

A Course of Study in Farm Shop Work

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*For Rural and Village
High Schools*



Prepared by

RAY FIFE

STATE SUPERVISOR OF AGRICULTURE
STATE DEPARTMENT OF EDUCATION
COLUMBUS, OHIO

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AS DIRECTOR OF EDUCATION
STATE OF OHIO

1921

New and Improved

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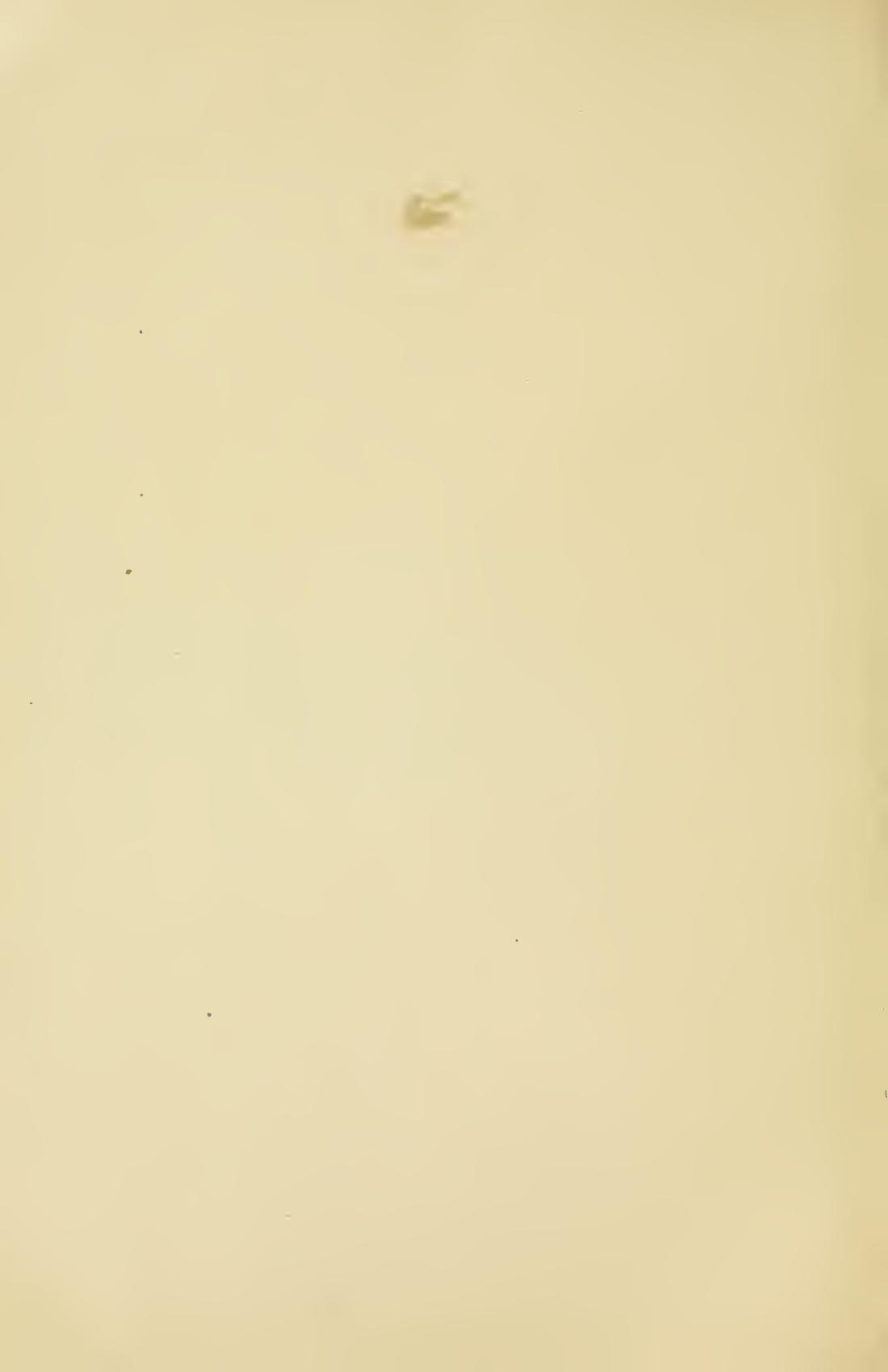
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INTRODUCTION

It would be difficult, if not impossible to prove the correctness of the statement of the ancient Greek philosopher that the superiority of man over the inferior animals is due to his having hands. There is in man, however, an instinctive impulse to construct, which has resulted in his becoming a maker of things. His ability to create is a manifestation of an innate, divine principle which causes him to be in the image of his Creator.

