

AN ABSTRACT OF THE THESIS OF

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Abstract Approved  -----  
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NEED FOR THE STUDY

The need for the study became apparent as a result of experience in teaching and in observing other teachers of woodworking. The need was for a course of study that would be flexible enough to allow for the individual differences, that all educators recognize, and still be definite enough to keep the teacher and student working toward the accomplishment of the defined objectives. Too often the teacher releases all controls and allows the students to follow their interests, regardless of the basic material to be learned. Under this system any common information learned by all the students is very small. Thus little material is learned to prepare for further work in woodworking. The other extreme is for the teacher to set up a rigid non-flexible course with no deviation for any student. All students work on identical exercises or projects regardless of interest or ability. Neither method seems to fill the requirements and both are the cause of much criticism from ex-students.

The need is evident for a course of study that has the advantages of the above methods, without including the disadvantages.

STATEMENT OF THE PROBLEM

The problems in this study are:

1. To determine the methods and material that make good instructional units for woodworking as recommended by educators, and incorporate them into contracts suitable for the ninth grade level.
2. To present the material in such a manner that it will hold the interest of the pupil, to the point where he will be able to work, think and develop according to his ability.

3. To develop examples of models that will encourage construction of worthwhile projects of the student's own choice.
4. To incorporate the necessary related information with the work in such a manner as to arouse interest and provide a suitable background for later work in the field.

#### METHOD OF STUDY

The method used in this study is that of curriculum research. Included in this is the necessary descriptive method of library and documentary research, covering the following steps:

1. Check present offerings
2. Determine aims of course
3. Select course offerings
4. Secure judgment of specialists
5. Organize the course
6. Try out the course experimentally
7. Revise the course

#### SUMMARY AND CONCLUSIONS

The contract plan, to be successful, requires the highest degree of teacher cooperation, in addition to the teachers' firm belief in the method. This plan has not been too successful in the American schools when used by the entire school, but individual teachers have reported unusual success.

The names contract plan, project plan etc. do not have definite meanings in literature, but are used to indicate any system of unit assignment.

Experience of the writer and others, indicates that the contract plan offers a satisfactory solution to the problem of presenting instructional material to the students.

A CONTRACT PLAN FOR WOODWORKING INSTRUCTION AT THE  
NINTH GRADE LEVEL

by

JACK CLIFFORD BOGGESS

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A CONTRACT PLAN FOR WOODWORKING INSTRUCTION  
AT THE NINTH GRADE LEVEL

CHAPTER I

INTRODUCTION

Much work has been done on instruction sheets of various kinds. Bollinger, Selvidge, Fryklund and others have written directions for making and using instruction sheets. These include job sheets, operation sheets, assignment sheets and information sheets.

Little appears, however, to have been done on the written contract. The teacher usually has an understanding with the pupil that he will expect a certain amount of work during the year. This is sometimes rather indefinite to the pupil and may encourage the thought that he can "get by," by pretending to misunderstand.

The "Project Plan" has been the basis of instruction for many years. In the project plan, construction projects are grouped around the common tool processes. The projects may be given to the students as a definite, rigid assignment, or the students may be able to plan their projects as long as they keep within certain tool process limits.

Methods of teaching have been listed as "imitative," "discovery," and "inventive." No one of the three is sufficient in itself. All three must be combined to fulfill

requirements for teaching. Too often the inventive part is not given enough emphasis.

In this method the freedom of selection is given more emphasis. Bennett (2:104-111) discusses the inventive method as follows:

The inventive method begins, not with something planned ready to make and materials all selected, but with a conscious need for something to serve a known purpose and a desire to make something to supply that need. The procedure by this method is: first, to know definitely the conditions to be met by the thing to be made; second, to invent or design the thing to fulfill the conditions; third, to select materials and (fourth) to make the thing designed. From beginning to end the mind is centered on the thing being made and whether it will serve its purpose; the process of producing the thing...is here given secondary consideration. The instruction is largely individual, though the problem may be presented and discussed in class. It consists in supplying ideas from which the pupil may choose; it stimulates original thinking by questioning, by criticism, and by the statement and exposition of laws and principles...The inventive method places the worker in relation to his work that is entirely different from that of the imitative method. It places him in the position of a master, of a person with authority to control. If a student is working from a blueprint or other working-drawing given him by the teacher, he is expected to follow the drawing exactly in material and form and dimensions. On the contrary, if he has designed or invented the piece he is making, he is the guiding force in the work; he can change material or form or dimension. His own ideas are carried out, not those of some other man; except, of course, as he takes advice from the teacher. In this method, then, the teacher is more an inspirer, a counselor, than a boss who makes demands.

The contract plan can cover all of these three methods very well. In the "C" contract the "imitative"

method is stressed as this is the contract for the boy who likes to follow directions or has not developed to the stage where he can do his own planning. The "B" and "A" contract students use the imitative method for basic material, but they are required to use the discovery and inventive method to fulfill the requirements.

In woodworking, as in every subject in the school, each student should know exactly what he is expected to do and know. He should know what he can expect from the course. Selvidge (22:59) says,

One of the most profitable things a teacher can do is to ask himself this question, "What do I expect my pupils to be, to know, and be able to do, at the end of the year, as a result of their experience and my teaching in this subject?" and then answer the question, unbiased by speculative theories or fanciful hopes. It is of no particular value to state these things in terms of "general objectives" or indefinite and high-sounding terms. They should be stated in terms so simple, so definite, and so exact that every pupil may understand them readily. Such a statement supplies definite goals and when the student knows exactly what he is expected to do, he is much more likely to do it than when the requirement is hazy and indefinite.

Industrial arts work has an advantage over most other school subjects, in that the student may have the opportunity to plan his own project. For this reason there has been much to arouse interest, develop initiative and allow for individual differences in the industrial arts courses. Bawden (1:23) writes the following:

Industrial-arts teachers were among the first to make practical application of the discoveries and teachings of the psychologists on the subject of individual differences. "It was really the manual-arts teachers who, some 30 or 40 years ago, discovered the 'individual pupil,' of whom the psychologists have been making so much." Any teacher of shopwork or drafting can furnish an objective demonstration of the fact that one boy can complete in 30 minutes a task for which another boy may require three or four hours. In some school subjects, differences in capacity and attainment among pupils are not plainly discernible, and the quality and extent of these differences are merely matters of conjecture and assumption.

The contract plan was attempted in other subjects, perhaps where it was less suited, but seldom tried in the industrial arts field because the shop teacher had most of the advantages generally attributed to the contract plan.

#### Need for Further Study in this Field

There is a definite need for the "contract" in the shop classes. It would remove any doubt in the boy's mind as to what is offered in the course, and give him a clear idea of what he can expect in return for his time and effort. The use of the "contract" would require little change in the present "project" plan, but would encourage initiative, give a better application of ability, and perhaps increase the interest in the work.

Siepert (1:94) states, "Whenever teachers of industrial arts neglect the use of methods leading toward independence

of the pupil, they fail in realizing the full possibilities of their subject."

A contract furnishes "guide lines" for the work without making the subject matter too difficult for some and too easy for other students. Miller and Hargreaves (18:25-26) have the following to say on individual differences in relation to guide lines of the contract:

We are prepared to say without the slightest dogmatism that pupils working under controlling guide lines do find a way of liberating powers. A firm gripping of principles in work laid out in a challenging manner tends to remove inhibitions. Petty methods and cheap panaceas are eliminated. Provision is made for lucid intervals when the flood gates of the mind are open and astounding results are attained in a brief time. Provision is also made for bad days--times when things don't seem to go at all. Adults who do any creative work or thinking know something about their own variability in performance. Yet the old school goes on insisting upon results by the clock. We know by adequate demonstration that no two pupils indicate the same difficulty or work with the same speed or are ever equal in any attainment. The same individual runs in "high," in "low," in "intermediate," in "reverse"--all in a day's adventure.

There appears to be a tendency for woodworking instructors to be too formal and rigid, or to be too free and liberal with the instruction, to the point that the likes and dislikes of the students dominate the subject matter and no definite goal is reached. Neither is the best teaching procedure. The instructor should give assistance and guidance to the extent that the required objectives are reached and

still give the student a feeling that he is working out his own plans and procedures.

### General Statement of the Problem

The purpose of this study is to determine the methods and material that make good instructional units for woodworking, as recommended by educators, and incorporate them into contracts suitable for the ninth grade level. The material must be presented in such a manner that it will hold the interest of the pupil, to the point where he will be able to work, think and develop according to his ability. Examples of projects must be developed that will encourage worthwhile projects of the students' own choice. The sequence of projects must be such that the students' interest is kept alive during the course.

Relative information must be taught with the units, and encouragement must be given the better students to use initiative in their work.

This course must provide a suitable background for any later work in this field.

### Terminology

Since this study will require the use of terms that may be construed to have different meanings, certain definitions will be appropriate.

Contract - A specified amount of work that the student agrees to perform during a definite work period. The contract is the student's goal for the period. While there is a specific quantity of work in the contract, the project in the contract may vary according to the student. There are three "degrees" of contracts; A, B and C. The contract chosen depends on the experience, ability and interest of the student.

Project - The terms project and job are used interchangeably in the industrial arts field. In this study the project indicated is a piece of work being done. It may be a sandpaper block or library table, but in either case it is a finished piece of work involving several operations.

Operation - Fryklund's (11:40) definition will be used.

"It is a unit of work in a job that involves the making, servicing, or repairing of something."

Job and project are defined by Fryklund as being the same.

Grade Point - A comparative value expressed as a number to indicate the value earned by each student for his shop work, library work and tests.

### Limitations of the Study

The study is limited to the ninth grade level. This is the level at which the students usually have their first choice of electives, and the place where the interest factor, in many cases, decides the amount of further study in the industrial arts field.

The purpose of the limitation is to develop the contracts on a level which seems most suited and to limit the field to the extent that a suitable program can be covered in the time available.

## CHAPTER II

### HISTORICAL BACKGROUND

#### Development of the Contract Idea

Educators throughout the years have recommended, "freedom from formal classes," avoid the "lock-step method," "learn by doing" etc. John Locke (7:25-26) reasoned that as each pupil's body was different, then his mind must also vary. This being the case, each individual must be taught differently depending on his mental make-up. He held that education was not a uniform process but a process that must be applied to each individual in a different manner.

Jean Rouseau (7:48-49) had somewhat the same idea as regards the individual. He says that the "natural" man is one that does not follow in the path set by his associates. The best education then is the one that makes the man an individual, who is ruled by no one but himself. To get this education a man must be allowed liberty that will enable him to develop these individual qualities. He believed that man is basically good and restraint should not be placed on him that "has not the sanction of his personality."

Numerous other educators have had ideas of improving instruction so that the individual would receive more attention. Some have been theories only; others have been tried in the classrooms.

Dr. Montessori, an Italian woman, was one who put her theories into practice. Boyd (7:142) writes, Dr. Montessori's method was to establish all instructional material on a fundamental base--"the liberty of the pupils in their spontaneous manifestations." She first worked with feeble minded children and then applied her method to normal children. Dr. Montessori seemed very successful in her field and stimulated other teachers to follow her ideas or to develop teaching methods of their own after working with her.

Helen Parkhurst, one of her students, developed the "Dalton Plan" at the Dalton School, Dalton, Mass. Here she put into practice a plan using the contract method and little or no formal classes. The students were allowed to work on any subject at any time of the day, as long as their contracts were completed in a definite period. Miss Parkhurst (20:18-19) writes:

But in order that he may accomplish this educative process--in order that he may be led to educate himself--we must give him an opportunity to survey the whole of the task we set. To win the race he must first get a clear view of the goal. A whole twelve month's work should therefore be laid before the pupil at the beginning of the school year. This will give him a perspective of plan of his education. He will thus be able to judge the steps he must take each month and each week so that he may cover the whole road, instead of going blindly forward with no idea either of the road or the goal. How so handicapped can a child be expected to be interested in the race or even to desire to win it? How can a teacher hope to turn out a well-equipped human being unless he takes the trouble to study the psychology of the child? Both for

master and for pupil a perception of their job is essential. Education is, after all, a cooperative task. Their success or failure in it is inter-locked.

Children learn, if we would only believe it, just as men and women learn, by adjusting means to ends. What does a pupil do when given, as he is given by the Dalton Laboratory Plan, responsibility for the performance of such and such work? Instinctively he seeks the best way of achieving it. Then having decided, he proceeds to act upon that decision. Supposing his plan does not seem to fit his purpose, he discards it and tries another. ... This is real experience. It is culture acquired through individual development and through collective co-operation. It is no longer school--it is life.

Parkhurst (20:105) continues:

Under the old system the teacher has become the chief actor in the play. She is, perhaps unconsciously, occupied in trying to impress her personality and her ideas upon the children. But the Dalton Plan reverses these parts and gives the child's personality a chance; the teacher's part being to accompany the unfolding life step by step. This is not to relegate the instructor to an inferior plane. To understand the child and to keep pace with his growth she must grow herself, for the same fundamental laws that govern growth prevail on every successive plane.

In general, the plan does not seem to have been too successful in this country. The failure may have been for many reasons. Some educators were in favor of the plan, however, and in different schools throughout the country adaptations of this plan have been used with varying degrees of success. Miller (17:28-31), of the University of Wisconsin, speaks very favorably of his contract plan in the following paragraphs:

In the "set-up" (through the guide lines) of the Contract Idea in its first intention, the lesson stereotype, the recitation method, the examination habit are all challenged. Pupils are not assigned "lessons" in the usual manner. Recitations are not conducted in the customary ways. Examinations will come to have a totally different purpose from that of determining what marks shall be recorded. The procedure is definitely opposed to the methods of the lesson-hearing school.

If not a lesson every day and the familiar motions connected therewith, what is to be done? A unit of learning is to be substituted. It ought to be, in so far as possible, a comprehensive and creative unit in which a genuine and fruitful recognition of individual differences may be realized. This new unit should not be handed down by methods of indoctrination. It should never be regarded as a finished product to be delivered to the minds of students. If we are to think of the Contract Plan as an extended assignment, or a glorified "lesson," or a body of organized subject-matter to be transferred from book, lecture, or laboratory to the receptive minds of students, it were better never to try it. ....

The time element is an important consideration. How many days should be allocated to a contract? Make the time factor flexible. It is conceivable that a genuine short unit might require only a day. A week, more or less, might be regarded as a safe beginning in projecting a contract.

