

AN OUTLINE FOR INDIVIDUAL INSTRUCTION SHEETS
FOR SEVENTH AND EIGHTH GRADE
WOODWORK

By

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PREFACE AND ACKNOWLEDGMENTS

The aim of this thesis is to develop a course of study for woodwork in the seventh and eighth grades that could be analyzed into instructional units for the writing of instruction sheets.

For the assistance rendered by a number of publishers, friends, and co-workers, acknowledgment is here made. To the Manual Arts Press the writer is indebted for the loan of many books and for permission to use its illustrations in his set of instruction sheets; to Mr. Harry E. Wood, Director of Practical Arts, Indianapolis Public Schools, and to the corps of teachers working under him for the many project sketches and for encouragement; to the group of teachers over the state who answered the questionnaires and made helpful comments; and to Mr. Huntington, Mr. Yeager, and Mr. Abell, whose thoughtful guidance in methods of procedure and criticism of the manuscript have added much to the value of the completed work, the writer expresses appreciation. To Mrs. Margaret McWethy, who did the grammatical editing, and to the author's wife, who did the typing, this thesis is dedicated.

J. S. M.

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I. INTRODUCTION

A. Statement of the Problem

In attempting to write a set of instruction sheets for seventh- and eighth-grade woodwork the writer was faced with two problems which had to be overcome before the sheets were written. They were: (1) What are the units of instruction that should be taught in such a course? and (2) What is the form of the sheet to be used?

Since there is not a standard course of woodwork followed in Indiana, it was necessary to ascertain from the teachers of the state what they believed should be taught in such a course. This was done by sending questionnaires to all teachers listed as teaching seventh and eighth grade woodwork and then tabulating the results into instructional units.

In surveying the types of instruction sheets on the market, the writer found that no standard form is used. A study was made of all instruction sheets obtainable, and the best features of each were blended into a type which is herein presented as a model.

To make the study complete, with the questionnaire was sent a list of 120 selected projects from which the teachers selected twenty-four which they considered the best for presenting the instruction to their classes.

Thus knowing what should be taught, the type of projects to teach, and the form of the instruction sheets to be used, each teacher who so desires may write a set of instruction sheets which fits his own particular teaching problems.

B. Reasons for the Study

Because of the unusual economic conditions of the past few years and the resulting widespread reorganization of curricula, the teachers of industrial arts in the grades below high school are facing the problems of increased enrollment in classes and shorter teaching periods. In order to maintain the quality of their work under these new conditions teachers must bring to their aid some means that will enable them to present their subject-matter more effectively to their students.

Industrial arts teachers have made new applications of the individual instruction movement, but much of the success they have attained is to be attributed to the fact that heretofore they have dealt with a relatively small number of students in their classes. Now, if their classes are to be enlarged to be on a par with those of academic teachers, will they be able to use the same individual instruction methods as before and still do effective teaching? Obviously not. But to give up individual instruction would be a step backward. No one refutes its advantages. If this very desirable method is to remain practicable under these changed conditions and still maintain its high level of effectiveness, it seems imperative to provide some adequate means of supplementing the work of the teacher. This may possibly be done by bringing some means of visual supplementary instructional material to the aid of the teacher.

Industrial arts teachers have never been friendly to the use of textbooks in shop class-work and no doubt are justified in this attitude. They have relied upon demonstration and lectures, supplemented by individual instruction, to accomplish

their purposes. However, under present conditions the time-element is limiting the individual instruction to a minimum.

To meet the situation there seems to be but one solution: the use of properly written and carefully selected instruction sheets.

This study attempts to show the method of selection of topics that should be taught and the correct form of instruction sheets for general class-work in the subject of woodwork for grades seven and eight. The criteria here used can be applied to other subjects and other grades. The author chose woodwork in the seventh and eighth grades because he is most familiar with this grouping.

C. How the Study Was Made

The ultimate purpose of this study is to set up criteria for the writing of individual instruction sheets for a shop course in industrial arts. For an instructor to attempt to write all the sheets necessary for a given subject is a stupendous task, especially when he has no assurance the work when completed will be a success. Before the sheets can be written, it is first necessary to determine what to teach. Not only the units that deal with manipulative skill but also those that deal with the informational side of the subject must be considered. Secondly, the instructor must have some form to follow. Since there are many types of instruction sheets in use, it is difficult to tell which one to choose. The author endeavored to analyze the two problems in the following manner.

In the first place a questionnaire was sent to all persons listed as teaching seventh- and eighth-grade woodwork in Indiana,

and from them the course of study was arrived at. In the second case an analysis was made of many instruction sheets both commercial and private, and a form for the sheets was determined from this analysis.

To go a step further a study was made of the purpose of the junior high school with special reference to the part industrial arts plays in its curriculum. This was done to afford the proper background for the rest of the study and to help to keep foremost in mind that this is an educational problem and not one wherein manipulative skill alone is the determining factor.

II. THE IMPORTANCE OF INDUSTRIAL ARTS AS A CONTRIBUTING FACTOR TO THE JUNIOR HIGH SCHOOL

Today educators recognize the junior high school as an integral part of the school curriculum, but it is enlightening to look back and see the aims and objectives advanced for this particular type of school as a foundation upon which to base any study on a part of its curriculum.

A. Purpose of the Junior High School

Smith, in his book The Junior High School¹, devotes a chapter to the major purposes of the junior high school as advanced by some sixteen representative leaders in the movement and summarizes those which stand out most prominently. Arranged in the order of the emphasis accorded them, they are as follows:

I. To provide a suitable educational environment for children approximately twelve to sixteen years of age.

II. To explore the interests, abilities, and aptitudes of children of junior-high-school age.

III. To explore the major fields of human endeavor.

IV. To provide for individual differences.

V. To continue common integrating education.

VI. To provide for a more gradual transition from elementary to secondary education.

¹Wm. A. Smith, The Junior High School (New York: Macmillan Co., 1925), p. 203.

VII. To democratize the school system.

VIII. To effect economy of time in education.

IX. To provide for socialization.

X. To provide vocational training for those who must leave school early.

Smith² goes on to say that the above contains considerable overlapping; then he organizes the purposes under these three main headings:

I. To provide a suitable educational environment for children approximately twelve to sixteen years of age.

II. To democratize the school system.

III. To effect economy of time in education.

Struck³ says there are three community objectives worked toward in the junior high school:

I. Better economic conditions.

II. Better social conditions.

III. Better civic conditions.

The Department of Superintendence of the National Educational Association in its Fifth Yearbook⁴ gives the objectives of the junior high school as follows:

1. The retention of pupils in school.
2. The recognition of individual differences.
3. Providing for differentiated curricula.

²Wm. A. Smith, op. cit., p. 204.

³T.F. Struck, Methods in Industrial Education, (New York: J. Wiley and Sons, 1929), p. 198.

⁴Fifth Yearbook of the Department of Superintendence, N.E.A., (1927) Chapter XVII, p. 406.

4. Providing opportunities for educational and vocational guidance through exploratory courses.

5. Providing means for prevocational and vocational training.

6. Providing for better teaching and scholarship through departmentalized organization and specialized teaching.

7. Preparing pupils better to perform the academic work of the senior high school.

8. Providing training in the ideals of citizenship.

Briefly, we have here a picture of the junior high school as a new idea in modern education with the definite aim and objective of providing a differentiated curricula to stimulate and guide pupils through the adolescent period. One of the acknowledged means to gain the desired reactions is some type of shop-work.

B. Importance of Industrial Arts in the Junior High School

The junior high school when first introduced laid great stress on the manual activities in its curricula. While today the manual activities have become more nearly balanced with the other subjects, the industrial arts work still plays an important part in the successful plan of any junior high school.

Why has industrial arts played such an important role in this transition period in the child's life, and why should it continue to do so? Turning to the authorities on junior high school curricula construction, we find many arguments in favor of the manual activities.

The Fifth Yearbook of the Department of Superintendence of

the N.E.A. (1927)⁵ gives the following objectives of the manual arts:

1. To develop handiness.
2. To promote the immediate carrying of ideas into action.
3. To help, through exploratory courses, in the discovery of special interests and attitudes important for proper educational and vocational guidance.
4. To provide a means for developing technical skill.
5. To provide a means for imparting technical knowledge.
6. To enable the pupil to apply the test of practice to some of his thinking.
7. To develop the mind by providing constructive problems, in materials, which demand a vigorous mental reaction.
8. To interest in school work, through the concrete application of theory to practice, those pupils to whom the academic studies do not appeal strongly.
9. To create interest in the arts and industries without any reference to their vocational significance.
10. To enable the pupil, through the making of minor repairs and the undertaking of minor construction in the home, to contribute to its economic and material upkeep.
11. To enable the pupil, through participation in cooperative problems, to perform better his duty as a member of his home, his school, and his country.
12. To serve as an introduction to vocational and prevoca-

⁵Fifth Yearbook of the Department of Superintendence, N.E.A. (1927), p. 406.

tional training.

Snedden⁶ says there are at least eight fairly distinguishable purposes that might be realized through industrial arts projects and related intellectual studies by boys from twelve to fifteen years of age:

1. The training of "hand and eye" (formal discipline).
2. Definite training towards a future vocation (prevocational training).
3. Assistance in vocation finding (guidance).
4. Utilizes appreciation.
5. Development of "handy man" and vocational interests, skills, and appreciation.
6. Development of economic and other appreciations of major fields of the world's work (civic values).
7. Centers of correlation for studies intrinsically abstract.
8. Provision of opportunities for developmental experience.

William E. Warner⁷, of the Ohio State University, says in the selection of objectives there are fifteen specific notions or central purposes as selected from books, courses of study, periodicals, government bulletins, and the annual reports of the National Education Association, which fairly represent objectives used during the last fifty years:

⁶David Snedden, "Industrial Arts in the Junior High School Certain Postulates and Hypotheses." T.C. Record, Vol. 27.

⁷William E. Warner, Policies of Industrial Arts Education. Ohio State University Press, 1928.

1. Exploration.
2. Educational guidance.
3. Vocational guidance.
4. Consumers' knowledges and appreciations.
5. Household mechanics.
6. Social habits and attitudes.
7. Prevocational purposes.
8. Avocational purposes.
9. A degree of skill.
10. The seven cardinal principles.
11. Mechanical intelligence.
12. Correlation with other subjects.
13. Developing the "faculties".
14. Coordinating the "hand and eye".
15. Vocational training.

It may be assumed, then that the following objectives are relatively more important than the remainder for industrial arts of the junior high school: exploration, educational guidance, vocational guidance, consumer's knowledge, household mechanics, social habits and attitudes, avocational purposes, and a degree of skill.

Before adopting these, however, it should be remembered that serious question was raised concerning the importance or unimportance of: educational guidance, vocational guidance, prevocational purposes, mechanical intelligence, and correlation.

Relative unimportance is attached to the first two of the following objectives, while definite disapproval is made of the last three: prevocational, the seven cardinal principles, developing the faculties, coordinating the hand and eye, voca-

tional training.

On the same subject, Struck⁸ says, "Industrial Arts education aims to give exploratory, try-out, and guidance training. It seeks to make persons intelligent consumers and aims to give an appreciative understanding of what the world is doing industrially. Vocational education on the other hand seeks to develop specific vocational competence..... It aims to make an efficient producer at the same time it is making a better citizen."

Struck⁹ gives his aims for industrial arts as follows:

1. To provide exploratory experiences in the realm of the industrial arts.
2. To enable pupils to get try-out experiences with a variety of tools, materials, and processes.
3. To develop a better understanding and fuller appreciation of what the world is doing.
4. To develop desirable physical skills and habits.
5. To develop a keener and more discriminating taste concerning proper materials, good construction, and appropriate and beautiful design.
6. To stimulate and develop desirable attitudes and ideals.
7. To increase the pupil's knowledge concerning man's industrial accomplishments and aims.
8. To develop the general intelligence through a combination of mental and physical work.

⁸T. F. Struck, op. cit., p. 79.

⁹Ibid., p. 79.

9. To give prevocational training through contact with typical elements of trades and occupations.

A statement of aims and objectives of industrial arts in the junior high school, as prepared by Frank Leavitt¹⁰, is given in the Fifth Yearbook of the Department of Superintendence of the National Education Association:

1. The retention of pupils in school.
2. The recognition of individual differences.
3. Providing for differentiated curricula.
4. Providing opportunities for educational and vocational guidance through exploratory courses.
5. Providing means for prevocational and vocational courses.
6. Providing for better teaching and scholarship through departmentalized organization and specialized teaching.
7. Preparing pupils to better perform the academic work of the senior high school.
8. Providing training in ideals of citizenship.

Cox¹¹ gives seven core-curricula of the junior high school. One of these is practical arts, concerning which he says: "The desire and ability to sew, to cook, to repair, and to construct in connection with the activities of home and school and neighborhood are of greatest importance in the normal functioning of these institutions."

¹⁰ Frank Leavitt, Fifth Yearbook of the Department of the National Education Association.

¹¹ Phillip W. Cox, The Junior High School and Its Curriculum, (Boston: Scribners, 1929), p. 20.

Later on in his book he says: "Practical arts in the Junior High School functions, however, to co-ordinate the practices and uses which involve the use of concrete materials and tools and processes. As such, the activities of practical arts classes re-enforce and make more meaningful the activities of the other required and elective subjects, on the one hand, and, on the other hand, they find their practical applications in promoting better homes, better neighborhoods, and other better social participations and individual adequacies."¹²

Quoting from Selvidge and Fryklund¹³, we find: "There are certain fundamental skills, attitudes, and habits that are common to many types of work that may be developed through one type of work almost as well as through another. The emphasis, therefore, should be placed upon the things we wish to teach rather than upon the things we wish to make. Neither broad, general objectives nor a list of projects constitute a satisfactory program. One program should be expressed in terms of the information, the attitudes, the interests, the skills, and the habits of work we expect the boy to have when he has completed his period of training. These may be expressed as follows:

1. A well-developed interest in industrial affairs.
2. How to care for and use properly the things we buy.

¹²Phillip W. Cox, op. cit., p. 26.

¹³R.V. Selvidge and V.C. Fryklund, Principles of Trade and Industrial Training, (Peoria, Illinois: Manual Arts Press, 1930), p. 36.

3. Appreciation of good workmanship and good design.
4. Attitude of pride and interest in one's ability to do things.
5. A feeling of self-reliance or confidence in one's ability to take care of oneself in an unusual situation.
6. A habit of orderly and methodical procedure in the performance of any task.
7. Knowledge and understanding of the conventions of mechanical drawing, and ability to express one's ideas accurately by means of a drawing.
8. Elementary skills in the use of the more common tools and machines, and in the methods of modifying and handling materials."

Continuing, Selvidge and Fryklund¹⁴ attempt to show how industrial arts work helps to contribute to general education.

"The general purpose of education and training is to aid the individual in living a useful, happy, and successful life to as high a degree as is possible in view of his abilities. In order to do this, it is necessary that he should know the social conventions of language, manners, and the customs of the group in which he moves. It is also necessary for him to have the information and a knowledge of the facts that are known to the majority of his group. In addition to this, he must have certain attitudes and ideals which make for social betterment.

¹⁴R.V. Selvidge and V.C. Fryklund, op. cit., pp. 34, 35.

He must be self-reliant, capable, and self-respecting. In his vocation he must be competent.

"In the teaching of trade and industrial subjects we are interested chiefly in those experiences which build up the doing side of our ideal---the things which tend to make one competent in his vocation, or which enable one to meet with confidence the situations in his daily life in which some mechanical ability, elementary skills, or knowledge of industrial practices are required. We are, therefore, confronted with the question of what the individual must know and be able to do with respect to industrial practices and processes, in order that he may attain the ideal we have set up for him.

"The question is more difficult in the field of industrial arts than it is in the field of trade education, for the reason that in the field of trade education the scope is relatively limited, while in the field of industrial arts a very wide range of experiences may contribute with equal effectiveness to the desired end. In this field we seek to give the youth the information and experiences which will interest him in industrial life and enable him to do effectively the things that most boys and men are called upon to do without respect to their vocation. It is by no means necessary to give the pupil training in making the identical things he later may be called upon to make, but it is important that we give him experiences capable of wide application, and develop in him a habit of orderly procedure and systematic work which will be of value to him in any line of endeavor."

Any school system that attempts a junior-high-school program, if it be a true program in the sense we have come to look

upon such an organization, must give an important position to the manual arts activities. The subject matter of the activities should not be vocational in character but of general educational experiences that will enable the boy to meet the situations in life that he will be called upon to face regardless of his vocation.

C. Woodwork as a Subject for Realizing the Objectives

The relative importance of various subjects to be included in the industrial arts curriculum of a junior high school has been and still is a source of controversy with some school administrations. In some schools the work is all of a general shop nature; in others it is built on the home mechanics idea. Other schools divide the work so that the boys receive experience in a different subject each term. In a great many schools only one type of work, usually woodwork, is given. In nearly all schools we find woodwork included in the curriculum.

In discussing this point Selvidge and Fryklund¹⁵ say: "The next question presented, and one which has troubled many teachers and school officials, is, 'What type of shop shall we have?' There are many factors involved in the answer to this question. Perhaps the first step in the solution of the problem is to point out that the real question is not, 'What type of shop?' but 'What arrangement and what available work will give us the best opportunity to teach the things we have placed in our list

¹⁵R.V. Selvidge and V.C. Fryklund, op. cit., pp. 48-51.

of things we wish to teach?"

"The answer to this question involves an entirely different approach. Instead of selecting a particular type of shop, we determine what we will do on the basis of what we wish to teach. When we examine the field from this standpoint, it will be found that any one of a great many activities may contribute almost equally well to these ends, if wisely chosen and well organized; but the activity must be chosen because of its positive and direct contribution. It will be observed that while skills are important they do not constitute a major portion of the training program.

"For example, woodwork may be so arranged as to involve many of the things we wish to teach. Wood is one of the most common materials used in construction and is easily shaped and made to conform to our use. It, also, is one of the materials most easily and commonly used by the average man. Many of the tools involved in its use are the common tools of every household. Its production and manufacture form an interesting story. Its use in projects involves a number of other materials, some of the fundamental principles of science we wish to teach, and an opportunity to teach certain principles of design and construction in that field. Successful work with this material will tend to develop confidence, self-reliance, and pride in workmanship. It offers an excellent opportunity to develop the habit of planning.

"There certainly can be no objection to teaching the things we wish to teach through a great variety of activities, but it is by no means necessary to give courses based upon a few simple jobs abstracted from four or five of the skilled trades. Most

of the so-called exploratory or finding course have been promoted by school men who are so far removed from industrial contact that they do not realize that the number of industries that can be adequately represented in the shops of any school is but a drop in the great ocean of industry. It is not the purpose of the work to give practice in the elementary skills of a variety of industries; but to give certain information and develop certain attitudes and habits that are valuable and important in any industry."

Roberts¹⁶ in his book Woodwork in the Junior High School attempts to show the educational importance of woodwork in the manual activities program. He says: "It can hardly be denied that the primary aim of manual arts is general and not specific education. Incidentally, the work has a vocational aspect in the same sense that all that is taught in the schools contributes indirectly to the future life career. If this is true the selection of subject-matter from the vast field of possibilities should be based upon child interests, capacities and future general, rather than specific, needs---work as broad as possible, without being superficial on the one hand or too specialized on the other. In other words, the purpose is the same as in any of the other school subjects, or perhaps better stated, as in all the other school subjects, for manual arts rightly conceived must have much in common with all the other school work.

¹⁶Wm. E. Roberts, Woodwork in the Junior High School (Peoria, Illinois: Manual Arts Press, 1929), pp. 10-13.

"Our first and fundamental problem, then, would be the determination of a basis for selecting subject-matter for the manual arts in the junior high school, assuming, as we must, from the name and nature of our work, that the selection must be from existing activities in industry, adapted to educational needs of children of the seventh, eighth, and ninth school years.

"From the beginning of our work the method of choice has been that of selecting typical trades of trade units---carpentry, cabinet making, pattern making, forging, machine shop---and analyzing these into fundamental processes and devising ways and means of presenting them to classes. This procedure is a tradition inherited from the early days of manual training, strengthened by the movement for vocational education. While it is probably the best procedure in the choice of subject-matter for special and trade instruction, it is quite manifest that it fails to meet the broader requirements of general education demanded by the junior high school. Here information and general skill are more important than specific knowledge and skill; general acquaintance with the great field of industry rather than detailed and complete knowledge of a specific industry. This is also true from the strictly vocational guidance point of view. Knowledge implies voluntary choice based upon a knowledge of things from which to choose.

