Feirer states that many junior high school programs fail to meet objectives because they overemphasize isolated hand skills, providing only limited insight into the field represented. He further comments that in woodworking, the teacher most often concentrates on making some small wood projects involving mostly hand-tool skills (9:15).

If a junior high school beginning woodworking course is to have more direct relevance in the rapidly growing technical world discussed herein, students must be better prepared to handle the challenges of tomorrow. Practices of past decades will have little usefulness in an age of automation (7:18).

In preparing students for these challenges of tomorrow the curriculum must be able to stimulate each student so that he no longer merely wants to repeat past tasks or perform simpler tasks, but is encouraged to accept newer, broader, more complex experiences. Arthur J. Dudley contends that we must offer an instructional program with content and experience not only to challenge the able, but also to motivate the average, and to provide suitable learning experiences for the less able (5:59).

To do this it will seemingly be necessary to deviate

from presently accepted practices such as constructing a simple bookcase at the beginning level and a larger bookcase at an advanced level. Typical of these concerns is that of John L. Feirer. Mr. Feirer, a developer of national curriculum for industrial arts, suggests that learning units be divided by grade levels and that suggested content to be covered at each grade level be indicated (10:15).

The need for evaluating, experimentation and redirection of teaching procedures and emphasis is supported by Arthur J. Dudley. He states:

> Changes in attitudes; review of goals; use of new techniques; identification of the best of past experiences and a search for new horizons are imperative if industrial arts education is to prosper (5:59).

Thus, it may be concluded from the perspective gained from contemporary writings that industrial arts classes must emerge from the "hobby" image of their origins and strive for a wider, more effective role in providing basic preparation in a society increasingly oriented toward technology in the various aspects of living.

This would appear, then, to render valid this experiment proposing to evaluate observed current practices and compare them in some measure with techniques developed by this author.

CHAPTER III

PROCEDURE FOR STUDY

After securing permission from the Issaquah Junior High School administration to do the study, the author selected two randomly scheduled woodworking classes. First and second periods were selected for this experiment because of the commonality the two periods offered. It is commonly accepted that early period classes maintain higher interest. There are usually fewer disruptive factors at this time. The classes were comparable in size and scheduled back-to-back.

The first period of the day was selected to implement instructional Method A. This class involved ten ninth grade boys and eleven eighth grade boys scheduled into beginning woodworking by the eighth and ninth grade counselors. Method A entailed a presently accepted procedure of allowing each student to select, design, and construct each project on an individual basis. Therefore, this method allows the individual to select skills, techniques, and procedures to be experienced.

The second period of the day was selected to implement instructional Method B. This class consisted of seven ninth grade boys and fifteen eighth grade boys scheduled by

the counselors. Method B allows for limited project selection from a designated group of projects determined by the teacher, small group instruction and small group construction. Skills, techniques, and procedures to be experienced by the student are determined by the instructor.

On the third day of school, a pre-test--Examination I - Basic Woodworking Knowledge (See Appendix A) was administered to both classes to establish the group mean of basic woodworking knowledge. If any proper relationship was stated, credit was given. Subject matter contained in this test is regarded as basic to all junior high school beginning woodworking courses.

Examination I was repeated on the 87th day which enabled measurement of the mean increase.

The second pre-test, Examination II - Power Tools and Power Tool Operations (see Appendix B), was given the twenty-sixth day of school to both classes to establish the group mean of knowledge of power tools and their operations. All power tools were numbered. The students were asked to write the name of each tool and as many of its basic operations as possible on the answer sheet beside the corresponding number. If any proper relationship was stated, credit was given. There was no set number of basic operations required. No attention was given to spelling or

grammar.

Examination II was repeated on the 88th day to establish a basis for measurement of the mean increase. An attempt was made to keep demonstrations and presentation of materials parallel and equal as to time and method; however, limitations were imposed by various human factors and school routine. The groups differed only in their application of the presented material.

I. METHOD A

Project and Process Tabulation Sheet

The first period class (Method A) chose the following listed twenty-one projects and related processes as recorded on the Project and Process Tabulation Sheet. There were 7.66 processes per project. Nineteen of the twenty-one completed projects are pictured on page 18.

TABLE I

METHOD A PROJECT AND PROCESS TABULATION SHEET

21 - 161 = 7.66	Table saw	Jointer	Doweling	Glueing	Band saw and/ or Jig saw	Hand shaping	Drill press	Sanding	Assembly	Finish	TOTAL
1. TV Trays	x	x	x	x		x	x	x	x	x	9
2. Desk-Top Storage Box	x	x		x				x	x	x	6
3. Record Box	x	x		x				x	x	x	6
4. Oriental Stool	x	x		x				x	x	x	6
5. Mexican Stool	x	x	x	x			x	x	x	x	8
6. Car Kit Storage Box	x	x		x				x	x	x	6
7. LP Record Rack	x	x	x	x			x	x	x	x	8
8. Foot Stool	x	x		x	x	x		x	x	x	8
9. Spice Rack	x	x		x	x	x		x	x	x	8
10. Magazine Rack	x	x	x	x	x	x	x	x	x	x	10
11. Magazine Rack	x	x		x				x	x	x	6
12. Octagon Bowl	x	x		x	x	x		x	x	x	8
13. Book Shelf	x	x	x	x				x	x	x	7
14. Night Stand	x	x	x	x				x	x	x	7
15. Flower Pot Stool	x	x	x	x	x	x		x	x	x	9

TABLE I (continued)

21 - 161 = 7.66	Table saw	Jointer	Doweling	Glueing	Band saw and/or Jig saw	Hand shaping	Drill press	Sanding	Assembly	Finish	TOTAL
16. Bedroom Stool	x	x	x	x				x	x	x	7
17. Gun Rack	x	x		x	x	x		x	x	x	8
18. Tea Table	x	x	x	x	x	x		x	x	x	9
19. Coat & Hat Rack	x	x	x	x	x	x		x	x	x	9
20. Record Rack	x	x	x	x			x	x	x	x	8
21. Gun Rack	x	x		x	x	x		x	x	x	8

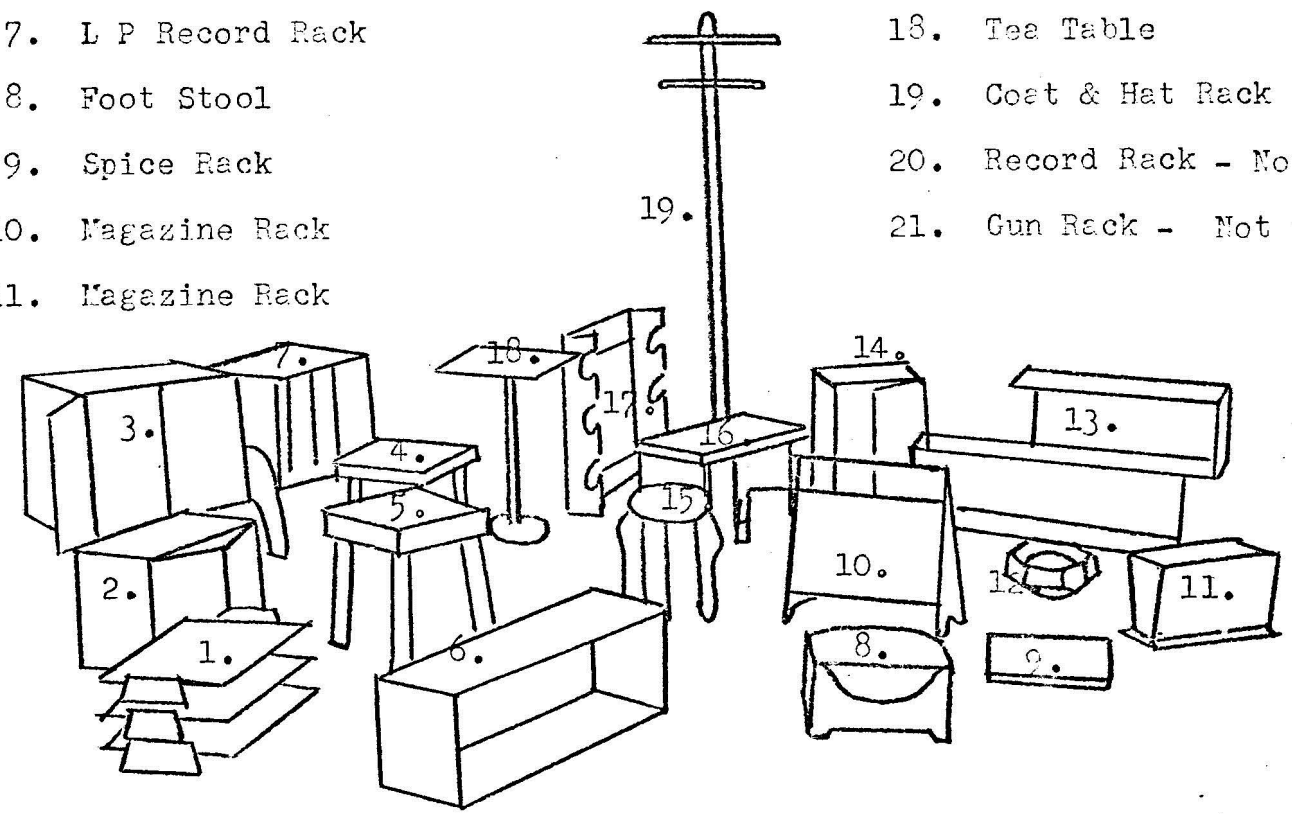
Projects

The following picture illustrates the projects designed and constructed by students in Method A.

METHOD A - PROJECTS COMPLETED

LEGEND METHOD A PROJECTS COMPLETED

1. T V Trays
2. Desk-top Storage Box
3. Record Rack
4. Oriental Stool
5. Mexican Stool
6. Car Kit Storage Box
7. L P Record Rack
8. Foot Stool
9. Spice Rack
10. Magazine Rack
11. Magazine Rack
12. Octagon Bowl
13. Book Shelf
14. Night Stand
15. Flower Pot Stool
16. Bedroom Stool
17. Gun Rack
18. Tea Table
19. Coat & Hat Rack
20. Record Rack - Not pictured
21. Gun Rack - Not pictured



II. METHOD B

Project and Process Tabulation Sheet

The second period class (Method B) made their selection from the following named projects:

1. Upholstered Foot Stool page 24
2. Current Literature Rack page 25
3. Long Play Record Rack page 26
4. News Stand page 27
5. Triangular Stool page 28

The above named projects were selected by the teacher because each project provided for exposure to all teacher designated processes as shown on the following Project and Process Tabulation Sheet. There were 10.0 processes per project.