... One advantage of the Contract Plan is the opportunity it offers to delete lock-step methods and any objectionable forms of regimentation. There will be no need of apprehension where there is freedom in work. ... It will be highly important to look ahead and develop a sense of direction and proportion along with a sense of values. Only however, by regarding all systems of advice, all manuals of instruction as a compass, will it ever be possible to catch the spirit of the Contract Plan. Each teacher and class will make their charts. Methods will be imminent, self-originating, constant, and pragmatic.

Teacher and pupils by participation contribute the social forces of control, direction, and associated management. ... Individuality has a chance to operate in the plan proposed.

One of the outstanding schools to sponsor Miller's Contract Plan is at Scarsdale, New York. The Summit, New Jersey, Junior High School and many other schools tried plans similar to this.

Another plan, the Morrison Plan, has enjoyed a wave of popularity. According to a survey (4:228-237) of 8594 schools, conducted by Dr. Koos of the University of Chicago, and reported by Billett, almost 9% were using the Morrison Plan. This is a large percentage as compared to 2% that reported using the Dalton Plan and only 1% using the Winnetka Plan.

Wrightstone (28:9-10) characterized the Morrison Plan as having five steps of procedure:

1. The exploratory step is used to discover by quiz, test, discussion, and the like, the apperceptive background and mastery which pupils already have for a unit of work.
2. The second step, or presentation, occurs when the teacher presents a sketch of the whole unit of work as an overview for the pupils.
3. The third step, or assimilation, provides for pupil activity, investigation, and research until the pupil has passed the mastery test on the unit.
4. The fourth step, or organization, follows when the teacher is convinced that assimilation has been mastered by all the pupils. The class in the organization stage gathers up the argument of the unit in outline form,

and this outline is a coherent and logical argument, not merely an exhibit of facts.

5. The fifth, or recitation, is to allow a series of floor talks in which pupils who have mastered the unit, present it, the teacher and class sitting as an audience.

In the survey mentioned above of the 8594 schools, only one-fourth of the 737 schools reported using the Morrison Plan had unusual success; of those using the Dalton Plan only fifteen out of 160 schools had unusual success and of the Winnetka Plan fourteen out of 119 schools reported unusual success.

According to this same survey, Billett (4:228-237), during the period of 1916 to 1918 the terms used in writing and speaking of unit instruction were "project teaching," and "project problem." These terms, at that time were generally connected with agriculture, home economics, manual training, industrial arts, science, elementary education and teacher training.

In the period from 1919 to 1921 the terms "project teaching," "problem project" and "problem" begin to be applied to the academic field. The terms "Dalton Plan," "job," "contract unit," "Winnetka technique" and "goal" came into use.

During the period of 1922-1924, "project teaching," "problem method," "projects and problems" and "project problems" began to be applied to the following fields: the

home, elementary education, geography, agriculture and art, science, civics, English, printing, social studies, aesthetic appreciation and missionary education.

From 1925-27 the term "project teaching" was on the decrease and the terms more generally used were "individual," "individual instruction" and "Dalton Plan."

The period 1928 to 1930 the terms "Dalton Plan," "individual" and "individual instruction" were on the decrease, and the terms "contract," "laboratory" and "unit" were replaced, as terms, by plans called the "contract plan," "unit plan" and "laboratory plan."

Later other terms came into use such as "integrated units," "integrated activity," "integrated activity unit" and "core curriculum."

Although terms are used as if they have a definite meaning, they are actually used to describe any system according to the whims of the creator. Billett (3:656) sums up the situation as follows:

Hence if a person sought to establish the fact that there is no such thing as an orthodox project method, problem method, differentiated assignment, long unit assignment, contract plan, laboratory plan, or method of individualized instruction, he need go no farther than the literature in the field, where the evidence is written in letters so high that he who runs may read.

Work that has been done on the Contract Plan in Industrial Arts

The written contract has never been generally accepted for the industrial arts classes. This may have been because the project method was satisfactory; the contract required more preparation, or the value of the contract was not evident.

Manzer (13:20; 14:55), of the University of Wisconsin, wrote several articles on the "contract plan" for metal work and has some very favorable arguments for the advantages of the plan. A few theses and articles have been written on the contract plan for industrial arts, but there appears to have been little or nothing written on the subject of wood-working.

## CHAPTER III

### DEVELOPING THE PROBLEM

There are many ways of developing a course of study, regardless of the method to be used in teaching. The most common one is to start with an analysis of the occupational field or trade. Considering the amount of work done by educators in curriculum development it seems wise to apply this knowledge for our benefit, instead of attempting to go back and start at the beginning.

#### Factors in Developing the Contract

Fryklund (11:140) lists six definite steps in a course of study. They are:

1. a clear statement covering the grade level or placement of the students and their types and ages, the time, equipment, materials available, and any other information of value in orienting the problem
2. a set of aims for the course
3. the content of the course, consisting of a list of instructional units and suggested typical jobs selected from the analysis of the trade
4. suggested teaching and management procedures
5. suggested testing or evaluating procedures
6. miscellaneous suggestions and directions, such as text and reference materials, requisition procedures, safety regulations of the school, information covering supplementary services such as clubs in which the students may take part, drawings of projects, sample instruction sheets, a glossary, and any other materials

supplementary to carrying out successfully the duties involved in teaching a given subject. These miscellaneous materials should be placed in the final section, called the appendix.

The same six steps may well be followed in making a course of study for the contract plan.

Selvidge (22:79-80) offers the following information pertaining to the selection of subject matter:

The solution of the problem lies in a wise combination of extremes. The list of things to be taught or learned must have a prominent place as the specific objectives of the course and the progress of the pupils should be checked against this list. The teacher must realize that it is his job to teach these things. This does not mean that these things are to be taught as independent or isolated things but as a part of some worthy undertaking. To be effective, however, the teacher must recognize these things as parts of the job and put forth a conscientious and determined effort to teach them. In this way the pupil not only is taught the skills and methods of construction, but he sees them in their practical application.

Some teachers have encountered difficulties in working out a satisfactory plan for carrying on the work in this manner. The following plan is simple, effective, and has the advantage of being flexible. After the teacher has arranged his list, he should select the projects that have the following characteristics:

1. Simple enough to be within the capacity of the boy
2. Handled readily under classroom conditions
3. Completed in a short period of time
4. Has a real use in the estimation of the boy.

The order of difficulty of an operation does not mean so much in the order of teaching. According to Fryklund (11:126), it is not necessarily the easy operations that should be taught first in a course. An operation that is easy for one person may be very difficult for another because of the difference in human characteristics. The difficulty of the operation may be dismissed as a factor in the order of teaching. The more important factor is frequency of the use of the operations. This will apply regardless of whether the subject is arithmetic or industrial arts shop work.

Experience has proven that the best way to discourage a boy is to present him with too difficult a problem at the beginning. It has been general practice in woodworking courses, in the secondary school, to start a boy by planing a square board. In many cases he works half the term on this exercise or project, has nothing to show for his work, and try as he may he cannot seem to succeed in squaring the board. It is advisable to start him off with finished planing and fastening with nails and screws. If the lumber is cut to size and only needs smoothing and nailing, the boy finishes his project quickly, sees he is making progress, and has a big boost in morale.

In 1940 the author made the following experiment with two classes of ninth grade woodworking. Each class had

twenty-two pupils at the beginning. The I.Q.'s, ages and school progress were generally the same in both groups. The groups were not selected, but taken as they registered for the elective course.

In group I the students were given the regular course. They did all of their work with hand tools from the beginning, even to cutting the stock from large pieces.

Group II were given assistance on their first two projects by having the lumber cut to size beforehand. The students' work consisted of surfacing, assembling and finishing. The second project consisted of the same method with chisel work and spoke-shave work added. On the third and fourth projects the group did all work by hand.

At the end of the year both groups had attempted the same operations, applied to similar projects. The results follow:

	Group I (All hand- work, no aid given by machines)	Group II (Aid given on first two projects by cutting stock)
Number students dropped before end of year	6	2
Number students failed to pass at end of year	2	0
Average grade Based on 100 points	70	80
Average projects com- pleted	3	4

This experiment, limited as it was, seems to indicate that factors other than difficulty of operations influence success of learning.

Group II was successful in turning out a project early in the year thus developing interest in the work. The reverse seemed true of Group I. Many became discouraged when the time taken to learn all the operations held up production. As little progress was seen in the way of completed work, the students lost interest and gained no initiative.

This experiment has influenced the selection and sequence of material in the contracts.

#### Analysis of Courses of Study

Rather than analyze the trade and develop a course of study, advantage was taken of material already written by authors who have analyzed the woodworking trade and determined by experience the material to be taught.

Four courses of study are listed on the following pages showing the material included. These seem to give a fairly good representation of the field. Number 1 (Column 1, Table I) was developed by a large school system to improve instruction in its own schools. Number 2 (Column 2, Table I) represents the result of the wide experience of R. W. Selvidge (22:79-80), a long-time leader in industrial arts teacher education. Number 3 (Column 3, Table I) was the result of an

analysis of the wood-working trade applied to a course. Number 4 (Column 4, Table I) is from a state course of study developed by leading industrial arts educators in the state of Oregon. The basic items listed in Table I are those recommended by a committee on "Standards of Attainment in Industrial Arts." It was the aim of this committee to list all of the items which should be taught in woodworking, without limitations as to time for teaching.

None of these four listings attempted to set up definite, rigid courses of study. They were given as suggestions to follow according to the time, equipment and materials available. The items in each case, formed the basis of an outline covering the first year's woodworking course of study.

Permanized

INTERNATIONAL BOND

TABLE I

STANDARDS OF ATTAINMENT IN INDUSTRIAL ARTS (21:35-39)	COURSES OF STUDY				Number of times item appears 5
	*1	*2	*3	*4	
I. THE THINGS YOU SHOULD BE ABLE TO DO					
Group I					
Read a working-drawing	x	x	x	x	4
Make out a bill of ma- terial.	x	x	x		3
Plan the procedure in doing your jobs	x	x	x	x	4
Check material when received	x	x	x		3
Measure and divide spaces with a rule	x	x	x	x	4
Lay out pattern on stock	x	x	x	x	4
Check the layout	x	x	x		3
Lay out curves with di- viders or compass	x	x	x	x	4
Divide spaces with di- viders	x				1
Gage with a pencil	x	x	x		3

- \*1 Hubbard, O. S. Course of Study in Ind. Arts for the Sec. Schools, Fresno, Calif., Committee on Ind. Arts, 1936.
- \*2 Selvidge, R. W. The Teacher's Plan, Industrial Arts Mag., Vol. 16, p. 79, March, 1927.
- \*3 Shipp, V. E. Graphic Analysis of General Woodworking for a School Shop, Unpublished Thesis O.S.C., 1933
- \*4 State Course of Study, Ind. Arts for Oregon Secondary Schools, 1937.

	1	2	3	4	5
Gage with a marking-gage	x	x	x	x	4
Test for squareness with the try square	x	x	x	x	4
Lay out square cuts with the try square	x	x	x	x	4
Adjust a jack-plane or a smooth plane	x	x	x	x	4
Plane a surface true	x	x	x	x	4
Plane an edge square with an adjoining surface	x	x	x	x	4
Plane end-grain	x	x	x	x	4
Proceed properly in squaring up a board	x	x	x	x	4
Saw to a line with cross-cut or rip-saw	x	x	x	x	4
Use a back-saw	x		x	x	3
Saw inside or outside curves with coping saw	x		x	x	3
Round edges	x		x	x	3
Finish outside curves	x		x	x	3
Finish inside curves	x		x	x	3
Drill holes in wood	x	x	x	x	4
Countersink holes	x	x	x	x	4
Bore holes with an auger-bit	x	x	x	x	4
Fasten with screws	x	x	x	x	4
Use brad-awl for making holes for screws or nails		x	x		2

	1	2	3	4	5
Trim or pare with a chisel	x		x	x	3
Smooth a surface with sandpaper	x	x	x	x	4
Drive and draw nails		x	x	x	3
Shape ends, edges, and curves with wood rasp	x		x	x	3
Set a nail or brad			x	x	2
Lay out and test bevel cuts with the sliding T-bevel	x	x	x	x	4
Round or form work with a spokeshave	x	x	x	x	4
Lay out and cut a chamfer		x	x	x	3
Lay out an octagon			x		1
Use handscrews and clamps	x	x	x	x	4
Apply stain		x	x		2
Clean and care for stain brushes			x		1
Apply stain for two-tone effect					0
Apply fillers		x	x	x	3
Apply shellac		x	x	x	3
Clean and care for shellac-brushes			x	x	2
Transfer a design		x	x	x	3
Lay out irregular design by means of squares				x	1
Make a butt-joint	x		x	x	3

	1	2	3	4	5
Sharpen edge tools, such as a knife, chisel, and plane	x	x	x	x	4
Keep tools free from rust					0
GROUP II					
Adjust a block-plane	x		x	x	3
Cut curves with a compass-saw	x		x	x	3
Use a gouge for gouge work			x	x	2
Smooth a surface with a scraper	x	x	x	x	4
Lay out a hexagon					0
Prepare glue	x	x	x	x	4
Glue up work	x	x	x	x	4
Give a fumed-oak finish					0
Apply paint with brush			x	x	2
Clean and care for paint-brushes			x	x	2
Lay out duplicate parts		x	x	x	3
Make a notch joint					0
Make a half-lap joint	x		x		2
Lay out and cut a dado joint	x	x	x		3
Cut a groove or rabbet	x	x	x	x	4
Lay out and cut a cross-lap joint	x	x	x	x	4

	1	2	3	4	5
Make an edge-to-edge glue joint	x		x	x	3
Lay out and cut tapers			x	x	2
Do upholstery involving webbing and rolled edges				x	1
Do simple upholstery involving use of springs					0
Dress a screwdriver		x			1
Set and use an expansive-bit			x		1
GROUP III					
Lay out an ellipse					0
Cut curves with a turning saw			x		1
Put on locks		x			1
Put on drawer-pulls					0
Fit hinges		x			1
Put on ball-catches					0
Apply varnish		x	x	x	3
Clean and care for varnish brushes			x	x	2
Apply lacquer					0
Clean and care for lacquer brushes					0
Apply finish with a spray gun					0

