LESSON III -- DUTIES OF THE LOOKOUT

Lesson Outline

In order to be an efficient and useful lookout the individual must pay diligent attention to a certain number of things.

a. **Dependability**

The success of the entire protection organization is dependent on the lookout. He must be on the job from daylight to dark, constantly on the alert for possible fires.

Fires must be discovered and reported before the suppression crews can take action.

The report must be made rapidly but not at the sacrifice of accuracy. Speed is essential but should not come at the expense of making the fireman look for a fire an hour or two longer than need be. This is very important during periods of high hazard.

b. **Knowing the Country**

It is essential that the lookout be familiar with the country which is under his observation. Learn the names of all the ridges, streams, meadows, lakes, and other prominent points and identify them on the map.

Plat on the map anything that is not there that may be an aid in the determination of the location of a smoke. The biggest time killer in reporting a fire is lack of knowledge on the part of the lookout.

Learn the country by the following methods:

1. By studying the country and the map and using the firefinder for correlation between the two
2. By information secured from superiors, and any others who are competent
3. By use of the panoramic photographs and by checking by phone with superiors
4. By utilizing every opportunity, as in spring

maintenance work to travel his territory and learn its features

c. <u>Legitimate Smokes</u>

These are smokes that come from controlled fires such as homes, schools, sawmills, railroads, etc. The lookout must identify these and record them so that they will not be turned in as fires.

Record the location and azimuth of each of the smokes for your own information and as a help to someone who might have to cover while the regular lookout is gone.

d. <u>False Smokes</u>

These are not smokes at all but are objects such as rock slides, dead trees, dust, etc. which may give the appearance of smoke under certain conditions.

The lookout must determine and record these so that he will know them and as an aid to the next lookout.

e. <u>Making the Report</u>

The tendency is often to jump to the phone to report a fire as soon as it is seen. This results in lost time.

All information must be at the fingertips of the lookout before he lifts the phone. Practice this gathering of information until it is routine.

f. <u>Lightning Storms</u>

These are the most important weather phenomena that the lookout observes. Every bolt which hits the ground is a potential fire.

1. Record the azimuth on all lightning strikes
2. Record the location of all lightning strikes
3. Mark these locations on the map in red
4. Report all approaching storms
5. Keep a lightning storm report if required

Often lightning strikes will sleep for days and even weeks before showing up. When they do show up they are dangerous because the forest litter has had an opportunity to dry out.

g. <u>Schedules and Check Looks</u>

The lookouts are part of a coordinated system of protection and will have certain schedules for going for water, making check looks, and for leaving the station. These must be observed.

h. <u>Maintenance of Station</u>

It is important that each station be maintained. The lookout will have opportunity to paint, clean, and do other improvement work that not only preserves the station but makes the time spent less tedious.

The living quarters must be kept neat and clean not only because of visitors but because in a neat and clean establishment tools and other articles may be quickly located in an emergency.

i. <u>Safety Measures</u>

<u>Lightning storms</u>: Do not use the telephone when a storm is close or overhead. If it is necessary stand on an insulated table.

Put out any fire in the stove as smoke and heat attract lightning.

Do not go out-of-doors during storms unless it is necessary.

During storms avoid the vicinity of:

1. Lightning conductors and downspouts
2. Metal objects
3. Screened doors and windows
4. Stoves
5. Telephones
6. Radio aerial

If it is necessary to remain outdoors avoid:

1. Small sheds and shelters if in exposed
   positions
2. Isolated trees
3. Wire fences
4. Hill tops and open spaces

Seek the protection of dense woods, a grove of trees, deep valleys, or overhanging cliffs

TELEPHONE COMMUNICATION

INSTRUCTION SUGGESTIONS

A. The purpose of this course is to give the trainee a working knowledge of the operation and maintenance of the various communication systems.

B. The course should be given by an individual who has had experience in the field with telephone maintenance, construction, and use.

C. The course should be given out-of-doors. If the camp is not located near a forest line a short line could be built during the time spent on the second lesson.

D. The course will consist of four lessons.

E. The instructor should attempt to keep the subject open to discussion at all times so that the interest of the trainees will be easy to maintain.

F. The course should be taught by discussion and the demonstrated lecture.

G. The benefits of the course to the trainees in their future work in the field should be emphasized.

Allen, E. T. The Western Fire Fighter's Manual. Western Forestry and Conservation Association, Portland, Oregon.

U. S. F. S., North Pacific Region, Guard Handbook. Portland, Oregon, Revised, April 1933.

Department of Forestry, State of Oregon, Fire Warden's Handbook. Salem, Oregon, 1939.

LESSON I -- LINE SYSTEMS IN USE

Instruction Suggestions

1. This lesson may be given indoors as a lecture.

2. The purpose of the lesson is to be an opening into the field of telephone communication in the protection set-up.

3. Emphasize the advantages and the disadvantages of the two types of circuits.

4. The instructor should attempt to draw from the students as much as is possible in order to make it easier to maintain their interest.

LESSON I -- LINE SYSTEMS IN USE

Lesson Outline

a. Importance

Fire control is dependent upon quick and dependable communication. Without communication the fires could not be reported, crews could not be dispatched, and follow up crews could not be arranged for, except at great sacrifices of time.

Telephone communication depends upon a current of electricity flowing from the transmitter of one phone to the receiver of another and vice-versa.

Every forest employee should know the rudiments of line construction, maintenance, and use so that each can do his part to maintain the efficiency of the system.

An important thing to remember is to stay off the line when someone else is using it. "Listening in" interferes with service and is poor practice.

b. The Grounded Line System

Principle: Every electric current must make a complete circuit. In the grounded system the current travels one way by a single wire and returns by way of the ground or earth.

Good grounds and good connections are essential for this type of line construction. The ground must reach wet soil and this wet soil must be continuous.

In this system the lines are generally strung from trees instead of from poles.

Advantages of the grounded circuit: This type of circuit has the following advantages;

1. Its construction costs are at a minimum
2. It is easy and inexpensive to maintain
3. It is dependable
4. It is not easily interfered with due to the nature of its construction

Disadvantages of the grounded circuit: The following disadvantages are characteristic of the grounded circuit;

1. It is subject to static interference
2. It is limited as to the number of phones that may be used on it
3. It is limited as to the distance a single line may be carried

c. The Metallic Circuit

Principle: The metallic circuit carries the electric current to the other phone and back again by means of metal. That is, two lines are used. The current travels all of the distance by means of the two wires.

Metallic circuits are not generally used. However, they are used in some places where the line is subject to a great deal of use or where interference is so great as to prohibit the use of a grounded line.

Advantages of the metallic circuit: The advantages of the metallic circuit are;

1. It will accommodate high usage
2. It does not restrict the number of phones that can be used
3. It is comparatively free of static interference
4. It may be used over long distances

Disadvantages of the metallic circuit: The disadvantages of the metallic circuit are;

1. It is expensive to construct
2. It is difficult to maintain
3. It is subject to certain breakage by falling trees
4. It is more subject to short circuiting
5. It is difficult to construct

LESSON II -- CONSTRUCTION OF GROUNDED LINE

Instruction Suggestions

1. This lesson is offered to give the trainee the basic principals of telephone construction.

2. Have the students put up a short line if the material is available. This line could later be used for trouble shooting and other maintenance problems.

3. Draw from the knowledge of the class as much as possible.

LESSON II -- CONSTRUCTION OF GROUNDED LINE

Lesson Outline

a. Essential Features

The line wire is attached to trees instead of poles, and it is held by swinging insulators.

The insulator is attached to the tree by a tie wire that will pull loose should the line be subjected to a strain more than one-third of its breaking strength.

Sufficient slack is left in the line to permit it to be carried to the ground if struck by falling timber without breaking either the line or the tie wire.

b. Location of Line

Trails: The line should be so located as to be in full view of the trail. Sharp angles must be avoided. Build lines below the trail whenever possible if trail is on a slope.

Roads: Keep the line on one side of the road. Do not hang the line over the roadway as this may cause interference both with communication and with transportation.

Clearing: Remove all brush, limbs, etc. so that they cannot come within four feet of the line in any direction. It is desirable that the line be clear for eight feet below so as to allow for any sag that may occur. If this is not excessive line leakage will occur. Small trees that are likely to fall on the line should be felled.

Tie trees: Select sound trees to insure their long use as tie trees. Avoid the use of snags and other trees that are rotten or have some other defect that will make them likely to fall or blow down.

Spans should be 100 to 125 feet long and equalized as far as possible. This is to avoid excessively tight spans on the short ones and excessive slack in the long ones.

The tie trees should be staggered so that the line is pulled away from each tie tree. When this is not possible tree pins may be used to get the proper clearance between the tree and the line.

When long spans are necessary stay ties may be used to prevent excessive slack. However, stay ties should be used only when necessary.

Poles set up to cross a clearing should also be staggered to keep the line away from the poles. Use the same method for attaching as is used for trees.

c. Construction Details

Insulators: Use the split insulator. This insulator is the most practicable because of the necessity of stringing the solid insulator on the line before starting to hang it.

Ties: The tie consists of the tie wire wrapped around the split insulator with a length for attachment to the tree. This should be demonstrated carefully by the instructor. The insulator should be wrapped twice leaving a long and short end. Make several turns with the short end and use the long end to fasten to the tree.

One way stay ties are used to prevent all of the slack from running down steep hills, for road crossings, for dead ends, and for entry into buildings. The split insulator may be used here in much the same fashion as above except that more turns will be taken about the long wire which in this case will be the line. Solid insulators are preferred.

A two way stay tie may be used to negotiate sharp turns. Split insulators may be used but solid ones are preferred.

Another method of making sharp angle turns is that of using two ordinary ties on either side of the tie tree that is placed at the turn. (For illustrations of the above ties refer to The Western Fire Fighter's Manual, pages 8 and 9)

<u>Tree pins</u>: Tree pins may be used if it is necessary and if it is not practicable to have the wire pull away from the tree. They are merely a metal or wooden pin which holds the insulator away from the tree.

<u>Slack</u>: There should be enough slack to permit the line to be pulled down to the ground in any span without pulling out a tie. Allow two to four feet of slack in each span, more in long spans.

<u>Connections</u>: These should be made with a neck two or three inches long with two twists, with from five to seven close wraps on each side. They must be made carefully so that they will slide through the insulators with a minimum of resistance.

<u>Hanging the line</u>: A light 12 foot ladder is the most practicable to use. A pair of tree climbers should be on hand for use on trees with limbs that cannot be reached for removal with the ladders. Tree climbers cause a tendancy to hang the line too high.

d. <u>Crossings</u>

<u>Railroads</u>: The crossing of the railroad right of way should comply with the requirements of the railroad as well as comply with the state laws. Ordinarily, it should cross at right angles and underground if at all possible.

For underground crossings the tie pole should be not less than 25 feet away from the track on each side. Steel or some other approved metal conduit should be used.

<u>With other phone lines</u>: The crossing of electric lines should be at right angles and should be underground if the voltage of the electric line is over 2,200. This crossing will be the same as used for underground railroad crossings. If an overhead crossing is used on lines of less than 2,200 volts clearance must be at least six feet. The line must not be less than 12 feet from the nearest power pole.

<u>Electric power transmission lines</u>: Telephone wires should be dead ended at least 50 feet on either side of the power line and the crossing made underground.

Roads: Crossings over wagon roads should be at right angles with a short crossing span. They should be tied in on each side of the road. The line must be at least 20 feet from the ground at its lowest point.

e. Equipment and Supplies

The size of the construction crew may vary and the amount of the different items will vary with the size of the crew. The following list is of the things that will be needed:

1. Light ladders
2. Tree climbers
3. Connectors
4. Pliers
5. Reel for wire
6. Staples, 3"
7. #9 wire
8. Double bit axes
9. Lineman's belt and rope
10. Bucking saw
11. Insulators

LESSON III -- MAINTENANCE OF SYSTEM

Instruction Suggestions

1. This lesson may be given as the first lesson in the course. However, if the lesson on construction does not precede this lesson splicing and the various methods of tying must be taught.

