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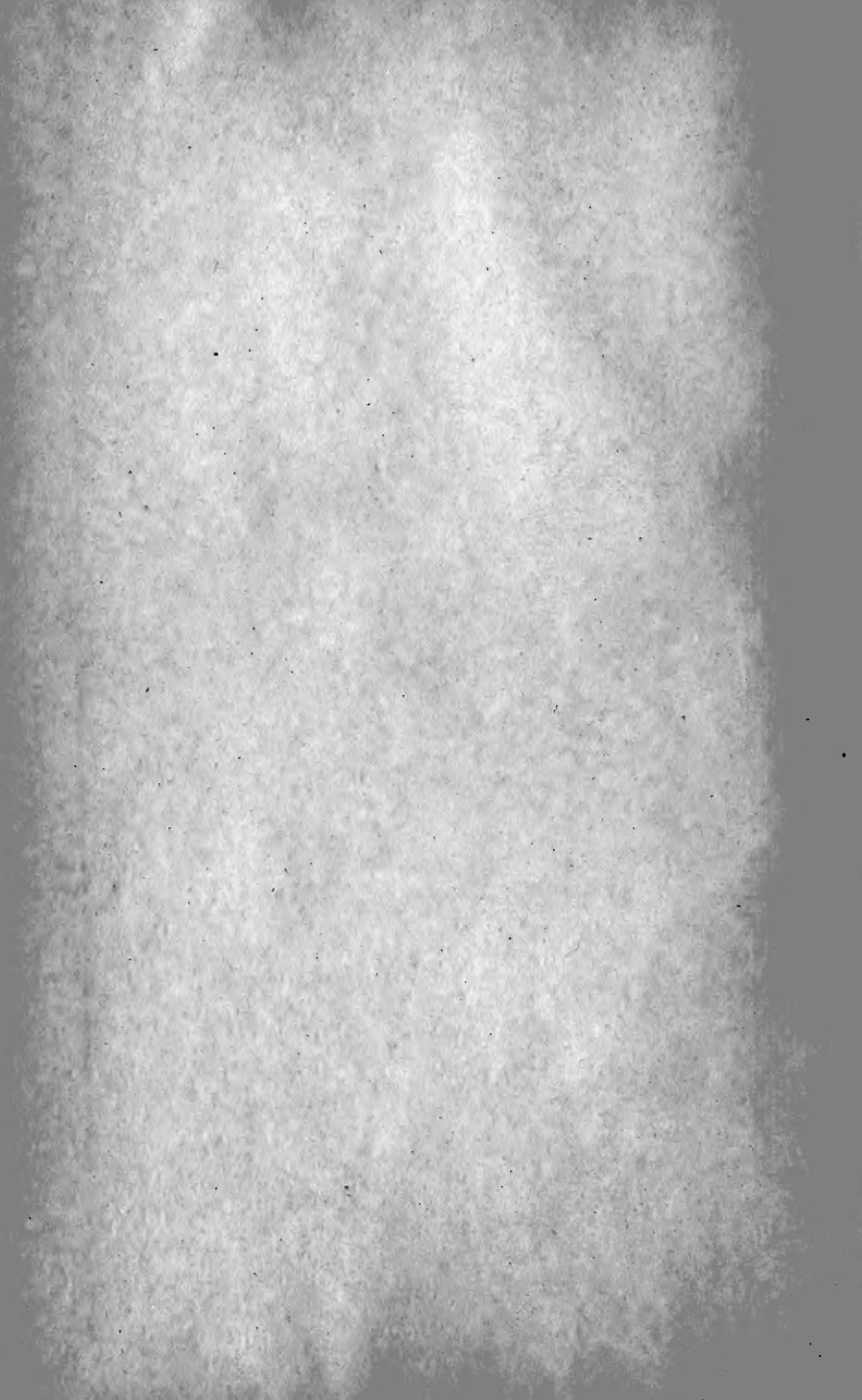
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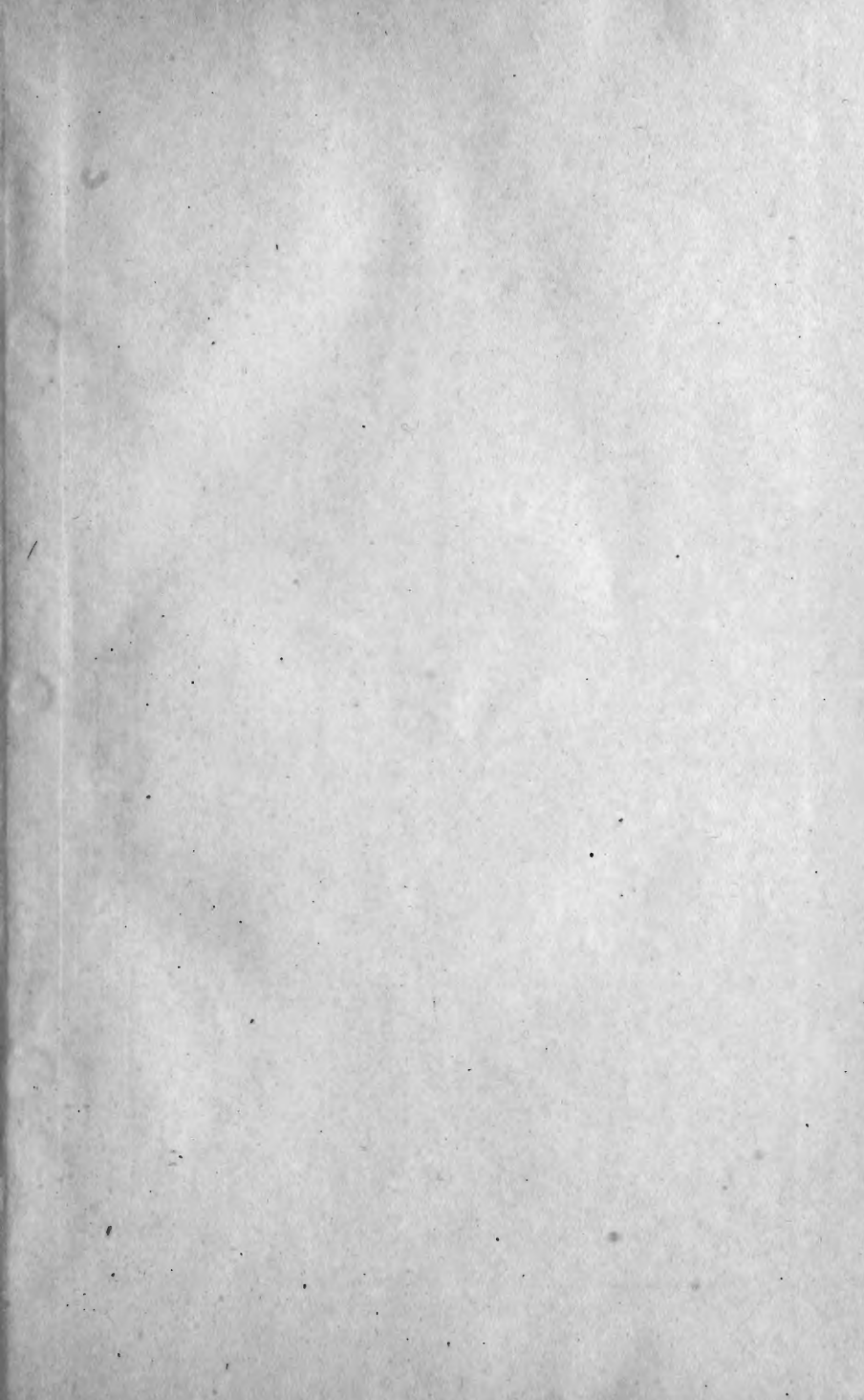


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Farm Craft Lessons

Issued by the Educational Section
of the
U. S. Boys' Working Reserve,
" U. S. Employment Service,
Department of Labor

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for
U. S. BOYS' WORKING RESERVE

**TRAINING THE BOY
FOR
NATIONAL SERVICE**

PUBLISHED BY THE U. S. DEPARTMENT OF LABOR

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United States Boys' Working Reserve

Farm Craft Series

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TO THE TEACHER AND THE SCHOOL

It was inevitable that the United States should be drawn into the Great World War, in which more than thirty nations have become involved in determining by force whether democracy shall remain upon the earth.

Substantially all the available energy of the civilized world has been engaged in this titanic struggle. Not only has it taxed to the utmost the resources of every country involved, but not an interest, not a family, not an individual has remained unaffected, and even when actual hostilities have ceased there yet remains the gigantic labor of reconstructing ravaged countries, of clothing destitute millions, of feeding starving races, and of establishing law and order, for it must not be overlooked that as the power of the enemy crumbles, a full half of the world is without a stable government. The work of the war is not yet done, and it will be many months before "The Boys" come marching home again. Even the cessation of hostilities and the promise of peace will make no immediate change in the need for additional labor on the land.

THE UNITED STATES BOYS' WORKING RESERVE

So desperate is the need for labor now and for many months to come, and so easy is it for the high school boy to render valuable service in the field during the growing season with but little interruption to his educational progress, that the Government of the United States is calling upon the high schools of the country everywhere to do their utmost in three definite lines of special service:

1. To enlist in the Boys' Working Reserve for summer work upon the farm, all able-bodied boys from sixteen to eighteen years of age who are now in school (together with as many as may be reached of those who have left school).

2. To do everything humanly possible to give these boys the right point of view as to the importance and the nature of the service to be rendered and of the new associations involved.

3. To make them really useful to the farmer by teaching them some of the things which they will need to know in order to be instrumental in increasing food production and in order not to do more harm than good.

ENROLLMENT: There has been great activity and much success in reaching and enrolling city boys for service on the land, but there has been a very general neglect of the *country boy who is already engaged upon his father's farm*. This boy is and has been doing really expert service and

schools are *earnestly entreated* to enroll such boys as well as those who go for hire, else great injustice will be done the boy who has labored always on his father's farm, not only faithfully but skillfully and effectively. In no other way, either, can the city boy and the country boy come together *in the country* under conditions mutually agreeable and therefore most favorable to success.

While the Government does not admit to membership in this particular organization youth *under* sixteen years of age, it none the less earnestly invites all such able-bodied and right-minded young people to prepare for actual membership by rendering, so far as possible, the same kind of service. It invites the schools and all other public agencies to encourage them to that end, and to train them for that service by the same methods employed for the Boys' Working Reserve.

THE POINT OF VIEW: The great object to be achieved is *the production of more food than would otherwise be possible*. It is not to make more money for the boy, because that would take him to the shops where wages are higher than upon the farm, but from which he would likely not return to school. It is not the making of more money for the farmer, though unless the boy is both *willing* and *able* to be really useful he will do more damage than good. It is a challenge to service on the part of boys too young to fight. The next most useful thing is to help in the production of food for which millions are in dire distress.

Can the boy make more money in other ways? So could the soldier. Is he impatient if a "job" is not ready at once on April 1, or May 1, as he may have hoped and expected? So is the soldier who imagined himself walking into Berlin soon after joining the army, but who finds instead that he must undergo long periods of training, waiting anxiously for his opportunity to serve. One day it will come, but until then his business is to still better prepare himself.

Will he have hardships to endure? Certainly he will. This is no picnic; this is business. Upon the whole he will have a good time with most excellent people, and he will see a new side of life, all of which is good for him. But, like the soldier, his "chow" will not always be good nor to be had on time, and he will sometimes be wet and hungry and tired. Is he therefore to be downhearted? No! If he has the stuff in him of which soldiers are made, he will "pack up his troubles (most of which are imaginary) in his old kit bag and smile, smile, smile."

But upon the whole and at the most, he will have it better than the soldier, for he will sleep every night under shelter and free from bullets, shells, and bombs.

Above all, this young crusader is not to assume that he is going out into the wilderness and among illiterates, nor that all which he sees that is *different* is therefore either better or worse than what he has known before. What he has undertaken is an Adventure in Contentment as well as an enlistment for service.

PREPARATION: To assist the schools in preparing the Boys' Working Reserve for service on the farm, a series of Farm Craft Lessons have been prepared and furnished by the Federal Government, to be supplemented by Practical Exercises of the laboratory type.

These lessons and exercises deal not with the theory of agriculture nor with the scientific principles involved in farming, but rather the *processes* and the *equipment which the boy will be expected to know* when he presents himself as a helper in the business of food production. It is highly important that both the school and the pupil make no mistake at this point. The boy is going as a helper in farm work, not as a partner nor as a business adviser.

The farm is an exceedingly busy place, especially during the growing season. That is the time he will be there; and while the farmer must tell his helper how the work is to be done, yet he must not be obliged to devote so much time to that as to lose more than he gains in actual and effective work upon the fields, else food production will be retarded, not promoted. Hence the importance of doing everything possible by way of

getting ready before the boy goes where things are in "full blast" with "no time for long stories."

EDUCATION NOT TO BE SACRIFICED

Germany has put her school boys in the army and cut the period of instruction to about half the usual. *That must not happen in this country.* Boys can, however, devote three or four months of the summer season to production and yet lose little from the class room, so little that if matters be well handled the loss in schooling is fully compensated by the greater experience, the enlarged viewpoint, and the recognition of the need for specific preparation for something definite to be accomplished.

CREDIT IN SCHOOL COURSES

There is no good reason why school credit should not be given for this work, but on the contrary there is every reason why it should be given. It has educational value as to content, and the performance of faithful service has a disciplinary value in excess of anything which goes with ordinary school work.

Full credit however should be conditioned upon faithful service, and in order to see that such service is actually rendered and that the boy has a fair opportunity to render it, the school should send its own representative; that is, *the school should follow the boy to the field* both as a friend and as an inspector. Here is a rare opportunity to combine good teaching with real service, thereby securing that adequate *motive* which is so often lacking in our educational effort.

THE LESSON LEAFLETS

The Lessons are limited to a few standard operations and deal solely with *craftsmanship* rather than with the scientific principles underlying agricultural practice. Their whole aim is to prepare the boy to be *immediately useful* to the farmer in a few major capacities, to make him teachable, and to insure from the first that the farmer will not need to spend valuable time in teaching the boy while his own team stands idle, or otherwise suffer more loss than would be made *good* by the service of the pupil.

Of necessity these lesson leaflets are confined to subjects either of universal or of large sectional application. It is manifestly impossible for such a series to cover every minor local agricultural enterprise—such as peppermint growing in restricted districts of Michigan and Indiana, or citrus fruit production in California or Florida—and there is no alternative but to ask the schools themselves either to prepare or to have prepared *such additional lessons* as shall make the instruction *fit the local conditions*.

It is also impossible to cover adequately in any general series even such regional subjects as potato growing for example, first because of profound variation in local practices, and second because these lessons should be *limited to those phases of production in which school boys can assist*. Manifestly, a series of monographs on the crops of the country and the breeds of farm animals would defeat their own purpose.

Last of all, even in the subjects treated in the Lessons, modification and elaboration will be found necessary in order to make that *fit* with local conditions which is essential to success in acquiring skill. For example, in many sections mules are used instead of horses and in others left-hand machinery and driving with a single line are still in vogue.

These Farm Craft Lessons therefore must be considered as outlines and suggestions rather than as iron-clad courses to be administered without alteration. Nevertheless, whatever courses are decided upon should be thoroughly carried out, because these Lessons are designed to be *learned*, not casually read for entertainment. Besides that, if we are to succeed, the Practical exercises must be as faithfully administered as any laboratory course which the school has ever conducted. It is at this point of fortifying the Lesson with the Exercise that Success will be assured, or Failure invited.

A COURSE OF TRAINING

This is not a "Course" to be finished, "passed," and forgotten, but rather a line of preparation to be pursued, and like the soldier the pupil should continue in his preparation until called into service. Some dissatisfaction has been experienced if a "job" were not ready and waiting on the very day when the last lesson was finished.

That would be ideal, of course, but like war this is emergency work. The soldier that is called may and does desire to go at once to the front. But he is put into a long course of training and then more training and even after he is across the water he may not be needed at once; so he goes on with his training—always training.

With the Boys' Working Reserve, as with the soldier, there may be some waits, but it is all a kind of insurance scheme in a national emergency and the well-trained and right-minded boy may be certain that his services will be needed.

THE MINIMUM

As has been indicated, this is not a course of specified length; a definite number of lessons of specified character. Obviously many of the suggested lessons will be found poorly adapted to certain localities. In the name of education, then, let them be dropped or let others be substituted.

As there is no definite number of "lessons" that must be completed, so there is no iron-clad formula for computing the number or the exact nature of the Practical Exer-

cises that should be required. From the farmer's standpoint the more the better only so the Lessons and the Exercises fit his conditions. Manifestly, a Nebraska farmer would not be much interested in proficiency with an axe and crosscut saw, while it would be a very valuable accomplishment in New England. But everybody would have horses to be harnessed and driven.

From the standpoint of the school there must be a minimum number of lessons and a minimum amount of practice to entitle to credit. As the school is free to fix the amount and conditions of credit, these amounts and conditions will of course vary greatly, but if the training is to be of much use to the farmer, a minimum of fifteen lessons and fifteen periods of two hours each, or their equivalent, devoted to practice would be as little as is worth considering. Much more, especially of practice work, is in every way desirable.

THE HIGH SCHOOL TO GET THINGS DONE

The Federal Government cannot supply teachers. There is no alternative but to expect the high schools either to provide this teaching from members of their own staffs who have the skill, or to secure the instruction from outside sources. Results only are important. In general, the schools, being accustomed to the business of instruction, are competent to manage the methods necessary to meet this emergency.

In the neighborhood of every school is plenty of material in the shape of teams, wagons, and implements; and in the person of retired farmers, teamsters, implement men, and through such special craftsmen as harness makers and sailors, a vast amount of skill in handicraft may be enlisted for teaching purposes. It is hoped that the schools of the United States will be earnest and untiring in the utilization of the material and the men which may be enlisted for this purpose. This service must not be perfunctory or dispirited. It must be aggressive and enthusiastic. It is the teacher's great opportunity and duty in lieu of active service at the front.

A "REASONABLE SERVICE"

The Government of the United States realizes that it is asking herein a very great service on the part of the teacher and the high schools. On the other hand, it is obliged to employ every organized agency to the best possible advantage, and it appeals with special confidence in this matter to the secondary schools supported by public money, believing that in this emergency neither time nor funds can be used to better advantage than in training this army of production. Business as usual cannot continue. Nothing is as it was.

WHEN TO BEGIN

Experience indicates that the time to begin this work is not later than three or four months from the opening of the growing season in the region where the school is located. After it is begun it should be intensively prosecuted, with no less than one lesson and one practice exercise a week, with more if feasible, and with all the speeding up possible in the academic work. Experience shows also that when the boy is sufficiently interested he can nearly double his effectiveness as a student.

PLACING

The business of the school is to do the educational work of enrolling, training for farm work, and seeing to it that the conditions agreed upon are met and fulfilled upon the farm in order to justify school credit.

In most cases the school is not the best agency for actually placing the boys, at least while war conditions exist. The Council of Defense, if there is one, or some equivalent public body closely connected with farmers will be found the better agency for the purely labor side of the enterprise, although there must be the closest co-operation and the most cordial relations between the schools and whatever organization does the placing, and accurate records must be kept of location, terms, et cetera.

SPECIAL PRECAUTIONS

Whatever agency is concerned in administering the Boys' Working Reserve will need to guard carefully the following five points. It will need to:

1. Establish a system of inspection to insure that the boy is faithful and efficient and lives up to his contract.
2. Insure against exploitation of the boy by the farmer in any way whatever, although the wage must largely lie with the farmer.
3. Do everything possible to insure mutually desirable social relations between the city boy upon the one hand, and the family and the neighborhood upon the other.
4. Guard against the natural impulse of some farmers to hire a particularly good hand away from a neighbor at a slight advance, thus demoralizing the Boys' Working Reserve and doing an injustice to right-minded farmers.
5. Hold in check as fatal to the purposes of the Boys' Working Reserve the natural impulse of some boys to "jump" one job for another that promises more pay or "a better time."

United States Boys' Working Reserve

Farm Craft Series

PRACTICE WORK

The test of good preparation for service on the farm is not the learning and reciting of lessons about the various phases of farm work; the real test lies in *doing* so far as possible the things that the farmer will expect to have done in actual work upon the farm.

Accordingly, the Farm Craft Lessons are intended to be enforced and supplemented by practice work, in periods covering not less than two hours and if possible a half day on Saturday. A list of exercises is offered upon which the school may draw so far as it is able, and from which it should deviate so far as local conditions would seem to make it wise. If half the entire time to be devoted to preparation for farm service be given to well-conducted laboratory practice of this kind, it would not be too large a proportion.

HORSE WORK: No class of exercises stands in anything like the same relation to good farm service as does the horse work. When asked what are the things that boys ought to know before going to the farm, the farmer invariably says that he should know how to handle horses, and some add, "If he knows that, I will teach him the rest." Because so much of the labor on the farm is done with a team, and because good driving is a fine art, it is not too much if half the entire laboratory time be devoted to horses and their handling.

SIZE OF CLASSES: Experience shows that for this kind of work classes should not be large, and while the size of sections may vary considerably, depending upon the particular subject, yet in general the number working together at any one time under a single instructor should run from six to twelve.

LOCAL ASSISTANCE: Obviously the schools will be very dependent upon local materials and upon local help, and unless a man can be found who knows, for example, how an axe or a crosscut saw

should be handled, it would be better to omit the exercise. The same would be true of the pitchfork or the hoe, for pitching hay is not "tossing" it, as recorded in rural poetry or in literary skits about country life, and hoeing is something besides piling up soil with a hoe.

Similarly, if sailors are to be found, a multitude of knots and splices not given in the lessons may be included; otherwise, it would be well not to feature this line but to confine the work to what can be thoroughly done. Experience shows that farmers, both active and retired, are exceedingly willing to help, as are also teamsters and implement dealers.

MATERIALS: It is upon local sources, too, that schools will need to depend very largely for the material with which to work, and it is hardly necessary to emphasize the importance of exercising care in the *use* of such equipment or of compensating for damage done. The same man who would willingly give his time does not care to have his equipment injured, nor can he afford it from an operative point of view. Because of this fact the school should have a fund with which to provide the smaller pieces of equipment and to make good any damage to the material loaned. To do this work well will require the closest cooperation between the school and the community.

CAUTION: This list of exercises is not to be taken *seriatim* and *pro forma* and then left behind like a study that is "passed." Some of them, like greasing a wagon for example, may well be done once for all, but others like grooming, harnessing, and driving horses, should be done over and over again until the movements and the "feel" of things become "second nature" to the pupil. This is the ideal. It will seldom be attained but every effort should be made to approach it, so far at least as horse work is concerned.

LIST OF EXERCISES

1. Grooming horses—commonly spoken of as "currying." Grooming, however, is the technical term used by all real horsemen; besides, the currycomb is never used below the knee or the hock.

2. Harnessing, hitching, and unhitching horses, using time contests to secure precision and speed.

3. Driving—utilizing so far as possible the business of local teamsters and to some extent the farms and livery stables.

4. Milking cows. If cows are not available, the strength and endurance required of the fingers and the muscles of the forearm in

the process of milking may be acquired by the exercise of repeatedly opening and closing the fingers of both hands with considerable force.

5. Greasing wagons and locating the oiling places in farm machinery. To do the latter, trace the movements from the drive wheel through the gearing and the bearings.

6. Taking down and setting up farm machinery.

7. Repairing farm machinery, securing broken or discarded implements from actual farmers.

8. Running and cleaning the cream separator.

9. Operating gas engines, and in rare cases tractors.

10. Using the axe, the crosscut saw, the hand saw, and the hammer.

11. Sharpening tools, especially scythes, mower knives, hoes, and spades.

12. Using the hoe, the spade, the shovel, and the pitchfork.

13. Digging post holes and setting posts, being careful to work to a line and to tamp the earth firmly, especially at the *bottom* of the post and at the surface of the ground.

14. Rope work in tying and splicing.

15. Running the fanning mill, and cleaning seed, mixing and recleaning the same seed if necessary.

16. Recognizing and separating foul seed from seed store samples.

17. Treating oats and wheat for smut.

18. Treating potatoes for scab.

19. Making and applying spraying mixtures.

COLLECTIONS

Make as complete a collection of farm tools as possible, calling upon implement houses and farmers for gifts, loans, or sales of new or used machinery.

1. HORSE-DRAWN MACHINERY: Walking plow, sulky plow, disk harrow, smoothing harrow, corn planter, grain drill, mower, self-binder or header, rear-delivery hay rake, side-delivery hay rake, hay loader, ensilage cutter.

2. HAND TOOLS: Fanning mill, cream separator, 4-, 3-, and 2-tined pitchforks, manure fork, spading fork, hay rake, garden rake, hoe, common spade, tile spade, post hole digger, wheelbarrow, scythe and snath, axe, 2- and 1-man crosscut saws, beetles, and wedges.

Make as complete collections as possible of :

1. *The grains* and other crops grown in the locality, that everybody may know what they look like.
2. *The weeds and insects* of the region, with examples of insect and fungous injury.
3. *Weed seeds*, both indigenous and as cleaned from farm seeds in local stores.

United States Boys' Working Reserve

Farm Craft Series

FOR THOSE WHO HAVE FARM EXPERIENCE

These Lesson Leaflets and these Practical Exercises are *not* intended for high school boys who are living upon the farm or for others who have had farm experience. For these pupils the schools should organize some definite course in agriculture, using for the text such a book as Mosier's "Soils and Crops," Rand McNally and Company, Water's "Essentials of Agriculture," Ginn and Company, or other text suitable for the region. *Do not mix these two classes of pupils.*

REFERENCE READINGS FOR BOYS WITH EXPERIENCE

For students with some farm experience, the following books will be found useful for occasional reference or for collateral reading. In addition to providing such a list it would be well also to subscribe for the principal agricultural papers of the section.

It is not advised that reference readings be assigned to the inexperienced pupils, but rather that these latter be confined to the field of craftsmanship. The school has upon its hands two distinct classes of pupils: those with more or less farm experience, and those with none—and the two should be handled by radically different methods.

The public libraries of the country have the books included in the list following, and will gladly lend these books to boys who are interested in the study of agriculture.

AGRONOMY:

Alfalfa in America: Wing. Sanders. \$2.00. Written in popular vein.

A reliable account of the writer's experience with alfalfa, with much valuable information concerning the growing and handling. 520 pp. Ill.

The Corn Crops: Montgomery. Macmillan. \$1.60. Discusses production, distribution, botanical relations, physiology, environmental relations, cultural methods and breeding. Sorghums and broom corn are also considered. 340 pp. Ill.

Diseases of Economic Plants: Stevens and Hall. Macmillan. \$2.00. Designed for those who wish to recognize and treat plant diseases without a long study of their causes. It deals with the prominent characters of the most destructive diseases of the United States, caused by bacteria and fungi. 510 pp. Ill.

Weeds of the Farm and Garden: Pammel. Orange Judd. \$1.00. A general discussion of weeds, their injurious effect, and their uses. Methods of propagation are described. Special attention is given to contamination of agricultural seeds by weed seeds, including laws for protection and general methods of eradication. Botanical descriptions and illustrations of important species are given. 300 pp. Ill.

The Story of the Soil: Hopkins. The Gorham Press. \$1.00. The fundamental principles of soil conservation and improvement have been woven into fiction in an interesting manner. The narrative contains a store-house of valuable information. 5th ed. 360 pp. Ill.

The Farm that Won't Wear Out: Dr. C. G. Hopkins, Author and Publisher, Champaign, Ill. Paper 15 cents; cloth 30 cents. Full of information of vital importance to American farmers on the subject of soil improvement.

Soil Fertility and Permanent Agriculture: Hopkins. Ginn. \$2.25. An authority on the subject of soil improvement. Of inestimable value to all who are actually engaged in farming, as well as to teachers of agriculture. It is especially satisfactory on account of the large amount of data upon which the deductions are based. The author carefully explains the processes by which the land may be brought to its greatest economic productivity. 660 pp. Ill.

The Soil: King. Macmillan. \$1.50. A popular book on soils, their origin, physical properties and management, for the general reader. 13th reprint. 300 pp.

FARM MECHANICS:

Farm Gas Engines: Hirshfeld and Ulbricht. Macmillan. \$1.50. A popular discussion, especially good for the farmer who is considering the purchase of a gasoline or kerosene engine. 230 pp. Ill.

ANIMAL HUSBANDRY:

Types and Breeds of Farm Animals: Plumb. Ginn. \$2.00. A comprehensive book on the history of breeds. Discusses their characteristics and adaptabilities. 560 pp. Ill.

Beef Production: Herbert W. Mumford, Author and Publisher, Urbana, Illinois. \$1.50. The feeding and breeding of beef cattle for market is presented clearly and concisely from the feeder's standpoint. Authoritative and accurate. Its teachings will materially aid in making cattle feeding profitable. 200 pp. Ill.

The Horse: Roberts. Macmillan. \$1.25. All breeds and grades are discussed. It tells how to breed, train, feed, and care for them. 400 pp. Ill.

- Principles and Practice of Poultry Culture*: Robinson. Ginn. \$2.00. Index and full poultry bibliography. Thoroughly reliable, up-to-date and adapted to farmers' use. 590 pp. Ill.
- Productive Sheep Husbandry*: Coffey. Lippincott. \$2.50. A comprehensive text covering flock management, sheep and lamb feeding, and buildings and equipment required for sheep. The leading breeds are discussed and instructions given for the judging of sheep. 480 pp. 262 Ill.
- Forty Years' Experience of a Practical Hog Man*: Lovejoy. Frost. \$1.25. Discusses all phases of the business, including shows and sales, advertising, shipping, meat curing, and buildings. 170 pp. Ill.
- Domesticated Animals and Plants*: Davenport. Ginn. \$1.25. Discusses the origin and development of domestic animals and plants with special methods of improvement. Interesting to any family. 320 pp. Ill.
- Feeds and Feeding*: Henry and Morrison. Henry. \$2.25. Contains elaborate and up-to-date tables giving the average composition of American feeding stuffs, their digestible nutrients and fertilizing constituents, feeding standards for farm animals and a glossary of scientific terms. An excellent index and system of cross references greatly enhances its value and convenience. 1915. 15th ed. entirely rewritten. 700 pp.
- Dairy Cattle and Milk Production*: Eckles. Macmillan. \$1.60. Describes the breeds and their qualifications, milk production and care, from farmers' and city standpoint; milk houses and calf raising. 340 pp. Ill.
- Clean Milk*: Belcher. Orange Judd. \$1.00. Location and construction of barns; manure; keeping cows clean; milking; bottling. 140 pp. Ill.
- Milk and Its Products*: Wing. Macmillan. \$1.50. Discusses the secretion, composition, and testing of milk; separation of cream; butter, cheese, and ice cream making. 14th ed. Entirely rewritten. 310 pp.

HORTICULTURE: †

- The Principles of Fruit Growing*: Bailey. Macmillan. \$1.50. Discusses principles underlying fruit growing practice, including protection from frost, disease, and other dangers. 510 pp.
- The Nursery Book*: Bailey. Macmillan. \$1.50. Complete guide to the cultivation and propagation of plants with methods employed in nursery practice.
- Design in Landscape Gardening*: Root and Kelly. Century. \$2.00. Invaluable for student or amateur. Gives simple basic principles for ornamenting home grounds. 1914. 270 pp. Ill.
- Productive Vegetable Growing*: Lloyd. Lippincott. \$1.50. The cultural requirements are fully analyzed, and the underlying principles presented clearly and concisely. 1914. 320 pp. Ill.

INSECTS AND BIRDS:

- Insect Pests of Farm, Garden, and Orchard*: Sanderson. Wiley and Sons. \$3.00. The best comprehensive work on economic entomology. 690 pp. Ill.

MISCELLANEOUS :

A Year in Agriculture: Nolan. Row, Peterson and Company. A good text and reference book with home projects. 386 pp. Illus.