TABLE II

METHOD B PROJECT AND PROCESS TABULATION SHEET

22 - 220 = 10.0 43.6% increase	Table saw	Jointer	Doweling	Glueing	Band saw and/ or Jig saw	Hand shaping	Drill press	Sanding	Assembly	Finish	TOTAL
1. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
2. News Stand	x	x	x	x	x	x	x	x	x	x	10
3. Upholstered Foot Stool	x	x	x	x	x	x	x	x	x	x	10
4. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
5. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
6. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
7. Upholstered Foot Stool	x	x	x	x	x	x	x	x	x	x	10
8. News Stand	x	x	x	x	x	x	x	x	x	x	10
9. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
10. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
11. News Stand	x	x	x	x	x	x	x	x	x	x	10
12. Triangular Stool	x	x	x	x	x	x	x	x	x	x	10

TABLE II (continued)

22 - 220 = 10.0 43.6% increase	Table saw	Jointer	Doweling	Glueing	Band saw and/ or Jig saw	Hand shaping	Drill press	Sanding	Assembly	Finish	TOTAL
13. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
14. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
15. Upholstered Foot Stool	x	x	x	x	x	x	x	x	x	x	10
16. News Stand	x	x	x	x	x	x	x	x	x	x	10
17. Triangular Stool	x	x	x	x	x	x	x	x	x	x	10
18. Triangular Stool	x	x	x	x	x	x	x	x	x	x	10
19. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
20. Triangular Stool	x	x	x	x	x	x	x	x	x	x	10
21. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10
22. Long Play Record Rack	x	x	x	x	x	x	x	x	x	x	10

Projects

The following pictured projects graphically illustrate the likeness in construction procedures desired to implement Method B's technique of instruction while offering a variation in design and function.

UPHOLSTERED FOOT STOOL

CURRENT LITERATURE RACK

LONG PLAY RECORD RACK

NEWS STAND

TRIANGULAR STOOL

NEWS BASKET

This project served as a practical examination of applied laboratory work. The news basket repeats all processes incurred in the construction of any one of the selective group.

III. DAILY SUBJECT MATTER PRESENTATION AND LABORATORY EXERCISES

DAY	METHOD A	METHOD B
1.	Introduction of teacher and students. A thorough explanation was given to both groups concerning the comparative experiment. Information covered: Testing Method A - First period--design own project Method B - Second period--choose from a group of five projects Academic materials and physical demonstrations--same exposure for all students Wood available--presentation and discussion: Philippine mahogany Honduras mahogany Japanese sen American black walnut	
2.	General room procedures personal locker area proper shop attire attendance	(same)
	Shop conduct use of facilities personal conduct safety	(same)
3.	EXAMINATION I (Pre-test) KNOWLEDGE 55 minutes	BASIC WOODWORKING (See Appendix A)
4.	Project discussion design cost physical limitations of wood general size of project storage space available	Project discussion Project selection from group of five projects design cost physical limitations of wood storage space available

DAY	METHOD A	METHOD B
4. (continued)		
	Display woods available Assignment - five pencil sketches of possible projects	Display woods available in the form of sample projects Assignment - discussion of projects and cost with parents (selection to be made at a future date)
5.	Discussion of Student Hand Book--as assigned by administration for all first period classes	Filmstrip and Discussion -75 frames of 149 frames Hammers Screw Drivers Nails Screws
6.	Filmstrip and Discussion -75 of 149 frames Hammers Screw Drivers Nails Screws	Filmstrip and Discussion -74 frames Hammers Screw Drivers Nails Screws
7.	Filmstrip and Discussion -74 frames Hammers Screw Drivers Nails Screws	Demonstration and Student Participation Hammers Screw Drivers Nails Screws Review of materials and demonstrations presented days 5, 6, and 7

DAY	METHOD A	METHOD B
8.	Demonstration and Student Participation Hammers Screw Drivers Nails Screws Review of materials and demonstrations presented days 6, 7, and 8	Filmstrip and Discussion -63 of 141 frames Hand saws for woodworking
9.	Filmstrip and Discussion -63 of 141 frames Hand saws for woodworking	Filmstrip and Discussion -78 frames Hand saws for woodworking
10.	Filmstrip and Discussion -78 frames Hand saws for woodworking	Demonstration and Student Participation Hand saws for woodworking Review of materials and demonstrations presented days 8, 9, and 10
11.	Demonstration and Student Participation Hand saws for woodworking Review of materials and demonstrations presented days 9, 10, and 11	Filmstrip and Discussion -57 of 126 frames Planes
12.	Filmstrip and Discussion -57 of 126 frames Planes	Filmstrip and Discussion -69 frames Planes

DAY	METHOD A	METHOD B
13.	Filmstrip and Discussion -69 frames Planes	Demonstration and Student Participation Planes Rasps Review of materials and demonstrations presented days 11, 12 and 13
14.	Demonstration and Student Participation Planes Rasps Review of materials and demonstrations presented days 12, 13, and 14	Filmstrip and Discussion -74 of 118 frames Measuring, Testing, and Marking Tools for Woodworking
15.	Filmstrip and Discussion -74 of 118 frames Measuring, Testing, and Marking Tools for Woodworking	Filmstrip and Discussion -44 frames Measuring, Testing, and Marking Tools for Woodworking
16.	Filmstrip and Discussion -44 frames Measuring, Testing, and Marking Tools for Woodworking	Demonstration and Student Participation Measuring, Testing, and Marking Tools for Woodworking Review of materials and demonstrations presented days 14, 15, and 16

DAY	METHOD A	METHOD B
17.	Demonstration and Student Participation Measuring, Testing, and Marking Tools for Woodworking Review of materials and demonstrations presented days 15, 16, and 17	Filmstrip and Discussion -71 of 151 frames Boring Tools for Woodworking
18.	Filmstrip and Discussion -71 of 151 frames Boring Tools for Woodworking	School Assembly
19.	Project Discussion Project selection Wood selection Assigned final drawing	Project Discussion Project selection Wood selection (allowing for the preparation of a pre-cutting parts list)
20.	Filmstrip and Discussion -80 frames Boring Tools for Woodworking	(Same as Method A)
21.	Demonstration and Student Participation Boring Tools for Woodworking Review of materials and demonstrations presented days 18, 20, and 21	Demonstration and Student Participation Boring Tools for Woodworking Review of materials and demonstrations presented days 17, 20, and 21
22.	Filmstrip and Discussion -73 of 139 frames Chisels for Woodworking	(Same as Method A)

DAY	METHOD A	METHOD B
23.	Filmstrip and Discussion -66 frames Chisels for Woodworking Assignment of storage area	(Same as Method A)
24.	Demonstration and Student Participation Chisels for Woodworking Review of materials and demonstrations presented days 22, 23, and 24	(Same as Method A)
25.	Review - EXAMINATION I to reinforce previously presented materials	(Same as Method A)
26.	EXAMINATION II (Pre-test) 55 minutes (See Appendix B)	POWER TOOLS AND POWER TOOL OPERATIONS
27.	Circular Table Saw Demonstration and Discussion safety terminology maintenance operations Review	(Same as Method A)
28.	Band Saw, Jig Saw, and Jointers Demonstrations and Discussion safety terminology maintenance operations Review	(Same as Method A)

DAY	METHOD A	METHOD B
29.	Drill Press, Grinder, and Wood Lathes Demonstrations and Discussion safety terminology maintenance operations Review	(Same as Method A)
30.	Review - EXAMINATION II	(Same as Method A)
31.	Hand Tool Demonstration Miter box Doweling jig Sandpaper holders Review	(Same as Method A)
32.	Shop Clean-up Procedures	(Same as Method A)
33.	Project Materials Select and dispurse materials on an individual basis	Project--Pre-cutting All students involved in the pre-cutting of all projects
34.	Project Materials (Continued)	Project--Pre-cutting (Continued)
35.	Project Materials (Continued)	Group Instruction (Five groups) Project plans and procedures Steps and methods Tool sequence

DAY	METHOD A	METHOD B
36.	Individual Instruction Project plans and procedures Steps and methods Tool sequence	Glueing Demonstration Glue mixing Glueing demonstration Clamping Jig use
37.	Individual Instruction (Continued)	Project Construction: For the remainder of the comparative period, this group continued to work on their projects on an individual and small group basis. Each student worked at all power tools either on his project or another student's. All instruction from the teacher was on a small group basis.
38.	Glueing Demonstration Glue mixing Glueing demonstration Clamping Jig use	Finishing: At a point when the first project was completed, the entire class was given instruction and demonstrations of the finishing process.
39.	Project Construction: For the remainder of the comparative period, the class was involved in individual continued construction of their projects. This included project modifications and corrections and individual instruction at power tools when necessary. Finishing: At a point when the first project was	

DAY	METHOD A	METHOD B
39.	(continued) completed, the entire class was given instruction and demonstrations of the finishing process.	
87.	Final Testing - EXAMINATION I (See Appendix A)	
88.	Final Testing - EXAMINATION II (See Appendix B)	

Text

Basic Tools for Woodworking by Lee Frankl, was used as a supplementary text throughout the semester. The text was available for each student to check out and use and was used during all hand tool demonstrations.

Filmstrips

Filmstrips: Stanley Tools. Stanley Film Strips for Woodworking. New Britain, Connecticut: Stanley Tools Education Department, 1960.

CHAPTER IV

SUMMARY OF FINDINGS

I. EXAMINATION I

There were twenty-one students involved in Method A (N=21) and twenty-two students in Method B (N=22). Test scores from Method A ranged from nine to thirty-nine (Range 30) on the first testing and from twenty-one to seventy-seven (Range 56) on the second testing. Test scores for Method B ranged from six to thirty-one (Range 25) on the first testing and from twenty-seven to eighty-eight (Range 61) on the second testing.

The increase of score from the first testing to the second testing for Method A ranged from nine to fifty-three (Range 44). The mean increase was 33.7. The increase of score from the first testing to the second testing for Method B ranged from fifteen to fifty-six (Range 41). The mean increase was 38.0.

A comparison of the mean increase in test scores of Method A and Method B yields a t-ratio of 1.05. This information is shown in Table III. This means that the difference between the mean of Method A and the mean of Method B falls below the 95 per cent level of confidence. Table III was compiled from scores from EXAMINATION I - pre-test (1st) and final test (2nd).