2. Enlarge on the points in the Lesson Outline in order to bring the problems of maintenance close to the trainee.

3. If any time has elapsed between the giving of the lesson on construction and the giving of this lesson review some of the essential points of construction.

4. Encourage questioning on the part of the students. If they ask questions they are alert and interested.

5. Have on hand all of the tools and supplies that are listed in the last section of the lesson. In addition have a telephone, preferably two and a short line so that they can be talked over, to use for practical problems.

LESSON III -- MAINTENANCE OF SYSTEM

Lesson Outline

Construction of the line to certain standards is most important but those standards are of no avail if the line is not cared for after construction. The line must be kept in as good condition as when it was first built. Maintenance often offers an opportunity to build toward the set standards if hasty original construction prohibited the reaching of these standards.

a. Maintenance of Line

Down timber: Every year trees and snags fall damaging or breaking the line. Remove all limbs, trees, snags, and other debris from the line. Make sure that when the line is cleared it swings back into place.

Excessive slack may show in the line when debris is first removed but this may be due to a break somewhere ahead. It is wise not to take up slack until on the return to headquarters in the evening. Taking up slack unnecessarily means many splices which is undesirable.

Brushing out: All brush, limbs, and trees should be trimmed so that there is nothing within four feet of the line. Allow for the weight of rain and snow and for the effect of the wind. Young trees that will grow into the line should be removed.

Tie wires and insulators: Inspect all insulators and ties. Make sure that the tie wires are twisted tight around the insulators. Replace broken insulators. If an insulator is in the wrong place put in a tree pin or swing the insulator from another tree, or change the wire and insulator to another tree.

Connections: If any loose or rusty splices are found the line should be cut and the good splices made. Good splices are important to the proper functioning of the line.

Breaks: Repair all breaks with a good splice. If the cause of the break has not yet been removed see that it is removed so that the trouble will not be repeated.

Slack: There should be enough slack so that the line can be pulled to the ground between any span. If the line is too tight cut in more slack. When this is done, cut the line at an old splice so that only one new splice is made.

Ties: If the ties are pulled out of staple examine them to make sure that they have not been damaged. If damaged, put on a new tie wire.

Drop wire: Make certain that there is enough slack to allow for any tree sway. If the drop line is copper see that the connection is either soldered or that a Fahnstock connector is used.

Maintenance tools for a two man crew:

Tools:

1 pair climbers
1 pair pliers, 8"
1 pair connectors
1 double blade axe
1 hatchet
1 "come-along"
1 lineman's belt and rope

Materials:

Supply of #9 iron telephone wire
Supply of 3" staples
Supply of split insulators

b. Safety Measures

If climbers are used they should not be used without the safety belt. Take spurs off when not actually using them to climb. Do not jump at trees that are below the trail or road.

Do not sacrifice safety for speed in the use of any of the tools.

Do not let familiarity breed carelessness.

Think of the others that are working with you.

c. Inside Wiring and Instrument Maintenance

Insulated wire: All the insulated wire from the line to the phone should be No. 14 rubber covered, single braided, copper wire. If inferior wire has been used it should be replaced. If wire is loose and carelessly run fasten neatly in place with insulated tacks.

Connections: Examine all connections and if they are not properly made cut them out and remake them. All bare places must be taped.

Lightning protection: If the lightning protectors are in place see that they have not been damaged in any way. Check their proper wiring.

Switches: Go over all contacts and see that the knife blades work freely and fit tight in their clips. If necessary bend the clips together. If they are damaged replace them.

Battery: Put new batteries in each spring and date them.

Telephone: See that all screw contacts with the phone are tight. Remove receiver up and down while the door of phone is open to see if the three spring contacts function properly. Test phone by calling dispatcher or someone else on the line. If it does not work properly clean out diaphragm, adjust bells, and test the ground.

Maintenance tools for a one man crew:

Tools:

1 screw driver
1 pair of 8" pliers
1 small hammer
1 blow torch and soldering iron

Materials:

Supply of #14 covered copper wire
A roll of tape
A box of insulated staples

Wire solder
Solder paste
Small supply of tinfoil
Extra Fahnstock connectors
Extra fuses
A supply of 1"--#8 round head screws
3 dry batteries for each telephone

LESSON IV -- TROUBLE SHOOTING

Instruction Suggestions

1. Telephones should be set up and the common troubles listed in the Lesson Outline should be simulated.

2. Give each trainee an opportunity to run down the common phone troubles that he may come in contact with in the field.

3. Use the demonstrated lecture method for detailed work.

4. Encourage the asking of questions on the part of the trainee.

5. Materials needed will be two phones, wire, screwdriver, pliers, tape, and vacuum arestors.

LESSON IV -- TROUBLE SHOOTING

Lesson Outline

The most common telephone troubles are caused by line grounds, broken wires, loose connections, poor grounds on the instruments, and short circuits. These troubles may occur in the phone or on the line. Trouble may also be the result of weak batteries. The first step in the process of trouble shooting is determining whether the trouble is on the line or at some telephone station.

a. Common Troubles

Grounds: A ground on any part of the line will cause trouble according to how effective the ground is. If it is a complete ground it may cut out the line entirely and the only solution is to find the ground and correct it. If the line is not up to standard in effectiveness it should be checked for possible line grounds.

Loose connections or broken wires: Either of these will make it impossible to use the line because the flow of electricity is broken. However, two phones on the same side of the break may be used. If broken or if a loose connection is present it must be found and repaired.

b. Determination of Troubles

Generator turns easily, you cannot ring out: This may be caused by a ground on the line or by the line and ground wires becoming crossed or tangled.

To test open the line switch. If the generator now turns easily the trouble is on the line. If it still turns hard the trouble is in the inside wiring or in the phone itself. If the phone is disconnected and still turns hard then the trouble is in the phone.

Phone trouble is usually caused by shorting of the wiring due to damage by oil. This wiring should be replaced.

Bell rings, you can hear others but they cannot hear you: The trouble can only be in the transmitter circuit and may be caused by;

1. Weak batteries
2. Batteries improperly connected
3. Transmitter "set" or "packed"
4. A broken wire in the telephone
5. Switch hook contacts dirty and not making contact

Test: Shake up the transmitter. If trouble is still there, look at the batteries and battery connections. If the batteries are O.K. look for a broken wire in the primary or battery circuit.

Bell rings, but you cannot hear anything: The trouble may be caused by;

1. Dirt in the receiver
2. A dent in the receiver diaphragm
3. A broken wire in the receiver circuit
4. A loose connection
5. A burned out condenser
6. Switch hook spring contacts out of adjustment
7. Receiver cord loose in receiver
8. Fine wire in receiver coils burned out by lightning

Test: Connect one wire of the receiver cord to a dry cell and then touch the other post with the loose wire. If the cord is workable, the contact will impart sound to the receiver.

No one can ring you but you can ring others. You can hear and talk: This trouble may be caused by;

1. Burned out wire in the ringer coils
2. Faulty bell adjustment
3. Loose connection or broken wire in the ringer circuit of the telephone

Test: Test the bell adjustment. If the bell still does not ring, test the ringer coils. Connect the generator directly to the ringer. If the bell does not ring it indicates that the fine wire in either or both of the coils has been burned out. A new frame and coils must then be substituted. Check the wiring in the ringer circuit.

<u>You cannot ring others and others cannot ring you, but you can hear and talk well</u>; This is usually caused by;

1. Poor ground connection
2. Poor connection in the inside or outside wires

Test: First make a test for a poor connection. If the wiring is found to be all right make a new ground connection or reconstruct and reset the ground.

RADIO

INSTRUCTION SUGGESTIONS

A. This course will be given principally for the purpose of passing the examination for restricted commercial Radio-Telephone Operator's License.

B. The course will also include instruction in the part that radio communication plays in the protection set-up.

C. Lesson 2 will consist entirely of the teaching of the glossarized questions and answers. These questions should be mimeographed and given to each trainee that takes the course.

D. Encourage open discussion and attempt to have every trainee take part in it.

E. This lesson may be given indoors. It is not a field class.

F. At the end of the course the trainees should take an examination made up of the questions in the Lesson Outline.

Schroeder, George, Prof. Compiled Questions and Answers, School of Forestry, Oregon State College, 1940.
U. S. F. S., North Pacific Region, Guard Handbook. Portland, Oregon, Revised, April 1933.

LESSON I -- RADIO IN PROTECTION

Instruction Suggestions

1. This lesson may be given indoors.
2. All of the trainees should take the course as they may all have occasion to use radio in the field in their protection work.
3. No preparatory work by the students is necessary.
4. Student will have to have notebook and pencil for the taking of notes.

LESSON I -- RADIO IN PROTECTION

Lesson Outline

a. Radio is used chiefly to supplement telephone service. It is not intended that it take the place of the telephone system.

In some cases, where the cost of building a telephone line is prohibitive, radio is used in lieu of the telephone.

Complete instructions for operation are furnished with each set.

At the present time, the place of radio in communication systems is based on the following uses:

1. For communication with emergency points manned for short periods

2. For communication with adjoining national forest protective organizations

3. To connect trail construction and maintenance crews when not camped along telephone lines

4. To equip firemen of lookouts, firemen in certain inaccessible or remote districts, and particularly where there is an incendiary risk, so that they may be kept in communication while engaged in fire chasing

5. To equip patrolmen whose routes are not along telephone lines

6. For communication on going fires. This is the most important use of radio in the protection set-up. The use of radio by scouts and for communication between fire camps is important

LESSON II -- RADIO OPERATOR'S EXAM

Instruction Suggestions

1. On the following pages is a comprehensive survey of the field for a Restricted Radio Operator's examination. This survey is in question and answer form.

2. The instructor will teach directly from the questions.

3. At the end of the lesson, or in a short time, give the trainees the examination.

EXAM FOR RESTRICTED COMMERCIAL RADIO-TELEPHONE OPERATOR'S LICENSE

1. Q State five grounds on any one of which the Federal Communications Commission has authority to suspend a radio operator's license or permit.

   A 1. Violation of any radio law. 2. Malicious destruction of any radio apparatus. 3. Alteration of service record. 4. Wilfully causing interference. 5. Use of profane, obscene, or indecent language. 6. Transmission of unnecessary signals.

2. Q Is an operator subject to the penal provisions of the Act if he violates the terms of a radio treaty to which the United States is a party?

   A No. He would be liable for a $500 fine and for license suspension.

3. Q State at least two provisions made in the Communications Act to insure the priority of communications or signals relating to ships in distress.

   A 1. All radio stations shall give absolute priority to distress signals. 2. All radio stations shall assist the vessel in distress as much as possible.

4. Q In what class of radio station and under what conditions is an operator permitted to adjust the transmitter for a maximum of radiation without regard to the interference produced?

   A A radio station on shipboard when communication is distress signals.

5. Q In what cases may a transmitter on shipboard be adjusted to produce a maximum of radiation irrespective of the interference which may be caused?

   A When sending radio communications or signals of distress or communications relating thereto.

6. Q What communications, if any, are not subject to the secrecy provisions of the Communications Act?

   A Radio communications by amateurs or others for the use of the general public or relating to ships in distress.

7.Q State in your own words the prohibition, if any, against the transmission of false calls and communications relating to distress.

A No person in U. S. shall transmit or cause to be transmitted any false signal of distress or communication relating thereto. No station shall rebroadcast without permission.

8.Q State in your own words the law regarding the transmission of false or fraudulent signals of distress or communications relating thereto.

A No one in the U. S. shall transmit or cause to be transmitted any false signal of distress or communication relating thereto.

9.Q State in your own words the substance of the Communications Act that is provided to ensure the secrecy of radiograms.

A No person shall divulge or publish contents of any interstate or foreign radio communications to anyone other than the addressee, his agent, attorney or upon written order of a court, and shall not use same for benefit of self or others.

10.Q Does the Communications Act of 1934, as amended, contain any provision that prohibits the interception, use and publication of radio communications?

A Yes. No one shall publish or otherwise pass on to anyone else not authorized to receive same, any information received over the radio nor shall he use that information for benefit of self or others.

11.Q What form of language if transmitted by an operator other person makes him subject to the penal provisions of the Communications Act?