There is such an intimate relation between the hand and the brain that the hand is believed to be more directly connected with the brain than the other sense organs. The hand of the mental imbecile is listless, expressionless, and lacks the power of precision of movement. The frankness and honesty of manual expression more accurately reveals character than the face, the expression of which man has learned to control so as to deceive. Helen Keller says: "Not only is the hand as easy to recognize as the face but it reveals its secrets more openly and unconsciously. People control their countenances, but the hand is under no such restraint. It relaxes and becomes listless when the spirit is low and depressed; the muscles tighten when the mind is excited or the heart is glad, and permanent qualities stand written in it at all times." Ex-President Eliot of Harvard University declares: "Accurate work with carpenter's tools, lathe, or hammer and anvil, or violin, or piano, or pencil, or crayon, or camel's hair brush trains well the same nerves and ganglia with which we do what is ordinarily called thinking." Professor Francis W. Parker remarks: "It is impossible to do all-sided, educative work without training in hand work. Manual training is the most important factor in all education. Making has done more for the human race than the exercise of any, if not all, of the other modes of expression." Professor John Dewey says: "The child who employs his hands intelligently in the school room, in due preparation, is satisfying one of the most powerful interests within him. He is cheerful, he is a picture of health, and his best emotions and impulses are easily kept active. The greatest mistake in education consists in shutting children away from nature, and in trying to teach them almost entirely from books."

We were a long time in finding out these important truths and our dilatoriness in acting upon them, after having discovered them, subjects us to most severe censure. We are conscious that action as well as thought is necessary to make education complete, yet we go on turning out products of our schools that are bookish, theoretical, and imprac-

tical — men and women who know but who cannot do. Science has been separated from art, and history, mathematics, and literature have been emphasized without practical application to actual conditions. Achievement can be honestly measured only when ideas are expressed in deeds.

Manual activity causes a proper attitude toward work. Ideals of the past whereby education was thought to give culture and distinction, exempting the individual from social service and qualifying him for the aristocracy of idleness, must be rejected. The purpose of schooling is not to prepare the boy to make a living without work. Ruskin well said, "Life without labor is a crime." There are thousands of men and women in the world today who are misfits in society and who are trying to make a living without work because they have never discovered their predominating powers and capabilities and because they have never learned to have a proper conception of labor. Manual labor is not menial nor degrading and a boy should consider it a privilege to put on his overalls and go into the workshop, into the factory, or to the farm.

That the manual and mental in education in the rural and village schools may be more properly and honestly balanced, this course in farm shop work has been prepared. Its adoption is urged that practical standards in manual training may be established. The activities to be performed in pursuance thereof in every particular are closely correlated with farm life, thereby blending school and industrial interests. By proper instruction this course will become one of the most important elements of the complete education of the country boy.

Respectfully submitted,

VERNON M. RIEGEL,
*Superintendent of Public Instruction,
as Director of Education.*

Probably the best justification for farm shop work can be found in its definition, viz. "Farm shop work consists of teaching the farm boys to do the ordinary repair and construction work that arises on the farm with such tools and equipment as the average farmer may reasonably be expected to have."

"That farm shop course is of most value to the farm boys that offers the widest range of such mechanical experiences as boys will encounter as farmers."

"Any mechanical or other experience that does not function on the farm has no place in the farm shop course in the school."

While farm shop instruction thus becomes vocational to the boy who remains on the farm on account of its direct association with home interests, it is also more interesting and more valuable to the student who enters other pursuits.

The writer is aware of the fact that this treatment of farm shop is a mere beginning. Many phases of shop work which can be easily and economically treated in a course of reasonable length have been entirely omitted. No attempt has been made to give specific detailed directions or methods for instruction. While the importance of technical direction is not minimized, our first concern is that rural school superintendents, supervisors, and manual arts instructors realize the demands of modern rural education for farm shop instruction.

Purpose and Place of Farm Shop Work

A farm shop course in the rural high school should be conducted with four primary aims in view:

1. It should give practice in all the common tool operations with special emphasis on those operations which the boy will use most on the farm.
2. It should be planned so that each article can be put to practical use on a farm in the community when completed.
3. It should be correlated with the agricultural interests of the home, particularly with the projects of boys enrolled in agricultural classes or in boys' agricultural clubs.
4. It should result in a farm shop on every farm with the necessary tools required to do the farm repair and construction work.

In presenting this material it is realized that it is a step very far removed from present practices in Ohio. As one author has aptly stated, the manual arts work of our rural schools has consisted mainly in a bodily transposition of manual training and drawing courses from the

city schools to the schools of the rural community. Generally speaking, instructors have been concerned only with giving skill in the use of woodworking tools, and mental and physical training regardless of any practical application. With the almost incredible growth of the consolidation movement in the state and the consequent extension of the facilities for the proper kind of rural education, the continuation of such teaching practices becomes increasingly serious.

In many rural high schools of the state there is an immediate need for a new vision of shop work on the part of those in charge of it. Superintendents and teachers should be as vitally concerned with shop work functioning directly in the present and probable future life of the farm boy as the English teacher in stimulating the use of correct English in the pupils' everyday life. In urging a new viewpoint in the rural shop instruction of Ohio, we do not wish to minimize the importance of the mastery of tool operations. They become of added importance if applied in such a manner that the finished product must stand the test of practical use.

Fortunately, the added aims are not antagonistic to the previous ones. A course in farm shop work which will have a direct economic and practical relation to a boy's home life can give as complete a mastery of tool operations as the other type of course. In fact such a course should be even more effective in the teaching of such operations on account of the added interest which would result from a closer correlation of school and home life.

Any treatment of the farm shop problem must take into account the difficulties which such a course will encounter at the present time if an attempt is made to include it in the curriculum of the average rural high or elementary school. The many manual training departments of the state already established are equipped for wood working only, usually of the "cabinet making" type. Farm shop work as such is a comparatively new subject hence few teaching helps such as textbooks, etc., are available. The number of trained instructors who can present any phase of the work except woodworking is negligible.