Adventures in Contentment: Grayson. Doubleday. \$1.25. Excellent narrative essays showing how Grayson found contentment in every turn of country life. 300 pp. Ill.

United States Boys' Working Reserve

Farm Craft Series

LESSON 1

MAKING THE VICTORY GOOD

A year ago our slogan was, Win the War or All the World Will Work for Germany. Now our job is to *Make the Victory Good*.

It is not enough to have defended ourselves against a blood-thirsty, treacherous, and powerful enemy. It is not enough to have defeated him and driven him off the territory he has made desolate. It is impossible to bring back to life and happiness the victims of his atrocities, but we can *feed* and *clothe* the millions he has made destitute, and we can work with our Allies in establishing *law, order, and liberty* upon the earth. This now is the great task of America in making the victory good.

RECONSTRUCTION: This labor of reconstructing an exhausted and bleeding world is the inevitable burden of the Allies and it will tax their wisdom and their energies to the utmost. Mere cessation of hostilities means that the gigantic task is but well begun, for *over half the world is to-day without a stable government, and millions of men, women, and children from the occupied territory are without food, clothing, or shelter except as supplied by the Allies; and other millions will be added with the crumbling of the Central Powers.* Our burdens in this respect are increased rather than diminished by victory.

SOURCE OF FOOD: Much of this food must come from America. Some of it can of course be brought from other countries, but *the world was consuming all that was produced before the war.* Since then, thousands have been drawn off the land and out of production, and the best parts of Europe have been given over to desolation, producing nothing. (The Germans even cut down the fruit trees of France.) Many thousands of soldiers and of civilians, both men, women, and children, have been killed, and other millions have already starved or have been deliberately starved to death. (Paderewski says there are no children left in Poland under seven years of age.)

And yet the number that have died or been killed is far less *in proportion* than the country that has been devastated or otherwise left uncultivated. There is no question that as a whole the world was never so near famine as it is to-day, with no prospects for relief until after another season and then only through the few countries that have a stable government.

MUCH LABOR NEEDED: The cessation of actual fighting means of course the stoppage of production in munitions of war, and our problems of transportation will be simplified, but there are many things that have been put aside "until after the war is over" that must be given attention at the earliest possible moment. Next to food, clothing, and shelter, *labor* will be the most precious and needful commodity for some years to come, partly because the limiting element in food production now is not land but *labor*.

FARM HELP NEEDED: The need of the farmer for help is even greater than a year ago *if we are not going to let these millions starve*. It will be many months yet before the soldiers that have been taken from the land can be back again, and the best substitute for this skilled labor is to be found in the high school boys of the United States.

THE BOYS' WORKING RESERVE

Realizing all the conditions that are upon us, together with the ability and the anxiety of the high school boy to help his country fight its battles, meet its duties, and discharge its obligations, the Government of the United States has organized the Boys' Working Reserve, a voluntary organization of young men between the ages of sixteen and twenty-one, pledged to do what they can in production as the soldiers do in battle.

FARM LABOR: Those boys who have definitely left school can best help in the shops, because the shop runs continually. On the other hand it so happens that the busy time on the farm is during the growing season and this is almost the same as the vacation time for the schools. For this reason a boy can work on the farm two, three, or even four months during the busiest season, with but little interruption to his schooling and probably with no detriment to his education, for if while in school he will "hump himself" as the soldier does, he will make up for the time lost and have his experience and a little money as "clear gain."

THE OBJECT: The great need for this farm work is not to help the farmer (or the boy) make more money, but to help the land raise more food. In doing this, however, both the farmer and the boy

must use methods that will "pay," or the attempt to increase production will swamp the farmer. The best possible plans and workmanship will therefore be needed. The farmer will provide the plans; the business of the boy is to perform his share of the labor in a workmanlike manner.

THE LESSONS

Accordingly the Government has caused to be prepared, and the high schools will teach, a few lessons and a considerable number of exercises that deal with *the things a farmer would like the boy to know and be able to do* when he comes to the farm to help in food production.

WILL IT "PAY?"

But cannot the boy make more money by going into manufacturing plants or other enterprises which offer exceedingly high wages? Certainly he can, and so could the soldier, but when our country was fighting for its life, it was not a question of making money but of defeating the enemy and making him powerless to threaten us again. It is so now with the high school boy and with the business of producing the food which will help to avert famine from a stricken world. Of course people who are very poor must work where they can earn the most money. All others should work where they can do the most good.

WHY THE FARMER PAYS LOW WAGES

There are three reasons why you cannot get as much money on the farm as in a factory:

1. Most manufactured articles are more or less of the nature of luxuries; that is, we can live without them. Being of such nature, they go mostly to the well-to-do people at good prices, and wages can be high. Food, on the other hand, is an absolute necessity for every person every day, and for this reason the price must be kept as low as possible. If the farmer should pay as high wages as do the factories, the very poor would be unable to buy food.

2. It takes a "green hand" longer to learn farming than to learn to tend a machine in a factory. He is therefore longer in really becoming useful—yet he eats just the same.

3. Wages on the farm generally include board and lodging, and as about half the employe's earnings go for food and shelter, wages in the country cannot be compared directly with those in the city.

Your going to the farm may be a financial sacrifice, but it is the "reasonable service" of those fortunate enough to be in school at a time like this. Do not think of yourselves as "boys" any longer. You must do men's work now. The United States Government is calling upon every able-bodied boy in the high school to join the Boys' Working Reserve and to do his bit upon the farm just as the soldiers have done theirs at the front. How good a job will *you* do? The school and the Farm Craft Lessons will do what they can to help *you*.

United States Boys' Working Reserve

Farm Craft Series

LESSON 2

WHEN THE CITY BOY GOES TO THE FARM TO THE CITY BOY

The farmers are short of labor and they must have help if they are to increase production. What they need is skilled labor, and yet the able-bodied, right-minded city boy, above fourteen or fifteen years of age*, can make himself very useful, provided he trains himself for the purpose. Whether he fights or whether he works, the same clear-cut object must be kept constantly in view, and the same iron discipline must be maintained. The boy on the farm must be his own disciplinarian and keep himself in training, not only physically but in every way if he is to be an efficient aid in food production.

OBJECTS: When the city boy goes to the farm to help feed the world, he must keep three distinct purposes always before him:

1. To serve his country by doing his bit in production and in the prevention of waste, whether of food, animals, crops, or machinery.

2. To serve the interests of his employer by caring for his property and working to the best advantage possible.

3. To gain experience, to the end that he may be worth more every year both to the country and to himself.

These three objects should be always in mind and in the order named. This is duty and with the true soldier no task in the line of duty is too difficult.

METHODS: This boy must also have a Plan, and this Plan must include definite methods of going about the new undertaking. There is both an art and a science in farming. The art means the "what" and the "how" of things and this comes first. The science means

* Only boys sixteen years old and over can belong to the United States Boys' Working Reserve, but others can help to raise food. In some States, as in Illinois, there has been organized a Junior Boys' Working Reserve.

the "why" and that comes later with observation, reading, and study. This is the way to go about the job:

1. Learn the materials and the equipment of the farm—its animals, its crops, its machinery. Learn their names and the names of their various parts. Learn the language of the farm. Learn to know timothy from clover; learn to know a swath from a hay cock. Learn to know the hock of a horse, the king bolt of a wagon, the breeching of a harness.

2. Learn how to care for the equipment of the farm. If not properly cared for and kept in repair, this equipment will not do the work well and, besides, it may break down just when it is most needed in a busy time. More horses are ruined by lack of care than are worn out in work.

3. Learn how properly to use the equipment of the farm. In no other way can it do its work efficiently or economically. This equipment costs money, and with neglect and improper use it rapidly goes to pieces causing unnecessary loss to the farmer and an increase in the cost of food.

4. Learn the common processes of the farm—the morning and evening chores; feeding and care of horses, cattle, and pigs; care of the harness; plowing, disking, making the seed bed, sowing, planting, cultivating—the thousand-and-one things that all need to be done and well done each time, not simply "turned off." Most farm work is skilled labor. In a shop the workman does but a few things, repeating them day after day; on the farm he does many things—some of them every day, others but a few times a year, but all should be done in the best possible way.

5. Gain skill first, and afterwards speed. The highly skilled workman makes all his movements with rapidity and precision. To become a good workman learn first to do a thing well, afterwards to do it rapidly. The one who begins with speed will never become a skilled workman.

6. Acquire a high degree of physical endurance. It is not the one who rushes into a job or the one who makes the largest number of motions for a few minutes that accomplishes the most. The day is long, and the work is severe. Moderate speed, precision of movement, and endurance that lasts to the end of the day and the next and the next—that is what gets things done.

7. Learn a new thing every day. Let no day on the farm go by without learning to do some new thing or a better way of doing an old one, or getting a new idea about farming.

8. Observe closely. Ask questions. Read books and papers about farming. So shall you perfect your art, and so shall you by and by begin to know the reasons for things, and that is the science of farming.

Precautions.—Certain precautions need to be always in mind:

1. Don't get "cocky" when you have learned a few things. The road to becoming a good farmer is a long one, and there is nearly always a better way than the one you have learned.

2. Guard against abuse of, or damage to, the animals, machinery, or other equipment of the farm. Mistreatment of any kind will mean loss to your employer. It is an evidence of your own lack of knowledge or of care, possibly both; besides, it defeats by that much the objects you intend to achieve.

3. Do all in your power by forethought and hard work to prevent losses to your employer, whether of equipment or of crops. Preventing loss and avoiding waste are even more important than production itself. *Why?*

Keep things "picked up"; know where things belong. After using a hoe or other tool, clean it and put it back in its place. Keep doors and gates shut, and do not expect others to pick up after you, to do your work, or to inquire whether you have fed the pigs.

4. Do what you can to win the confidence of your employer, not only as to your intention but also as to your ability to do things.

Your faithfulness and efficiency must not depend upon your wages. Whatever your pay, you owe it to everybody, yourself included, to do your best. No man can expect to be paid large wages until he has first shown his ability and willingness to earn more than he was paid for doing.

5. Accept responsibility, and, having accepted it, do not break down. Certainly do not avoid responsibility; on the contrary, be quick to see obligations about to arise and get ready to meet them. The most common failing is unwillingness to accept and carry responsibility, and the next common failing is inability through previous thoughtlessness.

6. Be clean, physically, morally, and mentally. Only clean men can carry heavy responsibilities without breaking down. Leave your bad habits behind. Don't swear and you had better not smoke.

7. Be considerate of all the courtesies due your employer, not only in a business way upon the farm, but in a social way while in his house as a member of his family. Do not track in mud. Do not talk too much. You owe it to yourself as well as to the household and the community to be always a gentleman. So shall you not

only "get on" with your employer and his family, but you will be respected and all the objects you sought will be attained.

8. Be a real member of the community you enter. Don't look down upon nor up to others of your own age, but be a good fellow in the best sense of the term. So shall you avoid being either a prig or a dub.

9. Keep a diary of your experience and as opportunity offers report to your school on what you have learned while in the voluntary service of your country on the farm.

10. When you return to the city ask your employer for a letter saying whether he has found you capable, faithful, and a gentleman. With this report you will be the more certain to receive credit in your school work and, if you have fulfilled the requirements of the Reserve, the recognition of the Government in the form of the United States Boys' Reserve Bronze Medal.

TO THE FARM BOY

When the city boy comes to the farm, much will depend upon the way in which you receive him. He has come to help but he doesn't know exactly how. It is certain that he desires to be useful or he would not have come, for he could have made more money in the shops than he can make upon the farm. He doesn't know much about farm work because he has never had opportunity to learn. Be his big brother now and teach him all you can, remembering how you would feel if you were trying to learn some city job.

"But he is different!" Just so, and that is one of the good things about it all. You are both "different" and therefore good for each other. Warm up to him: first, because he is on strange ground and therefore your guest; second, because you need each other. He has had some practice in knowing boys and you will probably find him a good fellow even if he is different. You will both be different after you have been friends awhile and worked at the new job together.

United States Boys' Working Reserve

Farm Craft Series

LESSON 3

CRAFTSMANSHIP

FARMING DIFFICULT: Farming is a complicated industry and whoever touches it at any point must know something about it or he will do more harm than good, either to himself, to others, or to both.

HOW STUDIED: Farming may be studied from any one of four different standpoints:

1. The scientific principles involved.
2. The economics of the business—costs and income, or profit and loss.
3. The equipment—land, buildings, animals, and machinery.
4. Craftsmanship, or the processes involved, commonly called farm work.

WHERE TO BEGIN: The farmer must study his business from all four angles, but the helper must begin with craftsmanship and go on up the scale as he gains experience. Though the good workman will become interested at once in the equipment of the farm, though he will have his eye open always to the question of profit and loss, and though he will become fascinated in his desire to know and to understand the principles according to which he must work, yet, if his labor is to be effective, the only road to good farming is through skill in performing the ordinary operations of the farm.

However much he may become interested in these other matters, the chief question in the helper's mind for a long time must be the "knack" of getting things done. *How to develop skill in craftsmanship is his constant query.* Not only is this true of the helper, but the experienced farmer all his life is looking for "a better way."

FACTORY AND FARM: When a new man goes into the factory he is shown how to do a single piece of work and he does the same

thing day after day, soon becoming exceedingly skillful. On the farm he may do a half dozen different kinds of work in a single day and some of these he may not be called upon to do a dozen times in the entire summer. It is much more difficult, therefore, to become a good craftsman on the farm than in the factory.

The problem is complicated in another way. In the factory many men are gathered together in the same room under a foreman. On the farm the work is scattered and the helper must work independently, because if the farmer must follow him everywhere to show him how, he would better do the work himself. To acquire real skill in craftsmanship, therefore, is the first great duty of the helper who would really help.

WHAT CRAFTSMANSHIP IS: Craft means skill or ingenuity in doing things with the hands. It means precision in movements. It means strength with dexterity. It means rapidity without hurry. It means accuracy without lost motion. It means resourcefulness in adapting methods and movements to the thousand-and-one new situations that constantly arise when dealing with machinery and with animals.

BRAIN WORK: It used to be assumed that the hand had so little connection with the brain that craftsmanship was independent of intelligence, but now we know that good workmanship never becomes automatic. Instead the highest craftsmanship requires constant supervision of the brain. *The vision of what the man is to accomplish must first exist in the mind*, just as the sculptor "sees" the finished statue even before he begins to chip away the marble.

EDUCATIVE VALUE OF CRAFTSMANSHIP: Work with the hand is now recognized as highly educative in three exceedingly important particulars:

1. For teaching precision and accuracy, in which nothing equals the work of the hands.
2. For teaching speed and what may be called general efficiency, or the adjusting of means to the end desired.
3. For gaining experience in bringing success out of failure, because in manual operations the principle of "try, try again" till success comes can be more quickly and more cheaply applied than in any other line. A boy would better experiment upon a box than upon himself. It takes but a few minutes to find a mistake in making a box; it may take years to prove that a plan of life is wrong.

ADVANTAGES OF GOOD CRAFTSMANSHIP: Quite aside from the educative influence upon the individual, there are six advantages that result from good workmanship as compared with poor:

1. The work is more interesting than when the craftsmanship is careless.
2. The work is actually more easily performed.
3. A greater amount is accomplished in the same length of time and with the same expenditure of energy.
4. Mistakes are fewer, and breakage, together with waste of every kind, is reduced.
5. The worker gains in producing power every day, and therefore in the value of his labor to his employer and to the world.
6. In the end the man himself is improved and developed through good craftsmanship, just as he is injured and ultimately destroyed by careless workmanship.

HOW TO BECOME A GOOD CRAFTSMAN: To become a good craftsman, six rules must be observed:

1. You must really desire to be a superior workman.
2. Construct in your mind an accurate picture of what is to be accomplished—the transfer of hay from the ground to the wagon, the welfare of the plant in cultivation, the work which the horse can perform, what the machine is designed to do.
3. Learn accuracy of performance, or the exact way to do the job.
4. Learn speed through unceasing precision of movement and cutting out all “false motions” that do not get ahead. Acquire the most direct and convenient methods of getting results, then practice, *practice, practice*.
5. Keep the eyes open always for “a better way” of doing a standard piece of work. You may learn it suddenly some day from an unexpected quarter.
6. Develop endurance as well as accuracy and speed. The workman who soon “gives out” will accomplish but little. The good workman is “tireless” as well as skillful. This does not mean that you should never get tired—you will be “dog tired” if you do your duty—but it does mean that you should not become exhausted with the day’s work. Try to master your job, that is, to be a master workman.

THE HAND: Next to the brain, the hand is the most wonderful part of the body. Man is about the only animal that has a hand good

for much, and this, next to speech and brain power constitutes his chief advantage over the animals. What could the horse or the dog accomplish with good hands! What could we do without them? It was a great thing when man first learned to walk on his two feet, leaving his hands for work! Yet how many men and women have left the hand untrained. It is our best servant; learn to use it, and in using it make it obey and do always a good job.

CARE OF THE BODY: The body is not only the house in which you live, it is also the machine with which you think and work. As the good workman always takes the best care of his tools, so should you take the very best possible care of the body. You will frequently get wet on the farm, and sometimes heated, but neither will injure the body that is well cared for.

United States Boys' Working Reserve Farm Craft Series

LESSON 4

THE HORSE

VALUE OF THE HORSE: Oldest of all domesticated species except the dog, the horse is by far the most useful as he is the noblest of the animals. Under the saddle he carries the rider or the pack upon his back. In harness he draws the carriage for pleasure, or he hauls the wagon, the plow, the harrow, the cultivator, and the reaper as matters of business. Without the horse, modern American farming would be impossible. To make the most of his services, the best of horsemanship must be employed.

PREREQUISITES OF A GOOD HORSEMAN: Before one can be a good horseman, he must:

1. Understand the nature of the horse.
2. Know the methods employed by the best horsemen, both in the handling and in the care of horses.
3. Get practice, practice, and yet more practice.
4. Have always, as a driver, a clear comprehension of precisely what the horse is expected to do *before* attempting to set him to work.
5. Be able to convey to the horse exact information as to what is expected of him, and do it in ways that will encourage and stimulate, not frighten or confuse him.
6. Like horses so well that if they were human beings they would be his intimate friends.

NATURE OF THE HORSE: While horses, like people, vary greatly in their individual dispositions, yet in general it may be said that the following are outstanding characteristics of the horse:

1. *Timidity:* Wild or domesticated horses are timid and therefore inclined to run away from strange objects or frightful sounds, and even from things familiar if suddenly and unexpectedly encountered. Hence, never punish a horse except for definite disobedience, and then *be certain that he knows exactly what it is that he has done wrong.* He will accept this kind of punishment like a gentleman and profit by it, but a good horse will either resent abuse and fight, or he will be made so unreliable as to be dangerous.

The horse is especially "skittish" about what comes up from behind. For this reason a good horseman always "keeps an eye

to the rear" in driving and speaks before touching a horse, especially when he is in the stable.

The horse may easily frighten himself. For example, a slight "start" when he is hitched to something which rattles when it moves, is likely to be converted into a first-class runaway. Therefore, if there is danger that a horse will become frightened, keep him moving, but do not let him trot if it can be helped. Whatever happens, the driver must keep his head.

It is the driver's business to discover any fearsome object before the horse discovers it. If he refuses to go up to it or pass it, by no means should he be whipped. If given time to study it out, with an encouraging word from the driver, he will, in nine cases out of ten, proceed upon his way.

2. *Curiosity*: Curiosity is a highly developed faculty of the horse, and if left to himself he will ordinarily return to examine the object that has frightened him. Hence it is useless to follow a colt that is shying away from you—he will return presently to look you over. However, never strike a horse with a halter when you turn him into the pasture, even in a spirit of play, for you will have trouble in getting him again when you want him.

3. *Pride*: Of all his characteristics, none is more prominent than pride. While some horses are indifferent, others are as proud as Lucifer, and most good horses work best in good harness well fitted. Some of them behave decidedly better when hitched to a good turnout than when asked to haul a dilapidated and rattling piece of machinery.

4. *Workmanship*: The good horse well trained is a good workman. That is to say, he likes to do the things that he has learned. In most teams one or the other takes the lead. It is only the horse inferior in intellect or abused in treatment that takes no interest in his work. Furthermore, it is the horse which is most interested in his work that will last the longest and accomplish the most. The experienced farm horse knows how to do most kinds of work and is an exceedingly good judge of his driver. It is good policy to stand well in his esteem.

5. *Dependence*: The horse is naturally dependent upon his driver, and this is the driver's chief advantage over him. No man can master a horse except by winning his confidence. A good horse well trained depends upon man's superior intelligence, and such a horse will no more "run away" than will a dog leave his master. Good horsemen frequently take advantage of this trait in training green colts and purposely get them into predicaments from which they cannot extricate themselves, as, for example, allowing them to become entangled in the harness. Once having been relieved from such a difficulty, the horse quickly comes to depend at all times upon his driver.

6. *Memory*: The horse has an excellent memory and seldom forgets what he has learned, bad as well as good. Be careful, therefore, what you teach him.

7. *Temper:* A few horses are vicious and some are insane. The vicious horse is likely to kick, to bite, or to strike with the front feet. Of these three habits the last is the most dangerous. Almost any horse is likely to kick if something touches him from behind without warning. Therefore always speak to a horse before touching him. Some horses have been ruined by ill treatment and a few are intolerably stupid, but these are extremes and most cases of the kind have been produced by bad management.

LEARNING THE METHODS OF GOOD HORSEMEN: These can be learned only by wide observation and long experience, keeping the eyes always open to the customs of good horsemen—what they do and what they do *not* do. For example: If you have occasion to quiet a horse, pat him upon the shoulder or the neck, not upon the nose. He resents the latter just as you would. If he is afraid to pass an object, walk beside him, but *never lead him by the bit*. A good horseman never drops his lines until he is ready to unhitch.

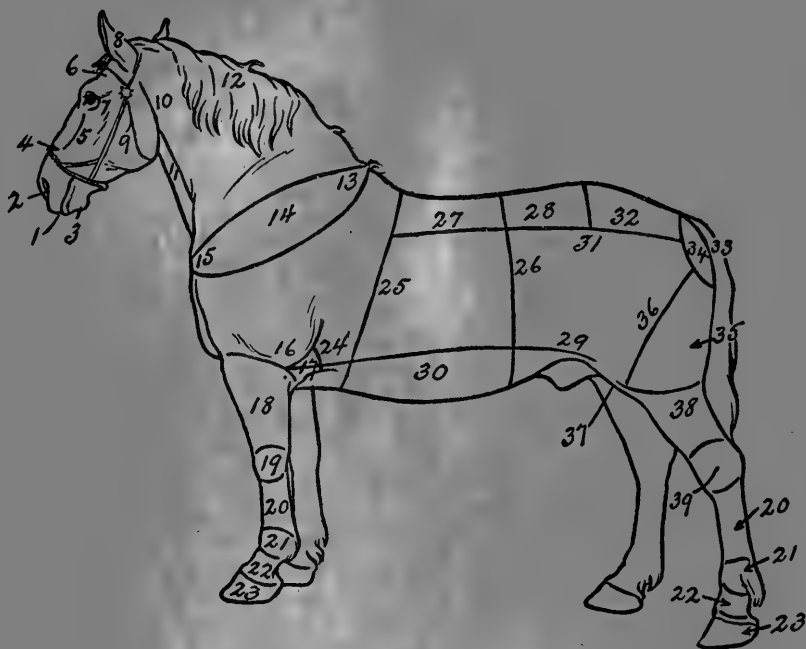
Practice: Wide observation and much study are required for good horsemanship, but even so practice is absolutely necessary in order to acquire the “feel” of the lines, the feeling of assurance that goes with good driving, and the ability to inspire confidence on the part of the horse, without which the best results are impossible.

KNOWING IN ADVANCE WHAT IS TO BE DONE: Many unskilled horsemen strike the horse with the whip or the lines before telling him to start. Now the horse is entitled to know what he is expected to do. Before giving orders, therefore, be assured that you yourself know exactly what is to be done, how you are going to do it, and the part which the horse is expected to perform.

COMMUNICATING WITH THE HORSE: Good horsemen do not yell at horses nor do they continually tap with the whip or the lines. The one will confuse and possibly frighten; the other will breed laziness. A few words of command are necessary, but for the most part *horses are driven with the lines*. Continual talking will make them careless of what is said. They do not understand a general conversation, and they grow heedless of continuous and harmless clatter of any kind. Around horses, therefore, keep silent or speak to good purpose; and when you speak, do it distinctly and in a tone of quiet assurance, as if obedience were to be taken for granted without being enforced.

ATTITUDE TOWARD HORSES: No man can be a good horseman who dislikes horses, or who believes that “every horse should know his master.” It is imperative for good horsemanship that the animal should have confidence in and place absolute reliance upon his human companion as a very superior creature. Never deceive a horse except to encourage him in the belief that no harm can come his way while you are there. This laudable deception is the key to good horsemanship.

Whoever is to handle horses should familiarize himself with the names and the location of the different parts of the body. This work can be done by study of the following chart, and it should be completed with the live animal at the first opportunity for practice work.



- | | | | |
|-----------------|--------------|-------------------|--------------|
| 1. Mouth | 11. Windpipe | 21. Fetlock joint | 31. Hip |
| 2. Nostril | 12. Crest | 22. Pastern | 32. Croup |
| 3. Chin | 13. Withers | 23. Foot | 33. Tail |
| 4. Nose | 14. Shoulder | 24. Fore flank | 34. Buttocks |
| 5. Face | 15. Breast | 25. Heart girth | 35. Quarters |
| 6. Forehead | 16. Arm | 26. Coupling | 36. Thigh |
| 7. Eye | 17. Elbow | 27. Back | 37. Stifle |
| 8. Ear | 18. Forearm | 28. Loin | 38. Gaskin |
| 9. Lower jaw | 19. Knee | 29. Rear flank | 39. Hock |
| 10. Throatlatch | 20. Cannon | 30. Belly | |

The left side of the horse is the "near" side; the right side is the "off" side.

United States Boys' Working Reserve

Farm Craft Series

LESSON 5

GROOMING AND CARE OF THE FARM HORSE

The first step in learning the handling of horses is grooming, commonly but erroneously called "currying." As it must be done every day, it is important to know how this work should be performed in the very best way and with the least consumption of time and labor.

OBJECT: While good grooming improves the coat of the horse and adds to his appearance, the main reason for doing it carefully and regularly is to assist in keeping the skin and coat healthy. Keeping clean those parts upon which the collar and other portions of the harness bear, aids in preventing them from becoming "galled," that is, irritated and sore.

TOOLS: The ordinary grooming tools are: currycomb ("humane," or "reform," type preferred), dandy brush, rub rag, and hoof pick. The card is sometimes used but it is a crude tool; and the sweat scraper, while used with race horses, is but rarely found upon the farm.

1. *The currycomb* is used to loosen up dirt which has "caked" upon the coat. This should be the first step in grooming. The movement employed by the hand and arm in the use of this tool should be circular and the pressure only enough to get results and not enough to irritate the skin. Keep the currycomb off the head, and do not use it on the knees, hocks, or the parts below.

2. *The dandy brush:* When particular attention is given to grooming and an extra glossy coat is desired, a good body brush of bristles will be needed. With farm horses, however, the work can be well done, and much more speedily, with the dandy brush. This brush should be vigorously applied in the direction in which the hair lies. The groom should stand far enough away from the horse to enable the use of considerable pressure in his strokes. Starting

in at the head, he should proceed over the whole body, remembering to brush thoroughly all parts of the legs, particularly under the fetlocks. Muddy legs should not be washed, but the mud should be allowed to dry and then be thoroughly removed with the brush. Manes and tails should be faithfully brushed out because, when neglected, the skin from which the long hair grows becomes itchy, and this leads to rubbing. Neither the card nor the currycomb should be used on manes and tails because too much hair would be broken off. Brushes may be cleaned by occasionally passing them over the currycomb and knocking the dust out of the comb against the side of the partition.

3. *The rub rag:* A linen salt sack is the best—it should be used in finishing in order to remove the surface dust. The rub rag is also used after the *sweat scraper*, which in some cases—although not as a rule with farm work horses—is employed to dry horses which are brought in hot and wet with sweat.

4. *The hoof pick:* At the time the horse is groomed, it is a wise plan to pick out the feet, that is, clean out the sand, gravel, and dirt that have collected under the frog and in the walls of the hoof. At this time also the condition of the hoof and the shoe should be noted. Unshod horses should have their feet leveled and the outer wall rounded off with a hoof rasp at least once a month. Rounding the outer wall tends to prevent its chipping off.

When to Groom: Although seldom practiced, the best time to clean the horse is in the evening after he has cooled out from his day's work. When this is the rule, a light grooming in the morning is all that is necessary. The work should be done well but with speed, for time will not permit more than the doing of bare essentials. There are a number of practices of the experienced groom which have to be omitted on the farm for lack of time.

Blanketing: Blankets are used, for the most part, on farm horses that have to stand exposed to the winter elements while waiting for their loads or drivers. It is a wise precaution, during the winter season, to blanket horses that come into the stable very hot. Putting a big handful of straw over the loin and under the blanket aids in cooling out. The doors and windows in the horse barn should be so arranged as to prevent drafts.

Care of the Shoulders: The most vulnerable part of a work horse is his shoulder. If the collar is too small it may choke him; if it is too large, which is more often the case, it will bear so

heavily on the point of the shoulder as to wear off the skin; and if it is lumpy, which is still more frequently the case, the shoulder is almost certain to become "galled", that is, hard bunches are raised upon which the skin will sooner or later break, leaving a sore.

Quite aside from all questions of cruelty, no horse can work well with a sore shoulder against which a collar is constantly pressing with more or less of a seesawing motion, the natural result of walking. A shoulder once made sore is exceedingly difficult to heal, and every good horseman prides himself upon never allowing such a condition to develop.

The collar is never too hard, but the driver should see that it fits like a good shoe, and even then he must give constant attention to the shoulder. The mane frequently works under the collar and irritates the skin, softened by the perspiration. The driver should be careful that this lock of mane is not allowed to remain under the collar while at work, and to prevent it very frequent attention is necessary.

Then, too, in the spring of the year when the horses are soft and the skin perhaps none too clean after a winter of "roughing through," the shoulder sweats profusely and a sticky gummy secretion is freely thrown out. If this is left all day without attention the shoulder will become "scalded" and with continued neglect extremely sore, even to the point of making the horse unfit for work. What the driver should do is to lift the collar from the neck at least once an hour in the early season—the neck becomes toughened later on—and wipe the shoulder and the collar with the hand or better with a cloth carried for the purpose. A little later all that will be necessary is to occasionally lift the collar off the neck to let the shoulder cool and dry.

Care of the Collar: A bad driver pays no attention to the collar until he is ready to put it on in the morning. He will probably then "scrape the gum off" with a pocket knife or an old file, and hammer the collar a little with a stick "to soften it."

The good teamster *cleans the collar as soon as he removes it from the neck in the evening and while the gum is warm and soft*, using a cloth or a wet sponge with a little soap. He never does anything to roughen the surface of the collar where it bears upon the shoulder of the horse. *No collar is too hard if only it is smooth*; indeed, collars have been made of steel.