"Accepting the major objective of manual arts as general rather than specific education, it would seem that a broader conception of the work would be found in what might be termed related activities included within certain of the larger units of industry. A survey of industrial occupations reveals the fact that a very large percentage of these is included in or a part of that carried on by these units.

closely related to the activities that have to do in some form with wood, metal, and the materials of the typographic arts; and, furthermore, that within these are found the industrial activities most intimately related to the lives and experiences of a great majority of people. It would seem logical, therefore, that activities adapted to manual arts in the junior high school should find their best expression through related work in the three fundamental occupational fields of woodworking, metalworking, and printing. Certainly within these fields, including drawing, will be found latitude for the broadest possible interpretation or expression of the manual arts, and much more material than can possibly be utilized in the time that can be given to this work. Under this analysis woodwork becomes one of the fundamental and basic subjects of manual arts."

It is not the purpose of this part of this study to belittle in any way the educational value of other manual arts subjects, but to attempt to show that woodwork is one basic subject of the manual arts. It was the first field of work to be educationally analyzed and no doubt has a wider range of contacts than any other occupational work in the schools. When an attempt is made to teach several activities in one shop, it at once becomes apparent that all of the activities are somewhat interrelated and interdependent. This being true, one might well use woodwork as the basic subject and then add to it related material from other manual arts subjects. This could be done with little added expense for equipment and supplies.

Since industrial arts has played such an important role in our junior high schools in the past, there is little doubt but that it has demonstrated its usefulness and should remain a part of that curriculum. However, there is still some con-

troversy as to the content of the subject matter, but in nearly all cases it is agreed that woodwork retains an important place. The problem of the woodwork teacher is not to look about for some new occupational fields to introduce but to improve, to the extent of his ability, the efficient teaching of woodwork, which has stood the test in the critical studies of the curriculum makers.

III. THE JUSTIFICATION OF THE USE OF INSTRUCTION SHEETS IN INDUSTRIAL ARTS

A. Instruction Sheets Defined

Perhaps it will be best to pause here and determine just what instruction sheets are. Let us see what some authorities have to say. Robert H. Rodgers¹ gives a brief history of the development of the instruction sheet idea as follows: "The job sheet is attracting an unusual amount of attention. To some it may seem that it has literally sprung into existence overnight when, as a matter of fact, it represents but a stage in the gradual development of improved methods of organization and teaching. As its development is reviewed, a great deal of credit must be given to the contributions made by the well-organized science laboratory manuals used in secondary and higher institutions. The correspondence school and its pamphlets and systems of examination gave an invaluable experience, as did scientific studies in industry and the factory production sheets. The use of blue prints in the manual-training shops and in the schools of engineering was a distinct step in the direction of the job-sheet idea. A great impetus came at the period of the World War when Allen and Selvidge were confronted with almost overwhelming problems of training the personnel of the shipyards and the special branches of the service in the army. Job sheets

¹Robert H. Rodgers, "Job Sheets in Vocational Training", Industrial Arts Magazine, Vol. 16 (April, 1927), pp. 119, 120.

made up in the form of instruction manuals were one of the many successful means employed. The inauguration of the part-time-school program in the state of New York resulted in the drawing together of the best elements of each of these movements and the development of a plan of organization for teaching by the use of individual units, called by some job sheets, by others units of instruction. The staff of the Division of Vocational and Extension Education of the New York State Educational Department was confronted with the problem of making the instruction most effective for the many thousands of young men and women returning to school for a short period of time each week. The result of their efforts was but another step in the refining process that was and is taking place in the field of organization and methods. It is apparent, therefore, that job sheets or units of instruction, or whatever term may be used, are not new, but rather they represent the present status of a progressive educational movement."

In this same book, Rodgers defines the job sheet or unit of instruction as follows: "It is one unit of a body of organized instructional material prepared for the use of the learner, and consists of educational assignments so organized as to provide for the greatest amount of individual progress."

1. Elements entering into the make-up of individual units.
 - a. Objectives stated clearly and readily understood.
 - b. Students must be introduced to the new assignments in a manner conforming to accepted pedagogical practice. This will require a short introductory paragraph.
 - c. Assignments clearly given to enable students to

undertake work without loss of time. Arrangement and illustrations cannot be overlooked.

- d. Assignments should involve the solution of an educational problem. Merely specific directions for carrying out a certain number of manipulative operations is in violation of the principle of self-activity and should be used only in a limited way (7B). First sheets may give specific directions, but succeeding sheets should gradually place more and more responsibility upon the learner.
- e. All assignments should be progressive, thereby tending to insure the learner's progress.
- f. All of the assignments on a given unit should be as closely coordinated as is possible and should include both the practical and related technical aspects. Technical material thus given becomes vital to the learner.
- g. Provision should be made on each unit for the learner to record his procedure or knowledge of essential information.
- h. Assignments should cover only one day's work. The student should complete a definite task each day.

Selvidge² says, "It will contribute greatly to the clearness of thought and discussion if we can come to an understanding of

²R. V. Selvidge, Individual Instruction Sheets (Peoria, Illinois: Manual Arts Press, 1926), pp. 8-10.

what is meant by instruction sheets. "Instruction sheet" is a general term applied to written or printed instructions, quite generally issued in loose-leaf form. Job sheets, operation sheets, information sheets, and lesson sheets are special forms of the instruction sheet. These special forms differ somewhat in method of organizing the material and in special purpose, but the general aim of bringing to the student definite instruction in a permanent form is the same in all of them. They usually are based on the results of an analysis of a trade or vocation. This analysis may be on the basis of jobs or it may be on the basis of the units of instruction. When the instruction sheets deal with the units of instruction, they usually are divided into three groups: those giving instructions for performing manipulative operations, called operation sheets; those dealing with topics of information, called information sheets; those dealing with assignments for reading or observation, called assignment sheets. When the instruction sheet outlines and tells how to do each step of a complete job, whether it is one of the almost numberless jobs of a trade or an isolated and unrelated job such as repair work about the home, it is properly called a job sheet.

"The following outline shows the relationship of the different types of instruction sheets;

The Instruction Sheet deals with

1. Instruction Units.

a. Operation Sheets. The instruction sheets that tell how to perform manipulative operations are called operation sheets.

b. Information Sheets. Instruction sheets that deal with items of information are called information sheets.

c. Assignment Sheets. Instruction sheets, composed largely of questions, designed to direct observation, reading and drill, are called assignment sheets.

2. Jobs.

a. Job Sheets. Instruction sheets that tell how to do complete jobs which may involve a number of operations are called job sheets. They are especially designed to secure production. They also may be used for small unrelated jobs requiring little skill, such as mechanics.

"The instruction units are the points in the trade in which the learner usually will require instruction. They ordinarily fall into two rather distinct groups: those dealing with the manipulative operations, and those dealing with matters of information or knowledge. It is considered advisable to divide the units into these two groups because the methods required in giving instructions for performing manipulative operations, or developing skill, are quite different from those required for imparting information or training in using it."³

Struck⁴ says: "There seems to be no definite standards or definitions set up for instruction or job sheets". He then gives three major types of instruction sheets:

1. Instruction sheets centering around doing or executing

³R.V. Selvidge, op. cit., pp. 110, 111.

⁴T.F. Struck, Methods in Industrial Education (New York: J. Wiley and Sons, 1929), p. 61.

exercises, jobs, or projects.

2. Instruction sheets designed primarily to give related information.

3. Instruction sheets designed to give skill.

B. The Need for Supplementary Visual Aid

The teacher of a general shop readily recognizes the need of some form of supplementary instructional material if he is to do an effective job of teaching. It is physically impossible for any one person to carry on a program of four activities at one time in a shop class and expect to teach enough required fundamentals by demonstrations and oral instructions. However, the question is raised here, if it would not make the teacher of a one-course shop more efficient, if he too would use supplementary instructional material. One may walk into almost any shop and find charts on the wall, various exhibits and models, all testifying to the unconscious admitting by the instructors that they are in dire need of some other forms of material for putting across their work. So why should they not organize their work in a systematic and scientific manner, using the material available as an aid to their oral instructions and demonstrations?

Selvidge⁵ says, "The instruction sheet represents very carefully prepared instructions based upon a definite teaching

⁵R. V. Selvidge, op. cit., pp. 6, 7.

plan. One advantage it has over oral instruction lies in the fact that in the preparation of the written instructions we may examine them with great care, get expert criticism and assistance, be sure that every necessary element is present and properly arranged, and that no unnecessary or confusing elements are introduced. If well written it is better organized and more nearly complete than any oral instructions could be. Any instruction that may be given orally, may be written in a language just as simple and just as easily understood as the spoken language, and it will have the advantage of being briefer, more accurate, and in a permanent form. If the student fails to understand the instructions at first reading, he may read the instructions again, while he must remember oral instructions from a single statement. Further, it places on the student the responsibility for getting the instruction. It changes the situation from one where the student is passive, or receptive, and takes what is given to him, to one where the necessary instructions are placed before him and it is his responsibility to master them. Such a situation represents a great improvement from the standpoint of developing a feeling of responsibility and self-reliance.

"Often it is necessary to illustrate our oral instructions by gestures, drawings, and by demonstrations. It is equally necessary to use illustrations in written instructions, and, frequently, it is necessary to supplement them by demonstrations and oral instructions. The teacher may find it very difficult to write these instruction sheets in a sufficiently definite and acceptable form, but there is no reason to believe that he would do it better by word or mouth. The task is somewhat

simplified if he attempts it on the basis of writing exactly what he would say if he were giving the instruction to a single individual. There is no reason why any facts or directions that may be given orally may not be given in writing also."

Brown and Tustison⁶ says: "The modern trend is to provide for individual needs. To do this the general shop has been introduced. The difficulty of providing adequate instruction has become a real problem in classes where a variety of things are being done at one time by individuals or groups. The Job Sheet is a teaching devise which has been developed to supplement instruction in this field."

Herman S. Hall⁷, in presenting arguments for instruction sheets, says: "Instruction Sheets which are thought-provoking, and which stimulate the learner to purposeful mental activity, are worth while. Instruction Sheets can be so designed as to state the problem, give the necessary functioning information, and outline the method the student should pursue in planning the work of solving the problem. Such sheets are desirable.

"Related knowledge which must be given as information can be presented through instruction sheets. The usual trade handbooks contain such information, but, where the handbook is lacking in detail or certain information has been omitted, instruction sheets covering the condensed or omitted information

⁶A.G. Brown and F.E. Tustison, Instructional Units in Hand Woodwork (Milwaukee, Wisconsin: Bruce Publishing Co., 1930), p. xx.

⁷Herman S. Hall, Trade Training in School and Plant (New York: The Century Co., 1930), pp. 347-542.

are valuable."

Ericson⁸ offers the following reasons as his argument for using Instruction Sheets:

1. Instruction Sheets are means for offering a greater variety of work.

2. They save time of students that would otherwise be used in waiting for attention of the instructor.

3. They save the time of the teacher.

4. Interest of students is maintained, because they can proceed with the work without waiting for demonstrations and personal instructions.

5. They furnish printed directions to be followed.

6. Students are left on their own resources in carrying out the work.

7. They are of great value as an aid to and follow-up of the demonstration.

8. If standard instruction sheets are used, it is likely that they are better organized with reference to procedure and other material than would be the oral instruction of the teacher.

9. They assist the teacher who might not be expert mechanically with reference to all phases of the work.

Instruction sheets are now finding wide range in the academic studies as well as in the shop courses. Undoubtedly, they are here to stay, and the problem to be faced today is not so

⁸E.E. Ericson, Teaching Problems in Industrial Arts (Peoria, Illinois: Manual Arts Press, 1930), pp. 67, 68.

much whether to use them, as it is whether they are properly prepared in the light of scientific study and research, and whether they make a real contribution to education.

What shall be the criteria upon which to formulate and devise instruction sheets? There are many commercial forms on the market, but few if any of these can be applied in full to any particular course of study. Today, and perhaps for some time to come, industrial arts work is not standardized, nor should be, for all communities differ in some respects and the industrial make-up of the community should always be taken into account when developing industrial courses for that community. These differences should be cared for in the courses taught rather than basic content of courses. The latter is derived from industrial practices.

C. The Development of the Instruction Sheet

Selvidge⁹ says: "There seems to be a well-founded conviction that the written instruction sheet is a valuable contribution to modern educational practice. The most serious objections so far developed are the result of a lack of the necessary technique required in the preparation of the sheets and in the failure to develop a classroom procedure adapted to this method of instruction."

⁹R. V. Selvidge, Individual Instruction Sheets (Peoria, Illinois: Manual Arts Press, 1926), Preface.

Too often committees are appointed to work out sheets without proper enthusiasm created and without special preparation in the technique of writing instruction sheets. They try to combine too much---information, operation and job sheets---into one sheet and as a result have too little. The cost of the printing and mimeographing necessary to the proper illustration of the sheets is a great drawback. One copy is usually furnished and that is the end of it. Courses of study are not well enough standardized to warrant commercial sheets.

Selvidge¹⁰ continues: "The instruction sheet is a teaching device of great value where directions are to be given or where principles or facts are to be presented to members of a group who are unequal in attainment, ability or aptitude. It has found quite general application in the school shop, the science laboratory, and in industry, but its value is not confined to those fields. It is, perhaps, the most efficient and economical system of individual instruction yet devised. It permits independent progress among the members of a group and makes it possible to take into account individual differences. The favor it has found in shop and laboratory is not because the differences among pupils are greater in such work but because the differences are more readily recognized and more effectively dealt with..... When we develop an effective method of measuring the efficiency of our instruction, we will

¹⁰R. V. Selvidge, op. cit., Preface.

realize that it is important that we reduce the size of our groups or devise a system of instruction that will provide for independent progress of the members of the group.

"Where attendance, is irregular, as in part-time schools and evening schools, or in the case of large classes, the instruction sheet is indispensable."

Walter Benton Jones¹¹ is quoted as saying: "The curriculum builder should include only the facts that will be taught; not those that ought to be taught. An instructional outline if used intelligently means a specific starting point and a positive goal with very definite material between the terminals..... There should be two kinds of sheets; Instruction Sheets and Operation Sheets. The basis of Instruction Sheets is the job to be made. Operation Sheets are based on trade operations."

Quoting from Selvidge and Fryklund¹², we find: "It has been established by careful investigation that there is a very wide range in the learning abilities of individuals, and we are confronted with the task of providing instruction that will permit individual progress.

"A system of grouping on the basis of ability reduces the range of differences, but it does not solve the difficulty. In many cases such a grouping is impossible.

"Teaching is an individual process just as learning is an individual accomplishment. Some pupils will have more difficul-

¹¹Walter Benton Jones, Job Analysis and Curriculum Construction in the Metal Trades Industry (New York: Bureau of Publication, Teachers College, Columbia, University, 1927), p. 8.

¹²R.V. Selvidge and V.C. Fryklund, Principles of Trade and Industrial Training (Peoria, Illinois: Manual Arts Press, 1930), pp. 148, 149.

ty is present in all their work, and is one of the misfortunes of the less gifted pupils."

Later on in the above-mentioned book the authors add: "Oral instruction habits, poor reading habits, and the use of difficult words in the preparation of instructions, are factors that must be taken into account in attempting to use instruction sheets. More emphasis must be given to habit in cases of suspected typemindedness. If we recognize that many difficulties are caused by habits of doing things in the wrong way, we have taken an important step in the solution of our difficulties. We are annoyed at the thought of changing old habits; we hesitate to break them and build new ones. We do not like the thought of changing old ways of teaching, but we shall be compelled, sooner or later, to strengthen our methods to better provide for individual differences. Improving written instructions by careful preparation and word selection, and using these instruction effectively, is probably one of the best means of attaining this end."¹³

Individual instruction sheets, then, may be defined as definite units of instructional material in permanent form based on an analysis of a trade or vocation. They should be divided into two or more groups, preferably three. One group should contain the operation or skills to be learned, one group the information related to the trade or vocation, and the other group the jobs to be performed by which the learner acquires the skills and information.

¹³R.V. Selvidge and V.C.Fryklund, op. cit., p. 355.

The advantages of using individual instruction sheets may be summed up as follows:

1. Saves time and energy of the teacher.
2. Provides a carefully prepared teaching plan.
3. Presents an easy means of "recall" for the student.
4. Places responsibility on the student.
5. Allows better means for illustrations.
6. Allows for better individual progress.
7. Provokes thought and causes mental activity.
8. Allows pupil participation in planning their jobs.
9. Makes possible a large variety of jobs.
10. Constantly reminds both teacher and student of the less significant information items often overlooked.

When any attempt is made to develop a set of individual instruction sheets, it is first necessary to determine a technique to follow and a classroom procedure adapted to the full use of such sheets. One that writes a set of instruction sheets should first of all be a teacher of the subject chosen. The sheets should be written with the thought that the teacher is talking to an individual student and that the sheet is a teaching device. Only the facts to be taught should be included, and for these there must be a specific starting point and a positive goal. Uppermost in the mind of the writer should be the thought that these sheets are a means of providing for better individual instruction.

IV. DETERMINING THE OUTLINE FOR INSTRUCTION SHEETS

A. The Analysis of Many Sheets

A compilation of fifty-three sets of sheets was made to determine the most common characteristics used in the outline or form of the sheets. Many of the sheets were commercial sets found in book form while other were mimeographed or otherwise duplicated and were from grade teachers, high-school teachers, university professors, and from committees of teachers.

The sheets were divided into four groups---information, operation, job, and combination. Many sheets that were called job sheets were placed in the last classification because they not only contained directions for doing the job but information and operations as well and could not be called strictly job sheets in the sense that job sheets are defined in this study.

The fifty-three sheets were listed vertically down the left side of a table, while horizontally at the top the form headings were listed. There were thirty different form headings. The sheets were each tabulated to determine the most common headings. Table. No. I, p. 39 shows the condensed result of this study.

All form headings that did not appear more than two times are not shown here. There were fourteen of these. Of these fourteen, six appeared twice and seven only once. Those that appeared twice were: "Applications", "Operations", "Description of Operations", "Job Specifications", "Record", and "Operations Necessary to Complete Job". The seven that appeared only once were: "Approval", "Testing Ability and Knowledge", "Mathematics",

"Given", "Required", "Instructions", "Purpose of the Job", and "Assignment".

Selvidge does not list more than eight headings on any one sheet, while in these fifty-three sets we have thirty different headings. There is no standard form for any of these sheets. Yet when we look at the table, we can readily see that there are certain headings which seem to be fairly common to all; for instance, nearly all are agreed that the sheet should have a title.

Since the purpose of the information, operation, and job sheets in each case is different, it is necessary to consider them separately.

Information sheets are designed merely to convey information. There seems little use to divide this sheet into many headings. In most cases it is of the essay type, giving the information in brief, simple statements. Oftentimes the paragraphs are numbered and references and questions given.

The operation sheets begin with a title of the operations. Materials are listed in most cases as well as the tools used to perform the operation. Where the explanation of the operation begins, the heading in most cases is "Procedure". The steps are usually numbered and each step stated briefly in simple language. References and questions complete the headings.

Job sheets are titled usually by stating how to make a given project. Sometimes a foreword telling of the usefulness of the project or a reason for doing the job is given. In most cases tools and materials are listed. Then the explanation of how to do the job is headed with "Procedure". This is sometimes sub-titled into various steps and the steps numbered. References are given in many cases and also questions.

Combination job sheets that give the required information and operations needed to do the job are found in several cases. It is no doubt possible to use these with a degree of success. But from the standpoint of one writing the sheets there is the question of whether or not the time spent in making such sheets is well spent. It seems a better arrangement would be to write one set of sheets covering all points of information and one set of sheets covering all the tool operations. Then it is possible to write any number of job sheets that will only refer to the information and operation sheets as needed. The value of this arrangement lies in the fact that much labor in repeating information and operations time and again as they appear in the various jobs can be saved.

Some of these combination job sheets use a method of referring to other sheets to find the information needed, but this practice confuses the boy, as he must look through several pages of material to find what he needs. It is simpler and more effective to refer by number to a sheet within another separate group that deals exclusively with the information he is seeking.