	1	2	3	4	5
Apply inlay				x	1
Lay out and cut a miter joint	x	x	x	x	4
Make a dowel joint	x	x	x	x	4
Use a doweling jig	x		x	x	3
Lay out and cut a blind mortise-and-tenon joint	x	x	x	x	4
Lay out and cut a through mortise-and-tenon joint	x	x			2
Lay out and cut a haunched mortise-and-tenon joint	x	x	x	x	4
Construct a panel		x			1
Make a splined joint					0
Lay out and cut a housed joint					0
Make a drawer-slide					0
Make and fit a drawer					0
Fasten on a table-top	x		x		2
Fasten with lag-screws or bolts	x				1
Cut an edge mold	x			x	2
Sharpen a scraper	x	x	x		3
Sharpen auger-bits		x			1
Sharpen a saw					0
Use a Forstner bit					0
Clean and care for a spray-gun					0

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1            2            3            4            5

## II. THINGS YOU SHOULD KNOW

### A. Concerning Lumber

You should be able to identify the following kinds of lumber and any other kinds in common use in the community: the pines, spruce, cypress, oak, walnut, birch, maple, mahogany, red cedar, hickory, gum, chesnut, poplar		x	x		2
You should know the principal characteristics, the working qualities, the principal uses, and the sources of supply of each	x	x	x		3
You should know the methods of cutting and milling lumber	x	x	x		3
You should know the effect of moisture on wood	x	x	x		3
You should know the standard dimensions of lumber and how classified	x		x		2
You should know the nominal and the actual dimensions of lumber	x		x		2
You should know how veneer and plywood are made, and their uses		x	x	x	3

### B. Concerning Finishes

The object of finishes		x	x		2
The kinds of finishes in common use; such as stain, oil, wax, shellac, varnish, lacquer, enamel, paint		x	x	x	3

	1	2	3	4	5
The durability of different finishes		x	x		2
The conditions or places in which various kinds of finishes may be used to advantage		x	x		2
Materials from which finishes are made		x	x	x	3
<b>C. Concerning Glue</b>					
The kinds of glue	x	x	x	x	4
The preparation of glue	x	x	x	x	4
The conditions and requirements in use	x	x	x	x	4
<b>D. Concerning Nails, Brads, and Fasteners</b>					
The kinds of nails		x	x	x	3
The uses of the different kinds	x	x	x	x	4
The sizes of nails		x	x	x	3
How nails are sold		x			1
How nails are manufactured		x			1
Sizes of brads and how sold					0
Sizes, kinds, and uses of corrugated fasteners					0
Sizes and uses of clamp-nails					0
<b>E. Concerning Screws</b>					
The kinds of screws		x	x	x	3
The uses of the different kinds	x	x		x	4

	1	2	3	4	5
How the sizes and kinds of screws are indicated	x	x	x		3
How they are sold		x			1
F. Concerning Sandpaper and Steel-Wool					
The kinds of sandpaper		x	x		2
Grades of sandpaper	x	x	x		3
Principal uses		x			1
Grades and uses of steel-wool					0
G. Concerning Styles of Furniture					
The distinguishing characteristics of different types of period furniture			x		1
H. Concerning the Design of Furniture; in the design of furniture you should develop a fair judgment with respect to the following:					
Is it adapted to the use for which it is indicated?	x		x		2
Is it structurally good?	x		x		2
Is it well made?	x		x		2
Are the structural members in good proportion	x		x		2
Does it have an appearance of stability?	x		x		2
Is the structure as a whole well proportioned?	x		x		2

	1	2	3	4	5
Are the outlines pleasing	x		x	x	3
Is it well finished with an appropriate finish?			x		1
<b>I. Concerning Manufacture of Wood Products</b>					
The location of important manufacturing concerns		x			1
The division of labor in industry					0
The use of automatic machinery					0
<b>J. Concerning Joints</b>					
Types of joints, where used, and why			x		1
<b>K. Concerning Hardware</b>					
Types of hinges and their uses			x		1
Types of latches and where used			x		1
Types of locks and where used			x		1
Types of nails and where used			x		1
Special types of fittings					0
<b>L. Types of Tools and Their Uses</b>					
Saws, planes, knives, chisels, hammers, boring-tools, files	x	x	x	x	4
<b>M. Kinds of Grinding Sharpening Stones, Their Grades and Uses</b>					
			x	x	2

	1	2	3	4	5
N. Opportunities and Requirements in Carpentry and Other Woodworking Trades					0

#### IV. WHAT YOU SHOULD BE

This list of attitudes and habits contribute to the success of individuals in any vocation

Industry	x	x			2
Cooperation	x	x			2
Consideration of others	x	x			2
Self-reliance	x	x			2
Readiness to assume responsibility	x	x			2

Limit Material to the Ninth Grade Level

The next step was to prepare contracts with the information and operations to cover this recommended material. The total time allowed for the course is 180 periods of fifty-five minutes each.

According to Miller (17:72) important points in a contract are:

1. Each individual will be stimulated to find his stride within the circle described.
2. No upper limit will be set for any pupil in the group.
3. No pupil will be isolated in a selfish individualism by which goals are worked up and checked off.
4. Functional drill work will receive due emphasis.
5. The spirit of the game the contest, will not be deleted.

The following objectives were considered in this study when developing the contracts:

1. Stimulate pupil interest
2. Allow for individual differences
3. Act as a guide to cover operations and information that each student should master
4. Act as a guide to the student for further study.

Four contracts were prepared. The items covered in these contracts were made to compare favorably with the items listed most frequently in the four courses of study

analyzed in Table I.

The first two contracts were based on projects that included only assembling and finishing. In this way an attempt was made to cut down on initial operations to be learned, and thus to hasten the completion of the first projects. This should tend to keep up interest in the work.

Individual differences were considered in the three "degrees" of contracts "A," "B" and "C." The "C" contract is presented to the pupil to work out with no originality on his part. He merely follows instructions and does the work as he is directed. This is for the slower type of student who likes to work with his hands, but who has little initiative or creative ability. The "A" and "B" contracts require additional work above that of the "C" contract and demand originality in varying degrees. The student must design and develop his own project in these cases.

No test is given on the work above the C contract but all work requested must be handed in for grading. The excellence of the reports accompanying the A and B contracts will be considered, along with the projects themselves.

References are given with each contract, to cover the basic material and furnish additional sources of information for further study. The references are broad enough to stimulate the student's interest in further study, provided he is interested in the field.

As ample instruction is given in these references, it did not seem economical of either time or material to attempt to develop information or operation sheets for these contracts.

### Grading and Testing

Grades will be based on the following:

1. Quality and quantity of the work,
2. Originality of work-- A and B contracts,
3. Library work-- A and B contracts and reference material.

All students, regardless of contract, will be given five tests per contract or twenty tests during the year. The purpose of the tests are:

1. To determine difficulties students are meeting,
2. To determine faulty teaching methods,
3. To stimulate student to keep up on reference material as it is needed in his work, and not postpone reading material until after the need for it has passed.

Both bench work and tests are rated to determine the grade received. The bench work receives a grade point of from 20 to 80 depending on the contract completed and the quality of the work done. (See grading chart in appendix A)

Each student reports the contract that he has completed, when he turns in the written work. If the instructor disagrees, a conference is held with the student before a change is made.

A model with excellent workmanship is furnished as a guide and the students give each project in the class a grade of, (1) minimum accepted standards, (2) average, (3) superior or (4) excellent.

In a few rare cases the instructor will need to adjust an obvious error. This happened on an average of once for each twenty students during two years teaching by this method.

Tests for each contract count a maximum of fifty grade points, on a percentage basis.

The grade points for the bench work and tests are arranged in order and the grades for the report cards are based on these. This has been considered a fair way of grading by students as they report that they like the system because:

1. They are free to work at their own speed;
2. They are not limited to a definite project;
3. They know the requirements for the contracts and by comparison of their bench work with others can judge their progress at any time;
4. They feel that for the slow student the competition is not so keen on workmanship and tests as the B and A student must do additional work to receive these higher grades.

No progress chart is displayed to the class, but any student who asks is shown how he stands with reference to others in the class.

Any student who cannot meet the standards, but has proven that he did his best, will receive a grade of D. Any

student who fails to meet the standards because of lack of effort will receive a grade of F. These have proven to be few. Usually means can be found to correct the student's attitude or place him in a class where he is interested, before the work has progressed to a point of failure.

## CHAPTER IV

### SUMMARY AND CONCLUSION

The Contract Plan, as such, has proven to be none too successful in this country. Other plans are being attempted continually under different names, with the idea of organizing the material into some sort of a unit which will meet the individual needs.

The Contract Plan, as any other departure from orthodox methods, requires a higher degree of cooperation throughout the entire teaching staff. For this reason, the plan was more successful in small schools with young teachers, than in the larger schools or with older teachers who had been teaching with other methods.

Due to these factors, the contract plan evidently is not too well adapted to the American school, when used throughout the entire school system.

The plan, as applied to woodworking, a single department, does appear to have certain advantages, and if properly administered should prove a worthwhile and satisfactory method of teaching.

Unit assignments have many names such as, integrated activity, project, project problem and contract laboratory, and all have been used more or less interchangeably for the same type of work. The term "contract" however, seems to be a more suitable term for the unit in this study.

The material, when presented as contracts, can be such that it gives the pupil and the teacher a definite, concrete view of the course as a whole.

Due to the "Guide Line" idea allowances can be made for individual differences. Each contract requirement is such that it can be expanded to meet the needs of the most advanced pupil; or it can be limited to the extent that the slowest can be assured of a degree of success. By having the material consolidated in a contract the skills and related information are presented as a unit.

Selection of a project, within a group, may be made by the individual, thus adding to the interest of the work. Provision has been made to enable the student to complete his first contracts within a reasonable length of time, and thus avoid discouragement so common in many shop classes.

No claim can be made for any teaching method, that it is the best method, or that it has overcome all the disadvantages of other methods. Under actual shop conditions, over a period of two years, this method has proven quite satisfactory for woodworking instruction. The students seemed more interested, the quality and quantity of the work was better and there were fewer failures.

The success of any method will depend to considerable extent upon the instructor. Much interest in individual problems is required. By means of this method, however,

more time should be available to the instructor for working with the individual.

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## APPENDIX A

### COURSE OF STUDY FOR WOODWORKING AT THE NINTH GRADE LEVEL, BASED ON THE CONTRACT AS THE UNIT OF INSTRUCTION

Level of Course: Ninth Grade

While the course is designed for ninth grade application, beginning students may enter the course at any time during the four years of high school.

Time Allotted:

55 minutes per day; 180 periods per year. The approximate breakdown is:

25% class discussion and tests  
25% study and planning  
50% work at bench

General Objectives of the Course Are:

1. To meet the commonly accepted industrial arts objectives as recommended by a committee on standards of attainment for industrial arts (21:14-15). They are:
  - a. To develop in each pupil an active interest in industrial life and in the methods of production and distribution.
  - b. To develop in each pupil the ability to select wisely, care for, and use properly the things he buys or uses.
  - c. To develop in each pupil an appreciation of good workmanship and good design.
  - d. To develop in each pupil an attitude of pride or interest in his ability to do useful things.
  - e. To develop in each pupil a feeling or self-reliance and confidence in his ability to

- deal with people and to care for himself in an unusual or unfamiliar situation.
- f. To develop in each pupil the habit of an orderly method of procedure in the performance of any task.
  - g. To develop in each pupil the habit of self-discipline which requires one to do a thing when it should be done whether it is a pleasant task or not.
  - h. To develop in each pupil the habit of careful, thoughtful work without loitering or wasting time (industry).
  - i. To develop in each pupil an attitude of readiness to assist others when they need help and to join in group undertakings (cooperation).
  - j. To develop in each pupil a thoughtful attitude in the matter of making things easy and pleasant for others.
  - k. To develop in each pupil a knowledge and understanding of mechanical drawing, the interpretation of the conventions in drawings and working diagrams, and the ability to express his ideas by means of a drawing.
  - l. To develop in each pupil elementary skills in the use of the more common tools and machines and a knowledge of the methods of procedure in tasks frequently encountered by the average man together with the knowledge of the working qualities and characteristics of some of our most used materials.

#### Material Included in Course

According to the four courses of study analyzed in Chapter IV, the following material was selected for presentation in the form of contracts. The four contracts are given in appendix B.

The first contract includes the construction of a simple, box-like project with butt joints. It is to be assembled with screws and nails. The stock is cut to size for the student and his work will consist of surface finishing, assembling and painting. The following operations and information are included:

A. Things to do:

1. Make a working drawing
2. Plan procedure in doing your job
3. Make out a project card complete with bill of material
4. Check material when received
5. Sharpen a plane iron
6. Sharpen a chisel
7. Assemble and adjust a plane iron
8. Make a butt joint
9. Plane a flat surface
10. Lay out and cut a chamfer
11. Sharpen a cabinet scraper
12. Assemble and adjust a cabinet scraper
13. Scrape a flat surface
14. Drill holes in wood
15. Countersink holes
16. Sand a flat surface
17. Assemble with nails and screws
18. Apply paint with brush

## 19. Clean and care for paint brushes

## B. Things to know:

1. The kinds of softwood lumber generally available in the west; some characteristics of each
2. The standard dimensions of lumber and how classified
3. The nominal and actual dimensions of lumber
4. The object of finishes; the kinds of opaque finishes; advantages and disadvantages of paint, enamel, and lacquer
5. How to apply paint; the care of paint brushes
6. Kinds, sizes and classification of screws; how sold and manufactured
7. Kinds, sizes and classification of nails; how sold and manufactured
8. Sandpaper, kinds, grades and uses
9. What is meant by a butt joint

The second contract includes the construction of a small piece of furniture, such as a stool or shelf, consisting of butt joints and assembly with nails and screws. The stock is cut to size for the student and his work consists of smoothing the surface, assembling with nails and screws and finishing with enamel.

The following new operations and information are included:

## A. Things to do:

1. Lay out curves with dividers or compasses
2. Test for squareness with a try square

3. Round edges
4. Finish outside curves
5. Apply enamel
6. Clean and care for enamel brushes

B. Things to Know:

1. The sources of our soft woods; the working qualities and their principal uses
2. The methods of cutting and milling lumber
3. How lumber is dried
4. The effect of moisture on wood
5. How to apply the following questions on design of a piece of furniture
  - a. Is it adapted to the use for which intended?
  - b. Is it structurally good?
  - c. Is it well made?
  - d. Are the structural members in good proportion?
  - e. Does it have the appearance of stability?
  - f. Is the structure, as a whole, well proportioned?
  - g. Are the outlines pleasing?
  - h. Is it well finished with an appropriate finish?
6. Types and sizes of nails and where used

The third contract includes the construction of a project consisting of a flat board, to be finished to size.