It will be found, however, that the equipment required will be inexpensive when compared with much of the equipment already installed in existing manual training departments, especially if the criterion is applied that "All farm shop work must be done with such tools as the farmer can be expected to have and use on his farm." With the marked attention which is being given to the subject in many states, text books, courses of study, etc., are rapidly becoming available. Standards of work are developing with equal rapidity. Furthermore, the successful manual training teacher who has the farm shop point of view, will require but little additional training in preparation for the added phases of work.

Rooms for the School Farm Shop

The question frequently arises, "Should the school farm shop be located in a separate building or in a room of the regular school plant?" Each plan has certain advantages. The separate building removes all question of any noise interfering with other class work, provides easy entrance for bringing farm machinery into the shop building and permits of conditions and arrangements like those found on the farm. On the other hand, facilities for heating and lighting, building economy, inconvenience in changing classes, and numerous other factors unquestionably favor the plan of locating the shop in the regular school plant.

Where space has not been provided in the present school plant, the farm shop work can be cared for very well in a separate building. With either plan certain facilities not found in present buildings must be provided.

Home Work

There is an increasing tendency on the part of superintendents and farm shop instructors to arrange for shop projects at the home or on the farm, e. g., a boy may be caring for the home flock of poultry, in which case he may wish to arrange for a shop project in the construction, or alteration and repair of a poultry house.



Applying the finishing touches to a shop project that is related directly to home and project needs. Raymond Clark, Grove City, Ohio, constructed this self-feeder at a cost of only \$24 for use on the home farm.

Home work presupposes sufficient tools at home for the performance of the project and sufficient skill to perform the work without the close supervision common to the school shop.

School credit should be given for shop work done at home as well as for work done in the school farm shop, providing such home work can be properly supervised. Where credits on home work have been based entirely on the reports of the pupil, the results have often been unsatisfactory.

The Home Shop

The value of a shop at home should be emphasized throughout the course. Whenever possible, the instructor should visit the pupil's home and discuss with him desirable places for the location of the shop. It may be desirable to take the entire class to nearby homes for this purpose. A consideration of the home shop should be included in the subject matter of the course.

The Farm Shop Instructor

The question has arisen, particularly in schools having departments of vocational agriculture, as to who should teach the farm shop course. Generally, the course should be taught by the regular manual arts instructor, even though this may mean additional preparation on his part combined with a radical revision of his present point of view. He has the technical skill in tool operation which the average agricultural instructor does not possess. He may be handicapped somewhat by not coming in close contact with the home interests and needs but this deficiency can be overcome by close cooperation with the agricultural instructor if the school has a department of vocational agriculture, or by visits to the boys' homes.

If the school has no regular manual training instructor, or does not offer manual training courses, the farm shop work should be correlated with the agricultural course in the school and taught by the agricultural instructor.

Methods of Instruction

Farm Shop work can well be taught by the project method. The project method allows each boy to work on articles, in construction or repair work, adapted to his skill in the use of tools and to his individual interests. It also offers a ready solution to the problem of adjusting the work to home interests where farm boys and village boys are enrolled in the same class. The use of the project method, adapted to the boys' home interests will necessitate a knowledge of such interests on the part of the instructor. In case a boy is engaged in agricultural project work, it should be drawn upon for his farm shop projects.

Farm shop instructors should also make free use of the demonstration. It is far more desirable that the instructor demonstrate the plan-

ing of a board, the fitting of a saw or the making of a harness stitching thread than to attempt such instruction through "lecturing".

According to present high school standards, farm shop instruction will usually be given, in a double period of at least ninety minutes. The early part of some periods should be given over to the various demonstrations mentioned above. Parts of other periods may be devoted to a consideration of such problems as kinds and strengths of lumbers adapted to various uses, builders' hardware, including kinds and size of nails, hinges, locks, bolts, etc., adapted to common farm use. Farm shop experience has proven that a boy is usually as ignorant of proper selection of materials as of tool operations.

Extent of the Farm Shop Course

The fact that a comparatively comprehensive program for farm shop work is offered should not be regarded as an encouragement to attempt such a program without adequate equipment and adequate preparation on the part of the instructor. Such an experiment might easily result in a hodgepodge of manual processes which would mark but little improvement over the boys' present practices. While the making of a stitched harness splice or the soldering of a tin pail may be a simple process compared to the construction of a library table or a buffet, there is a proper procedure for each performance.

The following course also presupposes that woodworking, at least, has been given in the grades. Unless such work has been offered, a farm shop instructor should not attempt to complete the entire program of work in one year. If not more than one year's work can be offered, the instructor should carefully analyze the course from the standpoint of community needs in order that the less valuable parts may be omitted.

It should be constantly kept in mind that we are not training professional draftsmen, cabinet makers, carpenters, harness makers, tanners or machinists; that the boy and especially the farm boy, in his future life, will be concerned far more with repair work than with construction. Such thoughts should greatly influence the kind of instruction, the choice of projects and the amount of time devoted to the different divisions of the course.