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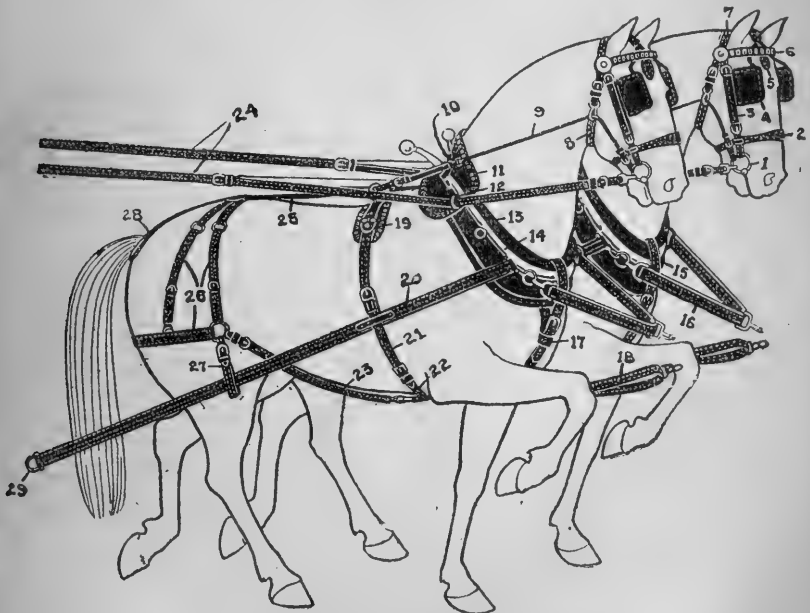
United States Boys' Working Reserve Farm Craft Series

LESSON 6

HARNESSING AND HITCHING UP FARM HORSES

There are many different styles of work harness and good teamsters vary somewhat in their methods of doing similar things, yet all agree with the old saying, "A team well harnessed and put together is half driven."

GENERAL STATEMENT: The universal custom is that all harness is put on and taken off from the *left*, or near, side. The novice will



HEAVY WORK HARNESS

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> 1. Bit 2. Nose band 3. Cheeks 4. Blinds 5. Face drop 6. Brow band 7. Crown 8. Throat latch 9. Check rein 10. Top hame strap | <ul style="list-style-type: none"> 11. Housing 12. Hame line rings 13. Collar 14. Hames 15. Bottom hame strap 16. Breast strap 17. Collar strap 18. Martingale 19. Pad 20. Traces | <ul style="list-style-type: none"> 21. Girth billet 22. Girth 23. Breeching straps 24. Lines or reins 25. Back strap 26. Breeching 27. Trace carrier 28. Crupper 29. Cockeye |
|--|---|---|

commend himself, therefore, at once if he knows which side of the horse to approach for harnessing and unharnessing, just as he will discredit himself by going up to the right-hand side.

PARTS OF THE HARNESS: The first step is to learn the parts of the harness as shown in Fig. 1.

HARNESSING THE HORSE TO BE DRIVEN SINGLY

We shall assume that the horse is in his stall, groomed and ready to be harnessed. How shall we proceed?

HANDLING AND PLACING THE HARNESS:

1. Remove the harness from the hanger and carry it on the right arm, the right hand grasping the off side of the saddle and the left hand the near side.

2. From the near side of the horse, place the harness gently on the back near the loin (in order to allow slack for the crupper), pull down the breeching to proper position, and put the crupper in place. See that there are no hairs from the tail caught between the crupper and the dock.

3. Lift the saddle clear of the back, carry it forward into place, and draw the pad girth sufficiently tight. For two-wheeled carts, this girth must be tight, but for four-wheeled vehicles only moderately so.

4. Get the bridle and breast collar, carry them on the left arm, take off the halter and slip the breast collar over the head. Hold the bridle by the crown piece in the right hand, which may also grasp the foretop to steady the head, raise the bridle until it is in position, and then with the left hand slip the bit into the mouth.

Do not crowd the bit against the teeth. If the horse is reluctant to take it, he can usually be induced to do so by crowding the thumb into one side of the mouth and a finger into the opposite side. In very cold weather the bit should be warmed by the breath or by holding it a moment in the hand, else it may stick to the tongue.

When the horse has taken the bit, gently draw the crown piece over the ears, being careful to straighten out the foretop and the mane. The foretop should be *underneath* the brow band. Fasten the throat latch loosely and see that blinds, brow band, and throat latch fit comfortably. The bit should not be so low that the horse will be likely to get his tongue over it; neither should it be so high that it will wrinkle and make the skin sore at the corners of the mouth.

5. Secure the lines to the bit (assuming they are doubled through the pad-terrets—the rings on the pad), straighten the lines, *buckle their ends together*, double them, and run them through the near pad-terret.

HITCHING UP:

1. In "hitching up" or "putting to" the single horse, remember that shaft ends are rather frequently broken by attempting to back the horse between them while the shafts or thills are resting upon the ground. The shaft should be raised from the ground and the

horse brought under, or he should be placed in front of the shaft and the vehicle brought forward from behind.

2. With the horse in the shafts, run the shaft ends through the tugs, or shaft bearers. Fasten the traces and so adjust the length as to bring the horse as close to the vehicle as possible without danger of hitting the quarters, hocks, or feet. Then draw the tug girth tight enough to hold the shafts firmly in place (this for four-wheelers; for carts, allow a little slack), and finally fasten the hold-back straps.

3. The hold-back straps should be so wrapped about the shafts that when the traces are drawn taut, the breeching can be pulled three or four inches back from the quarters. It is well to wrap hold-backs or breeching straps in the following manner: Bring the point of the strap *underneath* the trace and shaft a few inches in front of the leather loop on the shaft, then bring it around over the shaft and pull it tight. Give it two or three wraps about the shaft, depending upon the length of the strap; bring the point back through the loop on the shaft from the *outside*, and carry it under the trace to the buckle.

HARNESSING THE TEAM

PLACING THE HARNESS:

1. If the collar is closed at the top, turn it upside down, slip it gently over the head, and reverse it to the proper position at the throat before attempting to adjust it to the shoulder. If it is buckled, unfasten the top and, raising the collar into position, hold it there with the left hand while fastening it at the top with the right hand. Collars taken off and put on over the head without unfastening will last longer than those which are opened at the top—some teamsters say at least twice as long. The open collar will last longer and fit better if it is buckled together as soon as it is removed.

With the horse's head in the position in which he holds it when at work and with the collar pressed firmly back, it should fit snugly on all its bearing surface and leave room to insert the flat of the hand at the windpipe. If sweat pads are used to make collars fit, they should be always in place. Well-fitting collars which are kept clean go far toward enabling a horse to do his full duty with ease to himself and his driver.

2. After the collar is in place, take the harness from the hanger with the right arm underneath it, the right hand grasping the off hame, and the left, the near one. Do not drag the harness on the back of the horse, *but lift it clear of him*, and carry it well forward, putting the hames on the collar and the rest of the harness on the back with enough slack to enable the hames to go into place easily. Buckle the hames, remembering that they should fit the collar snugly. The hame strap at the bottom should be drawn tight. One day's work with improperly fitted hames may ruin a good collar, or if the hames are loose the neck is almost certain to become sore.

3. Lift the breeching clear of the back, put it in place, buckle the belly band, and fasten the breeching straps to the ring in the rear end of the martingale, or choke strap.

4. Put on the bridle as directed for the single horse. Then, using the hitch rein, back the horse out of his stall, secure his mate, and after watering, the team is ready to be "hitched up" or "put to," whatever kind of wagon or tool is to be used.

HITCHING UP

1. If the team is to be hitched to a wagon, walk it to the point of the wagon tongue. Then, with a hitch rein up close in each hand, quietly step each horse into his place beside the tongue. Leading or driving horses across tongues causes needless breaking, particularly when the tongues are made of brash wood, as are those of many farm implements.

2. Take down the lines, throwing the off line over the horse's back to the near side; fasten them to the bit rings after seeing that the checks are not twisted, double them twice, and hang them on the outside bame of the near horse. Then tie up the hitch reins.

3. Pick up the neck yoke and adjust the martingale and breast straps. Slip the center ring of the neck yoke over the point of the tongue, and quietly back the horses into position for fastening the traces, the length of which should be such as to prevent the neck yoke from slipping off the tongue and not so tight as to be uncomfortable.

4. Fasten the inside trace of the near horse, and the inside and outside traces of the off horse; then walk around the horses' heads, carry back the lines, and fasten the outside trace of the near horse. The team is now ready to be driven.

This procedure is handiest for hitching to right-hand machinery. In hitching to carriages and wagons, it is frequently the practice to finish on the off side and mount the driver's seat from that side. With young or restive horses, it is advisable to carry the lines on the arm while hitching and unhitching.

UNHITCHING: In unhitching, reverse the procedure as outlined above for "hitching up," and be careful to prevent lines and traces from being dragged about and cut or soiled by tramping. Going at these things unsystematically is often the cause of damaged harness and spoiled horses. The careless handler of horses' harness and machinery frequently costs more in delay and repairs than his services are worth, to say nothing about losing the pleasure which is derived from work well done.

United States Boys' Working Reserve

Farm Craft Series

LESSON 7

WORKING FARM HORSES

A horse that is well groomed, properly harnessed, and hitched up is ready for work, and his usefulness depends entirely upon the skill with which he is driven and managed:

DRIVING

Do not hurry at the start. Take up your lines, draw them taut, speak to the team, and start slowly. Start both horses of the team together; do not let one of them get ahead of the other. The most useful gait of the farm horse is a rapid walk, and the teamster has much to do in maintaining and perfecting this gait. Horses work best for firm, though quiet and kind teamsters; more work is usually done where there is the least fuss. Keep your eyes open, watch the team, and watch the road ahead. A gentle pressure, just feeling the horse's mouth, should be exerted on the lines, except for emergencies, when a firm line promptly applied may save trouble. The two extremes are bad, that is, driving with loose, flopping lines, or hanging on to the lines with a "hard hand," making the horse pull the weight of the driver with his mouth. The one gives no control of the team and may be dangerous. The other teaches the horse to pull with the mouth, making him a "hard driver," besides giving no slack of line for an emergency. It is the sudden taking up of the slight slack, which goes with all good driving, that may prevent a runaway.

HORSE TALK

Horses cannot understand conversation. All good horsemen therefore teach them the few words they need to know and are careful not to confuse them by a conglomeration of horse talk which they cannot comprehend. The words commonly used are:

"Whoa," pronounced "*whō*" in a moderate voice but with a

short decided inflection which seems to command instant obedience. The life of the driver or of his passengers may some time depend upon its being promptly obeyed. Do not, like poor horsemen, utter a succession of commands—"whoa," "whoa," "whoa," etc. The effect of this is to excite the horse and probably to send him off, at least to give him a very poor opinion of you, in which case you have lost his confidence. Say "whoa" once and expect it to be heeded, enforcing the injunction with the lines if necessary.

This is the first command taught a green colt and it should never be used for any other meaning than to *stop and stand still*. Indifferent horsemen sometimes use the word with a long drawn-out pronunciation, "whoa-a-a," to steady the team when under conditions likely to irritate or frighten it. But a different word is better, so that "whoa" shall mean but one thing. The term "Steady" is commonly used to quiet the team.

"Get Up." This command, or a clucking sound made by the tongue against the side of the mouth, means to go ahead. Many good horsemen start the team by tightening the lines as a signal that everything is ready for a start. In general, good horsemen use the lines as much as possible for conveying information and speak only when necessary.

"Back" means, of course, to go backward in a straight line. It is the last word taught the green horse because, in general, horses do not like to back. Their legs are built for going ahead, and a horse never goes backward unless compelled to do so. The lines help, but no good horseman will pull a horse backward rapidly. It is not only cruel but sometimes dangerous.

"Gee" and "Haw." As oxen are not driven with lines, the ox teamster has no means of turning to the right or the left except by words of command. With him "Gee" means "turn to the right," and "Haw" means "turn to the left." Horses are generally guided by the lines, but in some kinds of work both hands are employed, and for this reason most work horses are taught to mind "Gee" and "Haw."

The same terms are used with mules, but all horse talk varies somewhat in different localities. The driver must adopt the terms of his own section, whatever they may be. No good teamster ever yells at his horses. Nothing will confuse or frighten them quicker. Nothing must be said or done to give them the slightest reason to suppose that the driver is excited, confused, frightened, or otherwise than in full command of the situation. It is never to be forgotten that safety around horses depends upon the confidence which

the horse has in his human companion, whom he regards as a very superior being, and nothing must be done to dispel that illusion.

SPECIAL PRECAUTIONS

WATERING: *Never water a horse when he is warm; it may easily ruin him. Some horses drink very rapidly, especially when thirsty, and if allowed to go to the tank they will drink enough to injure themselves before it would be suspected. A horse is never too hot for a few swallows, say a gallon or even two gallons, and he ought to have as much as that. An hour later when fully cooled he may have all he wants.*

FEEDING: *Never feed grain when the horse is heated. Hay may be fed at any time, but to feed grain to a heated horse is to "founder" him almost as certainly as to give him all the water he wants. The foundered horse is permanently "stiffened" and his usefulness, like his value, is easily reduced by one half; besides, he works in constant misery. Feed hay at any time, but withhold grain and water until the horse is "cooled out"—anyway an hour after unhitching. This all applies with special force in the early spring when the horses are "soft." Later in the season or when at moderate work, the team may commonly be watered and fed at once upon unhitching. What constitutes a "warm" horse will have to be learned, but if sweating freely or if "lathering," he is too warm to feed or water.*

SWEATING: A "soft" horse at any time, or any horse in hot weather, will sweat when at heavy work, but he should not show signs of weariness. *If the sweat suddenly dries up on a hot day, get him into the shade and give him a rest.*

RESTING: Rather frequent short stops for rest are preferable to occasional long ones. At these times raise the collar to air the shoulders, and pull out any strands of mane which may have worked under it.

CRUELTY: Probably the most cruel and useless habit a teamster can have is that of punishing his horses by savagely jerking them. No horse which is continually afraid of his mouth will pull well, neither will he thrive. How would you like to wear a bit in your own mouth? The only case in which punishing the mouth is necessary or justifiable is in stopping horses which have started to bolt or run away. This should be done by a sudden heavy jerk with one line, followed by attempted control with both lines, keeping the team in a straight-away course, if this is possible, until they have quieted down. In general the driver is the one to be blamed

for a runaway, but it must be understood that no man can by main strength hold a horse—it is always a question of management.

BACKING: Be careful in backing; back slowly because horses are frequently strained in backing heavy loads for careless drivers. Mares heavy in foal may lose their foals from strains brought on in this way.

HITCHING: One must use discretion in leaving horses untended; it is not safe to tie them to wire fences which they may paw into and in which they may get their feet fastened, to the injury of both horse and fence. Bad accidents have occurred because of carelessness regarding this point. When moving from one place to another either lead or drive the horse; never leave him to wander about. Above all do not slip off his halter and let him go loose to the water tank.

PRACTICE: Get as much practice as you can by riding with a good teamster. Helping him to do a few jobs will likely result in his allowing you to handle the team a bit under his direction. The local harness man can tell you much about harness and may be persuaded to permit you to become familiar with the different harness parts in his shop.

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Farm Craft Series

LESSON 8

THE COW

CHORES: Milking is one of the "chores" which every farm boy seems to learn without being taught. While sometimes not so considered, milking is really a delicate operation and one which reveals much as to the milker's common sense and poise. It is worth learning carefully and is, of course, particularly important on farms where milk is extensively produced.

MILKING MACHINES: Milking machines are in successful use on specialized dairy farms, but because of breakdowns, hand milking is likely to become necessary at any time even there. Milking by hand is the rule on ordinary farms, and as it is also necessary in finishing after using the machine, it may be called one of the standard jobs upon the farm.

NATURE OF THE DAIRY COW

The dairy cow, sometimes referred to as a *milch* cow, is naturally of a rather nervous disposition. It might be more accurate to speak of her as sensitive. At any rate, she is a highly organized machine for converting feed into milk and must be so regarded.

MILKING QUALITY: The extent of the cow's ability to convert feed into milk rather than into fat to be laid on the body is known as milking quality. Because of this conversion of feed into milk, the dairy cow is a thin-skinned, lean-looking animal, sometimes loose jointed and even clumsy in appearance, carrying little or no fat. As she has a thinner covering of fat than has the beef cow, she is more easily chilled in cold and stormy weather.

THE CALF: The young dairy animal of either sex is called a calf, the male being known as a *bull calf*, and the female as a *heifer calf*. When the young animal approaches twelve months of age it is called a *yearling heifer* or *yearling bull* and retains that designation until it reaches twenty-four months of age. The heifer ordinarily "freshens"—that is, bears young—at from twenty-four to thirty-six months of age. She is then "in milk" and is called a cow. After milking from ten to eleven months, the cow ceases to give milk. She is then called "dry," and if she fails to freshen the next season she is called "farrow." The bull calf of dairy breeding is

not usually of much account to fatten for beef, but in case he is used for this purpose he is castrated or emasculated when quite young, and from then on is known as a *steer*.

MILK SECRETION

THE GLANDS: The mammary glands of the cow and all their external attachments are referred to as the *udder*, or quite commonly in farm language, as the *bag*. This is divided internally into four compartments, each connecting with one of the four teats (pronounced tits). Emerging from either side of the cow's belly and running back to the udder, is a rather large and more or less tortuous "vein." These two veins, although actually carrying blood, are commonly referred to as *milk veins*, and the openings through which they leave the body are called *milk wells*. In expert cow judging the fulness of these veins and the size of the milk wells are considered as a good index of milking quality.

AMOUNT SECRETED: The amount of milk which a cow will be able to yield will depend upon three factors:

1. Her breeding.
2. The kind and amount of feed.
3. Her general care.

As the breeding is beyond the control of the helper, and as the ration is fixed by the farmer, the subject of interest here is the *care* of the cow, and too much attention cannot be given to this phase of the dairy business.

CARE OF THE DAIRY COW

FEED: Whatever the ration, it should be fed regularly, and the cow permitted to enjoy herself while earning it.

TREATMENT: Remember always that the secretion of milk is the function of a mother and that the cow requires, as well as deserves, gentle treatment. She must always be free from excitement or fright. It has been noted on specialized dairy farms that if a strange dog happens to run through the barn at milking time it may cause a striking decrease in the amount of milk yielded at that time. More than with any other farm animal, except the horse, the workman coming near should always let his presence be known by speaking, and, if he is working close to the cow, he makes his presence grateful by stroking his hand across her back. Men accustomed to working with cows do this instinctively.

CLEANING: In cleaning the cow with currycomb and brush, remember that she is a thin-skinned and nervous animal and be gentle accordingly. Take particular pains to brush the udder and adjacent region, because naturally this makes a difference in the cleanliness of the milk produced. Always exercise extreme care in cleaning or touching the cow's udder, as this is a delicate gland, very easily injured. Even a slight blow with some hard substance like a currycomb may cause inflammation.

THE FRESH COW: At the time of calving, the cow's udder is full and distended and may sometimes be feverish. At this time the greatest care is required in milking and only someone thoroughly familiar with cows should attempt it. Incorrect handling may cause serious inflammation and injury. The cow's milk for the first three or four days is especially adapted to the needs of the new-born calf, but it is not considered fit for human food until the "ninth milking"—some say the "seventh." The time varies with different cows, but when the milk looks normal it is fit for consumption. The farmer will determine that point.

THE PROCESS OF MILKING

This is something which cannot be taught without practice, but there are several hints well worth learning. The principle ones are the following:

1. Remember that the milker works on the right-hand side of the cow. To approach her on the left is to betray ignorance.

2. The first movement is to put the hand upon the right hip of the cow with a gentle push, when, if well broken, she will "hoist," that is, set her right hind foot somewhat back of the left, giving ready access to the udder.

3. The milker should not work at arm's length, but, seated upon the stool with the pail between the knees, his head should be close against the flank.

4. Grasp one teat in each hand, working with diagonal quarters; that is, when the right hand is working with the *right fore* teat, let the left hand work with the *left hind* teat, and correspondingly for the other two quarters.

5. In grasping the teats, remember that milking is a pumping process. Grasp first around the upper end close to the udder with the thumb and forefinger. This prevents the milk from flowing back into the udder when the teat is squeezed. By practice you will learn to squeeze regularly from the top downward, so that the milk is forced out in an even stream. The expert milker is not necessarily the most rapid. However, you should keep working steadily in order that the milking may be completed promptly. If it is unduly delayed, the cow will gradually fail in her milk flow.

6. Do not milk out two quarters of the udder entirely before starting on the other two. Instead, milk a little while on two quarters and then change off so that the entire udder is emptied at practically the same time.

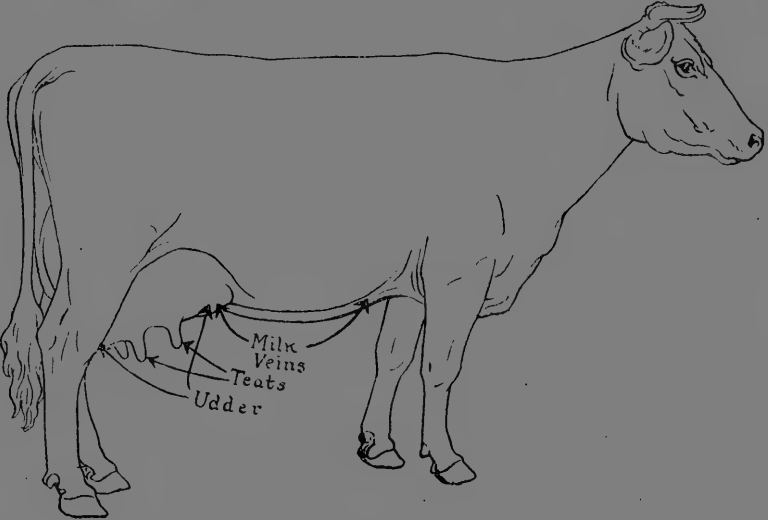
7. The final process of milking by which the last drops of milk are extracted is called *stripping*. It is important to milk out this last small quantity carefully because it is richer than any other part of the milk and because unless it is drawn out it has a tendency to encourage the cow to go dry.

With a strange milker a cow will sometimes "hold up" her milk. This is not, as is often believed, due to perversity of the animal, but is involuntary and the result of nervousness. The remedy is

simply to continue to be gentle and go on milking until she gets over the nervousness.

Only a few cows are chronic kickers. That is to say, when a cow kicks, it is ordinarily because she has some good reason for it. If the cow kicks, examine her udder and teats and see if there is any evidence of soreness, and breaking out, or any lumpy condition which might indicate internal inflammation. In such cases report at once to the owner, but do not attempt any treatment yourself.

The expert milker is the cow's best friend and she is always glad to see him. No man is ever justified in assaulting a cow with a milk stool or a club, and any man who does so betrays himself at once as not having the proper understanding of, or the ability to work with, live stock.



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LESSON 9

HANDLING MILK ON THE FARM

Milk is a delicate and valuable food easily injured by careless handling. The dairyman, therefore, must be constantly trying to produce an article that is both clean and wholesome. This is not as easy as it might first appear, for those of us who drink milk are interested in the following requirements:

1. That it be free from disease.
2. That it be free from sediment.
3. That it possess good keeping quality.
4. That it have a satisfactory food value.

FREEDOM FROM DISEASE: Milk may become contaminated with disease directly from the cow, from some milker or barn helper who is not in good health, or from utensils that are not kept properly sterilized. Healthy cows, healthy workmen and clean vessels are therefore a combination necessary to produce good milk.

SEDIMENT: People who use milk form their opinion of its cleanliness quite largely by the amount of sediment they can see in the bottom of the pail or bottle. Milk should be produced and handled in such a way that it will be practically free from any sediment.

SOURING: The souring of milk is due to the growth of microscopic plants called bacteria. Milk always contains some of these organisms. They get in with the dust from the cow and from the vessels in which milk is handled. In order to grow and multiply, bacteria must have food, moisture, and heat. Milk is therefore an ideal medium for their growth. The problem of the dairyman in keeping milk sweet is accomplished through clean milking, scrupulously clean milk vessels, and covered pails, which keep the numbers of bacteria as low as possible, and by thorough and rapid cooling, which creates unfavorable conditions for bacterial growth.

FOOD VALUE: Milk is almost a perfect food, especially for the young, though its proportion of water unfits it for an exclusive diet for adults.

The composition varies principally as to fat which may range from 2 to 7 percent, generally from $3\frac{1}{2}$ to 4 percent. These differences in composition are due principally to the individual and not to the kind of feed; that is, you cannot feed fat into milk.

Milk is used largely for its fat in the form of cream or butter, but whole milk either "raw," condensed, or dried, is used in immense quantities in all parts of the world. As most of it is consumed in the raw state, that is without sterilizing, it is exceedingly important that it be kept clean. Inasmuch as all kinds of organisms will grow in milk, dirty milk is always dangerous.

CARE OF MILK UTENSILS: Pails, strainers, cans, dippers, stirrers, and other milk utensils are the most common sources from which milk becomes contaminated and their condition has much to do with the quality of milk that reaches the consumer. The following suggestions for washing and sterilizing these utensils may prove to be helpful:

1. Rinse the tinware in lukewarm water.
2. Wash thoroughly with hot water containing some good washing powder. Always use a brush instead of a cloth in washing these utensils.
3. Rinse thoroughly with boiling water or sterilize by steaming.
4. Dry all utensils. This may be done by placing them in the oven or on the top of a warm stove or by setting them in the sunshine. A dry vessel is unfavorable for the development of bacteria and sunshine is a good sterilizer.

RULES FOR PRODUCING GOOD MILK: Cleanliness and rapid cooling will result in good milk. Therefore—

1. The owner should be sure that the cows are healthy and that the workmen handling the milk are not suffering from any disease.
2. Be sure that all vessels coming in contact with the milk are clean and sterilized.
3. Keep the cows clean.
4. Keep the barn clean.
5. Milk with dry hands.
6. It is preferable to use a covered or small-top pail.

7. If possible carry the milk to a separate room as soon as drawn and strain it. Cool it as quickly as possible. This may be done by running it over a mechanical cooler or by setting the can in a tank of cold water.



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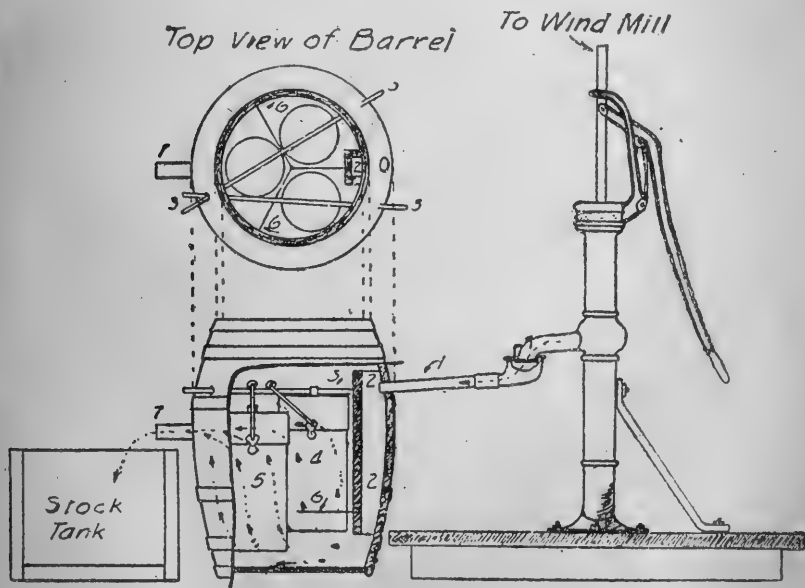
LESSON 10

SEPARATING AND HANDLING CREAM

CARE OF CREAM

On farms where dairying is not the principal business it is frequently the custom to sell sour cream to be made into butter, retaining the skim milk at home to feed young calves and pigs. Cream for this purpose is often neglected, which means that it arrives at the manufacturer's door in poor condition. To maintain our standards for creamery butter, the factory must be furnished with a good grade of cream.

It is an economic proposition for a producer of cream to dispose of his product at the best possible price. Yet a good many do not stop to consider that their cream must be of the best quality in order to command the highest



A PROPERLY CONSTRUCTED COOLING TANK

1. Inlet, usually $1\frac{1}{2}$ inch pipe. 2. Wooden trough, conducting water to within 3 inches of bottom. 3. Sticks, holding cans in place as shown by cut. 4. Shows position of half filled can; run stick through handle in cover to prevent it from sliding out from under the stick. 5. Shows position of can when filled. 6. Shows position of wire which prevents the cans from tipping. 7. Outlet, usually 2-inch threaded nipple.

price. In order to pay the highest price for cream the buttermaker must make a very good marketable grade of butter, and to do this he must have a good grade of raw material from which to make his product. His finished product will be no better than the cream from which it is made. Therefore, if a farmer expects to receive the best market price for his cream, he must produce a quality of cream which will warrant such a price.

The following rules offer suggestions for caring for cream on the farm:

1. Keep the cows clean.
2. Use covered milk pails.
3. Milk with dry hands.
4. Remove all milk from the barn immediately and separate it at once.
5. Set the separator so that it will skim cream that will test from 35 to 40 percent in the winter, and from 40 to 45 percent in the summer.
6. Wash, scald, and dry the separator and all utensils immediately after using. The separator bowl may be dried in a warm oven, though the oven should not be so warm that it will melt the tin on the bowl parts. Setting utensils in the sun is a good practice, as the sunshine acts as a germicide.
7. Keep all utensils and separator parts dry when not in use.
8. Cool the cream immediately after skimming by setting the can in cold running water. Construct a cooling tank so that the cream will be cooled with the water that is used to fill the stock tank.
9. Never mix warm cream with cold cream. Cool the cream before mixing it with previous skimmings.
10. Do not allow the cream to freeze in cold weather.
11. Stir the cream at least twice a day; this will keep it smooth and free from lumps. Do not use a wooden paddle for a stirrer, as it is insanitary.
12. The cream should be delivered frequently, at least twice a week in winter and three times a week in warm weather.

CARE OF THE CREAM SEPARATOR

There are a great many different makes of separators on the market, and most of them will do efficient skimming if they are run and cared for properly. If a separator fails to do good work, it is more often the fault of the operator than of the construction of the machine. No matter how well a separator may be constructed, if it is abused by improper usage it will soon fail to do properly the work for which it was designed.

The following suggestions may be of help to separator operators:

1. Set the separator level on a solid foundation and bolt it down firmly. It is well to have a piece of rubber packing under each leg of the separator to serve as a cushion for absorbing vibration.
2. See that all bearings are clean and well lubricated at all times. Clean the bearings occasionally with gasoline or kerosene to remove all grease that may have become gummy and thus prevent proper lubrication.
3. Use only the best hand-separator oil. Never use common machine oil.
4. Be sure to turn the separator at the speed designated by the manufacturer. Time it with a watch or speed indicator.
5. In cold weather run about a gallon of warm water through the bowl to warm it before turning on the milk.
6. Separate the milk as soon after milking as possible, for the milk is then warm and in good condition to secure a clean separation. No separator will skim cold milk as well as warm milk. The temperature of the milk should be at least 75° Fahrenheit.
7. When through skimming, flush the bowl with about two quarts of the skim milk. In cold weather, warm water may flush the machine more effectively.
8. Wash the separator each time it is used. Wash all separator parts with moderately warm water containing washing soda. When all parts are clean, scald with boiling water and place parts in a warm oven to dry.

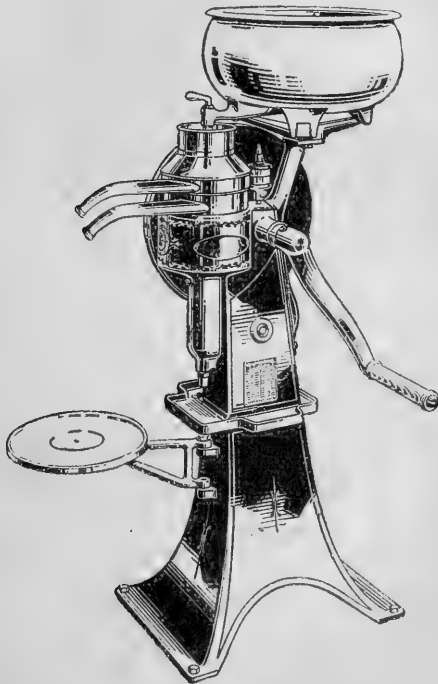
Be sure that the oven is not too hot, as it is likely to melt the tin plating from the bowl parts. Allowing the separator to go unwashed not only causes the bowl parts to deteriorate but also injures the quality of the cream. It is a filthy practice.

9. When a separator is running, the bowl should spin like a top, with no vibration. If the bowl does vibrate, examine the bearings to see if they are loose or worn.

The important bearings are always replaceable. Follow the book of instructions sent with the separator you are using.