The work consists of gluing stock edge-to-edge, sawing and planing to size and smoothing the surface. The following new operations and information are included:

A. Things to do:

1. Measure and divide spaces with a rule
2. Gauge with a marking gauge
3. Lay out square cuts with a try square and carpenter's square
4. Plane an edge square with an adjoining surface
5. Plane end grain
6. Proceed properly in squaring up a board
7. Saw to a line with a crosscut or rip saw
9. Use a back saw
10. Saw outside curves with a coping saw
11. Trim or pare with a chisel
12. Bore holes with an auger bit
13. Round or form work with a spokeshave
14. Use handscrews and clamps
15. Prepare glue
16. Glue up work
17. Make an edge to edge joint

B. Things to know:

1. The kinds of glue
2. The preparation of glue
3. The conditions and requirements in use

The fourth contract includes the construction of a small piece of furniture made of hardwood and finished in a natural finish. All work is by hand. The following new operations and information are included:

## A. Things to do:

1. Lay out and test bevels with a sliding T-bevel
2. Apply stain
3. Clean and care for stain brushes
4. Apply fillers
5. Apply shellac
6. Clean and care for shellac brushes
7. Apply wax
8. Lay out duplicate parts
9. Lay out and cut tapers
10. Apply oil varnish
11. Clean and care for varnish brushes
12. Lay out and cut a miter joint
13. Use a doweling jig
14. Fasten on a table top

## B. Things to know:

1. The kinds of finishes in common use; such as stain, oil, wax, shellac, varnish lacquer, enamel and paint
2. The durability of different finishes
3. The conditions or places in which various kinds of finishes may be used to advantage
4. Materials from which finishes are made
5. Grades and uses of steel wool
6. Grades and uses of rotten and pumice stone
7. The location of important manufacturing concerns
8. The division of labor in industry

9. The use of automatic machinery
10. Types of joints and where used
11. Types of hinges and where used
12. Types of locks and where used
13. Special types of fittings

The references for the above operations and information are:

1. Brown and Tustison, "Instructional Units in Hand Woodworking."
2. McGee and Brown, "Instructional Units in Woodfinishing."
3. Noble and Everill, "From Forest to Woodworker."
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#### Teaching Methods:

Instruction is by group or individual demonstration and class discussion. The time for the demonstration or discussion is when a need arises by the group or by the entire class.

All available visual aids are used to the best possible advantage. During discussion periods an attempt is made to link this material with other subject matter in the school.

#### Evaluating Procedures:

Grades are based on the following:

1. Quality and quantity of work
2. Originality of work
3. Initiative shown in library work

The differentiation of numbers two and three above is largely by the degree of Contract completed. (See following page for grading chart) Five short tests per contract are given to determine mastery of the basic material. (See Appendix B) Students participate in the grading of the bench work and each individual judges the degree of contract that he has completed.

Instruction to Students (given verbally, with any explanation needed)

The material in this course is divided into four contracts. This division has been made and the contracts presented to you to give you a definite idea of what to expect for your time and effort. Each contract has three different "degrees" of work; the "C" "B" and "A"; some of you have had more experience than others or may be more keenly interested in or better adapted to this type of work. You are free to choose the type of contract (A, B or C) that you think is best suited to your needs. Remember, however, that the more you put into the work the more benefit you will receive. You cannot obtain great enjoyment or returns from anything in which you are "half" interested.

METHOD OF GRADING

GRADE POINTS

<i>bench work and "A" &amp; "B" contract assignments</i>	<i>contract I</i>			<i>contract II</i>			<i>contract III</i>			<i>contract IV</i>		
	C	B	A	C	B	A	C	B	A	C	B	A
<i>minimum acceptable standards</i>	20	30	40	20	30	40	10	20	30	30	40	50
<i>average workmanship</i>	30	40	50	30	40	50	20	30	40	40	50	60
<i>superior workmanship</i>	40	50	60	40	50	60	30	40	50	50	60	70
<i>excellent workmanship</i>	50	60	70	50	60	70	40	50	60	60	70	80
<i>maximum grade points for tests</i>	50	50	50	50	50	50	50	50	50	50	50	50
<i>maximum grade points for contracts</i>	100	110	120	100	110	120	90	100	110	110	120	130

*Report card grades will be based on these grade points and will generally run on the percentage curve for the woodworking enrollment*

### Shopwork

This is a very important part of your contract. Suggested projects are given on large wall charts. You are not required to make a specified project. The "C" contract student may substitute a project taken from a book or magazine, providing it fills the requirements. The "B" and "A" contract student must design and make a shop drawing of his own project. All the information needed to choose your project is included in the contracts. The material for the first two projects will be cut on the machines, as ordered on your bill of material.

### Related Information

The assigned information is just as important as bench work. This work, in many cases, gives you the knowledge necessary to do your bench work. This also gives you the background necessary for any further work in this field.

### Tests

Tests will cover both the bench work and the information material assigned. Just as accuracy and good workmanship will count in the bench work, neatness and orderliness will count on any written work. Your English teacher can perhaps help you on your composition of written material.

Five short tests will be given on the work of each

contract. This will mean approximately one each week. This means that you must keep up on your reference work. You cannot postpone the assignments for they are part of your bench work and tests.

### Project Card

You will note that each contract calls for the completion of a project card and a bill of material. This is a form that is convenient for your information and also helps the instructor give you more of his time. Completion of this form is the first step in any project.

On pages 57 and 58 are a sample project card and bill of material.

### References

References needed are given in your contract and may be found in the shop library. Be safe! Read this material as you plan your work and avoid mistakes.

### Procedure

In general, the purpose of the contracts is to enable you to use your time to the best advantage. You should have a very definite idea of what you are going to do. There should be no delay and hesitation while you waste time thinking of what you are going to do next. If you

decide to make a change in your project, after making out your project card, consult with the instructor. He must know exactly what each student is doing if he is to give maximum aid to the class.

Do not hesitate to ask the instructor for advice at any point, but do not waste time asking questions which are already answered in your instructions.

Each contract consists of:

1. Purpose of contract and a list of operations that are new and must be included in the selected project. References are included for needed instruction.
2. Drawing of suggested project
3. Plan of procedure for making the project shown in the drawing
4. Differentiation of contracts: The requirements to meet the A, B and C contracts
5. Method of grading (see page 53)
6. Questions for study.

PROJECT CARD

STUDENT - John Brown  
 DATE STARTED - Sept. 25, 1946  
 WOODWORKING - I  
 PROJECT - Nail Box

PERIOD - third  
 DATE FINISHED - Oct. 15, 1946  
 CHECKED BY - J.B.  
 CONTRACT - I

Steps in Building Project

Old	New		Old	New	
	1	Make a working drawing		14	Apply second coat of paint
	2	Make out a project card			
	3	Turn in project card to receive material			
	4	Check material when received			
	5	Plane all mill marks and defects from sides and edges of stock			
	6	Smooth all sides and edges of stock with cabinet scraper			
	7	Bore holes for screws			
	8	Sand all surfaces			
	9	Lay out position of partitions			
	10	Assemble with nails and screws			
	11	Apply undercoat for paint			
	12	Sand undercoat			
	13	Apply first coat of paint			

**BILL OF MATERIAL**

no.	lumber	thickness	width	length	kind and grade	amount	rate	cost			
<i>finishing material and hardware</i>								<b>total</b>			
<u><i>Reverse Side of "Project Card"</i></u>											
							<b>total</b>				58

## APPENDIX B

### CONTRACT I

This contract will give you an introduction to the processes and materials used in woodworking.

The success of your later contracts will depend, to a great extent, on how you master this one. Plan carefully, work carefully and your project will be one that you can display with pride.

The basic requirements are the construction of a project and the learning of certain items as listed under "things you are expected to know."

A. The specifications for the project are:

1. To be made of a suitable soft wood
2. To be finished with one undercoat and two coats of paint
3. To include the following listed operations

B. Things you are expected to do:

	Ref.	Unit or Chap.
1. Make a working drawing	1	2
2. Plan a procedure in doing your job		
3. Make out a project card, complete with bill of material		
4. Check material when received		
5. Sharpen a chisel	1	12
6. Sharpen a plane iron	1	12
7. Assemble and adjust a plane iron	1	12
8. Make a butt joint	1	27
9. Plane a flat surface	1	13&14

	<u>Ref.</u>	<u>Unit</u>
10. Lay out and cut a chamfer	1	16&21
11. Sharpen a cabinet scraper	1	17
12. Assemble and adjust a cabinet scraper	1	17
13. Scrape a flat surface	1	17
14. Drill holes in wood	1	23
15. Countersink holes	1	28
16. Sand a flat surface	1	18
17. Assemble with nails and screws	1	27&28
18. Apply paint with a brush	2	9
19. Clean and care for paint brushes	2	8

C. Things you are expected to know

1. The kinds of softwood lumber generally available in the west; some characteristics of each	3	1
2. The standard dimensions of lumber and how classified	3	5
3. The nominal and actual dimensions of lumber	3	5
4. The object of finishes; the kinds of opaque finishes; advantages and disadvantages of paint, enamel, lacquer	3	7-8-9
5. How to apply paint; the care of paint brushes	2	8
6. Kinds, sizes and classification of screws; how sold and manufactured	1	28
7. Kinds, sizes and classification of nails; how sold and manufactured	1	27
8. Sandpaper, kinds, grades and uses	1	18
9. What is meant by a butt joint	1	27

D. Habits you are expected to develop

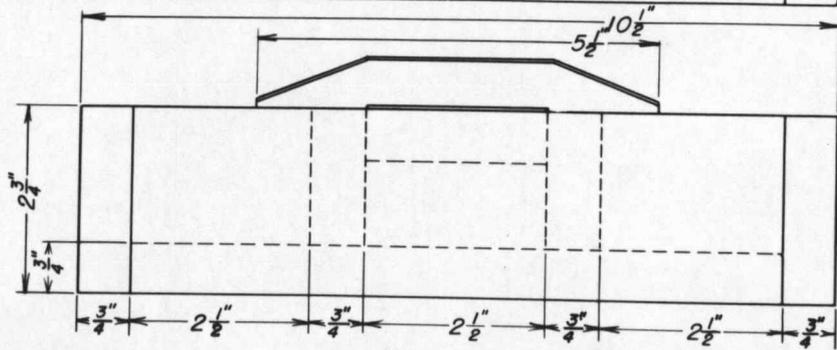
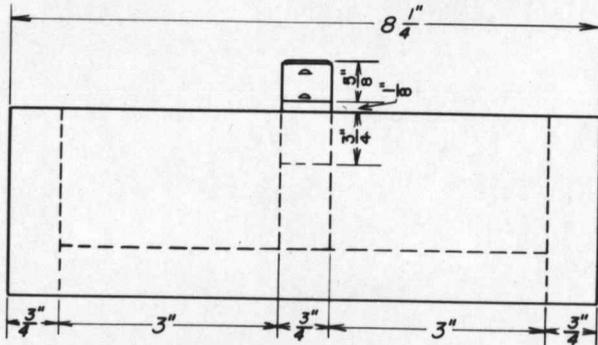
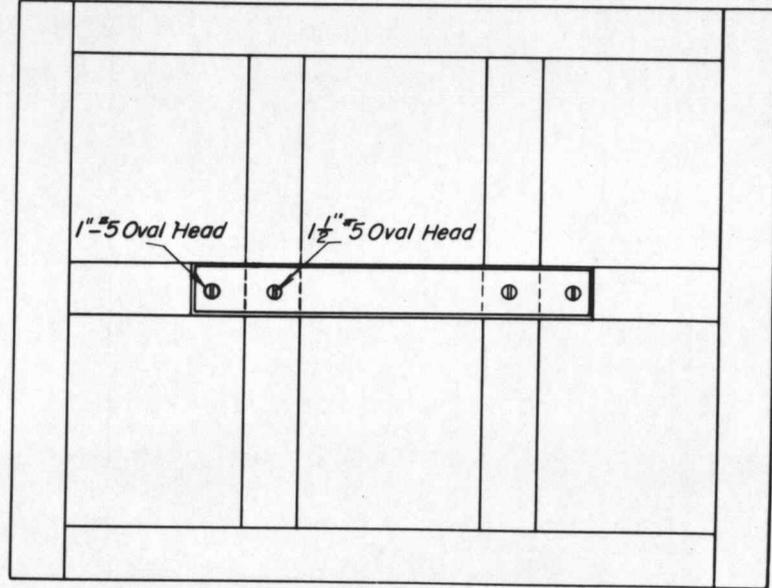
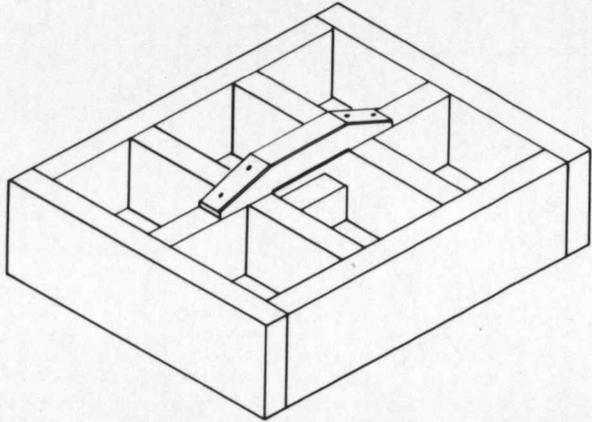
1. Industry-- keep busy at all times toward the completion of the project
2. Cooperation-- help others and accept needed help from them
3. Self-assurance-- Learn to depend on your own efforts when possible
4. Neatness-- keep work, tools and ideas in order

E. Five tests will be given on the references listed.

Books in shop library are marked with these reference numbers below. Where no reference is indicated in the "ref." column, material will be covered by class discussion and demonstration. The reference books are:

1. Brown and Tustison, "Instructional Units in Hand Woodworking."
2. McGee and Brown, "Instructional Units in Woodfinishing."
3. Noble and Everill, "From Forest to Woodworker."
4. Bradley, C. B. "Design in Industrial Arts."
5. Shea and Wenger, "Woodworking for Everybody."