Course of Study

In preparing the following outline, while but little local experience could be drawn upon, care was taken to recommend only those problems and operations which are justified by the experience of instructors and supervisors, elsewhere, where farm shop courses are prevalent. The farm shop instructor is urged to study the needs and shop practices of the community in which he is working. It is far more desirable that he plan his course and secure his shop projects directly from such sources than from book or bulletin.

In listing the subject matter of the farm shop course, no attempt at proper sequence has been made. It is presumed, however, that wood-working will usually be the first subject considered. With many subjects, if the instructor endeavors to adapt his work to community needs, he will ascertain that there is usually a proper place in the course for each subject, e. g., harness work should commonly be given during the late winter months before the opening of spring farm operations. Harness can then be brought from the homes of the boys for actual work in cleaning, oiling and repairing. In communities where 'sugaring' is common, no better time for instruction in soldering can be found than during the period when equipment is being repaired, prior to the opening of the season. Usually these arrangements can be made without seriously disturbing the so-called logical arrangement of subject matter.

We need only study the practices of farmers to realize the very great importance of repair work on the farm. If our farm shop work is to function, there is then a need for a marked emphasis of repair work in the farm shop course. One authority has stated "that at least fifty per cent of the farm shop course should be devoted to repair work."

No attempt has been made to completely separate repair and construction jobs in the suggested course which follows. Each instructor should work out with his students a list of repair jobs which are practical for the community. This practice can be followed with construction work as well but it is particularly valuable with repair work since the problems must be taken directly from the pupils' homes.

THE FARM SHOP COURSE

Agricultural Drawing.

1. Reading working drawings, including reading of plans of farm buildings.
2. Sketches (free hand) in isometric of parts of farm appliances, equipment, buildings etc. All work is to be done as need for it arises. Work is to be done in pencil only.
3. Working drawings of appliances in shop.
4. Lettering and dimensioning, and necessary drawing terms to be given as needed.

Farm Woodworking.

1. Selection of tools.
 - a. Kind of tools.
 - b. Exact name of each.
 - c. Size.
 - d. Quality.
 - e. Uses to which adopted.

2. Care of tools.
 - a. Oiling.
 - b. Storing.
 - c. Sharpening.
3. Sources.
 - b. Bills of material.

The preceding points on selection and care of tools and materials and supplies required may well be repeated in each phase of the course.

4. Mastery of farm shop tool operations through the construction of practical farm and home appliances.

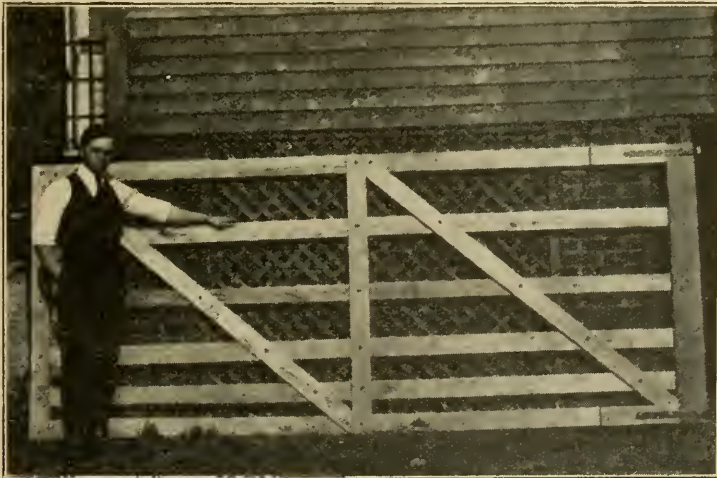
A teacher should make a careful analysis of each boy's work so that he may know which operations he already uses skillfully and those in which he needs more training and practice.

Pupils should be expected to perform tool operations with a reasonable degree of speed and accuracy. The instructor should have these operations in mind when the pupils' shop projects are planned, with the idea of including them in their work without at the same time sacrificing home and individual interests.

CARPENTRY TOOL OPERATIONS

measuring
marking
squaring

sawing
ripping
cross grain



In constructing this gate Paul White used the following tool operations: cross sawing rip sawing, planing, bevelling, boring, counter sinking, and screwing. Skill and neatness in the performance of tool operations are worthy ends in shop instruction.

planing	nailing
boring	screw driving and drawing
countersinking	tapering
shaving	mortising and tenoning
chiseling	beveling and chamfering
hewing	rounding
scraping	doweling
wood filing	sanding
plumbing	wood filing
leveling	assembling
gluing	

SUGGESTED PROBLEMS IN WOODWORKING

CROPS PROBLEMS

- | | |
|--------------------|------------------------------|
| 1. Seed testers. | 6. Exhibition tray for corn. |
| 2. Seed corn rack. | 7. Seed cabinets. |
| 3. Seed corn tree. | 8. Seed corn sled. |
| 4. Potato grader. | 9. Sled cutter. |
| 5. Hay rack. | |

LIVE STOCK PROBLEMS

- | | |
|--------------------------|-------------------------------|
| 1. Self feeder for hogs. | 9. Feed rack. |
| 2. Hog trough. | 10. Milk stool. |
| 3. Hog hurdles. | 11. Dehorning chute. |
| 4. Hog chute. | 12. Dairy record sheet board. |
| 5. Hog rack for hauling. | 13. Grain trough for sheep. |
| 6. Individual hog house. | 14. Shearing table. |
| 7. Colony hog house. | 15. Wool baling press. |
| 8. Individual hog crate. | |