A No person within the jurisdiction of the U. S. shall utter any obscene, indecent, or profane language by means of radio communication.

12.Q What provisions are made in the Communications Act to insure inter-communication between stations in the mobile service?

A All radio stations on land or sea which are open to general public service shall be bound to exchange radio communications or signals with any other station on shipboard or in aircraft.

13.Q Does the Federal Communications Commission have authority to issue a radio operator's license or permit to a citizen of a country other than the U. S.?

A No. The Commission can issue them to citizens of the United States only.

14.Q Has the master of a ship radiotelephone station the authority to forbid the transmission of a message by anyone on board?

A Yes. He may forbid any communication except as it is regulated by law.

15.Q Has the master of a ship station the authority to regulate the transmissions and reception of messages on shipboard?

A Yes, except as regulations require.

16.Q Under what conditions is the utterance or transmission of a false or fraudulent signal of distress or communications relating thereto permissible?

A Under no conditions.

17.Q Under what conditions is the utterance of obscene, indecent or profane language by means of radio communications permissible?

A Under no conditions.

18.Q What is the radiotelephony safety signal?

A In radiotelephony, the word "security" repeated three times, shall be used as a safety signal.

19.Q Under what conditions may a mobile station, if necessary, disregard the General Radio Regulations?

A During distress any use of the equipment is legal.

20.Q What is the radiotelephony urgent signal?

A Pan Pan Pan

21.Q What signals and messages are forbidden by international agreement?

A The transmission of unnecessary or unidentified signals or correspondence shall be forbidden to all stations.

22.Q What precaution must an operator observe before proceeding with a transmission?

A Listen in on frequency until sure no interference will result.

23.Q What does the receipt of the signal "Pan" transmitted by radiotelephony indicate?

A The urgent signal shall indicate that the calling station has a very urgent message to transmit concerning the safety of a ship, an aircraft, or another vehicle, or concerning the safety of some person on board or sighted from on board.

24.Q What should an operator do if he intercepts the word "Security" repeated three times?

A Continue listening on wave length until message is completed.

25.Q When should the safety signal be transmitted by telephony?

A When the transmitting station is about to transmit a message concerning the safety of navigation or giving important meteorological warnings.

26.Q The urgent signal sent by an aircraft and not followed by a message indicates what?

A Transmitting station is in trouble and forced to land but is not in need of immediate help.

27.Q What obligation rests on an operator intercepting the signal "Pan"?

A Has priority over all but distress signals and a station must not interfere with the message following the urgent signal.

28.Q What procedures must be followed by a radio station receiving a distress call from a mobile station which is unquestionably in its vicinity?

A Acknowledge receipt at once then aid in every way possible.

29.Q What essential information should be transmitted in a distress message?

A Distress call, name of ship, aircraft or vehicle in distress, help wanted, position, nature of distress and anything else to help.

30.Q By what authority may the operator of a ship or aircraft station transmit a distress call or message?

A By order of master or person responsible for ship, aircraft or vehicle.

31.Q What is the international distress signal to be used in radiotelephony?

A "Mayday."

32.Q What does the interception of the word "Mayday" transmitted by radiotelephony announce?

A Ship, aircraft or other vehicle sending signal threatened with serious and eminent danger and requests immediate assistance.

33.Q What radio waves may be used under the provisions of the Treaty in transmitting distress messages in case of an emergency by aircraft stations?

A Any waves available.

34.Q State the priority of radio communications in the mobile service.

A Distress, urgent, safety, and regular communication.

35.Q What information must be contained in a distress message transmitted in an emergency, from a radio station aboard aircraft flying over land?

A As a general rule, an aircraft flying over land shall signal its position by the name of the nearest locality, its approximate distance from this point, accompanied, according to the case, by one of the words, North, South, East, or West, or in some cases, words indicating intermediate directions.

36.Q What information must be contained in a distress message?

A Distress call, name of ship, aircraft or vehicle in distress, position, nature of distress, help wanted, and anything else to help.

37.Q When after having sent its distress message an aircraft station is unable to signal its position, what procedure shall be followed to assist others in determining its approximate location?

A Send call signal long enough for radio direction finding stations to determine its position.

38.Q State at least two classes of stations which cannot be operated by the holder of a restricted radiotelephone operator permit.

A 1. Broadcast station other than a relay broadcast station.
2. Coastal telephone or coastal harbor station other than in Alaska.
3. Ship station licensed to use Type A-3 emission for communication with coastal telephone stations.

39.Q Under what conditions may the holder of a restricted radiotelephone operator's permit operate a station for which the permit is valid?

A If he doesn't make adjustments to transmitter proper. If equipment is designed so that normal service will not cause off-frequency operation or unauthorized radiation, and if needed adjustments are made as needed by an operator holding a first or second-class license.

40.Q State at least two classes of ship stations which the holder of a restricted radiotelegraph permit is permitted from operating?

A 1. Any broadcast station other than a relay broadcast station.
2. A ship station licensed to use A-3 emission for communication with coastal telephone stations.
3. A radiotelegraph station on board a vessel re-

quired by treaty or statute to be equipped with a radio installation.
4. Or for the operation of any ship telegraph, coastal telegraph or marine-relay station open to public correspondence.

41.Q Who is permitted to make adjustments or tests in the presence of the licensed operator responsible for the maintenance of the transmitter and under his responsibility for the proper operation of the equipment?

A The licensed operator responsible for the maintenance of a transmitter may permit other persons to adjust a transmitter in his presence for the purpose of carrying out tests or making adjustments requiring specialized knowledge or skill, provided that he shall not be relieved thereby from responsibility for the proper operation of the equipment.

42.Q Within what period of time must any person receiving official notice of a violation of the terms of the Communications Act of 1934, as amended, Treaty or Rules and Regulations of the Commission, answer same?

A Within 3 days of receipt of notice of violation.

43.Q What is the obligation of an operator whose license or permit has been lost, mutilated, or destroyed?

A An operator whose license or permit has been lost, mutilated, or destroyed, should immediately notify the Commission, submit sworn application for duplicate. If license is lost, must state search was made and that if found original or duplicate will be returned for cancellation and statement of service record.

44.Q How may the holder of a radiotelegraph or radiotelephone first or second-class license indicate to representatives of the Commission that he legally qualified to adjust equipment operated by holders of restricted radiotelephone operator permits?

A By posting his operator's license or a verified statement from the Commission in lieu thereof.

45.Q How may operator show proof of his legal qualifications to operate a radio transmitter?

A The original license of each station operator shall be posted at the place where he is on duty or kept in his possession in the manner specified in the regulations governing the class of station concerned.

46.Q What is an operator or a radio station, who has submitted his license for renewal or applied for a duplicate license required to exhibit as his authority to continue operation of the station pending receipt of the license?

A Signed copy of the application for duplicate or renewal.

47.Q What is the holder of a radiotelegraph or radiotelephone first or second-class operator at stations operated by holders of restricted operator's permits, obligated to post at the stations?

A His operator's license or a verified statement from the Commission.

48.Q How may corrections be made in a log?

A Person responsible for entry shall cross out erroneous portion, initial the correction and list date of correction.

49.Q Is it lawful to erase an entry made in a station log?

A No.

50.Q What are the Commission's requirements with regard to the retention of radio station log?

A Shall be retained for one year except that logs containing communications incident to a disaster or incident to or involved in an investigation shall be kept until the FCC says to destroy them and logs incident to or involved in any claim or complaint shall also be retained until FCC OK's destruction.

51.Q How long must the licensee retain a station log which involves communications incident to a disaster?

A Until notified by the Commission to destroy them.

52.Q What is the Commission's rule with regard to rough logs?

A Rough logs may be transcribed into condensed form, but in such case the original log or memoranda and all portions thereof shall be preserved and made a part of the complete log.

53.Q What procedure should one follow if he desires to resist an order of suspension of his operator's license or permit?

A Within 15 days or as soon thereafter as possible after receipt of notice of suspension, the operator shall file application for hearing with FCC. He will file pertinent material and the Commission will affirm, modify or revoke the order of suspension as a result.

54.Q What is the responsibility of a licensee of a radio station with respect to permitting it to be inspected by representatives of the Commission?

A Have station available for inspection at any reasonable time.

55.Q Who is responsible for the control of distress traffic?

A The control of distress traffic shall devolve upon the mobile station in distress or upon the mobile station which is authorized to send and has sent the distress call.

56.Q Are logs subject to inspection by representatives of the Commission?

A The logs shall be made available upon request by an authorized representative of the Commission.

57.Q By whom may the log of a radio station be kept?

A Each log shall be kept by the person or persons competent to do so, having actual knowledge of the facts required.

58.Q Under what conditions may a distress message be retransmitted?

A Any station which becomes aware that a mobile station is in distress may transmit the distress message in the following cases:

a. When the station in distress is not itself in a position to transmit a message.

b. In the case of mobile stations, when the master or the person in charge of the ship, aircraft or other vehicle carrying the station which intervenes believes that further help is necessary.

c. In the case of other stations, when directed to do so by the station in control of distress traffic or when it has reason to believe that a distress call which it has intercepted has not been received by any station in a position to render aid.

59.Q What tolerance in operating power is permissible under normal circumstances?

A The operating power of all radio stations shall be maintained within the following tolerance of the assigned power:

1. When the maximum power only is specified, the operating power shall not be greater than necessary to carry on the service and in no event more than 5% above the maximum power specified.

2. When an exact power is specified, the operating power shall not be more than 5% above or less than 10% below such power.

60.Q Under what conditions may a station be operated in a manner other than that specified in the station license?

A During a period of emergency in which the normal communication facilities are disrupted as a result of hurricane, flood, earthquake, or similar disaster.

61.Q What is the Commission's rule with respect to measurement of the radio station frequency?

A The licensee of each station shall provide means for the measurement of the station frequency. The measurement of the station frequency shall be made by a means independent of the frequency control of the transmitter and shall be conducted in accord with the regulations governing the class of station concerned.

62.Q When may operation be resumed after a station has been notified to cease transmission because of interference to distress traffic?

A After notification by the station issuing the original notice that the station involved will not interfere with distress traffic or until notification that need for handling distress traffic no longer exists.

To apply for application blank and appointment for the exam, write:

Federal Communications Commission
Inspector District #13
207 New U. S. Court House Building
Main and Sixth Streets
Portland, Oregon

CARE AND USE OF THE COMPASS

INSTRUCTION SUGGESTIONS

A. This course may be given to any enrollees who desire to take it, but is intended chiefly for those working on road location parties, timber survey parties, and others who have occasion to use the compass. Classes should be limited to 12 men.

B. This course should be taught by a Junior Civil Engineer, Junior Forester, District Forest Ranger, or a qualified Project Superintendent, or Foreman.

C. Instruction should be given not as a part of work time. Lessons 1 and 2 may be given in evenings. Lessons 3, 5, 6, 7, 8, and 9 must be given in daylight, preferably in the afternoon, after work hours. The first part of Lesson 4 should be given on a clear night, outdoors, the second part in daylight.

D. Lessons 1 and 2 may be given indoors. All other lessons are to be given outdoors.

E. This course consists of nine lessons.

F. This course should be taught by demonstration by the instructor and practice by the students.

G. Lesson aids are listed in the Instruction Suggestions for each lesson. Each student should have a notebook and pencil. The following are absolutely necessary: Compass (Forest Service staff type) and case, ball and socket joint, Jacob Staff, stakes, axe. If the compass at hand has no clinometer, omit Lesson 9. Instructions are referred to standard books on surveying. The following are suggested:

"Plane Surveying" by John C. Tracy
"Elementary Surveying" by Breed and Hosmer (Vol.1)
"Manual for Northern Woodsmen" by Austin Cary
"Surveying" by Davis, Foote, and Rayner.

LESSON I -- PARTS OF THE COMPASS

Instruction Suggestions

1. The compass described in this lesson is the Forest Service Standard Staff compass, with square base, and clinometer pendulum, similar to K. & E. #5340. For other types of staff compasses adapt description of parts to suit.

2. The main purpose of this lesson is to acquaint the students with the parts of the compass. Have the students gather around while the instructor points out each part of the compass. Proceed slowly so that all become familiar with the instrument. Question each student as to the names of the various parts until they are thoroughly familiar with them.