**SUGGESTED PROJECT  
FOR CONTRACT-I**



**SPARE PARTS BOX**

Scale:  $4\frac{1}{2}'' = 1'$

## CONTRACT I

### PLAN OF PROCEDURE FOR SUGGESTED PROJECT

1. Make a working drawing (copy one from chart or make your own)
2. Make out a project card and bill of material
3. Turn in a project card to receive material
4. Check material when received
5. Plane all mill marks and defects from sides and edges of stock
6. Shape handle
7. Smooth all sides and edges of stock with cabinet scraper
8. Bore holes for screws
9. Sand all surfaces
10. Lay out position of partitions in box
11. Assemble with nails and screws
12. Apply undercoat for paint
13. Sand under coat
14. Apply two coats of paint

## CONTRACT I REQUIREMENTS

### Contract C

1. Make the project as given in the drawing or substitute another drawing of similar construction from book or magazine.
2. Master the information assigned and presented in class.

### Contract B

1. Design and construct your own project, similar to the one shown in the drawing. It should include all the listed operations.
2. Master the information assigned and presented in class.
3. Figure the cost of producing your project. (Labor cost is figured at prevailing wage. Consider each period in the shop as one-half hour.)
4. Collect pictures or drawings of ten projects, with construction similar to your own and paste neatly in a manila folder scrapbook. Estimate the cost for you to produce each article.

### Contract A

- 1,2,3,4, same as in Contract B above
5. Workmanship and design should be of a higher quality than that of a B contract.
  6. Explain why you chose the dimensions of your project and give the rules of design to support your decisions. Give reference for your authority.

If you are interested in making a special study of any other phase of woodworking, see instructor for permission to substitute this study for item 6 in Contract A.

## CONTRACT I

## METHOD OF GRADING

<u>Bench work and "A" &amp; "B" contract assignments</u>	Grade points		
	Contract I		
	C	B	A
Minimum acceptable standards	20	30	40
Average workmanship	30	40	50
Superior workmanship	40	50	60
Excellent workmanship	50	60	70
Maximum grade points for tests	50	50	50
Maximum grade points for contracts	100	110	120

Report-card grades will be based upon the grade points earned, as outlined above. The student earning the highest number of grade points will receive the highest grade.

## CONTRACT I

QUESTIONS FOR STUDY

The following questions are given as suggestions for study. Study the questions that pertain to your work as you make your project. This study should help you with your test.

1. What are the common types of working drawings?
2. How many views are usually used in orthographic drawings?
3. What is the general advantage of isometric drawings?  
Orthographic drawings?
4. Give examples of lines used in drawings?
5. How do you determine which direction to plane, when planing a surface?
6. What is meant by bevel? Chamfer? Stop chamfer?
7. What tool is used to test the angle of a bevel?
8. What is the approximate size of a 2 x 4, S-4-S?
9. What is the size of a rough or unplaned 2 x 4?
10. In general softwood lumber is sold in what lengths?
11. Give procedure in sharpening a plane iron or chisel?
12. What determines the angle of grinding a plane iron or chisel?
13. What are the common types of planes used in the shop?
14. Be able to demonstrate the method of adjusting a block plane.
15. What is the purpose of the plane iron? Plane iron cap? Lateral adjusting lever? Adjusting nut?
16. How do you detect a sharp plane iron or chisel?
17. What is the unit of measurement in selling lumber?

18. How far should the plane iron project beyond the shaving breaker?
19. What is the purpose of planing a board, when it has been cut to size on a woodworking machine?
20. What are the four common types of wire nails?
21. What is meant by a jointed edge?
22. Which is best for gauging a line for a chamfer, a knife, marking gauge or pencil?
23. List the steps in sharpening a cabinet scraper?
24. What is the difference in a scraped surface and a planed surface?
25. Does a scraper actually have a scraping or a cutting action?
26. What are the common abrasives used on sandpaper?
27. What is the purpose of sanding?
28. How would you order sandpaper? Amount? Size? Kind?
29. What is the best method of cutting sandpaper to smaller size?
30. Why is sanding usually done parallel to the grain of the wood?
31. What tool is used to sharpen an auger bit? Twist drill? Bit stock drill?
32. How are nails sold? Size? Unit?
33. What is the general rule for the length of a nail in comparison to the thickness of the board in which the nails are used?
34. What is meant by "setting" nails?
35. What material is good for lubricating nails for easier driving?
36. What is the reason for placing a block under the claws of a hammer when pulling a nail?

37. What is the advantage of clinching a nail across the grain?
38. How are sizes of twist drills and bit stock drills indicated?
39. How would you indicate specifications for wood screws?
40. What material is suitable for lubricating the threads of a screw for driving? Would oil be satisfactory?
41. What is the purpose of a counter sink?
42. What method is usually used to hide the heads of screws?
43. What is the apparent difference in paint and enamel?
44. What kind of strokes do you use in applying paint?
45. What is the best method of cleaning and caring for paint brushes, after use?
46. What do we mean by a vehicle used in paint; a drier; a thinner?
47. What are the more common soft woods used in the west for house lumber?
48. Which of these soft woods would you choose for?
  - a. shingles
  - b. Siding
  - c. interior trim
  - d. flooring
  - e. framing
  - f. window sash
49. What is the purpose of paint?
50. What do we mean by a butt joint?

## CONTRACT II

This contract will enable you to review some of the things that you learned in Contract I and add knowledge and skills for future work.

Look back over your experiences, check on any mistakes you have made and try to avoid them in this contract.

The basic requirements are the construction of a project and the learning of certain information as listed under "things you are expected to know."

### A. The specifications for the project are:

1. To be made of a suitable softwood
2. To be finished with at least two coats of undercoater and two coats of enamel
3. To include the following operations

### B. Things you are expected to do:

	<u>Ref.</u>	<u>Unit or Chap.</u>
1. Lay out curves with dividers or compasses	1	19
2. Test for squareness with a try square	1	14
3. Round edges	1	21
4. Finish outside curves	1	21
5. Apply enamel	2	9
6. Clean and care for enamel brushes	2	8

### C. Things you are expected to know:

1. The sources of our softwoods; the

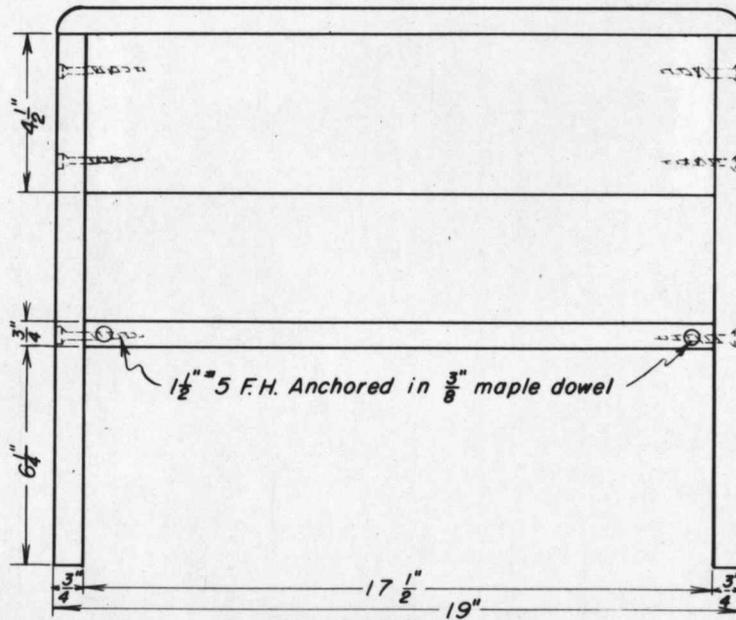
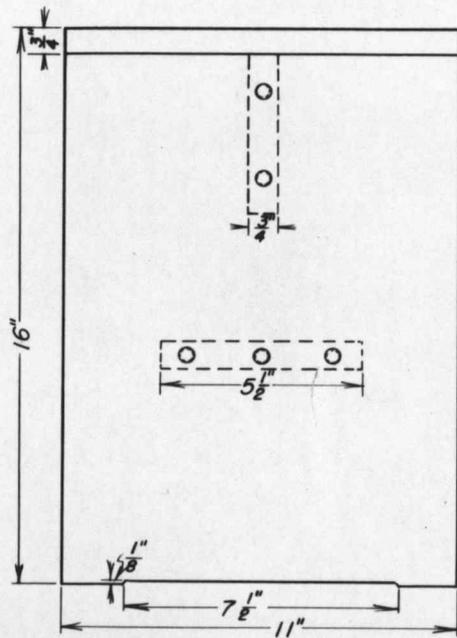
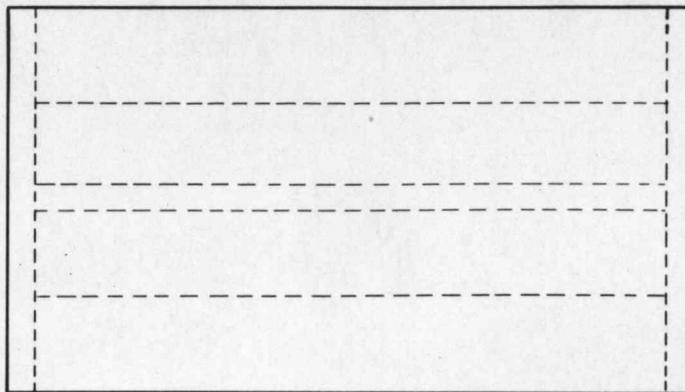
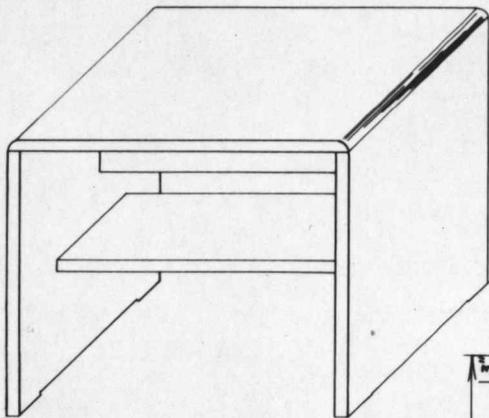
	<u>Ref.</u>	<u>Unit or Chap.</u>
working qualities and their principal uses	3	1
2. The methods of cutting and milling lumber	3 5	2 1
3. How lumber is dried	3	2
4. The effect of moisture on wood	3	2
5. How to apply the following questions on design of a piece of furniture		
a. Is it adapted to the use for which it is put	4	3
b. Is it structurally good	4	5
c. Is it well made	4	5
d. Are the structural members in good proportion	4	7
e. Does it have the appearance of stability	4	7
f. Is the structure, as a whole, well proportioned	4	7
g. Are the outlines pleasing	4	15
h. Is it well finished with an appropriate finish	4	15
6. Types and sizes of nails and where used	5	4

D. Five tests will be given on the references listed.

Where no reference is indicated in the reference column, material will be covered by class discussion and demonstration. The reference books are:

1. Brown and Tustison, "Instructional Units in Hand Woodworking."
2. McGee and Brown, "Instructional Units in Woodfinishing"
3. Noble and Everill, "From Forest to Woodworker."
4. Bradley, C. B. "Design in Industrial Arts."
5. Shea and Wenger, "Woodworking for Everybody."

SUGGESTED PROJECT  
FOR CONTRACT-II



*Specifications: to be made of soft wood and finished with enamel*

UTILITY BENCH

Scale:  $2\frac{1}{4}" = 1'$

## CONTRACT II

### PLAN OF PROCEDURE FOR SUGGESTED PROJECT

1. Make a working drawing (copy one from chart or make your own.)
2. Make out a project card and a bill of material
3. Turn in project card to receive material
4. Check material when received
5. Plane all mill marks and defects from sides and edges of stock
6. Lay out rounded corner on "top" with dividers
7. Plane rounded corner
8. Relieve lower part of "ends" with chisel and spokeshave
9. Bore holes and glue in short dowels to anchor screws in and grain
10. Smooth all sides and edges with the cabinet scraper
11. Lay out and bore holes for screws
12. Sand all exposed surfaces
13. Assemble rails and ends with screws
14. Fasten top with nails
15. Set nails
16. Plug screw holes and sand smooth
17. Apply undercoat for enamel
18. Putty nail holes
19. Sand first undercoat
20. Apply second undercoat
21. Sand second undercoat
22. Apply third undercoat, if necessary

23. Apply first coat of enamel
24. Sand with wet sand paper or pumice stone
25. Apply final coat of enamel
26. Rub with FF pumice stone and water, with felt pad

## CONTRACT II REQUIREMENTS

### Contract C

1. Make the project as given in the drawing or substitute another drawing of similar construction from book or magazine.
2. Master the information assigned and presented in class.

### Contract B

1. Design and construct your own project, similar to the one shown in the drawing. It should include all of the listed operations.
2. Master the information assigned and presented in class.
3. Collect 10 pictures or drawings of projects similar to your own and paste neatly in your scrapbook.
4. List the kinds of joints you think have been used in these projects.

### Contract A

- 1,2,3, and 4, same as in Contract B above.
5. Workmanship and design should be of a higher quality than that of the B contract.
6. Give three kinds of wood that would be suitable for your project. Give advantages and disadvantages of each.

If you are interested in making a study of some phase of woodwork see instructor for permission to substitute the work for items 4 and 6 in Contract B and A.

## CONTRACT II

## METHOD OF GRADING

	Grade points		
	Contract II		
<u>Bench work and "A" &amp; "B" contract assignments</u>	<u>C</u>	<u>B</u>	<u>A</u>
Minimum acceptable standards	20	30	40
Average workmanship	30	40	50
Superior workmanship	40	50	60
Excellent workmanship	50	60	70
Maximum grade points for tests	50	50	50
Maximum grade points for contracts	100	110	120

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Report-card grades will be based upon the grade points earned, as outlined above. The student earning the highest number of grade points will receive the highest grade.

## CONTRACT II

### QUESTIONS FOR STUDY

The following questions are given as suggestions for study. Study the questions that pertain to your work as you make your project. This study should help you with your test.

