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OREGON AGRICULTURAL COLLEGE

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R. D. HETZEL,
Director.

COURSE OF STUDY

IN

MANUAL TRAINING

(Second Edition)

BY

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CORVALLIS, OREGON

The bulletins of the Oregon Agricultural College are sent free to all resi-
dents of Oregon who request them.

PREFACE

The placing of this bulletin in the hands of those who are interested in the development of our schools toward meeting the present-day requirements and in fitting the pupils of our State for an efficient life, is in line with the general policy of the Oregon Agricultural College, to render service to the people.

We know that there is a need for a more united effort, on the part of all the people, looking forward to the complete education of all the children of all the people. This is particularly true in the field of manual training, a field in which the writer has made considerable investigation in the State of Oregon during the past year.

The new State Course of Study for the high schools of Oregon sets a standard in the various branches, which will be particularly helpful in the industrial subjects where there have necessarily been differences of opinion in the adaptation of courses to the needs of the communities, as well as in the selection of the subject matter.

The outline in manual training for the State Course of Study, submitted by this department on request of the State Superintendent, had to be brief because of the limited space available. The purpose of this bulletin is to supplement that outline by giving more details and additional suggestions as to the aim and theory of the course. It also provides for the third and fourth years' work for schools that will desire to offer full four years of manual training in the high school. While there may be only two or three schools in the State outside of the City of Portland that are equipped to carry out the course suggested, there are few schools that cannot begin the installation of the course with the school year 1915-16 and within the ensuing four years complete the installation of the entire course.

Many sources of information have been available in the preparation of this bulletin, including valuable suggestions from many teachers in Oregon and in other states. To make a list of these would be difficult, and to avoid the possibility of overlooking some, I make acknowledgment of indebtedness in blanket form to each and every one of you. I shall appreciate your continued help and shall welcome criticism at any time. The department and this College stand ready at all times to render all assistance possible to the teachers of the State. The undersigned will be pleased to reply promptly to all inquiries in regard to this course and whenever possible will visit the schools where the course is in use.

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PREFACE TO SECOND EDITION.

In placing this second edition of the "Course of Study in Manual Training" in the hands of the teachers of manual training it is unnecessary to make any apology for the suggestions it contains.

The very favorable reception which the first edition met at the hands of directors, supervisors, and teachers of manual training; the many favorable reviews by different educational publications; the increasing requests for copies that are received from different educational institutions where efforts are made to prepare teachers of manual training; the favorable comments from leading instructors in manual training, prevocational and vocational schools, justify the assumption that in the main the outlines and suggestions generally conform to the requirements of well-organized schools, where education for efficiency is the dominant aim.

From the many suggestions and criticisms received; from careful observations and frequent reports from a few schools where they have made conscientious efforts to follow the course; after another year devoted largely to a study of the problem of preparing the pupils in our public schools to make an intelligent choice of an occupation, it seems advisable to add a few suggestions in different places throughout the second edition. These added thoughts are more in the nature of explanations or for the purpose of emphasis than in the line of changes in the subject matter.

In issuing this second edition it is a pleasure to extend thanks to P. P. Claxton, Commissioner of Education; Wm. T. Bawden, Specialist in Vocational Education, Bureau of Education, Washington, D. C.; Ira S. Griffith, University of Missouri; Frank M. Leavitt, Chicago University; Fred D. Crawshaw, University of Wisconsin; George F. Buxton, The Stout Institute, and Phillip Parcher, The Dalles, Oregon, for valuable criticisms, constructive suggestions, and practical experiments bearing directly on the value of the work as outlined in the first edition.

FRANK H. SHEPHERD.

GENERAL CONSIDERATION.

"Manual Training is any form of constructive work that serves to develop the powers of the pupil through spontaneous and intelligent self-activity." (1)

"Manual training in upper grades and high school, as the term is now used, applies mainly to wood and metal working, including printing, book binding, and various forms of construction work as arranged for boys from twelve to sixteen or eighteen years of age. In the field of manual training, well-defined programs of bench, forge, and metal working are now found. This work is usually taught by a department teacher." (2)

"Prevocational training is a conscious attempt on the part of society to equip an individual to make an intelligent choice of occupation, by giving him an opportunity to undergo a series of typical practical experiences." (2)

"Vocational education is any form of education, whether given in a school or elsewhere, the purpose of which is to fit an individual to pursue effectively a recognized profitable employment." (2)

Definition. Education is the adjustment of the individual so that he may secure the greatest amount of happiness from the environment in which he is placed.

Aim. To educate the individual so that he may obtain the widest possible view of the past, present, and future social, political, and economic conditions in the life-history of the human race.

In the light of the above quotations, definition, and aim it seems impossible to think of any phase of manual training as other than prevocational as well as generally broadening. In the lower grades a boy is taught to read, to write, and to spell. This is preparatory for his future work in his chosen line, be it medicine, law, or theology. Without the ability to read, he may never advance very far in a professional calling. Cases may arise where the ability to read is acquired after the period of manhood is reached and yet before life be done the individual may attain heights in his chosen profession. In either case the learning to read seems to be preparatory to a vocation.

A boy in the grades or high school is taught the care and the use of tools. He is taught how to make and how to apply useful, common joints. He is instructed in wood finishing and given practical work until he can finish a project in French polishing equal to the best piano finish. He is learning the A B C's of industrial occupations. If he be instructed in such a manner that he "be given an opportunity to undergo a series of typical practical experiences" this work will be prevocational.

(1) Definition adopted by the Eastern Manual Training Teachers' Association.
(2) Report of Committee on Terminology, N. E. A. 1914.

A young man who had taken manual training, benchwork, mechanical drawing, carpentry, through the seventh and eighth grades and through two years of high school left school on Tuesday, June 11; on Thursday, June 13, he began work with a building contractor as a carpenter's helper. On the following Monday morning, June 17, he was taken to a nearby city where this contractor had another building in course of construction; here he was put to work as a regular carpenter, at the regular wage paid in that city for such work. He continued to work for this contractor until September 9, when he quit work and again entered school as a junior. His training seemed to be prevocational as well as vocational although his purpose was to fit himself to be a teacher of manual training.

As teachers of manual training it is our privilege, and our duty to ourselves, our pupils, our schools and to society, to make our work of such practical value that it may meet the requirements of the definition of prevocational as well as vocational education.

"Much reading maketh a wise man." By this same rule an extensive acquaintance with many tools, a comprehensive knowledge of industries, trades, and vocations, re-enforced by thorough, practical working knowledge, produce a good craftsman.

THE TEACHER.

"The two chief elements in the equipment of the special vocational teacher are: (1) mastery of the technic of the occupation, and (2) teaching ability." (Commissioner of Education. Report, 1914, Vol. 1).

Referring to the definitions as given by the committee on terminology, it will be seen that the above requirements are for those who are teachers of vocations. To make the statement that all manual training is prevocational, and should be vocational, square up with this, our teachers of manual training must be masters of the technic of the occupation and possess teaching ability.

There seems to be a tendency on the part of many persons to demand that manual training be taught by carpenters, and in many of our schools men are employed as teachers of manual training who have no conception of "Teaching Ability." After the failure on the part of the workmen successfully to teach manual training has become evident, schools often go to the other extreme and employ some old-line school man who has been a great success as a teacher of English, or Pedagogy, or some related subjects, and who has gained a "Hatchet-and-hand-saw" knowledge of carpentry by building a few chicken coops, helping some neighbor through his vacations in rough carpentry work, or by taking a six weeks' course in some school where manual training is taught. In the latter case the failure is generally more marked than in the former.

In the State of Oregon, as in most states of the Union, a high-school teacher is required to have a working knowledge of the subject he is to teach, plus fifteen semester hours in education (this refers to teachers of English, etc.). As a general statement he must have had four-years'

work in a university or standard college with fifteen semester hours devoted to the study of Education—theory, practice, history, psychology, etc. How then can a reasonable person expect to get competent teachers in manual training who have had only one little part of such a training? Why do men who have devoted years to the study and practice of traditional subjects of the curriculum think that in helping a neighbor build a dwelling house they have acquired a "Mastery of the technic of the occupation"? Why will a school board or a superintendent assume that, because a given individual is successful as a general workman, by becoming a member of the teaching force of a high school he will acquire "Teaching Ability"?