3. Do not attempt here to explain the use of any part of the instrument. Defer this until later lessons.

4. The dip of the needle is taken up in Lesson 4. The reversed position of E and W on the compass plate is explained in Lesson 3. Do not take time here to go into these points.

5. Let the best students in the class explain the parts of the compass to the rest of the class. Let all examine the instrument so that they see each part themselves.

LESSON I -- PARTS OF THE COMPASS

Lesson Outline

a. The compass box is a circular case of brass or aluminum with a glass top so built as to practically exclude moisture. The box is made of one of these metals because they do not affect the compass needle. Iron or steel would attract the magnetic needle.

b. The compass needle is a steel bar pointed at the ends, and balanced carefully on a needle pointed pivot in the center of the box. The needle rests on a jeweled bearing. The north pointing end of the needle is usually marked by a small engraved arrow. On the south end of the needle a small weight of wire is attached to compensate for the downward dipping tendency of the north end of the needle. When allowed to move freely, the compass needle will swing from side to side until it comes to rest in a north and south direction.

c. The needle stop consists of a brass lever and screw for clamping the needle against the glass of the compass box, thus raising the needle off the pivot to prevent wearing of the pivot when the compass is carried.

d. The four principal points of the compass are North, South, East, and West. A complete circle is divided into 360 degrees and each quadrant or fourth of a circle, is therefore divided into 90 degrees. These degrees are marked on a circle inside the compass box and the circle is so placed that the ends of the needle almost touch the graduated circle so that degrees are easily read. The quadrants are marked from North and South, both of which are zero; therefore, East and West are marked 90 degrees.

e. Located at the zero points (North and South) of the compass box are two slitted sights, or vanes, so placed that when sighting through the slits, the line of sight passes through the two zero points and the pivot which supports the needle at its center. The sight vanes are hinged so that they may be folded flat on the top of the compass box when carrying the compass.

The sight vane at the south end of the compass has a simple slit; the vane at the north end has a wide slit in the center of which is a fine, vertical wire.

f. Most compasses are equipped with spirit level tubes by which the compass is leveled. On some compasses, the spirit level is circular and is mounted inside the box. In other types two level tubes are provided, mounted at right angles to each other and placed either inside the box, on the base outside the box, or on the arms of the compass in older types.

g. Inside the compass box, suspended from the pivot is a pendulum arm, the end of which is provided with a wire for reading degrees on the clinometer arc. When the compass is turned on its side, so that the pendulum swings freely, the degrees of rise or fall may be read on the arc which is graduated to degrees for 90 degrees in each direction from "plumb," which is zero.

h. The square base of the compass box has two edges marked in degrees as a protractor for platting bearings or angles, one edge graduated in inches and tenths of inches, the other edge graduated in inches and eighths.

i. The compass box is mounted on a brass ball and socket joint, one end of which screws into the box, the other fits over the end of a Jacob Staff or compass tripod. The friction of the ball against a leather washer holds the compass in whatever position it is placed and by this means the compass is leveled. The upper part of the joint contains a spindle on which the compass turns freely. After being leveled and sighted, the compass may be clamped in position by a thumb screw. The knurled cuff that tightens the ball has a segment cut out of it to permit the compass to be turned on its edge while mounted on the Jacob Staff or tripod.

j. When in use, the compass is usually supported on a Jacob Staff which is about 3½ feet long. The top end is shaped to fit the bottom of the ball and socket joint, the bottom is armed with an iron shoe. A light tripod is sometimes used to support the compass.

k. The compass is usually carried in a leather case which is provided with a shoulder strap and with belt slits. The case contains a pocket for the ball and socket joint.

LESSON II -- CARE OF THE COMPASS

Instruction Suggestions

1. Demonstrate each correct practice in caring for the compass. Let the student handle the compass and become familiar with each point of care.

2. Amplify the discussion under each point in the Lesson Outline. Bring out, and let the students bring out, incidents in your own camp which demonstrate correct and incorrect practices in caring for a compass.

3. Keep this lesson in mind for use with later lesson on the use of the instrument. Correct every error of omission or commission as it occurs in field practice with the compass.

LESSON II -- CARE OF THE COMPASS

Lesson Outline

a. The compass is a surveying instrument of considerably greater accuracy than might be supposed by the novice. It is an instrument of precision, costing about $75.00, and warrants the greatest care in handling to avoid damage or throwing the instrument out of adjustment, thus preventing accurate work.

b. When not in use the compass should always be placed in the leather case.

The needle should be clamped so that it does not move, thus preventing wear on the pivot or chipping of the jewel. The clamping screw should not be tightened too much. Turn it easily until it is snug.

The sight vanes should always be folded down to prevent them from being bumped out of alignment.

The ball and socket joint should be unscrewed from the compass rather than the spindle being detached by removing the thumb screw. The latter method frequently causes loss of the spindle or the thumb screw. The ball and socket joint should not be left on the Jacob Staff while carrying.

The compass, although in its case, should not be placed on the floor of a truck or in a tool box where it may receive jolts sufficient to damage it.

The compass should be held by the compassman or slung across his shoulder by the shoulder strap or carried in the case on his belt.

c. When in use, the compass should never be left unattended by the compassman responsible for it because it may fall over or be knocked over, severely damaging it.

The Jacob Staff should not be thrust into the ground with the compass attached. Always set the staff first, then place the compass on it.

Never force any part of any surveying instrument. All parts are made to work easily. If they do not, the part is probably damaged or out of adjustment and further damage will result from forcing.

When moving from station to station the needle should first be clamped, the sight vanes folded down, and the compass, with ball and socket joint attached, removed from the Jacob Staff, and either carried in the hand or placed in the compass case, which usually has a U cut into the face to accommodate the ball and socket joint.

The knurled cuff on the ball and socket joint should be tightened only enough to hold the compass in position. If the cuff is tightened too much the compass is not leveled easily and the leather washer is compressed so much that it loses its friction and the ability to hold the ball easily.

The compass should never be left overnight in the woods. The instrument is light and easily carried and there is no excuse for thus failing to protect it from damage and theft by the simple expedient of carrying it back and forth to the job.

d. The leather case and shoulder strap should be dressed, at least twice a year, with Neat's Foot Oil, to preserve the leather. When rips occur in the sewn seams, they should be repaired currently by sewing with waxed thread.

LESSON III -- READING THE COMPASS

Instruction Suggestions

1. This class should be held outdoors in good light where little or no local attraction will disturb the needle.

2. The instructor should set up the compass, explaining each operation as he does it.

3. Turn off the bearing as suggested and show each student how to read it.

4. Explain the reversed position of E and W until all understand it.

5. Let each student read a different bearing and give you the reading. Check each one's accuracy.

6. Let each student set up the compass and turn off a bearing you give him. Correct each error in setting up as soon as it occurs. Check the accuracy of the bearing he turns off. Have each one take down the compass properly and give it to the next man who in turn sets up, turns off a bearing and takes down.

7. Repeat this lesson as often as necessary until each man becomes fairly adept at setting up, reading a bearing, and taking down before proceeding to the following lesson.

LESSON III -- READING THE COMPASS

Lesson Outline

a. How to Set Up Compass

The compass, with ball and socket joints detached, should be in the case on the belt, in front. Both hands should be free to use the Jacob Staff. Set the staff at the point indicated by a series of churning thrusts (especially in stiff or gravelly soil) using both hands. Set the staff so firmly that it will not lean or fall over. Set the staff as nearly vertical as conditions will permit.

Remove the compass from the case. Screw the ball and socket joint to the base of the compass. Place the compass gently on the staff, the head of which fits into the bottom of the ball and socket joint. Raise the sight vanes. Loosen the thumb screw on the spindle.

Level the instrument by moving on the ball and socket joint, with the hands holding the base of the instrument, observing the position of the bubbles in the level tubes. Remember that the bubble is in the high end of the tube. Bring it to the center of the tube as marked on the glass. Do this for both tubes.

For instruments having a circular level, bring the bubble to the center of the circle.

To check the level of an instrument with two level tubes after both bubbles have been brought to the centers of the tubes, turn the compass slowly on its spindle to several positions. Observe whether the bubbles come to the centers of the level tubes in all positions. The compass is then leveled.

Unclamp the needle. Let it swing freely until it comes to rest. A lively needle will continue to quiver after swinging motion stops. The compass is now ready to use.

b. Reading Bearings

Turn the compass slowly until the north end of the needle is exactly opposite the O at the north end of the compass box. The sight line as observed through the sight vanes is now on a magnetic north line.

Turn the compass slowly about 45 degrees to the right, to Northeast. Note that the needle remains stationary; the compass box turns. Note that the graduated ring is marked to degrees and half degrees, the latter shown by short lines, the former by longer lines. Each 10 degrees is marked by a number (10, 20, 30, etc.), the 5 degree marks between (15, 25, 35), by a long line.

To read the bearing, start from North, count by tens to the last numbered mark, then count the degrees to the needle point. Observe the nearest half degree mark. Quarter degrees are estimated. Assume the reading to be 45½ degrees. This bearing is given as "North, 45 and ½ degrees, East" and is written as "N 45½° E." Always read bearing <u>from</u> North or South <u>to</u> East or West.

c. <u>The E and W marks on the Compass Plate</u>

Note that when the line of right of the compass was turned to NE, the needle, remaining stationary, apparently marked 45½ degrees in what would be the Northwest quarter of the compass box. If W was marked on the surveyor's compass as it is on some other compasses, the bearing would read "North 45½ degrees <u>West</u>" instead of "North 45½ degrees <u>East</u>." Therefore, to check the reading of bearings, and so that they may be read directly from the compass plate, the letters E and W engraved on the compass plate, are deliberately reversed. With this arrangement it is almost impossible for the compassman to read the wrong bearing as he can always tell by a glance at the north end of the needle and the letters N, E, S. and W, on the compass plate, in which direction he is sighting, though errors are occasionally made by reading the south end of the needle instead of the north end.

d. <u>Taking Down the Compass</u>

After the bearing has been read and the compassman is ready to move, the compass should be taken down for carrying with the following points observed:

First, clamp the needle
Second, clamp the spindle thumb screw
Third, fold down the north end sight vane
Fourth, fold down the south end sight vane
Fifth, pick up the compass by the ball and socket joint. Place in case on belt or carry in hand
Sixth, pick up the Jacob Staff

Never pick up staff with compass mounted on it because the instrument may easily fall off and be damaged.

Never unscrew the spindle thumb screw so that the lower portion of the ball and socket joint remains on the Jacob Staff. To do so will likely result in the loss of the part.

LESSON IV -- DECLINATION, VARIATION, AND LOCAL ATTRACTION

Instruction Suggestions

1. Declination may be taught best by actually establishing a true meridian and showing the students the declination of the needle.

   On a clear night, select a place where Polaris may be seen and the ground will permit of a fairly level sight to the north for about 100 feet. Set a stake; set up the compass immediately behind it. Sight on Polaris with the compass, illuminating the sight vanes with a flashlight or lantern. Polaris can probably be sighted through the sight vanes, since the altitude of the star will be less than 37° in this Region. Be sure to point out to the students how Polaris is found from the Big Dipper. Suggest that motion of Polaris be explained, and that this instruction be given when the star is at culmination, this being determined by position of Big Dipper. Thus magnetic declination can be determined for any locality, sufficiently close for compass readings. For the purpose here, the motion of Polaris may be ignored and the star assumed to be a fixed point.

   Then set a stake about 100 feet away on the true north line.

   The next day or at the next class in daylight session, set up again at the first stake and sight on the second. Release the needle and show the students that the needle points several degrees off north. For this lesson the compass should <u>not</u> have the declination set off.

   Then set off the proper declination on the compass so that although the needle still points to magnetic north, and reads 0, the sight vanes are set on true north. Show the students how this is done.

2. Variation of the declination should be discussed with the class, but since these variations are of little importance in ordinary surveying, no great amount of time should be spent on them.

3. Demonstrate local attraction with an axe or other piece

of iron or steel and, if possible, by proximity to an electric line. Defer reading bearings from both ends of a line until the next lesson, in which this is taken up.