POULTRY PROBLEMS

- | | |
|--------------------|----------------------------|
| 1. Egg tester | 7. Brooder. |
| 2. Feed hopper. | 8. Feed trough. |
| 3. Poultry house. | 9. Water trough. |
| 4. Colony house. | 10. Show crate. |
| 5. Shipping crate. | 11. Poultry catching hook. |
| 6. Trap nests. | |

GARDENING AND ORCHARD PROBLEMS

- | | |
|--------------------------|------------------------|
| 1. Hot bed. | 7. Plot or row marker. |
| 2. Cold frame. | 8. Sorting table. |
| 3. Fruit picking ladder. | 9. Apple box press. |
| 4. Step ladder. | 10. Berry stand. |
| 5. Garden marker. | 11. Dibbles. |
| 6. Tree or shrub labels. | |

PROBLEMS IN EQUIPPING THE HOME FARM SHOP

- | | |
|---------------------|-----------------------------|
| 1. Farm work bench. | 6. Lumber rack. |
| 2. Bench stop. | 7. Saw filing clamp. |
| 3. Bench hook. | 8. Harness stitching horse. |
| 4. Tool cabinet. | 9. Harness stitching clamp. |
| 5. Saw horses. | |

MISCELLANEOUS PROBLEMS OF HOME AND FARM

- | | |
|-------------------------|------------------|
| 1. Bread board. | 13. Evener. |
| 2. Nail and staple box. | 14. Neck yoke. |
| 3. Small step ladder. | 15. Scoop board. |
| 4. Ladder. | 16. Wood box. |
| 5. Bag holder. | 17. Sled. |
| 6. Folding bench. | 18. Bird house. |
| 7. Ironing board. | 19. Dog house. |
| 8. Fly trap. | 20. Farm gate. |
| 9. Door screen. | 21. Wagon box. |
| 10. Window screen. | 22. Spring seat. |
| 11. Wagon jack. | 23. Window box. |
| 12. Single tree. | |

CARPENTRY REPAIR WORK

BUILDING REPAIR PROBLEMS

- | | |
|-----------------------------|----------------------------|
| 1. Shingling a roof. | 4. Floor of farm building. |
| 2. Door of farm building. | 5. Bins in granary. |
| 3. Window of farm building. | 6. Replacing a door sill. |

APPLIANCE ROAD PROBLEMS

- | | |
|--------------------------|---|
| 1. Farm gate. | 6. Fitting handle of fork,
hoe, rake, etc. |
| 2. Feeding rack. | 7. Parts of hay rack. |
| 3. Rung in ladder. | 8. Scoop board. |
| 4. Step ladder. | 9. Breeding crate. |
| 5. Reel on grain binder. | 10. Door. |

Tool Sharpening.

Commonly any problems in sharpening tools would be regarded as a direct part of the course in metal working and woodworking. They are given separate treatment in this discussion because many schools may not be able to include a course in metal working at an early date. The tool sharpening, of course, cannot wait until metal working can be included. In training carpenters or mechanics, many instructors would place no unusual emphasis upon such work. The average condition of tools on the farm will usually merit special



Sharp tools are necessary for good workmanship. Farm Shop instruction includes practice in tool sharpening with the use of practical labor-saving equipment.

consideration from the farm shop instructor. After a boy has learned to fit tools properly he should be allowed to bring saws, chisels, plane bits, etc., from home and fit them as a part of his shop work. Such work should be correlated with the woodworking and metal working. In this connection the temper of tools and drawing of temper may be studied.

PROBLEMS IN TOOL SHARPENING

Grinding.

1. Study of grinders suited to farm use, the grindstone vs. high speed, foot power grinders.
2. Grind and whet a chisel.
3. Grind and whet a plane bit.
4. Grind and whet a draw knife.
4. Grind and whet a draw knife.
6. Grind and whet an axe or hatchet.
7. Grind and whet a butcher knife.
8. Grind and whet a cold chisel.

Filing.

1. Filing a hand rip saw.
2. Filing a hand cross cut saw.
3. Gumming a cross cut saw (timber saw).
4. Filing a cross cut saw.
5. Filing an auger bit.

Painting.

1. Selection of brush.
2. Selection of paint or varnish.
3. Proper mixing of paint.
4. Preparation of surface.
5. Tinting.
6. Use of thinners and driers.
7. Care of brush.
8. Care of unused paint.
9. Application.
10. Problems.

Harness Work.

Harness work should consist almost entirely of repair problems. The ease of purchasing harness, halters, etc., should make it unnecessary and impractical for the farmer to make them. The average farmer considers himself fortunate if he has the ability and time to do his repair work properly.

HARNESS REPAIR PROBLEMS

1. Make a stitching thread.
2. Make a stitched harness splice.
3. Punching and riveting.
4. Use a riveting tool.
5. Taking harness apart.
6. Cleaning harness.
7. Oiling harness.
8. Selecting and applying repair parts.
9. Riveting and applying repair parts.
 - (a) Replacing a broken hame staple.
 - (b) Replacing a broken cockeye.
 - (c) Repairing a trace with a trace splicer.
 - (d) Riveting in place of hame clip.
 - (e) Repairing a trace with two hame clips and a link.
 - (f) Attaching a buckle with a riveting tool and tubular rivets.
 - (g) Replacing a hame clip.