Up to this time there has been no satisfactory solution to the problem. When our schools are equipped with competent teachers, teachers who are masters of the technic as well as competent in teaching ability, they will turn out pupils from the manual training classes who fill the requirements as laid down in the definitions of prevocational as well as vocational education.

EQUIPMENT.

Under this heading nothing can better serve as an introduction than a quotation of a quotation made by Wm. Hawley Smith in an article printed in the April (1915), number of the "Industrial Arts Magazine," "Over Equipped and Under Taught."

The equipment should be good. There is no economy in buying poor tools. There is no call in an ordinary school for a planer that costs from one hundred seventy-five dollars up to three hundred dollars when you know, in all reason, that you will not handle over one hundred dollars' worth of all kinds of lumber. It seems to be poor economy to buy a hollow chisel mortising machine at a cost of from seventy-five to three hundred dollars, for the use of boys who do not know how to use a chisel.

Throughout the grades and the first two years of the high school, at least, do away with the use of power machinery except as incidental work. In the last two years of the high school, if you are going to put in a course in Mill Work in connection with your carpentry and cabinet making, then put in woodworking machinery and teach it from the practical, prevocational standpoint.

Many of the boys in your class are to be farmers and very few of these boys will have access to woodworking machinery on their farms; they all may have sets of carpentry tools.

Good benches with serviceable vises are indispensable. From a standpoint of economy in space as well as price, double benches should be used (two boys working at one bench). The class in summer school at the Oregon Agricultural College worked out plans and specifications for a bench that in their opinion meets all requirements for the schools of Oregon. A blue print of this bench may be had by addressing a request to the College and paying the cost of material required in making the blue print.

In arranging the equipment one has to be guided by the size and shape of the room or rooms, but the thought of ordinary shop conditions should always be kept in mind. A manufacturing company would hardly build a fifty-thousand-dollar building and furnish it with twenty-thousand-dollars' worth of equipment to turn out five-hundred-dollars' worth of furniture. The finished product for which the manual training school is striving is the efficient boy, and to produce such the school must place him in an environment where he will be given "an opportunity to undergo a series of typical practical experiences that will equip him to make an intelligent choice of occupation."

In submitting the following suggestive equipment for the woodwork shop the principal thought has been economy. The list of tools has been kept down to the minimum. Many other tools will be useful and at times almost necessary, but as the work progresses from year to year tools that are required will be added.

The equipment should be ordered through the local dealers as they are directly interested in the school and will often make better prices than could be secured through a firm in some distant city. It is suggested that each teacher write to different houses for their catalogs and price lists. These will be very useful in many ways in the class room or shop.

Individual Tools.

Bailey Iron Jack Plane, No. 5.
 Try Square, 6"
 Boxwood Rule, 2-foot, one fold
 Bench Knife (sloyd knife)
 Buck Bros. chisel, $\frac{3}{4}$ "
 Buck Bros. chisel, $\frac{1}{2}$ "
 Buck Bros. chisel, $\frac{1}{4}$ "
 Bench Brush
 Bench Hook—Make them
 Bishop Back Saw, 10"
 Stanley Marking Gauge.

General Tools

Arranged on a basis of twenty pupils
 2 Bishop Hand Saws—Cross cut, 8 point, 22-inch
 2 Bishop Hand Saws—Cross cut, 10 point, 24-inch
 4 Bishop Hand Saws—Rip, 8 point, 24-inch
 6 Countersinks
 6 Stanley Block Planes, 7"
 3 Braces—Plain—10" sweep
 1 Brace—Ratchet, 12" sweep
 1 Set Irwin Auger Bits in box
 2 Doz. Auger bits, small sizes, assorted
 1 Doz. Handscrews
 1 Doz. Clamps, iron, open 8 inches

- 1 Doz. sets wood bar clamps, irons, only.
- 2 Stanley T bevels, 8"
- 2 Stanley 608 Jointers, 24"
- 8 "Orlock" Hammers, assorted sizes
- 2 Wing Dividers
- 12 Hardwood Mallets—Make them
- 1 Ball-bearing Grindstone
- 3 Lily-White Washita Oil Stones
- 2 Oil cans
- 3 Screw Drivers, 4-6-8 inches
- 2 Screw Drivers, Ratchet, 6"
- 12 Screw Driver Bits for Brace, Assorted sizes
- 12 Nail sets, assorted sizes
- 12 Cabinet scrapers
- 3 Buck Bros. chisels, 1"
- 2 Buck Bros. chisels, 1 1/4"
- 2 Buck Bros. chisels, 1 1/2"
- 1 Yankee Automatic Drill
- 1 Set Bit Stock Drills, for metal or wood
- 1 Glue Heater
- 1 Draw Knife
- 1 Bench or broad Hatchet
- 3 Steel or Carpenter's Squares

This suggestive list will cost approximately one hundred and fifty dollars. About ten percent should be added for additional tools and small articles that may be required.

For mechanical drawing there should be some arrangement for drawing tables and if possible this work should be offered in a room used exclusively for the drawing. In schools that are equipped with woodworking machinery, the furniture, boards, T squares and cabinets may be made by the advanced classes in wood work.

In schools that are doing four-years' work along this line there should be the following power machinery:

1 Sliding top saw-table, 1 36" band-saw, 1 jointer, 1 hollow-chisel mortising machine, 1 power grinder.

For a number of reasons the individual motor-driven machines are preferred, but the choice of machinery is a matter to be determined by location and local conditions.

The local hardware dealer will be pleased to take these matters up with you and will render every assistance in his power. Perhaps no two mechanics in your town will agree on all points in regard to equipment, but it is well to advise with each of them. You are trying to equip your shop so that your pupils may have an opportunity to undergo a series of typical practical experiences so that each may make an intelligent choice of an occupation.

THE PUPIL.

When we are able to see that all this expense for buildings, equipment, and teachers is for the pupil and realize that the product of our manual training, prevocational, vocational, shop is the pupil, we shall adjust our teaching to fit the requirements of the pupil.

There is absolutely no reason why a boy or a class of boys in a manual training shop should "putter around," lounge on the benches, talk, whistle, kill' time in any way. They should be on the job all the time. They should know something of shop methods and should be taught to follow general shop rules of conduct. The foreman of a shop would give a workman his time check before the first period was over if he even attempted to establish such shop conduct as is frequently noticed in a manual training shop.

There is no reason why from the seventh grade on, or at any time when shop work is taught, the pupils should not have every opportunity to undergo typical practical experiences that will tend to fit them to make an intelligent choice of occupation.

The pupil in the senior class in English would be somewhat disgusted if he should be required, in ordinary class work, to continue studying the story of "The Three Bears." The pupil in the more advanced grades would be justly entitled to register a protest if he be required to continue year after year, constructing book ends, coat hangers, foot stools, etc.

There are shop conditions, however, where a workman works for years making only one of the many small parts for some more or less complicated machine. This is specialization, and one of the points to be considered in fitting an individual to make a choice of a vocation.

INDUSTRIAL ARTS COURSE.

MANUAL TRAINING.

Note—Numerals and letters following name of course refer to description of course.

Freshman Year.

1st Semester.	2nd Semester.
English	English
Algebra	Algebra
Mechanical Drawing 1	Mechanical Drawing and Design 1 a
Benchwork in Wood 1	Bench Work in Wood 1 a

Sophomore Year

English	English
Algebra	Geometry
Architectural Drafting & Design 2	Concrete Work 2 a
Carpentry 2	Architectural Drafting & Design 2 a

Junior Year.

English	English
Geometry	Shop Mathematics 3 a
Machine Drafting and Design 3	Machine Drafting and Design 3 a
Woodturning and Patternmaking 3	Forging 3 a
or	
Machine Shop Practice 3	

Senior Year.