1. What do we mean by template?
2. What is the method used to lay out a rounded corner with the dividers?
3. How can you test the try square to determine if it is square?
4. Why do we always use a face side and face edge for marking all square cuts?
5. Why are we able to plane sharper curves with a spokeshave than a block plane?
6. What is meant by the term paring?
7. What precaution should be taken when using a chisel to prevent injury to the operator?
8. How is the size of a gouge indicated?
9. Which of the following would be best for floors of dwelling houses, Redwood? Douglas fir? Sugar pine? Spruce?
10. Where is our source of the following lumber, Redwood? Ponderosa pine? Douglas fir?
11. What is meant by gang saws? band saw? re-saw? planer?
12. What is the effect of moisture on wood?
13. Will vertical grain lumber or slab sawn lumber have the greater shrinkage when drying?
14. What is meant by annual ring?
15. What is meant by plywood?

16. Name some advantages of plywood over solid wood?
17. What is the source of rayon, cellophane, and newsprint?
18. Which is the faster method of drying lumber, air? or kiln?
19. What are the advantages of air drying?
20. What is meant by verticle grain lumber?
21. What do we mean by flat grain lumber?
22. Which lumber is the more expensive, flat or vertical grain? Why?
23. Does plywood usually warp as badly as solid lumber?
24. What unit of measure is used when selling plywood?
25. What do we mean by veneer?
26. Plywood, with a single ply of expensive wood may be used to make furniture. This is sometimes criticized as putting up a "false front." Do you think we are justified in making furniture in this manner? Why?
27. Can lumber be satisfactorily dried while still in the log?
28. The growth of a tree takes place in what part of the tree?
29. Is heartwood dead wood?
30. What is the purpose of sap wood?
31. How do we determine if a piece of furniture is adapted to the purpose intended?
32. What are some of the things to be taken into consideration when designing a piece of furniture?
33. What is the advantage of anchoring screws in making furniture in this manner? Why?
34. What damage may occur if lumber is dried too fast in a kiln?
35. What is meant by mill marks?

36. How would you specify a screw needed for the job?
37. How would you specify a nail to be used in a project?
38. What is the usual method of covering nail heads?  
Screw heads?
39. A piece of stock 2" x 4" x 23" costs how much at 30¢ per foot?
40. How do you determine the size screwdriver to use when driving a screw?
41. How does enamel differ from paint in finish and composition?
42. What is the composition of enamel?
43. Why is enamel more suitable as a furniture finish than paint?
44. What is the composition of shellac?
45. Why is it necessary to build up a body of flat paint before applying enamel?
46. Which is usually considered more pleasing, a rectangle 4" x 8" or 3" x 5"? Why?
47. Which is usually considered more pleasing: an arc or a "curve of force"?
48. When applying enamel, what is the result if brushed too vigorously?
49. What is an undercoater?
50. What is the main difference in the use of pumice stone and rotten stone?

## CONTRACT III

This contract will give you a chance to construct a simple project, without the aid of machines.

This is a simple piece of work, and if properly planned, will be quickly finished. Some of the operations are new, and careful planning is necessary before cutting.

The basic requirements are the construction of a project and the learning of certain items as listed under "things you are expected to know."

A. The specifications for the project are:

1. To be made of a suitable wood without disagreeable odors or stains
2. To be finished with one coat of boiled linseed oil
3. To include the following listed operations

B. <u>Things you are expected to do:</u>	<u>Ref.</u>	<u>Unit or Chap.</u>
1. Measure and divide spaces with a rule	1	4
2. Gauge with a marking gauge	1	6
3. Lay out square cuts with a try square and carpenter's square	1	5
4. Plane an edge square with an adjoining surface	1	14
5. Plane end grain	1	15
6. Proceed properly in squaring up a board	1	13,14, &15
7. Saw to a line with a crosscut or a rip saw	1	7

	<u>Ref.</u>	<u>Unit</u>
8. Use a back saw	1	7
9. Saw outside curves with a coping saw	1	20
10. Trim or pare with a chisel	1	21,32
11. Bore holes with an auger bit	1	22
12. Round or form work with a spokeshave	1	21
13. Use handscrews and clamps	1	24
14. Prepare glue	1	25
15. Glue up work	1	26
16. Make an edge to edge joint	1	26

C. Things you are expected to know:

1. The kinds of glue	1	25
2. The preparation of glue	1	25
3. The conditions and requirements in use	1	25

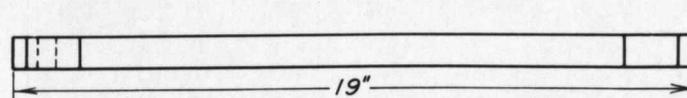
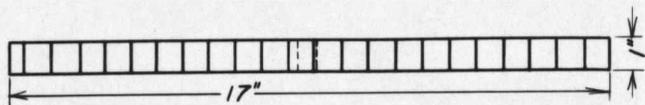
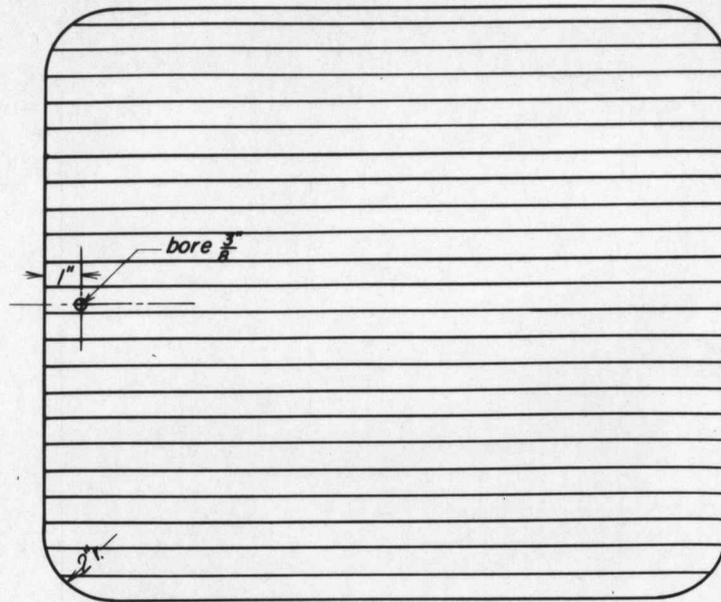
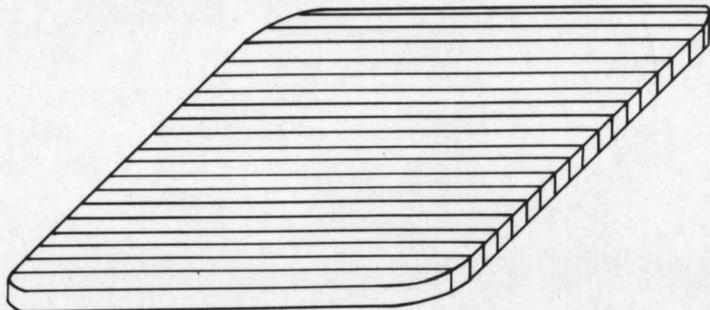
D. Five tests will be given on the references listed.

Where no reference is indicated in ref. column, material will be covered in class discussion and demonstration.

The reference books are:

1. Brown and Tustison, "Instructional Units in Hand Woodworking."
2. McGee and Brown, "Instructional Units in Woodfinishing."
3. Noble and Everill, "From Forest to Woodworker."
4. Bradley, C. B. "Design in Industrial Arts."
5. Shea and Wenger, "Woodworking for Everybody."

**SUGGESTED PROJECT  
FOR CONTRACT III**



**Specifications:**

*To be laminated of wood that is free  
of objectionable odors and stains*

**CUTTING BOARD**

Scale:  $2\frac{1}{4}'' = 1'$

## CONTRACT III

### PLAN OF PROCEDURE FOR SUGGESTED PROJECT

1. Make a working drawing (copy one from chart or make your own.)
2. Make out a project card and bill of material.
3. Get material from lumber room and cut to length.
4. Glue stock edge to edge.
5. Square board to dimensions.
6. Lay out corners.
7. Round corners.
8. Smooth all surfaces with a cabinet scraper.
9. Bore hole.
10. Sand all surfaces.
11. Give board a coat of boiled linseed oil.

## CONTRACT III REQUIREMENTS

### CONTRACT C

1. Make the project as given in the drawing or substitute another drawing of similar construction from a book or magazine.
2. Master the information assigned and presented in class.

### CONTRACT B

1. Design and construct your own project similar to the one suggested in the drawing. It should include all of the listed operations.
2. Master the information assigned and presented in class.
3. Collect 10 pictures of "boards" that are sold commercially and paste neatly in scrapbook.
4. Which of the following kinds of lumber would make a suitable food chopping board?  
a. Redwood  
b. Sugar Pine    c. Black Walnut    d. Sugar Maple  
Give your reasons why or why not.

### CONTRACT A

- 1, 2, 3, and 4; same as in Contract B above.
5. Workmanship should be of a higher quality than that of the B Contract.
6. Look up principles of design in the library and answer the following questions.
  - a. What is functional design?
  - b. What is meant by "Dynamic Symmetry"?
  - c. Give five different proportions that would be good for a picture frame?

If you are interested in making a special study of some phase of woodworking, see instructor for permission to substitute this study for item 4 and 6 in Contract A.

## CONTRACT III

## METHOD OF GRADING

	Grade Points		
	Contract III		
<u>Bench work and "A" &amp; "B" contract assignments</u>	<u>C</u>	<u>B</u>	<u>A</u>
Minimum acceptable standards	10	20	30
Average workmanship	20	30	40
Superior workmanship	30	40	50
Excellent workmanship	40	50	60
Maximum grade points for tests	50	50	50
Maximum grade points for contracts	90	100	110

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Report-card grades will be based upon the grade points earned as outlined above. The student earning the highest number of grade points will receive the highest grade.

## CONTRACT III

### QUESTIONS FOR STUDY

1. What are the kinds of glue used in the shop?
2. From what is animal glue made?
3. Casein glue is made from what material?
4. In using animal glue, better results can be had by heating the stock to be glued. Why?
5. Which of the glues used in the shop is more water resistant?
6. Will a glued-up piece of stock warp as badly as a single piece of stock of the same dimension?
7. Why would redwood be considered a poor material for a cutting board?
8. What qualities are required for wood to be used in a cutting board? A drawing board? A bread board?
9. In drying lumber, the shrinkage occurs more along or across the grain?
10. Should surfaces be sanded that are to be glued?
11. For what operation is a marking gauge most generally used?
12. What would you consider the main differences in planing end grain and side grain?
13. What are the accepted steps in squaring up a board?
14. Is a back saw a crosscut or a rip saw?
15. Give an accurate method for checking the setting of a marking gauge?
16. If a plane cuts deeper on one side than the other, how is it corrected?
17. Should the shaving breaker of a plane be set back from the cutting edge for coarse shavings?
18. Should the bevel of a jack plane iron be on the top or bottom when assembled in the plane? Block plane?

19. The saw kerf or cut should be on which side of the gauge line?
20. Does oil prevent glue from holding?
21. Is it easier to plane a long straight edge with a short plane or a long one?
22. Should all the clamps be used on one side of the work when using bar clamps?
23. Is the cutting edge of a plane bit made of harder steel than the scraper blade?
24. Should animal glue be boiled before using?
25. What is meant by saw set?
26. Which is the most satisfactory for cutting a board to length, a rip saw or a crosscut saw?
27. Would animal glue be suitable for gluing a surf board?
28. Why, in general, are the new glues unsuited to the small workshop?
29. What is meant by "wind" in a piece of stock?
30. Which has the larger teeth - a saw with an 8 stamped on the heel or one with a 10 stamped on the heel? What does this number mean?
31. How would you prevent the wood from splintering around the hole when boring through a piece of stock with an auger bit?
32. Does 00 sandpaper or #4 sandpaper have the smaller abrasive?
33. Which are the larger, 8d. or 10d. nails?
34. Where is the downward pressure placed on a plane-when starting the stroke? When finishing the stroke?
35. An auger bit for boring a 1/2 inch hole would be stamped with what number? What does this number mean?
36. What is the most important safety precaution in using a chisel?

37. What do we mean by a hand screw? bar clamp?
38. What is the time necessary for animal glue to set sufficiently for the clamps to be removed?
39. What are the requirements for a wood surface that is to be glued?
40. Should the teeth of a coping saw point toward or away from the handle?
41. What is the most common cause of breaking coping saw blades?
42. What is the source of linseed oil?
43. Is linseed oil considered a wood preservative?
44. Does linseed oil tend to keep wood from absorbing moisture?
45. When boring holes for dowels, what is a good method for checking the size of the bit?
46. Is linseed oil suitable for use on oil stones?
47. Which is the best bit for boring an accurate hole for a dowel, an auger bit or bit stock drill? Why?
48. What is meant by a jointed edge?
49. In a cutting board, which would you consider more essential, beauty or serviceability?
50. Which glue is more suitable for gluing a vegetable cutting board: casein or animal?
51. What is the disadvantage of using "cellulose" type glue on multiple joints?

## CONTRACT IV

This contract is the final test of whether you have mastered the information in your past work. This is a piece of furniture and requires more skill than your past projects. You must be very careful in smoothing the wood surfaces. You cannot cover scratches or defects with filler and varnish.

If you can do superior or excellent work in this project, your future in woodworking will be one of enjoyment, whether it be in the school or in your own shop at home.

The basic requirements are the construction of a project and the learning of certain items listed under "things you are to know."