Rope Work.

Instruction in rope work should be designed to do a few things well. When a multiplicity of knots, hitches, etc., is taught, the student will seldom retain a knowledge of any of them. For this reason the list is confined to those for which the student will find a frequent need at home. Whatever emphasis is placed on rope work should be given to frequent practice with the idea of fixing the operations firmly in mind.

1. Uses of rope on the farm.
2. Finishing rope ends.
 - a. Whipping.
 - b. Crown and end splice.
3. Splicing.
 - a. Short.
 - b. Long.
 - c. End.
4. Making hitches and halters.
 - a. Half hitch.
 - b. Clove.
 - c. Timber.
 - d. Rope halter.
 - e. Double bowline.
5. Making knots.
 - a. Bowline.
 - b. Manager.
 - c. Weavers.
 - d. Square knot.
 - e. Slip.
 - f. Miller's.

Belt Lacing.

1. Selection of punch.
2. Spacing of holes.
3. Proper use of an awl.
4. Methods of fastening ends of thong.
5. Problems.
 - a. Lacing with rawhide.
 - b. Lacing with patent belt lacing.
 - c. Cutting belt for proper length.

Metal Working.

Again the instructor should keep before himself the practicability of home application of his instruction, e. g., in forge work much time might

be given to the construction or repair of log chains when they could be more economically secured by purchase and their repair taken care of by the purchase of patent links commonly kept in stock at hardware stores or on the farm. The same mechanical experiences can be secured by the student in other construction and repair problems which will not admit of purchase.

The inclusion in the farm shop course of farm blacksmithing and particularly farm plumbing will need to be given careful consideration. The community availability of blacksmiths and plumbers, amount of time given to shop work in the high school curriculum, probable financial expenditure necessary for equipment and supplies, ability of the instructor, desires of the students and parents are factors which should govern the inclusion or omission of this work.

When selecting tools for such work it must be kept in mind that the average farmer's equipment of necessity will be limited.

1. Selection of farm metal working tools.
2. Care and housing of tools.
3. Saw filing (included under "Tool Sharpening").
4. Grinding (included under "Tool Sharpening").
5. Drilling.
 - a. Study of drill outfits suited to farm use.
 1. Brace and drill.
 2. Chain drill.
 3. Breast drill.
 4. Post drill.
 - b. Grinding drills.
 - c. Locating holes and center punching.
 - d. Size of drills needed in farm repair work.
 - e. Problems.
 1. To bore a hole of a given size at a given point by the use of a vise.
 2. To bore a hole of a given size at a given point in the various positions in a farm machine.
6. Vise Work.
 - a. Hack sawing.
 - b. Punching.
 - c. Chiseling.
 - d. Riveting.
 - e. Filing.
 - f. Problems which give practice in a, b, c, d, e.

7. Taps and dies.
 - a. Kinds needed on the farm.
 - b. Sizes required for farm repairing.
 - c. Use of oil.
 - d. Problems in overhauling of farm machinery and other farm appliances.
8. Soldering.
 - a. Selection of an outfit suitable for farm use.
 - b. Operating a blow torch.
 - c. Preparation of surface to be soldered.
 - d. Fluxes and their use.
 - e. Tinning a soldering iron.
 - f. Problems.
 1. Soldering a small hole in tin or galvanized iron.
 2. Soldering a seam in a pan or pail.
 3. Patching a hole in any sheet metal.
 4. Riveting sheet metal.

Practice in soldering may be continued by having pupils bring leaky pails, pans, cans, etc., from home.

9. Farm blacksmithing.
 - a. The forge suitable for farm repair work.
 - b. Building and keeping a fire.
 - c. Operations.

Upsetting.	Straightening.
Drawing out.	Bending.
Shaping or forming.	Punching.
Tempering.	Measuring.
Babbiting.	Cutting hot metal.
Heating.	
 - d. Problems.
 1. Shaping and tempering cold chisels and punches.
 2. Sharpening a pick axe.
 3. All such work as arises in overhauling farm machinery.
 4. Babbiting drive shaft on mower.

FARM SHOP EQUIPMENT

Woodworking.

The following are required, one for each pupil:

Bench hook (shop made).

Bench stop (shop made).

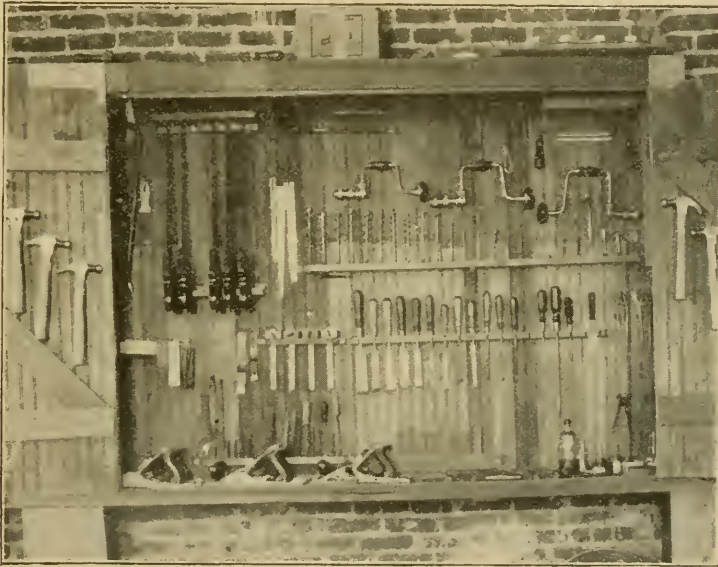
Carpenter's hammer, $\frac{1}{2}$ of total number of hammers in shop, bell face, adz eye, curved claw; $\frac{1}{2}$ plain face, straight claw.