American History	Civics
Shop Mathematics 4	Vocational Study 4 a
Advanced Shop Drafting and Design 4	

	Carpentry 4		Carpentry 4 a
	or		or
Woodwork	Cabinet Making 4 .	Woodwork	Cabinet Making 4 a
or	Forging 4	or	Forging 4 a
Ironwork	Machine Shop Practice 4	Ironwork	Machine Shop Practice 4 a

The above syllabus was arranged to conform to the State Course of Study for the high schools of Oregon and with the thought that many of our boys may continue in school after graduating from the high school. For these reasons, English, Algebra, etc., were included. In cases where it seems impossible for the pupil to continue in school or where he well knows that his preparation should be along prevocational lines, less mathematics may be given and more time devoted to prevocational work. Industrial history, commercial geography, civics, and vocational study may well be substituted.

In schools where it is possible, there should be arranged a list of electives that include printing, sheet metal work, art metal work, wood carving, plumbing, brick work (masonry), etc.

MECHANICAL DRAWING.

Mechanical drawing is a fundamental principle of all shop work. It is an essential prerequisite to thorough training in shop courses in the school or efficient work in the industrial vocations. It bears the same relation to many of the trades that reading bears toward a liberal education.

Mechanical drawing should be a prerequisite or at least a parallel course for all shop courses and must closely correlate with all shop projects.

The workman who builds a table, dresser, house, barn, engine, lathe, or any other project, obtains the necessary information regarding the size, shape, and details of construction from different projections or views of the object to be made. These views are called working drawings.

The words "mechanical drawing" at once bring to the mind a drawing made by or with the help of mechanical devices, such as a T square, triangles, compasses, etc. For that reason shop drawing, projection drawing, machine drafting, architectural drafting, and all related phases of drawing, are considered under the head of mechanical drawing.

A much-appreciated criticism indicated that in the opinion of the critic this course contained too much formal mechanical drawing.

In a school where the course as arranged was tried with a class of sixteen pupils the work of the first year was well finished five weeks before the close of the second semester. The remaining five weeks were devoted to a review of difficult problems and the making of working drawings, intersections, and developments from models placed before the members of the class.

As drawing and design are emphasized throughout all the work, beginning with the seventh grade, it may be possible in some cases to eliminate some of the work in mechanical drawing.

The most reasonable argument in favor of a more extended course in formal mechanical drawing is its value as a prevocational course and its correlation with so many of the industries.

In doing the work in mechanical drawing the best results have been secured by combining three methods of instruction, using a book, black-board illustrations and, where possible, a working model placed before the class: illustration, draw the intersection of a square pyramid pierced by a cylinder. This problem is, perhaps, illustrated and explained in detail in Mechanical Drawing, by Tracey. Before calling the attention of the pupil to the problem in the text the teacher should briefly explain the assignment and illustrate important steps by the use of the black-board. After this he should place the model before the pupil and let him work it out to a successful conclusion. The different models are splendid projects for the boys in the different shops.

DESIGN.

On every hand you see objects that have been made for some definite purpose; book end, dog house, hammer, lathe, band saw, forge, dwelling

house. These things have been in existence and common use so long, "The mind of man runneth not to the contrary." You never pause to think that each and all of these present-day conveniences are the result of plans or designs worked out by some person ages ago to meet some of his requirements for protection, comfort, and pleasure.

We may see an Indian basket maker working out some intricate pattern with her basket-weaving material, and we may know that she never made a drawing on paper to express her conception of the particular symbol she is weaving. But the expression of her thought in the materials of her basket weaving is a design.

The work design traced back to its derivation means to mark out for a purpose.

In our study of design we must try to apply certain principles or laws that govern artistic expression of all kinds. Whether we work in wood, metal, clay, or textiles, we must strive to produce articles of beauty as well as of utility. We are to work out designs under two general heads (a) constructive, as plans for book end, pedestal, piano bench, house, etc.; (b) decorative, as carved or inlaid work on our book end, turned legs, or ties for our piano bench, etc. Through all our work in design the media of expression and the purpose for which the project is intended must be the first consideration.

Mechanical Drawing 1.

Paper to be 12" x 18".

1. Parallel Lines in Pencil. (1 plate)
2. Geometrical Problems. (2 plates—6 selected problems to the plate.)

Suggested Problems:

Plate I.

- a. Bisect a straight line, or an arc of a circle.
- b. Erect a perpendicular to a given line at a given point in the line
- c. Draw a perpendicular to a given line from a point outside the line.
- d. Erect a perpendicular to a given line at its end.
- e. Construct an equilateral triangle on a given base.
- f. Construct a square on a given base.

Plate II.

- a. Bisect a given angle.
- b. Construct a triangle having given its sides.
- c. Inscribe a regular hexagon within a given circle.
- d. Inscribe a regular pentagon within a given circle.
- e. Draw an ellipse, its axis being given.
- f. Draw upon given axis an approximate ellipse.

3. Orthographic Projection (3 plates—4 selected problems to the plate).

Suggested Problems:

Plate I.

- a. Make drawing of three views of a line perpendicular to H.
- b. Make drawing of three views of a line perpendicular to V.

- c. Make drawing of three views of a line parallel with V, slanting downward to the right at 30 degrees to H.
- d. Make drawing of a line parallel with H, slanting back toward the right at 60 degrees from V.

Plate II.

- a. Draw three views of a square standing vertically.
- b. Draw three views of a vertical hexagonal prism.
- c. Draw three views of a cylindrical object standing vertically.
- d. Draw three views of a circular cone standing vertically.

Plate III.

- a. Draw three views of a square pyramid standing vertically.
- b. Draw three views of a hexagonal pyramid standing vertically.
- c. Draw three views of a frustum of a circular cone.
- d. Draw three views of a frustum of a square pyramid.

4. Developments (2 plates—4 selected problems to the plate).

Suggested Problems:

Plate I.

- a. Develop the surface of a cylinder.
- b. Make a pattern for a tin cup.
- c. Develop the surface of a cone.
- d. Make a pattern for a lamp shade.

Plate II.

- a. Draw the top and front views and the developed surface of a hexagonal prism cut by a plane at 45 degrees with its axis.
- b. Draw the top and front views and the developed surface of a cylinder cut by a plane at 45 degrees with its axis.
- c. Make a pattern for a milk can, with cover.
- d. Draw the views and the developed surface of a square pyramid standing vertically, the sides of the base making angles of 45 degrees with V. The pyramid is cut by a plane oblique to its axis. Show the true shape of the section.

5. Solids Cut by Planes. (1 plate—4 selected problems to the plate.)

Suggested Problems:

Plate I.

- a. Draw a longitudinal section of a hollow cylinder cut by a plane coinciding with its axis.
- b. Draw a transverse section of a hollow cylinder cut by a plane perpendicular to its axis.
- c. Draw the front and end views of an oil-stove, and show a transverse section.
- d. Draw the front and end views of a screw driver, with a longitudinal section.

6. Intersections. (3 plates—2 problems to the plate.)

Suggested Problems:

Plate I.

- a. Draw the intersection of a square prism pierced by a cylinder.
- b. Draw the intersection of a cone pierced by a hexagonal prism.

Plate II.

- a. Draw the intersection of a square pyramid pierced by a cylinder.
- b. Draw the intersection of a hexagonal and a triangular prism.

Plate III.

- a. Draw the intersection of an oblique and a vertical hexagonal prism.
- b. Draw the intersection of a vertical cone pierced by a triangular prism.

7. Machine Details. (4 plates—2 problems to the plate.)

Suggested Problems:

Plate I.

- a. Draw a helix of one revolution about a cylinder.
- b. Make a drawing of a coil spring which is to be made of round material.

Plate II.

- a. Make drawings representing the actual helical curves of a Sharp V thread, and a U. S. Standard thread.
- b. Make drawings representing the actual helical curves of a Square thread and an Acme Standard thread.

Plate III.

- a. Draw three views of a bolt having an hexagonal head with a spherical top.
- b. Make a drawing of four machine screws. Round head, flat head, and flat and oval fillister head.

Plate IV.

- a. Make a working drawing of a face plate.
- b. Make a working drawing of an iron clamp.

8. Lettering. (2 plates.)

Plate I.

- a. Upper and lower case inclined Gothic letters, figures, and fractions.

Plate II.

- b. Upper and lower case inclined Gothic as applied to titles and dimensioning.

9. Review.

Practice inking in of plates already made.

Mechanical Drawing and Design 1 a.

Paper to be 9" x 12".