LESSON IV -- DECLINATION, VARIATION, AND LOCAL ATTRACTION

Lesson Outline

a. Declination

The compass needle points in a northerly direction but does not point exactly to true north. True north is the direction which if followed would lead exactly to the North Pole.

True North may be ascertained by sighting on the North Star.

The compass needle, instead, points to the Magnetic North Pole which is several hundred miles from the true north pole. The angle between the Magnetic North Pole and the True North Pole is called the Magnetic Declination. This angle varies from place to place. Declinations have been observed and recorded at a large number of places. Lines connecting points of equal declination are called isogonic lines. It so happens that at a number of places the declination is zero and the compass needle points true north. The line connecting these points is called the agonic line. This agonic line runs across the United States approximately from the corner of South Carolina, Georgia, and the ocean, northward across South Carolina, North Carolina, Tennessee, Kentucky, Ohio, Indiana, and Michigan. (Refer to an isogonic chart)

East of this line the compass points west of true north and the declinations are called West Declinations. West of the agonic line, the compass needle points east of true north and the declinations are called East Declinations. In northern Maine the declination amounts to 21 degrees, West Declination, in northern Washington, the declination amounts to 24 degrees East Declination.

b. Variation

The angle between Magnetic North and True North, that is, the Declination, does not remain constant for any given place. The changes in the value of the Declination are called Variations of the Declination. They are:

1. Secular Variation

Secular variation means the slow change through the years. The agonic line is moving slowly westward and declinations are consequently affected. The secular change amounts to a few degrees over a period of 50 years.

2. Daily Variation

The compass needle varies about 7 minutes of arc each day. In the morning the needle swings east until about 9 o'clock, then swings west until about one or 2 o'clock. Then it swings slowly east again until about 6 o'clock, where it remains practically steady during the night. This variation has little or no effect on ordinary work with the compass.

3. Annual Variation (Suggest this be omitted as negligible. Many authoritatic works do not mention it.)

There is a periodic variation of about one minute per year called the annual variation, but this is so small that it need not be considered in survey work.

4. Irregular Variations

The compass needle is subject to irregular variations due chiefly to magnetic storms. These storms are uncertain in character and cannot be predicted. They are, however, usually observed whenever there is a display of the Aurora Borealis. The variation amounts to as much as 20 minutes, in the United States.

In spite of these variations, the compass is a reliable instrument and the surveyor need ordinarily concern himself only with the determination of the declination. The compass is the simplest instrument for determining direction from a detached point.

c. Local Attraction

Any iron or steel objects, such as axes, tapes, chain pins, knives, etc., will attract the needle. Electric wires have the same effect. Deposits of iron ore or other magnetic materials will also deflect the needle. In surveying, care should be taken to keep iron or steel objects away from the compass. The compassman should have none on his person.

Local attraction can be detected by reading the bearing from both ends of a line. If the bearings differ, local attraction is present at either or both stations.

LESSON V -- RUNNING STRAIGHT COMPASS LINES

Instruction Suggestions

1. The purpose of this lesson is to teach the students to run a straight line with the compass in spite of local attraction.

2. Organize the class into parties of four. Give this lesson to only four men at a time. Repeat the lesson as often as necessary until all members of the class have worked all positions. Rotate each of the following positions:

    1. Compassman
    2. Recorder
    3. Front rodman
    4. Rear rodman

3. Provide:

    1. Compass
    2. Jacob Staff
    3. Front rod) Simple home-made rods will do.
    4. Rear rod)
    5. Stakes
    6. Axes
    7. Notebook headed as follows:

Station	Forward Bearing	Back Bearing

4. Select a point at which you are reasonably sure there is no local attraction. Drive a stake, set up, give the compassman a bearing, have him turn it off on the compass and line in the front rodman. Check the bearing. Have the recorder put it in the notebook.

5. Proceed to the new station, set up, read the back bearing, check it with the forward bearing. If they agree, turn the compass 180° and set a new station ahead. Proceed in this manner, having the members of the party work at each job.

6. If the back bearing at any station does not agree with the forward station (and both readings are correct, and the needle moving freely), turn 180° from the back bearing, thus prolonging the straight line in spite of local attraction.

7. If no local attraction occurs naturally, create the condition by placing a piece of iron near the compass.

8. The form of notes will appear about as follows:

Station	Forward Bearing	Back Bearing
1	N 53° E	
2	N 53° E	S 53° W
3	N 53° E	S 53° W
4	N 59° E	S 59° W
5	N 53° E	S 53° W
6		S 53° W

There was evidently local attraction at Station 4.

9. In this lesson pay no attention to distance. Stay out of brushy country if possible. Select stations not more than 100 feet apart. The more set ups that can be made in the class period, the better.

LESSON V -- RUNNING STRAIGHT COMPASS LINES

Lesson Outline

a. The back bearing of a line at both ends of which there is no local attraction will be exactly the same in value as the forward bearing, but in the opposite quadrant. A forward bearing in the NE quadrant will have a corresponding back bearing in the SW quadrant; a forward bearing in the SE quadrant will have a corresponding back bearing in the NW quadrant. For example, the direction of a line may be S 39° W. Running in the opposite direction, the bearing of the line would be N 39° E.

b. In reading the bearing either forward or back, the compassman always stands at the S end of the compass box; looks through the sight vane with the slit, at the one with the wire and reads the north end of the needle.

c. The following common mistakes in reading the compass should be guarded against.

1. Reading the wrong end of the needle.
2. Not letting the needle down on the pivot.
3. Reading the wrong side of the 10th degree, that is, 61° instead of 59°.
4. Reading a needle which, on account of dullness or improper centering of the pivot, or improper leveling of the compass, comes to rest slightly off of its natural free swinging position.

LESSON VI -- RUNNING TRAVERSE LINES

Instruction Suggestions

1. The purpose of this lesson is to teach the students how to read the compass bearings of a broken line, such as might be encountered in traversing a road or trail.

2. Select an open field, free from brush, for this lesson. Drive about 6 stakes, numbered consecutively, at distances apart of 50 to 200 feet, in a broken or zig zag line. Do not attempt to make a closed traverse as this will tend to be confusing.

3. Organize the class into parties of four and give this lesson to only four men at a time. Rotate positions of the four men until each has worked at the jobs of compassman, recorder, front rodman, rear rodman. Repeat the lesson as often as necessary to include the entire class.

4. Provide the following:

    1. Compass
    2. Jacob Staff
    3. Front rod
    4. Rear rod
    5. Stakes
    6. Axe
    7. Notebook, ruled same as for Lesson 5.

5. Have the compassman set up at station 1, sight on station 2, read the bearing, call it correctly to the recorder, who enters it and repeats it as a check.

    Have the compassman move ahead to station 2, set up and read the back bearing, call it to the recorder, who enters and checks it by repeating. Have the recorder compare the forward and back bearings for local attraction.

    Have the compassman sight on station 3 and read the bearing, entering and checking as before. Continue this to the end of the traverse. Let each member of the party have a turn at all positions, each compassman making at least 6 set ups.

    Do not bother about distances.

6. If no local attraction exists, the form of notes will look about as follows:

Station	Forward Bearing	Back Bearing
1	S 39°	
2	S 1° E	N 39° E
3	S 89° W	N 1° W
4	N 50° W	N 89° E
5	N 10° E	S 50° E
6		S 10° W

7. Keep the points of previous lessons before the students at all times. Correct every error of omission or commission when it occurs. No Lesson Outline is given with this lesson. The object is to develop proficiency in actual use.

LESSON VII -- MEASURING ANGLES WITH THE COMPASS

Instruction Suggestions

1. This class should be held outdoors. Provide a compass and Jacob Staff. Provide notebooks or paper and pencils to each student.

2. Demonstrate each problem in the Lesson Outline on the compass, in your own notebook, and have the students work each problem in their own notebooks.

3. Repeat this lesson until all students have had a chance to work each type of problem on the compass itself. Vary subsequent lessons with different problems and have each student work all of the problems. Impress the fact that proficiency comes only with practice.

4. Bring out the usefulness of this lesson by citations of practical examples in their own experience in the work of the camp.

LESSON VII -- MEASURING ANGLES WITH THE COMPASS

Lesson Outline

a. To Calculate Angles from Bearings

The surveyor frequently needs to determine the angle between two intersecting lines, such as property lines, and to do this, he reads the bearing of both lines.

1. Bearings in the same quadrant.

No difficulty occurs if both bearings are in the same quadrant as for example: The bearing of the first line is N 10° E, the bearing of the second line is N 37° E, the angle between them being 27°, by simple subtraction (Fig. 1).

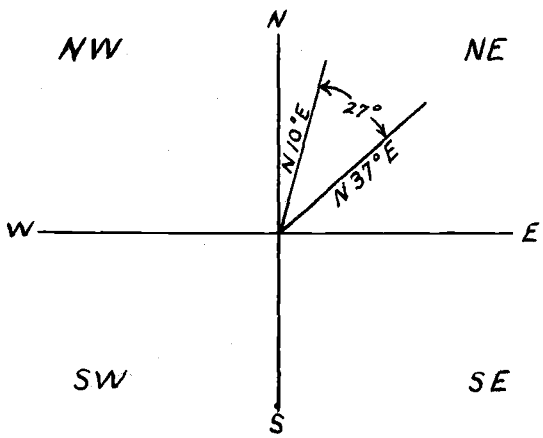


Figure 1

The same method applies to bearing in other quadrants as, for example, S 79° W, and S 13° W, the angle between them is 66°, by subtraction.

2. Bearings in adjacent northern or southern quadrants (NW and NE, or SW and SE).

When the two bearings have the same initial letter, that is, N or S, simply add the two bearings as, for example, the bearing of one line is N 15° E, the bearing of the second line is N 30° W. Both have the same initial letter, N, therefore, they are added: 30 + 15 = 45, which is the angle between the two lines. (Fig. 2)

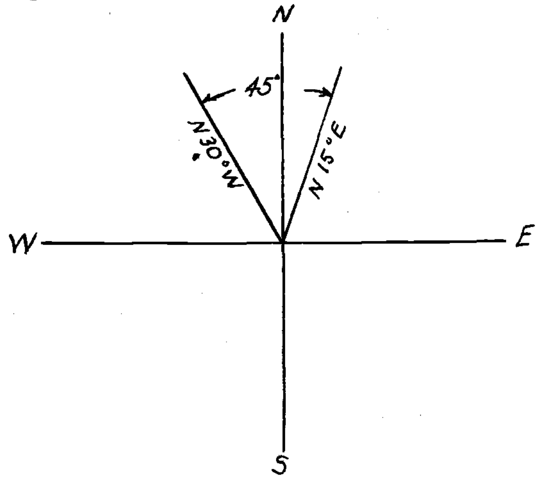


Figure 2

3. Bearings in adjacent eastern or western quadrants (NE and SE, or NW and SW).

Adjacent eastern and western quadrants have the same end letter as E or W. In this case subtract each bearing from 90 degrees and add the results. Example. Find the angle between N 19° E and S 28° E. Both bearings end in the same letter, therefore are in adjacent E quadrants.
$90^\circ - 19^\circ = 71^\circ$. $90^\circ - 28^\circ = 62^\circ$. $62^\circ + 71^\circ = 133^\circ$. (Fig. 3)

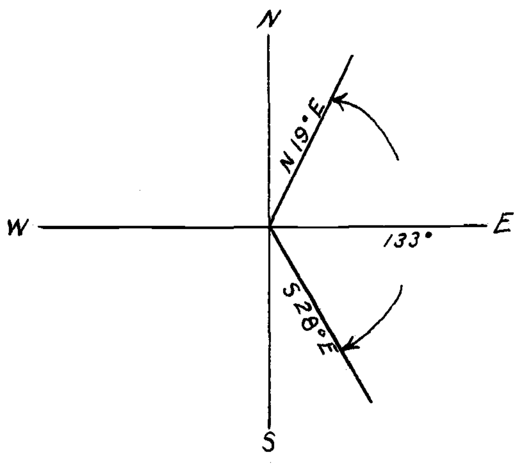


Figure 3

4. Bearings in diagonally opposite quadrants (NW and SE, NE and SW).

In diagonally opposite quadrants neither the initial letters nor the end letters are alike. For example, find the angle between N 60° E and S 19° W. Refer to Figure 4.