TABLE III

RESULTS OF EXAMINATION I - BASIC WOODWORKING KNOWLEDGE

METHOD A					METHOD B				
Student	1st	2nd	X	X^2	Student	1st	2nd	Y	Y^2
A	22	66	44	1936	A	9	56	47	2209
B	19	68	49	2401	B	12	64	52	2704
C	14	42	28	784	C	19	42	23	529
D	32	77	45	2025	D	9	51	42	1764
E	23	68	45	2025	E	14	52	38	1444
F	29	64	35	1225	F	21	63	42	1764
G	28	77	49	2401	G	12	27	15	225
H	14	34	20	400	H	29	62	33	1089
I	25	57	32	1024	I	20	64	44	1936
J	15	66	51	2601	J	13	61	48	2304
K	19	56	37	1369	K	16	53	37	1369
L	12	21	9	81	L	27	75	48	2304
M	17	55	38	1444	M	6	41	35	1225
N	39	70	31	961	N	29	67	38	1444
O	21	31	10	100	O	31	84	53	2809
P	21	48	27	729	P	24	45	21	441
Q	13	28	15	225	Q	27	88	61	3721

TABLE III (continued)

METHOD A					METHOD B				
Student	1st	2nd	X	X^2	Student	1st	2nd	Y	Y^2
R	17	32	15	225	R	18	49	31	961
S	19	48	29	841	S	27	46	19	361
T	9	62	53	2809	T	19	46	27	729
U	21	67	46	2116	U	22	49	27	729
					V	22	78	56	3136

X = increase

X^2 = increase squared

Y = increase

Y^2 = increase squared

	Method A	Method B
Number of cases	21	22
Sum of X scores, Y scores	708	837
Sum of X^2 scores, Y^2 scores	27,722	35,197
Mean	33.7	38.0
Standard Deviation	13.6	12.5
Standard error of the mean	3.0	2.8

Standard error of difference - 4.1

*t-ratio - 1.05

Difference between means did not reach the 95 per cent level. The null hypothesis can not be rejected.

*t-ratio formula: Underwood, Benton J., Duncan, Carl P., Taylor, Janet A., Cotton, John W. Elementary Statistics. New York: Appleton-Century-Crofts, Inc., pp. 127.

II. EXAMINATION II

(PART II - POWER TOOL OPERATIONS)

Again with twenty-one students in Method A and twenty-two students in Method B, test scores from Method A ranged from four to nineteen (Range 15) on the first testing and from nineteen to forty-eight (Range 29) on the second testing. Test scores for Method B ranged from two to twenty-one (Range 19) on the first testing and from fifteen to fifty-two (Range 37) on the second testing.

The increase of score from the first testing to the second testing for Method A ranged from eleven to thirty-nine (Range 18). The mean increase was 17.5. The increase of score from the first testing to the second testing for Method B ranged from ten to thirty-nine (Range 29). The mean increase was 22.6.

In comparing the mean increase in test scores of Method A and Method B, a t-ratio of 2.68 is yielded. This information is shown in Table IV. Therefore, the difference between the mean of Method A and the mean of Method B is significant at the 99.26 per cent level of confidence.

The following table was compiled from EXAMINATION II - PART II POWER TOOL OPERATIONS KNOWN - pre-test (1st) and final test (2nd).

TABLE IV

RESULTS OF EXAMINATION II - POWER TOOL OPERATIONS KNOWN

METHOD A					METHOD B				
Student	1st	2nd	X	X^2	Student	1st	2nd	Y	Y^2
A	12	29	17	289	A	7	25	18	324
B	6	23	17	289	B	11	31	20	400
C	4	19	15	225	C	8	28	20	400
D	13	24	11	121	D	5	17	12	144
E	10	25	15	225	E	9	28	19	361
F	12	25	13	169	F	14	40	26	676
G	8	25	17	289	G	5	28	23	529
H	5	24	19	361	H	13	31	18	324
I	19	43	24	576	I	4	24	20	400
J	9	25	16	256	J	11	35	24	576
K	8	27	19	361	K	9	30	21	441
L	4	19	15	225	L	17	44	27	729
M	7	32	25	625	M	2	19	17	289
N	18	48	30	900	N	5	15	10	100
O	13	28	15	225	O	17	41	24	576
P	4	23	19	361	P	8	26	18	324
Q	5	24	19	361	Q	8	31	23	529
R	11	23	12	144	R	5	44	39	1521
S	9	32	23	529	S	8	33	25	625

TABLE IV (continued)

METHOD A					METHOD B				
Student	1st	2nd	X	X^2	Student	1st	2nd	Y	Y^2
T	5	21	16	256	T	14	45	31	961
U	13	24	11	121	U	19	50	31	961
					V	21	52	31	961

X = increase Y = increase

X^2= increase squared Y^2= increase squared

	Method A	Method B
Number of cases	21	22
Sum of X scores, Y scores	368	497
Sum of X^2 scores, Y^2 scores	6908	12,151
Mean	17.5	22.6
Standard Deviation	4.8	6.4
Standard error of the mean	1.1	1.5

Standard error of difference - 1.9

*t-ratio - 2.68

Difference between means is significant at the 99.26 per cent level of confidence.

The above test scores were taken from EXAMINATION II POWER TOOLS AND POWER TOOL OPERATION TABULATION SHEETS. (See Appendix C).

*t-ratio formula: Underwood, Benton J., Duncan, Carl P., Taylor, Janet A., Cotton, John W. Elementary Statistics. New York: Appleton-Century-Crofts, Inc., pp. 127.

The two different methods of instruction, Method A, utilizing individual student project selection, design and construction; and Method B, utilizing limited project selection from a designated group determined by the teacher, small group instruction and small group construction, did not yield a significant difference in knowledge as measured by Examination I (Basic Woodworking Knowledge) from the pre-test to the final repeat test.

The two different methods of instruction used with Method A and Method B did yield a significant difference in performance as measured by Examination I, Part II (Power Tool Operations) from the pre-test to the final repeat test.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Although there was more basic knowledge gained in Method B than in Method A, as measured on Examination I, the gain was not statistically significant. There was, however, indication of significant difference in growth in knowledge of power tool operations as measured on Examination II. It was concluded, however, there were results achieved through this program which could not be tested directly or measured concretely, but could be observed empirically. These results, in the author's opinion, manifest this program to be effective in a more universal learning of basic operations and in the application of basic knowledge. The following conclusions, therefore, would appear to have some validity.

The primary direction of controlled project experiences found in Method B, not only provides a broader knowledge and skill foundation for each student, but also is pedagogically sound in that the professional teacher interprets, establishes, and effects ever-changing useful classroom goals.

There were exposures in Method B to some production-line techniques that probably cannot as readily be derived

from instructional Method A. These experiences prove more directly related to our technological society as well as providing necessary background for home craftsmanship. An observed secondary result of the above exposures was an increase in the sharing of group and individual responsibility. It has been said that man cannot be "an island unto himself." Thus, the carpenter who alone builds a home is nearly extinct. Now, the brick mason, cement finisher, framing carpenter, roofer, glazer, electrician, plumber, dry-wall specialist, painter, carpet layer, cabinet maker, heating specialist and architect, by the methods of today, all share responsibility in one structure. This shared responsibility is not only necessary in the work-a-day world but is quite commonplace in most aspects of our interdependent society.

The teacher felt that the factors of security, responsibility, and project techniques manifest in Method B were translated into higher individual output and quality. This is evidenced by 17 of 22 students in this group completing a second class project and 3 completing a third. By contrast, 3 of 21 students in Method A completed a second project and none completed a third. With a shrinking work day, increased output with continued quality is a prime goal desirable both in training and practice.

Increased output of Method B also resulted in a 43.6 per cent increase in basic exposures as listed by the instructor. This increase was based on a one-project-to-one-student basis in both groups. Therefore, it is the writer's opinion that the additional exposures to basic processes helped to establish more depth in basic woodworking knowledge and application of that knowledge. It is this depth and application of knowledge that will assist in providing opportunities to occupy the increased leisure time supplied by our shortening work day.

A somewhat subjective, unmeasurable, yet desired effect noted in Method B was the group's maintenance of continued interest. This possibly was enhanced in one respect by a continuing change in responsibilities and experiences within the group. Also, students were able to work in small groups more frequently.

A most important incidental result observed was a greater student awareness of the necessity for shop safety. This is largely attributed to wider usage of shop facilities, causing more natural awareness as well as providing more opportunities for incidental safety talks.

In conclusion, advisors and this author believe experimentation of this type necessary to the improvement of education. Though there was no statistical significance in

the difference between the two groups in tested growth of basic knowledge, there was significant difference, as summarized previously, in the knowledge of power tool operations. It is held then, that statistically and empirically, Method B gives evidence of positive results and is worthy of continued evaluation utilizing perhaps new criteria.

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APPENDIX A

NAME_____

DATE_____

PERIOD_____ SCORE_____

115

INDUSTRIAL ARTS EXAMINATION I - BASIC WOODWORKING KNOWLEDGE

1. How are the sizes of hammers indicated?

2. Name two types of claw hammers.

   1. 2.

3. Name the three types of nails most commonly used.

   1. 2.

   3.

4. How are screw drivers specified for size?

   1. 2.

5. Name three common types of wood screw heads.

   1. 2.

   3.

6. Name the two hand saws most commonly used in a wood shop.

   1. 2.

7. Name the parts of a hand crosscut saw.

   1. 2.

   3. 4.

   5.

8. How should a saw cut be started?

9. Where is the saw cut made in regard to the guide line?

10. Name two types of chisels according to the method of attaching the handles.

    1. 2.

11. In what position should the bevel of a chisel be held when removing waste wood quickly?

12. In what position is the bevel of a chisel when finishing to the guide line?

13. What is done to avoid overheating or burning a tool when grinding?

14. Name two types of gouges according to the location of the bevel.

    1. 2.

15. What two adjustments are necessary to adjust a plane blade?

    1. 2.

16. Why should work be held low in the vise when planing by hand?

17. At what angle should the plane blade bevel be ground?

18. Why is oil used on the oil stone?

19. How is the cutting edge of the plane blade protected when the plane is not in use?

    1. 2.

20. In what position should a steel rule be held to insure accurate marking?

21. Name three types of squares used for woodworking.

1. 2.

3.

22. Name three types of tools used for marking or scribing lines.

1. 2.

3.

23. What method of measurement is used to size auger bits?

24. What effect does the shape of a forstner bit have on the bottom of a hole?

25. Are auger bits and forstner bit sizes indicated in the same way?

26. Name two ways that lumber producing trees are classed,

1. 2.

27. Name the two methods of seasoning lumber.

1. 2.

28. Lumber is sold by what two units of measurement?

1. 2.