1. Working Drawings. (3 Plates—1 problem to the plate.)

Suggested Problems:

- Plate I. a. Working drawing of neck-tie rack.
 Plate II. a. Working drawing of foot stool.
 Plate III. a. Working drawing of taboret.

2. Isometric Drawings. (2 Plates.)

Suggested Problems:

- Plate I. a. Isometric drawing of cube. b. Isometric drawing of cylinder.
 Plate II. a. Isometric drawing of an oblique timber framed into horizontal timber.

3. Perspective drawings. (2 Plates.)

Suggested Problems:

- Plate I. a. Foot stool.
 Plate II. a. Dog house.

4. Tracing and Blueprinting.

5. Design. (See above note on design.)

- A. History and theory.
Assigned readings and lectures.
- B. Application.
 - I. Study of masses.

Suggested Problems: a. Book end. b. Pedestal. c. Piano bench.

II. Study of lines. (Rhythm, Balance, and Harmony.)

Suggested Problems: a. Book end. b. Pedestal. c. Piano bench.

III. Study of areas. (Rhythm, Balance, and Harmony.)

Suggested Problems: a. Book end. b. Pedestal. c. Piano bench.

Architectural Drafting and Design II.

Paper cut to suit the drawing.

I. Study of Buildings.

Lectures and assigned readings on: A. Use. B. Materials.

II. Types of Buildings.

Lectures and assigned readings.

Visits for inspection—reports.

A. Construction.

III. Drawing Plans.

A. Miniature house. (5 plates) 1. Floor plan. 2. Front elevation. 3. Side elevation. 4. Roof plan. 5. Perspective sketch.

B. One-Story Cottage. (7 plates). 1. Floor plan—Essential features: kitchen, bedroom, dining room, living room, bathroom, hall, pantry, closets.

Study of exterior. a. Types of roofs.

b. Porches. c. Openings: doors, windows.

2. Front elevation. 3. Side elevation. 4. Framing floor plan. 5. Framing roof plan. 6. Framing front elevation. 7. Framing side elevation.

Specifications. Review by inking in and lettering drawings of one-story cottage.

Architectural Drafting and Design II a.

1. Drawing Plans.

A. Two-Story Building. (20 Plates.)

1. First-floor plan. 2. Second-floor plan. 3. Cellar plan. 4. Front elevation. 5. South elevation. 6. North elevation. 7. Rear elevation. 8. Vertical section. 9. Framing first floor. 10. Framing second floor. 11. Framing side elevation. 12. Chimney construction. 13. Details. a. Section through water table. b. Section through cornice. c. Section through porch. d. Details of window frame. e. Details of window. f. Details of door frame. 14. Specifications. 15. Perspective drawing.

BENCHWORK IN WOOD AND SHOP DRAWING.

SEVENTH GRADE.

The best results will be obtained by devoting the first eight to twelve weeks of the school term to shop drawing. The reasons for this arrangement of the work are too many to be taken up here.

More criticisms of the sequence in tool processes have been received than of any other point. When I wrote the first edition, I kept in mind a nail box as a typical project, and I am perfectly willing to admit in this edition that I did not state the steps in an exact, or rather a logical, order.

In making a nail box $4\frac{1}{2}$ " deep, over all, x 7" wide x 10" long, with one partition in which is a hand hold, it is quite reasonable to suppose that the instructor will get out three pieces of lumber, sides, bottom, partition. Using the sides, and ends, as an illustration, it is quite likely that this will be one piece S2S 7-8" x 4" x 36". The first exercise will be to plane for a working surface; next a working edge; following this gage for thickness, and follow this, in turn, by planing to thickness and then by gaging for width and finally by planing to the gage line or mark. This will be followed by the use of the try-square for the purpose of sawing to length.

One will see at a glance that if the instructor gives the class lumber that is in length of 14' or 16' the first problem will be to measure, mark, and saw; but from observations extending over a number of years, I find that the general practice seems to be to furnish a seventh grade class with lumber in shorter lengths. These points are largely matters of individual opinion or individual practice and in general have little influence on the final result.

Aim. To teach the care and use of tools; to develop accuracy and skill; to teach the elements of industrial activities; to lay the foundation for the future selection of a life career, and to broaden the pupils' view of life's work.

Time. This outline is based on two double periods twice each week for the school year.

Drawing. Throughout the course an effort should be made to teach the principles of mechanical drawing as applied to shop drawings. The simple instruments for use in this grade should be mastered. No project should be undertaken until the pupil has first made a working drawing of the project.

1. Practice planing, sawing, laying out, gaging, marking, nailing, screwing, making duplicate parts. Butt joint used in nail box.

Tools—saws, cross-cut, rip, back; bench knife, try square, jack plane, hammer, screw driver, nails, screws, (block plane?).

Suggested projects—window stick, cutting board, coat and hat rack, key rack, nail box, loom for primary rug weaving, bench hook.

2. Planing to size, boring, gaging, squaring, laying off, more accurate sawing.

Tools—brace and bits, steel square.

Suggested projects—Counting board, ring toss, game board, spool holder, laundry list, bird house.

3. Use of coping saw, use of compass, compass saw, sawing curve with coping saw, chiseling, paring with chisel, spoke shave.

Suggested projects—sleeve board, elliptical bread board, sled, scouring board, wall bracket, round-top stool, coat hanger, wagon.

4. Review all past processes and add lap joint, end lap, middle lap, half lap.

Suggested projects—book rack, neck-tie rack, magazine rack, foot stool, wall shelf, table or desk shelf, milk stool.

5. Simple design as applied to the ornamentation of surface of woods. Use of compass saw, cabinet scraper, and sand paper.

Suggested projects—tea-pot blocks, thermometer back, calendar mount, card holder, mail box.

6. Simple joinery in box construction, dowel joint and glue joint.

Tools—continue the use of all tools learned and add the dowel plate and mallet. Use wood clamps and hand screws.

Suggested projects—bread box, knife-and-fork box, coat-and-trouser hanger, bread board, or desk tray (made of different kinds of wood) doweled and glued.

7. Finishing—staining, sanding, or rubbing down, shellac, wax.

Suggested projects—finish all articles requiring a finished surface and make two or three panels to illustrate different methods of finishing.

Note—Finishing may be taken up as individual work whenever enough projects requiring finish are completed.

8. For the purpose of reviewing former operations and processes, make a taboret or pedestal. Require very accurate work and make applications of different joints and processes learned.

EIGHTH GRADE.

Carpentry Construction and Joinery.

First Semester.

Elements of Carpentry.

Aim. To lay a broader foundation by making a more specific study of the occupation of carpentry and cabinet making; thereby training the pupil in accuracy and to think in concrete terms.

Time. Outline based on two double periods each week. Continue the work in drawing. Use more accurate instruments and do accurate work. Teach the use of the scale in making plans for your buildings. Be able to read and interpret house plans and blue prints.

Tools. Saws, steel square, plumb bob, level, carpenters' pencil, chalk line, miter box.

1. Plan to complete at least one project by group work the first semester.

Suggested projects—miter box, saw horses, dog house, a small building with "lean-to" roof, chicken house, wood house, play shed, or pavilion for the school grounds. Some interested patron of the school may be found who will furnish the material and accept the finished building on the school grounds.

Second Semester.

Farm Mechanics.

1. Review the steps of the projects of the seventh grade in sawing, planing, laying off, etc., and add projects that will involve the use of the following joints: hopper joint, ledge or rabbet joint, pinned mortise and tennon, thrust joint, stretcher joint.

Suggested projects—floor broom holder, rabbit trap, push-mobile, trap-nest, milk stool, camp stool, chicken coop, farm gate, wagon jack, fly trap, fireless brooder, feed trough, poultry feeder, poultry exhibit coop, poultry shipping coop, ladder, hurdles.

For individuals whose taste runs more toward cabinet work, the following projects are suggested: book, trough, wood-work for "electric cluster," electric table or desk light, calendar mount or memo board, hall rack or mirror frame, picture frame, taboret, waste-paper basket, pedestal, umbrella stand.