WHY CREAM TESTS VARY

The question is often asked why the richness, or test, of cream from the same separator varies from day to day. The answer to this question is found in the way the separator responds to the methods employed by



different operators. *First*, the richness of cream is partly determined by a device called a cream screw, which may be regulated by a screw driver. Turning the screw toward the center of the separator bowl will result in richer cream; turning it away from the center of the bowl will result in thinner cream. (Some separators have a skim-milk screw instead of a cream screw.) *Second*, the speed at which the separator is operated also has a marked influence on the richness of the cream. Turning too fast will make a richer cream; turning too slow will make a thinner cream. *Third*, skimming milk too warm or too cold may also cause a considerable deviation from the normal richness of cream.

Too much emphasis is often placed on the variations of the test of successive cream deliveries. The real comparisons from one delivery to the next should be based either on the total pounds of butter fat paid for, or on the amount of money received for the cream collected in a given number of days. A creamery statement, such as that illustrated, gives information which will make such comparisons possible.

STATEMENT	PINE GROVE CREAMERY	No. 10000
Test No. 1	DOVERS, ILL.	November 6, 1918
Lbs. Cream 40	To FIRST NATIONAL BANK	
Test 38		
Lbs. Fat 15.2		
Price 60c		
Amount \$9.12	Pay <u>Nine.....12/100</u> Dollars \$ <u>9.12</u>	
Check No. 10000	To the order of <u>John Smith, Dovers, Ill.</u>	
Pine Grove Creamery		
Dovers, Ill.		
For correction return this statement	_____ Manager	

The first item, "Test No.," is simply a factory record and has no significance to the cream shipper.

"Lbs. Fat" refers to the net weight of cream delivered.

"Test" refers to the percentage of butter fat in the cream delivered, as determined by the Babcock test.

CALCULATING THE PRICE

Multiplying the pounds of cream delivered by the test, or percentage of fat, gives the pounds of butter fat. In the illustration above, 40 pounds of cream testing 38 percent gives 15.2 pounds of butter fat.

If the price paid for butter fat is 60 cents per pound, the total amount due for the can of cream is found by multiplying the pounds of fat by the price; for example, $15.2 \times \$0.60$ equals \$9.12.

It is always well for a farmer selling cream to weigh his cream and to test it if possible before shipping.

United States Boys' Working Reserve

Farm Craft Series

LESSON 11

SWINE *

IMPORTANCE: From swine flesh we get the much-demanded lard, bacon, hams, spare-ribs, pork chops, sausage, and salt pork. The meat contains a large amount of fat which is "tried out" and is then known as lard. The average consumption of pork per person per year in the United States averages about seventy-five pounds. We export large quantities of pork to foreign countries each year, and at present are producing about one half of the total amount in the entire world. Hogs are found on nearly every farm in the United States. They have been selected and developed for one specific purpose—that of furnishing human food, although in packing houses we find that some of the inedible portions of the hog have very definite uses and distinct values in the industries; for example, bristles.

TERMS TO DENOTE SEX AND AGE: The female of any age is called a *sow*, but if she is under a year old or has not produced offspring, she is called a *gilt*. A *boar* is a male of any age which has not been castrated or emasculated—an operation frequently spoken of as "altering," "changing," or "doctoring." The castrated male is regularly called a *barrow*, but if the male is castrated after it has been used for breeding, or if it has developed the striking masculine characteristics, such as a heavy head, shoulder, or sheath, or large testicles and general roughness, it is called a *stag*. Young hogs of either sex are ordinarily called *pigs* up to the time they weigh one hundred and twenty-five pounds. *Shote*, or *shoat*, is a term applied to gilts or barrows weighing from seventy-five to two hundred pounds, there being no definite line where one term ceases to apply and the other begins. The term *hog* is correctly applied to mature animals, when referring to swine of any age or either sex.

* *Swine* is the correct name to apply to all ages and both sexes of hogs or pigs individually or collectively.

FARROWING: When the sow gives birth to young it is called *farrowing*, and the pigs which are farrowed at that time—there may be from one to twenty, but normally from six to ten—are spoken of collectively as her *litter*. Thus we may say that the sow farrowed a *litter of eight pigs*.

FEEDS: On account of the single purpose for which the hog has been developed, it is particularly efficient in converting grains into edible meat. It has limitations, however. The hog cannot handle bulky feeds, such as hay or silage, in very large quantities, although he is especially fond of clover and alfalfa in small amounts either as hay or pasture. The digestive tract is of small capacity and it is consequently adapted to the use of the more concentrated feeds like corn, oats, and the other grains and seeds, or any feed which has a small amount of crude fiber. Garbage, house-slop, and various other by-products are readily consumed by swine and through them converted into valuable food for the human diet.* The pig is a good scavenger. He will select food out of the manure of other farm animals, especially cattle, and secures from that source much food which is converted into pork rather than being wasted or returned to the soil.

SUPPLEMENTING CORN: Corn is the principal feed for swine especially in the corn-belt States, but to it we must add some other feed to furnish a balanced ration, since corn is noticeably deficient in protein and minerals. Young pigs just weaned will starve on a corn and water diet if allowed no other feed. Skim milk or buttermilk—dairy by-products—are the best supplements to use with corn. Tankage—digester tankage or meat meal, but not fertilizer tankage—ranks second as a supplement to corn and is used in the proportion of about one part to nine or ten parts of corn for pigs under one hundred pounds in weight, and one part to thirteen or fifteen parts with shots heavier than one hundred pounds. Other feeds, such as linseed oil meal, middlings, soy beans, oats, barley, wheat, rye and legume hay, or any kind of pasture, may be used with corn in varying proportions with good results. Since hogs have a limited capacity for handling roughage, they cannot consume enough of even the best of pasture, like alfalfa, rape, or clover, to balance the corn ration if they are given a full feed of corn. Thus for best results with corn and pasture some other supplement rich in protein should be used.

* A small amount of salt is good for hogs, but large amounts are fatal—a fact to be remembered in feeding table or dairy refuse.

MINERALS: Very few combinations of feeds give the pig enough mineral matter for proper growth and development. Some mixture, such as slack coal three parts, air-slacked lime or ground limestone two parts, and common salt one part, should be kept in troughs before the hogs at all times. They will grow more rapidly and be less subject to disease if such ingredients are supplied along with the grain ration.

WATER: Hogs will drink large quantities of water in both summer and winter—more than they commonly get—and an abundance of clean water goes a long way towards keeping the hogs in a healthy condition. The hog cannot sweat; therefore in hot weather he needs to “wallow,” not for the mud but for the cooling effect of the water.

FEEDING: The most common practice is to feed ear corn on the ground or feeding floor, and to mix the other ingredients with water, pouring this slop mixture into the troughs. This is done twice daily. The tendency now is to use methods which save labor, and with that in view many are doing away with slop feeding and use the tankage, mill-feeds, and other supplements dry. Hogs eat dry feed almost, if not quite, as well as when it is mixed with water. Many feeders are using self-feeders that hold a supply of grain sufficient for several days, thus obviating the necessity of feeding two or three times each day. When hogs are self-fed they gain rapidly and are fattened for market at a rather early age, requiring a minimum of labor but using about the same quantity of grain as with hand-feeding.

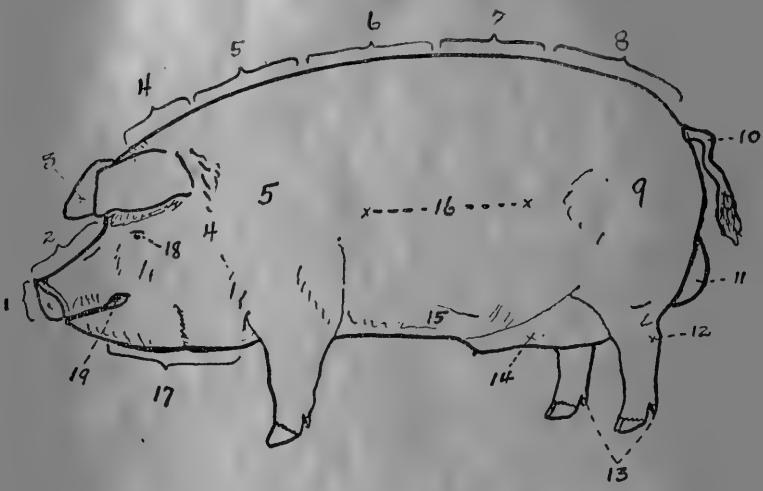
SHELTER: Hogs are commonly housed in small, low buildings, spoken of as “cots” or sheds. The prime requisites for a good shelter are dryness and freedom from drafts. During the summer some sort of protection from the sun’s rays is needed. Shade trees furnish the best means, but any other shelter, under which there is a free circulation of air, will answer the purpose.

GENERAL HINTS: Pigs should never be driven about the pens faster than a slow walk. Keep the dog away from the pigs, for he may chase and overheat them. If they start to run, get around them as best you can, but don’t run them, for they easily become overheated and may suddenly die from heat or from shock and excitement.

Pigs are stubborn, but two stubborn things together will never make much progress. Therefore keep your temper when handling hogs.

Hogs will do better in small bunches than in large droves. They appreciate kindness and will pay well for good care, good feed, and a good place in which to sleep and rest. They are naturally the cleanest of all farm animals, being the only ones that will not willingly foul their own quarters.

Take note of any animal appearing dull or "dumpish" and report it immediately to the owner. Timely action may save an entire herd from contagious disease.



PARTS OF THE HOG (MALE)

- | | | |
|-------------|---------------|---------------|
| 1. Snout | 8. Rump | 11. Sheath |
| 2. Face | 9. Ham | 12. Hock |
| 3. Ear | 10. Tail | 13. Dew claws |
| 4. Neck | 11. Testicle | |
| 5. Shoulder | 12. Hock | |
| 6. Back | 13. Dew claws | |
| 7. Loin | | |
| | | 14. Side |
| | | 15. Belly |
| | | 16. Side |
| | | 17. Jowl |
| | | 18. Eye |
| | | 19. Tusk |

United States Boys' Working Reserve

Farm Craft Series

LESSON 12

CARE OF FARM EQUIPMENT

A good many hundred dollars are invested in the buildings, fences, and machinery of the farm. These necessary adjuncts of the business are exceedingly perishable, and the careless workman will destroy more by his carelessness than he can produce by his labor. The proper use and care of this equipment, therefore, is one of the first obligations resting upon the helper.

BUILDINGS: Special care should be exercised not to drive against the corners of buildings or the sides of doorways. Manure should not be allowed to pile up against the side of the barn. If necessary make a guard of old boards. Windows should be protected against breakage. Doors should either be shut or fastened open, not left to be torn off the hinges by swinging in the wind. We say of the man who leaves doors open behind him that he must have been brought up in a saw mill. There is no surer way to injure a horse than to drive or lead him through partially opened doors or gates. It is only a question of time till one will close up with him, and when it happens *he will not back out*, but will probably injure himself in trying to go ahead.

FENCES AND GATES: Gates like doors should not be left to swing. Presumably a gate is always to be *closed*. Do not drive against gate posts nor into fences in turning at the ends of rows. Never hitch to a wire fence or a gate, for horses like to paw; and do not hitch to a shade tree, for they like to gnaw bark and to brouse twigs.

Do not climb over wire fences. If compelled to do so choose a place *next to a good post*, and step close to the supports. Never pile anything against a fence, for it will surely push it over.

PUMPS: Do not jerk a hand pump, but pump with a long, steady stroke. Do not leave the windmill running needlessly in a high wind.

MACHINERY: The proper use and care of farm machinery falls under a considerable number of definite heads that may be enumerated as follows:

1. Know before starting to use a machine *exactly* what it is designed to do, and how it is intended to work.

2. Never put a machine to a use for which it was not intended: For example, never use a monkey wrench for a hammer; never use the head of an axe to pound anything made of iron; and never use a good mowing machine or the best scythe to cut weeds unless positively directed to do so. In that case, look out for snags, old iron, and fence or baling wire that may injure or destroy the knives.

3. Know when the tool is working properly, and if it is a piece of geared machinery learn the peculiar sound it ought to make. When it begins to make a different sound stop and hunt for trouble.

4. Learn to know all the places for oil, or for grease on every machine you undertake to use. Be sure to *find all the places*, and be sure that the oil holes are open. Do not oil or grease a place not intended for lubrication; for example, an unprotected part working in the dust.

5. From time to time clean all running parts that collect gum or worn-out grease. If they cannot be readily reached, a little kerosene will cut the old gum and clean the part fairly well.

6. Never drive a geared tool faster than intended. Therefore do not trot the team with a mower, binder, drill, or even the disk harrow.

7. Keep all stationary parts tight, and all working parts snug but not tight. If a piece of wood is bolted between two pieces of iron, keep it well soaked with oil or the iron will eventually cut it in two by repeated swelling and shrinking.

8. If a nut works loose, take it entirely off, clean and oil the thread upon the bolt, and *clean the bearing against which the nut is to be screwed down*, for sand or dirt left there will act as roller bearings to loosen the nut again.

9. Do not let nuts become so tightly rusted that they cannot be removed. To prevent this, apply a little oil or kerosene occasionally.

10. Remember always that most bolts and nuts are *right-handed*; that is, to turn a nut with the hands of a watch is to tighten it, and vice versa.

11. When adjusting the wrench to tighten or loosen a nut, make the wrench fit snugly, else the corners of the nut are likely to be worn away.

12. To take off a stubborn nut it may be necessary to start it with a cold chisel. A glass stopper can be removed from a ground glass neck by heating, and a plug or cap can be twisted loose by doubling a stout string, beginning at the free ends and wrapping it around to the left until only the loop remains. A stick run through this loop as a lever will loosen almost anything.

SHARPENING TOOLS: Every cutting tool should be sharp, and each must be sharpened in a different way, the general principle being not to cut away any more metal than is necessary to get a good edge. In general the grindstone or the emery wheel is made to turn *against* the edge of the tool, else the edge will be "feathered" and rough. Touching special cases:

1. Mower knives are generally sharpened by a special emery wheel but the work may be done on the grindstone. In either case be careful to get a true bevel, *and do not sharpen the point of the sections more than is absolutely necessary.*

2. The axe and the scythe are sharpened on the grindstone, turning *against* the edge. The manner of holding must be learned by observation.

3. The spade and the hoe are sharpened with a flat file, doing the sharpening on the front or hollowing side in the case of the spade, and on the side next to the handle in the case of the hoe.

PRECAUTIONS: Never strike an axe into the ground or drop it carelessly, as it is almost certain to be dulled. Protect the cutting edge of every tool, even the spade and the hoe, against unnecessary abuse. Never lay a scythe upon the ground but always hang it up, lest people or animals run against it and get an ugly cut.

CARE OF BRIGHT SURFACES: Cutting tools should have their surfaces as well as their edges protected. If at all exposed to weather they should be kept well oiled.

Plowshares, moldboards, and cultivator shovels, as well as spades, hoes, and shovels, should be well cleaned whenever used in sticky soil, and immediately oiled. A flat brush with a dish of heavy oil is generally to be found prepared for this purpose. If not found, it might be well to ask for it.

CARE OF HARNESS: Lines should never be allowed to drag upon the ground or get under the horses' feet. Harness should be occa-

sionally taken apart, cleaned with soap and warm water, oiled, and carefully repaired where needed.

Next only to the proper handling of horses, the helper will endear himself to his employer more by showing intelligent and workmanlike care of equipment than by any other means, and this easy road to the farmer's good graces is heartily recommended.

United States Boys' Working Reserve

Farm Craft Series

LESSON 13

THE WAGON AND ITS PARTS

The wagons used on Illinois farms can be divided into two general types, namely, farm *wagons* and farm *trucks*.

THE WAGON: The farm wagon may have front wheels as large as forty-four inches in diameter and rear wheels fifty inches. Fitted with box and with rack, it is used for general farm work, but it is best adapted to the highway and for hauling to market grain, hay, live stock, and other finished products.

THE TRUCK: The truck has smaller wheels—not over thirty-six inches in diameter in front and forty inches behind—and hence requires more horse power, especially on uneven ground. To offset this disadvantage the wheels have wider tires, often from four to five inches. This prevents settling into the soft ground of the fields, for the truck is used mainly on the farm, where its low platform, instead of a box, and its smaller wheels especially adapt it to hauling hay, potatoes in boxes, grain in the bundle, fencing, and all sorts of materials that are moved about upon the farm.

DETAILS OF A WAGON

TRACK: The "track" of a wagon, as marked in Fig. 1, is the lateral distance between the centers of the wheels measured on the ground. There are two standard widths for track; the wide track, which is five feet in width; and the narrow track, most generally used, which measures four feet, six inches.

RUNNING GEAR: The entire part of the wagon shown in Fig. 1, including the wheels, axles, bolsters, and reach, is called the running gear. This is what in an automobile would be called the chassis. With this running gear can be used a tight box for hauling grain or other loose material, a hay rack, a hog rack, and various other types of special bodies.

Springs may be used to support the box on a wagon, but this is not common practice.

In putting a hay rack on a wagon the reach is lengthened and extra bolsters are put in to hold the rack up above the wheels.

In hilly countries brakes are necessary on the wheels, but in a flat prairie country these are not used.

PARTS OF THE WAGON: It is well for the student to familiarize himself with the names of the parts of a wagon. This knowledge is of importance because it will sometimes be necessary for the boy

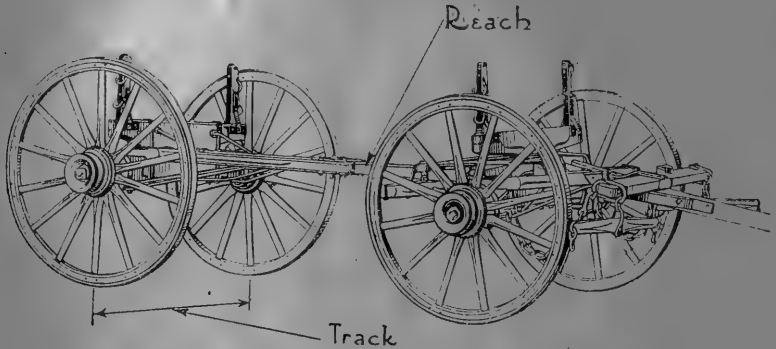


Figure 1

working on the farm to describe a certain part, as when something is broken or lost, and he will find this difficult if he does not know the names.

Fig. 2 shows the *tongue* and its attachments. It is often referred to as the *pole*. Note that the *wagon hammer* which attaches the *doubletree* to the wagon and through which all of the pulling force is transmitted is also a wrench which fits the nuts on the axles.

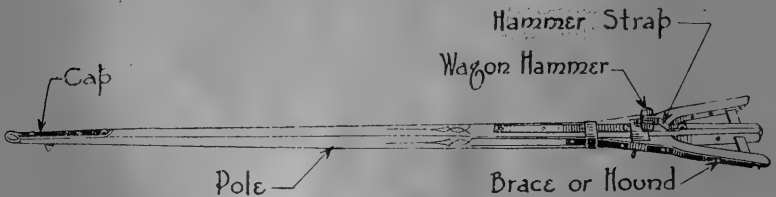


Figure 2

Fig. 3 shows the parts which are used with the tongue. The *neck yoke* fits on the front end of the tongue and is also fastened to the hames of each horse. The neck yoke, therefore, supports the front end of the tongue from the horses' necks and also guides the wagon as the horses turn one way or the other. In hitching the horses to the wagon always put on the neck yoke and slip its ring

over the end of the tongue first of all. It may readily be seen that if, with the end of the tongue still lying on the ground, the harness were attached to the singletrees and the horses should suddenly

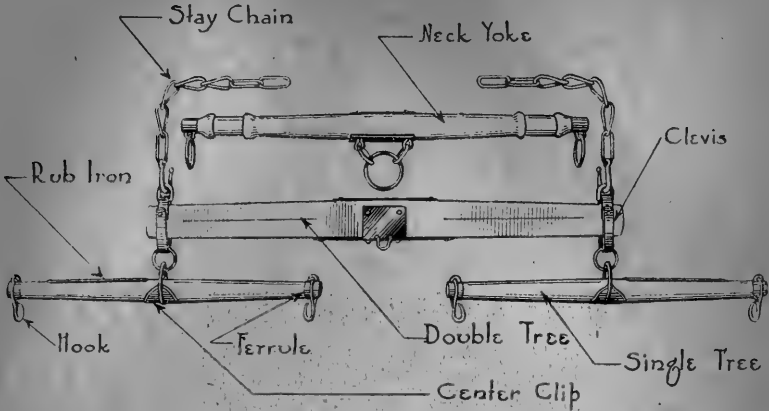


Figure 3

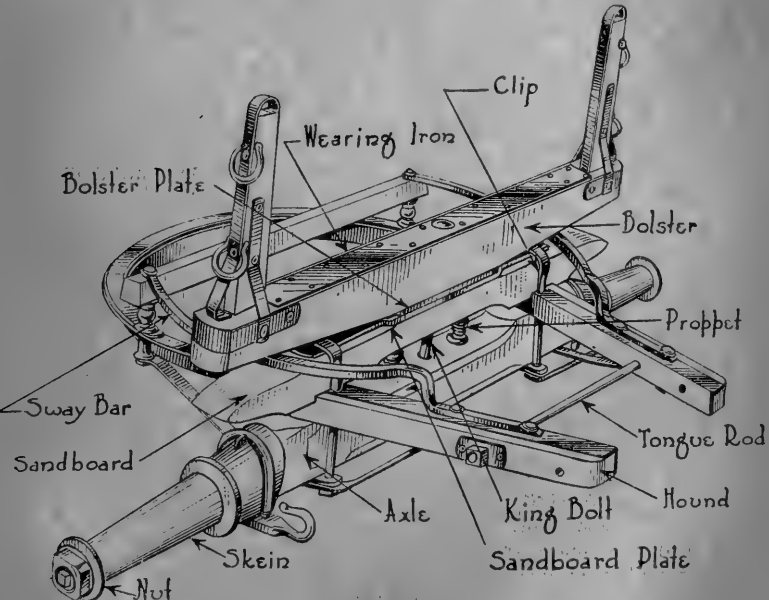


Figure 4

become frightened, the situation would be dangerous. Always attach the lines first, then the neck yoke, and last of all the tugs or traces.

Fig. 4 shows the details of the front part of the running gear. Fig. 5 shows the corresponding details of the rear part. Fig. 6 shows details of the wheel. (Felloe is pronounced felly.)

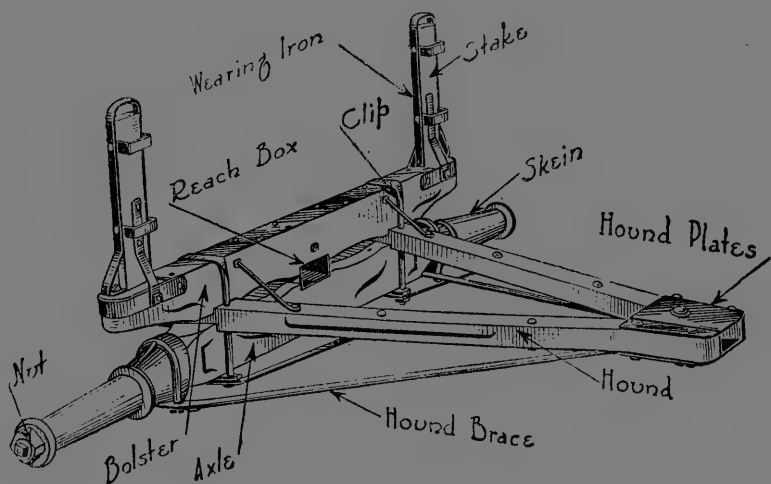


Figure 5

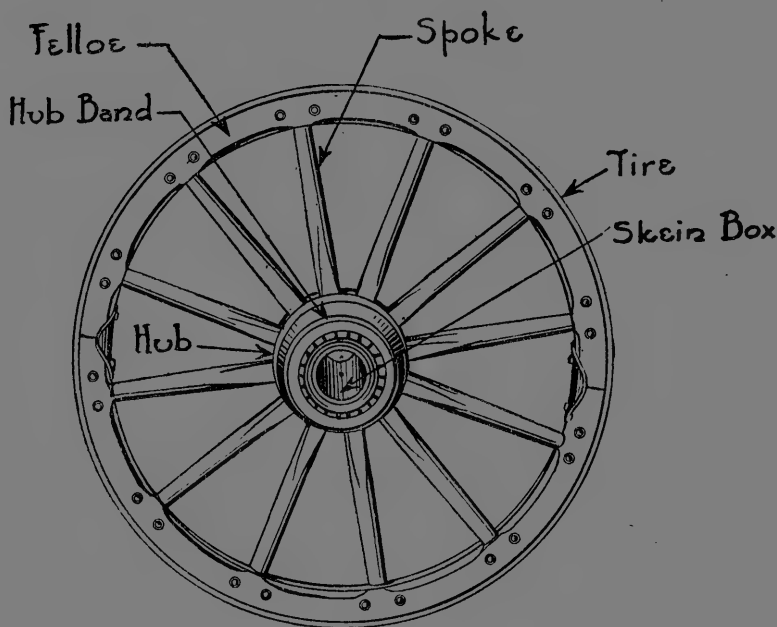


Figure 6

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Farm Craft Series

LESSON 14

CARE OF THE WAGON

The wagon like any other implement needs care if it is to do its work and last well.

GREASING: The bearings between the skeins and skein boxes, that is, the bearings upon which the wheels revolve, are the only parts of a wagon which require frequent lubrication. This should be attended to as often as necessary to keep the surfaces from wearing bright. It is hard on the wagon and also much heavier pulling for the horses if attention is not given to this point. A good grade of axle grease is ordinarily used for the purpose, and usually applied with a wooden paddle.

Fig. 1 shows the common method of greasing the wagon. The axle nut is taken off and the wheel slipped cautiously outward until the skein is partly exposed, when grease, to the amount of two or three tablespoonfuls, can be applied and the wheels slipped back into place. This operation requires caution because of the danger that the wheel will slip entirely off and let the axle fall to the ground. Most farms, however, are equipped with wagon jacks with which the weight of the wagon is lifted so that the wheel may be taken entirely off, giving a better opportunity for proper cleaning and oiling.

TURNING OR BACKING: In turning or backing a wagon, great care should be exercised that the angle of turn is not so sharp as to throw undue strain upon the tongue, the reach, and the wheel. This is one of the most common abuses to which a wagon is subjected.

When a wagon with a box is turned, one of the front wheels strikes the rub iron on the side of the box. If an attempt is made to turn still shorter, a strain is not only thrown upon the wheel and tongue, but the corner of the tire cuts into the lower corner of the box, ultimately wearing the rub iron in two. With trucks in which

the front wheel can turn under the rack or box, the condition will be somewhat eased, but there is an equal likelihood of breakage when too short a turn is made.

CARE OF THE FELLOES: The paint quickly wears off the felloes and they should be frequently oiled. Most farmers neglect this precaution, and the result is that when the dry season comes the



Fig. 1.—Greasing the Wagon

tires become loose. Perhaps the boy can persuade the farmer to supply a little linseed or crude oil for the purpose if he has not already provided it.

LOOSE TIRES: Never use a wagon with a loose tire, and as soon as you observe such a tire report it. The wheel is one of the most expensive parts of the wagon and is easily ruined when the tires

are loose. A loose tire not only means that sand will work beneath the tire and rapidly grind out the felloe so that the tire will not fit well even after setting, but also that the spokes will soon be loosened from the hub, ruining the wheels.

Temporary relief can be obtained by soaking the wheel in water or in hot oil, or by wiring the tire on the felloe. These measures, however, should be resorted to only in cases of extreme necessity. If a tire should come off when the wagon is in use, stop immediately, as a wheel in this condition will be quickly ruined.

SETTING: The only remedy for a loose tire is "setting," a job that is usually done by the blacksmith. To "set" the tire, it is removed from the wheel by tapping the *outside* of the felloe with a hammer until the tire gradually works off and comes away. It is then heated and "upset," that is, made smaller by a machine for the purpose. Being swelled by the heat it can be easily put over the wheel while hot and afterward "shrunk on" by cooling with water, which also prevents burning the wheel.

CARE OF THE BOX: Fence posts, stone, manure, and such rough or dirty material should never be put into the wagon box. Special dump boards are kept on all farms for this rougher use of the wagon, and the box itself should be kept clean and whole for hauling grain.

When the box is removed from the running gear, it should, if possible, be stored under shelter to protect it from the effects of the sun and the rain. If the wagon box must be left out of doors, every possible precaution should be taken to preserve it. If it is turned bottom up and with one end higher than the other, water will drain off much better than if it is left flat.

As a wagon box is too heavy to be removed in one piece, the tip-top and the top boxes are generally taken off separately. If these parts are removed while assembled, they are likely to be twisted out of shape or broken. It is much better to remove the end gates, replacing the rod so that it will not be lost, and store the parts flat.

RIVETS, BOLTS, AND RODS: As with other farm implements, any rivet or bolt on the wagon which comes loose should be tightened immediately. There are no minor abuses that will cause more rapid deterioration of a machine than carelessness in attending to these small details. "Do it now" is the motto to follow in the repair of wagons as of other machinery.



United States Boys' Working Reserve

Farm Craft Series

LESSON 15

THE PLOW

The plow is universally recognized as the fundamental implement for tillage of the soil. The hoe and the plow in very crude forms were undoubtedly the first tools used by man for agricultural purposes, and very probably the plow will be the first implement that the city boy employed on a farm will be called upon to operate.

GOOD PLOWING: Good plowing is an art. The real plowman who takes pride in his work is an artist, producing that which is not only necessary but also beautiful to look upon—a perfectly plowed field. He turns a *straight* furrow of *uniform width* and *depth*, covering the trash, pulverizing the soil, and leaving the ends regular.

THE WALKING PLOW: The walking plow, turning a single narrow furrow and drawn by a two-horse team, was used almost entirely until a few years ago, but in many sections it has now been replaced by the larger riding plow, turning two or more furrows. It is an advantage to have learned plowing with the walking plow because in that way a man is more likely to understand and appreciate the importance of proper plow adjustments. The more modern riding plows can be operated with fair success, even though not properly adjusted, while this is impossible with the walking plow.

LAYING OFF: In starting to plow a field the area is frequently "laid off" in spaces or strips called "lands," each of which is to be completed separately. The city boy going to the farm will not be called upon to lay out a field for plowing, as this is a matter requiring considerable experience and will be done by the owner or manager. After the land is laid out, however, the boy should be able to follow the furrow and to plow the field without troubling the farmer with anything beyond a little initial instruction. To become a really good plowman will require not only extreme care but much practice, for good plowing is not easy.

ADJUSTMENT OF THE PLOW: Different types of plows have varying sorts of adjustments which the boy must learn on the implement itself. As the owner decides upon the depth, so will he probably adjust the plow for the new helper, and it is the boy's job to

keep the adjustment as made; indeed, it is a good rule when a plow is once properly adjusted to "let it alone."

DEPTH: The depth at which the walking plow will run is regulated by raising or lowering the hitch at the front end of the beam. The depth at which the plowing should be done will vary from four to eight or nine inches, depending upon the kind of soil, the crop to be planted, and the previous treatment of the field. In general, sod ground is plowed considerably deeper than stubble.



A. Good Piece of Plowing

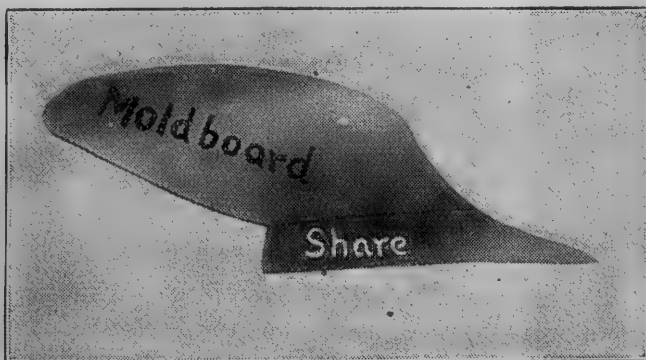
WIDTH: To increase the width of the furrow move the hitch at the end of the beam away from the plowed land, and to decrease it move the hitch toward the furrow. The maximum width of furrow which a plow will turn will depend upon the width of the plow bottom, and the plowman should never attempt a wider furrow, for the result will be only to "cut and cover," leaving a bad job to be followed by a poor spot in the crop.