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THE PARTS AS INDICATED

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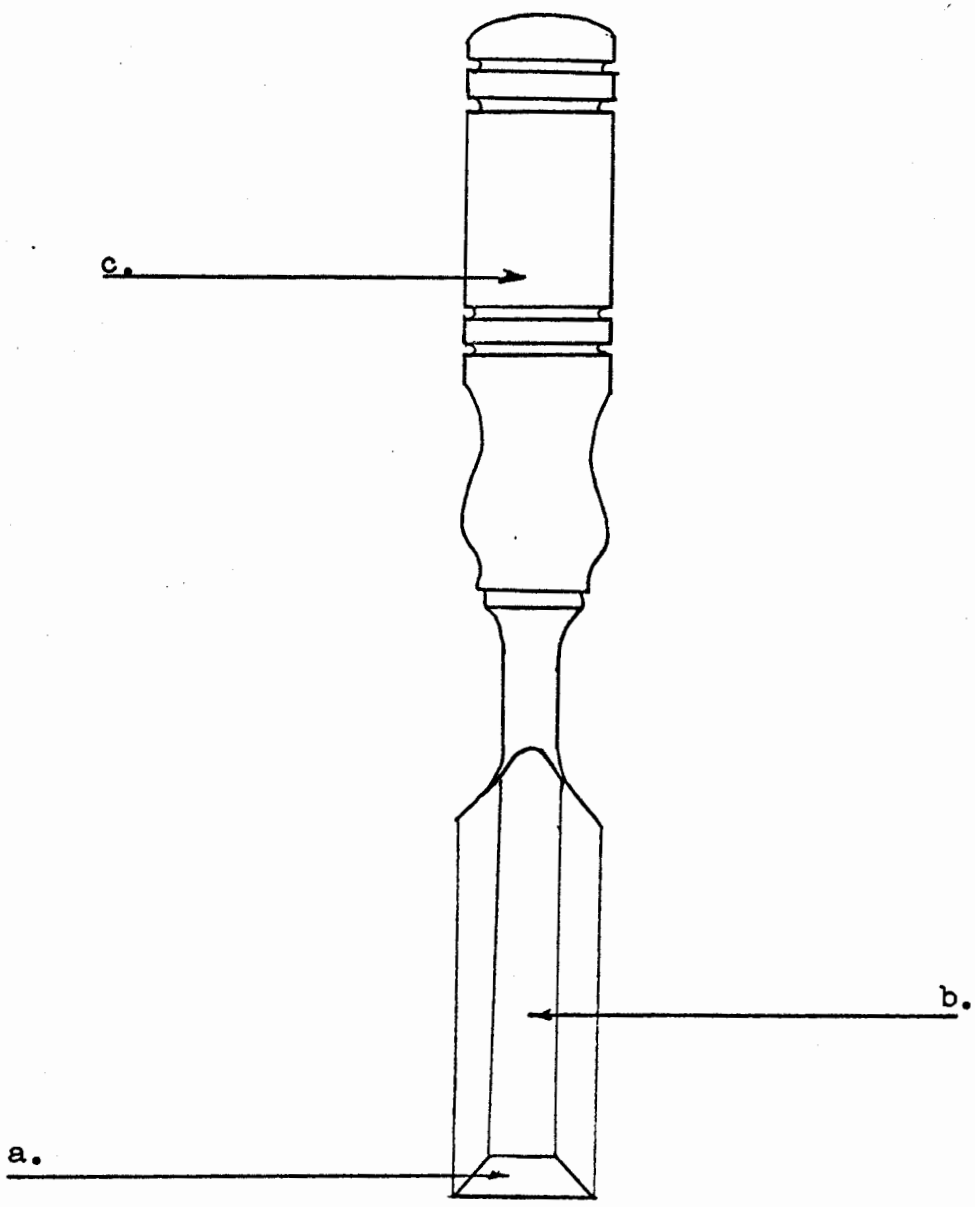

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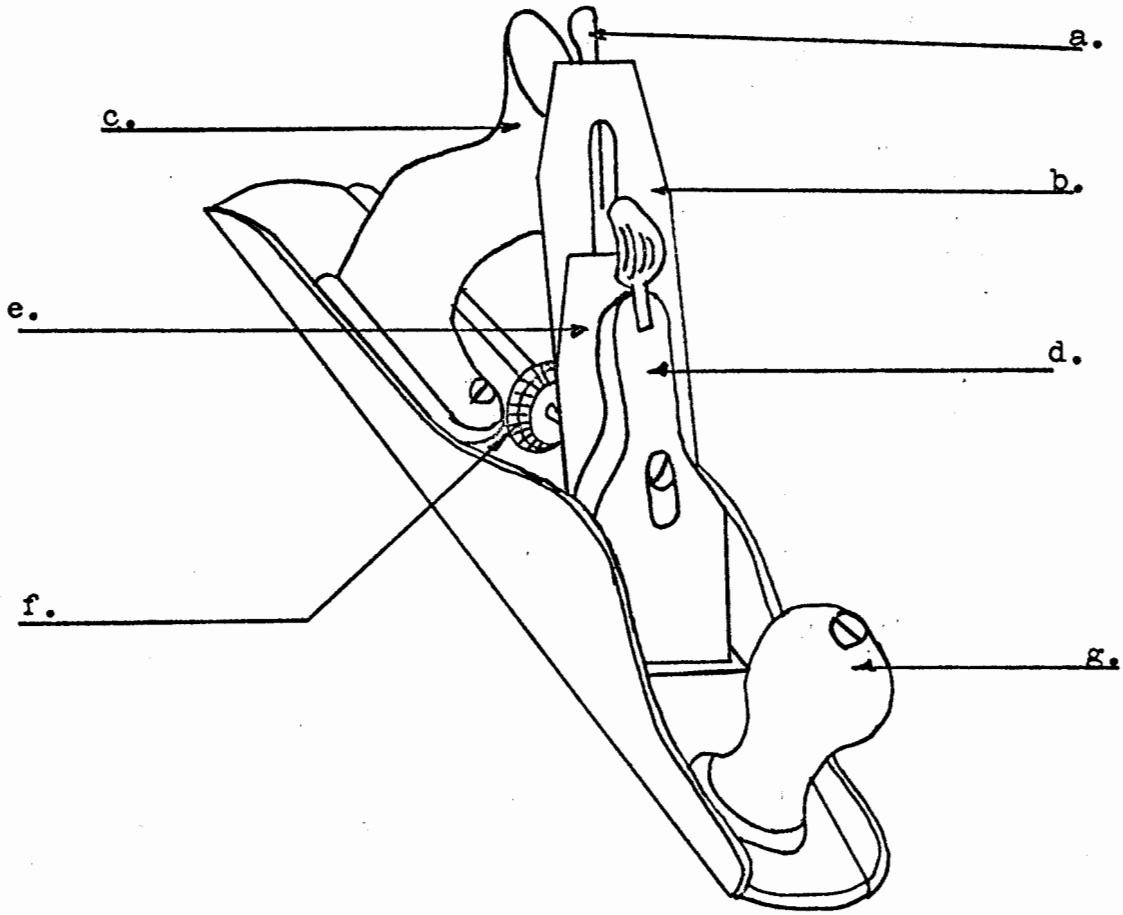

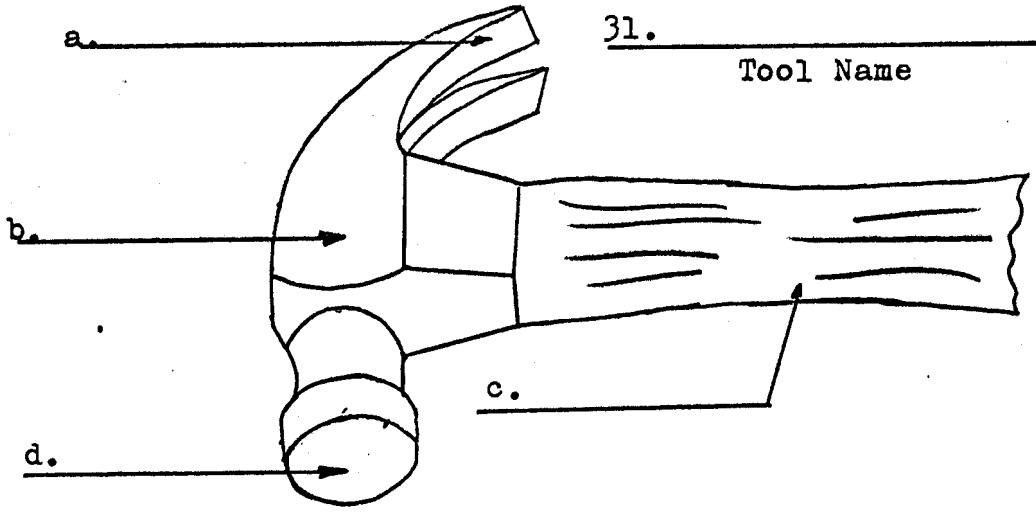

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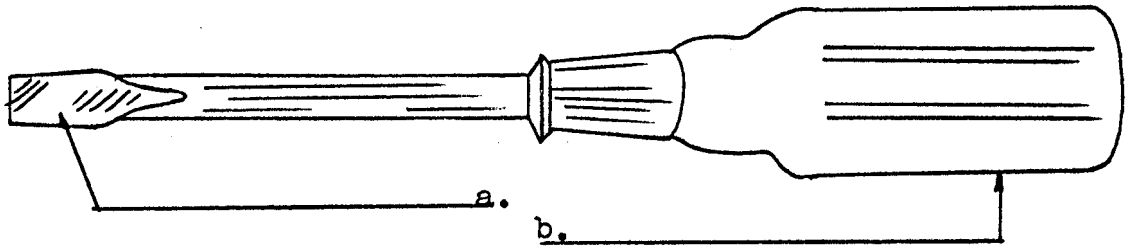

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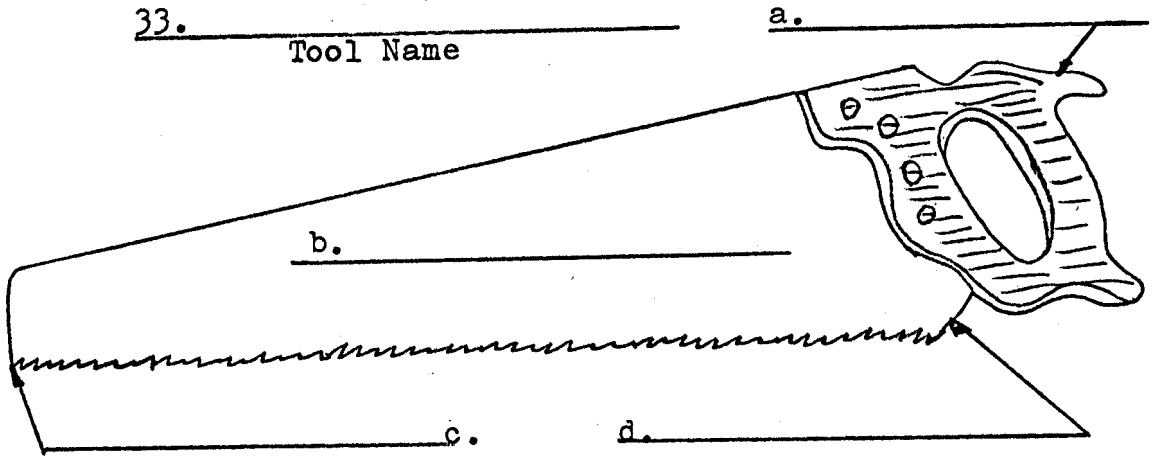