Finish—In this grade more care should be taken in the finishing of the articles, not because of greater value but because of the greater ability of the boy. Improvement should be marked in each step of each process. Specifications for finish should be written and followed to the letter. Stain, filler, shellac, wax, varnish and flat finish should be used with sand paper or pumice stone between each two coats. Too much care cannot be taken at any step of these different processes.

HIGH SCHOOL, FRESHMAN YEAR.

Benchwork in Wood. 1 and 1 a.

Foreword. In many of our high schools we have pupils who have not had the advantage of manual training in the grades. For the purpose of helping these pupils along, it is necessary to do a great deal of individual work. By reviewing the tool processes of the grades and adding an interesting point here and there, by assigning readings and requiring written reports of different kinds on related subjects, it is possible to obtain good results even though your class seems "mixed" at the beginning.

In the high schools mechanical drawing, shop drawing, architectural drawing, design and freehand drawings should be given as distinctively a place on the program as any subject of the curriculum, but in many of the high schools of Oregon, as well as other states, this is impossible on account of existing conditions.

In all cases the work of making sketches and working drawings, reading, blue prints and studying the relation of design to construction must be continued.

Time. Double period (90 minutes) five days each week.

Throughout the year definite and technical work on certain useful joints and their applications in practical and valuable articles should be taken up.

The care of the tools, grinding, whetting and stropping, is of first importance in this work. Good results cannot be obtained with poor, dull tools.

The following joints are suggested: butt joint, glued and blocked joint, doweled butt joint, ledge or rabbet joint, through mortise and tenon joint, stub or blind mortise and tenon joint, pinned mortise and tenon joint, dado joint, keyed mortise and tenon joint, doweled and glued joint.

The order in which these joints follow, or the sequence, must be left largely to the individual project in hand. Each of these joints might be applied in the construction of a single library table, but as each pupil will complete two at least, and should complete three of the suggested projects, such as a selection should be made as will involve the use of all the suggested joints.

Suggested projects. Book trough, taboret, magazine stand, light stand, red-cedar chest, sewing cabinet, Morris chair, wall cabinet, drop-leaf table, Roman seat, library table, writing desk, dressing table.

In addition to the application of the suggested joints it is well to note the opportunity that is offered in the above list for practice in putting on hinges, locks, drawer pulls and a wide range for study and application of design. The above list is full of opportunities for studies of related subjects; i. e. history of design, tools, woods, industries, vocations, historical relations of modern construction, etc.

Finishing. More work along the lines of benchwork in wood is spoiled by poor or incomplete finishing than by careless tool work. Make a study of wood finishing.

After making your specifications for your finish try the latter out on a piece of the same kind of wood from which your project is made. Study wood finishing in all its different phases.

Cabinet Making 4 and 4 a.

In this year the pupil is supposed to do more highly specialized work. He has elected woodworking as his major and should have the opportunity to do his work under conditions as nearly like commercial practice as possible.

During the preceding years the emphasis should be place on hand-tool construction, and woodworking machinery should only be incidental. In this year the care and use of woodworking machinery, shop methods and shop kinks should be made the predominating factor and the work carried on as nearly under shop conditions as is possible.

Cabinet Making 4.

- I. Review and further development of tool processes in Benchwork in wood 1 a.
- II. Mill work.
 - A. Care and use of woodworking machinery—planer, jointer, saw table, band saw, mortiser, tenoner, etc.
- III. Table Construction. Suggested projects: Library table, extension table, dressing table, sewing table, tea wagon, etc.

The work should be taken up in the following order: (a) Working drawing (b) Mill bill (c) Milling (d) Machining stock (e) Benchwork (f) assembling (g) Finishing. Note—A very careful and technical study of the various wood finishing processes should be taken up.

Cabinet Making 4a.

- I. Further development of tool process in Benchwork in Wood 1 and 1 a.
- II. Veneering. (Suggestion). As built-up material and veneers are extensively used in the types of construction that will predominate throughout this semester, a study of their construction and use should be made when the problem is met.

The work should be taken up in the following order: (a) Preparation of core (b) Matching (c) Jointing (d) Gluing.

III. Cabinet Construction.

Suggested problems: Chafing dish cabinet, dresser, china cabinet, buffet, built-in cabinet work (Carpentry 4a).

The work should be taken up in the following order: (a) Working drawing (b) Mill bill (c) Milling (d) pairing up and laying out (e) Machining stock (f) Gluing and clamping (g) Assembling (h) Finishing.

Note—Do not slight the work in finishing. The results obtained will pay for the time and labor used in learning the different processes used by the best finishers. Write to different paint and varnish houses for their material on wood finishing.

Carpentry.

The great difficulty in teaching carpentry is the lack of projects that will give the class actual carpentry work.

W. J. Breit, in the Excelsior Springs, Missouri, schools, now in the University of Missouri and Phillip Parcher, in The Dalles, Oregon, schools, are teachers who have been successful with classes in carpentry by building houses, barns, and out buildings in miniature, cutting all lumber to scale and fully completing each project. E. A. Horton of Pine Bluffs, Arkansas, has very successfully carried through the plan of building and completely finishing (with the exception of excavation and the plastering) a house of five rooms, bath, pantry, closets, porches,

etc. In this case the material was furnished by the owner of the lot who was interested in the school and the boys.

These names are given so that the interested teacher who desires to try either plan may correspond with those who have successfully worked out these plans.

Many teachers have done successful carpentry work, so far as it goes, by building dog houses, smoke houses, garages, etc., for persons who wish them built.

Such buildings are hardly sufficient for more advanced carpentry, for there are so few steps required for completion.

In cases where the school board thinks of the education of the class—considers the efficient boy as the product of the school, the problem is easily met.

A method in use in many schools is to build certain parts of a house as each problem. Such a course is completely outlined in "Problems in Carpentry" by Louis M. Roehl, Director of Farm Mechanics, Milwaukee County School of Agriculture and Domestic Economy, Wauwatosa, Wisconsin; published by Webb Publishing Company, St. Paul, Minnesota.

Visit buildings in process of construction; advise with architects, contractors, and builders. Send for copies of tool catalogs, trade journals, magazines, and publications on all subjects related to the building trades. Keep these on your reading table for reference. See that they are used.

Carpentry 2.

Without attempting to tell how each step should be taken, the following is suggested as a sequence of steps or processes as a guide to the study of house building.

1. Foundations and forms of construction. Framing.
2. Roof construction. Study of Carpenter's square.
3. Boarding in. Roof coverings. Outside finish.
4. Wiring, plumbing, plastering.
5. Heating, ventilation, sanitation.
6. Floor laying, inside finish.
7. Doors, window frames and sashes, stair building.
8. Paint and hardware.

A study of arithmetic applicable to house construction should be made a part of this course. This should be worked out by the cooperation of the superintendent, teacher of mathematics, the teacher of manual training, and the teacher of commercial branches. Plans should be drawn to a given scale. Blue prints should be made from the selected plans. Specifications should be written in the accepted legal form and bids submitted for the construction as shown by the specifications.

Visits should be made by the class and the teacher to a house or houses in different stages of construction. If possible visit a sawmill and learn something of the lumber industry.

Suggested Projects. A one-story building to be used as a manual training shop. A building for some patron of the school who will pay for the materials used. A model two-story house built to a scale (all steps of construction may be carried out in such a building). Sections of building may be made. See "Problems in Carpentry"—Roehl.

Carpentry 4.

Each step should be preceded by lectures, reading, observation trips, reports, and general discussion. Cooperate with the teacher of English, the teacher of Mathematics, and the carpenters and builders of your town.

- I. Foundations: (a) Location (b) Excavation (c) Materials—brick, stone, concrete (see concrete work 2a).
- II. Forms of construction. Framing—1 Full frame. 2. Braced frame (a) Sills (b) Corner posts (c) Floor joists (d) Studing.
- III. Porch construction.
- IV. Roof construction (Study methods of laying out rafters with carpenter's steel square).
 - 1 Forms of roofs, 2 Plan of roof. 3 Pitch. 4 Rafters. 5 Collar beams, 6 Struts. 7 Sheathing.
- V. Boarding in. 1 Cornices. 2 Gable finish. 3 Outside finish. 4 Conductors.
- VI. Roof coverings. 1 Shingles. 2 Slate. 3 Tile. 4 Metal. 5 Gravel. 6 Paper, tar, rubber, etc.