BALKS: When plowing, if for any reason the plow should jump out of the furrow, do not continue, for that would leave an unplowed spot or "balk." It might be covered up by the soil from the next

furrow and might not show when the job was finished. That spot, however, would not be properly prepared to receive the seed and would not produce its proportion of the coming crop. In such a case, stop the team, pull the plow back, and start again.

TURNING A CORNER: To turn a corner when plowing a field with a walking plow, stop the implement so that the point is just at the end of the furrow slice. Then bring the horses around through an angle of forty-five degrees, at the same time pulling the plow back and over into the position to cut the desired width of furrow. This method will turn all the soil with a minimum of labor required in handling the plow.

SCOURING: One of the most important things in proper plowing is that the plow bottom should scour; that is, that the soil should not stick, but should roll clean from the surface, leaving a bright, smooth *land polish*. If the soil is of a type which does not scour



well, then before going to the field clean all grease or rust from the surface of the bottom of the plow and polish it as bright as possible. If the trouble is encountered in the field, clean the surface frequently until the trouble is remedied, that is, until the plow begins to scour. A wooden paddle will be found very useful for this cleaning process.

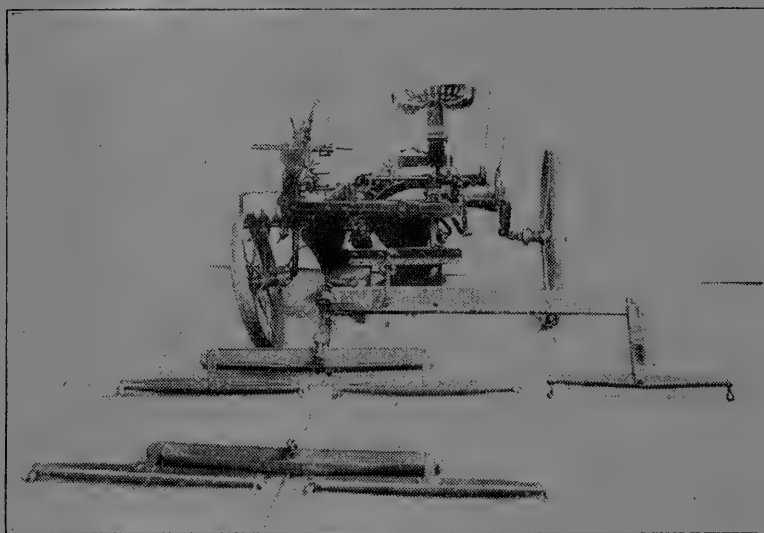
When through using a plow, the surface of the moldboard should be coated with axle grease or with some other rust preventive. This will preserve it in proper condition for use the next time.

THE LARGER PLOWS: In using a sulky, gang, or tractor plow, it is of particular importance that attention be given to the various lever adjustments. These could be explained at great length, but for practical purposes the city boy going to the farm should give close attention to the instructions given him by the farm manager and when in doubt he should ask for further information rather than go ahead with the possibility of being in error.

STEADY PLOWING: Sometimes an ambitious team on the plow may walk faster than is desirable for good work and in that case

it should be held in to a steady pace. Plowing is a long and tedious job which is accomplished not by sudden spurts nor by hurrying, but by steady, careful work so accomplished that every square foot of the field is well tilled and in condition to produce its part of the crop. Rapid plowing is undesirable because it throws the soil out of its normal position and tends to leave the field undulating instead of in continuous, uniform furrows.

SPECIAL PRECAUTIONS: Careless teamsters often leave the breast straps hanging while working a team on the plow, harrow, or other tongueless tool. When that is done the heavy iron snap strikes the knee every time the horse stops, often making an ugly sore. This is cruel heedlessness, and in all cases the breast strap should be snapped into the hame ring as if in actual use.



Riding Plow

United States Boys' Working Reserve

Farm Craft Series

LESSON 16

THE MOWER

Mowing is a job that is almost certain to fall to the lot of the boy who volunteers for farm work. This is not a difficult task, but one that requires a good deal of care.

POINTS NEEDING ESPECIAL ATTENTION: 1. Drive carefully, so that the sickle bar cuts a full swath, but do not let the inside shoe run onto the uncut grass, thus leaving a strip that will not be cut. Do not let the horses step on the uncut grass.

2. In approaching a corner drive straight ahead until the sickle bar is entirely out of the uncut grass. Then turn the team carefully so as to start in squarely. Many men who operate a mower are careless in turning at the corners, leaving bunches of uncut grass which give the field a ragged appearance. Show interest in your work by doing a neat job.

3. *Throw the mower out of gear every time you stop* to clear or adjust the sickle. Failure to observe this precaution is responsible for many fingers cut off and some ankles wounded, for when the machine is "in gear" a slight movement of one of the horses will move the sickle enough to make an ugly cut. Never shift the gear lever while the machine is in motion.

4. When working with the sickle always stand *behind* the sickle bar; *never in front*. This is a case of safety first.

5. When you stop for any purpose during the trip across the field, back the team a few inches before starting again. This will enable the sickle to get up motion before reaching the uncut grass.

6. The mower has many rapidly moving parts, and must be oiled frequently. Be sure that the oil ducts are open so that the oil can get down to the working parts where it is needed. Follow your employer's instructions carefully on this point. Feel of the

pitman bearings occasionally, and if they seem to be getting hot, oil more frequently.

7. Keep the sickle sharp.

MOWER ADJUSTMENTS

The following suggestions will help to keep the mower in proper adjustment for best work. Never attempt, however, to make radical adjustments of the parts of a mower or other implement without your employer's consent.

ALIGNMENT: When the mower is in operation the knife and pitman should work in line; the machine is then said to be aligned. Due to strains, or to wear in the hinge between the cutter bar and yoke and in the joint between the yoke and main frame, the outer end of the cutter bar on old machines often drops back of alignment

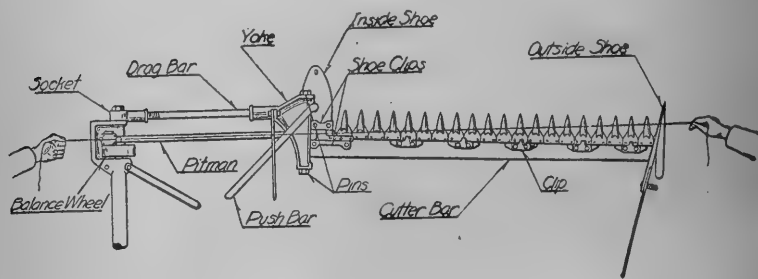


Fig. 1.—Nonalignment Causes Increased Draft

as shown by the string in Fig. 1. The power from the pitman must then be transferred to the knife through an angle, and this causes friction on the inside shoe parts, with increased draft and greater wear.

A good method of testing for alignment is the string method illustrated in Fig. 1. The resistance on a cutter bar will cause the outer end to drop back an inch or so when the mower moves forward at normal speed. Thus, when the machine is standing idle the outer end of the bar should have a slight lead when tested with the cord. The usual practice is to give the outer end of a five-foot cutter bar about an inch lead, and a six-foot bar, about one and one-half inches lead.

Many mowers are now equipped with special aligning devices. The operator should inspect his machine carefully to locate the aligning adjustment and then use it to secure lighter draft.

CENTERING: In order that the knife sections may have the greatest speed when they have the most work to do, they should "center"; that is, at the end of the instroke and outstroke the center of each knife section should come to rest at the center of its guard. If the knife does not center, as illustrated in Fig. 2, increased draft, side-draft, and poorer work will result, because one edge of the section fails to play past the edge of the guard sufficiently to make a clean cut, but pulls the grass off instead.

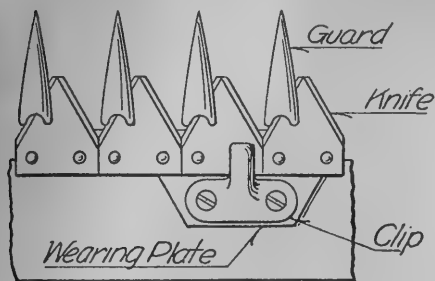


Fig. 2.—If the Knife Is Off Center, Side-Draft and Increased Draft Will Result

Non-centering is caused by carelessness in fitting a new pitman stick, by getting the knife rib too long when it is welded, or by the operator attempting to align the machine by shortening the drag-bar. Proper centering can be re-established on most machines by moving the entire cutter bar to the left or to the right, as the case may demand. In the case illustrated in Fig. 2, the cutter bar should be forced to the right, or the knives to the left. On most machines this can be done by lengthening the drag-bar at the socket connection described above. Some mowers carry other forms of centering devices, and operators should locate such features.

SIDE-DRAFT: Sharp scissors, properly adjusted, cut easily, but if one loosens the screw that holds the blades together, no matter how sharp the blades, they will spread sufficiently to wedge material between them instead of cutting it. This wedging, crushing action causes the scissors to work very much harder than when the blades are held close together.

The cutter bar of a mower is nothing more or less than a series of shears. The ledger plate in each guard and the corresponding knife section are the blades in each pair of scissors, while the clip, shown in Fig. 3, takes the place of the screw to hold these two shearing plates in the proper relation to produce a cutting rather than a wedging and crushing action. But, due to wear, the knife sections begin to leave the ledger plates after the mower has been some time in use. Thus the proper shearing action of the cutting mechanism is destroyed; the grass is drawn in and wedged between the cutting blades and, instead of being cut off easily, the stems

are crushed and pulled off as the cutter bar moves to the front. Each of these uncut stems helps to pull back on the cutter bar, causing increased draft.

Side-draft may be caused, too, by one or more guards being bent up or down. When the mower leaves the factory, the guards and the ledger plates are exactly in line, and the operator who

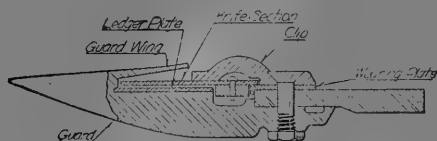


Fig. 3.—The Cutter Bar Is Simply a Series of Shears. Its Parts Can Be Easily Adjusted to Do Good Work with Light Draft

cares for light draft must keep them in that relation. Perhaps the best method of aligning is as follows. After the knife has been removed, place a straight piece of strap iron about $\frac{1}{4} \times 1\frac{1}{8} \times 15$ inches on the ledger plates and, using this piece as a straight edge, move it back and forth over the plates, noting which are high and which are low. Then drive a misplaced guard back into alignment by hitting it a sharp hammer blow where its stock is thick. The guards are malleable. If a new guard with new ledger plate has been supplied recently, it may set a little too high. In such case it is well to place a piece of tin between the guard and cutter bar where the two are bolted together.

Another common cause of side-draft is excessive wear on the underside of the lips of the clips. The faces of the clips wear away rapidly because there is considerable pressure upon them by the knife sections, as the latter tend to spread from the ledger plates. As the wear on these parts increases, the knife sections tend to raise farther from the ledger plates, until finally the same conditions will exist at every guard as exists in scissors when the screw is loosened.

United States Boys' Working Reserve

Farm Craft Series

LESSON 17

THE GAS ENGINE

Internal combustion engines produce power by burning an explosive mixture of fuel and air in a closed cylinder behind a piston. Gasoline and kerosene are the fuels usually used in farm engines. The force of the explosion pushes the piston toward the open end of the cylinder and, by means of a connecting rod between the piston and the crank, turns the crankshaft of the engine. Since practically all farm engines run according to the four-stroke cycle, and have poppet valves, only this type of engine will be described.

ESSENTIAL PARTS OF AN ENGINE

Inside of a straight, round *cylinder* is snugly fitted the *piston*. (See Fig. 1.) The piston is shaped like a straight-sided, flat-bottomed cup. To make the piston a leak-proof fit in the cylinder, *piston rings* are provided in grooves extending around the piston. These rings serve the same purpose as the leather on the plunger of a tire pump. The *piston pin* is fastened cross-wise in the piston and to it one end of the *connecting rod* is pivoted. The other end of the connecting rod has a *bearing* by which it is attached to the *crank* or *crank pin*. As the *crank shaft* is turned the piston moves to and fro in the cylinder. The end of the cylinder further from the crank shaft is a confined space called the *combustion chamber*, because in this space the fuel mixture is burned. Opening into the combustion chamber is an *inlet passage* through which the fuel mixture is drawn into the cylinder. The *exhaust passage* is another opening for the release of the burned gases. Each of these passages is closed by a *poppet valve*, a round disk fitting tightly against a circular *valve seat*. Each valve has a stem by which it is opened and closed, and which guides it to its seat. Extending into the combustion chamber is a *spark plug* (or an *igniter*) by which the fuel mixture is set on fire or *ignited* at the proper instant. On the *crankshaft* is a gear which drives the *half-time gear*. The half-time gear makes one turn while the crankshaft makes two turns. The half-time gear turns a *cam* which, through a rod or lever, opens the exhaust valve at the proper time. The valve is closed by a coiled spring around the stem. The inlet valve may be operated in the same way, but on farm engines the inlet valve spring is often made very weak, so that the valve can be opened by the suction of the piston. The ignition device is also timed from the half-time gear.

CYCLE OF OPERATION

Starting at the *inner dead center* (the position of the engine in which the piston is pushed furthest into the cylinder), a half turn of the flywheel and crankshaft moves the piston to the open end of the cylinder and greatly increases the space in the cylinder back of or above the piston. During this piston movement the inlet valve is open and the cylinder is sucked full of fuel mixture. The movement of the piston from one end of its travel to the other is called a *stroke*. This is the first or suction stroke. (See A, Fig. 2.)

At the end of the suction stroke the inlet valve closes and the piston moves into the cylinder, crowding the fuel mixture into the combustion chamber. This crowding of the mixture into a small space, called *compression*, raises its pressure and increases the power it gives when burned. Near the inner dead center the compressed gas is set on fire by an electric spark at the ignition device, and burns so quickly as to be called an explo-

sion. The explosion produces a very high pressure against the piston. When the spark occurs late, or past the dead center, it is said to be *retarded*. When an engine is running at its regular speed the spark should occur slightly before the dead center so that the burning of the gas will be complete before the next stroke begins. The spark when set to ignite before the dead center is said to be *advanced*. The amount of advance varies with different engines, but usually is between 10° and 20° . (See B, Fig. 2.)

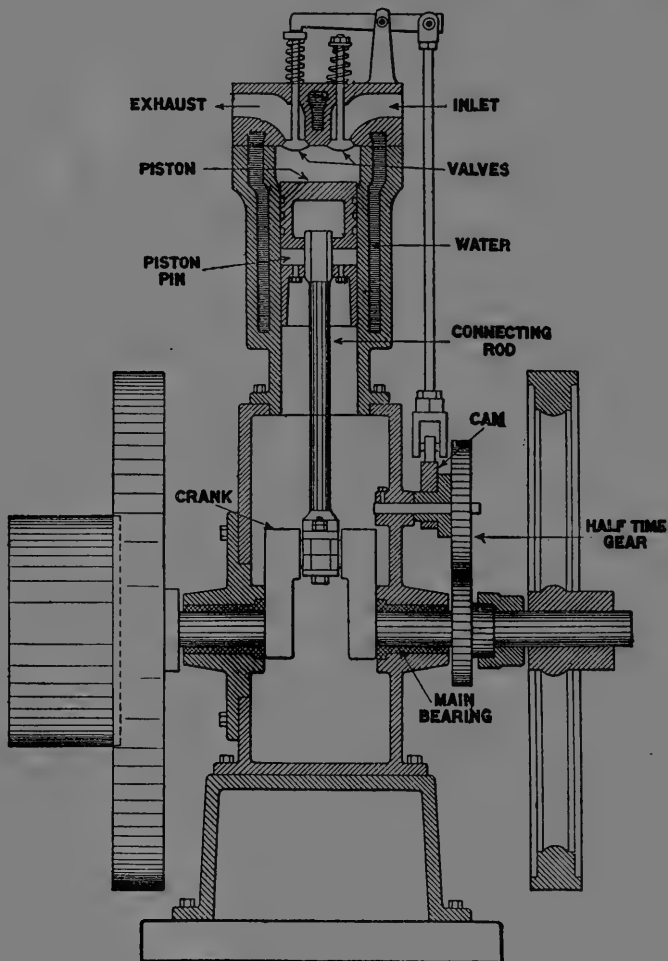


Fig. 1.—Construction of Single-Cylinder Vertical Engine

As soon as the piston has reached the inner dead center on the second or *compression stroke* it starts outward on the *working stroke*. Because of the high pressure of the burned gases a strong force is exerted against the piston and this increases the speed of the crankshaft and flywheels. Just before the end of the working stroke the exhaust valve is opened and the burned gases escape from the cylinder, making the report which is called the "exhaust" of the engine. This is the third stroke of the cycle. (See C, Fig. 2.)

During the fourth stroke the exhaust valve remains open and the piston moves inward, pushing out the burned gas remaining in the cylinder. (See D, Fig. 2.) At the end of this stroke the exhaust valve closes and the engine is ready to begin another suction stroke. This series of operations, which is repeated over and over as long as the engine runs, is called a *cycle*, and as it occupies four strokes of the piston it is a *four-stroke cycle*. This name is often shortened to *four-cycle*. It is because the four strokes of the cycle occupy two revolutions of the crankshaft that the valves and ignition are operated by the half-time gear. Because power is produced during only one of the four strokes heavy flywheels are provided to steady the motion.

CARBURETORS AND MIXING VALVES

The fuel mixture of which we have spoken is made by spraying gasoline or kerosene into the stream of air as it is drawn into the cylinder by the motion of the piston. In the suction feed fuel mixer the air inlet is made rather small so that the suction in the passage will be strong enough to

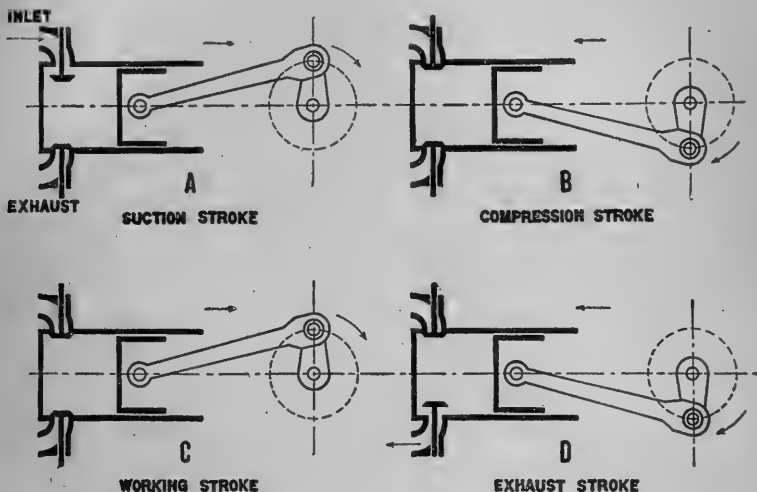


Fig. 2.—Diagram of Four-Stroke Cycle

lift the fuel from the tank to the spray nozzle. A check valve keeps the fuel from running back to the tank between suction strokes. The amount of fuel mixed with air is adjusted by a needle valve. (See a, Fig. 3.)

The needle valve of a simple mixer or carburetor should be set so that the engine gets enough fuel to run without missing explosions or back-firing (a popping in the inlet pipe), but not enough to produce smoke from the exhaust. Accurate adjustment of the needle valve cannot be made until an engine is warmed up to its normal temperature. Tiny amounts of dirt or water in the fuel are the usual cause of mixer or carburetor trouble.

In the float feed carburetor a float in a cup is used to maintain the fuel level just below the outlet of the nozzle. The nozzle and the cup are connected so that the fuel level is the same in both. As fuel flows into the cup the float rises, and when the level is high enough the float closes the valve which admits fuel from the tank to the cup. Carburetors of this type may be of complicated construction embodying a number of adjustments. When so made they are usually arranged so that the adjustments need not be disturbed in the ordinary running of the engine. The simpler ones have a needle valve for the regulation of the fuel flow only. (See Fig. 3, b.)

IGNITION OF THE COMPRESSED MIXTURE

Each cylinder charge of fuel mixture must be lighted at the end of the compression stroke in order that it may explode and produce power. This lighting or *ignition* is done by electric sparks, which may be produced by either a *low tension* system or a *high tension* system. A low tension system has only one circuit, while a high tension system has two circuits.

Low tension battery ignition is used on many farm engines. A *battery*

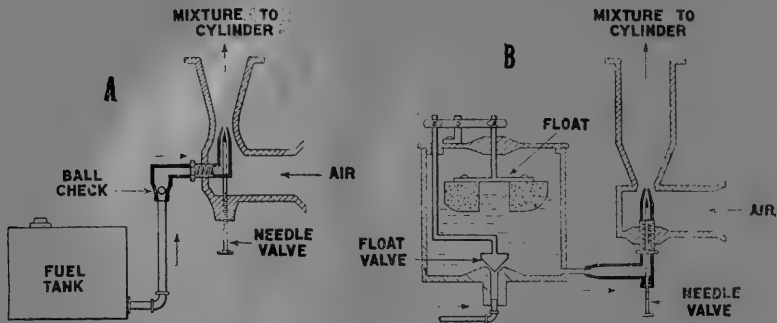


Fig. 3.—A: Simple-Mixer with Suction Feed. B: Float Feed Carburetor

(usually five or six dry cells), a *low tension spark coil* (a coil of coarse, insulated copper wire wound around a bundle of iron wire), a *make-and-break igniter*, and connecting wires make up this system. A switch is usually added for turning the ignition on and off. The igniter consists of a plate which is bolted over an opening into the combustion chamber, and of two *electrodes* which extend through the plate. The stationary electrode is insulated with mica washers so that current cannot pass from it to the surrounding metal, and is clamped firmly in place. The movable electrode is free

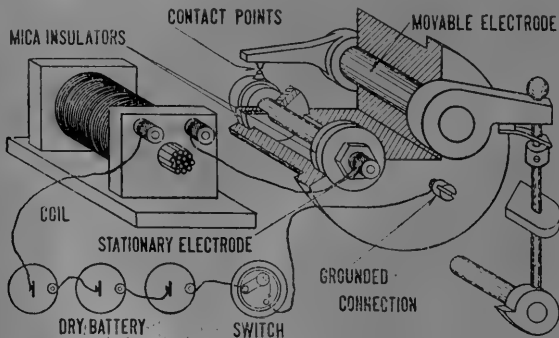


Fig. 4.—Diagram of Low Tension Ignition System with Battery

to turn and on its inner end has an arm which may be turned into contact with the stationary electrode. When the *contact points* of the electrodes come together and "make" the circuit, a current flows from the battery through the coil to the stationary electrode, then through the movable electrode to the metal of the engine, which is called *grounding* the current. The current flows through the metal of the engine to another wire which carries it back to the other end of the battery, the switch often being connected into this wire. When the contact points separate, the circuit is "broken" and a spark occurs between the contact points as they move apart. The movable electrode is moved by suitable mechanism connecting it to the half-time gear. (See Fig. 4.)

United States Boys' Working Reserve Farm Craft Series

LESSON 18

THE GAS ENGINE—Continued

In place of the battery and coil an *oscillating magneto* is often used. It is driven from the half-time gear and is located very close to the igniter, so that the movable electrode may be operated by the magneto shaft. By eliminating the battery and most of the connecting wires the use of an oscillating magneto avoids most ignition troubles and provides a very reliable source of current. (See Fig. 5.)

In high tension ignition, current of very high pressure or *voltage* jumps from a well-insulated electrode to a grounded electrode, both of which are

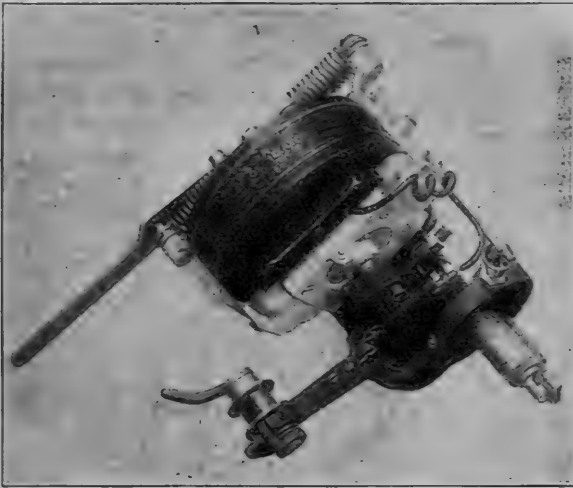


Fig. 5.—Oscillating Magneto Combined with Make-and-Break Igniter

stationary. These electrodes are made into a device called a *spark plug*. The porcelain or mica insulation of a spark plug should be kept reasonably clean from oil or soot. The spark points should be separated by the thickness of a worn dime at the place they are closest together. (See Fig. 6.)

The high tension current may be delivered to the spark plug by a *vibrating coil* in connection with a battery and *timer*. (See Fig. 6.) The battery current flows from the battery through the *primary winding* and *vibrator contacts* of the coil, thence by wire to the *timer*, which is simply a device for making or closing the circuit at the proper instant and which is driven by the half-time gear. Usually the current is grounded at the timer and flows from the metal of the engine through a wire and switch back to the other

end of the battery. The current flowing through the coil is stopped very frequently by the breaking of the circuit at the contact points of the vibrator, which buzzes when the coil is working. The coil is so made that instead of making a spark at the vibrator points, where the circuit is broken, a high

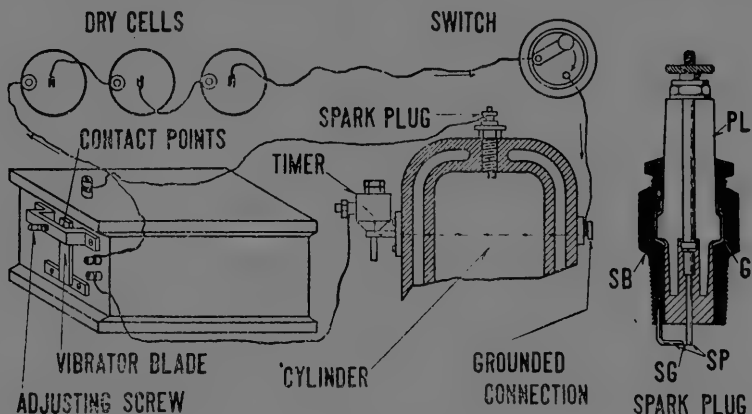


Fig. 6.—Left: High Tension Ignition with Battery and Vibrating Coil. Right: Section of Spark Plug
 PL=Porcelain Insulator
 SB=Steel Body
 G=Gasket
 SP=Spark Points
 SG=Spark Gap

tension current is produced in the *secondary winding* of the coil, and this high tension current is led by a well-insulated wire or cable to the spark plug where it makes a spark.

A very reliable source of high tension current is a *high tension magneto*. Between the ends or *poles* of a set of steel permanent magnets the space is called a magnetic field because in this space magnetic forces are strong.

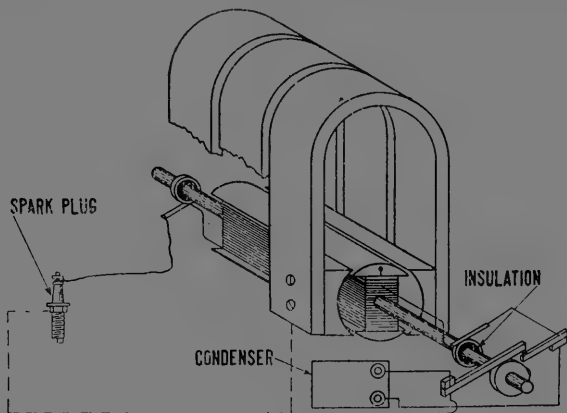


Fig. 7.—Diagram of High Tension Magneto

In the magnetic field is a *rotor* which, when turned, causes the magnetic forces to flow first in one direction and then in the opposite direction through a coil or *winding*. If a winding is part of the rotor and turns with it, the whole is called an *armature*. The variation in strength and reversal of

direction of the magnetic forces through the winding generates a current by *electro-magnetic induction*. In a true high-tension magneto the winding is in two parts, one of coarse wire called the *primary winding*, the other of fine wire and much longer called the *secondary winding*, the secondary being connected to the primary so as to form a continuation of it. A pair of contact points operated by a cam provide means for short circuiting the primary winding. A *condenser* is connected between the contact points. As the rotor or armature revolves, the primary winding is short circuited until the current in it reaches its maximum. The cam then separates the contact points, opening the primary circuit. As the primary current is suddenly stopped a high tension current is generated in the secondary winding and conducted to a spark plug. The distributor is a device by which the high tension current is directed in turn to the several spark plugs of multi-cylinder engines. Magneto bearings need very little lubrication, and most magneto troubles are due to excessive oiling. Fig. 7 shows in diagram form the construction of a high tension magneto.

LUBRICATION OF THE ENGINE

All working parts of the engine, where one piece of metal turns or slides in contact with another, should be lubricated with suitable oil or grease. The oil or grease forms a film which separates the parts enough to keep them from wearing rapidly. The oil which lubricates the cylinder and piston also seals the joints between the piston rings and cylinder walls and prevents leakage of gases past the piston. For the cylinder, only a gas engine cylinder oil of suitable grade should be used. Common machine oil or steam cylinder oil must not be used in a gas engine cylinder as either will cause damage or trouble. Cylinder lubrication is very important and the feeding of oil to the cylinder must be maintained all the time the engine is running. Grease cups should be filled with clean cup grease or hard oil, never with any other kind of grease. It is just as important to keep dirt out of the bearings as to get oil into them.

MULTI-CYLINDER ENGINES

Engines often have two or more cylinders. So far as the cycle of operation is concerned each cylinder is a separate engine, but in construction some parts serve all cylinders. In timing the valves and spark each cylinder should be considered as an engine by itself. If the wiring of an engine having more than one cylinder is disconnected or removed, care must be taken to put it back just as it was or some of the cylinders, perhaps all of them, will not get their sparks at the right time. The firing order of a four-cylinder engine is either 1-3-4-2 or 1-2-4-3. Fig. 8 shows a four-cylinder vertical engine.

STARTING AN ENGINE

Attend to lubrication, putting a drop in every oil hole, turning down grease cups, and setting the cylinder oiler to dripping. Be sure that there is fuel in the tank and sufficient water in the cooling system. Retard the spark, to avoid danger of the engine starting in the wrong direction, or "kicking back." Turn on the switch. If the gasoline needle was closed when the engine was stopped, open it about two complete turns. If means are provided for the purpose, reduce the size of the air inlet. The engine should now start when the crank or wheel is turned in the direction in which the engine is made to run. If the engine is of such size as to make it difficult to turn it past the compression stroke, look for means of releasing part or all of the compression. A priming cock or valve is usually provided, but sometimes an extra cam or roller is used by which the exhaust valve is held open to relieve the compression. If any such device is used it should be closed as soon as the engine starts. Some engines may be started by holding open the inlet or exhaust valve while starting to turn the wheels.

The momentum of the turning wheels is then sufficient to overcome the compression when the valve is released.

As soon as the engine starts, open the air inlet to normal size; shut the priming cock or other compression release, and advance the spark to running position. Then if the needle valve has just been opened, adjust it as directed under "CARBURETORS." The operation of the cylinder oiler and the cooling system should be watched from time to time while the engine runs. In freezing weather the filling of the cooling system with water may be delayed until the engine is running smoothly, but it should not be allowed to get hot.