Jack plane, iron, 14 inches long, 2 inch cutter.
 Ruler, two foot, four fold.
 Square, try, 9 inch.

GENERAL EQUIPMENT

Number required for 8 boys:

- 1 — complete set augur bit: $\frac{1}{4}$ " , $\frac{5}{16}$ " , $\frac{3}{8}$ " , $\frac{7}{16}$ " , $\frac{1}{2}$ " , $\frac{9}{16}$ " ,
 $\frac{5}{8}$ " , $\frac{11}{16}$ " , $\frac{3}{4}$ " , $\frac{13}{16}$ " , $\frac{7}{8}$ " , $\frac{15}{16}$ " and 1".
- 2 — bits, screw driver, $\frac{3}{8}$ " and $\frac{5}{16}$ " tip.
- 3 — braces, ratchet, one 8" , one 10" , one 12" .
- 11 — Chisels, socket, firmer, one $\frac{1}{8}$ " , one $\frac{1}{4}$ " , one $\frac{3}{8}$ " , two $\frac{1}{2}$ " ,
 one $\frac{5}{8}$ " , one $\frac{3}{4}$ " , one $\frac{7}{8}$ " , two 1" , one $1\frac{1}{2}$ " .
- 2 — clamps, carpenter's steel bar 4' .



In addition to holding tools of high quality the tool cabinet should be a model in convenience and orderliness of what the shop cabinet at home might be.

- 2 — counter sink, Rose.
- 2 — dividers, loose leg, wing, one 8" , one 10" .
- 2 — draw knife, 8" .
- 1 — set square shank, bit stock drills, for wood or metal, $4\frac{2}{32}$ " ,
 $5\frac{2}{32}$ " , $6\frac{2}{32}$ " , $7\frac{2}{32}$ " , and $8\frac{2}{32}$ " .
- 2 — files, mill cut, 10" .
- 6 — files, slim taper, triangular, 6" .
- 6 — files, regular taper, triangular, 8" .
- 2 — files, slim taper, triangular, 5" .
- 1 — cross cut saw file (Great American).

- 1 — file, augur bit.
- 1 — file card (cleaner).
- 2 — gauge marking, plain.
- 2 — glass cutter, (Red Devil).
- 1 — grinder, emery or carborundum, high geared, with one course and one medium grit wheel, with foot pedal.
- 1 — level and plumb, wood, 26".
- 1 — mallet (more, if shop made).
- 4 — nail sets, assorted.
- 1 — oiler.
- 2 — oil stones, coarse (80 grit) and fine (120 grit) face carborundum.
- 2 — pliers, assorted.
- 1 — pincers.
- 1 — putty knife.
- 1 — pinch bar 2'.
- 1 — plane, block, adjustable, 6".
- 3 — saws, crosscut, 24"; 8 or 9 point.
- 1 — saw, crosscut 22", 10 point.
- 2 — saws, rip, 24", 6 point.
- 1 — nest, compass saws.
- 1 — saw, coping, with dozen blades.
- 1 — saw, hack, 10", extension frame, with dozen blades.
- 1 — saw set.
- 1 — saw vise (can be shop made).
- 3 — screw drivers, one 4", one 6", and one 12".
- 2 — sliding T bevels. One 6" and one 8".
- 2 — squares, steel, 16" x 24", polished.
- 1 — miter square, adjustable.
- 1 — bench screw, 1" iron (one for each home made vise).
- 1 — wrench, monkey, 10", knife handle.
- 1 — center punch.
- 1 — bit, expansion, $\frac{3}{4}$ " to 3" (Steers Patent).
- 1 — vise, blacksmith's, solid box, $3\frac{1}{2}$ ", width of jaw.

Optional:

- 1 — plane, fore, 18" iron, 2" cutter.
- 1 — saw, back, 12".

Drawing

INDIVIDUAL EQUIPMENT

- 1 — drawing board, 14" x 20".
drawing paper.
- 1 — wooden T square, 24".
- 1 — 6" 45 degree angle triangle.

- 1 — 8" 30 and 60 degree angle triangle.
- 1 — scale (ordinary foot rule may be used).
- 1 — compass.
- 1 — lead eraser.
- 1 — doz. thumb tacks.

DEPARTMENT EQUIPMENT
(For use of teacher only.)

- 1 — large drawing board.
- 1 — large T square.
- 1 — 8" 45 degree angle triangle.
- 1 — 12" 30 and 60 degree angle triangle.
- 3 — assorted irregular curves.
- 1 — set drawing instruments.