Carpentry 4a.

Note.—See design, machine and architectural drafting.

- I. Wiring, plumbing, and plastering. Study methods.
- II. Heating, ventilation, and sanitation. Study methods.
- III. Stair building. 1 Forms. 2 Making measurements. 3 Laying out stairs. 4 Head room. 5 Stringers. 6 Skirting boards.
- IV. Floor laying.
- V. Inside finish. 1 Study of woods. 2 Casings. 3 Molding. 4 Closets. 5 Stairs.
 - (a) Stair posts. (b) Treads and risers. (c) Hand rails. (d) Balusters.
- VI. Door frames. 1 Hanging. 2 Fitting locks.
- VII. Window frames. 1. Window sashes.
- VIII. Review from note book, readings, etc., and submit plans and estimates for building.

Woodturning and Pattern Making.

Woodturning is given on account of its educational value in tool processes, design, sketching, the use of power machinery, its application

to ornamentation and the historical relation of the lathe in the evolution of woodworking tools.

In addition to the above, this course is arranged to lay the foundation for the elementary course in pattern making.

Pattern making has great educational value on account of the tool processes involved, the accuracy required in measuring and fitting, the application of drawing and design, and the opportunities for correlation.

To obtain the greatest value from a course in pattern making, the pupil should be given the elements of molding.

A "Flask" should be made, a small quantity of molding sand procured and an elementary project be completed from the rough drawing to the rough casting. Lead may be used in this work to take the place of iron. This is suggested as a means of increasing the interest in pattern making and to broaden the view of the pupil.

In a certain school where a splendid course in pattern making is offered, not a single pupil in a class of nineteen could answer any of the following questions at or near the end of the semester: In what is a casting generally made? What is a molding flask? Name the parts of a molding flask. Why are patterns made in two or more parts? What is a core? Of what are cores made? These pupils had been given very little opportunity to undergo a series of typical practical experiences.

Woodturning and Pattern Making 3.

I. Woodturning.

(a) Study of lathes, primitive, modern (b) Study of tools,—care, use (c) Turning between centers.

Suggested projects: Cylinder, step cylinder, socket chisel handle, potato masher, rolling pin, stocking and glove darning, mallet head and handle.

(d) Face turning.

Suggested projects: Tea pot stand, rosette, card tray, boxes, candle stick, goblets, picture frame.

(e) Chuck turning.

Suggested projects: Candle stick, bowl, napkin ring, wooden ball.

II. Pattern making.

Suggested projects: Pattern for planer block, pattern for angle iron, pattern for brass bushing, pattern for core box, pattern for pipe T, pattern for return bend, pattern for arm of eccentric wheel, pattern for gear blank, pattern for hand wheel, etc.

Machine-Shop Practice.

Many teachers insist that this course cannot be worked out in our small city or town high schools. The reason most commonly given is, "We have no lathes for doing iron work." At the same time they

have from one to twenty wood turning lathes that cost from fifty-five to one hundred-thirty dollars each. In reply to the above reason those who are interested in working out a complete course for their boys are advised to write to W. R. Price, 70 Fifth Avenue, New York City, New York, and ask him for his bulletin "Lathe Work by Some Amateurs."

The second reason is the lack of castings for machining. In many places this may be overcome by getting suitable castings molded at the local foundry. In towns where there are no foundries arrangements may be made to procure required castings from a foundry in any large city.

"Where there is a will there is a way."

Machine-Shop Practice 3.

- I. Cylinder turning.
 - (a) Location of centers, drilling, tool setting. (b) Plain turning to definite size. (c) Accurate location of shoulders, making a fillet, end facing between centers. (d) Turning, facing, squaring up a shoulder.
- II. Taper turning.
 - (a) Calculating of taper, and methods of turning.
 - (b) Finishing.
- III. Screw cutting.
 - (a) Calculating change of gear. (b) Cutting right and left hand threads.
- IV. Chucking and boring.
 - (a) Use of clutch and boring tools. (b) Use of chuck in finishing.
- V. Internal threading.
 - (a) Chucking, boring. (b) Threading.
- VI. Milling.
 - (a) Use of milling machine. (b) Gear cutting.
- VII. Shaper.
 - (a) Use of tools. (b) Squaring up.
- VIII. Bench work.
 - (a) Chipping, filing. (b) Use of common bench tools.
- IX. Drill press.
 - (a) Use.

Machine-Shop Practice 4.

- I. Lathe work.

Suggested projects: (a) Arbor. (b) Reamer. (c) Milling cutter. (d) Gear blank.
- II. Shaper.

Suggested projects: Such work as happens to be in progress.
- III. Planer work.

Suggested projects: Such work as happens to be in progress.

IV. Drilling.

Suggested projects: Such work as happens to be in progress.

V. Milling machine work.

Suggested projects: (a) Arbor. (b) Reamer. (c) Milling cutter. (d) Gear blank.

VI. Finish grinding.

Suggested projects: (a) Arbor. (b) Reamer. (c) Milling cutter. (d) Gear blank.

VII. Assembly and repair work.

VIII. Bench work.

Forging.

"For since the birth of time through all ages and nations,
Has the craft of the smith been held in repute by the people."

(Longfellow.)

Read the myths of Vulcan.

Tubalcain, an instructor of every artificer in brass and iron. (Gen. 4:22).

Forging is a fundamental subject and is so closely related to a number of other industries that it should have a place in all well organized manual-training schools. It should not be grafted on the curriculum as an appendage or taken up as a fad, but should have a prominent place on the program on account of its educational value and its value in broadening the vision of the pupil.

There are four points essential to good forge work; (a) know how to make a fire, (b) know how to keep a fire, (c) know your tools, (d) know the heat of your iron. Know these and work at your anvil and all the rest will be added unto you.

Take your classes to visit the blacksmith shops in your town. Arrange with the teacher of English for your group to write accounts of such visits. Visit other shops, if possible, where iron work is the predominant interest. Keep in close touch with the blacksmiths in town and occasionally review your own work by making some small article in his shop.

At the beginning of the senior year the pupil should elect either iron work or wood work as his major. After having made his selection he should work with the special aim of fitting himself to enter a shop for the purpose of specialization in his chosen line. As far as possible the manual training teacher should follow shop methods and take advantage of all shop practices and shop kinks.

Forging 3a.

I. The forge.

Lectures and assigned readings on (a) History of the forge, (b) Kinds of forges, (c) Fuel, (d) Tools.

II. Forging operations.

Exercises.

1. Drawing exercises; round stock to square stock and square stock to round stock.
2. Poker—squaring, drawing, bending.
3. Ring—upsetting, bending.
4. Staple—drawing, bending.
5. Gate hook—drawing, bending, twisting.
6. Door hasp—drawing, forging, punching, cutting and bending.
7. Square head bolt—upsetting, forging.
8. Square corner angle—upsetting, chamfering, and forging a square corner.
9. Fagot weld—welding and forging to dimension.
10. Round weld—scarfing and welding.
11. Flat weld—scarfing and welding.
12. Flat right-angle weld—scarfing and welding.
13. Flat T weld—scarfing and welding.
14. Welded eye pin—bending, welding, and drawing.
15. Hay hook—bending, welding and drawing.
16. Chain making—bending, scarfing, and welding.
17. Hook—drawing, punching, forging, and bending.
18. Chain swivel—bending, scarfing, welding, and riveting.
19. Chain grab hook—forging, punching, and bending.
20. Flat-jaw tongs—shaping, welding, and riveting.
21. Irons for double-trees (a) 4 clips (b) 4 hooks (c) 2 lap links (d) 3 clevises (e) 3 pins.
22. Irons for neck-yoke.

Forging 4.

I. Tool smithing and Art smithing.

Lectures and assigned readings on (a) Temperatures (b) color names (c) hardening and carbonizing (d) tempering.

II. Projects—Tool Smithing.

1 Review previous processes. 2 Cold chisel. 3 Center punch. 4 Blacksmith tongs. 5 Swages. 6 Hardie. 7 Heading tool. 9 Ball pein hammer. 10 Make needed tools for shop work.