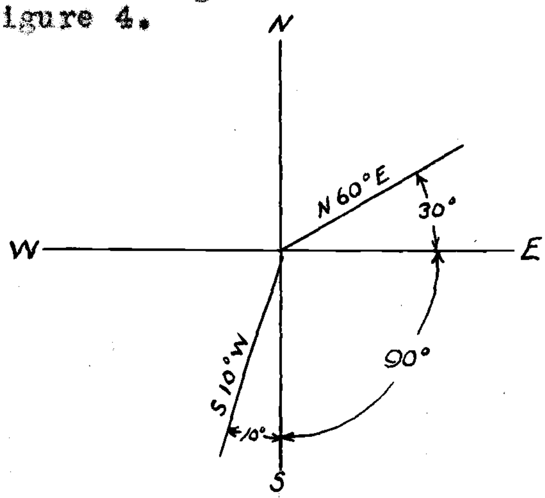


Figure 4

Subtract 60° from 90°	$= 30^\circ$
1 whole quadrant	$= 90^\circ$
Add 19° direct	$= 19^\circ$
	139°

To avoid mistakes, compassmen will do well to draw similar diagrams when calculating angles.

b. <u>To Calculate Bearings from Angles</u>

In the foregoing paragraph, angles have been calculated from two bearings. The subject of this paragraph is the calculation of the second bearing when the first bearing and the angle are known. The surveyor frequently needs to turn an angle from the line he is running and to find the bearing of the new line.

1. The simplest and most practical way to do this is by counting on the compass, and this method is frequently used by compassmen. The compass is set up and the needle reads the bearing of the first line. The compassman is given the angle to be turned off, either to the right or to the left. He then counts on the

graduated ring the number of degrees in the angle and thus finds the new bearing. For example. Suppose the bearing of the first line is N 23° E, the compassman is to turn an angle of 80° to the right. He counts to the right 67° to East, which is 90°, then 13° more in the Southeast quadrant which gives him a bearing of S 77° E. This method can be applied equally well for angles of any number of degrees, either to the right or to the left.

2. However, the compassman often has to calculate the bearing of a line at a given angle to the original line without having the compass in front of him. The "practical" method is also slow and cumbersome. Therefore, the compassman should learn to calculate bearings mathematically, without the use of the compass itself.

For convenience in computation, all angles measured to the <u>right</u> or <u>clockwise</u>, are <u>plus</u>; to the <u>left</u> or <u>counterclockwise</u>, <u>minus</u>. This applies not only to angles measured in the field but to bearings. Thus NE and SW bearings are <u>plus</u> and NW and SE bearings are <u>minus</u>.

The problem given above would be solved as follows:

1. Write down the bearing of the first line, with the proper plus or minus sign behind it, according to the quadrant it is in, thus:

N 23° E +

2. Write down below it the angle to be turned off with the proper sign behind it, according as it is right or left, thus:

N 23° +
80° +

3. Then, if <u>both</u> signs are <u>plus</u>, or if <u>both</u> signs are <u>minus</u>, <u>add</u>. If one sign is minus, and the other plus, <u>subtract</u>.

	N 23° E	+
	80°	+
<u>Add</u>	113°	+

4. Then give the angle the initial letter of the bearing of the first line, in this case N and the sign

(+ or -). In this case "N 113° +" means the angle is to the right 113° from North. 90° from north would be east; 180° from north would be south. Since 113° is between the two, the quadrant must be SE.

5. Then subtract 113° from 180° which equals 77°. The bearing of the second line is then S 77° E.

The whole problem would appear as follows:

$$\begin{array}{lrl} \mathrm{N} & 23^\circ & + \\ & \underline{80^\circ} & + \\ \mathrm{N} & 113^\circ & + \end{array} \qquad\qquad \begin{array}{lrl} & 180^\circ & \\ & \underline{113^\circ} & \\ \mathrm{S} & 77^\circ & \mathrm{E} \end{array}$$

The following is a case in which both signs are minus. The bearing of the first line is S 19° E. The angle to be turned is 40° to the left. Then:

$$\begin{array}{llrll} & \mathrm{S} & 19^\circ & \mathrm{E} & - \\ & & \underline{40^\circ} & & - \\ \text{(add)} & \mathrm{S} & 59^\circ & & - \end{array}$$

Note that adding plus signs gives a plus; addings two minus signs gives a minus.

In subtracting the remainder take the sign of the larger quantity, either plus or minus.

Then the minus sign (S 59° -) means the bearing is 59° to the left; the letter "S" indicates from south. 59° is less than 90° (which is East). Therefore, the quadrant is SE and the bearing is S 59° E. The following example illustrated a case in which one sign is minus, the other plus. The bearing of the first line is S 19° E. The angle to be turned is 40° <u>to the right</u>. Then:

$$\begin{array}{llrll} & \mathrm{S} & 19^\circ & \mathrm{E} & - \\ & & \underline{40^\circ} & & + \\ \text{(subtract)} & \mathrm{S} & 21^\circ & & + \end{array}$$

Since 40 is greater than 19, the sign is plus, meaning to the right. The letter is "S" meaning from the south, 21° to the right from south will be in the Southwest quadrant; since 21° is less than 90° (West), the bearing is S 21° W.

LESSON VIII -- TESTING THE COMPASS

Instruction Suggestions

1. The purpose of this lesson is to acquaint the students with the tests for proper adjustment rather than with the methods of making adjustments. Impress upon them the importance of not trying to adjust a compass.

2. Demonstrate each test yourself and then let the students check the instrument.

3. Refer back to Lesson 2 on the Care of the Compass and show how careless use results in maladjustment.

LESSON VIII -- TESTING THE COMPASS

Lesson Outline

a. Chiefly because of careless handling, compasses get out of adjustment and while so are not reliable surveying instruments. The following tests cover the usual maladjustments of the instrument and are given so users will know if instruments are in adjustment. Users of compasses in the Forest Service should never attempt to make adjustments. A compass out of adjustment, should be reported to one's official superior who will have the instrument repaired or adjusted by the makers, by the Supply Department, or by a qualified engineer.

b. Levels Out of Adjustment

To test the level tubes, proceed as follows:

1. Set up the compass firmly.
2. Level the instrument, that is, bring the bubbles to the centers of the tubes.
3. Turn the instrument half way around.
4. If the bubbles return to the centers of the level tubes, the levels are in adjustment.
5. If the bubbles do not return to the centers of the level tubes, the levels are not in adjustment.

c. Needle Not Horizontal

If the wire weight on the south end of the needle is not in the proper position, the needle will not be horizontal, consequently, it will not move freely or may wear the pivot. To test:

1. Set up the compass firmly.
2. Level the instrument, being sure the levels are in adjustment.
3. Observe if both ends of the needle are almost exactly on the level of the top of the graduated ring.
4. If the needle is not properly balanced, one end will be lower than the other. The usual

case is that the north end of the needle dips.

d. Sight Vanes not Perpendicular to the Plate of the Compass

As a result of a blow or of careless carrying, one or both of the sight vanes may not be perpendicular to the plate of the compass. To test:

1. Set up the compass.
2. Level the instrument carefully.
3. Hang up a plumb-line nearby.
4. Sight on the plumb-line.
5. Observe if the slit in the rear sight and the wire in the front sight coincide with it.
6. Either one or both of the sight vanes may be out of adjustment.

e. Needle Bent or Pivot off Center

Maladjustments of this sort occur only if the instrument has been badly abused. The adjustment is very delicate and usually requires the services of a skilled instrument maker. To test:

1. Set up the compass.
2. Level carefully.
3. Set the north end exactly at 0°.
4. Read the South end.
5. If the south end also reads exactly 0°.
6. Turn the compass one quarter turn and set the north end exactly at 90°. If the south end also reads 90° the needle is straight and the pivot is on center.
7. This may be tested at several other positions to be sure.
8. If at any position, the south end does not read exactly 180° from the north end, either the needle is bent, or the pivot is off center, or both.

LESSON IX -- USE OF THE CLINOMETER

Instruction Suggestions

1. The use of the clinometer on the compass is limited in practice. However, this lesson will afford the means of introducing vertical angles. This subject is best covered in the study of the Abney level.

2. Hold the class outdoors where some changes in elevation are available. Have each man practice reading the vertical angles from point to point after the instructor has demonstrated the procedure.

3. Demonstrate how the slope of a hill or of a roof may be measured in degrees by placing the compass edgewise on the surface.

LESSON IX -- USE OF THE CLINOMETER

Lesson Outline

a. In the first lesson mention was made of the clinometer arc, the pendulum, and the segment cut out of the cuff of the ball and socket joint to permit turning the compass on its side for the reading of angles of rise and fall. These angles are called vertical angles.

To read a vertical angle with the compass clinometer:

1. Set up the compass with needle clamped.
2. Turn the ball and socket joint so that the slot is on the right hand side, looking forward.
3. Turn the compass on its side, so that the pendulum swings freely.
4. Measure the distance from the ground to the center of the compass.
5. Hold the same distance on a rod at the far point.
6. Sight on the point thus marked on the rod.
7. Read the vertical angle on the clinometer arc.

This angle is then the same as that from the bottom of the Jacob Staff to the bottom of the rod.

The pendulum clinometer is not a very accurate instrument for measuring vertical angles and is not often used for this purpose. The Abney level is a much better instrument to use.

The compass may be removed from the Jacob Staff and placed on its edge on the slope to be measured and the angle determined. This is often done by geologists in measuring the dip of a vein of minerals.

FIRE CHASING

INSTRUCTION SUGGESTIONS

A. This course should be taught by an experienced fire chaser, someone who has had experience in the field preferably.

B. The course should be given in the field so that the student can get actual practice in the business of chasing fires.

C. The course presupposes a course in the care and use of the compass.

D. A course in pacing should also be given in conjunction with this course.

E. This course consists of three lessons.

F. Before closing the course lay out field problems to test the abilities of the students to reach their objectives. Stimulate actual fire conditions as nearly as possible.

G. Each man must have a hand compass, pencil, notebook, and field clothes.

H. Encourage a questioning attitude on the part of the students. This will make the maintenance of interest easier and insure the best results.

I. A review of mapping should be held if the time between the teaching of the two courses is very great.

Allen, Clay, The Western Fire Fighter's Manual, Western Forestry and Conservation Association, Portland, Oregon.
U. S. F. S., North Pacific Region, Guard Handbook, Portland, Oregon, 1933, revised.

LESSON I -- RECEIVING INFORMATION

Instruction Suggestions

1. As far as is possible, simulate the conditions as they will be in the field. Have a phone set up and use it to give the information about smokes to practice the receiving of information.

2. Emphasize particularly the necessity for getting all the information that is likely to be needed. Once the fireman has left the phone or radio he must rely on the information that he has gathered. No more will be forthcoming.

3. This lesson can be conducted indoors and may be given as an evening session.

4. The trainees should have notebooks and pencils for the taking of notes.

5. Make sure that they understand the use of the compass and the use of maps.

LESSON I -- RECEIVING INFORMATION

Lesson Outline

a. Importance of Fire Chasing

The fireman's principal job is the finding and putting out of fires. Before a fire can be put out it must be found. If the fire is not to attain large proportions it must be found quickly, particularly under certain conditions. Minutes Count.

If the objective of finding all fires while they are still small enough to put out by small crews is reached, many of these fires will be very difficult to find. The fireman must rely not only on physical prowess of being able to stand sustained periods of walking but must use all of the ingenuity that he possesses. He is fighting against time because time is aiding the fire to get a good start.

Fire chasing is of equal importance with fire fighting. They are the important parts of a fireman's job.

b. Preparation Necessary

The effectiveness of the fire chaser depends on his getting away in the least possible time. His supplies and equipment should be prepared in advance and should usually consist of:

1. Small supply of lookout forms
2. Map of the country in which he is working
3. A good compass (preferably an azimuth compass)
4. Small ruler
5. Protractor
6. The regular prepared pack containing supplies, shovel, pulaski, water bag and pump, and blanket if desired.

c. Receiving Information

When a fire is reported it is important that the data furnished by the lookout and the platting officer be written down in full.