Harness Repair Tools and Supplies

- 6 — sewing awls, assorted.
- 6 — awl hafts.
- 1 — knife, harness maker's, straight.
- 1 — punch, revolving, four or six tubes.
- 1 — sewing horse (made in shop).
- 1 — pound black shoe maker's wax.
- 1 — paper needles, No. 7.
- 1 — ball harness thread, No. 10 white.
- 2 — boxes 50 assorted split rivets.
- 1 — cake black harness soap.
- 1 — quart can harness dressing.
- 1 — pint Miller's edge ink.
- 1 — riveting machine (Rex).
- 1 — package Swede tacks, $\frac{1}{2}$ ".
- 6 — boxes tubular harness rivets, assorted.
- 1 — half pound iron rivets, $\frac{3}{8}$ " to $\frac{7}{8}$ ".
- 1 — pricking wheel, No. 6.
- 1 — wheel marker.
- 1 — hammer (riveting).

Optional:

- 1 — draw gauge.
- 1 — round knife.
- 1 — edging tool.

HARNES REPAIR PARTS

(Advisable to carry in stock in the School Farm Shop.)

- 6 — 1" sham roller buckles.
- 6 — 1" wire bent heel harness buckles.

- 6 — repair clips for end of hame.
 - 6 — wrought iron $\frac{3}{8}$ " hame staples with washers.
 - 6 — $\frac{3}{8}$ " hame staples with washers.
 - 6 — bottom hame repair loops.
 - 4 — common line rings and studs.
 - 2 — pairs hold-back plates and rings.
 - 1 — pound 1" and $\frac{1}{4}$ " soft iron hame rivets.
 - 18 — Conway loops, assorted.
 - 6 — screw cock eyes. 1 $\frac{3}{4}$ ".
 - 6 — wrought Concern clips.
 - 1 — box assorted repair dees.
 - 6 — 1" buckle shields.
 - 12 — repair roller buckles.
 - 12 — assorted snaps.
 - 6 — team trace splicers.
 - 6 — hame buckles and loops.
 - 12 — 1" halter squares.
 - 12 — assorted rings. $\frac{3}{4}$ ", $\frac{7}{8}$ " and 1" black.
 - 12 — assorted leather slide loops. $\frac{3}{4}$ ", $\frac{7}{8}$ " and 1".
 - 2 — trace squares.
- A piece of medium weight leather ($\frac{1}{2}$ hide weighs from 18 to 24 lbs.)

Farm Rope Work Equipment

Wooden rope needle.

Farm Metal Working Equipment

For Drilling:

- 1 — brace and drill (included in carpentry equipment).
- 1 — chain drill.
- 1 — breast drill.
- 1 — post drill.

Drills: $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ".

For Vise Work:

- 1 — hack saw (included in carpentry equipment).
- $\frac{1}{2}$ — doz. punches, assorted sizes.
- $\frac{1}{2}$ — doz. cold chisels, assorted sizes.
- 1 — box assorted rivets.

For Work with Taps and Dies:

- 1 — set Blacksmith's taper taps and dies. $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ", $\frac{1}{2}$ ".

For Soldering:

- 1 — blow torch.
- 2 — soldering coppers (light).

- 1 — tin snips.
- 1 — riveting hammer (included in harness repair outfit).
- 1 — bar solder.
- 1 — a flux — soldering paste or muriatic acid and zinc.

Farm Blacksmithing Equipment:

- 1 — anvil.
 - 1 — Hardie to fit anvil.
 - 1 — forge, blacksmith's, 2 lb.
 - 1 — hammer, machinist's, 1 lb.
 - 1 — flat tongs.
 - 1 — bolt tongs.
- (cold chisels, drills, riveting hammer, center punch, taps and dies, blacksmith's vise, etc., included in other equipment.)

Farm Plumbing Equipment:

- 1 — pipe cutter, 3 wheel, cutting $\frac{1}{4}$ " to 2".
- 1 — set of dies.
- 1 — pipe wrench, 18".
- 1 — pipe wrench, 12".
- 1 — pipe vise, capacity $\frac{1}{2}$ " to 2".

REFERENCE BOOKS AND HELPS IN FARM SHOP WORK.

(Numbers in parentheses refers to publishers).

- Roehl — Agricultural Woodworking (1).
 Roehl — Farm Woodwork (1).
 Roehl — Harness Repairing and Rope Work (1).
 Roehl — Rope Work (1).
 Burton — Shop Projects based on Community Problems (2).
 Brace and Mayne — Farm Shop Work (3).
 Blackburn — Problems in Farm Woodwork (4).
 Ramsower — Equipment for the Farm and Farmstead (2).
 Ekblaw — Farm Structures (5).
 Goss — Bench Work in Wood (2).
 King — Elements of Woodwork and Construction (3).
 Adams and Evans — Metal Working (6).
 Overholt — Ropes and Their Uses (Bulletin Agricultural College
 Extension Service, Ohio State University).

Blueprints of farm buildings and farm appliances can frequently be secured from the Department of Agricultural Engineering, College of Agriculture, The Ohio State University.

Bulletins and circulars from commercial concerns will afford considerable help, especially in instruction in painting and belt work where other sources of information are limited.

List of Publishers

- (1) The Bruce Publishing Co., Milwaukee, Wis.
- (2) Ginn & Co., Columbus, Ohio.
- (3) American Book Co., Cincinnati, Ohio.
- (4) Manual Arts Press, Peoria, Ill.
- (5) MacMillan Co., Chicago, Ill.
- (6) Longman, Green & Co., New York.

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