TABLE I
ANALYSIS OF THE HEADINGS USED IN INSTRUCTION
SHEETS

| KIND of SHEETS | INFORMA- TION SHEETS | OPERATION SHEETS | JOB SHEETS | COMBINA- TION SHEETS | TOTAL |
|-----------------------------|----------------------------|---------------------|---------------|----------------------------|-------|
| No. of Sheets | 10 | 10 | 20 | 13 | 53 |
| Untitled Fore- word | 0 | 0 | 3 | 3 | 6 |
| Specification | 0 | 0 | 0 | 2 | 2 |
| Reason for the job | 0 | 0 | 4 | 1 | 5 |
| Materials | 1 | 3 | 13 | 9 | 26 |
| Tools | 0 | 2 | 13 | 5 | 20 |
| Procedure | 1 | 3 | 10 | 5 | 19 |
| Procedure Sub- titled | 0 | 3 | 7 | 2 | 12 |
| Procedure steps numbered | 0 | 8 | 13 | 7 | 28 |
| References | 2 | 3 | 8 | 6 | 19 |
| Questions | 1 | 5 | 13 | 11 | 30 |
| Directions | 0 | 1 | 0 | 6 | 7 |
| Information | 0 | 0 | 1 | 6 | 7 |
| Check | 0 | 1 | 1 | 1 | 3 |
| Appraisal | 0 | 1 | 4 | 1 | 6 |
| Caution | 2 | 1 | 4 | 3 | 10 |

B. Comments on the Kinds and Types of Instruction Sheets

In surveying the field of literature devoted to the writing of instruction sheets, it is evident that authorities are not entirely agreed as to just what the sheets should contain and the best form to follow. Perhaps the most outstanding leader in this field is R. V. Selvidge of the University of Missouri. He has undoubtedly done more than any other person to standardize instruction sheets.

There are, however, several educators that have given some valuable contributions to the subjects. Let us see what some of them have to say.

"The Instruction sheet is based upon the idea that any subject or undertaking may be divided into certain fundamental units and that these units may be made the basis of instruction. This idea is not new in American industry. Every manufacturer recognizes that the analysis of the product into such elements is the first step in efficient production. The differences between the manufacturing process and the educational process is that the manufacturer is satisfied to teach the worker the one small part he must do in order to get a given product, and rest at that, while in teaching it is considered desirable to give attention to the various elements involved in order that the training may have as wide an application as possible. The manufacturer bases his analysis on convenient units of production; the teacher bases his analysis on convenient units of instruction. The manufacturer seeks efficient production on a given job; the teacher seeks to give a training that will be effective in any job that may arise within the field. In either case,

however, the analysis is necessary in order to find out what must be done to get the desired product."¹

Friese², in his book Exploring the Manual Arts, says of the characteristics of instruction sheets of an earlier day: "These instruction sheets begin with a title of the job or process. This is frequently followed with a statement of purpose. The procedure to be followed is then outlined, frequently illustrated with photographs, sketches and drawings. Sometimes there is a list of printed references. Usually the sheet ends with a number of questions about the work. There is usually a place for records of the work."

Instruction sheets of an earlier day were mostly job sheets. Not only did they tell how to do a particular job, but contained the operations and information necessary to do that particular job. Friese in his book mentioned above leads one to believe that instruction sheets have very limited use. His argument was sound at that time, for it would be necessary to have many job sheets to care for a great variety of jobs. However, since that time we have come to divide the instruction sheets into four classes; operation, information, assignment and job sheets. Thus classified, it is possible to have operation and information sheets to cover all required phases of a given trade. Job sheets may then be written for only the number of jobs wanted with man-

¹R.V. Selvidge, Individual Instruction Sheets (Peoria, Illinois: Manual Arts Press, 1926), p. 6.

²J.F. Friese, Exploring the Manual Arts (New York: The Century Co., 1926), p. 76.

ipulative skills and information left out but referred to in other sheets.

H. J. Van Westeirnen³ says: "The traditional job sheet is not adequate for several reasons. It is written on a basis of teacher direction with subject matter and skill as goals. The new education must provide for goals in terms of worthy individual and social purposes and allow for student choice and self direction. The answer has been a new type of lesson which has the following characteristics.

"These lessons should:

1. Stimulate the student to worthy individual and social purposes.
2. Reveal to the student the many opportunities of the course.
3. Serve the needs of students of varying abilities and cater to individual differences through a variety of optional and graduated assignments.
4. Serve as a means of enriching the experiences of the student.
5. Make all of the teacher's time available for giving individual assistance.
6. Serve as a solution for the large class problem in an adequate and efficient manner.
7. Relieve the teacher of many of the formal demonstrations and lectures that are too often inadequate, spontaneous,

³H.J. Van Westeirnen, "Preparation and Use of Instruction Sheets", Industrial Arts and Vocational Education (Peoria, Illinois: Industrial Arts Magazine, July, 1931), pp. 237-242.

and energy consuming.

8. Make it possible to eliminate the formal textbook. An adequate number of copies of several carefully selected reference books should serve the supplementary needs of the student."

He says there are three types of sheets, which are:

a. Lesson Sheets.

To present the opportunities of each unit of work to the class and should contain, stimulation, orientation, a minimum of supplementary information, a description of the methods to be used, assignment of activities, and references.

b. Instruction Sheet.

Should describe specific operations or processes in explicit detail. No assignments, but designed to take the place of the traditional demonstration.

c. Information Sheet.

A means of furnishing complete technical information. It should be concise, accurate, and adequate to the needs of the student.

When the above classification of types of sheets is carefully analyzed we call (a) the lesson sheet a job sheet, for the project the boy works on is nothing more than an assigned lesson to cover a given unit of work, (b) the instruction sheet an operation sheet as it deals with the manipulative skills, and (c) the last type is rightly called an information sheet..

Ericson⁴ lists four types of instruction sheets.

⁴E.E. Ericson, Teaching Problems in Industrial Arts (Peoria, Illinois: Manual Arts Press, 1930), pp. 70, 71.

1. Operation sheets are based upon an operation or unit of performance within a trade and not upon a job. It is based upon learning principles rather than jobs; as "how to cut a miter" rather than "how to make a picture frame".

2. Information sheets are made to cover some unit of information, and do not deal with performance or manipulative procedure.

3. Assignment sheets possess the following characteristics:

- a. A definite statement of problem is given.
- b. Sources of information are stated with reactions.
- c. Questions are assigned to direct the reading, observation and thought.
- d. Provisions are made for written answers to these questions.

4. Job sheets are designed to cover a job or assignment in manipulative work.

Ericson⁵ also says (1) the teacher may make the sheets himself, (2) he may have his students write them, (3) he may purchase them from publishers. He believes there are advantages in having students make their own sheets. He says: "As a matter of fact, such practice meets one of the arguments made against the job sheet, namely: that it takes away from the student the opportunity to do the planning of his work and thus prevents initiative. The time for actual manipulative work will be materially reduced as soon as the students are put to the task of doing their own planning, and many are not able or

⁵E.E. Ericson, op. cit., pp. 71, 74, 75.

willing to do it.....For students, even of junior-high-school ages, to make out a list of tools and equipment needed, the bill of material or supplies, and the proposed steps of procedure before attacking their problem is, indeed, excellent practice."

Selvidge's book Individual Instruction Sheets⁶, a book on the subject of writing instruction sheets, is, perhaps, the best treatise on the subject written to date. He divided instruction sheets as follows:

1. Instruction sheets.
 - a. Operation sheets.
 - b. Information sheets.
 - c. Assignment sheets.
2. Job sheets.

Selvidge and Fryklund⁷ say concerning the preparing of operation sheets:

1. The title should clearly indicate what instructions are given.
2. The instructions should deal with the learning units involved in work jobs, but without respect to any particular job.
3. The instructions for performing the operations should be given step by step in a very complete form, and the sentences should describe the operation in the order of movement,

⁶R.V. Selvidge, Individual Instruction Sheets (Peoria, Illinois: Manual Arts Press, 1926), p. 110.

⁷R.V. Selvidge and V.C. Fryklund, Principles of Trade and Industrial Teaching (Peoria, Illinois: Manual Arts Press, 1930), p. 143.

so that the understanding of the movement will flow along with the sentence.

4. In general, it is not advisable to explain why an operation is performed in a certain way. The why should be taken up in questions to give the boy an opportunity to do some thinking.

5. Illustrations should be given to clarify written instructions.

6. Give only the information necessary to the performing the operation.

7. In most instances it is well to add questions to an operation sheet in order to encourage the student to seek the reason for doing things in a particular way, but questions should never be asked unless they have a real purpose.

8. Give references to available sources of information if additional information is needed.

Suggestions for Information Sheets.

1. The title should clearly indicate the subject treated.

2. The information should be given in brief statements, and without discussions.

3. Questions should be given to act as a guide in reading and observation and to form the basis for group discussions.

4. Reference to available, additional sources of information should be given.

Selvidge and Fryklund⁸ give the following suggestions for

⁸R.V. Selvidge and V.C. Fryklund, op. cit., p. 144.

Job Sheets.

1. Title must be clearly stated.

2. General directions.

- a. Directions to examine a similiar exhibit of work.
- b. A statement that the student must read carefully the entire job-sheet, and make a list of steps he will take in doing the job. This is his job plan.
- c. A statement that the student must make a list of the tools and materials required for the job.
- d. A statement that both lists must be approved before starting work on the job.

3. Specification.

A statement of the requirements of the job. This constitutes the specifications for the job and should contain all drawings, dimensions, and kinds of material to be used. It should be a very definite statement of what is wanted.

4. Information.

A brief statement of any facts or information that may be needed in order to do the job successfully.

5. Directions.

Directions for doing the job. These should be stated briefly and in simple language. The different steps should be set off in different paragraphs. Use illustrations freely.

6. Checking.

A statement that the work must be finally checked at this point.

7. Questions.

Carefully chosen questions to point to the general application of the things learned in doing the job. Avoid irrelevant questions.

8. References.

Give one or two good references if needed. They should be exact, as to page.

T. F. Struck⁹ says there are three major types of instruction sheets:

1. Instruction sheets centering around doing or executing exercises, jobs, or projects.

2. Instruction sheets designed primarily to give related information.

3. Instruction sheets designed to give skill.

Jones¹⁰ says there should be two kinds of sheets:

1. Instruction sheets.

The job to be made.

2. Operation sheets.

Based on trade operations.

The following is an example that strikes a new note in instruction sheets. It is an operation sheet with the planning done by the student. Such a sheet as this is probably not advisable with beginning students unless the planning is done by class discussion and demonstration.

⁹T.F. Struck, Methods in Industrial Education (New York: J. Wiley and Sons, 1929), p. 61.

¹⁰Walter Benton Jones, Job Analysis and Curriculum Construction in the Metal Trades Industry, (New York: Bureau of Publication, Teachers College, Columbia University, 1927), p. 6.

R.A. Hinderman, Instructor

Date _____

Analysis by: _____

Student's Name: _____

Wisconsin High School

Elementary Machine-Tool Operation

Information Course.

Objective: To develop an understanding of the basic principles of forming, and of metal, thru study and mechanical participation.

Text: South Bend Lathe Works: HOW TO RUN A LATHE.

Reference: H.D. Burghardt: MACHINE TOOL OPERATION NO. 1.

Instructions:

- a. Column No. 3 is to be completed by each student. When filled in, the complete list is an outline of operations to be performed, in order. A careful analysis means a better job, a higher grade, and a greater satisfaction.
- b. Column No. 4 serves as a memorandum to help reduce the number of trips to the tool room.
- c. Cost is what manufacturers try to reduce. The problem in column No. 5 is to furnish an idea of the value of the metal being used.
- d. Checking and grading column No. 6 are to be done by the instructor.

| 1 | 2 | 3 | 4 | 5 | 6 |
|------|--|---|--|-------------------|-------|
| Unit | Project | Order of Operations | Tools | Cost of Materials | Grade |
| 1 | Conditioning Problem 3 weeks required | 1. Sawing to 6 1/8" 2. Centering 3. Facing--6" long 4. Roughing--13/16" D 5. Finishing--3/4" D 6. Shoulder-ing--1/2" D 7. Roughing 8. Tapering 9. Finishing 10. Threading 15 threads | Lathe-box Dog Center-drill Roughing tool Finish-ing Thread-ing | \$.15 | |

This illustrates a standard form which is quite flexible worked out for this high school. The author¹¹ claims two features from this form of instruction sheets.

1. Student participation in analysis of the project, determining the operations to be performed and arranging the order of procedure. Students have always appreciated the value of an outline of what to do, but they have also expressed the desire for opportunity to incorporate their own ideas and individuality

¹¹Roy A. Hinderman, M.A. Dept. Wisconsin High School. Industrial Education Magazine, July, 1930. P. 4.

in the plan of work.

2. Student participation in the organization and preparation of the instruction sheet. Students have pointed out that, at first, it would be helpful to consider the building of an instruction sheet with the class as a whole by taking a few steps at a time, and then follow this by actually performing the operations listed.

We can see that authorities on the subject are pretty well agreed that there are three distinct types of individual instruction sheets for shop work. No matter what name they go by they fall into three classifications:

1. Operation sheets.
2. Information sheets.
3. Job sheets.

C. Recommended Form for Instruction Sheets

Having analyzed several sheets and the comments of those persons who have expressed their opinions as to what instruction sheets should contain, let us reflect for a moment in an attempt to determine the type of sheets that will most benefit teacher and pupil. This study is made from the standpoint of helping teachers write their own sheets.

First, should sheets contain high-sounding titles and headings that mean nothing to the student, or should they be models of simplicity? Secondly, should they be so constructed as to cause the student hours of reading, planning and reference hunting, or should they be brief and to the point, an aid the students will seek rather than shun?

Let me quote here an excerpt from an address delivered

before an Industrial Arts section during the Indiana State Teachers Association in Indianapolis by Sylvan A. Yeager, who seems to sum up the situation clearly.

"Any type of shop organization or teaching method can only be justified to the extent that it is efficient. Efficiency in turn must be judged and measured by the extent to which objectives are realized. Most authorities agree that the present tendency toward larger classes makes more necessary than ever, the use of individual instruction sheets. Many teachers think that these teaching aids came into being as a result of the demands of the general shop. This idea is entirely wrong. Individual instruction sheets have been used to a large extent in various types of work before the development of the general shop. They were even used in industrial arts work many years before the present era of the general shop. In many respects this early type of instruction sheet was better than many of our present day instruction sheets.

"Too many teachers today use instruction sheets who either have no real need for them or who fail to realize the function which they should perform. They are properly used when they supplement the work of the teacher and are not considered a substitute for the teacher.

"Other just criticisms of instruction sheets would include the matter of their failure to stimulate thought. Many of the commercial sheets seem to vie with one another in their efforts to list every tool, process, operation, and step involved, thus eliminating any possibility that the boy might have an oppor-

tunity to think through even a part of a problem or job."¹²

For the past two years the writer of this thesis conducted an experiment with sheets of the type shown on pp. 60-67 inclusive. These sheets were patterned after those recommended by R.V. Selvidge¹³. There is one set of thirty-one information sheets covering all information in woodwork taught in his shop; one set of thirty-two operation sheets covering all operations taught; also a set of twenty-four job sheets which were used for a while and then discarded. The information and operation sheets have proved immensely successful, and the author of this study would not attempt to teach again without them.

These sheets are used as a teaching device to refresh the memory of the slow or dull student and, in a few cases, to stimulate the superior student. Demonstrations and lectures are still used, but a boy soon forgets. When sheets such as these are made available to the boy, he soon learns the value of refreshing his memory and that he can usually find an answer to his perplexities without taking the teacher's time to repeat that which has already been explained.

This try-out of instruction sheets written especially for a particular course of study has brought out one important factor. For beginning students in a shop class, instruction sheets must be extremely simple, both in the physical makeup and in the information they impart. The author's conclusions

¹²Sylvan A. Yeager, Instructor in Industrial Arts Department of the Indiana State Teachers College. Excerpt from an address delivered before the General Shop Section of the Indiana State Teachers Association in Indianapolis, Oct., 1932.

¹³R.V. Selvidge, Individual Instruction Sheets (Peoria, Illinois: Manual Arts Press, 1926), p. 110.

are that a sheet which is divided into many parts with titles and subtitles and many references and questions is confusing to the boy. When the student wants information, he looks through the sheet for the things that interest him and soon learns to skip over those parts that are meaningless to him.

Some authorities say there should be questions at the end of both information and operation sheets "to stimulate thinking". In many cases we find these questions unrelated to the subject matter of the sheet. The boy looks upon these questions as unfair but will answer the question if it tests his ability to remember what he has read in the sheet. The author recommends the questions be of that nature, for after all the criterion of a good sheet is its effect upon the learner.

On the operation sheet illustrated on page 62 the omission of the following titles is recommended: "Operations", "Materials", "Tools Used", and "Questions". The sheet would then have this simple form.

Operation Sheet No. 10.

I. Title of the operation.

A beginning statement telling why this operation is necessary or required.

II. Procedure.

III. Reference.

One or two good, available references.

"Materials" and "Tools" should be left out because the boy has and knows the material he will use. "Tools" should be omitted because it causes the boy, after reading this, to pile his bench full of tools, many of which he will not need for days. As the boy reads the operation, he is told just what tools to use.

The questions should be asked and answered during the demonstration. Questions will not be read by the boy unless he is forced to do so. The sheet should contain all the information necessary, as that is the purpose of the sheet. If it does, there is little need for many references.

Job sheets have been withdrawn for two reasons:

1. To write job sheets for all the projects made requires too much time. Repeated use of the same job sheets causes the teacher's work to become stereotyped.

2. Job sheets take from the boy any participation in the planning of his work. The following method has been successfully substituted. The boy makes a drawing of his project and then makes out a stock card, figuring the board feet and cost of material. On the back of the drawing he writes his plan of procedure. There are no fancy headings or titles. He thinks his way through the making of the project, beginning with the very first step. Each step is numbered and is his own statement. When he has it completed, the plan is checked. If it is not complete or needs altering, the boy makes the necessary corrections. When he has it completed, the plan is checked again. When the boy puts down an operation that is new to him, he inserts a caption similar to this, "See Operation Sheet No. 21". By this method the question "What shall I do next" is reduced to a minimum. These drawings are filed at the end of each period, and each boy has his drawing at his bench at all times while working. Beginning students do not make out a plan of procedure, as they have not yet had the experience which qualifies them to do so.

From this experience gleaned from the past two years'

experiment with the writer's own developed instruction sheets, the conclusion has been reached that in the past the sheets have been somewhat overburdened with useless captions, headings, and titles that look well in book form but add nothing to the usefulness of the sheet. This conclusion is further borne out by the fact that within the past two years two of our largest city school systems have adopted a type of instruction sheet that is very simple and effective.

The South Bend, Indiana, sheets printed in 1932 are uniform and contain only the following headings:

Title of the Sheet

Material

Procedure

Questions

The Indianapolis, Indiana, sheets, uniform for all courses in elementary work (7, 8, 9), were written in 1932-'33. They contain only the following headings:

Indianapolis Public Schools

JUNIOR HIGH SCHOOL INDUSTRIAL ARTS

Subject _____ Grade _____

Topic _____ Code _____

Step by step statements of the procedure are then listed.

In the South Bend sheets references are frequently given to a few selected textbooks. A code system for the book is used. (Example: BT refers to Brown and Tustison, Instructional Units In Hand Woodwork). In this way a great many of the operations and much of the information are not included in the sheets. Only those are included for which a good reference is not available.

The one objection to this type of sheet is that a number of reference books must be supplied and a means used to check the student on the reference reading. Boys will not look up the references as readily as they would read this same material were it included in the instruction sheet.

In drawing conclusions as to the form to follow in writing individual instruction sheets, the needs of each teacher and the group he teaches must be the determining factor. Should the teacher feel that he needs an elaborate set covering all phases of his work and that he has the time and reference material to do so, he should by all means write that type of sheet. The outline of the various sheets as recommended by Selvidge¹⁴ will, perhaps, be as good a source of material as is now available. These do not need to be used in the whole form as given but may be changed to suit the needs of the individual.

On the other hand, if time is limited or the teacher sees no immediate need of a complete set of sheets, the following type of sheet is recommended.

A. Information Sheets.

1. Each sheet titled and numbered in order to introduction to new work.
2. A few simply worded statements giving the information desired.
3. References to some text dealing in more detail with the subject.

¹⁴R.V. Selvidge, Individual Instruction Sheets (Peoria, Illinois: Manual Arts Press, 1926).

B. Operation Sheets.

1. Each sheet titled and numbered in order of introduction to the work and if possible to coincide with the same number of the information sheet.
2. An opening statement giving the importance or reason for knowing how to do the operation well.
3. Procedure.

List the method of performing the operation step by step, numbering each step. A given text which is well illustrated may be referred to for part of the procedure. If this is done, the sheets themselves need not be illustrated.

4. Reference.

In all cases give references to textbooks.

C. Job Sheets.

1. Have these made by the boy. After he chooses his project, he should write out a step-by-step plan of how he intends to make the project. New operations and information topics should be inserted into the job plan as they appear by referring to the numbers of operation and information sheets involved.