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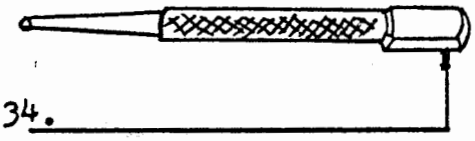

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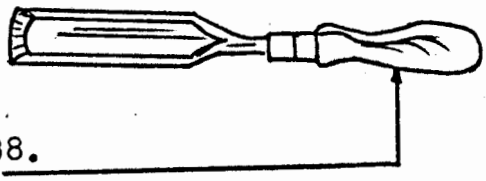

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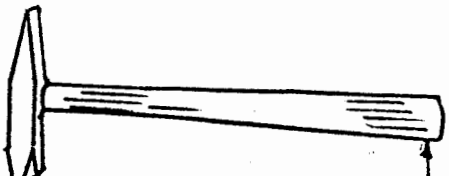

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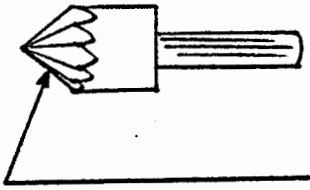

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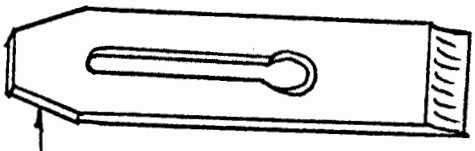

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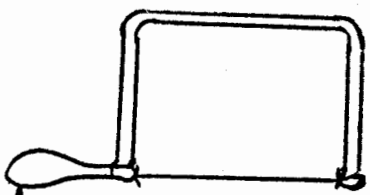

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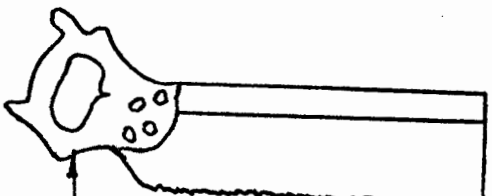

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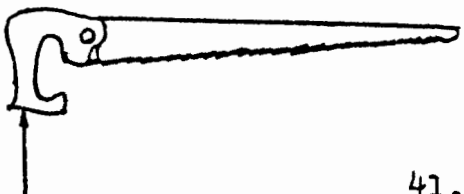

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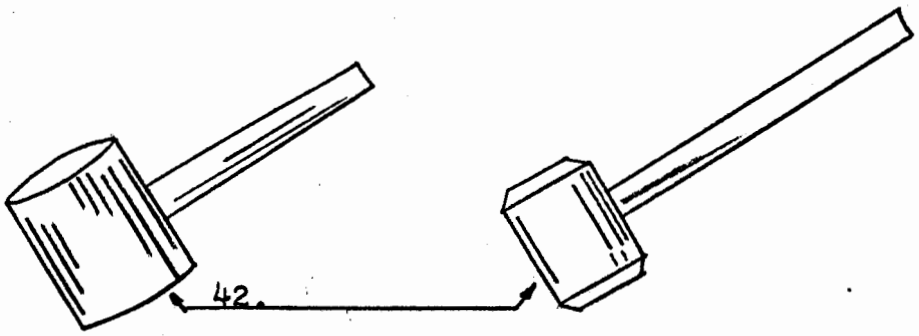
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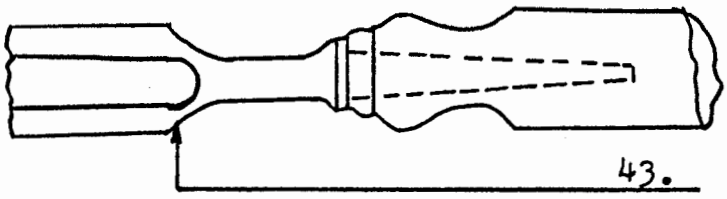
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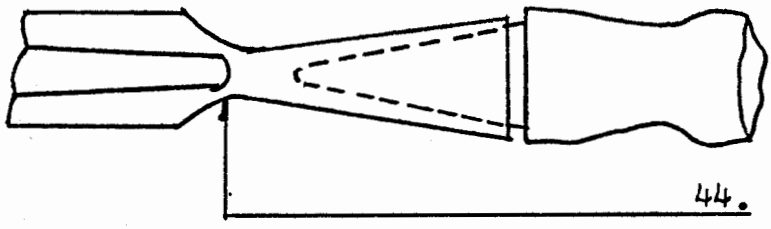
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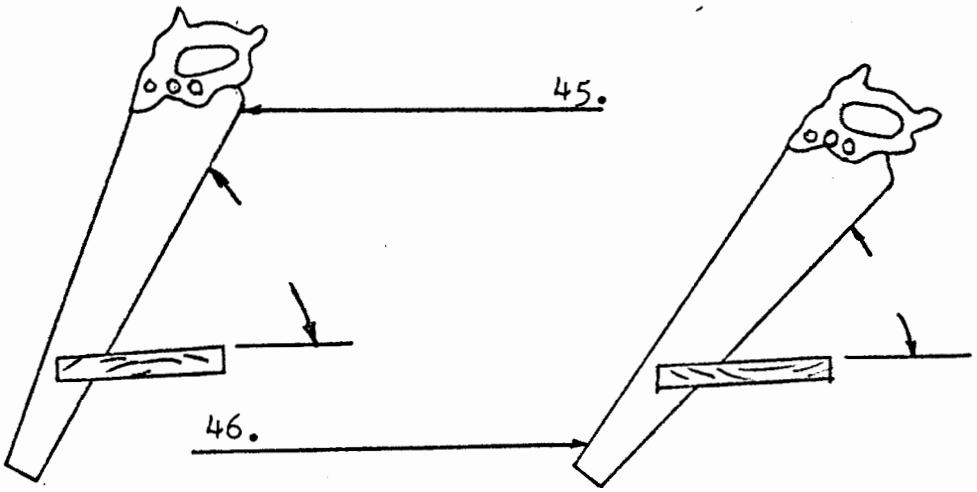
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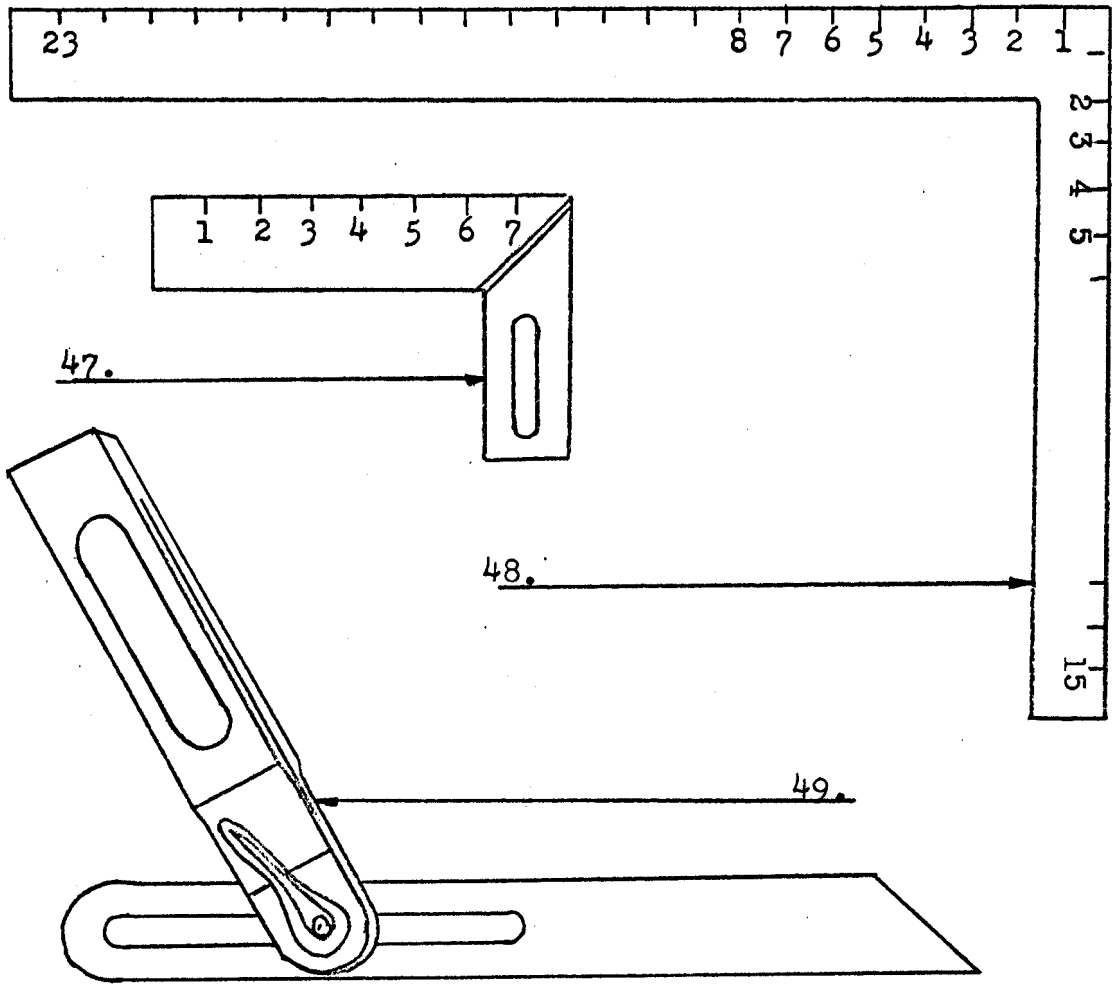
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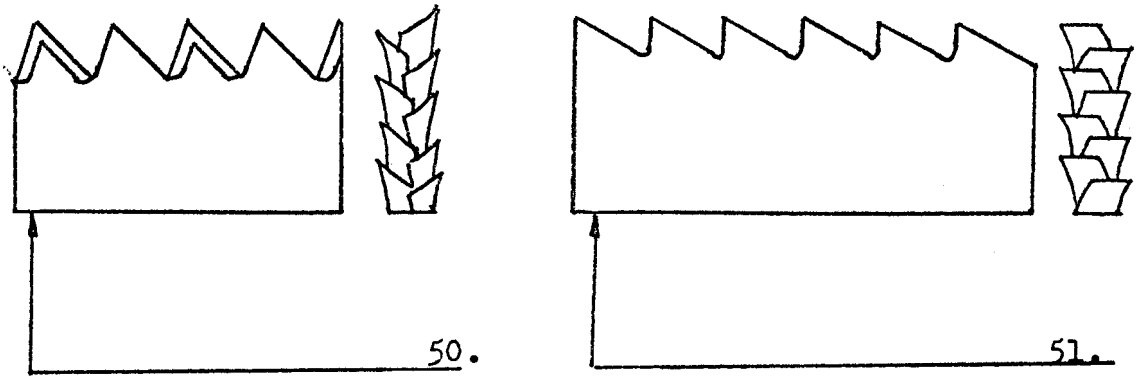
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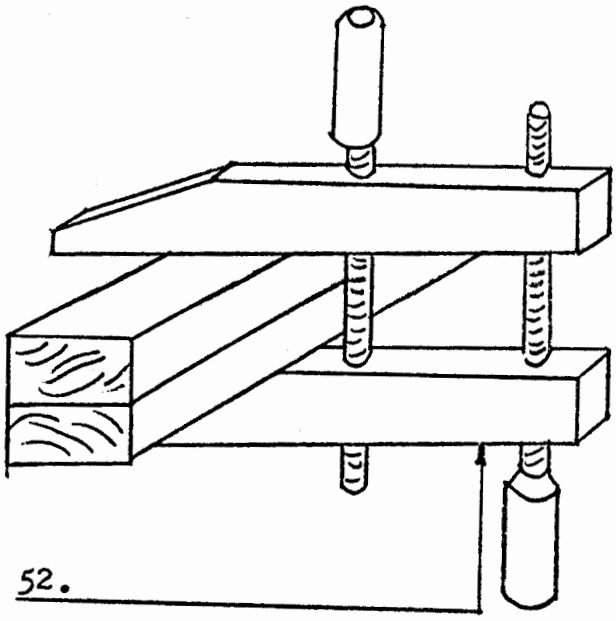