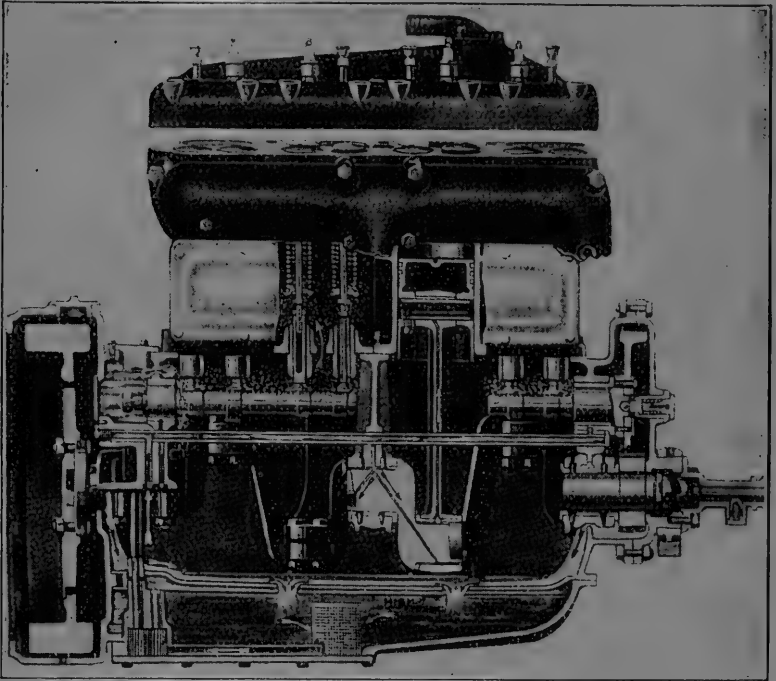


Fig. 8.—Four-Cylinder Tractor Engine. Arrows show direction of oil movement in lubricating system

STOPPING AN ENGINE

If the engine has a simple mixer, close the needle valve. If a float feed carburetor is used, do not disturb the needle valve or other adjustment. Turn off the ignition switch if one is provided. Stop the dripping of the cylinder oiler. In cold weather drain the cooling system, being sure that no water remains anywhere.

IMPORTANT POINTS.

To avoid serious damage to the engine it is necessary to make sure that cylinder lubrication does not fail; that the cylinder and piston do not become overheated through failure of the cooling system; and that no bearing gets hot enough to smoke. Constant watch should be kept for loose bolts, nuts, etc. If unusual sounds, such as knocking or pounding, should develop, the engine should be stopped and its condition called to the attention of the owner or manager.

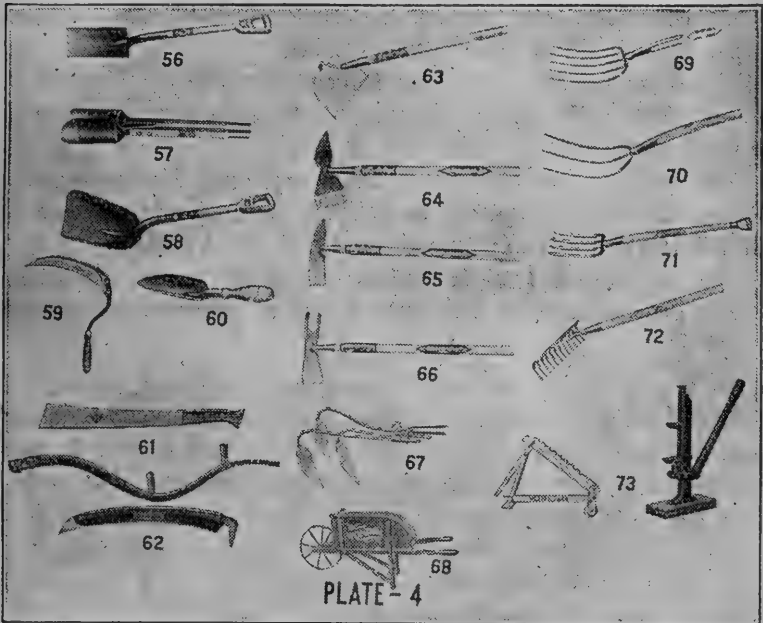
United States Boys' Working Reserve Farm Craft Series

LESSON 19

MISCELLANEOUS TOOLS AND SUPPLIES *

HAND TOOLS: Hand tools are common to every farm, and a little practice will make an operator proficient in their use.

The *spade* (56) has a steel blade 12 inches long and a wooden handle. The spade is sharpened with the bastard file. The size of



the spade is determined by the size of the blade. It should be kept polished, as it will then turn the earth with less labor. This tool may be used in digging a hole for a fence post.

* Illustrations from unpublished material supplied by G. H. Radebaugh, University of Illinois.

The *grass hook* (59) is used for trimming the grass and weeds around edges of the lawn. The blade may be sharpened with a scythe stone or grindstone. The *garden trowel* (60) is useful in transplanting flowers, cabbage, tomato plants, etc. The *hedge knife* (61) is made of a tempered steel blade and may be sharpened on the grindstone and oilstone. It is used, as the name implies, for trimming hedges. It is also used for cutting corn fodder, etc.

The *scythe* (62) will be found on every farm. Its principal use is for cutting weeds and for trimming close to fences. The blade is sharpened on a grindstone and whetted from time to time with a scythe stone. This puts what is called a wire edge on the blade.

The *hoe* (63) is used in the cultivation of cane, corn, sugar beets, and vegetables. The steel blade is about 5½ inches across. The *other hoes* (64, 65, and 66) are used for cutting weeds and for miscellaneous hoeing operations.

The *hand cultivator* (67) is very useful in the garden. Its principal use is to break the soil so that it will hold more moisture. It is used with the same action as the hoe.

The *three-tine hay fork* (70) is used in the hay field; also for handling feed in the stable. In many sections the four-tined fork is the more common.

The *spading fork* (71) is a garden tool used for turning over the ground. After using this tool, all the earth should be removed, and a light application of grease made to prevent rust.

The *wagon jack* (73) is made from wood or steel. It is used to raise the wagon so that the wheel may be removed for greasing the axle.

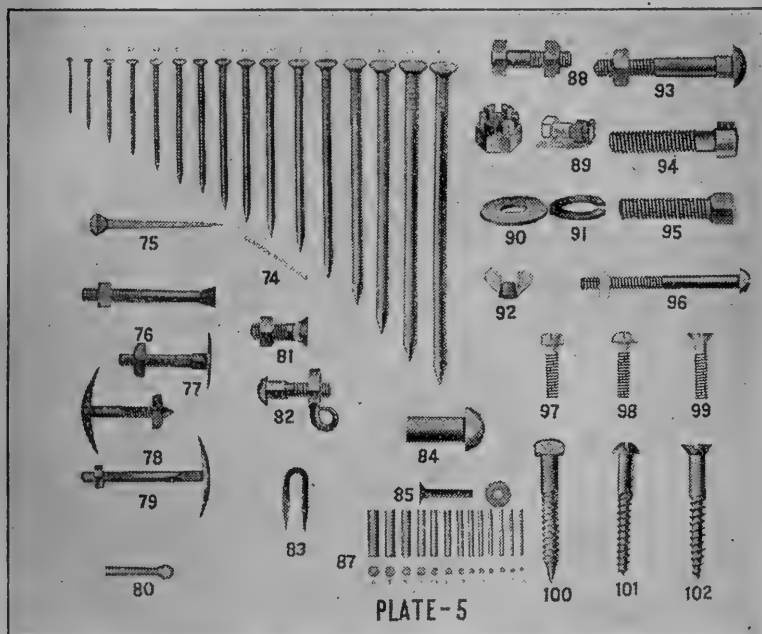
SUPPLIES: *Bolts* are used where great strength is desired. If a bolt is used on woodwork, *washers* (90 and 91) should be placed under the head and nut of the bolt. The *machine bolts* (88) have square, hexagon, or button heads. *Carriage bolts* (93) have a part of the bolt body square near the head. This is to keep the bolt from turning when the nut is being tightened. The *stove bolts* (96) have either flat or round heads, with a slot for the screw driver. As to sizes, stove bolts run by sixteenths from one-eighth to five-sixteenths. They are of special stove-bolt thread.

Preventing Rust: Rust is caused on iron or steel by oxidation due to the action of air and moisture. To prevent rust, the most common practice is to grease all polished parts with machine oil or axle grease. Sometimes salty fats are used. This is bad practice, as salt corrodes the metal. Another rust preventative, especially for-

mulated for larger tools that are kept out in the weather is an application, while warm, of a mixture of white lead and tallow. Equal parts of turpentine and linseed oil may also be used. These applications may be readily removed by scraping and wiping.

To remove rust from steel, cover the metal with sweet oil, well rubbed in. Forty-eight hours afterward rub with finely pulverized, unslaked lime. Then polish the surface with carborundum or emery cloth.

Sharpening Tools: The method of sharpening a tool is determined by its hardness. Tools may be sharpened by forging, filing,



grinding, and whetting. Most hand tools are tempered so hard that a file will not cut them. The group of tools (63, 64, 65, 66) are of fairly good steel and can be sharpened with the file. Axes, hatchets, knives, etc., are all hard, and must be ground on the grindstone and brought to an edge with the oilstone.

To properly sharpen tools requires experience. The beginner will encounter some difficulty in bringing a tool to a desired edge. This is accomplished: first, by grinding, then by whetting on the oilstone. In whetting, the motion may be back and forth or spiral. The tool must be held steadily on the stone. The position of hold-

ing the tool is controlled by the angle at which the edge has been ground on the grindstone.

A FEW PRACTICAL DON'TS FOR USING TOOLS

Don't say, "That's good enough."

Don't use a file for a pinch bar.

Don't use a monkeywrench for a hammer.

Don't try to cover up your mistakes.

Don't use a screw driver for a cold chisel.

Don't use a file without a handle.

Don't waste time by doing unnecessary work.

Don't use a pipe wrench on nuts; it burrs up the corners.

Don't forget there is a right and wrong way to use the monkey-wrench.

Don't use an open wrench that is too large for the nut.

Don't use the axe for a sledge hammer.

Don't use the axe for a lifting bar.

Don't use the pocket knife for a pry; it will snap the blade.

Don't use a spade for a crowbar; you may break the handle.

Don't forget that you turn the brace to the right when drilling holes.

Don't forget that pliers will not cut hardened steel wire.

Don't forget that when you go on the farm and are asked to get a tool you should at least know what it looks like.

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LESSON 20

ROPE AND ITS CARE

There are many uses on the farm for rope in sizes running from a quarter inch to an inch, rarely larger, and the helper should know a few things about its care and use. Knots and splices are treated in the two following lessons, but a few fundamental facts should be noted in advance.



Fig. 1.—Beginning

TAKING OUT THE KINKS: A new rope is "full of kinks," that is, it easily becomes partly knotted, will not run readily through pulleys, and is harsh and unpleasant to handle. If it is laid for a few minutes in boiling water it will be greatly softened and the kinks will very soon work out. If this plan is followed, a new rope will at once behave about as well as an old one.

PROTECTING THE ENDS: If the end of a rope is left unprotected, it will of course rapidly unwind and go to pieces. If this is prevented by tying a knot, then the end is always clumsy and impossible to thread through pulleys. The only proper way to protect the end of the rope is by wrapping or whipping.



Fig. 2.—Step 2



Fig. 3.—Step 3



Fig. 4.—Step 4

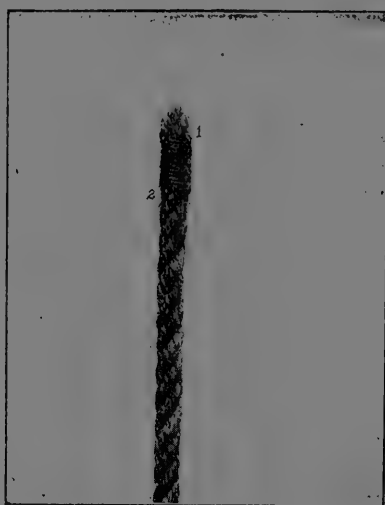


Fig. 5.—Completed

WHIPPING THE END OF A ROPE: In this method for whipping the end of a rope, the cord (Fig. 1) is placed so that end A points down and end B up. B is taken at C and wrapped tightly around the rope and both ends of the cord, leaving no space between adjacent windings and allowing no overlapping (Fig. 2). When a dozen or more wraps have been completed (Fig. 3), without putting an end through the loop, pull end A until the remainder of the loop is entirely pulled through (Fig. 4). Then pull tightly in opposite directions on A and B, and cut both ends off close to the wrapping (1 and 2), the result being a completed whip (Fig. 5). The last wrap should be made at least a half inch from the end of the rope.

PROTECTION AGAINST PULLEY WEAR: A bad pulley will soon cut out a rope which is worth more than many pulleys, and care should always be exercised to insure that ropes run free over pulleys and are not allowed to rub against corners or other sharp surfaces.

GENERAL CARE: In general, ropes should be kept as clean as possible and allowed to dry out promptly after having been wet. The observance of these precautions will not only add to the length of the service which the rope will give, but it will also add greatly to the comfort of handling, which after all is a considerable item, for there are few pieces of equipment more unpleasant and unsatisfactory to handle than badly frayed ropes full of knots.



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LESSON 21

SOME USEFUL KNOTS

Every boy or man should know how to tie a knot that will hold. A few of the simple knots that will be used almost every day on the farm are shown herewith.

THE SQUARE KNOT: This is the most common knot for tying two pieces of rope together end to end. Fig. 1 shows clearly the way to make this knot.

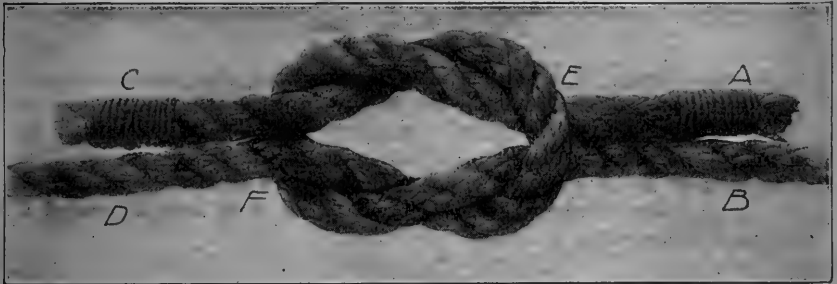


Fig. 1.—Square Knot

WEAVER'S KNOT: The weaver's knot, shown in Figs. 2 and 3, somewhat similar to the square knot, is tied by throwing a bight AC in one end, bringing end B through this bight at I, and throwing a loop at D. As both



Fig. 2.—Weaver's Knot

ends A and B (Fig. 3), can be made to point backward when passing through an opening, the weaver's knot is the best method of fastening the ends of binder twine together.

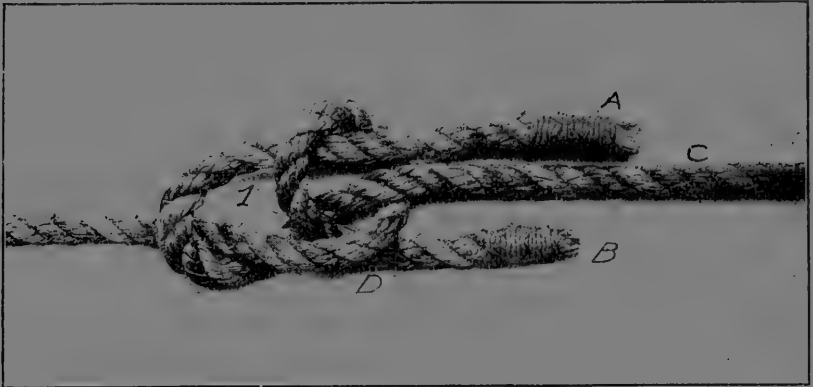


Fig. 3.—Weaver's Knot

BOWLINE KNOT. The bowline knot is one of the most useful to know, as with it a loop that will not slip can be tied in the end of a rope, and yet the knot itself can easily be untied. One method of tying this knot is shown in Figs. 4 to 7 inclusive. The important point to observe in tying this knot is to see that end A (Fig. 4), is put through loop 1 from the same side as rope C, in order to bind the knot together when A is brought around C and back through loop 1.

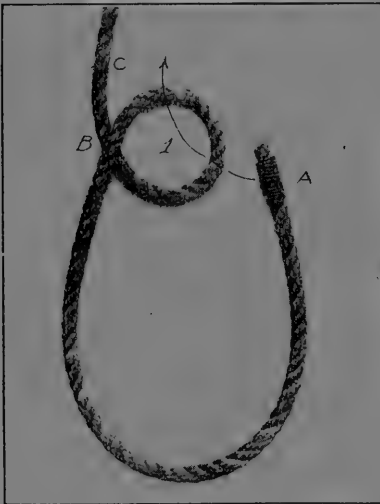


Fig. 4.—Beginning

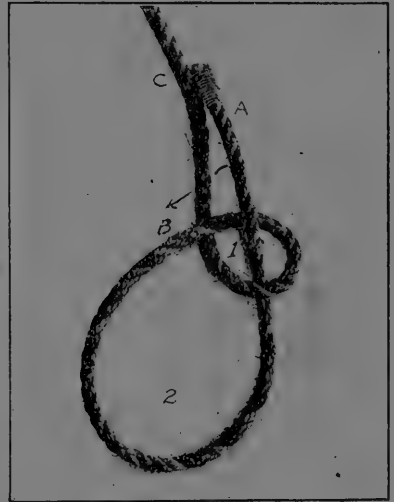


Fig. 5.—Step 2

Bowline Knot

DOUBLE BOWLINE: An effective way to tie a knot in the middle of a rope, which will not slip, is the double bowline method illustrated in Figs. 8 to 11 inclusive. Tie an ordinary overhand knot as B (Fig. 8), throw bight A up to C, as shown in Fig. 9, and pull the two ropes at D down to the position shown in Fig. 10.

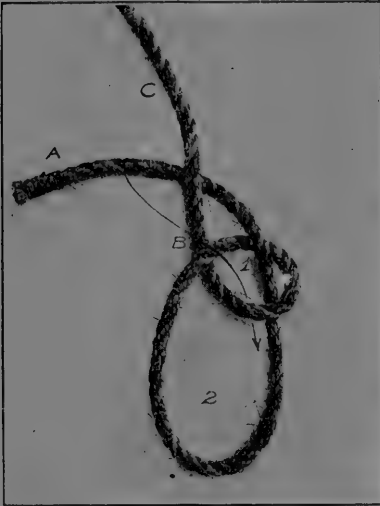


Fig. 6.—Step 3



Fig. 7.—Completed

Bowline Knot

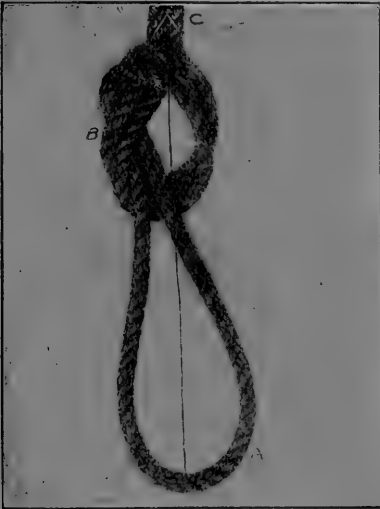


Fig. 8.—Beginning

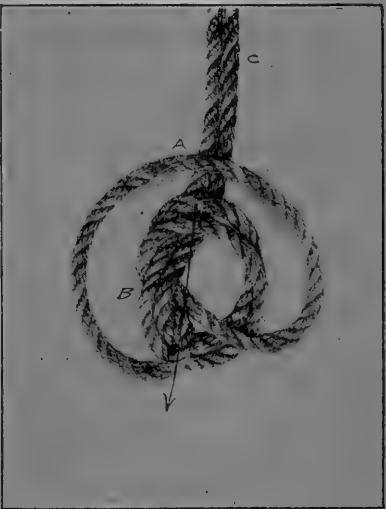


Fig. 9.—Step 2

Double Bowline Knot

GRAIN SACK KNOT: A quick way to fasten grain sacks securely is shown in Figs. 12 and 13. Strictly speaking, no knot is tied, but by passing the ends under the string, one part is made to bind the other. A little practice in order to learn the proper procedure will enable anyone to tie sacks very rapidly.

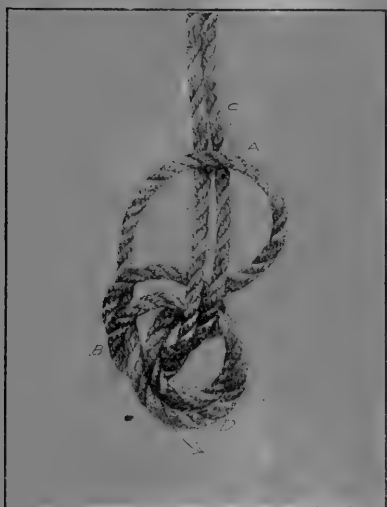


Fig. 10.—Step 3

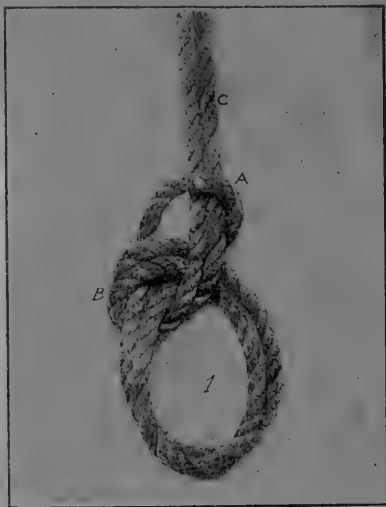


Fig. 11.—Completed

Double Bowline



Fig. 12.—Beginning



Fig. 13.—Completed

Grain Sack or Miller's Knot

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LESSON 22

SPLICING A ROPE

There are several methods of splicing rope, the most common being the short splice, a description of which follows:

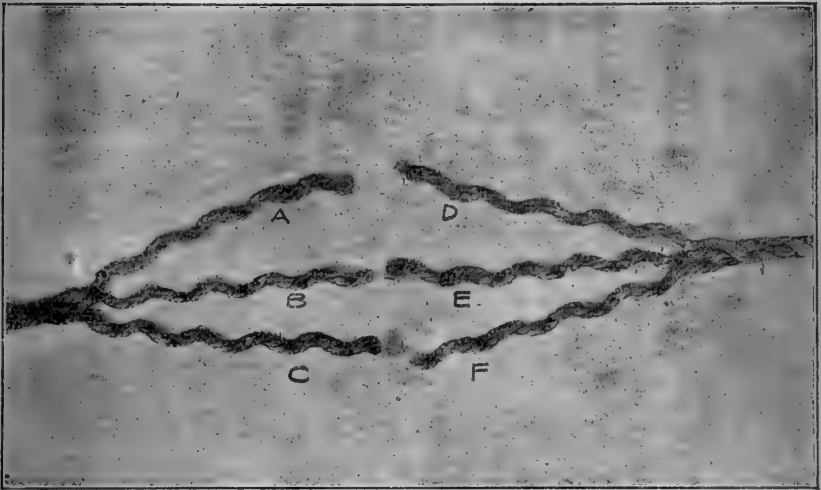


Fig. 1.—Beginning

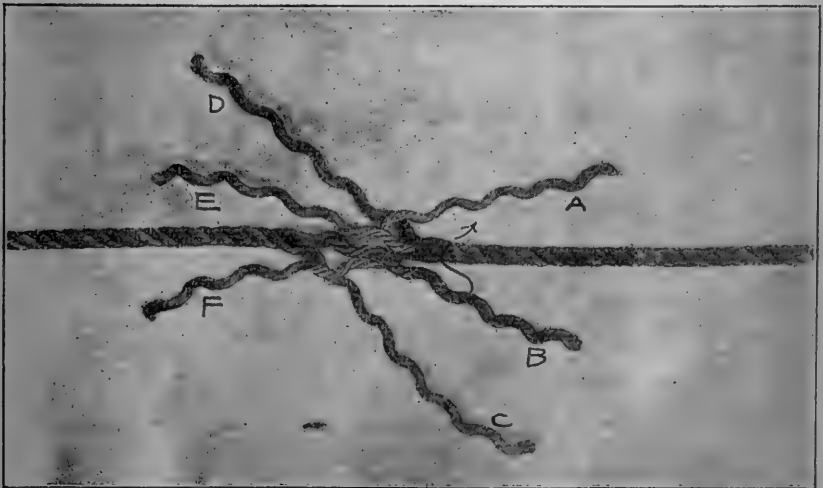


Fig. 2.—Step 2

SHORT SPLICE: To make a short splice, untwist the ends (Fig. 1), and lay them together (Fig. 2), so that no two strands of the same rope lie next to each other, that is, strand B is between E and F, strand A between E and D, strand E between B and A, etc. The short splice is simply a weaving of the ends over and under the strands of the rope, as shown in

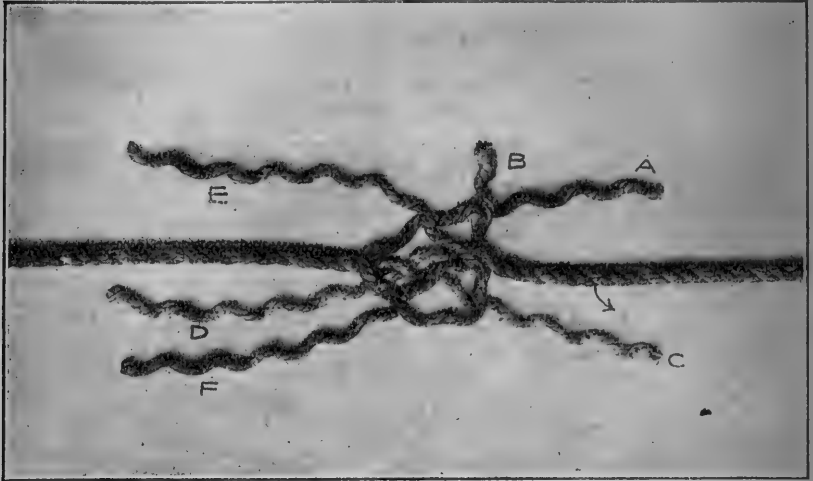


Fig. 3.—Step 3

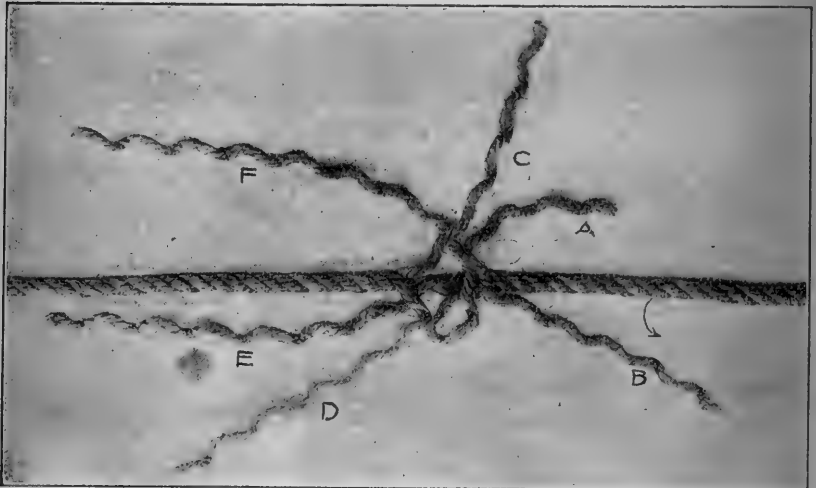


Fig. 4.—Step 4

Fig. 3. End B is put over E and under D, coming out at right angles to the same. For the next step the two ropes are turned one-third of the way around as indicated by the arrow (Fig. 3), and end A woven over strand D and under strand F and to the left of strand B, as shown in Fig. 4. Again, the rope is turned one-third of the way around in the

direction of the arrow (Fig. 4), bringing end C on top, which, as shown in Fig. 5, is woven over F and under E, and to the left of end A, which had previously been put over strand E. It will be noticed that in this weaving, the end being worked goes over the strand which the end just previously used goes under. When all three strands have been woven in once,

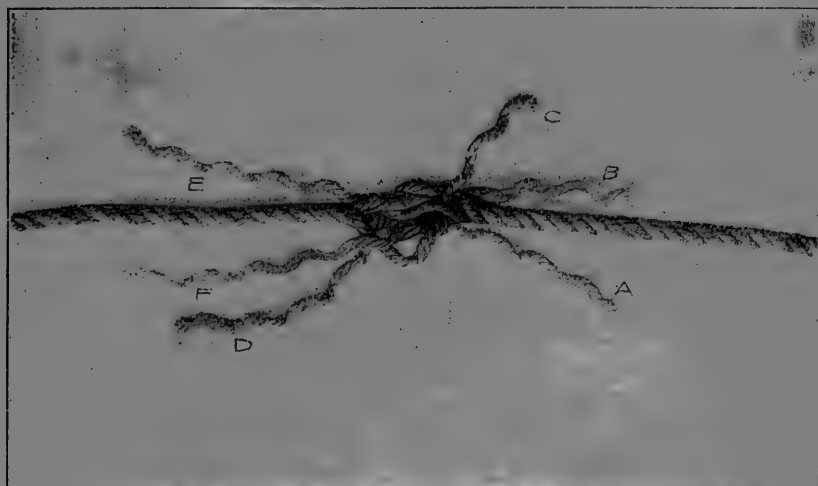


Fig. 5.—Step 5

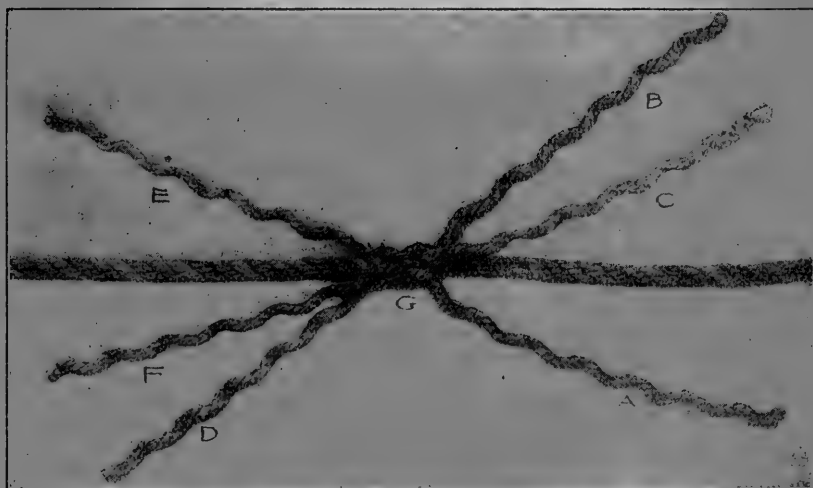


Fig. 6.—Step 6

as shown in Fig. 5, it is necessary, in order to have a good splice, to pull them tight, as shown in Fig. 6, so that there is no slack at point G. Then take ends D, E and F and weave them in exactly as was done with B, A and C, except they are woven into the other rope, and pull them tight, which will result in the partial splice shown in Fig. 7.