Simple sheets of this type need not take any more time to make than the planning of a demonstration or lecture on the subject. Once made they are then ready to be used over and over again.

One of the drawbacks to the making of instruction sheets has been the printing or duplicating of enough sheets to supply all boys with a set. This idea has been forced upon us by com-

mercial houses and is erroneous. One set of sheets is all that is necessary, and they may be typewritten. Most shops have enough wall space for a bulletin board upon which one set of sheets may be fastened. Usually there is only one boy at a time reading, when the sheets are used as a supplementary aid. However, if the sheets are to be used as a textbook and to replace the demonstration, then each boy should have a complete set.

SAMPLES OF INSTRUCTION SHEETS PREVIOUSLY USED BY THE
AUTHOR

INFORMATION SHEET NO. 10

STAIN

1. Stain is applied to freshly cut and seasoned wood to produce a rich and mellow color, to emphasize the grain, and to match the finish of furniture at home. Often times certain species of woods are stained to imitate others more costly, providing their grain and texture are similiar. Many species of wood, for example, gumwood, are stained to imitate mahogany or walnut. Commercial furniture thus stained should be labeled "mahogany finish" or "walnut finish", as the case may be. Any stain is transparent and does not obscure the grain of the wood.

2. WATER STAINS are made by dissolving powdered aniline colors in hot water. They are clear, penetrate deeply, and do not fade. They are inexpensive and widely used. They have a disadvantage for the beginner in that they raise the grain of the wood.

3. SPIRIT STAINS are also made from aniline colors but the solvent is alcohol. They dry so rapidly that it is difficult to cover a large surface without showing laps, unless applied with an air brush. They are mostly used in refinishing and shading work.

4. OIL STAINS are made by dissolving oil aniline colors in turpentine, benzine, or benzol. Asphaltum and naphtha are also often used. They are very easy to apply and spread evenly, but take considerable time (about 12 hours) to dry. They

fade when exposed to light. This is the kind of stain you will use on all your work in this shop.

5. Aniline is a coal-tar product and is an oily poisonous substance used in dye making. Benzine and benzol are also coal-tar products. Asphalt is a mineral pitch found around oil wells. Naphtha is distilled from petroleum, and turpentine is an oil produced from the sap of the long-leaf pine tree.

QUESTIONS:

1. Why do we apply stain to projects?
2. Name three kinds of stain.
3. Why is oil stain the easiest to apply?
4. From what is alcohol obtained? Turpentine? Naphtha?

REFERENCES:

- Hjorth, Herman---Principles of Wood Work, pp. 213, 214.
Griffith, Ira S.---Essentials of Woodworking, p. 181.
Jeffreys, Harry R.---Wood-Finishing, pp. 22-31.

Operation Sheet No. 10

OPERATION:

How to apply stain.

REASON FOR THE OPERATION:

To improve the appearance and to protect the finished project.

MATERIALS:

The finished project.

TOOLS USED:

Stain, brush, rags or waste.

PROCEDURE:

1. Read Information Sheet No. 10 and receive the approval of your instructor before beginning the operation.
2. Decide on the kind or color of stain to use, and pour out enough stain into the stain bucket to do the job.
3. Dip the brush about one-third of the depth of the bristles into the stain. Draw the brush lightly against the edge of the can to remove the surplus stain from the brush.
4. Stain the underneath and inside parts of the project first and stain the top last.
5. Begin in the center of each surface and brush out toward the edges in all directions from the center.
6. Hold the brush at a 45 degree angle, pointing the handle of the brush toward the direction of the stroke.
7. Do not let the brush bristles "flip" stain at the end of the stroke.
8. Never draw the brush onto or over the edges but brush out and off of the edges.

9. Let the stain dry a few minutes; then wipe off the surplus with a dry rag or waste.

10. Wipe off end grain quickly to prevent it's becoming too dark.

11. After staining, inspect the project for missed spots. Set the project to dry for at least 12 hours.

12. Set the brush back into container and pour any stain left in the bucket back into the stain can. Put away all your work and clean up any stain you may have spilled or dropped. Put the used rags into the used rag container.

QUESTIONS:

1. Why is proper preparation of the surface before staining so important?

2. What two things can you think of that should determine your choice of colors?

3. What will happen if a brush is allowed to "flip"?

4. Why do ends stain darker than edges?

5. What may be used to remove stain from the hands?

6. Why keep the used rags in a tight container?

REFERENCES:

1. McGee and Brown---Instructional Units in Woodfinishing, pp. 9-15.

2. Newell, A. C.---Coloring, Finishing and Painting Wood, Chapter IV, p. 50.

3. Jeffreys---Woodfinishing, p. 29.

JOB SHEET NO. 1

JOB SPECIFICATION: A Squared Board Problem.

To square up a board and make one of the problems of your choice shown on Blueprint No. 1.

REASON FOR THE JOB:

Before you can make any project it will be necessary to learn the method of squaring stock to dimensions. You will be given a board on which to learn the process of squaring stock. After you square this board according to the procedure in the Operation Sheet, you may make the board into one of the problems shown in the blueprint.

MATERIALS:

1 pc. poplar 13/16"x8"x8".

Sandpaper, stain, and wax.

TOOLS:

The bench tools which consist of the plane, rule, try-square, and back saw. Also the T-bevel, brace, bits, framing square, and sandpaper block.

PREREQUISITES:

Operation Sheets Nos. 1, 2, 2A, 2B, 2C, 2D, 2E, 3, 4, 5, 6, 7, 8, 9.

Information Sheets Nos. 1, 2, 3, 4, 5, 6, 7.

PROCEDURE:

1. Read Operation Sheet No. 1 and adjust the plane as directed.
2. Read Operation Sheet No. 2 and mark the best edge and best face.
3. Read Operation Sheet No. 2A and plane the best edge straight and square with the face. Have this checked by in-

structor.

4. Read Operation Sheet No. 2B and plane the best end as directed. Have this checked.

5. Read Operation Sheet No. 2C and reduce to length as directed. Have this checked.

6. Read Operation Sheet No. 2D and reduce to width. Have this checked.

7. Read Operation Sheet 2E and surface the best face as directed. Have this checked by the instructor. Surface the other face.

8. Cut the Chamfer.

Finger-gage lines for a $\frac{1}{4}$ " chamfer on the arrises of the best face. (See Operation Sheet No. 4) Read Operation Sheet No. 5 and set the T-bevel for 45 degrees. Cut the chamfer with the plane, planing the ends first and the edges last. Test frequently with the T-bevel when nearing the line. Have the results checked by the instructor.

9. Sand the Board.

Use No. $\frac{1}{2}$ sandpaper and sandpaper block and sand with the grain. (See Operation Sheet No. 9) On edges, ends, and chamfer, hold the sanding block flat against the surfaces so that the arrises will not be rounded.

10. Choose the project.

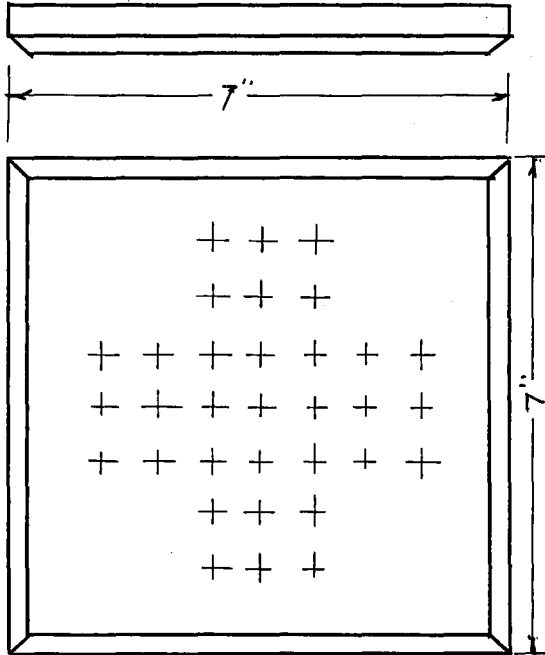
Lay out the necessary lines and mark center of the holes with light pencil lines. Have this checked by the instructor. Drill the holes as directed in Operation Sheet No. 6.

11. The Finish.

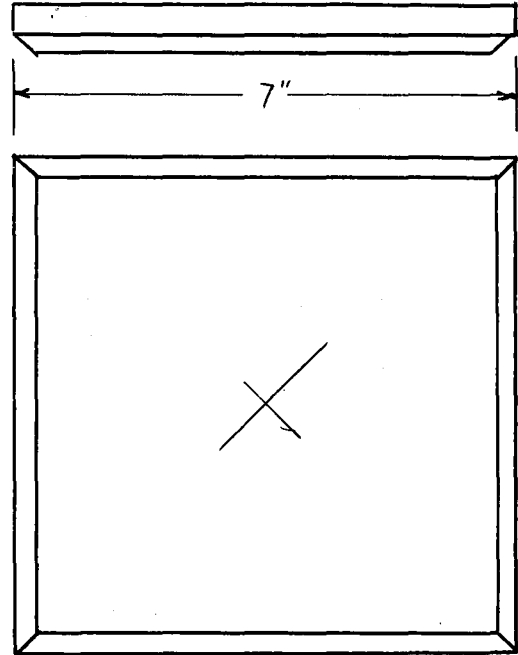
Your instructor may not want you to finish this pro-

ject at this time. Confer with him, and, if he does, read Information Sheets Nos. 10 and 12 before starting.

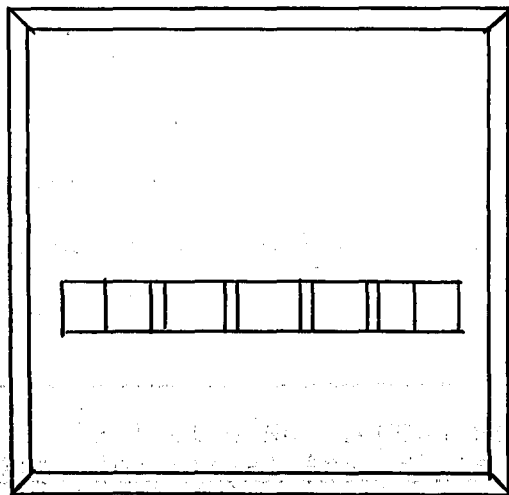
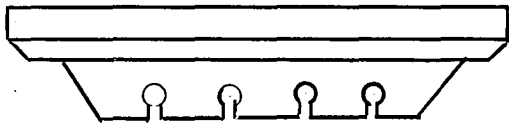
BLUE PRINT NO. 1



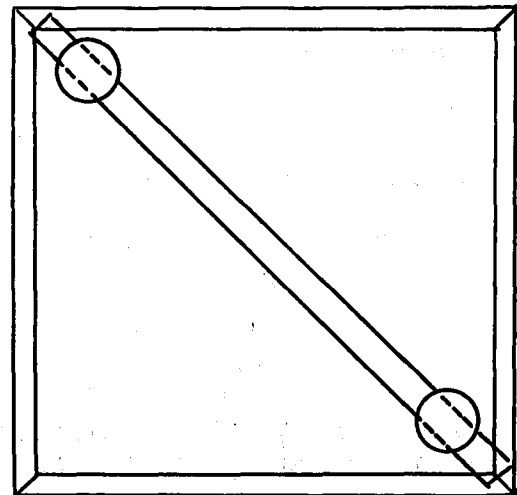
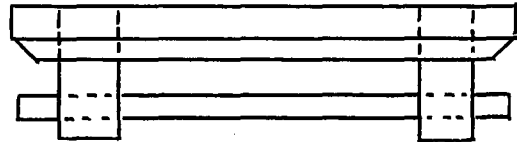
Peg Puzzle Game



Ring-a-peg Game



Tooth Brush Holder



Tie Rack

V. THE COURSE OF STUDY

A. Development of the Questionnaire

In order to include in this study the titles of the instruction sheets that will represent a somewhat standardized course of study, it was necessary to arrive at some definite units of instruction. Although there is a suggested state course of study for the subject¹, it was the opinion of the writer that this suggested course was not being followed very closely in most cases. This, if true, is probably due to the vagueness and incompleteness of the course as outlined. In order to have a clearer conception of what the teachers over the state were actually doing, it was decided to send out a questionnaire.

The questionnaire sent out was divided into three parts. One part contained the units of operations taught; another, the units of information taught; and the third, the type of projects being used. In order to make the questionnaire as effective as possible and contain all elements that probably would be taught by most teachers, it was decided to base it on the "List of Learning or Teaching Units" found in the American Vocational Association Bulletin entitled Standards

¹Bulletin No. 100G-4 State Department of Public Instruction, Industrial Arts State Course of Study for Secondary Schools (1929), pp. 116-120.

of Attainments in Industrial Arts Teaching². This list contains the consensus of opinion of the leading educators in this field and is considered the most acceptable analysis of the woodworkers' trade from an educational viewpoint.

With the above study used as a guide, the questionnaire shown on page 93 of the Appendix was developed. Not all of the units listed in the bulletin appear in the questionnaire, because the list given in the bulletin covered not only the seventh and eighth grades but the ninth grade as well. However, the units selected were those that would probably be taught in the seventh and eighth grades, and blank spaces were provided for any additional units that might be taught. In only five cases were additions made.

As may be noted from the questionnaire on page 95, the first sheet lists the operations taught, or things a boy should be able to do. The second sheet (page 96) lists the information, or the things a boy should know. In order to arrive at some knowledge of the type of projects that is being used, a set of ten sheets was drawn (page 99 of the appendix) from which the teacher was to select six projects representative of the type he used in each semester of work. The projects shown on these ten sheets were selected by taking every suitable project from all available textbooks and magazines, while many projects that have never been published were obtained

²Bulletin, "Standards of Attainments in Industrial Arts Teaching". American Vocational Association. Report of Committee (1931).

from teachers. When these were assembled, there were over 250 sketches, and from this group the 120 represented here were selected for the questionnaire.

The questionnaires were sent to 197 teachers listed in the state directory as teaching seventh and eighth grade woodwork. From this number 107 answers were received and tabulated.

B. Results of the Questionnaire

While the tabulated results of the questionnaire show that in most cases the teachers are teaching the same subject matter, there is a wide difference of opinion as to the semester or grade in which a given unit should be taught. There is also a wide difference of opinion as to the projects that should be taught. Below are the results of the first sheet of the questionnaire.

TABLE II
THINGS THE BOY SHOULD BE ABLE TO DO

| Unit of Operation | 7B | 7A | 8B | 8A | Majority |
|--|----|----|----|----|----------|
| 1. Read a working drawing. | 68 | 16 | 11 | 1 | 7B |
| 2. Make a bill of material. | 42 | 29 | 14 | 4 | 7B |
| 3. Plan the procedure of doing job. | 38 | 27 | 17 | 6 | 7B |
| 4. Check material when received. | 39 | 15 | 16 | 3 | 7B |
| 5. Use a rule for measuring and dividing spaces. | 84 | 3 | 6 | | 7B |
| 6. Lay out a pattern on stock. | 43 | 27 | 18 | 3 | 7B |
| 7. Check the layout. | 33 | 20 | 16 | 3 | 7B |
| 8. Use dividers or compass. | 31 | 16 | 17 | 6 | 7B |

TABLE II (Continued)

| | | | | | |
|---|----|----|----|----|-----|
| 9. Gage with a pencil. | 41 | 18 | 15 | 10 | 7B |
| 10. Gage with a marking-gage. | 56 | 21 | 16 | 5 | 7B |
| 11. Use a try-square. | 87 | 8 | 2 | | 7B |
| 12. Square up a board. | 80 | 9 | 6 | 1 | 7B |
| 13. Saw to the line. | 71 | 14 | 12 | 2 | 7B |
| 14. Use a back-saw. | 72 | 12 | 7 | 2 | 7B |
| 15. Use a coping saw. | 52 | 33 | 6 | 3 | 7B |
| 16. Use a compass-saw. | 13 | 19 | 15 | 15 | 7A |
| 17. Use a turning-saw. | 7 | 23 | 21 | 13 | 7A |
| 18. To round edges. | 19 | 59 | 12 | 7 | 7A |
| 19. Finish inside and outside curves. | 21 | 43 | 17 | 11 | 7A |
| 20. Drill holes with auger-bit. | 68 | 21 | 10 | 11 | 7B |
| 21. Drill holes in wood. | 70 | 17 | 4 | 1 | 7B |
| 22. Countersink holes. | 57 | 29 | 8 | 1 | 7B |
| 23. Fasten with screws. | 50 | 40 | 7 | 9 | 7B |
| 24. Use brad-awl for making holes for nails or screws. | 21 | 21 | 18 | 1 | 7B |
| 25. Trim or pare with chisel. | 9 | 32 | 32 | 13 | 7A |
| 26. Use the gouge. | 6 | 15 | 16 | 15 | 8B* |
| 27. Use a scraper. | 22 | 19 | 23 | 17 | 8B |
| 28. Use sandpaper. | 80 | 13 | 3 | | 7B |
| 29. Use a woodrasp for shaping curves. | 39 | 42 | 11 | 2 | 7A |
| 30. Drive and draw nails. | 52 | 33 | 9 | 3 | 7B |
| 31. Set nail or brad. | 45 | 35 | 10 | 3 | 7B |
| 32. Use T-bevel. | 13 | 20 | 30 | 18 | 8B |
| 33. Use a spokeshave. | 7 | 39 | 17 | 13 | 7A |
| 34. Lay out hexagon. | 8 | 15 | 13 | 16 | 8A |
| 35. Lay out octagon. | 7 | 18 | 33 | 17 | 8B |

TABLE II (Continued)

| | | | | | |
|--------------------------------------|----|----|----|----|------|
| 36. Lay out and cut chamfer. | 62 | 19 | 7 | 3 | 7B |
| 37. Prepare glue. | 4 | 18 | 15 | 24 | 8A * |
| 38. Glue up work. | 9 | 27 | 27 | 22 | 7A |
| 39. Use andscrew and clamps. | 22 | 24 | 28 | 14 | 8B |
| 40. Fit hinges. | 4 | 10 | 16 | 44 | 8A |
| 41. Apply stain. | 61 | 23 | 6 | 4 | 7B |
| 42. Apply stain for two-tone effect. | 5 | 15 | 19 | 22 | 8A |
| 43. Apply shellac. | 47 | 31 | 9 | 7 | 7B |
| 44. Apply filler. | 10 | 17 | 26 | 22 | 8B |
| 45. Apply wax. | 45 | 24 | 10 | 10 | 7B |
| 46. Apply varnish. | 13 | 23 | 21 | 25 | 8A |
| 47. Apply enamel. | 29 | 26 | 21 | 14 | 7B |
| 48. Apply lacquer. | 15 | 12 | 11 | 14 | 7B * |
| 49. To clean and care for brushes. | 60 | 18 | 16 | 4 | 7B |
| 50. Use a spray-gun. | | 4 | 3 | 13 | 8A * |
| 51. Apply paint. | 36 | 29 | 12 | 6 | 7B |
| 52. Transfer a design. | 11 | 28 | 24 | 11 | 7A |
| 53. Apply inlay. | 2 | 1 | 7 | 19 | 8A |
| 54. Lay out duplicate parts. | 11 | 36 | 23 | 12 | 7A |
| 55. Make a butt joint. | 33 | 34 | 17 | 2 | 7A |
| 56. Make a notch joint. | 2 | 16 | 18 | 6 | 8B * |
| 57. Make a half-lap joint. | 10 | 17 | 49 | 13 | 8B |
| 58. Make a dado joint. | 9 | 25 | 25 | 10 | 8B |
| 59. Make a croff-lap joint. | 11 | 17 | 38 | 6 | 8B |
| 60. Make a miter joint. | 4 | 13 | 16 | 31 | 8A |
| 61. Make a dowel joint. | 3 | 13 | 20 | 34 | 8A |
| 62. Make a housed joint. | | 5 | 6 | 23 | 8A * |
| 63. Make an edge-to-edge glue joint. | 3 | 18 | 20 | 35 | 8A |
| 64. Lay out and cut taper. | 8 | 15 | 21 | 18 | 8B |

TABLE II (Continued)

| | | | | | |
|-----------------------------------|----|----|----|----|------|
| 65. Fasten on a table-top. | 6 | 6 | 18 | 42 | 8A |
| 66. Simple upholstering. | 4 | 13 | 23 | 22 | 8B |
| 67. Sharpen tools. | 20 | 20 | 29 | 16 | 8B |
| 68. Keep tools free from rust. | 50 | 13 | 13 | 6 | 7B |
| 69. Set and use an expansive-bit. | 13 | 22 | 19 | 16 | 7A |
| 70. Use a Forstner bit. | 3 | 5 | 8 | 11 | 8A * |
| 71. Use a bench hook. | 1 | | | | 7B * |
| 72. Use a rip saw. | | 1 | | | 7A * |
| 73. File and set a saw. | | 1 | | | 7A * |
| 74. Countersink thick stock. | | | 1 | | 8B * |
| 75. Design a pattern. | | 1 | | | 7A * |

The figures appearing in the first four columns indicate the number teaching a given unit in each particular semester of work. The last column shows the semester in which the majority teach each unit. Although the majorities are not impressive, they will be used as the basis for classifying the units into semesters of work. This does not mean that they must be taught in the semester indicated, but is only a suggestion that this is the proper place for the unit to be introduced. The units starred (*) in the last column were answered by so few teachers that they will be considered as doubtful to teach if they should be taught in the seventh and eighth grades at all.