III. Art Smithing.

The selection of the projects in art smithing should be left largely to the pupil, the teacher advising with him as to design.

Suggested projects: Fire set, poker, shovel, tongs, and rack, andirons, door latch, candle stick, draw pulls, hinges, latches, door knockers, hat and coat rack, wall hook, lantern.

Forging 4a.**I. General Blacksmithing.**

Through this course a text book should be used and reports required on: 1 Machinery for blacksmith shop. 2 Materials. 3. Heat treatment of steel and related subjects.

In this semester, work in general blacksmithing should be taken up. Practical work in job and repair blacksmithing should be the principal projects. If possible get actual repair work to do by bringing in parts of wagons, farm machinery, etc.

Review all previous processes and demand that the work be done as far as possible under shop conditions. Study and take advantage of all shop kinks. Work in harmony with your local blacksmith. He is interested in the school and the boys and his cooperation will be a valuable asset.

Suggested problems: 1 Irons for a small wagon. 2 Theoretical study of horse shoeing, making horse shoes.

Concrete Work.

Concrete is so extensively used as a medium of construction that it may well be called a universal building material.

There is no place where a line may be drawn and the statement made that concrete has no place here. Concrete is found on the farm, in the city, far away in the mountains where reservoirs are made, on railroads, and in highway building; in all countries, and for many purposes ranging from a sidewalk to completed articles of furniture.

The pupil should be required to design and make a working drawing for each project. All forms and molds should be made in the bench room by the class in concrete work.

Throughout this as well as all other courses mechanical drawing, design, benchwork, and all related subjects should correlate. From the conception of the project to the final finishing touch by the worker, each step should be clearly understood and carefully worked out in class.

Concrete Work 2a.

Assigned readings and reports on the following: 1 Materials and uses. 2 Mixtures and uses. 3 Forms and molds. 4 Tools and equipment.

Suggested projects:

1. Sidewalk construction (a) Section of sidewalk, (b) Section of curb. (c) Section of gutter.
2. Foundation work (See Carpentry 4.)
3. Concrete step and porch construction.
4. Concrete floor work.
5. Building blocks.
6. Posts and columns. (a) Fence posts, (b) Hitching posts. (c) Ornamental posts.

7. Watering trough.
8. Flower box.
9. Garden seat.
10. Urn.

Vocational Study 4a.

While the schools are fitting the pupils for an efficient life in the environment in which they may be placed, common sense suggests that they be equipped to make an intelligent choice of occupation for their life work.

Through the six years devoted to the industrial course the time of the pupil has been devoted to the study of the theory and practice of different industries. The pupil has been led to acquire more or less skill or dexterity in the use of many different tools. If this work has been fairly well done, the pupil is now equipped with the fundamental principles of a number of different trades. This practical work should be rounded out by a careful study of vocations so that the acquired technic may be used to the best advantage to the pupil in particular and society in general.

A text book should be used as a basis for this study. Assigned readings, visits to local shops, mills, and factories should be made and written reports required.

Arrange with local business men to talk to your class at least one period each month. Cooperate with the commercial club of your town and all other business organizations that are available.

Suggested Outline.

I. Industrial Economics.

- 1 Evolution of economic life.
- 2 Development of our industrial system.
- 3 Industrial ownership.
- 4 Industrial organizations.
- 5 Labor problems.
- 6 Scientific management.
- 7 Industrial education.

II. Study of Vocations.

- 1 Agriculture.
- 2 Industries.
- 3 Commerce.
- 4 The professions.

III. Vocational Guidance.

Suggested books: Industrial Evolution of the United States, Wright, Scribners. Increasing Human Efficiency in Business, Scott, Macmillan Company. Outlines of Economics, Ely, Macmillan Company. The Industrial Training of the Boy, McKeever, Macmillan Company. Profitable Vocations for Boys, Weaver, A. S. Barnes Company. Vocation and Moral Guidance, Davis, Ginn and Company. Vocational Guidance, Puffer, Rand, McNally and Company. Industrial Education, Leake, Houghton, Mifflin and Company.

Shop Mathematics 3a.

A course in practical shop mathematics should be worked out by the teachers of the shop subjects and the teachers of mathematics.

Each group of problems should have direct relation to the shop subjects of the semester. As an illustration, in the books, "Elements of Construction" and "Inside Finishing" by King, there are a great many practical problems on woodwork and related industries that should be solved by the classes in benchwork and carpentry.

In this work the teachers and pupils should talk with contractors and craftsmen for the purpose of getting practical suggestions.

Shop Mathematics 4. (See Shop Mathematics 3 a.)

BOOKS RECOMMENDED FOR CLASS USE AND REFERENCE.

The Manual Arts Press, Peoria, Illinois, will secure and forward, at the publishers' list price, any book published on the manual arts or kindred subjects.

Agricultural Projects.

Farm Shop Work, Brace and Mayne, American Book Co.
Problems in Farm Woodwork, Blackburn, Manual Arts Press.
Agricultural Woodworking, Rcehl, Bruce Publishing Co.

Architectural Drafting.

Agricultural Drafting, Howe, Manual Arts Press.
Architectural Drawing, Edminister, Manual Arts Press,
Architectural Drafting, Greenberg and Howe, Manual Arts Press.

Art Metal Work.

Art Metal Work, Payne, Manual Arts Press.
Metal Work, Adams and Evans ?
Educational Metalcraft, Davidson ?

Benchwork, Joinery and Cabinet Making.

Teacher's Handbook in Woodwork, King, American Book Co.
Elements of Construction, King, American Book Co.
Bench Work in Wood, Goss, Ginn & Co.
Elementary Woodworking, Foster, Ginn & Co.
Essentials of Woodworking, Griffith, Manual Arts Press.
Correlated Courses, Griffith, Manual Arts Press.
Educational Woodwork, Park, The Macmillan Company.
The A. B. C. of Woodworking, Wheeler, G. P. Putnam's Sons.
Elementary Cabinet Work, Selden, Rand McNally & Co.
Hand Work in Wood, Noyes, Manual Arts Press.
Industrial-Arts Magazine, Bruce Publishing Co.
Manual Training Magazine, Manual Arts Press.
Woodwork for Secondary Schools, Griffith, Manual Arts Press.
Woodwork for Beginners, Griffith, Manual Arts Press.
Demonstrations in Woodwork, VanDusen, Manual Arts Press.
Furniture for Craftsman, Otter, David Williams Co.

Carpentry.

Constructive Carpentry, King, American Book Co.
Inside Finishing, King, American Book Co.
Problems in Carpentry, Roehl, Webb Publishing Co.
A Manual of Carpentry and Joinery, Riley, The Macmillan Co.
Progressive Carpentry, Meloy, David Williams Co.
A. B. C. of the Steel Square, Hodgson, Frederick Drake & Co.

Concrete Work.

Manual Training Course in Concrete, Assn. of Am. Portland Cement Mfrs.
Portland Cement, Meade, Chemical Publishing Co.
Concrete, Plain and Reinforced, Taylor, John Wiley and Sons.
Concrete Costs, Taylor, John Wiley and Sons.

Design.

Design, The Prang Co.
A Textbook of Design, Kelley, Houghton, Mifflin Co.
Design in Theory and Practice, Batchelder ?
Applied Design, Varnum, Scott, Foresman & Co.

Forge Work.

Forge Work, Bacon, John Wiley and Sons.
 Hand Forging and Wrought Iron Work, Googerty, Manual Arts Press.
 Forge Craft, Crowe, R. G. Adams & Co.
 Forge Shop Practice, Littlefield, Taylor-Holden Co.

Machine Drafting.

Engineering Drawing, French, ?
 Machine Drawing, Anthony, D. C. Heath & Co.
 Introduction to Machine Drawing & Design, Low ?

Machine Shop Practice.

Machine-Shop Primer, Colvin, Hill Publishing Co.
 Machine-Shop Practice, Kaup ?
 Machine Shop Tools and Methods, Leonard ?

Mechanical Drawing.

Mechanical Drawing, Cross, Ginn & Co.
 Mechanical Drawing, Anthony, D. C. Heath & Co.
 Elements of Mechanical Drawing, Faunce, ?
 Mechanical Drawing, Tracy, American Book Co.
 Grammar Grade Problems in Mechanical Drawing, Bennett, Manual Arts Press.