A. The specifications for the project are:

1. To be made of a suitable hard-wood.
2. Be finished with at least three coats of clear oil varnish
3. To include the following listed operations

B. <u>Things you are expected to do;</u>	<u>Ref.</u>	<u>Unit or Chap.</u>
1. Lay out and test bevels with a sliding T-bevel	1	5
2. Apply stain	2	1
3. Clean and care for stain brushes	2	1
4. Apply fillers	2	2
5. Apply shellac	2	3

	<u>Ref.</u>	<u>Unit</u>
6. Clean and care for shellac brushes	2	3
7. Apply wax	5	7
8. Lay out duplicate parts		
9. Lay out and cut tapers	5	3
10. Apply oil varnish	2	4
11. Clean and care for varnish brushes	2	4
12. Lay out and cut a miter joint	1	30
13. Use a doweling jig	1	29
14. Fasten on a table top		

C. Things you are expected to know:

1. The kinds of finishes in common use; such as stain, oil, wax, shellac, varnish, lacquer, enamel and paint	3	7-8-9
2. The durability of different finishes		
3. The conditions or places in which various kinds of finishes may be used to advantage	3	7-8-9
4. Materials from which finishes are made	3	7-8-9
5. Grades and uses of steel wool		
6. Grades and uses of rotten and pumice stone	2	6
7. The location of important manufacturing concerns		
8. The division of labor in industry		
9. The use of automatic machinery		

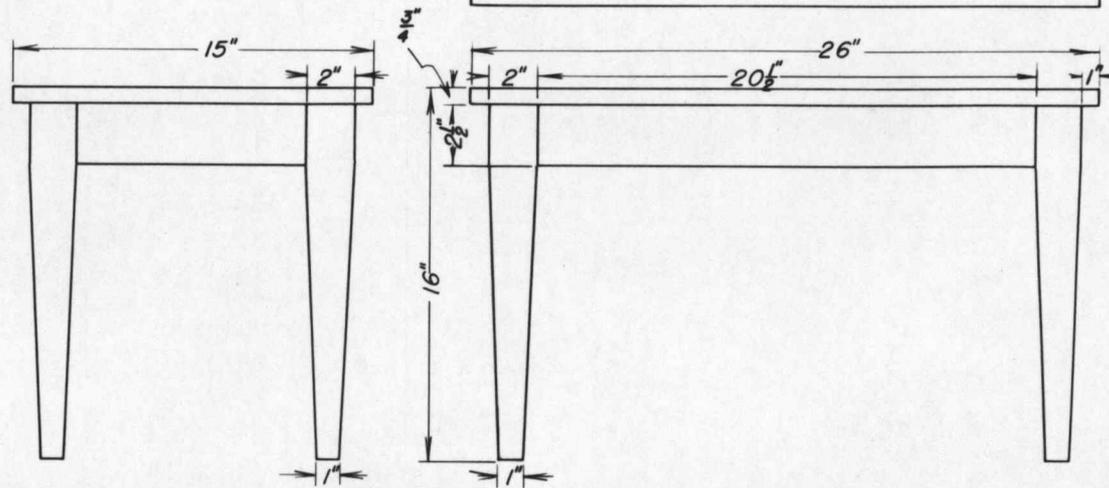
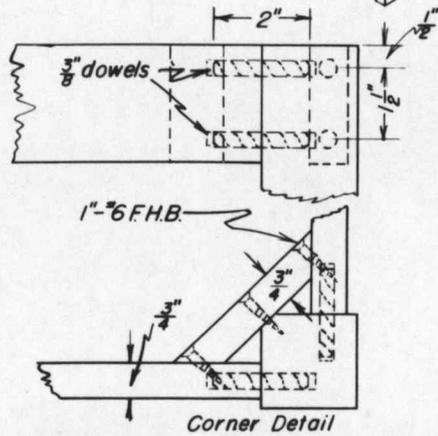
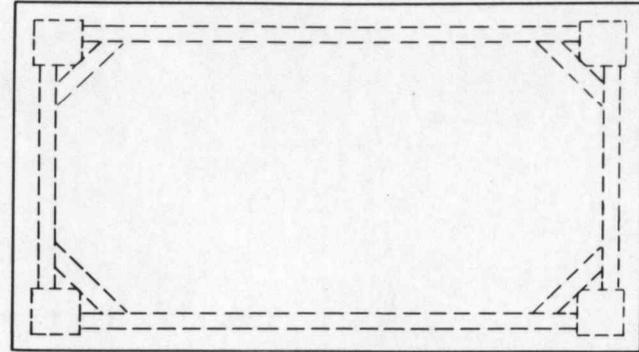
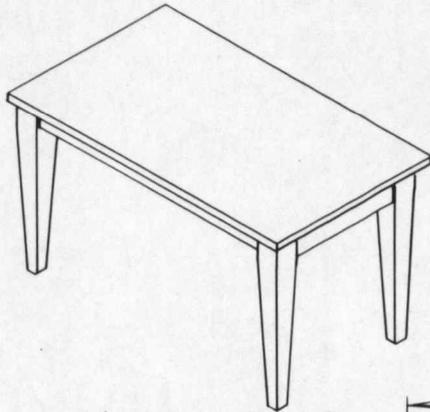
	<u>Ref.</u>	<u>Unit</u>
10. Types of joints and where used	5	4
11. Types of hinges and where used	3	19
12. Types of locks and where used	3	19
13. Special types of fittings	3	19

D. Five tests will be given on the references listed.

Where no reference is indicated in the ref. column, material will be covered by class discussion and demonstration. The reference books are:

1. Brown and Tustison, "Instructional Units in Hand Woodworking."
2. McGee and Brown, "Instructional Units in Woodfinishing."
3. Noble and Everill, "From Forest to Woodworker."
4. Bradley, C. B. "Design in Industrial Arts."
5. Shea and Wenger, "Woodworking for Everybody."

**SUGGESTED PROJECT  
FOR CONTRACT-IV**



**Specifications:**  
 Material—hard wood  
 Finish—stain & filler (if necessary) and  
 oil varnish

**COFFEE TABLE**

Scale:  $1\frac{1}{2}'' = 1'$

## CONTRACT IV

### PLAN OF PROCEDURE FOR SUGGESTED PROJECT

1. Make a working drawing (copy one from chart or make your own).
2. Make out a project card and a bill of material.
3. Get out stock.
4. Cut all stock to size.
5. Plane all surfaces.
6. Smooth surfaces with a cabinet scraper.
7. Lay out and bore holes for dowels.
8. Make trial assembly.
9. Sand all exposed surfaces.
10. Glue and clamp all dowel joints.
11. Fasten corner braces with screws.
12. Check for squareness.
13. Fasten top to rails.
14. Finish sanding.
15. Apply stain (if necessary).
16. Apply sealing coat of shellac.
17. Apply filler (if necessary).
18. Apply first coat of varnish.
19. Rub down with 000 wet sandpaper.
20. Apply second coat.
21. Rub down with #2 pumice.
22. Apply final coat.
23. Rub down with pumice stone (FF).
24. Polish with polishing oil.

## CONTRACT IV REQUIREMENTS

Contract C

1. Make the project as given in the drawing or substitute another drawing of similar construction from a book or magazine.
2. Master the information assigned and presented in class.

Contract B

1. Design and construct your own project similar to the one suggested in the drawing. It should include all of the listed operations.
2. Master the information assigned and presented in class.
3. Submit a notebook with magazine illustrations showing five different period designs. Indicate the approximate period of each design.

Contract A

- 1, 2, 3, same as in Contract B above.
4. What were the important events during these periods of history (no. 3). What can you find concerning industry and manufacturing during these periods?

If you are interested in making a special study of any other phase of woodworking, see instructor for permission to substitute this study for item 3 in Contract B or item 4 in Contract A.

## CONTRACT IV

## METHOD OF GRADING

Bench work and "A" & "B" contract assignments	Grade Points		
	Contract IV		
	C	B	A
Minimum acceptable standards	30	40	50
Average workmanship	40	50	60
Superior workmanship	50	60	70
Excellent workmanship	60	70	80
Maximum grade points for tests	50	50	50
Maximum grade points for contracts	110	120	130

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Report-card grades will be based upon the grade points earned, as outlined above. The student earning the highest number of grade points will receive the highest grades.

## CONTRACT IV

### QUESTIONS FOR STUDY

1. What is the difference between a hardwood and a soft-wood?
2. What is the difference between open grain, and close grain wood?
3. What are some of the qualities that have caused walnut, mahogany and oak to remain popular as a furniture wood?
4. Wood "substance" all weighs the same. What are some of the reasons that lumber varies so much in weight?
5. What depth should the holes be that are bored for the dowels? What is the result if they are too deep? Too shallow?
6. What is meant by a miter joint?
7. What is meant by a miter box?
8. What angle is a common miter joint?
9. What is the advantage of a miter joint in comparison to a square butt joint?
10. How can you lay out a miter joint with the try square?
11. Why is accuracy important in laying out a dowel joint?
12. What is the advantage of a doweling jig?
13. What is the purpose of a groove in the side of a dowel?
14. Is a trial assembly necessary before gluing the dowel joint? Why?
15. Are dowels necessary in edge to edge jointing of a drawing board?
16. What is the difference in a butt hinge and a surface hinge?
17. What is meant by a loose pin butt hinge?
18. How can you tell if a piece of rectangular furniture has square corners, by measuring the diagonals?

19. Which would you consider the best to use in marking the tapers on a table leg; pencil? knife? marking gauge?
20. How many methods of fastening a table top can you name?
21. What is the proper grade of sandpaper to use in the final sanding before finishing?
22. When sawing stock to size, how much should be allowed for planing?
23. What is the reason for using a block for sandpapering?
24. What is the difference in an arris and a corner?
25. Would you consider a table top in good proportion that measures 3 feet by 6 feet?
26. What is a good wood for a gun stock?
27. What is a good wood for a hammer handle?
28. What do we call the unusual enlargements on a tree from which ornamental veneers are cut?
29. Animal glue is thinned with what thinner?
30. The layer of a tree trunk that represents a growing period is called by what name?
31. What is the standard order of giving the dimensions of lumber?
32. What do we call a rectangular groove cut across the grain of a piece of stock?
33. Very thin wood used in making plywood is called by what name?
34. What is the order of applying varnish, stain and filler to a piece of furniture?
35. What is the danger in leaving waxed or oily rags in the finishing room?
36. What is the purpose of filler?
37. What is the purpose of a coat of shellac when used between the stain and filler?

38. What is an advantage of lacquer as compared to oil varnish?
39. Does a coat of stain, filler and varnish conceal sandpaper scratches?
40. Why is it important to have clean brushes and a clean room for varnishing?
41. What is used for a shellac thinner?
42. How long does it take for shellac to dry, when put on as a wash coat?
43. Should vigorous brushing\*be used when applying oil varnish? Why?
44. Which is considered the best for outdoor use, spar varnish? shellac? Why?
45. What is the principal ingredient of lacquer?
46. Which is considered the faster cutting when used on varnish, pumice or rotten stone?
47. Will pumice stone cut faster when used with oil or water?
48. What is the purpose of rubbing a coat of varnish before applying the next coat?
49. What is the use of stick shellac in finishing?
50. What is "wet or dry" sandpaper?

APPENDIX C

CONTRACT I

TRUE-FALSE TEST

This is a true-false test. If you think a question true circle the T; if false circle the F. Do not guess.

Example: The edge of the wood chisel is hollow ground T F

1. The plane iron is the part of the plane that does the cutting . . . . . T F
2. The purpose of a plane iron cap is to curl the shavings as they are cut by the plane iron . . . . T F
3. The lateral adjusting lever raises and lowers the plane iron and adjusts the depth of cut . . . . . T F
4. After planing with a jack plane, the surface is ready for painting . . . . . T F
5. A jointed edge is an edge that is straight and true, such as one that is to be glued to another surface . . . . . T F
6. Chamfering is the process of removing the sharp arris from a piece of stock . . . . . T F
7. When marking a line for a chamfer, it is better to use a marking gauge than a pencil . . . . . T F
8. A sliding T-bevel is the tool used to check the angle of a chamfer . . . . . T F
9. The angle of the cutting edge of a plane iron depends to a certain extent on the work to be done . T F
10. A jack plane is usually shorter than a block plane T F

## CONTRACT I

## COMPLETION TEST

This is a completion test to check your progress.

Write in the omitted word or words to complete the sentence.

Example: The three most common kinds of screw heads are

1. flat            2. oval            3. round .

1. The two most common kinds of working drawings are . . .  
 1. \_\_\_\_\_ 2. \_\_\_\_\_
2. Lumber is usually sold by the 1. \_\_\_\_\_  
 or 2. \_\_\_\_\_.
3. A line of short dashes on a drawing indicates \_\_\_\_\_  
 \_\_\_\_\_.
4. S-2-S means \_\_\_\_\_.
5. After a 1" x 4" is surfaced, we can expect it to be approximately \_\_\_\_\_.
6. By "scale" of a drawing we mean \_\_\_\_\_.
7. The width of a board is \_\_\_\_\_.
8. The length of a board is \_\_\_\_\_.
9. When measuring lumber per "M" means \_\_\_\_\_.
10. Two pieces of lumber 1" x 6" x 24 ft. contains \_\_\_\_\_  
 \_\_\_\_\_ Bd. Ft.

CONTRACT I  
MULTIPLE CHOICE TEST

Draw a circle around the correct answer.

Example: Nails are usually sold by the 1. gross, 2. hundred, 3. pound, 4. ream.

1. At \$120.00 per M., 20 board feet of lumber will cost  
1. 60¢, 2. \$1.20, 3. \$2.40, 4. \$12.00.
2. Which of the following are often made with butt joints?  
1. window sash, 2. picture frames, 3. floor lamps.
3. The abbreviation S-2-S means 1. sand, 2 surfaces,  
2. square 2 sides, 3. surface 2 sides.
4. The cabinet scraper should be used 1. parallel with the  
grain, 2. across the grain, 3. makes no difference.
5. Different grades of sandpaper mean 1. the difference in  
price, 2. the difference in cutting qualities, 3. the  
difference in size of the abrasive.
6. The correct way to sand is parallel with the grain of  
the wood because 1. the grain conceals the scratches,  
2. the sandpaper cuts faster in this direction,  
3. the paper will not wear so quickly.
7. The best way to divide sandpaper into smaller sheets is  
to 1. cut with a sharp knife, 2. tear over the arris of  
the bench, 3. cut with a crosscut saw.

8. The edge of a cabinet scraper is turned by the use of  
1. oil stone, 2. emery wheel, 3. burnisher, 4. edge  
of bench.
9. The use of the cabinet scraper should come 1. after  
the sanding, 2. before the sanding, 3. before planing.
10. By burnishing the edge of a scraper we mean 1. turning  
the edge, 2. sharpening with a file, 3. sharpening  
on the oil stone.

CONTRACT I

CONTROLLED WOODWORKING TEST

Answer each question as definitely as you can.

Example: List three reasons why nails are often used in preference to screws.