Any or all of the following information may be needed:

Observed from: The fireman wants to know what lookout can see the fire.

Azimuth: To compute backsights and get the lookouts' lines of sight.

Distance: This is needed mainly to check location.

Verticle angle: Needed to spot locations on panoramic photographs.

Location by legal subdivisions: Needed to spot the location on the map and to locate the fire in the field by survey markings.

Volume, character, and color of smoke: Needed as a guide in picking up the smoke and in telling what kind of a fire may be expected.

Smoke drifting from: Needed to guide fireman to right or left of line of sight if fire is not easily found.

Base of smoke (not) sighted: Tells the fireman whether or not he can backsight to the lookout from the vicinity of the fire.

Location by local landmarks: These often serve better to identify the location of the fire and may give the fireman starting points from which to run a compass line.

LESSON II -- TRAVELING TO THE FIRE

Instruction Suggestions

1. Emphasize the need for the utmost speed. However, it must also be emphasized that speed should not be carried to the extreme of leaving without proper equipment or information.

2. Emphasize that everything should be in readiness for a possible fire call at all times. Part of the fireman's job is to see that all equipment and transportation facilities are in readiness for any emergency.

3. Point out that it is also part of his job to learn the country by every practical means at his disposal.

4. At the close of the lesson hold time trials under actual conditions to see how fast the trainees can decide on a route to a particular point, gather their equipment, and get away.

5. Have on hand all the equipment used by the fireman.

LESSON II -- TRAVELING TO THE FIRE

Lesson Outline

a. Preparation

The fireman must be ready to go at any time of the day or night during the fire season.

His car must be gassed and oiled and checked after every trip.

His equipment must be put in readiness after every trip and checked occasionally if it has not been used over a period of time.

The fireman should keep posted currently as to all of the available help in his district should an emergency arise. This includes such temporary help as campers and fishermen as well as stockmen, ranchers, woodcutters, organized crews, etc. in and near his district.

b. Determination of Route

After recording the needed information, the dispatcher and the fireman should agree as to the best and shortest route.

Consult the map no matter how well the fireman knows the district.

Sometimes the route may be changed slightly to allow the fireman to go to the lookout reporting the fire in order to get a look at it himself. This is done only when the lookout is very near what would ordinarily have been the route of travel.

The route of travel may be changed to pick up additional help.

c. Get-a-way

Get-a-way time is defined as the time from the completion of the report to the fireman's actual start for the fire. Desirable standards are as follows:

By foot or automobile	3 minutes or less
By saddle horse	5 minutes or less
By pack and saddle horse	10 minutes or less

This means that the fireman's outfit must be completely packed, in the car or in alforjas if horses are used, and his car or horses in readiness.

e. Traveling to the Fire

Travel to the fire must be continuous unless interrupted by illness or accident.

The fireman should go as far as he can at night, and if he cannot find the fire because of darkness he should place himself as near to it as possible, ready to jump it at the crack of dawn.

Utilize highways, forest roads, and trails as much as is possible. Cross-country travel should be shortened as much as the road and trail system will permit.

When the fireman leaves the road or trail he should mark the point of departure so that follow-up crews will know the route he has taken.

LESSON III -- FINDING THE FIRE

Instruction Suggestions

1. Use demonstration methods in the field to illustrate the different methods of finding fires.

2. Give the trainees problems to work out. Probably these will have to be worked out on paper but wherever possible have them work them out in the field.

3. In the practical problems that are listed the instructor should illustrate the other alternatives that might be taken on the same problem.

4. Allow open discussion on each problem.

5. Review the method of changing foresights to backsights.

6. Have the trainees work out problems in changing backsights and foresights and in figuring tangent offsets.

7. When this lesson is completed take the trainees to the field to work on previously laid out problems in fire chasing.

LESSON III -- FINDING THE FIRE

Lesson Outline

a. The Vicinity of Fire

Under most circumstances in which accurate information has been obtained it is fairly simple for the fireman to get to the vicinity of the fire as it is platted.

When the fireman has reached the vicinity of the fire he must then locate it as quickly as is possible. The local conditions will determine which method he will use to actually find the fire. If the fire is known to be very near a certain prominent local landmark all that may be necessary is the climbing of a tree to locate the smoke that may be rising.

b. Methods of Finding Fires

1. Correlation of map and ground location
2. Getting on lookout's line of sight by back-sighting
3. Locating a fire from known point on road or trail, or from local landmarks
4. Gridiron method
5. By use of protractor and compass to determine two point intersection in field
6. Application of compass and protractor to obtain locations
7. Tangent offset
8. Two point intersection

Supplementary methods: It is nearly always necessary to use more than one method to find each fire that the fireman is sent to. As aids to the above methods some or all of the following are often used with them:

1. Utilizing local openings or points for observation
2. Climbing trees for view
3. Locating by smell from the windward side of fire
4. Direction of smoke drift
5. Utilizing the information as to volume and

character of smoke, timber type, whether or not case of fire was sighted, etc.

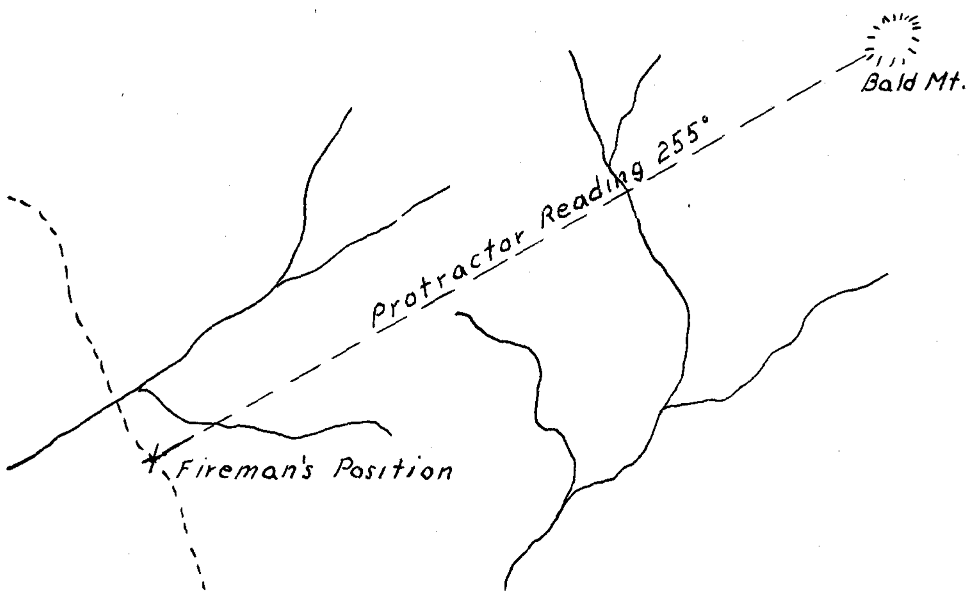
6. Running compass course at night. Two men with lights should work together on this

c. Practical Problems

Determining location on road or trail by compass reading: Spread out a map of the country and by looking at local landmarks quickly ascertain his location. Example: He may find himself on a bridge where a trail or road crosses a creek and by finding the bridge on the map he will know that he is in the N. E. Quarter of Section 8.

Section lines are often marked at points where they intersect roads and trails. Reference to the map fixes the location. Usually the fireman will know within a mile where he is and the section line will tell him exactly.

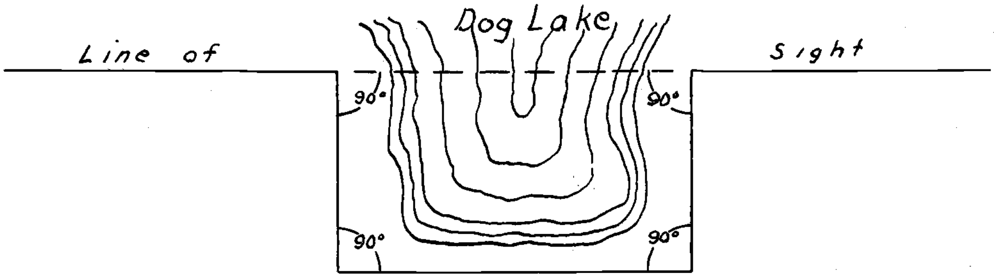
Sometimes a break in the trees will enable the view of a prominent peak or some other landmark marked on the map. Lay out the map, locate the peak on the map, take a reading on the peak with the compass, and plot the reversed reading from the peak to where it crosses the trail. This is the spot on which the fireman is standing.



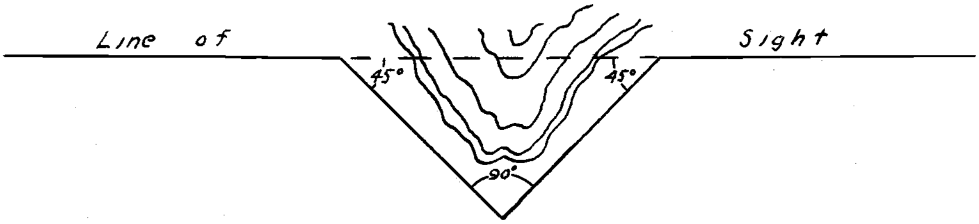
<u>Getting around obstacle on the line of sight</u>: The fireman following a compass course to the fire may encounter an obstacle that will prevent his staying on his compass course.

In many instances it will be fairly simple to mark a tree or some other object and then proceed to the other side and take a backsight to get on the compass course.

If the above is not possible, he will have to rely on mathematical calculations. This may be done in the following ways:



Turn a 90° angle, offset far enough to clear the obstacle, continue parallel to the original line of travel until the obstacle is cleared, return to the original compass line, and continue to the fire. Each angle turned will be 90°.

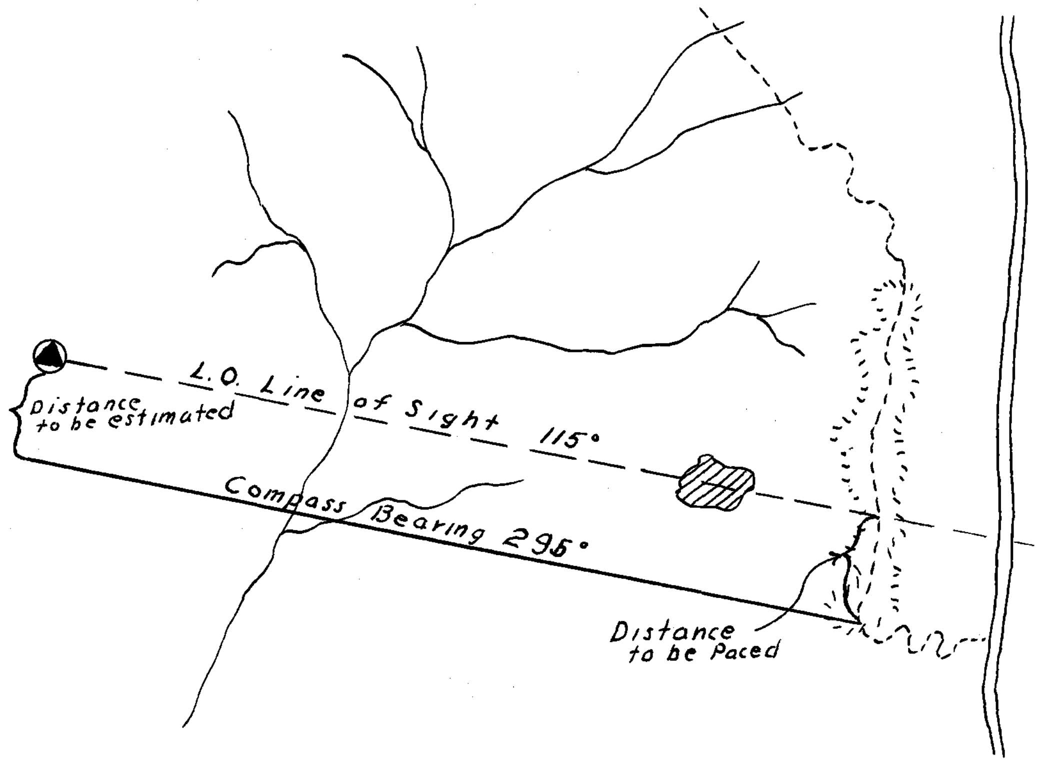


An angle of 45° may be turned from the original line and a distance great enough to clear the obstruction paced before turning a 90° angle back to the line. In this case both legs of the triangle are equal.