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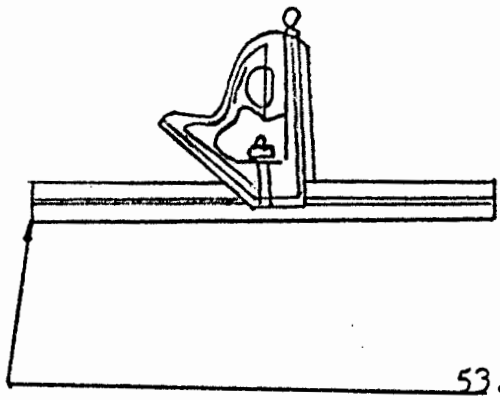

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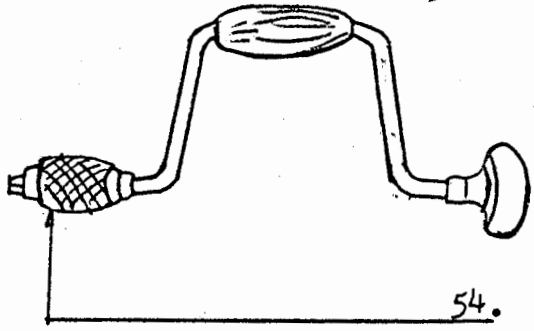

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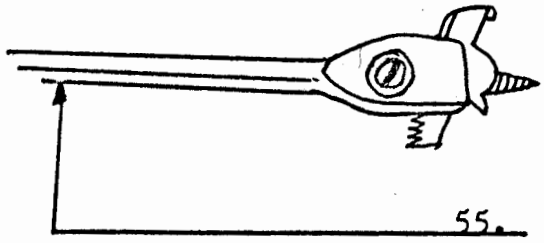

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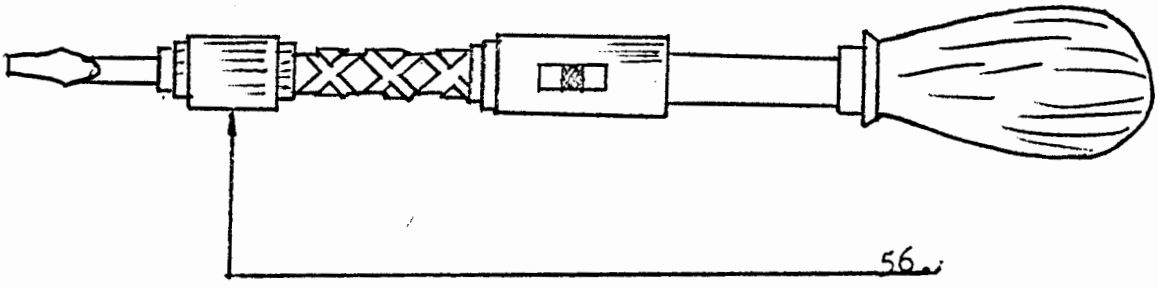

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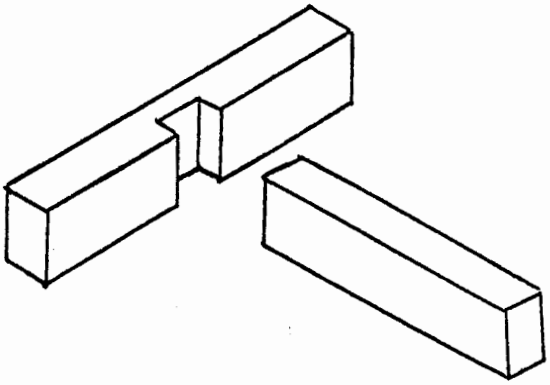

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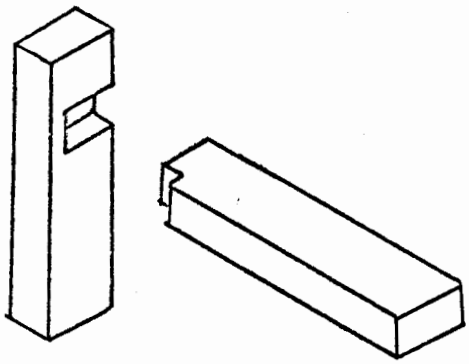

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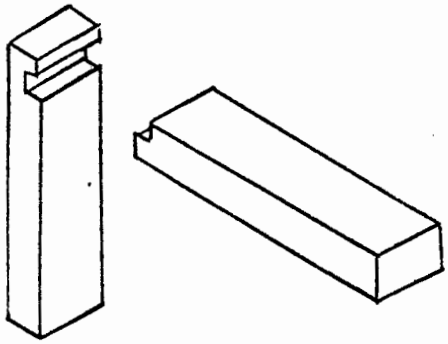

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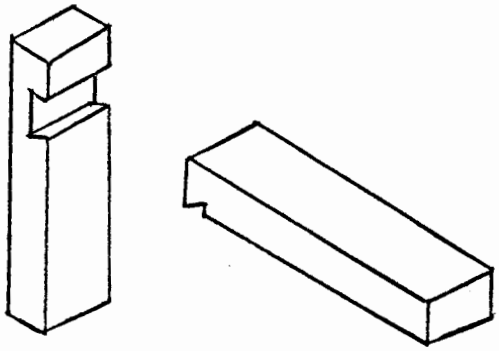

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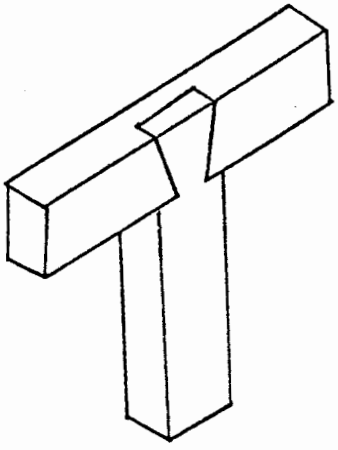

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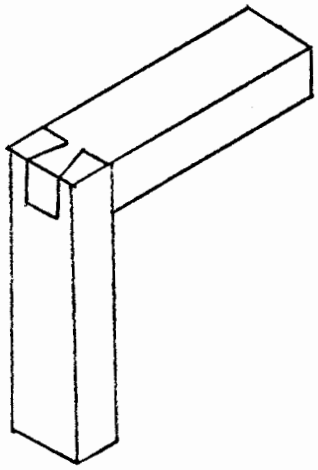

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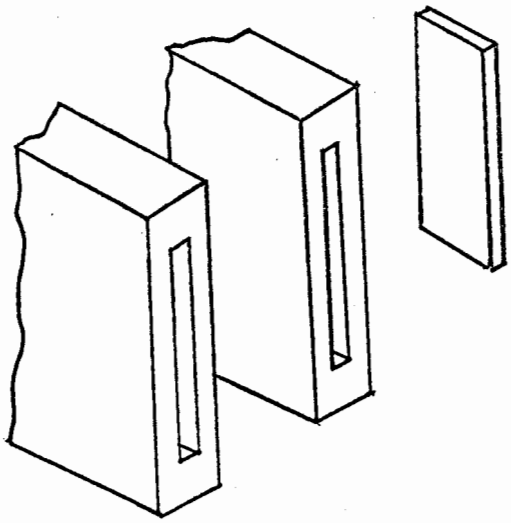

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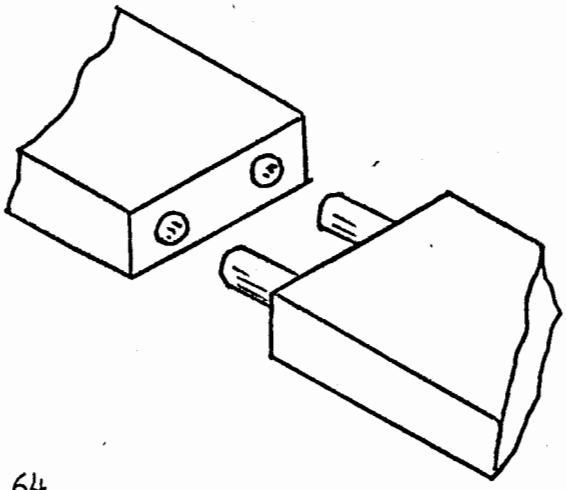