The titles for the operation sheets determined from the last column of Table II are listed on page 82 in combination with the other instruction sheets.

Below are the results of the second sheet of the questionnaire.

TABLE III
THINGS THAT A BOY SHOULD KNOW

| Unit of Information | 7B | 7A | 8B | 8A | Majority |
|--|----|----|----|----|----------|
| I. Lumber | | | | | |
| 1. Identify common kinds of lumber used in woodworking trades. | 45 | 18 | 12 | 19 | 7B |
| 2. Know principal characteristics, working qualities, principal uses, and sources of supply. | 26 | 21 | 11 | 21 | 7B |
| 3. Methods of cuttings and milling. | 20 | 18 | 18 | 18 | 7B |
| 4. Know how lumber is dried. | 22 | 26 | 17 | 15 | 7A |
| 5. Effects of moisture on wood. | 35 | 21 | 16 | 11 | 7B |
| 6. Standard dimensions of lumber and how classified. | 16 | 22 | 18 | 18 | 7A |
| 7. Know nominal and actual dimensions of lumber. | 14 | 19 | 18 | 17 | 7A |
| 8. How veneer and plywood are made. | 12 | 16 | 22 | 26 | 8A |
| II. Finishes. | | | | | |
| 1. Object of finishes. | 48 | 26 | 12 | 5 | 7B |
| 2. Kinds of finish in common use. | 43 | 27 | 16 | 7 | 7B |
| 3. Durability of each finish. | 25 | 26 | 24 | 10 | 7A |
| 4. Conditions or places affecting different finishes. | 19 | 15 | 26 | 11 | 8B |
| 5. Materials from which finishes are made. | 18 | 21 | 23 | 13 | 8B |
| III. Glue. | | | | | |
| 1. Kinds of glue. | 13 | 28 | 26 | 18 | 7A |
| 2. Preparation of glue. | 11 | 22 | 24 | 21 | 8B |
| 3. Conditions and requirements in use. | 10 | 23 | 24 | 20 | 8B |

TABLE III (Continued)

| | | | | | |
|--|----|----|----|----|------|
| IV. Nails and other fasteners. | | | | | |
| 1. Kinds of nails and fasteners. | 48 | 34 | 12 | 2 | 7B |
| 2. Uses of each. | 44 | 27 | 13 | 3 | 7B |
| 3. Sizes of each. | 38 | 32 | 13 | 4 | 7B |
| 4. How nails are sold. | 39 | 29 | 15 | 2 | 7B |
| 5. How manufactured. | 30 | 21 | 17 | 5 | 7B |
| V. Screws. | | | | | |
| 1. Kinds. | 44 | 31 | 13 | 5 | 7B |
| 2. Uses of different kinds. | 37 | 28 | 13 | 4 | 7B |
| 3. How sizes and kinds are indicated. | 35 | 29 | 17 | 6 | 7B |
| 4. How they are sold. | 34 | 25 | 16 | 6 | 7B |
| VI. Sandpaper and steel-wool. | | | | | |
| 1. Kinds of sandpaper. | 58 | 15 | 14 | 4 | 7B |
| 2. Grades of sandpaper. | 56 | 19 | 15 | 4 | 7B |
| 3. Principal uses. | 55 | 16 | 13 | 4 | 7B |
| 4. Grades and uses of steel-wool. | 23 | 7 | 23 | 11 | 8B * |
| VII. Characteristics of different types of period furniture. | | | | | |
| | | 4 | 8 | 27 | 8A * |
| VIII. Design of furniture. | | | | | |
| 1. Adaptability. | 4 | 10 | 18 | 26 | 8A |
| 2. Structure. | 4 | 9 | 20 | 28 | 8A |
| 3. Well made. | 4 | 10 | 21 | 26 | 8A |
| 4. Proportion. | 4 | 11 | 21 | 27 | 8A |
| 5. Stability. | 3 | 11 | 21 | 25 | 8A |
| 6. Pleasing outline. | 2 | 12 | 19 | 27 | 8A |
| 7. Finish. | 6 | 12 | 21 | 26 | 8A |
| IX. Manufacture. | | | | | |
| 1. Location of manufacturing concerns. | 6 | 6 | 14 | 28 | 8A |

TABLE III (Continued)

| | | | | | |
|---|----|----|----|----|----|
| 2. Division of labor in industry. | 3 | 3 | 13 | 29 | 8A |
| 3. Use of automatic machinery. | 4 | 2 | 16 | 28 | 8A |
| X. Types of joints, and use. | 11 | 15 | 35 | 11 | 8B |
| XI. Hardware. | | | | | |
| 1. Hinges, latches, and locks. | 4 | 8 | 21 | 33 | 8A |
| 2. Special fittings. | 3 | 4 | 18 | 32 | 8A |
| XII. Types of tools and their uses, saw, planes, hammer, etc. | 67 | 11 | 9 | 6 | 7B |
| XIII. Kinds of grinding and sharpening stones, grade, and uses. | 14 | 20 | 25 | 17 | 8B |
| XIV. Opportunities and requirements in the woodworking trades. | 5 | 12 | 16 | 37 | 8A |

This sheet shows the results of the answers by semester for each unit of information. These units involve the information concerning qualities and characteristics of materials and other matters of general interest in the field of woodworking. The form used for this questionnaire is shown on page 95 of the appendix. The last column indicates in which semester the majority teach each unit, and those starred (*) were answered by so few teachers as to make them doubtful, or to cause them to be taught in the ninth year. Many of these units may be only briefly touched in the seventh and eighth grade and emphasized later in the ninth grade, or 3rd course of woodwork.

This table shows only where the units should be taught, while the titles for the information sheets determined from these units appear on page 81.

The results of the third sheet follows.

TABLE IV
PROJECTS TO BE TAUGHT

| No. | Name | 7B | 7A | 8B | 8A | Majority |
|-----|-------------------------|----|----|----|----|----------|
| 1. | Game Board. | 49 | 2 | 1 | | 7B |
| 2. | Cutting Board | 44 | 4 | | | 7B |
| 3. | Tie Rack | 35 | 5 | 1 | 1 | 7B |
| 4. | Peg or Key Board | 28 | 2 | | | 7B |
| 5. | Sign or House Number | 25 | 2 | | 1 | 7B |
| 6. | Bread Board | 24 | 6 | | | 7B |
| 7. | Tie Racks | 15 | 2 | | | 7B |
| 8. | Broom Holder | 44 | 15 | 1 | | 7B |
| 9. | Tie Rack | 17 | 4 | 1 | | 7B |
| 10. | Watch or Calendar Stand | 20 | 5 | | | 7B |
| 11. | Tie Rack | 15 | 7 | | | 7B |
| 12. | Book Rack | 30 | 15 | 2 | 2 | 7B |
| 13. | Lamp | 5 | 7 | 1 | 1 | 7A |
| 14. | Bill File | 6 | 8 | 2 | | 7A |
| 16. | Tooth Brush Holder | 13 | 12 | 2 | | 7B |
| 17. | Foot Stool | 9 | 21 | 5 | 2 | 7A |
| 18. | Clock Case | | 3 | 3 | 1 | 7A |
| 19. | Corner Shelf | 7 | 21 | 5 | 2 | 7A |
| 20. | Flower Pot Holder | 2 | 7 | 2 | | 7A |
| 21. | Letter Rack | 24 | 13 | | | 7B |
| 22. | Book Ends | 10 | 14 | 5 | | 7A |
| 23. | Blotter Pad | 3 | 4 | 1 | | 7A |
| 24. | Wren House | 17 | 22 | 7 | | 7A |
| 25. | Bird House | 12 | 14 | 4 | | 7A |

TABLE IV. (Continued)

| | | | | | | |
|-----|--------------------|---|----|----|----|----|
| 26. | Scissors Holder | 7 | 9 | | | 7A |
| 27. | Candle Stick | 1 | 4 | 3 | | 7A |
| 28. | Lamp | 1 | 5 | 1 | | 7A |
| 29. | Skee Ball Game | 1 | 3 | 4 | | 8B |
| 30. | Match Striker | 8 | 2 | | | 7B |
| 31. | Bracket Shelf | 4 | 8 | | | 7A |
| 32. | Shelf | 4 | 14 | 2 | 2 | 7A |
| 33. | Broom Holder | 3 | 13 | 1 | | 7A |
| 34. | Book Rack | 8 | 11 | 5 | | 7A |
| 35. | Book Rack | 1 | 14 | 4 | 1 | 7A |
| 37. | Tie Rack | 1 | 6 | 4 | | 7A |
| 38. | Lamp | | 7 | 5 | | 7A |
| 39. | Candle Sconce | 1 | 4 | 2 | | 7A |
| 40. | Desk Set | | 8 | 6 | | 7A |
| 42. | Pen and Ink Stand | | 14 | 1 | 1 | 7A |
| 43. | Corner Shelf | 3 | 16 | 17 | 5 | 8B |
| 44. | Wall Shelf | | 16 | 17 | 6 | 8B |
| 45. | Corner Shelf | 5 | 11 | 6 | 3 | 7A |
| 47. | Foot Stool | 1 | 13 | 18 | 3 | 8B |
| 48. | Lamp | | 5 | 3 | 2 | 7A |
| 49. | Key Rack or Shield | 2 | 5 | 7 | | 8B |
| 50. | Dutch Stool | | 3 | 5 | 2 | 8B |
| 51. | Clock Case | | 3 | 5 | 1 | 8B |
| 52. | Lamp | 1 | 12 | 5 | 3 | 7A |
| 53. | Sewing Box | 2 | 6 | 14 | 10 | 8B |
| 54. | Bath Tub Duck | 4 | 2 | 3 | | 7B |
| 56. | Sled | | 2 | 9 | 5 | 8B |

TABLE IV (Continued)

| | | | | | | |
|-----|-------------------------|----|---|----|----|----|
| 57. | Foot Stool | | 1 | 4 | 8 | 8A |
| 58. | Doggie Door Stop | 11 | 7 | 7 | 2 | 7B |
| 59. | Toy Outboard Motor Boat | 1 | 3 | 2 | | 7A |
| 60. | Bitter Sweet Holder | 3 | 4 | 4 | 2 | 7A |
| 61. | Flower Pot Stand | 1 | 5 | 9 | 3 | 8B |
| 62. | Lamp | | 4 | 12 | 2 | 8B |
| 64. | Door Stop | 7 | 5 | 8 | 2 | 8B |
| 65. | Weather Vane | | 4 | 10 | 2 | 8B |
| 66. | Smoking Stand | | 3 | 21 | 9 | 8B |
| 67. | Pedestal | | 2 | 10 | 8 | 8B |
| 68. | Taboret | 1 | 9 | 30 | 8 | 8B |
| 69. | Bathroom Stool | | 4 | 15 | 5 | 8B |
| 70. | Jardinere Stand | | 2 | 6 | 2 | 8B |
| 77. | Taboret | | | 1 | 5 | 8A |
| 78. | Round Flower Stand | | | 6 | 4 | 8B |
| 79. | Flower Stand | | 2 | 6 | 1 | 8B |
| 80. | Fern Table | | | 4 | 3 | 8B |
| 81. | Smoking Cabinet | | | 4 | 8 | 8A |
| 82. | Hall Tree | 1 | 5 | 15 | 22 | 8A |
| 83. | Tilt-top Table | | | 3 | 7 | 8A |
| 84. | Flag Staff Holder | | | 3 | 3 | 8B |
| 87. | Costumer | | 1 | 5 | 9 | 8A |
| 89. | Book Trough | 1 | 2 | 2 | 3 | 8A |
| 91. | Animal Book Ends | 1 | 4 | 2 | 1 | 7A |
| 92. | Foot Stool | | 1 | 5 | 6 | 8A |
| 93. | Drawing Board | 1 | 1 | 6 | 11 | 8A |
| 94. | Radio Bench | 1 | 1 | 4 | 21 | 8A |
| 95. | Console Table | | 1 | 5 | 10 | 8A |

TABLE IV (Continued)

| | | | | | | |
|------|------------------------------------|---|---|---|----|----|
| 96. | Book and Magazine Rack | | 1 | 2 | 5 | 8A |
| 98. | Book Shelves | | | 2 | 11 | 8A |
| 99. | Foot Stool | | | 3 | 17 | 8A |
| 100. | End Table | | | 5 | 12 | 8A |
| 101. | End Table | | 1 | 1 | 23 | 8A |
| 102. | End Table | | | 1 | 10 | 8A |
| 103. | Tilt-top Table | | 1 | 2 | 6 | 8A |
| 104. | Smoking Cabinet | | | 2 | 10 | 8A |
| 105. | Drop-leaf Table | | | | 9 | 8A |
| 106. | Checker Board Table | | | | 6 | 8A |
| 107. | Magazine Basket | 2 | 2 | 4 | 30 | 8A |
| 108. | Foot Stool | | | 3 | 8 | 8A |
| 109. | Combination Book and Magazine Rack | | | 3 | 7 | 8A |
| 110. | Telephone Wall Cabinet | | | | 6 | 8A |
| 111. | End Table | | | | 12 | 8A |
| 112. | Coffee Table | | 1 | 2 | 2 | 8A |
| 113. | Hearth Basket | 1 | 1 | 2 | 2 | 8A |
| 114. | Sewing Cabinet | | 1 | 1 | 20 | 8A |
| 117. | Stand | 1 | 1 | 2 | 6 | 8A |
| 118. | Lamp | | 1 | 1 | 6 | 8A |
| 119. | Magazine Basket | 2 | | 2 | 4 | 8A |
| 120. | Lamp | | 2 | 2 | 3 | 8A |

On page 99 of the appendix appear the sketches of the 120 projects accompanying Sheet No. 3 of the questionnaire. Each recipient was asked to select six projects to represent each semester of work. This list of projects was chosen in the following manner; thirty-eight teachers of junior-high-school

woodwork donated sketches of projects they use satisfactorily in their own work, and this was supplemented by taking projects from all available textbooks and magazines dealing with mechanics, science, and homecraft work. From these sources over 250 projects were collected, and from this number 120 represented here were selected for the questionnaire.

The six projects receiving the majority of answers for each semester of work are shown in the table below.

TABLE V
RECOMMENDED PROJECTS

| | 7B | 7A | 8B | 8A |
|---|-----|-------------|-------|---------|
| 1 | 1 | 24 | 68 | 107 |
| 2 | 2-8 | 17 | 66 | 101 |
| 3 | 3 | 43-44 | 43-44 | 82 |
| 4 | 12 | 12 | 69-82 | 94 |
| 5 | 4 | 22-32-35-42 | 42 | 99 |
| 6 | 6 | 21-33-47 | 47 | 100-111 |

In several cases there is a tie between projects, and these are grouped together. For the third project in both 7A and 8B the choice is the same. However, in the final course of study the projects are listed for 7A, as they best fit the unit of operation for 7A. The fact that there are no outstanding majorities for a few projects is probably due to the lack of agreement as to the semester in which given units of operation are taught.

C. The Course of Study

From results given in the foregoing tables, the writer has

determined the semester in which each of the units of operation and information should be taught as well as the projects to be taught. Below are given the titles to the operation and information sheets that must be written to make a complete course of study involving all the units classified. It may be noted that the sheets are paired by numbers where possible and arranged by grades in the probable order in which they should be taught. The projects are entered at the proper places to take care of new learning units.

TABLE VI
COLLABORATED TITLES OF THE INSTRUCTION SHEETS

| Operation Sheet | Information Sheet | Learning Unit | Job or Project |
|---|---------------------------------|--------------------------|---|
| 7B | 7B | 7B | 7B |
| 1. How to square a board | 1. Description of a board | Squaring stock | 1. How to make a game board (1) |
| 2. How to use the rule | 2. The steel rule | Measuring | 2. How to make a cutting board (2) |
| 3. How to use the hand saws | 3. Saws | Sawing | 3. How to make peg board or key rack (4) |
| 4. How to gage with pencil and marking gage | 4. The marking gage | Gaging | 4. How to make a sign or house number board (5) |
| 5. How to lay out and cut chamfers | 5. Kinds of squares | Chamfering setting bevel | 5. How to make a bread board |
| 6. How to use sandpaper | 6. Sandpaper | Sanding | 6. How to make a broom holder (8) |
| 7. How to use the brace and bit | 7. The braces and kinds of bits | Boring | 7. How to make a book rack (120) |
| 8. How to apply stain | 8. Stain | Staining | |
| 9. How to apply wax | 9. Wax | Waxing | |

TABLE VI (Continued)

| | | | |
|---|--|-------------------------|---|
| 10. How to read a working drawing | 10. Common kinds of lumber | Reading a drawing | 8. How to make watch or calendar stand (10) |
| 11. How to make a bill of material | 11. Characteristics, qualities, and uses of lumber | Board feet and checking | 9. How to make a tie rack (7-9) |
| 12. How to plan the procedure of doing your job | 12. Effects of moisture on wood | | |
| 13. How to check material when received | 13. The lumberman's rules | | |
| 14. How to make a butt joint | 14. Types of butt joints | Butt joint | |
| 15. How to lay out a pattern on stock | 15. Simple designs | Laying out | |
| 16. How to use the dividers and compass | 16. The circle and its use | | |
| 17. How to use the back saw | 17. Type of back saws | Accurate sawing | |
| 18. How to drill holes in wood | 18. Kinds of screws and how they are made | Drilling | |
| 19. How to counter-sink and counterbore holes in wood | 19. Uses of different kinds of screws | Use of screws | |
| 20. How to fasten with screws | 20. How sizes and kinds of screws are indicated | | |
| 21. How to apply shellac | 21. Shellac | Shellacing | |
| 22. How to clean and care for brushes | 22. Brushes, kinds, and types | Brushes | |

TABLE VI (Continued)

| | | | |
|--|---|--------------------------------|--|
| 23. How to use the brad-awl | 23. Kinds of finishes, their object and use | Finishing | |
| 24. How to fasten with nails | 24. Nails | | |
| 25. How to keep tools free from rust | 25. Types of tools and their uses | Care of tools | |
| 7A | 7A | 7A | 7A |
| 26. How to make tapered edges | 26. The drying of lumber | Tapered edges | 10. How to make a wren house (24) |
| 27. How to apply paint. | 27. Paint | Painting | 11. How to make a foot stool (17) |
| 28. How to set and use the expansive bit | 28. Standard dimensions of lumber | Freehand and mechanical curves | 12. How to make a book rack (12) |
| 29. How to saw cut curves | 29. Saws used for cutting curves | Working curves | 13. How to make a pair of book ends (22) |
| 30. How to round edges | 30. Nominal and actual dimensions | Rounded curves | 14. How to make a corner shelf (43) |
| 31. How to smooth curves | 31. Files and rasps | | 15. How to make a wall shelf (44) |
| 32. How to use the chisel | 32. Chisels | Chiseling | 16. How to make a bracket shelf (32) |
| 33. How to use the spokeshave | 33. The spoke shave | | 17. How to make a book rack |
| 34. How to make a dado joint | 34. Kinds of glue | Dado joint | |
| 35. How to glue-up work | 35. Conditions and requirements in use of glue | Glueing | |
| 36. How to transfer a design | 36. Materials, use for decorative designs on wood | Designing | 18. How to make a pen and ink stand |

TABLE VI (Continued)

| | | | |
|---|---|--------------------------|---|
| 37. How to lay out out duplicate parts | 37. Good proportion in design | | |
| 38. How to apply enamel | 38. Enamel | Enameling | |
| 8B | 8B | 8B | 8B |
| 39. How to lay out a hexagon and octagon | 39. Use of geometrical figures in design | | 19. How to make a taboret (68) |
| 40. How to make a half-lap or cross-lap joint | 40. Types of joints and their uses | Cross-lap joint | 20. How to make a smoking stand (66) |
| 41. How to use the scraper | 41. Preparation of the surface for finishing | | 21. How to make a bathroom stool (69) |
| 42. How to use the handscrews and clamps | 42. Handscrews and clamps | Clamping | 22. How to make a hall tree (82) |
| 43. How to apply stain for two-tone effect | 43. Conditions or places affecting different finishes | Two-tone finishing | 23. How to make a foot stool (47) |
| 44. How to apply filler | 44. Filler | Filler | |
| 45. How to sharpen certain tools | 45. Kinds of grinding and sharpening stones | Tool sharpening | |
| 46. How to upholster | 46. Materials used in upholstering | Upholstering | |
| 8A | 8A | 8A | 8A |
| 47. How to fit hinges | 47. Kinds and types of hinges and hardware | Fitting cabinet hardware | 24. How to make a magazine basket (100) |

TABLE VI (Continued)

| | | | |
|----------------------------------|--|--------------|------------------------------------|
| 48. How to apply varnish | 48. Varnish | Varnish | 25. How to make an end table (101) |
| 49. How to make a miter joint | 49. The miter box | Miter joints | 26. How to make a radio bench (94) |
| 50. How to make a joint | 50. Lumbering and milling | Dowel joints | 27. How to make a foot stool (99) |
| 51. How to fasten on a table top | 51. Opportunities and requirements in the woodworking trades | | 28. How to make an end table (100) |
| | | | 29. How to make an end table (111) |

The foregoing list of instruction sheets are so titled that every unit of the questionnaire except those termed doubtful is included. This is rather a long list and would take considerable time to write. However, very few of these sheets need be more than one page long. If one stops and considers that these are the things that are actually taught, then sheets should be written to cover the entire group. Most of our commercial textbooks of instruction sheets contain only from twelve to twenty-four units, this at once makes them inadequate for a well-rounded course. With a little thought it is possible to combine several of the units and thus reduce the number of the instruction sheets.