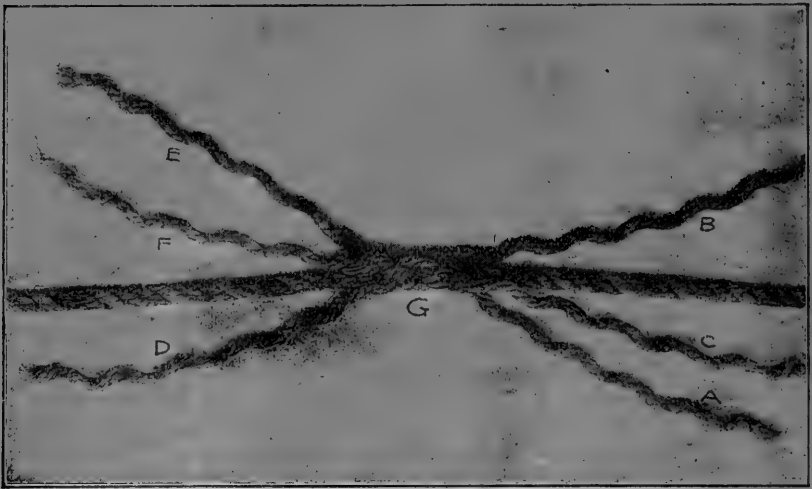


Fig. 7.—Step 7

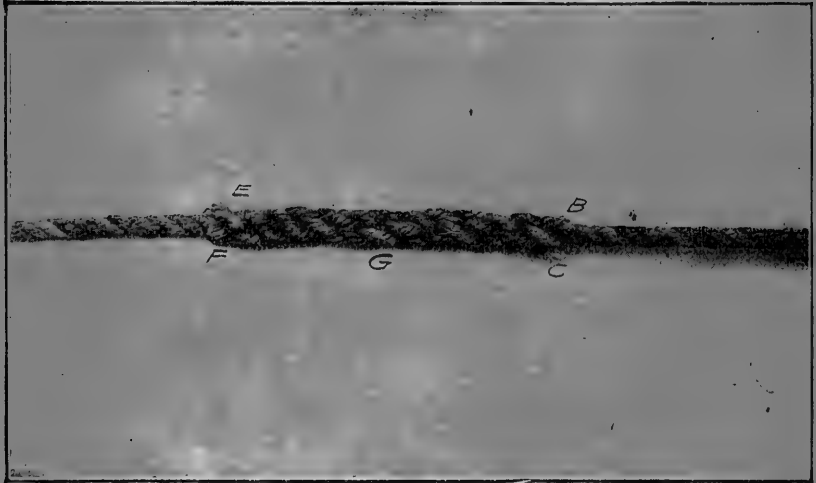


Fig. 8.—Completed

To obtain the completed splice shown in Fig. 8, each set of ends should be woven under and over from 3 to 8 times, depending upon the size of the rope.

LENGTH OF ENDS FOR SHORT SPLICE

Diameter rope	Length of ends	Times to weave each end
$\frac{1}{4}$ "	6"	3
$\frac{1}{2}$ "	4"	3
$\frac{3}{4}$ "	8"	4
$\frac{1}{2}$ "	10"	4
1"	12"	6
$1\frac{1}{4}$ "	14"	6
$1\frac{1}{2}$ "	16"	8

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LESSON 23

PREPARATION OF THE SEED BED

The object in preparing the ground for seeding is to provide the conditions necessary to the germination of the seed and to the life of the seedling.

CONDITIONS OF GERMINATION: There are two conditions of germination:

1. Heat
2. Moisture

If seeds are moist but cold, they will rot and die. On the other hand, if they are dry, whatever the temperature, they will lie dormant; and if they dry out after they have sprouted, the young plants will be killed. The farmer must depend upon the season for the proper temperatures, but he must so prepare his seed bed as to protect the young plants from drying out.

IF THE FURROWS WERE FLAT: One might think that after good plowing the furrows would lie flat like books upon a table or like the boards of the floor. If that were true, then all that would be needed in preparing a seed bed would be to pulverize an inch or two of the top. But the matter is not so simple as that.

HOW FURROWS ACTUALLY LIE: Furrows do not lie flat. The furrow has *thickness* as well as width, and on that account when it rolls off the moldboard of the plow it tends to stand on edge, and would stand exactly on edge if it were as thick as it is wide. But it is only six to eight inches thick, while it is twelve to eighteen inches in width, so that it tips over, *lapping* upon the last furrow by about its thickness. Hence the furrows of a plowed field lie the one upon the other like the siding of a house, or like a series of books lying upon the table with one edge of each resting upon its neighbor.

THE BOTTOM OF THE FURROW: Arrange some books as just described and note that under each book is a triangular space as thick as the neighboring book and running to a point. This gives a good idea of what you would see if you could look under the furrows of a plowed field. In practice, more or less soil rattles down into these spaces, but they are never filled in plowing, and on sod ground they are fully open.

DANGER FROM VACANT SPACES: If now the surface of the field should be prepared and the seed should be sown or planted with these spaces left open, the first heavy rain would gradually fill them up by washing in the soil from above. But this would wash out many tender roots of the young plants and expose others to rapid drying out as soon as the rain is over, for these spaces are, theoretically at least, from four to six inches deep. If all the roots are exposed, of course the plant will die; if only a portion are killed, the plant may not die but it will have a stunted growth. This is one of the commonest causes of a "bad stand" in the fields of those farmers who do not practice the best methods, and it is the reason why the good farmer is very particular as to the fitting of the seed bed.

FITTING THE UNDER SIDE OF THE FURROW: These spaces under the furrow must be filled up before it is worth while to pay much attention to the surface of the field. No surface harrow will run deep enough to do this work. Some farmers depend upon the roller

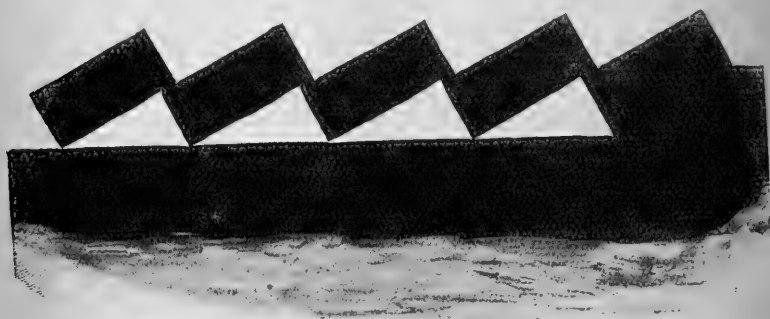


Fig. 1.—Graphic representation of the manner in which furrows overlap each other with open spaces below. The filling of these spaces is the first step in fitting the seed bed.

to press the furrow down, but it is not a case of pressing down; it is a case of filling up. Besides, any roller which a team can draw in plowed ground will have little effect, especially upon sod. The best tool for this work is the disk harrow, *set almost straight* and driven *lengthwise* of the furrow in the *same direction* in which the plowing was done. The slicing effect of the disks will rapidly fill any subsurface spaces, after which the soil will not be disturbed by rains. It is then safe to prepare the surface for planting. Some farmers even disk the land before plowing to make this work still more effective.

WORK DECEPTIVE: The chances are about even that your farmer may not do this job in the way described, for it is one of the newer practices, the reason for which is evident to any one who considers carefully what really happens in plowing.

Of course, you will follow directions and do the work as your

employer desires it done, but one reason why some farmers will not take pains to fit the bottom of the furrow as it ought to be fitted is that the work which is actually being done in slicing the furrows with a disk is *out of sight* and does not seem to be getting ahead. Many farmers want to "see the dirt move," and such will probably use the roller, believing that they are actually pressing the furrows down; or perhaps they may go at the surface at once, leaving the bottoms of the furrows to take care of themselves. If your farmer is of this kind, then do the best you can, even though you believe you know a better way.

FINISHING THE SURFACE: When the spaces beneath the furrows are well filled, which is usually accomplished by going once over the field, sometimes "lapping half," then the surface should be "finished"

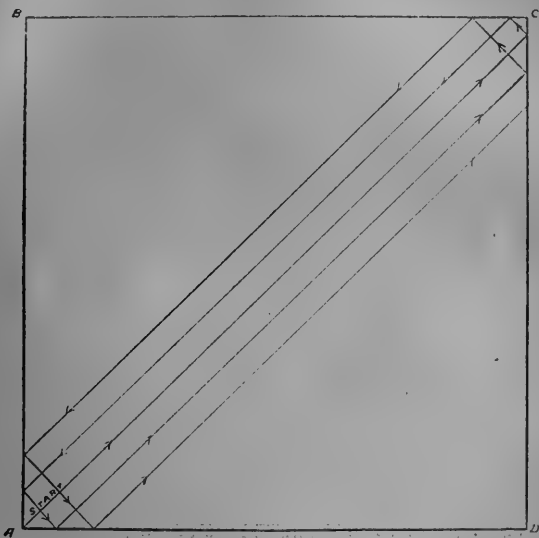


Fig. 2.—Driving plan to avoid driving crosswise of the furrows in fitting the surface seed bed with a floating harrow.

or prepared for seeding. This is done by the floating harrow—made in various designs, but covering a wide space, often as much as twelve or sixteen feet—working the soil for fineness rather than for depth.

HOW TO DRIVE THE FLOATING HARROW: The surface cannot be smoothly finished by continuing to drive lengthwise of the furrow, as was done with the disk. To drive crosswise of the furrows, however, would be to drive *against the lap* at least half the time, and this should never be done until the furrows are well worked down, for it will so loosen the edges as to injure the seed bed, and in sod ground grass will grow up between the furrows.

DRIVING DIAGONALLY: The best method of avoiding this difficulty is to drive diagonally, or cornerwise, of the field. There are two ways of doing this:

1. Begin at one corner and drive across the corner at an angle of about 45 degrees, backward and forward, until the field is covered. This method has its drawbacks because it is difficult to turn squarely about with a wide harrow.

2. A better way is to begin at one corner of the field and drive direct to the corner diagonally opposite, say, from A to C in a field whose corners shall be lettered A, B, C, D. Then return and drive back to the starting point, down the opposite side, across the end, and so on again and again. The short corner gradually lengthens and the long side grows shorter until soon you will be driving around a rectangular block constantly growing longer on one side and shorter on the other. The work is completed by a long "bout" between corners B and D. The actual driving plan is shown in Fig. 2.

Clearly, the field will be harrowed twice when it has been gone over once by this method of driving, but it is better than "lapping half," because no turn is over 45 degrees—an angle that is easily and quickly taken in driving; besides, in this way the driver is always turning *away from the fence*.

FINISHING THE SEED BED: This surface work should be continued until a fine, even tilth is produced. In dry weather and on clay land it is possible to overdo the fining process, for if clay is too finely pulverized it will run together when it becomes wet and bake when it dries out again.

A few lumps on top of the ground are not bad, providing they are really *on the surface* and not a part of the seed bed.

When plowing in extremely dry weather, land should be harrowed about as fast as it is plowed, partly because the lumps break up easily when first plowed up, and partly because ground that is harrowed will hold whatever moisture it has better than if it is left to bake in the sun with lumps and spaces exposed to the drying air.

United States Boys' Working Reserve

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LESSON 24

CULTIVATION

As the *preparation* of the seed bed is done with a view to securing the *conditions of germination*, so should the after *cultivation* be done with a view to *securing and maintaining the conditions of growth*.

THE CONDITIONS OF GROWTH: Now the absolute conditions of growth are:

1. Heat.
2. Moisture.
3. Plant food.
4. Sunlight.

It will be noted that the first two conditions are identical with those of germination. To these must be added *food*, for plants like animals must have the materials with which to build up their tissues; and *sunlight*, for it is only in the presence of light that plants can take in the carbon which comes from the air and which is their principal food.

As in the case of germination, the season must be depended upon to supply the heat, though good drainage will help. Plant food is mainly a matter of fertile soil or of the addition of manures and fertilizers, and yet, if weeds are allowed to flourish they will steal the food that should go into the crops. They will also take the moisture, and what is even worse than either, they will in many cases overtop the young seedling, shutting off the sunlight. To a very considerable degree, therefore, we depend upon good cultivation to *maintain* the conditions of growth, chiefly, but not solely, by controlling the weeds.

OBJECTS OF CULTIVATION: The direct objects of cultivation are:

1. The control of weeds.
2. Aeration of the soil.
3. Conservation of moisture.

Control of Weeds: Weeds are the natural and ever-present enemy of the crop. They are better rustlers than crops or they would not be weeds. They are the greatest of all thieves, and strangle where they cannot steal. If a young crop is to yield up both its moisture and its food to some robustious weed and have its supply of sunlight cut off as well, how can it thrive? The only answer is that it cannot thrive, and the farmer who expects a crop must control the weeds.

Of course the best way to kill weeds is by preventing as many as possible from seeding, but even so there will be plenty for every crop. Their seeds will germinate with those of the crop and the two will come along together, the weed generally the faster of the two, which means that one crop competes with many different kinds of weeds.

The best time to kill weeds is when they have just sprouted. They can be killed then by the millions, and before they have done damage, by the simple process of stirring the soil; whereas, if left to become firmly rooted they are much more difficult to uproot and they have already done more or less damage. *Early cultivation* is therefore the attempt of all good farmers.

But *thorough* cultivation is equally necessary, for if five or ten percent of the weeds are missed, there will still be about as many as could have stood the natural competition with each other, and plenty enough will be left to ruin or at least greatly reduce the crop. Right here the helper must understand that if the farmer loses ten percent or even six percent of his crop he has lost *all of his profit*. The cultivation therefore *must be thorough* as well as *early*.

Some weeds, like Canada thistle, quack grass, and morning glory, maintain themselves by underground root stalks or bulbs, and are much more difficult to keep out than are those which multiply by seeds. But any weed is bad enough, and the helper must understand that they are the farmer's worst enemy and the *principal cause for cultivation*.

Cultivation for Aeration: To insure a good growth of crops the air must circulate freely in the soil, not only to supply the roots with oxygen, but also to assist nitrification, which is one of the bacterial processes necessary to produce the supply of nitrogen. In loose soils cultivation would not be needed for the purpose of aeration, but it is often essential in tight and stubborn clays.

Cultivation to Save Moisture: In rare cases and to some slight extent, cultivation may save moisture by breaking up the crust that

tends to form on clay soils after a rain. Cultivation for this purpose should be very shallow, turning up as little of the soil as possible.

All Cultivation Bad for Crops: Cultivation for any purpose whatever, if thorough enough to be effective, is bound to injure the crops by cutting off a good many of the small roots on which the life of the plants depends. Besides this, there will be some injury by treading out and uprooting, especially in turning at the ends of the rows. These injuries must all be reduced to a minimum, and plants which are accidentally *covered up* by cultivation should be carefully *uncovered*.

Altogether, we may say that if seed should be planted in a *loose* moist soil *absolutely* free from weeds, the farmer would do better to keep entirely out of the field till harvest time. By this is meant that when the farmer cultivates his crop he chooses between two evils; one, the injury, which may be kept small; the other, the weeds, which if left alone would take the crop. Remembering all that is involved, therefore, *good workmanship in cultivation consists in doing as thorough a job as possible in killing weeds, with as little injury as possible to the growing crop.*



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LESSON 25

INSECT AND FUNGOUS ENEMIES

Weeds are not the only enemies of the crops which the farmer raises. Many insects make their living at the expense of the farmer, and several low forms of vegetable life are parasitic on some of the most important crops.

INSECT ENEMIES

MANNER OF INSECT INJURIES: There are three ways in which insects may injure or destroy crops:

1. By gnawing their leaves to such an extent as to check the growth and sometimes to kill the crop. Examples: The army worm, the canker worm, the striped beetle, and the potato bug, more properly the potato beetle.

2. By sucking the juices of the plant. Examples: Plant lice or aphids of any kind (especially the corn root louse), the chinch bug of the wheat and corn fields, and the San Jose scale attacking fruit trees.

3. By laying the egg in places where, after hatching, the young larva works havoc. Examples: The curculio of the plum, the borer of the peach tree, and the hessian fly at the base of the wheat stem.

COMBATING INSECT ENEMIES: In general, insects do their principal damage because of their immense numbers and inconceivably rapid multiplication. For example, a single corn root louse, as reported by Dr. Forbes, has been known to produce no fewer than ninety-eight young during her lifetime, and sixteen generations have been known in a single season. At half the rate, Dr. Forbes computes that this would make a solid column *one acre square*, and, if it could stand without crushing, nearly four hundred miles high. Fortunately natural causes intervene to prevent maximum reproduction, but even so mankind is constantly in danger of starvation by his insect enemies. As one would suppose, the greatest protection is in preventing so far as possible their multiplication, for when once at work their control is costly and laborious, if indeed it is possible. The best ways of combating insects are:

1. *By birds*, which live largely on insect life. This involves killing all stray cats, which invariably live on birds, and such pets

as have formed the bird-eating habit. Cats have been known to destroy more than fifty birds apiece in one season. *Without the birds*, mankind would soon be *starved out* by the insects, and any menace to the birds should be effectively combated. It is extremely difficult in the case of cats because of sentiment, but, even so, sentiment must be rationalized. The unfortunate habit of abandoning kittens by the roadside to hunt or starve has caused most districts to become inhabited with thousands of practically wild cats which live almost wholly upon birds. They are difficult to find because they hunt mostly at night.

2. *By poison foods*, such as poisoned meal for army worms.

3. *By poison sprays or powders*, which are destructive of insects that *gnaw* and chew the foliage.

4. *By spray materials that kill by contact*. These are used for plant lice and, in general, for many insects that live by sucking juices and cannot therefore be killed by poison.

5. *By trapping and collecting*, which is effective with insects that travel, like the chinch bug and the grasshopper.

The method and the material will be supplied by the farmer. The duty of the helper is to follow directions and *do a good job*, with a full understanding of the importance of controlling insect depredations at once—at once, for twenty-four hours may be too late.

FUNGOUS INJURIES

Fungous injuries are in general similar to those of insects that gnaw the foliage or suck the juices of plants, in that they destroy plant tissue or weaken the plants.

Fungi differ from insects in that they are plants instead of animals. Plants though they are, however, they elaborate no food of their own. They are therefore independent of sunlight. Penetrating into the very tissues of the host plant, these smuts, rusts and molds live a wholly parasitic life and in general they are extremely difficult to get at after they have entered the plant. Indeed, it is often next to impossible to control some of them, as for example the smut of corn.

TREATMENT

The attempt to control the depredations of insect and fungus enemies has given rise to an elaborate system of treatment of various kinds under the general head of spraying, a subject which will be treated briefly in the next lesson.

The scab of potatoes and the smut of wheat, oats and barley are treated by special methods briefly described as follows:

POTATO SCAB: If seed potatoes are soaked for one and a half hours in water to which corrosive sublimate has been added in the proportion of one ounce to eight gallons, the crop will be free from scab, provided the potatoes are planted on land that has not pre-

viously produced a crop of scabby tubers. This is a good disinfectant for common use upon the hands, but it must be remembered that corrosive sublimate is a dangerous poison.

SMUT: Wheat, oats, and barley are all attacked by the smut fungus, but if the seed be properly treated with formaldehyde (to be had in almost any drug store) the crop will be clean. There are two general methods: soaking and sprinkling.

The Soaking Method:

1. Provide one barrel or tank and two tubs or half barrels. Make a two-inch hole through the side of each in such a way that the bottom of the hole will be level with the bottom of the tub. Tack a small piece of wire screening inside the tubs over the holes in order that the wheat may not run out when the plugs are removed.



Fig. 1.—The Soaking-Skimming Method Is the Most Satisfactory for the Prevention of Stinking Smut of Wheat and Barley

2. Place one tub on a small table or pair of horses with the plug directly above the other tub on the floor.

3. Prepare the formaldehyde solution (one pint of formalin in thirty-five gallons of water), in the third barrel or tank, and fill the upper tub half or two-thirds full.*

4. Pour into this solution about a bushel of grain.

5. Stir the grain thoroughly so that all the smutted kernels may rise to the top of the solution.

6. Skim off the smut balls and light kernels that float on the surface.

* One pint of formalin in 20 gallons of water is sometimes used.

7. After from five to ten minutes, or when all the smut balls have been removed, pull the plug and allow the solution to drain into the lower tub.

8. Dump the grain on a clean floor or canvas.

9. Lift the lower tub upon the table, add enough solution to replace that removed by the grain, and repeat the operation.

10. After dumping five or six batches in one pile, cover with a canvas for two hours.

11. Uncover and spread out the grain so that it will dry quickly.

The Sprinkling Method:

1. Spread the grain to be treated on a clean floor or canvas.

2. Sprinkle with the formaldehyde solution (one pint of 40-percent formaldehyde in 35 gallons of water) using approximately one gallon to each bushel of grain.

3. Shovel the grain over several times to make sure that all the kernels are wet.

4. Place the grain in a pile and cover with a canvas or tarpaulin for two hours.

5. Spread out the grain so that it will dry quickly.



Fig. 2.—Treating Seed by the Sprinkling Method Requires from Two-Thirds to One Gallon of the Formaldehyde Solution to Each Bushel of Grain.

United States Boys' Working Reserve Farm Craft Series

LESSON 26

SPRAY MIXTURES AND THEIR APPLICATION

A great many kinds of insects and fungous diseases may be controlled by spraying. Each class of enemy, however, must be treated with the kind of spray material best suited to its control. It is not possible to kill *sucking* insects by the same treatment that would be effective against *chewing* insects, on account of the difference in their feeding habits.

KINDS OF SPRAY MATERIALS

STOMACH POISONS: Stomach poisons used for the control of *chewing* insects include arsenate of lead (in paste or powdered form), Paris green, and in some special cases, white hellebore. The active principle in arsenate of lead and Paris green is arsenic. Since arsenate of lead paste is about 50 percent water, the dry or powdered form is twice as strong, pound for pound, as the paste. Paris green contains about four times as much arsenic as does the paste arsenate of lead. Smaller quantities of the stronger poisons are used in making up spray mixtures. Arsenate of lead is less likely to injure the plants than is Paris green, and a large quantity of actual arsenic may be used in this form without danger of foliage injury.

Paris green and arsenate of lead are mineral poisons and retain their poisonous properties indefinitely, even though exposed to the air. White hellebore, on the other hand, is a vegetable poison (being the ground root of a plant), and it rapidly loses its poisonous properties when exposed to the air. It is used particularly for spraying currant bushes for the control of the currant worm, when the fruit is nearly ripe, and also for the control of cabbage worms on cabbage that are nearly mature.

CONTACT INSECTICIDES: These are used for the control of *sucking* insects. They include a number of different mixtures, but the most effective ones are lime sulfur solution and tobacco compounds. The lime sulfur is used for the control of *scale* insects, and the tobacco compounds for the control of *aphids*. Persons having large commercial orchards provide themselves with the necessary equipment, and manufacture their own lime sulfur. However, unless large quantities are to be used, it is more convenient to purchase the commercial lime sulfur solution, since no special equipment is needed to prepare this for spraying. Likewise, it is possible to make a decoction of tobacco from tobacco stems or other tobacco refuse. However, the strength of the material made in this way is exceedingly variable, and much more certain and satisfactory results can be secured from spraying

with the commercially prepared tobacco compounds. The form most commonly used at present is nicotine sulfate. One of the most popular brands of this material is known as Black Leaf 40.

The most widely used material for the control of fungus diseases is Bordeaux mixture. This is made from copper sulfate, lime, and water. For some special purposes a dilute lime sulfur mixture is used as a fungicide. This is the same material as is used for the control of scale insects, but as a fungicide it is used in much more dilute form.

CAUTION: The precaution should be taken to place a POISON label on all packages or receptacles containing the supplies for making spray materials. This is especially important in the case of dry arsenate of lead, since it is a white powder that might easily be mistaken for some other material.

FORMULAS: To make effective spray mixtures, the materials must be mixed in the proper proportions. Some plants are easily injured if a mixture is slightly too strong. It is also true that the treatment of some enemies requires stronger mixtures than are efficient against others. The proportions given in the following tables represent mixtures that will be effective in the majority of cases. If a large amount of spraying is to be done, it is convenient to mix the material in fifty-gallon or barrel lots. For small garden operations, however, a bucketful of material is often all that will be needed at a given time. The accompanying tables, therefore, give the quantities for both fifty-gallon and for three-gallon lots.

STOMACH POISONS

Barrel Lots:

Paris green	4 oz.	to 50 gals. water
Arsenate of lead (powder)	1 lb.	to 50 gals. water
Arsenate of lead (paste).....	2 lb.	to 50 gals. water
White hellebore	1 lb.	to 50 gals. water

Bucket Lots:

Paris green	$\frac{1}{4}$ oz.	to 3 gals. water
Arsenate of lead (powder)	1 oz.	to 3 gals. water
Arsenate of lead (paste).....	2 oz.	to 3 gals. water
White hellebore	1 oz.	to 3 gals. water

CONTACT INSECTICIDES

Barrel Lots:

Lime sulfur solution	5 gal.	to 45 gals. water
Nicotine sulfate	$\frac{2}{5}$ pt.	to 50 gals. water

Bucket Lots:

Lime sulfur solution.....	$1\frac{1}{3}$ qt.	to 3 gals. water
Nicotine sulfate	$\frac{2}{5}$ fluid oz.	to 3 gals. water

FUNGICIDES

Barrel Lots:

Lime sulfur solution.....	$1\frac{1}{4}$ gal.	to 50 gals. water
Bordeaux mixture:		
Lime	4 lbs.	
Copper sulfate	4 lbs.	
Water	50 gals.	

Bucket Lots:

Lime sulfur solution.....	1/3 qt. to 3 gals. water
Bordeaux mixture:	
Lime	4 oz.
Copper sulfate	4 oz.
Water	3 gals.

HOW TO PREPARE THE MIXTURES FOR SPRAYING

ARSENATE OF LEAD AND PARIS GREEN: To prepare either of these materials for spraying, all that is necessary is to mix the material thoroughly with the required quantity of water. However, in order that this may be done readily, it is necessary first to mix the powder or paste with a small quantity of water until a thin, smooth paste is obtained. This thin paste may then be stirred into the full quantity of water and a uniform mixture secured. When Paris green is used, a small quantity of slaked lime, representing about double the weight of Paris green itself, is thoroughly mixed with the Paris green in making up the paste before it is added to the full quantity of water.

LIME SULFUR SOLUTION AND NICOTINE SULFATE: These are prepared for spraying merely by measuring out the required quantity of solution, pouring it into the required amount of water, and thoroughly stirring.

BORDEAUX MIXTURE: The preparation of this spray is a somewhat more elaborate process. The copper sulfate is purchased in crystal form and must be dissolved in water before it can be used. The best method of dissolving the copper sulfate is to suspend it in a cloth sack near the top of a deep receptacle of water. Several hours are required to effect complete solution. It is best to dissolve the copper sulfate in a definite quantity of water so that the strength of the solution will be known; one pound of copper sulfate to one gallon of water is the usual proportion. The copper sulfate solution should be thoroughly stirred before any of it is measured out for making Bordeaux mixture.

The lime used in making Bordeaux mixture should be fresh stone lime. Dehydrated lime is not satisfactory. The lime should be carefully slaked in a small quantity of water, care being taken, however, to add sufficient water from time to time during the slaking process to prevent the lime from burning. After the slaking process has been completed, the lime should be diluted with water until one gallon of the mixture represents one pound of lime.

The solution of copper sulfate and the slaked lime will keep indefinitely provided they are covered to prevent evaporation of water. Whenever it is desired to make up a batch of Bordeaux mixture, all that is necessary is to measure out the required quantity of copper sulfate solution and dilute it to half the volume of the proposed quantity of Bordeaux mixture, and also to measure out and dilute the proper quantity of lime in a like manner; and then to pour the two dilute solutions together, stirring them thoroughly as they are being poured into a third receptacle.

COMBINED MIXTURE: If chewing insects and fungous diseases both attack plants at the same time, it is advisable to use a combined mixture of Bordeaux and arsenate of lead or Paris green for the control of the two enemies. In case the combined mixture is to be made, the arsenate of lead

or the Paris green is stirred into the diluted lime before it is combined with the copper sulfate. Arsenate of lead may be combined also with dilute lime sulfur solution if desired.

MACHINERY FOR APPLYING SPRAY MIXTURES: For applying spray mixtures to a few small plants in the home garden, no elaborate apparatus is required. Even a whisk broom may be made to serve the purpose when the material is to be applied to only a few small plants. An ordinary watering can with a fine hose is also a satisfactory implement for applying spray mixtures to low-growing plants. However, a watering can is rather wasteful of material, and a more economical and uniform application may be made by the use of some form of spray pump which will deliver the liquid with more force. A compressed-air knapsack sprayer is very satisfactory for applying spray materials to low plants in relatively small areas. For use in market gardens and in plantations of trees, a barrel spray pump is more satisfactory than a smaller outfit. For large areas of special crops, geared power sprayers and gasoline power sprayers make more rapid work possible.

HOW TO SPRAY: It is exceedingly important that spraying be done very thoroughly. The aim should be to cover all parts of the plant to be protected, with a thin, uniform application of spray material. Care should be taken to avoid putting an excessive amount of material on any part of the plant, as well as to avoid leaving any part of the plant unreached by the spray. A uniform application can be made much more readily and over-spraying avoided if a fine, rather than coarse, spray is used. A fine spray is made by using a nozzle with a small orifice and using high pressure. The person who holds the spray nozzle should keep it in motion continuously rather than hold it steadily at any given point.

WHEN TO SPRAY: It is also important that spraying be done at the right time. In general it is better to spray before serious damage to the plants has occurred, rather than after the insect or disease has gained headway. In the case of insects or diseases which usually attack a given crop at a certain season of the year, it is often possible to apply the spray before the enemy is visible. This is true in spraying apples for the control of codling moth and apple scab. It is also true, in general, for the control of many fungous diseases, such as potato blight, leaf spot of tomatoes, and black rot of grapes. In fact, effective control of fungous diseases involves anticipating the attack and having the spray material on the plants before they are attacked by the disease.

For the control of scale insects it is necessary to use so strong a mixture that if it were applied to the plants while they were in foliage, it would seriously injure them. Since the scale insects work upon the bark and are present on the twigs during the dormant season, it is possible to kill them by using a concentrated spray mixture applied while the trees are dormant. Spraying for scale insects may therefore take place either late in the fall after the foliage has dropped from the trees, or very early in the spring before the season's growth begins.

United States Boys' Working Reserve

Farm Craft Series

LESSON 27

CULTIVATING CORN

It is an old saying that the time to begin cultivating corn is before it is planted, which is one way of emphasizing the need of a thoroughly prepared seed bed.

HARROWING

The weeds that infest the corn belt are rapidly growing species and it is frequently unwise to wait to begin cultivation until the corn is four or five inches tall, the height required for using the cultivator.

Accordingly it is a common practice to run a floating harrow of the spike-toothed variety over the land as the corn is coming up, without regard to the hills of corn except to keep the horses off the rows. This work would seem to be ruinous to the crop, but as a matter of fact the injury is slight, due to the fact that before corn leaves show much above the ground the *roots* have already become quite long and firmly established in the soil. The young corn plants are therefore not easily uprooted either by the harrow or by the wire-toothed weeder that is sometimes used. However that fact furnishes no excuse for reckless driving.

CULTIVATION

The corn cultivator proper is driven down the row, cultivating both sides at once. On some farms two-row cultivators are in use.

To handle the cultivator requires skill in driving and undivided attention to business. A careless man or boy can cover up or plow up a good many corn plants in the course of a day's work, and every plant thus destroyed means one ear less at harvest time. Since it takes only one-hundred to one-hundred-and-twenty ears to make a bushel, and there are two to four stalks in every hill, you can see that with corn at a dollar and a half a bushel a few days' careless work on your part may cost your employer more than your entire summer's work is worth to him. Not only does every corn plant destroyed mean a loss to your employer, but it also means one ear of corn less to convert into meat.

Corn is usually "checked," that is, planted in hills, so that the

rows run both ways across the field. The corn is first cultivated in the same direction that it was planted. The second cultivation is across the field, at right angles to the first. After the first two cultivations all the ground in the field has been stirred except a small spot a few inches square around each hill.

The weeds and grass in the *hill* must be killed while they are small by covering them at the first two cultivations. Labor is so scarce and high-priced in this country that it is not profitable to hoe corn or pull the weeds from the hills. If they escape the cultivator they will use much moisture and plant food that would otherwise be used by the corn plant in the production of valuable grain.

It takes a considerable degree of skill and care to cover the weeds in the hill without covering the corn or digging it up. Even with the best of care you will cover a corn plant occasionally. When this happens, stop the team and uncover it carefully. Often this can be done with a long stick and without getting off the cultivator seat. Do not forget that if one hill in a hundred is covered up or cut out, one percent of the crop is gone, and five or six percent represents a very respectable profit.

ADJUSTING THE CULTIVATOR: Next to a careful operator, the most important factor in good corn cultivation is a properly adjusted cultivator. Your employer will show you how to adjust the particular kind of cultivator you are to use. The following directions should be studied carefully before you go to the farm, however, for if you are familiar with these general principles you will "get the hang" of operating a cultivator much more quickly.