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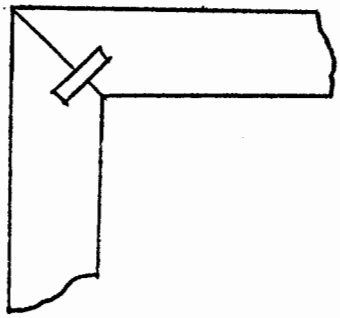
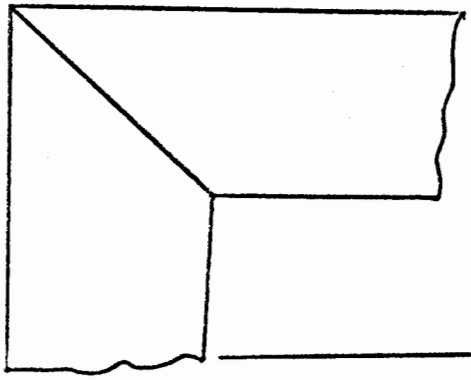
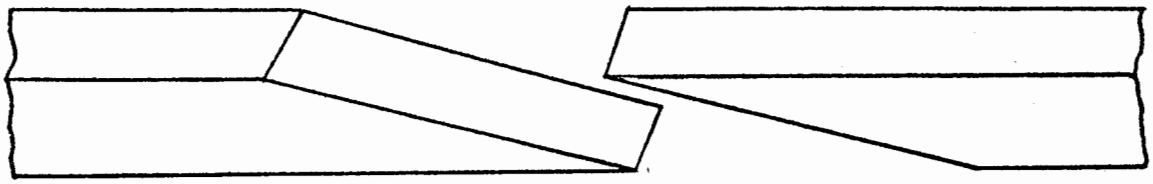


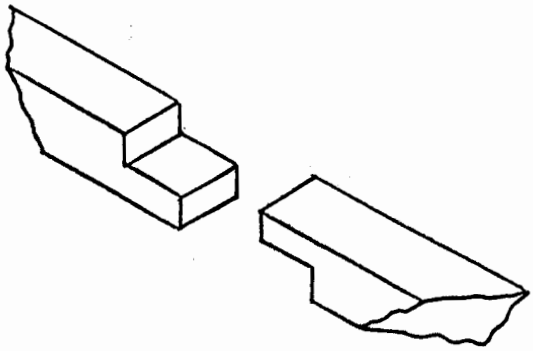
65.



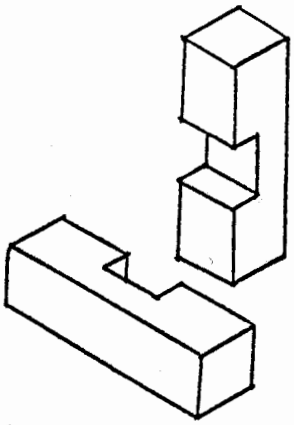
66.



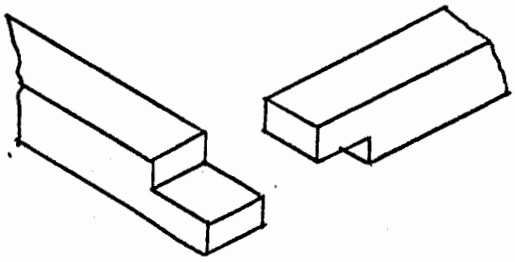
67.



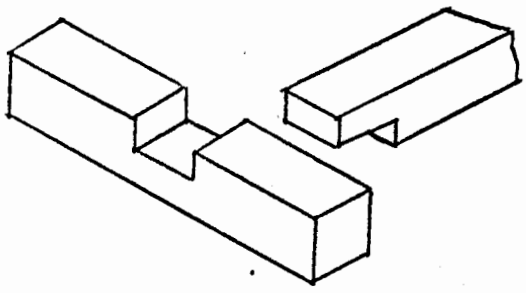
68. _____



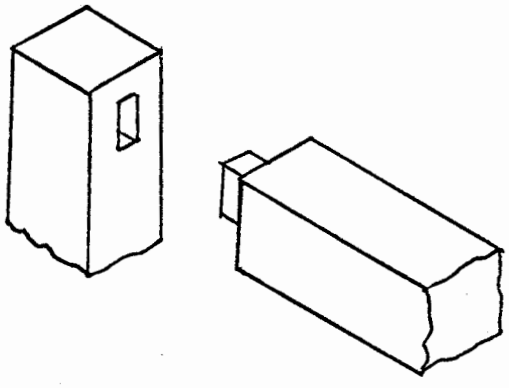
69. _____



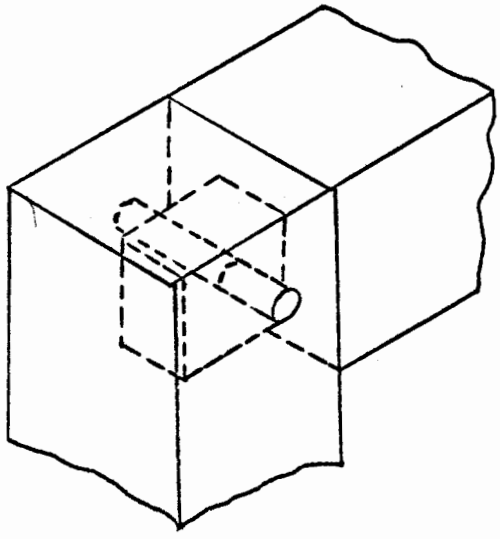
20. _____



21. _____



72. _____



73. _____

ANSWER SHEET

INDUSTRIAL ARTS EXAMINATION I - BASIC WOODWORKING KNOWLEDGE

1. weight
2. 1. straight 2. curved
3. 1. common 2. box 3. finish
4. 1. blade width 2. length
5. 1. flat 2. oval 3. round
6. 1. crosscut 2. rip
7. 1. handle 2. blade 3. toe
   4. heel 5. teeth
8. draw or pull back
9. in waste stock
10. 1. tang 2. socket
11. down
12. up
13. dip in water
14. 1. outside grind 2. inside grind
15. 1. depth 2. lateral
16. reduce vibration
17. 25° to 30°
18. keep clean - keep from plugging
19. 1. retracted 2. plane on side
20. edge
21. 1. try miter 2. combination 3. framing square
    steel square
22. 1. pencil 2. knife 3. scriber

23. fractions

24. flat

25. yes

26. 1. soft 2. hard

27. 1. air dried 2. kiln dried

28. 1. board foot 2. lineal foot

29. Wood chisel
    a. bevel
    b. blade
    c. handle

30. Hand plane
    a. lateral adjusting lever
    b. plane blade
    c. handle
    d. lever cap
    e. plane iron cap
    f. adjusting screw
    g. knob

31. Claw hammer
    a. claw
    b. head
    c. handle
    d. face

32. Screw driver
    a. blade
    b. handle

33. Hand saw
    a. handle
    b. blade
    c. toe
    d. heel

34. Nail set

35. Tack hammer

36. Plane blade

37. Back saw

38. Gouge

39. Countersink

40. Coping saw

41. Compass saw
42. Mallet
43. Tang chisel
44. Socket chisel
45. Rip saw
46. Crosscut saw
47. Try miter square
48. Steel Framing square
49. T-bevel
50. Crosscut saw
51. Rip saw
52. Hand screw clamp
53. Combination square
54. Brace
55. Expansive bit
56. Spiral screw driver
57. Dado housed
58. Gain or stop dado
59. Stopped housed or dado and rabbet
60. Dovetail dado
61. Half lap dovetail
62. Through single dovetail
63. Spline
64. Dowel

65. Spline miter
66. Miter
67. Scarf
68. Half lap
69. Cross lap
70. End lap
71. Middle lap
72. Mortise and tenon
73. Mortise and tenon with dowel

APPENDIX B

INDUSTRIAL ARTS EXAMINATION II - POWER TOOLS AND POWER TOOL OPERATIONS

Procedure All power tools were numbered. The students were asked to write the name of each tool and as many of its basic operations as he could remember on the answer sheet beside the corresponding number. There were no set number of basic operations required.

Examination II

Part I (power tools covered)	Part II (power tool operations) -some desired answers
1. Circular table saw	a. ripping b. crosscutting c. miter d. dado e. rabbet f. paralleling
2. Jointer	a. edging b. surfacing c. rabbeting d. beveling
3. Jig saw	a. circular cutting b. radius work c. scroll work
4. Band saw	a. cut off work b. ripping c. bevel work d. trimming e. miter work f. edge cross lap joint
5. Drill press	a. boring b. drilling c. sanding d. circle cutting

Examination II (Continued)

Part I	Part II
6. Router	a. beveling b. edging c. dadoing d. trim work e. hole cutting f. name writing g. formica work h. radius work
7. Oscillating sander	a. general sanding b. buffing c. polishing
8. Belt sander	a. general sanding b. grooving c. shaping
9. Wood turning lathe	a. general turning b. sanding c. boring
10. Hand drill electric	a. boring b. drilling c. sanding d. buffing e. polishing f. circular cutting

APPENDIX C

TABLE V

EXAMINATION II - POWER TOOLS AND POWER TOOL OPERATION
TABULATION SHEET, METHOD A PRE-TEST

Student	Circular table saw	Operations	Jointer	Operations	Jig saw	Operations	Band Saw	Operations	Drill Press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood turning lathe	Operations	Hand drill-Electric	Operations	Tools Known - Operations Known
1.	x	2	x	1	x	1	x	2	x	2	x	1	x	1	x	1	x	1	x	2	10 - 12
2.	x	1					x	1	x	1					x	1	x	1	x	1	6 - 6
3.							x	1	x	1					x	1			x	1	4 - 4
4.	x	3	x	1	x	1	x	1	x	2	x	1	x	1	x	1	x	1	x	1	10 - 13
5.	x	2	x	1	x	1	x	1	x	1			x	1	x	1	x	1	x	1	9 - 10
6.	x	2	x	1	x	1	x	1	x	2	x	1	x	1	x	1	x	1	x	1	10 - 12
7.	x	1			x	1	x	1	x	1	x		x	1	x	1	x	1	x	1	9 - 8
8.	x	1					x	1	x	1					x	1			x	1	5 - 5
9.	x	3	x	1	x	1	x	1	x	5	x	1	x	1	x	1	x	1	x	4	10 - 19
10.	x	1					x	1	x	3					x	1	x	1	x	2	6 - 9

TABLE V (continued)