The number in parentheses following the titles of the job refers to the number of the project on the questionnaire. A blueprint of pictorial drawing should be made for each job. As suggested before, it is recommended that no job sheets be written, but that the boy be required to make a working drawing of each project he elects to make and write a plan of procedure for each, which would eliminate the writing of job sheets.

VI. SUMMARY

In this study the writer has attempted to do two things.

1. Establish a background for a better understanding of the problem by:
 - a. Reviewing the purposes of the junior high school.
 - b. Showing the importance of the industrial arts work in a junior-high-school program.
 - c. Showing the educational value of woodwork as an industrial arts subject.
2. Develop a course of study that would be clearly analyzed into units for the writing of instruction sheets.
 - a. The determination to some extent of the physical arrangement of efficient instruction sheets from a teacher's viewpoint rather than from a trade foreman's viewpoint.
 - b. A course of study based on the opinions of teachers in the field analyzed into definite and systematized units of information, operation, and jobs to be performed, with the titles of such sheets so presented that they may be used as a guide for the writing of the sheets.

It is hoped that this study may be in some way a help to those who seek to improve their methods of teaching and to save their time and energy, and that this may prove to be a step in the direction of the standardization of units of instruction in seventh and eighth grade woodwork.

VII. APPENDIX

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B. The Questionnaire

January 12, 1934.

Dear Fellow Teacher:

As part of a study I am making in co-operation with Indiana State Teachers College, I find it necessary to call upon several men that are doing exceptional work in the field of Industrial Arts to help me analyze a problem that seems to be of general interest at this time.

My problem is to select from the American Vocational Association's "Standards of Attainment" those teaching units that apply only to hand woodwork in the seventh and eighth grades. I want to find out just what is most profitably taught in these two grades by the majority of our Junior High School teachers and to select problems or projects to fit the instructions. This will then afford a basis for the writing of instruction sheets for a course of study.

Enclosed are two sets of sheets to be checked. On one are the teaching units with a column in which you are asked to mark the grade in which you teach each particular unit. For instance, if you teach the first unit in 7B mark it as follows:

EXAMPLE

| | | | |
|--------------------------------|----|------------------------|----|
| 1. Read a working drawing.... | 7B | 43. Apply shellac..... | 8B |
| 2. Make a bill of material.... | 7A | 44. Apply filler..... | 8A |

Should you teach units not listed write them in the vacant spaces provided.

The other set of sheets contain 120 numbered projects, selected from magazines, books and gathered from teachers, suit-

able for teaching in seventh and eighth grade hand-woodwork. You are asked to choose six (6) projects for each grade, 7B, 7A, 8B, 8A. List these by number on Sheet No. 3. Please keep in mind while selecting the projects that they should include the "Standards of Attainment" previously marked. There should be a correlation between each project and the things you wish to teach for each grade.

I realize that you are no doubt very busy at this time and to ask you to do this places an added burden on you, but I believe you also realize the benefits such a study will have when the results are made available. In addition to what the A.V.A. and I.I.E.A. are doing with this problem, this study, I hope, will be a valuable contribution to our work.

Hoping for your earnest co-operation, may I thank you in advance for your consideration and help.

Very truly yours,

John S. McWethy,
R.R.1, Box 185,
Bridgeport, Indiana.

Sheet No. 1.

A.V.A. TEACHING UNITS

Things The Boy Should Be Able To Do

In Column at right of each unit check the units you teach in the 7th and 8th grade by marking the units taught with 7B, 7A, 8B, or 8A, depending on the grade in which it is taught.

| | |
|--|---|
| 1. Read a working drawing.... | 40. Fit Hinges..... |
| 2. Make a bill of material.... | 41. Apply stain..... |
| 3. Plan the procedure of doing job..... | 42. Apply stain for two-tone effect..... |
| 4. Check material when re- ceived..... | 43. Apply shellac..... |
| 5. Use a rule for measuring and dividing spaces.... | 44. Apply filler..... |
| 6. Lay out a pattern on stock | 45. Apply wax..... |
| 7. Check the layout..... | 46. Apply varnish..... |
| 8. Use dividers or compass... | 47. Apply enamel..... |
| 9. Gage with a pencil..... | 48. Apply lacquer..... |
| 10. Gage with a marking-gage. | 49. To clean and care for brushes..... |
| 11. Use a try-square..... | 50. Use a spray-gun..... |
| 12. Square up a board..... | 51. Apply paint..... |
| 13. Saw to the line..... | 52. Transfer a design..... |
| 14. Use a back-saw..... | 53. Apply inlay..... |
| 15. Use a coping saw..... | 54. Lay out duplicate parts. |
| 16. Use a compass-saw..... | 55. Make a butt joint..... |
| 17. Use a turning-saw..... | 56. Make a notch joint..... |
| 18. To round edges..... | 57. Make a half-lap joint... |
| 19. Finish inside and outside curves..... | 58. Make a dado joint..... |
| 20. Drill holes with auger- bit..... | 59. Make a cross-lap joint.. |
| 21. Drill holes in wood..... | 60. Make a miter joint..... |
| 22. Countersink holes..... | 61. Make a dowel joint..... |
| 23. Fasten with screws..... | 62. Make a housed joint..... |
| 24. Use brad-awl for making holes for screws or nails | 63. Make an edge-to-edge glue joint..... |
| 25. Trim or pare with chisel. | 64. Lay out and cut tapers.. |
| 26. Use the gouge..... | 65. Fasten on a table-top... |
| 27. Use a scraper..... | 66. Simple upholstering..... |
| 28. Use sandpaper..... | 67. Sharpen tools..... |
| 29. Use a woodrasp for shap- ing curves..... | 68. Keep tools free from rust..... |
| 30. Drive and draw nails..... | 69. Set and use an expan- sive-bit..... |
| 31. Set nail or brad..... | 70. Use a Forstner bit--.... |
| 32. Use T-bevel..... | 71. |
| 33. Use a spokeshave..... | 72. |
| 34. Lay out hexagon..... | 73. |
| 35. Lay out octagon..... | 74. |
| 36. Lay out and cut chamfer.. | 75. |
| 37. Prepare glue..... | 76. |
| 38. Glue up work..... | |
| 39. Use handscrew and clamps. | |

Sheet No. 2.

A.V.A. TEACHING UNITS

Things a Boy Should Know

In the column at right of each unit check the units you teach in the 7th and 8th grades by marking each unit with 7B, 7A, 8B, or 8A, depending on the grade in which it is taught.

1. Lumber.

1. Identify common kinds of lumber used in wood-working trades.....
2. Know principal characteristics, working qualities, principal uses and sources of supply.....
3. Methods of cuttings and milling.....
4. Know how lumber is dried.....
5. Effects of moisture on wood.....
6. Standard dimensions of lumber and how classified.....
7. Know nominal and actual dimensions of lumber.....
8. How veneer and plywood are made.....

II. Finishes.

1. Object of finishes....
2. Kinds of finish in common use.....
3. Durability of each finish.....
4. Conditions or places affecting different finishes.....
5. Materials from which finishes are made.....

III. Glue.

1. Kinds of glue.....
2. Preparation of glue...
3. Conditions and requirements in use.....

IV. Nails and other fasteners.

1. Kinds of nails and other fasteners.....
2. Uses of each.....
3. Sizes of each.....

4. How nails are sold..
5. How manufactured....

V. Screws.

1. Kinds.....
2. Uses of different kinds.....
3. How sizes and kinds are indicated.....
4. How they are sold....

VI. Sandpaper and steel-wool.

1. Kinds of sandpaper....
2. Grades of sandpaper...
3. Principal uses.....
4. Grades and uses of steel-wool.....

VII. Characteristics of different types of period furniture.....

VIII. Design of furniture.

1. Adaptability.....
2. Structure.....
3. Well made.....
4. Proportion.....
5. Stability.....
6. Pleasing outline.....
7. Finish.....

IX. Manufacture.

1. Location of manufacturing concerns.....
2. Division of labor in industry.....
3. Use of automatic machinery.....

X. Types of joints, and use.

XI. Hardware.

1. Hinges, latches and locks.....
2. Special fittings.....

XII. Types of tools and their uses.....

XIII. Kinds of grinding and

sharpening stones, grade,
and uses.....

XIV. Opportunities and re-
quirements in the
woodworking trades.....

Sheet No. 3.

Selection of Drawings

Will you please select from the inclosed 120 drawings six drawings for each of the grades 7B, 7A, 8B, and 8A. Choose the drawings that you believe will best teach the units you marked on the attainment sheets.

Place the number of the drawings selected, in order, under the proper heading listing six drawings for each semester of work.

| | 7B | 7A | 8B | 8A |
|----|-------|-------|-------|-------|
| 1. | _____ | _____ | _____ | _____ |
| 2. | _____ | _____ | _____ | _____ |
| 3. | _____ | _____ | _____ | _____ |
| 4. | _____ | _____ | _____ | _____ |
| 5. | _____ | _____ | _____ | _____ |
| 6. | _____ | _____ | _____ | _____ |

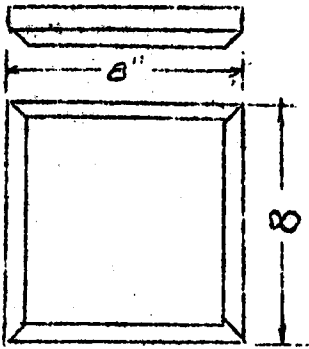
You may keep the ten sheets of drawings for your kindness in filling out these blanks. Send back only this sheet and the other two "Attainment Sheets" which you were asked to check.
Nos. 1, 2, 3,

Please fill in:

Name _____
 School _____
 Grades you teach _____

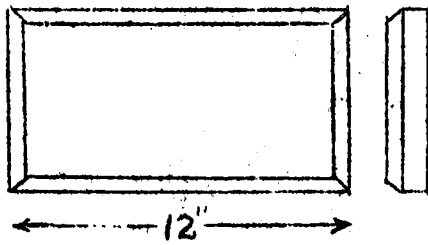
GAME BOARD

1



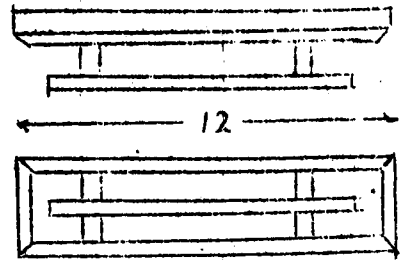
CUTTING BOARD

2



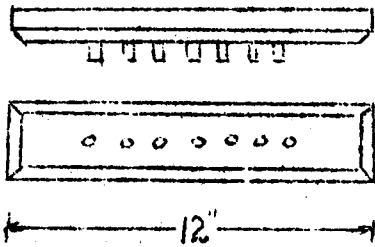
TIE RACK

3



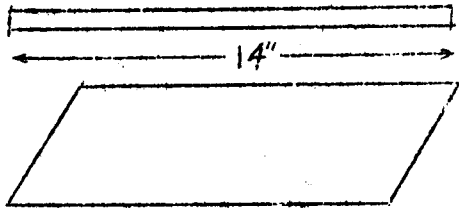
PEG or KEY BOARD

4



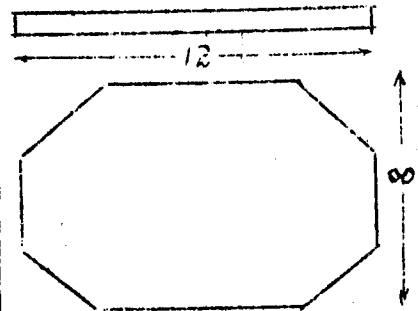
SIGN or HOUSE NUMBER

5



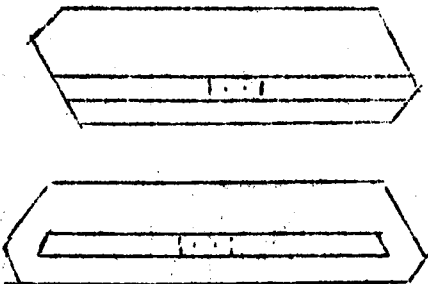
BREAD BOARD

6



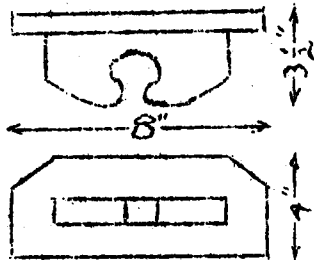
TIE RACKS

7



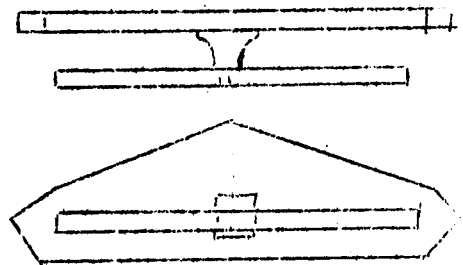
BROOM HOLDER

8



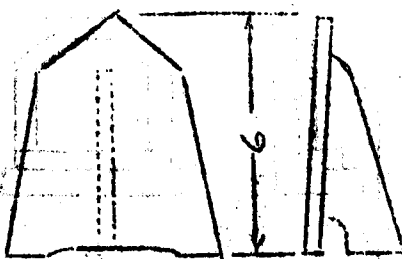
TIE RACK

9



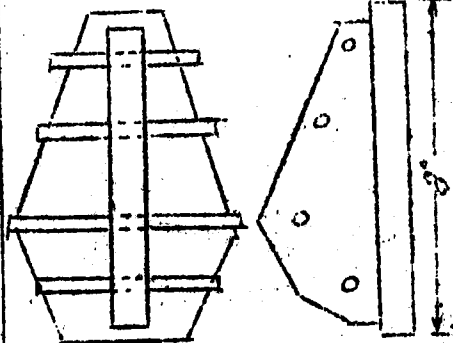
WATCH or CALENDER STAND

10



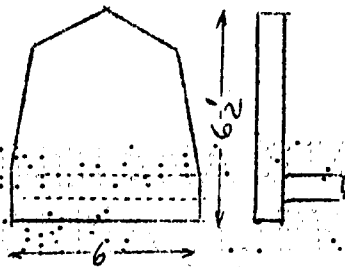
TIE RACK

11

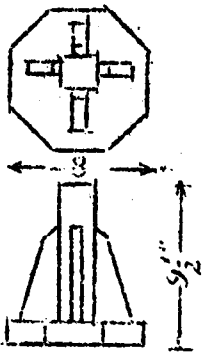


BOOK RACK

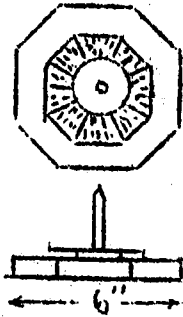
12



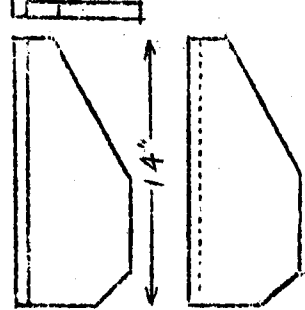
LAMP 13



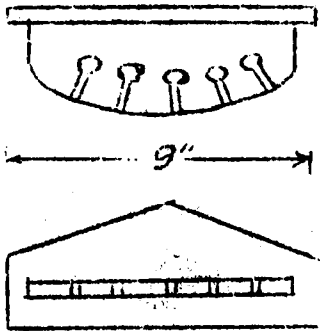
BILL FILE 14



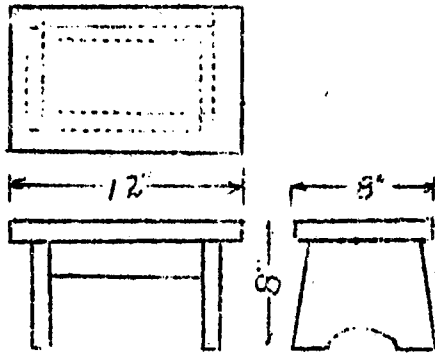
TELEPHONE SCREEN 15



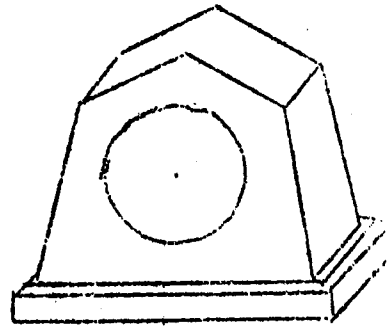
TOOTH BRUSH HOLDER 16



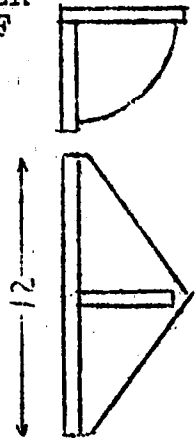
FOOT STOOL 17



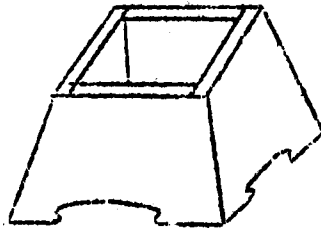
CLOCK CASE 18



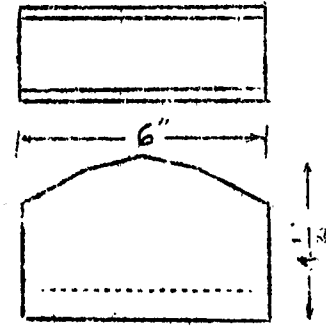
CORNER SHELF 19



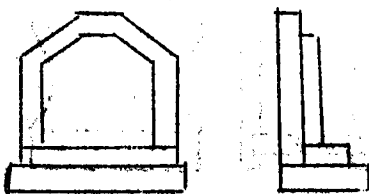
FLOWER POT HOLDER 20



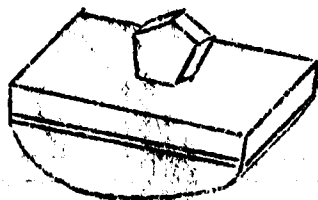
LETTER RACK 21



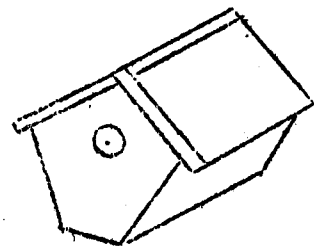
BOOK ENDS 22



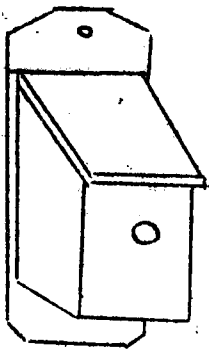
BLOTTER PAD 23



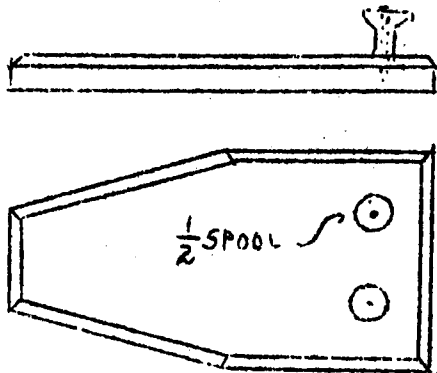
WREN HOUSE 24



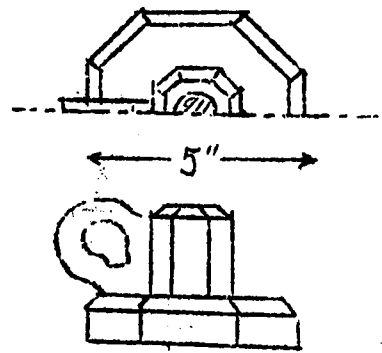
BIRD HOUSE 25



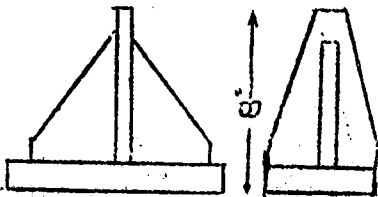
SCISSOR HOLDER 26



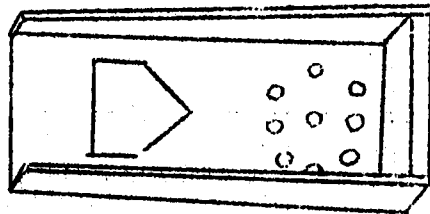
CANDLE STICK 27



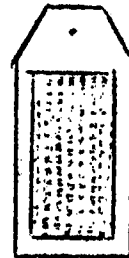
LAMP 28



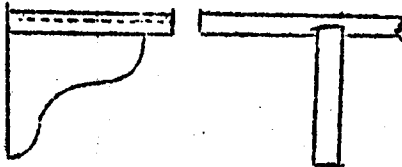
SKEE BALL GAME 29



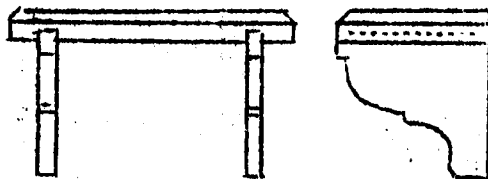
MATCH STRICKER 30



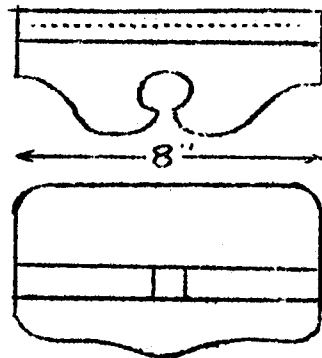
BRACKET SHELF 31



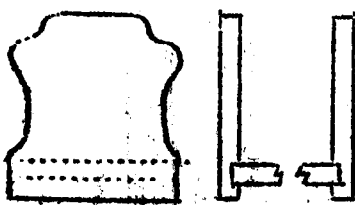
SHELF 32



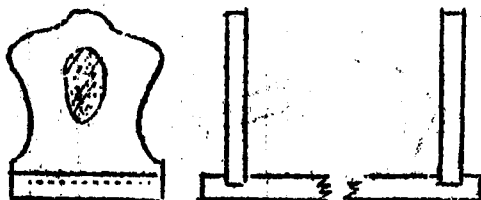
BROOM HOLDER 33



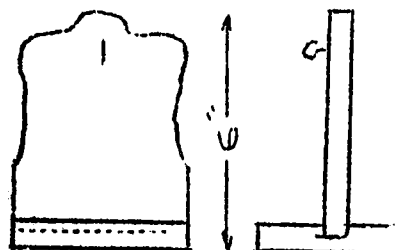
BOOK RACK 34



BOOK RACK 35

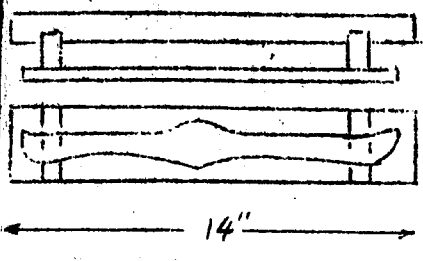


WATCH HOLDER 36



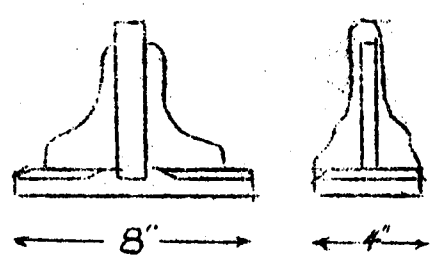
TIE RACK

37

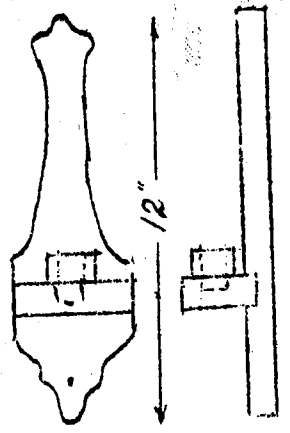


LAMP

38



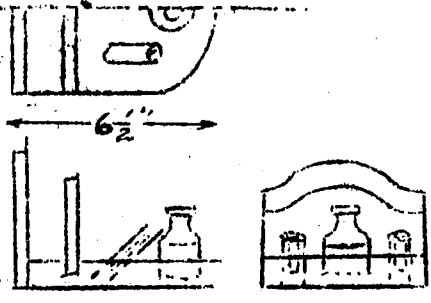
CANDLE SCONCE



39

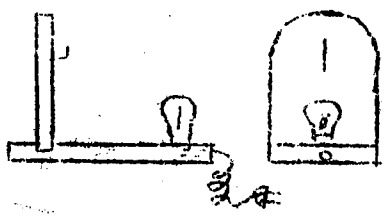
DESK SET

40



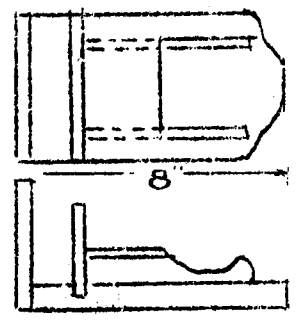
WATCH AND NIGHT LIGHT STAND

41



PEN AND INK STAND

42



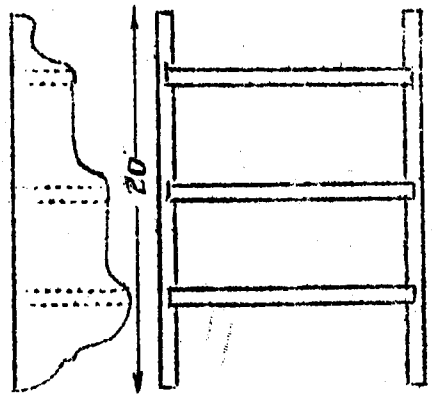
CORNER SHELF

43



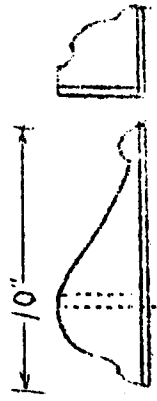
WALL SHELF

44



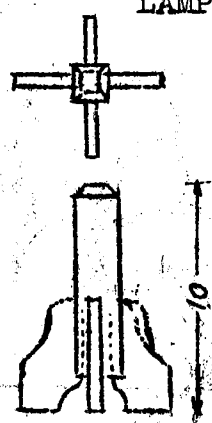
CORNER SHELF

45



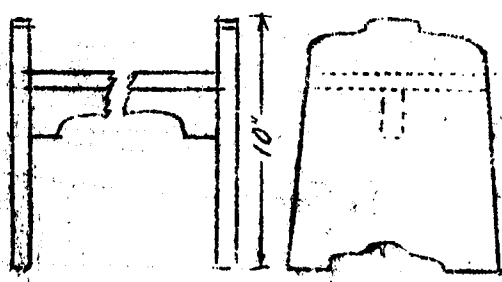
LAMP

46



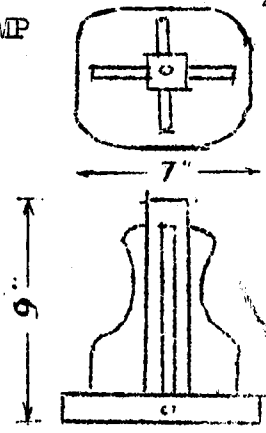
FOOT STOOL

47

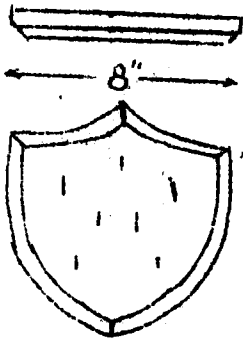


LAMP

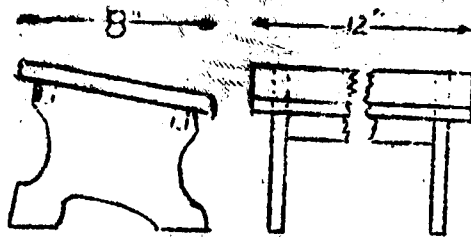
48



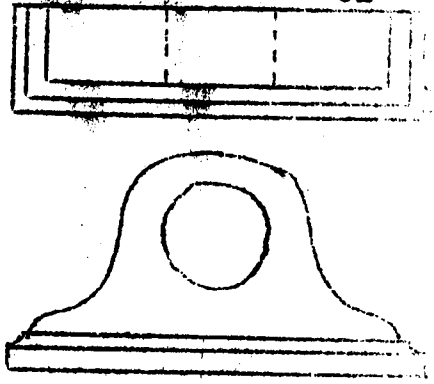
KEY RACK or SHIELD 49



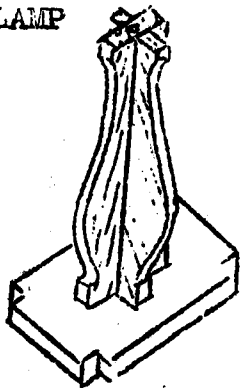
DUTCH STOOL 50



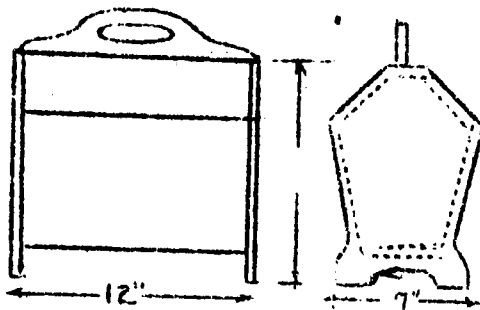
103
CLOCK CASE 51



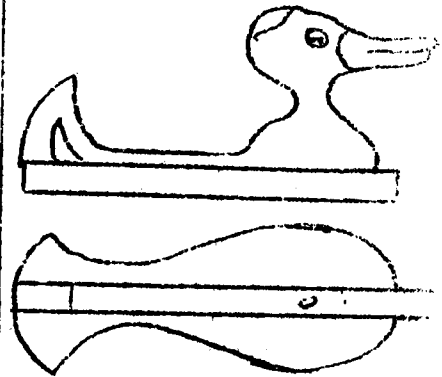
LAMP 52



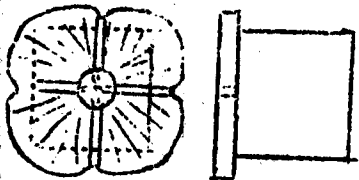
SEWING BOX 53



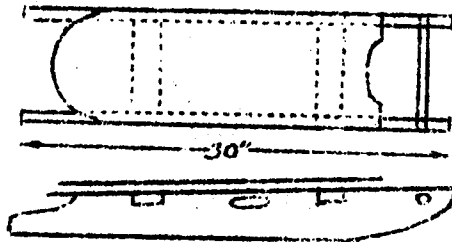
BATH TUB DUCK 54



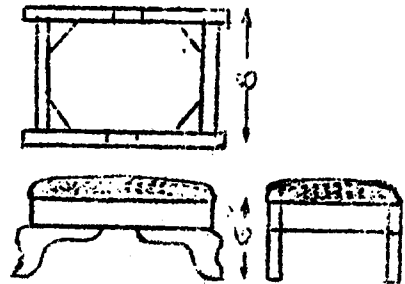
STRING BOX 55



SLED 56



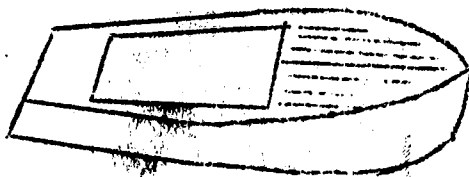
FOOT STOOL 57



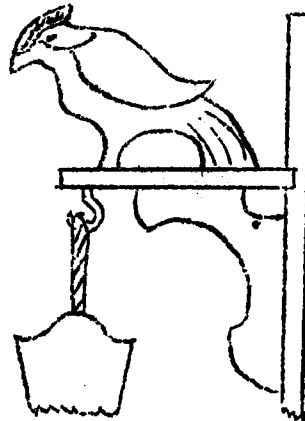
DOGGIE DOOR STOP 58



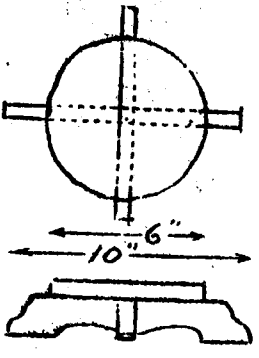
TOY OUTBOARD MOTOR BOAT 59



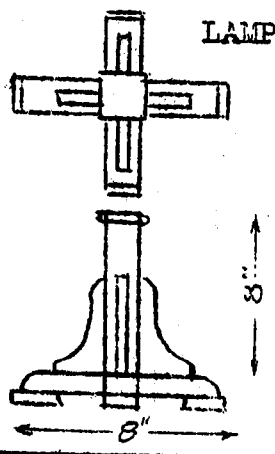
BITTER SWEET HOLDER 60



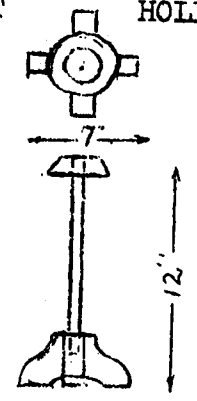
FLOWER POT STAND 61



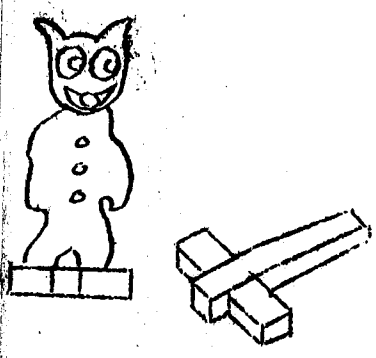
LAMP 62



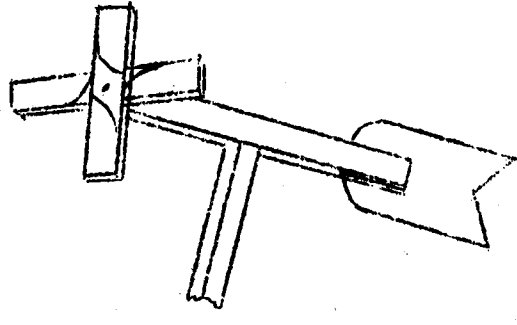
HAT HOLDER 63



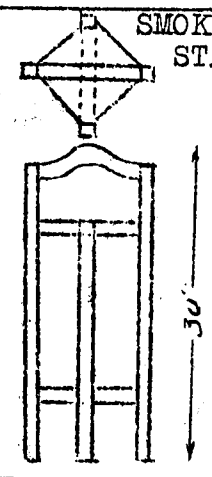
DOOR STOP 64



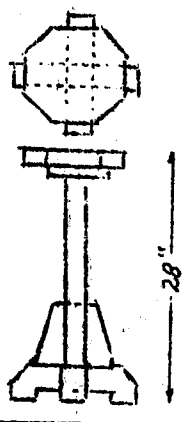
WEATHER VANE 65



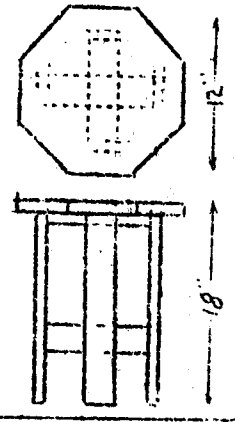
SMOKING STAND 66



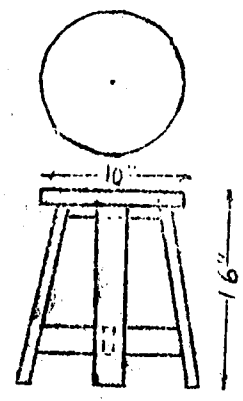
PEDESTAL 67



TABORET 68



BATHROOM STOOL 69



JARDINERE STAND 70

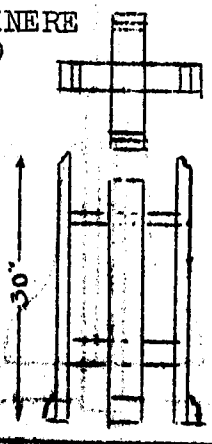
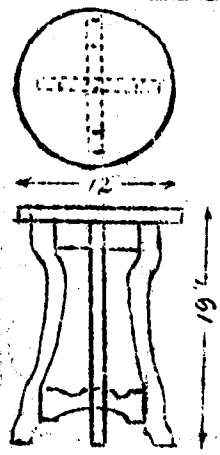
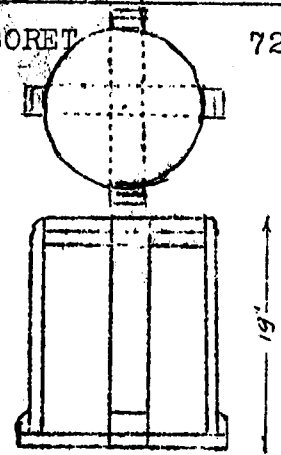


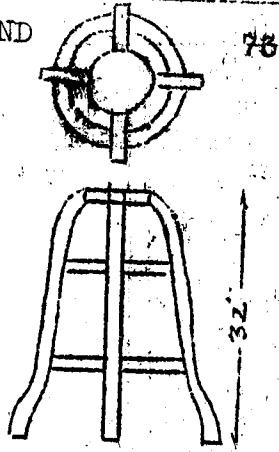
TABLE 71



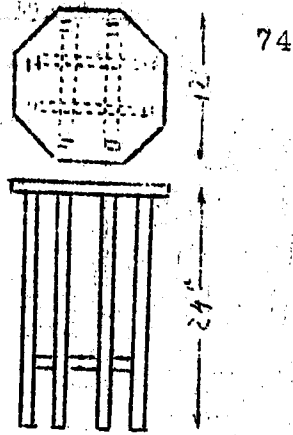
TABORET 72



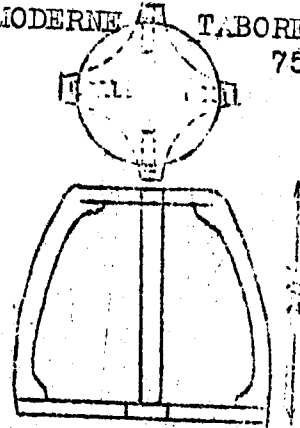
STAND



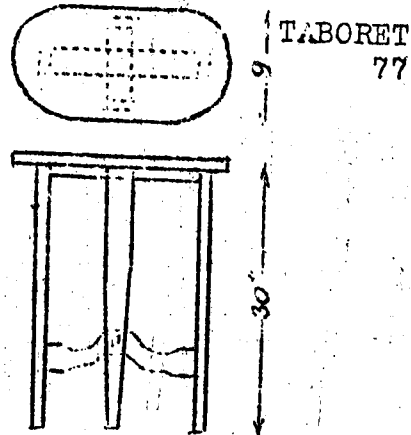
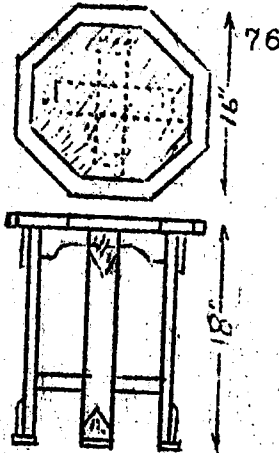
FLOWER STAND