- 1. quicker
- 2. cheaper
- 3. easier to use

- 1. List two advantages of using screws in preference to nails.
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
- 2. Name the three kinds of wood screw heads.
  - a. \_\_\_\_\_ b. \_\_\_\_\_ c. \_\_\_\_\_
- 3. Name the four types of common wire nails. a. \_\_\_\_\_  
b. \_\_\_\_\_ c. \_\_\_\_\_ d. \_\_\_\_\_
- 4. List 4 ways of fastening a butt joint. a. \_\_\_\_\_  
b. \_\_\_\_\_ c. \_\_\_\_\_ d. \_\_\_\_\_
- 5. What are the two kinds of bits used in a brace?
  - a. \_\_\_\_\_ b. \_\_\_\_\_
- 6. The size of these 2 bits (ques. 5 above) are indicated by a. \_\_\_\_\_ b. \_\_\_\_\_
- 7. The term depth gauge, as applied to a bit means \_\_\_\_\_  
\_\_\_\_\_

8. The abbreviation F. H. B. as applied to screw specifications means \_\_\_\_\_
9. What does the term "pilot hole" mean in reference to applying screws? \_\_\_\_\_  
\_\_\_\_\_
10. A countersink is a tool for \_\_\_\_\_.

## SUBJECTIVE TEST

1. What is meant by a paint vehicle?
2. What is the most common paint thinner?
3. What kind of western soft wood would be adapted to each of the following:
  - a. shingles \_\_\_\_\_
  - b. siding \_\_\_\_\_
  - c. interior trim \_\_\_\_\_
  - d. flooring \_\_\_\_\_
  - e. framing \_\_\_\_\_
  - f. window sash \_\_\_\_\_
4. Give two reasons for the use of paint on surfaces exposed to the weather.
5. What is a good method of cleaning and storing paint brushes where they are to be used once a month?
6. What is a good method of caring for paint brushes where they are to be used every day?
7. What do we mean by "setting" nails?
8. What are three most common abrasives that are used on paper and cloth backing for woodworking?

9. How far should the plane iron cap of a jack plane be set from the cutting edge of the plane iron?
  
10. What is the advantage of using a sealing coat of shellac on knots before applying paint?

## CONTRACT I

## RECOGNITION TEST

Several pictures of woodworking tools will be shown on the screen for you to identify. Each tool will have a number. Place the name of the tool opposite the corresponding number below.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

## CONTRACT II

## TRUE-FALSE TEST

If you think a question is true, circle the T; if false circle the F. Do not guess.

- Example: The block plane is shorter than the jointer plane . . . . . T F
1. Our main source of redwood lumber is from the state of New York . . . . . T F
  2. Sugar pine is too soft to make good floors for a dwelling house . . . . . T F
  3. A spokeshave has the same cutting action as a plane, but has a shorter bed . . . . . T F
  4. The inside bevel gouge is sharpened with a slip-stone . . . . . T F
  5. The degree of curve of a gouge is called the "sweep" . . . . . T F
  6. A plane iron should have a "wire edge" to cut properly . . . . . T F
  7. A template is a pattern for cutting stock to a definite shape . . . . . T F
  8. When planing mill marks from a board one heavy cut should be taken with the plane . . . . . T F
  9. Identical parts are parts that are exactly the same . . . . . T F
  10. Douglas fir is one of our most popular hard woods . . . . . T F

CONTRACT II  
COMPLETION TEST

Write in the omitted word or words to complete the sentence.

Example: Three woods used in house construction of the west coast are:

a. Douglas Fir

b. Ponderosa Pine      c. Redwood

1. The two methods used in drying lumber are  
a. \_\_\_\_\_ b. \_\_\_\_\_
2. By veneer we mean a \_\_\_\_\_ wood.
3. Lumber is usually sold by the \_\_\_\_\_ foot.
4. Rayon and cellophane are made from \_\_\_\_\_.
5. Two or more layers of veneer glued together is called \_\_\_\_\_.
6. The annual ring represents \_\_\_\_\_.
7. The growth of a tree takes place in \_\_\_\_\_.
8. By verticle grain lumber we mean \_\_\_\_\_  
\_\_\_\_\_
9. A burnisher is a tool used to \_\_\_\_\_  
\_\_\_\_\_.
10. The bit used to bore a hole for the shank of a #10 screw is \_\_\_\_\_/64<sup>th</sup> inches. The pilot hole for the same screw in softwood should be \_\_\_\_\_/64<sup>th</sup> inches.

## CONTRACT II

## MULTIPLE CHOICE TEST

Draw a circle around the answer that you consider the most correct.

Example: The edge of a cabinet scraper is turned by the use of

- a. oil stone, b. emery wheel,  
c. burnisher, d. edge of bench.

1. Plywood warps a. about the same, b. more, c. not as much as solid wood of the same size.
2. Lumber dries faster a. when cut and piled, b. when still in the log, c. when in the kiln.
3. The heart wood of a tree is a. dead wood, b. where the growth takes place, c. where the sap circulates.
4. A planer is a machine for a. sawing lumber, b. smoothing the surface, c. sanding lumber.
5. Moisture causes wood to a. shrink, b. swell, c. has no effect on size.
6. In drying, warp is more likely to occur in a. verticle grain lumber, b. slab sawn lumber.
7. The size of a gouge is indicated by the a. the length of the handle, b. the length of the blade, c. the width the cutting edge.
8. The nails that we use are a. cut nails, b. wire nails, c. forged nails.
9. Which of the following rectangles would you consider more pleasing? a. 4 in. x 8 in., b. 8 in. x 12 in. c. 8 in. x 11 in.
10. The advantage of anchoring screws in dowels, when used in end grain wood is a. it makes the screw hold better, b. it makes the screw easier to drive, c. it makes the screw self tightening.

## CONTRACT II

## SUBJECTIVE TEST

State the answers to the questions in short, concise terms.

1. What is the purpose of an undercoat?
2. How does enamel differ from paint in composition?
3. What is our source of shellac?
4. What is the result if enamel is brushed vigorously when being applied?
5. What is the purpose of an undercoat for enamel?
6. What is the chief difference in the action of pumice stone and rotten stone?
7. Why is enamel more suited than paint for the finish on furniture?
8. What size screwdriver should be used for driving a screw?
9. What thinner should be used for shellac?
10. What is meant by "wet" sandpaper?

## CONTRACT II

## RECOGNITION TEST

Several pictures of woodworking fasteners will be shown on the screen for you to identify. Each fastener will have a number. Place the name of the fastener opposite this number below.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

## CONTRACT III

## TRUE-FALSE TEST

If you think a question is true circle the T; if false circle the F.

Example: Douglas Fir is one of our most popular hard woods . . . . . T F

1. Casein glue is made from milk . . . . . T F
2. Animal glue is very water resistant . . . . . T F
3. Surfaces of glue joints should be well sanded before gluing . . . . . T F
4. When wood is dried, it shrinks more across than along the grain . . . . . T F
5. Animal glue is easier to apply and holds better if the surfaces to be glued are cold . . . . . T F
6. Douglas Fir is a very good wood for drawing boards . . . . . T F
7. A laminated board has less tendency to warp than a solid board . . . . . T F
8. Animal glue should be boiled to get it to dissolve properly . . . . . T F
9. Redwood is an ideal wood for food cutting boards. T F
10. A marking gauge is used to gauge lines parallel to the face side or face edge . . . . . T F

## CONTRACT III

## COMPLETION TEST

Fill in the blank lines with the word or words to complete the sentence.

Example: The two methods used in drying lumber are

air and kiln.

1. The setting of the marking gauge is checked with a \_\_\_\_\_.
2. The bevel of a \_\_\_\_\_ plane iron is on top when assembled in the plane.
3. The plane used to plane long true surfaces is a \_\_\_\_\_.
4. The saw that is used to saw along the grain is called \_\_\_\_\_.
5. The long steel clamps are called \_\_\_\_\_.
6. The number on the heel of a saw indicates \_\_\_\_\_.
7. The way to distinguish between a cross cut or a rip-saw is by \_\_\_\_\_.
8. A saw kerf is \_\_\_\_\_.
9. Linseed oil is obtained from \_\_\_\_\_.
10. The kinds of glue used in the shop are \_\_\_\_\_,  
\_\_\_\_\_ and \_\_\_\_\_.

## CONTRACT III

## MULTIPLE CHOICE TEST

Draw a circle around the right answer.

Example: Moisture causes wood a. to shrink, b. to swell

1. The saw cut should a. be on the side of the line next the stock to be used, b. be on the waste side of the line c. remove the line.
2. Sandpaper with #4 abrasive is a. coarser than, b. finer than, c. about the same as, number 00.
3. Casein glue should set sufficiently in a. two hours, b. 6 hours, c. 12 hours, so the clamps may be removed.
4. Coping saw blades usually break as a result of a. sawing too fast, b. getting too hot, c. twisting or bending the blade.
5. The oil used on an oil stone is a. linseed oil, b. light machine oil, c. olive oil.
6. The most important consideration when designing a cutting board is a. beauty, b. function.
7. The term S-4-S means a. surface four sides, b. smooth four corners, c. square four edges.
8. The cabinet scraper should be used a. before sanding b. after sanding, c. before planing.
9. In measuring lumber "M" means a. million, b. thousand, c. more than two.
10. The board feet in two pieces 2 in. x 12 in. x 24 ft. are a. 48, b. 64, c. 96.

## CONTRACT III

## SUBJECTIVE TEST

Answer each question as definitely as you can.

Example: Name the two kinds of bits that are used in a brace?

- a. auger bit
- b. bit stock drill

1. What are the usual steps in squaring up a board?
2. Why should we postpone sanding until all edged tool work is completed?
3. If a jack plane cuts deeper on one side of the blade than the other, how is it corrected?
4. What is meant by saw "set?"
5. What is the size of a board foot?
6. Draw two sketches showing the difference in a bevel and a chamfer?
7. What is meant by cross planing?
8. What is meant by face side?
9. What determines the direction of the stroke in planing?
10. Why is a surface planed?

## CONTRACT IV

## RECOGNITION TEST

PUPIL'S NAME \_\_\_\_\_ DATE \_\_\_\_\_

Several pieces of numbered wood samples will be passed to you for identification. Take your place at your bench and when you receive the sample write the name of the wood and information requested opposite the corresponding number below.

<u>NAME OF WOOD</u>	<u>CLOSE GRAINED</u>	<u>OPEN GRAINED</u>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

## CONTRACT IV

## TRUE-FALSE TEST

If you think the question is true circle the T; if false circle the F.

1. The difference in hardwood and softwood is in the density . . . . . T F
2. Black walnut is an open grain wood . . . . . T F
3. The angle of most miter cuts is  $90^{\circ}$  . . . . . T F
4. Holes for dowels should be slightly deeper than the length of the dowel to allow for glue space . . . . . T F
5. Wood "substance" (wood with air, minerals etc. removed) will not float in water . . . . . T F
6. The purpose of a groove in the side of a dowel is to allow the air and surplus glue to escape . . . . . T F
7. The purpose of a trial assembly is to determine the fit of all parts . . . . . T F
8. House door hinges are usually of the loose pin, butt type . . . . . T F
9. When sawing stock to size,  $1/4$  inch should be left for planing . . . . . T F
10. Douglas Fir is a very good wood for hammer handles . . . . . T F

## CONTRACT IV

## COMPLETION TEST

This is a completion test to check your progress.

Write in the omitted word or words to complete the sentence.

Example: A line of short dashes on a drawing indicates an invisible outline

1. The beauty of the veneer obtained from burl is the \_\_\_\_\_.
2. Animal glue is thinned with \_\_\_\_\_.
3. The three dimensions of lumber are usually written in the following order \_\_\_\_\_.
4. The layer of a tree trunk that represents a growing period is called \_\_\_\_\_.
5. A rectangular groove cut across the grain of the wood is called \_\_\_\_\_.
6. The order of applying varnish, filler, and stain are  
a. \_\_\_\_\_, b. \_\_\_\_\_, c. \_\_\_\_\_.
7. The purpose of paste wood filler is \_\_\_\_\_.
8. Shellac is thinned with \_\_\_\_\_.
9. Lacquer is thinned with \_\_\_\_\_.
10. A \_\_\_\_\_ should be used for marking where the greatest accuracy is desired in the lay-out.

## CONTRACT IV

## MULTIPLE CHOICE TEST

Draw a circle around the correct answer.

Example: The edge of a cabinet scraper is turned by the use of; a. oil stone, b. emery wheel, c. burnisher, d. edge of the bench

1. When laying out the tapers on a table leg the lines should be scribed with a a. knife, b. pencil, c. marking gauge.
2. An excellent wood for making gun stocks is a. black walnut, b. oak, c. alder.
3. The best transparent finish for wood exposed to the sun and rain is a. spar varnish b. lacquer, c. shellac.
4. Which of the following is used for the final rubbing of varnish where an exceptionally smooth finish is desired? a. pumice stone? b. rotten stone?
5. a. Maple, b. Oak, c. Douglas fir, is an open grained wood and requires paste wood filler.
6. Surplus paste filler is removed with a. brush, b. burlap, c. soft cloth.
7. Stick shellac is applied to wood defects by means of a. brush, b. the fingers c. a hot piece of metal.
8. Brown and Tustison recommend a. #2, b. #0000, c. #0

grade of garnet sandpaper for final sanding, before the application of a finish.

9. A piece of stock is  $1/16$  inch too large; a. sandpaper, b. a plane, c. a scraper, would be used to remove the extra material.
10. When sanding varnish the sandpaper should be "backed" with a. a wooden sandpaper block, b. the fingers, c. a felt block.

## CONTRACT IV

## SUBJECTIVE TEST

State the answers to the following questions in short concise terms.

1. Give a use to which each of the following wood is especially suited?
  - a. Hickory \_\_\_\_\_
  - b. Ash \_\_\_\_\_
  - c. Yew \_\_\_\_\_
  - d. Spruce \_\_\_\_\_
  - e. Mahogany \_\_\_\_\_
  - f. Hard Maple \_\_\_\_\_
  
2. What are the requirements of a finishing room where varnish is to be applied?  
\_\_\_\_\_  
\_\_\_\_\_
  
3. Give 3 reasons why it is better to have a working drawing, than to work without plans for a project?
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_
  - c. \_\_\_\_\_
  
4. Why is quarter sawed lumber preferred in oak lumber?  
\_\_\_\_\_  
\_\_\_\_\_
  
5. How can you tell the approximate age of a tree?  
\_\_\_\_\_  
\_\_\_\_\_
  
6. Which two kinds of wire nails would you use if the head is to be hidden? \_\_\_\_\_
  
7. How is the length of brads indicated \_\_\_\_\_  
\_\_\_\_\_
  
8. What size hole would be made by a number 8 auger bit?  
\_\_\_\_\_