21 - 158 = 7.52 Tools known

21 - 189 = 9.00 Operations known

Student	Circular table saw	Operations	Jointer	Operations	Jig saw	Operations	Band Saw	Operations	Drill Press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood turning lathe	Operations	Hand drill-Electric	Operations	Tools Known	Operations Known
11.	x						x	1	x	2			x	1	x	1	x	1	x	2	7	8
12.							x	1	x	1					x	1			x	1	4	4
13.	x	1					x	1	x	1			x	1	x	1	x	1	x	1	7	7
14.	x	4	x	2	x	2	x	2	x	2	x	1	x	1	x	1	x	1	x	2	10	18
15.	x	2	x	1	x	1	x	1	x	2	x	1	x	1	x	1	x	1	x	2	10	13
16.	x	1					x	1	x	1									x	1	4	4
17.							x	2	x	1					x	1			x	1	4	5
18.	x	2	x	1	x	1	x	1	x	1			x	1	x	1	x	1	x	2	9	11
19.	x	1	x	1	x	1	x	1	x	1	x		x	1	x	1	x	1	x	1	10	9
20.							x	1	x	1					x	1	x	1	x	1	5	5
21.	x	3	x	1	x	1	x	1	x	2			x	1	x	1	x	1	x	2	9	13
TOTALS:	17	30	10	11	11	12	21	24	21	34	8	6	13	13	20	20	16	16	21	23	158	189

TABLE VI

EXAMINATION II - POWER TOOLS AND POWER TOOL OPERATION
TABULATION SHEET, METHOD A FINAL TEST

Student	Circular table saw	Operations	Jointer	Operations	Jig saw	Operations	Band saw	Operations	Drill press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood turning lathe	Operations	Hand drill-Electric	Operations	Tools Known	Operations Known
1.	x	4	x	2	x	2	x	4	x	4	x	3	x	2	x	2	x	2	x	4	10	29
2.	x	4	x	1	x	2	x	4	x	3			x	1	x	1	x	3	x	4	9	23
3.	x	3	x	1	x	1	x	3	x	2	x	1	x	1	x	1	x	2	x	4	10	19
4.	x	4	x	3	x	2	x	3	x	3	x	2	x	1	x	1	x	2	x	3	10	24
5.	x	4	x	3	x	2	x	2	x	3	x	2	x	1	x	2	x	2	x	4	10	25
6.	x	5	x	2	x	2	x	3	x	4	x	1	x	1	x	1	x	2	x	4	10	25
7.	x	3	x	2	x	2	x	3	x	4	x	2	x	1	x	2	x	1	x	5	10	25
8.	x	3	x	2	x	3	x	2	x	3	x	1	x	2	x	2	x	2	x	4	10	24
9.	x	6	x	4	x	5	x	3	x	6	x	4	x	3	x	2	x	4	x	6	10	43
10.	x	3	x	2	x	3	x	2	x	4	x	1	x	2	x	1	x	3	x	4	10	25

TABLE VI (continued)

21 - 209 = 9.95 Tools known

21 - 565 = 26.90 Operations Known

Student	Circular table saw	Operations	Jointer	Operations	Jig saw	Operations	Band Saw	Operations	Drill Press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood turning lathe	Operations	Hand drill-Electric	Operations	Tools Known	Operations Known
11.	x	3	x	2	x	2	x	2	x	4	x	2	x	3	x	1	x	3	x	5	10 - 27	
12.	x	3	x	3	x	1	x	2	x	2	x	1	x	1	x	1	x	2	x	3	10 - 19	
13.	x	5	x	4	x	2	x	2	x	3	x	3	x	2	x	2	x	4	x	5	10 - 32	
14.	x	8	x	5	x	3	x	4	x	7	x	5	x	3	x	2	x	5	x	6	10 - 48	
15.	x	4	x	3	x	3	x	2	x	3	x	3	x	1	x	1	x	3	x	5	10 - 28	
16.	x	3	x	3	x	2	x	2	x	3	x	2	x	1	x	1	x	2	x	4	10 - 23	
17.	x	3	x	2	x	2	x	2	x	4	x	2	x	1	x	1	x	2	x	5	10 - 24	
18.	x	3	x	2	x	3	x	2	x	3	x	2	x	1	x	1	x	2	x	4	10 - 23	
19.	x	5	x	3	x	4	x	3	x	3	x	2	x	2	x	1	x	4	x	5	10 - 32	
20.	x	3	x	2	x	1	x	2	x	3	x	1	x	1	x	1	x	2	x	5	10 - 21	
21.	x	5	x	2	x	3	x	2	x	2	x	2	x	1	x	1	x	3	x	5	10 - 24	
TOTALS:	21	84	21	53	21	50	21	54	21	73	20	42	21	32	21	28	21	55	21	94	209	565

TABLE VII

EXAMINATION II - POWER TOOLS AND POWER TOOL OPERATION
TABULATION SHEET, METHOD B PRE-TEST

Student	Circular Table saw	Operations	Jointer	Operations	Jig Saw	Operations	Band Saw	Operations	Drill Press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood turning lathe	Operations	Hand drill- Electric	Operations	Tools Known - Operations Known
1.	x	2	x				x	1	x	1			x	1	x	1			x	1	7 - 7
2.	x	3	x	1	x	1	x	1	x	1			x	1	x	1	x	1	x	1	9 - 11
3.	x	2	x	1			x	1	x	1					x	1	x	1	x	1	7 - 8
4.	x	1					x	1	x	1					x	1			x	1	5 - 5
5.	x	2			x	1	x	1	x	1			x	1	x	1	x	1	x	1	8 - 9
6.	x	4	x	1	x	1	x	2	x	1	x	1	x	1	x	1	x	1	x	1	10 - 14
7.	x	1					x	1	x	1					x	1			x	1	5 - 5
8.	x	3	x	1	x	1	x	2	x	1			x	1	x	1	x	1	x	2	9 - 13
9.	x	1					x	1							x	1			x	1	4 - 4
10.	x	3	x	1	x	1	x	1	x	1			x	1	x	1	x	1	x	1	9 - 11
11.	x	2	x		x	1	x	2	x	1			x	1	x	1			x	1	7 - 9
12.	x	4	x	2	x	2	x	2	x	1	x	1	x	1	x	1	x	1	x	2	10 - 17
13.							x	1											x	1	2 - 22

TABLE VII (continued)

22 - 167 = 7.59 Tools known

22 - 220 = 10.00 Operations known

Student	Circular table saw	Operations	Jointer	Operations	Jig Saw	Operations	Band Saw	Operations	Drill Press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood turning lathe	Operations	Hand drill-Electric	Operations	Tools Known	Operations Known
14.	x	1			x		x	1	x	1					x	1			x	1	6	5
15.	x	5	x	1	x	2	x	1	x	2	x	2	x	1	x	1	x	1	x	1	10	17
16.	x	1	x	1	x	1	x	1	x	1					x	1	x	1	x	1	8	8
17.	x	2	x	1	x	1	x	1	x	1					x	1			x	1	7	8
18.	x	1			x	1	x	1	x						x	1			x	1	6	5
19.	x	2	x				x	1	x	1			x	1	x	1	x	1	x	1	8	8
20.	x	3	x	1	x	1	x	1	x	2	x	1	x	1	x	1	x	1	x	2	10	14
21.	x	4	x	1	x	2	x	2	x	2	x	2	x	1	x	1	x	2	x	2	10	19
22.	x	5	x	1	x	2	x	2	x	3	x	1	x	1	x	1	x	2	x	3	10	21
TOTALS:	21	52	15	13	15	18	22	28	20	24	6	8	13	13	21	21	13	15	21	28	167	220

TABLE VIII

EXAMINATION II - POWER TOOLS AND POWER TOOL OPERATION
TABULATION SHEET, METHOD B FINAL TEST

Student	Circular Table saw	Operations	Jointer	Operations	Jig Saw	Operations	Band Saw	Operations	Drill press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood Turning lathe	Operations	Hand drill-Electric	Operations	Tools Known	Operations Known
1.	x	4	x	3	x	2	x	3	x	4	x	1	x	1	x	1	x	2	x	4	10	25
2.	x	5	x	3	x	2	x	4	x	4	x	3	x	1	x	2	x	2	x	5	10	31
3.	x	3	x	3	x	2	x	4	x	4	x	2	x	1	x	2	x	3	x	4	10	28
4.	x	3	x	2	x	1	x	2	x	3	x		x	1	x	1	x	1	x	3	10	17
5.	x	4	x	3	x	2	x	2	x	5	x	1	x	2	x	2	x	2	x	5	10	28
6.	x	6	x	4	x	3	x	3	x	7	x	3	x	2	x	2	x	4	x	6	10	40
7.	x	3	x	3	x	1	x	2	x	4	x	2	x	2	x	2	x	4	x	5	10	28
8.	x	5	x	4	x	2	x	3	x	5	x	2	x	1	x	1	x	3	x	5	10	31
9.	x	3	x	2	x	2	x	4	x	4	x	1	x	1	x	1	x	2	x	4	10	24
10.	x	5	x	4	x	3	x	4	x	6	x	2	x	1	x	1	x	3	x	6	10	35
11.	x	5	x	3	x	3	x	3	x	4	x	2	x	2	x	2	x	2	x	4	10	30
12.	x	6	x	4	x	3	x	4	x	7	x	4	x	3	x	2	x	4	x	7	10	44
13.	x	4	x	1	x	2	x	1	x	2	x	1	x	2	x	1	x	2	x	3	10	19

TABLE VIII (continued)

22 - 220 = 10.00 Tools known 22 - 717 = 32.59 Operations known

Student	Circular Table saw	Operations	Jointer	Operations	Jig Saw	Operations	Band Saw	Operations	Drill press	Operations	Router	Operations	Oscillating sander	Operations	Belt sander	Operations	Wood Turning lathe	Operations	Hand drill - Electric	Operations	Tools Known	Operations Known
14.	x	4	x	1	x	1	x	1	x	2	x	1	x	1	x	1	x	1	x	2	10	15
15.	x	6	x	4	x	3	x	4	x	6	x	4	x	2	x	2	x	4	x	6	10	41
16.	x	3	x	4	x	3	x	3	x	2	x	2	x	2	x	2	x	2	x	3	10	26
17.	x	4	x	3	x	3	x	3	x	5	x	3	x	1	x	1	x	4	x	4	10	31
18.	x	6	x	4	x	4	x	4	x	8	x	4	x	2	x	2	x	3	x	7	10	44
19.	x	4	x	4	x	3	x	2	x	6	x	3	x	1	x	1	x	4	x	5	10	33
20.	x	5	x	4	x	4	x	4	x	7	x	4	x	3	x	2	x	5	x	7	10	45
21.	x	7	x	5	x	4	x	4	x	9	x	4	x	2	x	2	x	5	x	8	10	50
22.	x	7	x	6	x	4	x	5	x	8	x	5	x	3	x	2	x	4	x	8	10	52
TOTALS:	22	103	22	74	22	57	22	69	22	112	22	54	22	37	22	35	22	66	22	111	220	-717