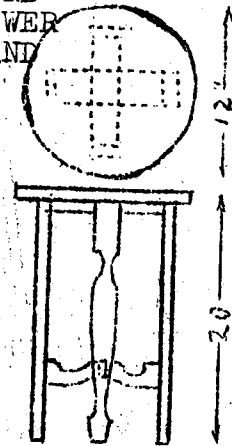
MODERNE TABORET 75



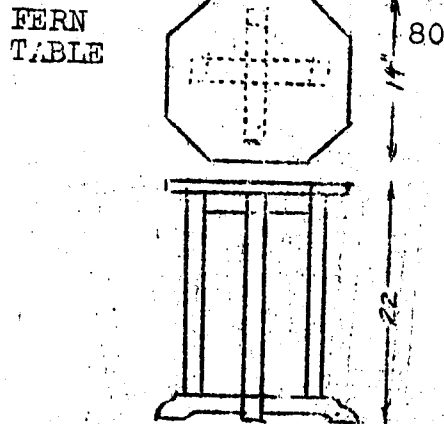
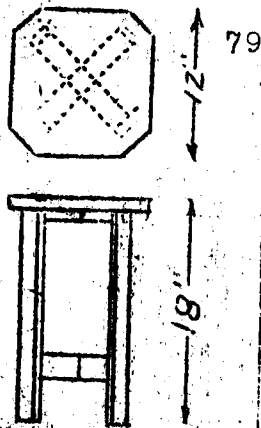
COFFEE TABLE



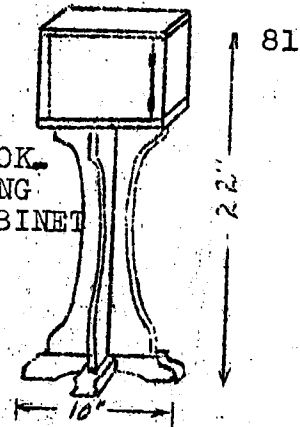
ROUND FLOWER STAND 78



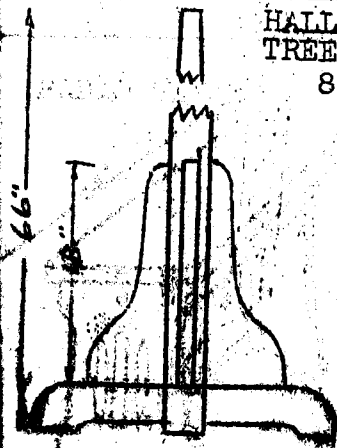
FLOWER STAND



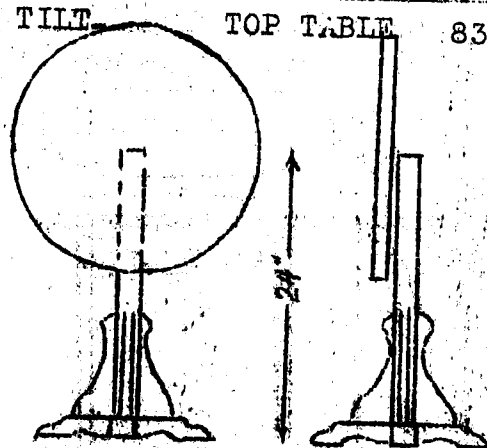
SMOKING CABINET



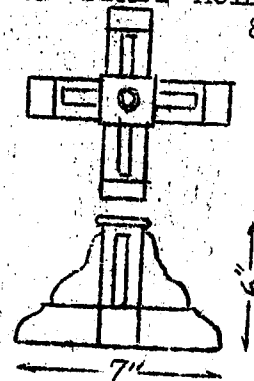
HALL TREE 82



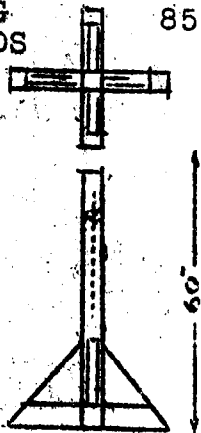
TILT TOP TABLE 83



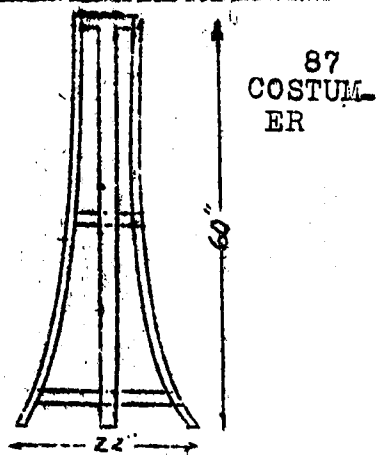
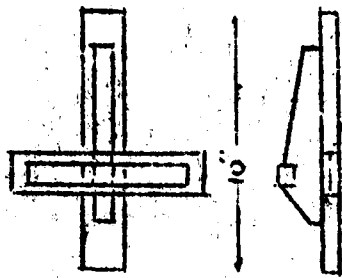
FLAG STAFF HOLDER 84



JUMPING STANDARDS 85

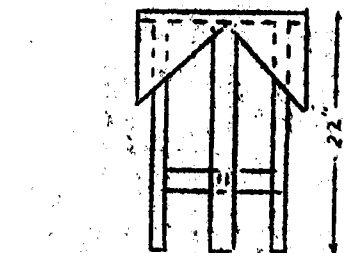
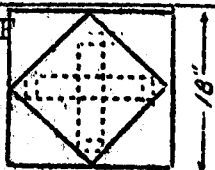


TIE RACK 86

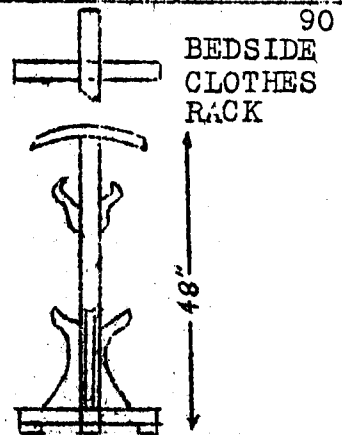
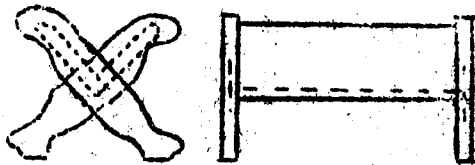


87
COSTUMER

4-LEAF DROP-LEAF TABLE 88

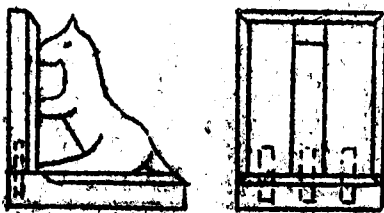


BOOK TROUGH 89

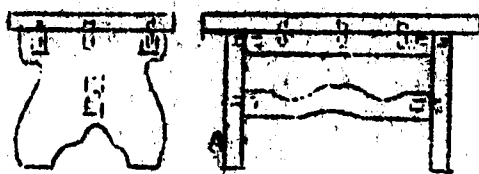


90
BEDSIDE CLOTHES RACK

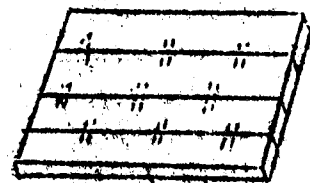
ANIMAL BOOK ENDS 91



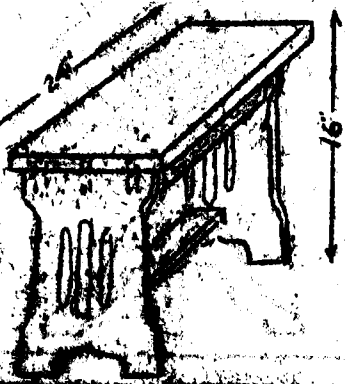
FOOT STOOL 92



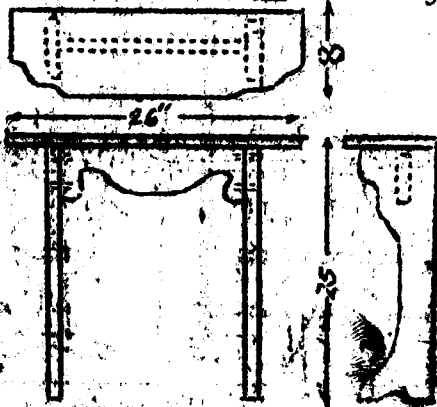
DRAWING BOARD 93



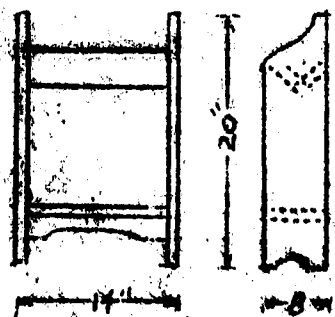
RADIO BENCH 94



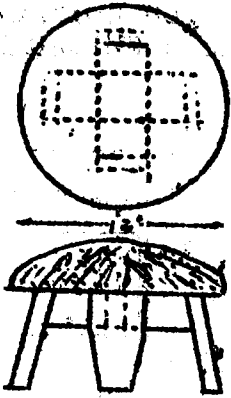
CONSOLE TABLE 95



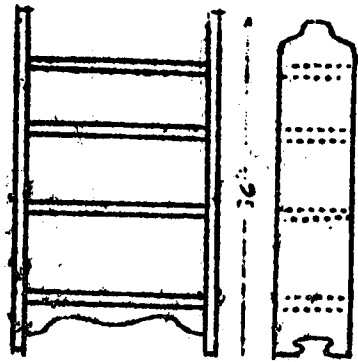
BOOK AND MAGAZINE RACK 96



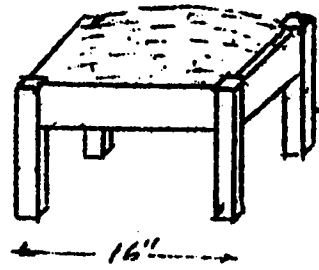
FOOT STOOL 97



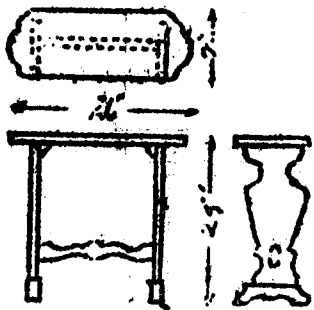
BOOK SHELVES 98



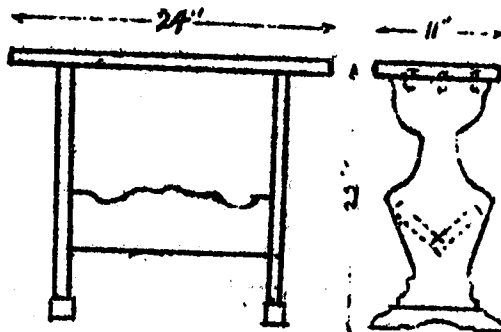
103
UPHOLSTERED
FOOT STOOL 99



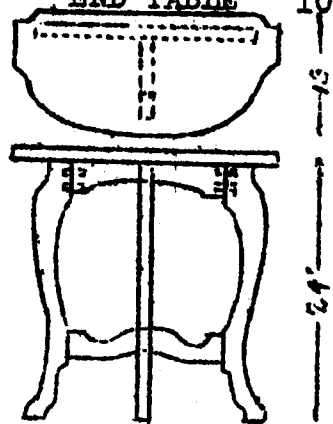
END TABLE 100



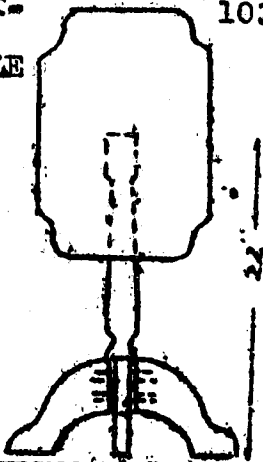
END TABLE 101



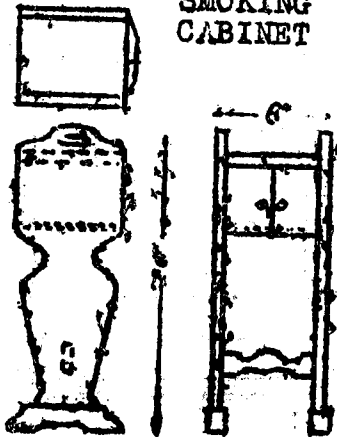
END TABLE 102



TILT-
TOP
TABLE 103



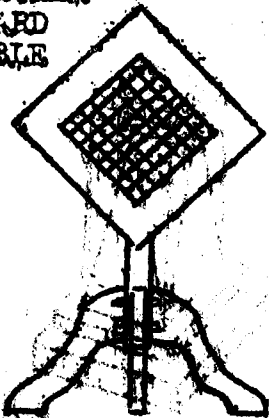
SMOKING
CABINET 104



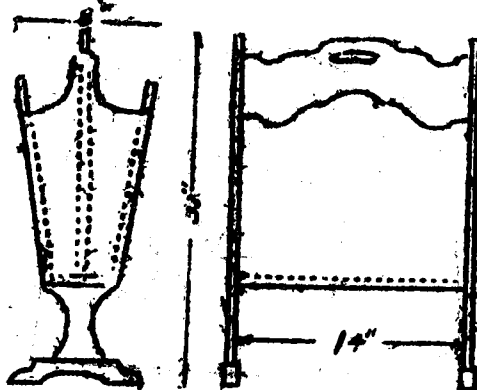
DROP-LEAF
TABLE 105



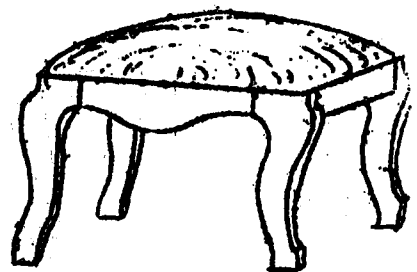
CHECKER
BOARD
TABLE 106



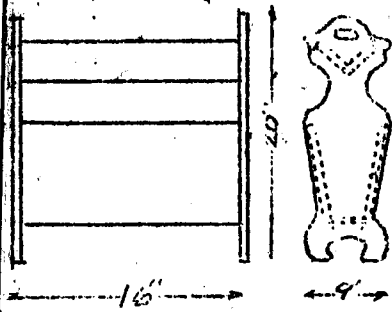
MAGAZINE BASKET 107



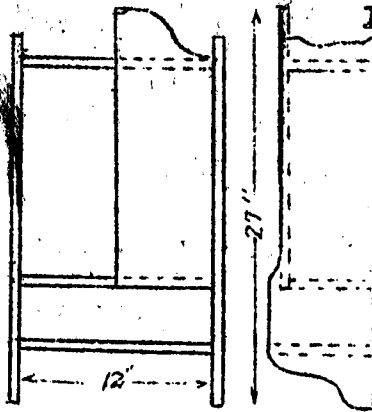
FOOT STOOL 108



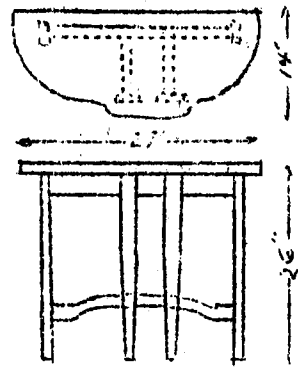
COMBINATION BOOK AND MAGAZINE RACK 109



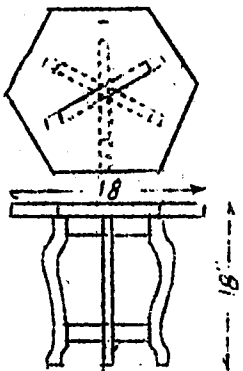
TELEPHONE WALL CABINET 110



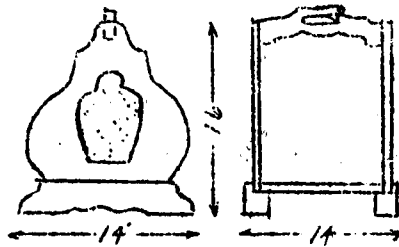
END TABLE 111



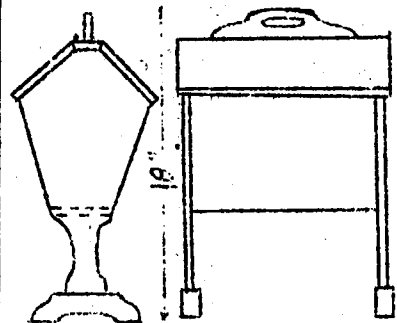
COFFEE TABLE 112



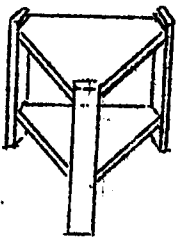
HEARTH BASKET 113



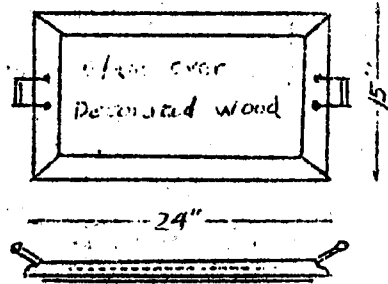
SEWING CABINET 114



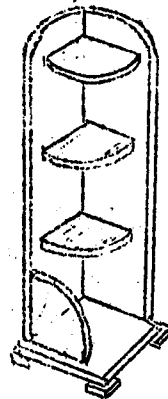
STAND 115



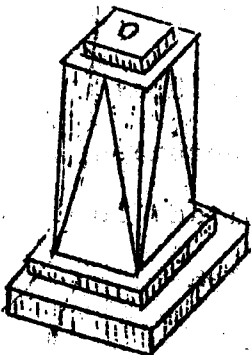
SERVING TRAY 116



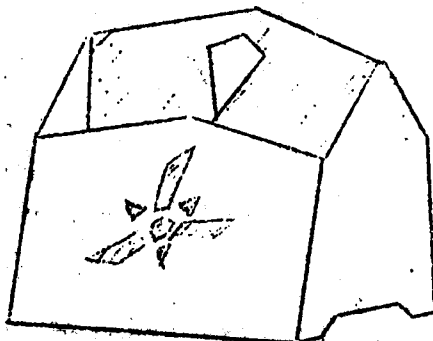
CORNER CABINET 117



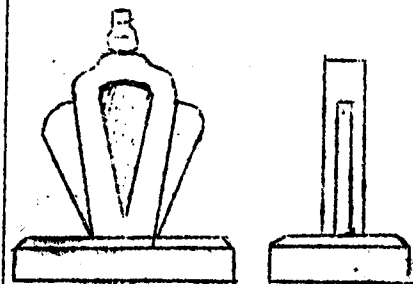
LAMP 118



MAGAZINE BASKET 119



LAMP 120



C. Suggested Simplified Instruction Sheets

Information Sheet No. 10

Stain

A. Stain is applied to freshly cut and seasoned wood to impart a rich and mellow color, to emphasize the grain and to match the finish of your furniture at home. Some cheaper woods are often stained to imitate more costly woods: for example, gumwood is stained to imitate mahogany.

B. There are three kinds of stains.

1. WATER STAIN is made by dissolving powdered aniline colors in hot water. It is clear, penetrates deeply, and will not fade.

2. SPIRIT STAIN is also made from aniline colors which are dissolved in alcohol. It dries rapidly and is difficult to apply with a brush.

3. OIL STAIN is made by dissolving oil aniline colors in turpentine, benzine or benzol. Asphaltum and naphtha are often used. They are easy to apply, spread evenly, and dry slowly.

C. Aniline is made from coal-tar and is an oily, poisonous substance used in dye making. Benzine and benzol are also coal-tar products. Asphalt is a mineral pitch found around oil wells. Naphtha is distilled from petroleum and turpentine is an oil produced from the sap of the long-leaf pine tree.

Reference:

Hjorth, Herman---Principles of Woodwork, pp. 213, 214.

Operation Sheet No. 10

Staining

You have spent several days making your project and now comes the fun of applying the finish. If you use great care and patience, you will be able to secure an excellent job that will reflect your ability as a woodfinisher.

PROCEDURE:

1. Read Information Sheet No. 10 and receive the approval of your instructor to begin staining.
2. Having decided upon the color to use, pour out enough stain into the stain bucket to do the job.
3. Dip the brush into the stain about one-third of the depth of the bristles. Draw the brush lightly against the inner edge of the can to remove the surplus stain.
4. Begin in the center of each surface and brush out toward the edges in all directions.
5. Hold the brush at a 45° angle pointing the handle toward the direction of the stroke. Do not let the brush "flip". Brush over and off the edges and not onto them.
6. Let the stain dry a few minutes while doing another surface. Return to the first surface and wipe off the surplus stain with a rag or waste.
7. After staining, inspect for missed spots.
8. Let your project dry for at least 12 hours.
9. Set the brush back into the container and pour any stain left in the bucket into the stain can. Put everything

in its place and clean up any stain that may have dropped or spilled. Put rags in rag container.

References:

McGee-Brown---Instructional Units in Woodfinishing,
pp. 9-15.