KINDS OF CULTIVATORS: Two common types of riding cultivators used in the corn belt are the *surface*, or "gopher blade" cultivator, and the *shovel* cultivator.

THE SURFACE CULTIVATOR: The surface blade cultivator was introduced for shallow cultivation and to prevent cutting roots. It is a very successful implement when properly set and used under the right soil conditions. It is not entirely satisfactory in stony fields, in fields where the weed growth has reached considerable height, or where the soil gets very hard and breaks up into clods.

The following points will help in adjusting the surface cultivator properly:

1. If there is a difference between the inside and outside blades in length or shape, care should be taken always to place the proper set on the inside shanks. On all the old surface cultivators the top edge of each inside blade tapers off toward the rear end, while the edges of the outside blades run straight back, as shown in Fig. 1. The sets can be distinguished in this way.

2. The shanks should be adjusted so that the inside blades are about an inch higher than the outside blades.

3. The cutting edges of the inside blades should lie in the same plane, those of the outside blades should lie in their plane, and these two planes should be parallel.

4. The cutting edge of each inside blade should be parallel to the cutting edge of the corresponding outside blade. In other words,

both cutting edges of either rig should form the same angle with the row as shown in Fig. 2. On most surface cultivators the distance between the front points of the inside blades should be about twenty-two inches, while the distance between the rear points of the same blades should be about four inches. After the inside blades have been set in this way the outside blades can be set parallel to them.

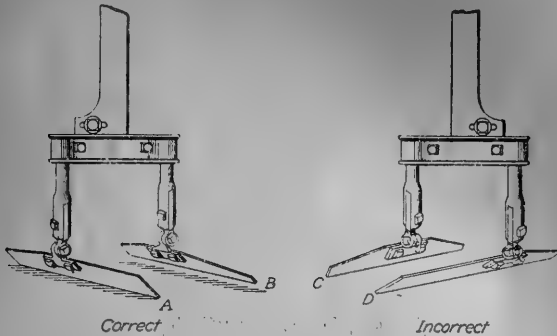


Fig. 1.—Correct and Incorrect Method of Setting the Blades

5. For average conditions each blade should be set at about a forty-five degree angle with the surface, as shown at A and B in Fig. 1. When the blades are set too flat, as at D, they lose suction; if set too deep, as at C, they scrape and cause ridging, because the soil cannot move smoothly over the blade and thus cannot leave the proper blanket on the surface to produce a mulch and to close all cracks.

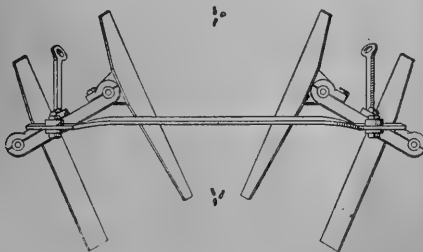


Fig. 2.—Both Cutting Edges Should Form the Same Angle with the Row

THE RAKES: By all means use the rakes. Not only do they level the surface and produce a finer mulch, but they also perform the very important function of dragging weeds to the surface for exposure to the sun.

As a rule, set the rakes about five inches apart at the rear, at about a twenty-five degree angle with the surface, and low enough to just drag the surface. If the rakes tend to hold the weeds and drag them a considerable distance over the surface, they are set too straight or too low.

If the soil is mellow and weedy and the weeds lodge over the cutting edges of the blades, increase the depth slightly if possible, set the blades a little steeper, and raise the points slightly.

THE SHOVEL CULTIVATOR: The shovel cultivator can be used under a much greater variety of conditions than the surface blade machine, but it is apt to do more damage to the roots.

A cultivator shovel must be set at the proper angle to cause it to penetrate. A common angle is shown at C in Fig. 3: If difficulty is experienced in getting a sharp shovel to penetrate, lessening this angle, or causing the blade to run a little flatter, as at A in Fig. 3, will usually overcome the trouble. If the shovel is set too flat, however, its penetrating ability will be greatly decreased. These general rules hold for nearly all conditions, but just what angle is best for any particular condition can be determined only by trial. Failure to penetrate may also be due to too much tension in the lifting springs.

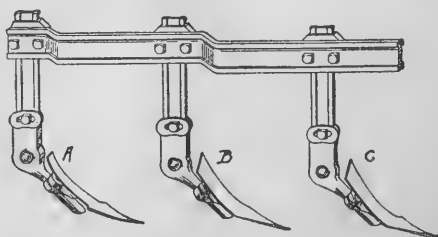


Fig. 3.—Different Angles of Setting Shovels

If the operator desires as light draft as possible he should use great care to secure the proper set of the shovels. If the shovels are set a little flatter than necessary and thus have more suction than is required, a greater force is needed to hold them at the proper depth, and the draft may thus be increased. Shovels set too straight and then forced into the ground will also cause increased draft.

In setting the shovels for light draft, however, one cannot entirely disregard the way in which they handle the soil. Under given soil conditions some shovels may make better pulverization when set fairly steep, while others may leave the surface slightly smoother when set a little flatter.

If the rig jumps, skips, or bobs along instead of taking to the ground and working steadily, one or all of its shovels are probably set too straight, provided of course that the shovels are in good shape.

When all the shovels of one rig are set to throw the soil to or from the row, the rig is bound to crowd sidewise. If the rigs crowd together under these conditions the operator may have to hold them apart with his legs, but if the rigs crowd out they can be held together with the spread arch or spread chain. If the main purpose is simply to throw the soil to or from the row with the front shovels, however, this rig crowding can be overcome by setting the rear shovel in each rig to throw the soil in the opposite direction.

United States Boys' Working Reserve

Farm Craft Series

LESSON 28

SHOCKING WHEAT AND OATS

By shocking is meant putting together bundles of small grain in groups of about a dozen for the purpose of curing preparatory to threshing.

OBJECT: All small grain must stand in the field for a considerable number of days in order to become dry enough for threshing or for stacking. During this time the grain is exposed not only to sunshine but to wind and rain as well. It must therefore be kept protected as much as possible from the wet, and by all means it must be kept off the



Fig. 1—Setting the First Bundles. Note How Firmly They are Placed Together at the Top. They Will Not Fall

ground, otherwise should the weather chance to be bad for a number of days it is certain to sprout, greatly damaging its market value. Three things must be aimed at by a good workman in shocking grain: First, a dozen bundles must be put together so that they will stand up against any ordinary wind; second, they must shed rain; and third, the work must be rapidly done.

THE LONG SHOCK: Many farmers shock grain, especially oats, in long shocks; that is, they set up the bundles in long rows by pairs. The reason for choosing the long-shock method is that it is rapid. However, the bundles are almost certain to pull each other over, and there is no method of capping to shed rain. In a rainy region the grain should always be put into the round shock and capped, except only in those rare cases where the winds are too severe.

THE ROUND SHOCK: The advantage of the round shock is that it can be capped and protected against rain. On the other hand, by most methods employed for this process the time consumed for a good job is more than double that required for the long shock. The method herein illustrated, however, is almost as rapid as the long-shock method and vastly better for all kinds of small grains, unless it may be barley. Even oats are better capped, because they shatter less in hauling and the quality of the grain is better.

PROCEDURE: In the round shock ten bundles are "set up" and two are used for caps. There are many ways of assembling these ten bundles, most of them bad, either because the bundles will not stand firmly, because they are set so closely together as to exclude all air,



Fig. 2.—Two Bundles Placed at Right Angles to the First Pair. They Support the First Bundles Set Up

or because the process requires too much time. The particular method here shown, though not commonly employed, is recommended for four reasons.

1. It makes the strongest shock known, because the bundles are braced in all directions.
2. It is the most rapid method known.
3. A few bad bundles do not destroy the shock.
4. Whereas in most methods of shocking only the best workman can be used at all;

by this method men may work either singly or in pairs, and one of the pair may be an indifferent workman without injury to the quality of the work.

When working in pairs, the leading man should choose for the first two bundles those which seem to be among the largest of the dozen. Facing either east or west and taking one bundle in each hand, holding the heads close together with the butts of the bundles far apart, he should drive them firmly into the stubble, being sure that they lean *squarely against each other so that they will not shut by each other like a pair of scissors.* (See Fig. 1.)

If this first pair is properly set, the bundles will have an angle of about 45 degrees

with the ground. The common failure is in getting them too straight. (These are bundles 1 and 1 in Fig. 5.)

Next he should place a pair of bundles at right angles to the first pair, with heads well together, and bearing on one of the bundles of pair number 1 at about the place of the band. (See Fig. 2 and bundles 2 and 2 in Fig. 5.) If two men are working together bundles 3 and 3 will be placed by the second man. These six bundles furnish the strength of the shock because they brace in all directions. Four other bundles are next added, two on either side. (See 4 and 4, and 5 and 5 in Fig. 5.) If there are any bad bundles in this particular set, they should be reserved for this place in the shock, as they have nothing to do with its essential structure. By bad bundles is meant those which are unusually short, fuzzy, or filled with weeds.

CAPPING: This shock is not quite round. If properly made it will be somewhat longer north and south than it is east and west thus securing the best exposure to the sun. The purpose in making it slightly oblong is to be sure of a good circulation of air. (See the arrow in Fig. 5.) There ought always to be room here, as the farmer says, for the dog to run through.



Fig. 3. Preparing the First Cap Bundle. This Bundle Should Protect the Top of the Shock from the Weather

Two of the best bundles have been saved for caps. By the best bundles we mean those that have long straight straw and are well bound. These illustrations are faulty because they were made in the winter with fuzzy bundles which had been stored for class use. In actual practice the straw will be limber and tough, therefore easily "broken over" to make a cap. If two men are at work the less skilled of the two should put on the first cap, which according to the prevailing winds in most sections of the country should be on the south side of the shock.

To prepare the first cap, take the bundle as shown in Fig. 3; one arm holds the butt of the bundle against the body and the other hand and arm are used to break the straw down above the band, dividing it equally right and left. When the top of the bundle has been so divided, catch the butt with both hands, opening it well in equal halves. Do not simply lay this cap on top of the shock, for unless well settled it is certain to blow off. Drive it down into the heads of the bundles and do not be afraid to put a

little weight upon the shock. If properly set the portion of this bundle near the base will have an angle of not far from 45 degrees.

The second bundle is prepared exactly the same as the first except that a few straws at the top are left without breaking in order to lap over on top of the first bundle, making a kind of ridge for the roof.



Fig. 4—The Finished Shock. Both Cap Bundles in Place. This Shock Will Not Blow Down. Observe the Air Passage in the Side of the Shock

FINISHING THE SHOCK: The only additional point to bear in mind is that in placing each cap the body of the workman should crowd the shock closely enough to bring in the straggling heads and tuck them well under the caps. If care is taken in choosing and placing the first two pairs of bundles, the shock will stand, and if long straw is chosen

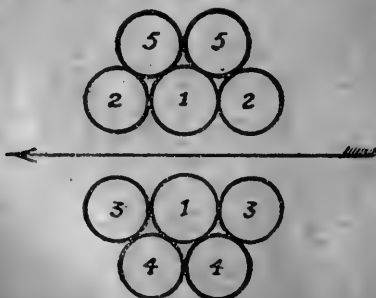


Fig. 5—Arrangement of Bundles in the Shock

for the caps, and if placed as directed, this shock will shed water and dry out rapidly by the action of both sun and wind. There is no need of spending an inordinate amount of time in doing this work. It requires precision in carrying out a well-defined system of procedure; nothing more.

United States Boys' Working Reserve

Farm Craft Series

LESSON 29

MARKET GARDENING

The food shortage in Europe will demand for some years to come exports of meats and cereals from the United States. In order that we may make generous contributions of those products, vegetables should be more largely grown and used as substitutes for meat and cereals. Market gardening requires the maximum amount of labor for the area cultivated and this has been the limiting factor in all the important gardening centers. Here is a great opportunity for the Boys' Working Reserve.

METHODS: It is seldom that two market gardeners even in the same community do things in exactly the same way. This makes it necessary for student laborers to adapt themselves quickly and willingly to the several methods that may be followed in a given community. It is not a matter of executing plans in accordance with your own ideas, but rather of conforming to the wishes of the employer who is financing the proposition, and to this end certain general points must be observed.

THOROUGHNESS is absolutely essential in the performance of all garden work and many garden failures are due to lack of this one element alone.

ORDER AND SYSTEM are at a premium in the vegetable garden. They count for efficiency and invite favorable comments from employers.

SPEED in an enterprise involving so much hand work as does market gardening is of the utmost importance. The hands should be trained to move with dexterity.

CARE OF TOOLS AND IMPLEMENTS: Tools are costly and difficult to obtain. Leaving them in the field at the end of the day's work means that they may disappear. Besides, tools exposed to the weather rust out faster than they wear out, and it takes only a few moments to clean and scour the metal parts with a piece of burlap and put the tool where it belongs. With small tools it is an advantage for the workmen to retain the same ones day after day, a practice which operates as an incentive for keeping them in the best possible condition.

APPLYING MANURE: When coarse stable manure is used it is generally applied before the land is plowed. Fine, partly decayed manure gives better results when spread after the land is plowed and then thoroughly mixed with the soil by frequent harrowing. When applying either coarse or fine stable manure, it should be distributed *evenly* and *uniformly* over the ground and not in lumps or *patches*.

TILLAGE: Most soils should never be plowed, harrowed, rolled or cultivated when wet, for this is certain to injure their physical

properties. A simple test is to squeeze in the hand as much soil as can be conveniently held. If, after opening the hand, the soil crumbles and falls apart, tillage may proceed without danger of injury; if the soil particles remain intact and the ball of earth does not break apart readily, no tillage of any kind should be undertaken until the ground is drier. The tillage of wet soil, unless it be sand or muck, invariably results in the formation of lumps, and these make the land hard to work for several years and decrease crop yields.

PLOWING: The most important of all the tillage operations is plowing. It should be as deep as the character of the soil will permit. The furrow slices should be of medium width and left on edge as much as possible rather than in a perfectly flat position. Heavy applications of manure, or a large amount of any kind of coarse vegetable matter plowed under instead of between the furrows, are likely to interfere with the upward movement of water in the soil.

HARROWING: Whether seeds are to be sown or plants set, the soil should be *thoroughly pulverized*. This is accomplished by harrowing repeatedly until the surface of the land is smooth and the soil reduced to a fine state of division. Most market gardeners have special disk harrows which are exceedingly valuable in the work of leveling and pulverizing. Drags or floats made of heavy plank are also used to a large extent for this purpose.

SEED SOWING: The requirements for germination are heat, moisture, and oxygen. If the student gardener will keep these points in mind, he will be careful to sow seeds under the very best conditions.

It is folly to sow seeds in lumpy, poorly prepared ground, because the soil particles will not settle closely around the seed; under such conditions an adequate supply of moisture cannot enter the seed, unless there are frequent and profuse rains. Poorly prepared soils, too, dry out very rapidly and thus prevent rapid growth of the young plants.

It is important to avoid sowing more seed than the employer considers necessary in order to obtain a good stand of plants. The extravagant use of seed is not only wasteful, but it may necessitate a large amount of work in thinning. At the same time we should be careful to use enough seed.

The depth of covering is a matter which should have the most careful consideration. Ordinarily the larger the seeds the greater should be the depth of covering. Again, the character of the soil and the season of the year also have a bearing on this question. Seedlings are able to force their way through a much greater covering of sandy soil than of stiff, tenacious clay.

Mechanical seed drills are employed almost entirely by commercial growers. Whether these are used or the seed is sown by hand, the rows should be as straight as they can be made. Straight rows not only facilitate cultivation and reduce injury by the cultivator, but they enhance the appearance of the market garden, and all of us would much rather work in an attractive garden than in one showing crooked rows and haphazard methods.

As stated before, the soil particles should come into close contact with the seed, and for this reason it is generally an advantage to *firm* the soil over the seeds immediately after they have been sown. This may be done by the use of the feet, or perhaps with the hoe blade or other device.

TRANSPLANTING: Again, a fine, moist soil is essential to successful transplanting, and the all important thing is to see that the soil is brought into the *closest contact* with the *roots*. Some of the most extensive growers use transplanting machines. They do the work well and save labor. When machines are not used, furrows of the proper depth are often made with small shovels attached to wheel garden hoes or perhaps to horse-drawn implements. Trowels and dibbers of various descriptions are in general use among gardeners. As a rule, the opening in the soil is made with a dibber or trowel in the right hand. The left hand sets the plant in the hole, generally a little deeper than it stood in the seed bed, and holds it in place while the right hand draws enough soil over the roots to hold the plant erect. After both hands have been used to firm the soil about the roots, the hole is filled, and, as you move along the row to set the next plant, additional pressure is brought to bear on the soil over the roots. If the soil is well supplied with moisture, watering after transplanting will be unnecessary. As in the case of seed sowing, we should also be careful to have the rows straight.

CULTIVATION: All the crops grown by market gardeners require more or less cultivation. The stirring of the soil by any suitable tool or implement conserves soil moisture, aerates the soil, modifies soil temperature and destroys weeds. Cultivation should be frequent enough to maintain a surface mulch of very fine soil. Cultivators with many small teeth are more effective for this purpose than are those with a few large shovels. The ideal plan is to cultivate the land after every rain, as soon as the ground becomes dry enough, but gardeners are often so busy that this cannot be done. We should bear in mind that the cultivation of wet soils is just as harmful to their physical properties as plowing when they are wet.

The student workman should be cautious to cultivate with proper care. It is an *easy* matter to run the wheel-hoe down the *middle* of the space between the rows without stirring the ground *near* the *plants*. This kind of cultivation will not have the approval of the up-to-date grower. He will expect the cultivator to be run *just as close* to the plants as is possible without damaging them. He will likely be willing to sacrifice a few leaves or even an occasional plant in order to have the ground practically all covered. Nor will he be pleased if you barely scratch the surface of the soil. Here is an opportunity to use some muscle and to develop more muscle by forcing the cultivator teeth into the soil to the proper depth. Your employer will tell you how he wants the ground cultivated for each crop and at different stages of growth.

HOEING: A certain amount of hoeing is required in all market gardens and on all truck farms. It is work that requires thoroughness and patience. We will not attempt to describe the great variety of hoes used by commercial growers. All of them have their special

uses. The most important thing to keep in mind in using any kind of a hoe is to see that you stir the ground *not touched* by the wheel-hoe or horse cultivator. If we are not thorough and faithful in this respect, weeds may spring up in great numbers on the missed area, and the lack of thorough tillage will prevent the fullest development of the crop under cultivation.

Special skill may be developed in the use of the hoe. In the first place we should select the right hoe for the particular piece of work to be done. Then we should see that the blade is set at the proper angle with the handle to suit the person who is to use the hoe. The cutting edge should also be kept sharp by the frequent use of a coarse file. Then study the effect of different movements of the hoe. Note that it is wholly unnecessary to raise the blade to any great height from the ground, as you would in the use of an axe or a mattock. Also observe that a drawing motion of the blade is more effective than a chopping motion.

WEEDING: There are various kinds of small weeding tools commonly called weeders. They are employed between small plants in the rows, with such crops as onions, beets, carrots, etc. An immense amount of time may be wasted in weeding. Unless the work is done well it is hardly worth doing at all. Moreover, the hands must move rapidly if much work is to be accomplished in a day.

THINNING: It is necessary when we get too thick a stand of plants like beets, onions, carrots, radish, lettuce, etc., to thin them out. The surplus plants may be pulled out or removed with the hand weeder at the same time that young weeds are destroyed. We should endeavor to get rid of the weakest plants, and at the same time strive for a uniform spacing of the plants.

SPRAYING: One of the essential operations of all well-managed market gardens is spraying. Thoroughness of application is the most important point for employees to keep in mind. Many a crop has been lost from disease because all parts of the plant susceptible to attack from disease germs have not been well covered with the spray material. In most instances we should be careful to see that the under surfaces of the leaves as well as the upper are fully covered with the spray.

HARVESTING: A few don'ts are in order in this connection. Don't harvest a tomato or an ear of corn or anything else until it is fully ready for market. Be alert and don't miss specimens that have reached the proper state of development and should be marketed. Be careful and don't bruise or damage the specimens that are being harvested. Be speedy and don't lag in gathering the crops, for the season's profits and the sustenance of our teeming city population depend largely upon prompt harvesting.

PREPARATION FOR MARKET: Attractiveness is the keynote to the successful marketing of garden crops. If the vegetables look well when they reach the market, they generally sell well. This means that they must be clean, they must be carefully graded, and they must be tastefully arranged in the packages. Student workmen should vie with each other in their effort to prepare the best appearing packages, and in the shortest possible time.

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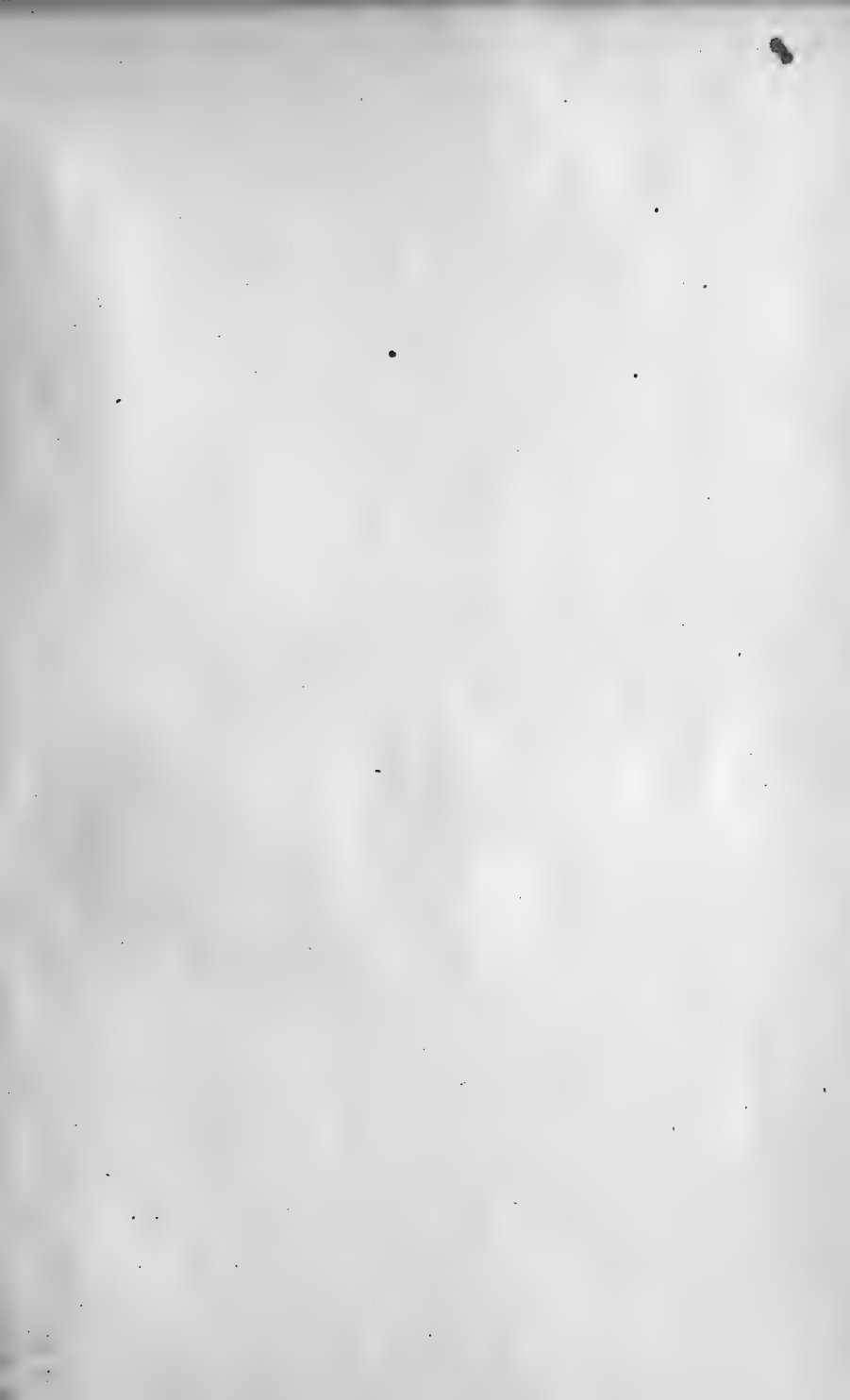
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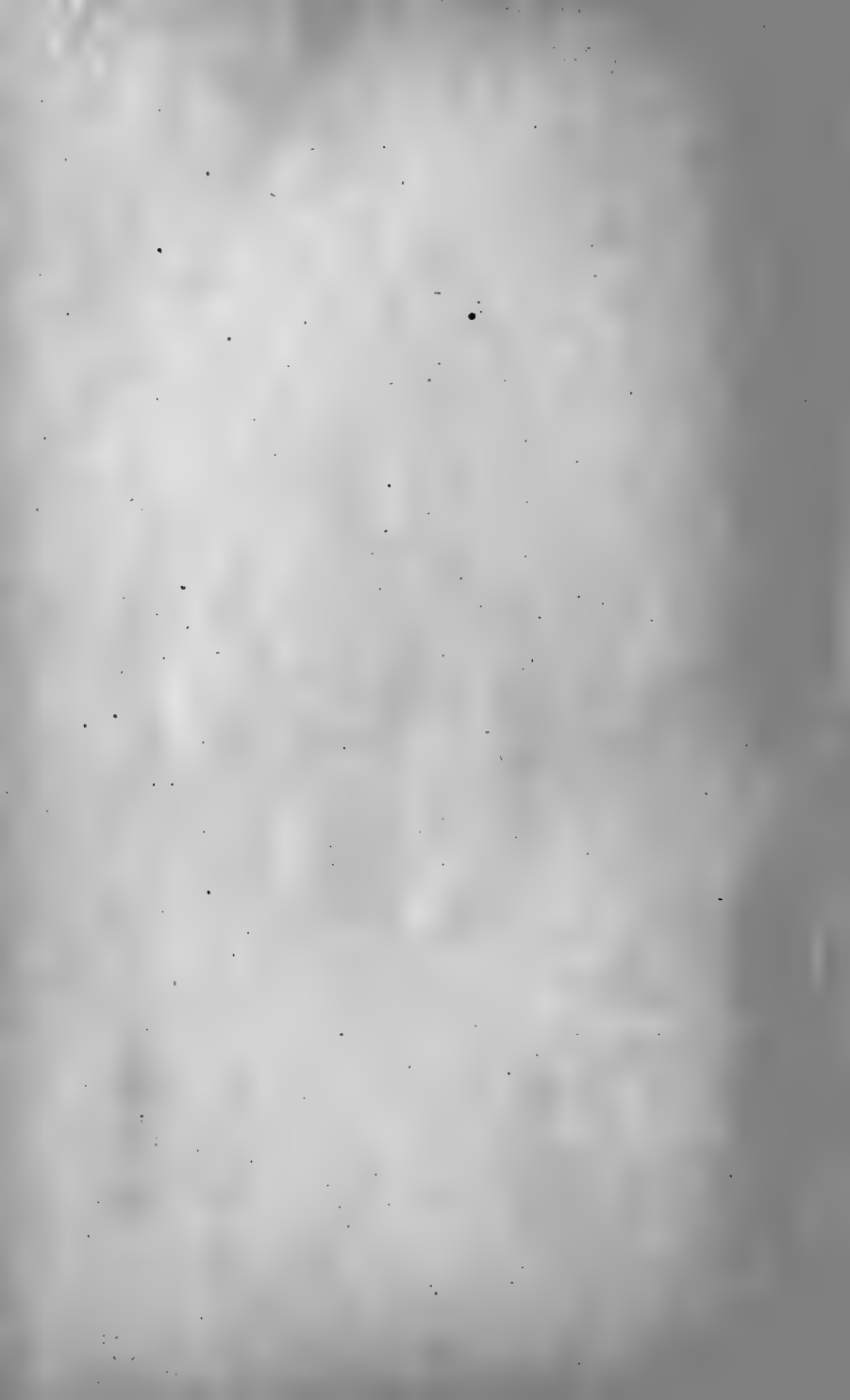
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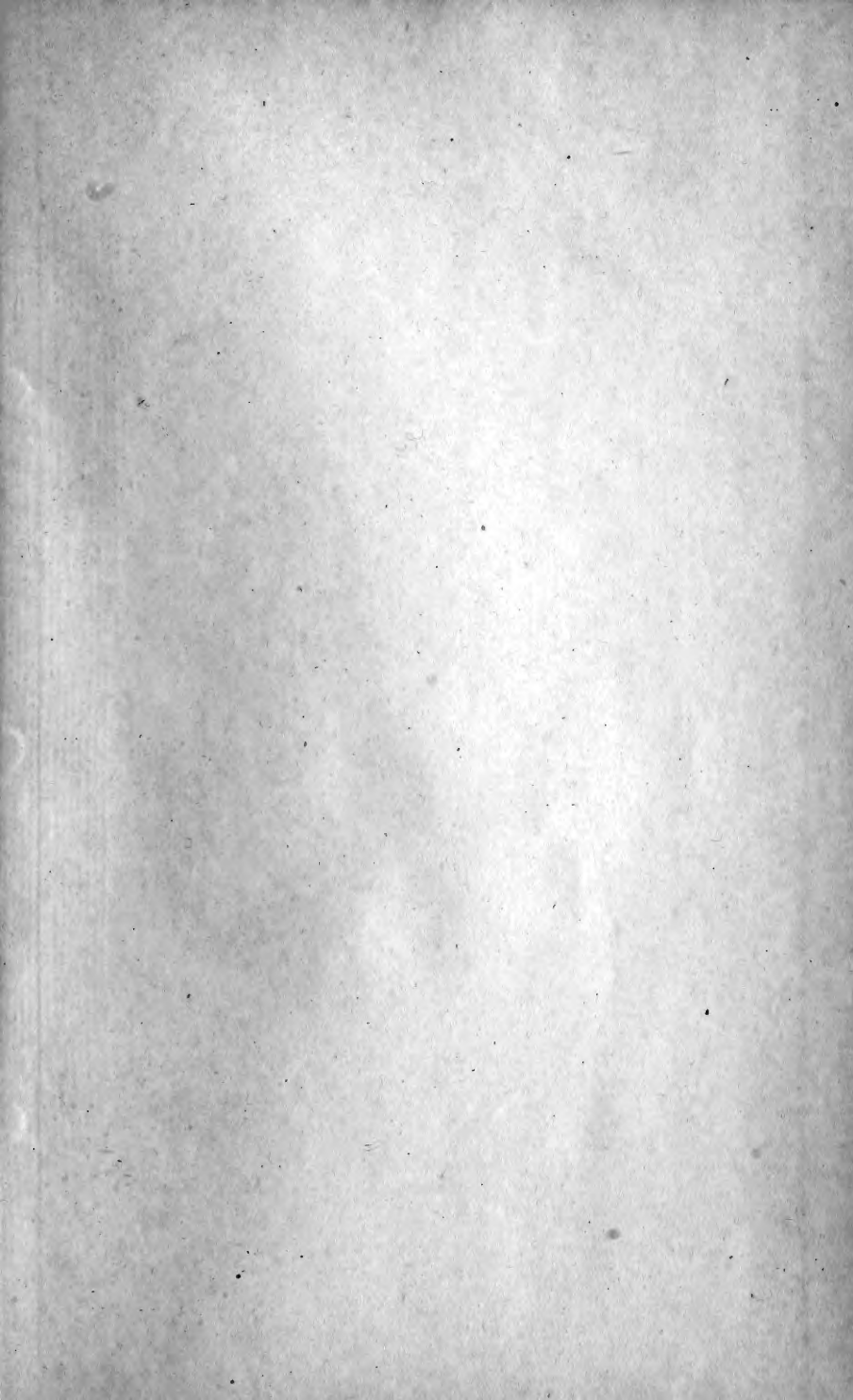
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