Pattern Making.

The Art of Pattern Making, Chase, John J. Wiley & Sons.
 Wood Pattern Making, Purfield, ?
 Pattern Making, Willard, ?

Printing.

Practical Typography, McClelland, Manual Arts Press.
 Progressive Exercises in Typography, Loomis, Taylor-Holden Co.
 Printing and Bookbinding, Vaughn, Public School Publishing Co.
 Modern Press Work, Gage, The Inland Printer Co.

Turning.

Problems in Wood Turning, Crawshaw, Manual Arts Press.
 Wood Turning, Ross, Ginn & Co.
 Elementary Turning, Selden, Rand McNally & Co.

Vocational Study.

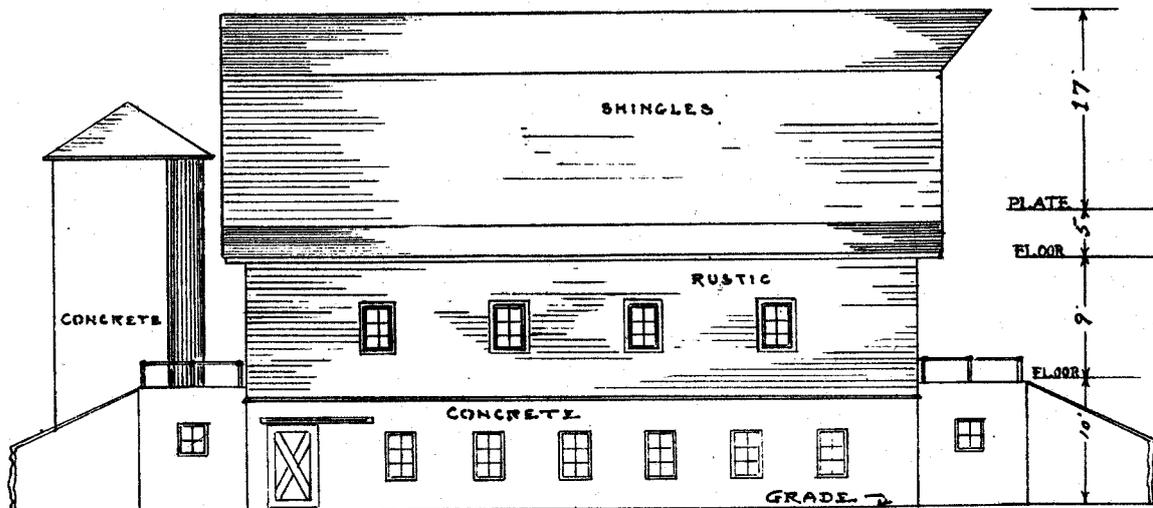
Industrial Evolution of the United States, Wright, Scribners.
 Increasing Human Efficiency in Business, Scott, The Macmillan Co.
 Outlines of Economics, Ely, The Macmillan Co.
 The Industrial Training of the Boy, McKeever, The Macmillan Co.
 Profitable Vocation for Boys, Weaver, A. S. Barnes Company.
 Profitable Vocation for Girls, Weaver, A. S. Barnes Company.
 Vocation and Moral Guidance, Davis, Ginn and Company.
 Vocational Guidance, Puffer, Rand, McNally & Co.
 Industrial Education, Leake, Houghton, Mifflin & Co.
 Readings in Vocational Guidance, Bloomfield, Ginn & Co.
 Prevocational Education in the Public School, Leavitt and Brown, Houghton, Mifflin Co.
 Occupations, Gowin and Wheatley, Ginn & Co.
 Starting in Life, Fowler, Little Brown & Co.
 Education for Social Efficiency, King, A. Appleton & Co.
 Education and Industrial Evolution, Carlton, Macmillan Co.
 Learning to Earn, Lapp and Mote, Bobbs, Merrill Co.

COOPERATIVE EXTENSION WORK
 IN
 AGRICULTURE AND HOME ECONOMICS
 STATE OF OREGON

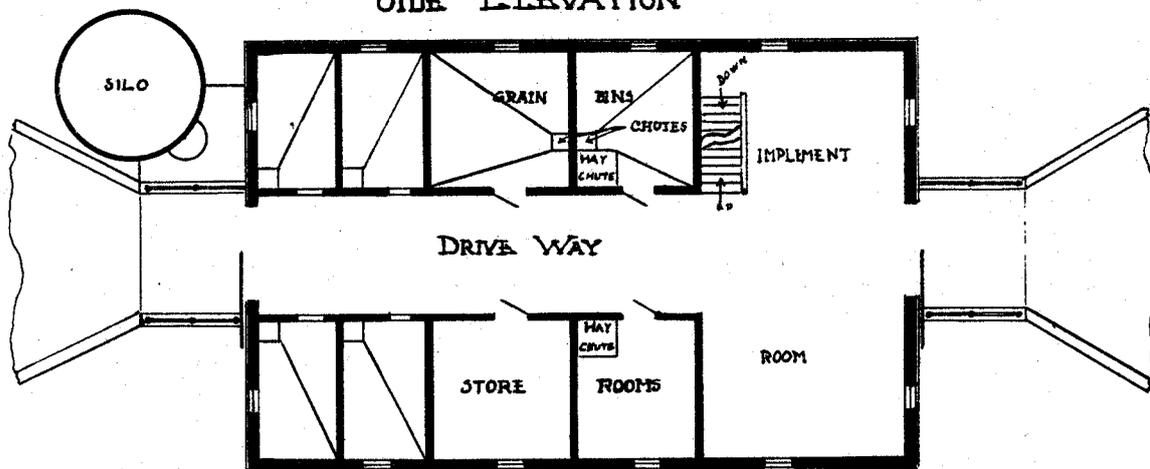
OREGON STATE AGRICULTURAL COLLEGE
 AND THE UNITED STATES DEPARTMENT OF AGRICULTURE
 COOPERATING

EXTENSION SERVICE

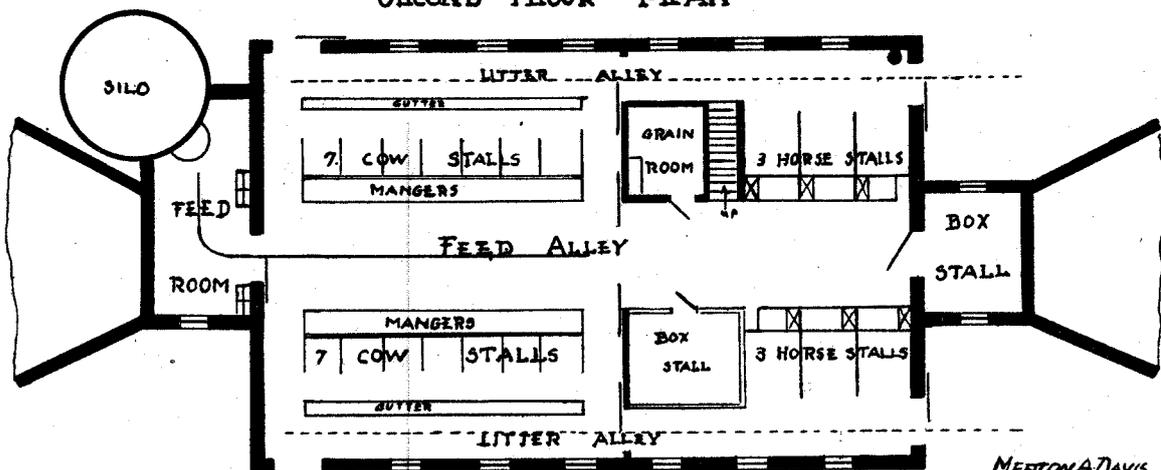
CORVALLIS, OREGON.



SIDE ELEVATION



SECOND FLOOR PLAN



FIRST FLOOR PLAN

MERTON A. DAVIS

RURAL ARCHITECTURE SERIES	PLATE - 1 COMBINATION BARN 36'-0" X 56'-0" SCALE $\frac{1}{16}'' = 1'-0''$	SCHOOL OF AGRICULTURE O.A.C.
L. EUGENE ROBINSON		