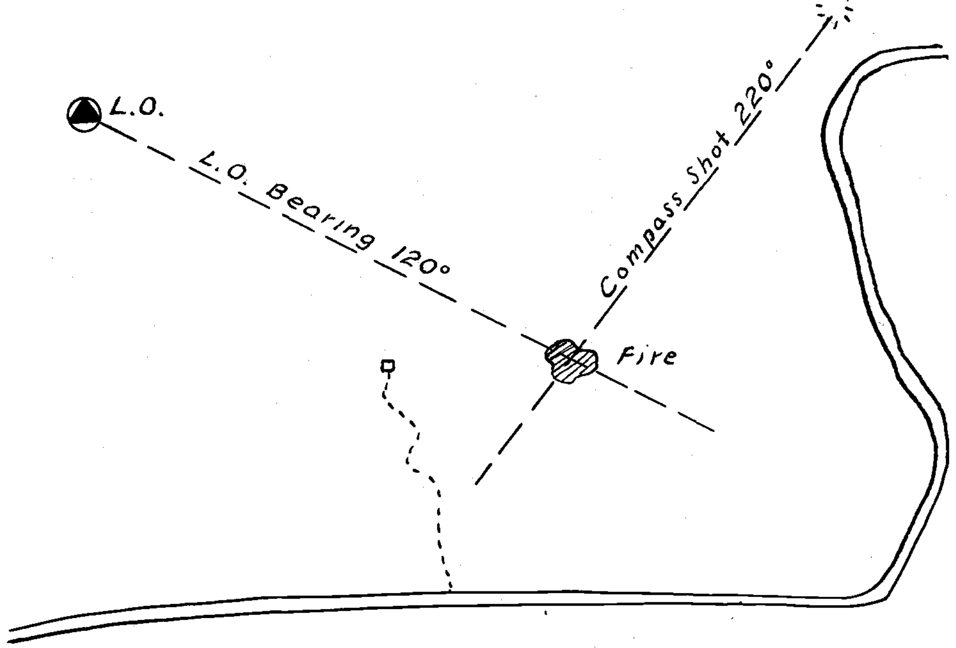
<u>Getting on lookout's line of sight to fire by observation from ridge</u>: A fireman may have only the line of sight of the lookout to the fire and the information that the fire is between the lookout and a certain ridge. By going to the ridge he may find a spot that

is on the line of sight and by reversing the reading he can run the line to the fire.

If the lookout is not visible from the point on the line of sight but is from another he may estimate the distance he is away by setting his compass on a reading corresponding to a backsight on the lookout's reading and estimating the distance from the lookout to the point where his backsight cuts the country. He can then pace the distance on the ridge, set off the backsight again and run to the fire.

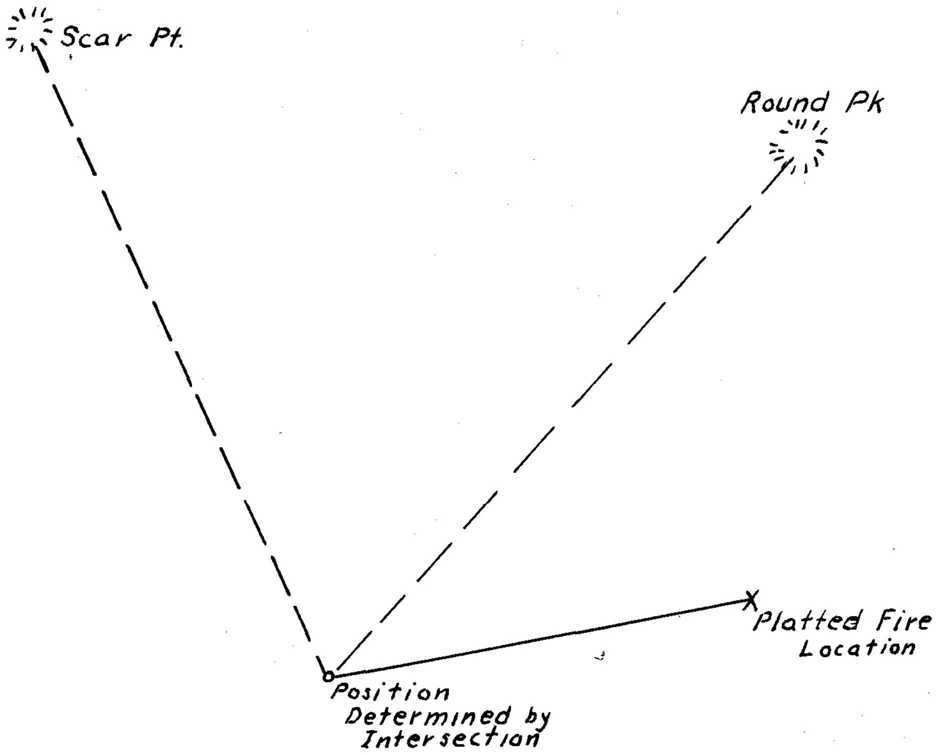


<u>Getting to the fire's edge by locating the fire in reference to landmarks in the field</u>: It may be that the fireman will sight his fire long before he gets to it. When this happens it is well to locate the fire on the map in reference to all landmarks available so that when the fireman can no longer see the fire he will have other known landmarks to go by. This also affords an opportunity to check the lookout's location by a cross-shot.



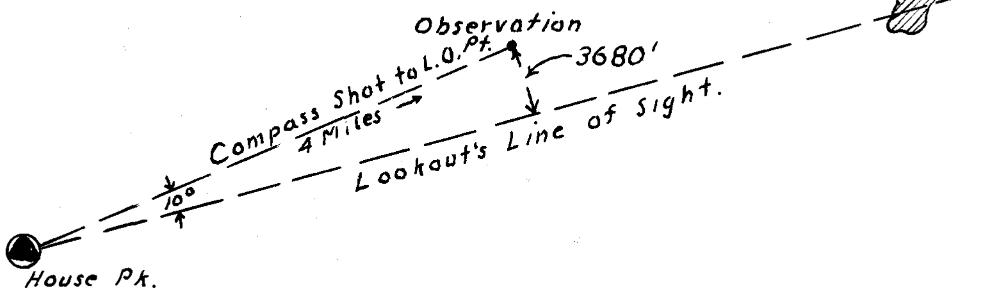
In the above illustration the fireman climbed to a high point and from there he could see the fire. He took a reading on the fire (Az. 220^{O}) and platted this cross-shot on his map. The intersection with the lookout's line of sight (already platted) gave him the definite location of the fire. He then noticed this platted location in reference to the road, the cabin, and ridge, and decided that his best route would be to go due south until he hit the road, hike down the road to the trail, up the trail to the cabin, and then almost due East to the fire.

A two point intersection in the field from which a compass reading to a platted fire can be figured: The fireman may find himself in back country at a point where he doesn't know his position. If he can work himself to a position from which two landmarks are visible he can sight on these landmarks, reverse the compass reading, and plat his own location by running these reversed lines of sight from the landmarks until they intersect. This is the point at which he is standing. From this point on the map he can draw a line to the platted location of the fire as given by the lookout. By orienting his protractor over his position as platted on the map he can read the azimuth to the fire and proceed to it. (See illustration on the following page.)

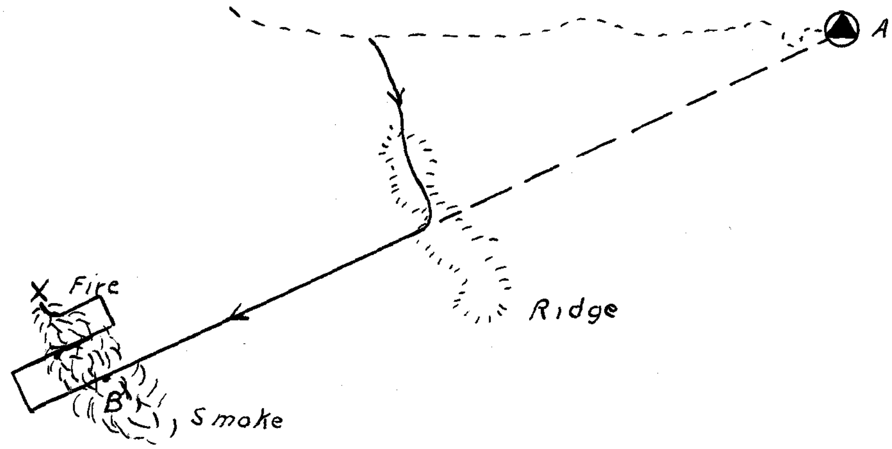


<u>Figuring distance to lookout's line of sight by the tangent offset method</u>: A fireman may reach a point from which he can see the lookout who gave a reading on a fire and from which he knows his distance. By the tangent offset the fireman may calculate his distance from the line of sight of the lookout, turn a right angle and proceed to the line of sight. Once on the line of sight he follows it to the fire.

This method is based on the fact that the tangent of 1° at 1 mile is approximately 92 feet. Stated in minutes, the tangent of one minute at one mile is approximately $1\frac{1}{2}$ feet.



<u>Getting on the fire's edge by gridironing</u>: This method is used where fires are very small and the fireman, after arriving in the vicinity of the fire, finds himself unable to locate it.



Lookout "A" picks up smoke on line of sight "A-B". He is looking over a ridge and the base of smoke is not visible. The fireman gets on the lookout's line of sight and runs through the country where the fire should be, but because of the smoke drift does not locate the fire. Since the smoke is drifting from the northwest he knows that the fire must lie northwest of the lookout's line of sight. He therefore gridirons as is shown in the illustration.

CARE AND USE OF AXES

INSTRUCTION SUGGESTIONS

A. All of the members of the crew who are not experienced axemen should take the course.

B. A skilled axeman should give the course.

C. Lessons 1, 2, and 3 should be given at the tool shop; Lesson 4, in the woods.

D. The course consists of four lessons.

E. Instruction methods to be used are demonstration and lecture by instructor and actual practice by students.

F. Teaching aids to be used are single and double bit axes, sandstone and carborundum grinders, files, whetstones, and a stand of trees in which cuttings may be done.

G. Teaching periods should be about one hour each lesson.

H. No preparatory work by the students is necessary.

LESSON I -- GRINDING

Instruction Suggestions

1. Take the group to the shop. Have ready several axes perfectly sharpened and hung double bit and single bit axes, a good sandstone grinder, a carborundum grinder, several dulled single bit and double bit axes.

2. Give each two or three students one of the sharpened axes. Point out each of the features mentioned in the Lesson Outline, as desired in a well sharpened axe.

3. Use the sandstone grinder yourself. Sharpen one double bit axe. While sharpening discuss each of the points listed in the Lesson Outline. Be sure to explain why each point is important. Best way to do this is to ask individual students to explain why.

4. Have one or two of the students take a turn at the grinder and practice grinding. Correct each mistake made at the time. If time permits have every student practice on the wheel.

5. Use the carborundum grinder yourself. Sharpen one double bit axe. Explain each point in the Lesson Outline. Emphasize the differences in the use of the sandstone grinder and the carborundum grinder.

6. Have one or two students take turns at the grinder and practice sharpening. Point out correct and incorrect practices while the students are actually at work. If time permits, have each student practice on the wheel. Encourage practice in spare time.

7. Keep the sharpened axes for Lesson II.

LESSON I -- GRINDING

Lesson Outline

a. <u>Conditions Desired in Sharp Axes</u>

1. Sharp cutting edge
2. Durable cutting edge
3. Smooth sides
4. Smooth cutting edge
5. Preserve balance
6. Proper convexity (sides and edges)
7. Centered edge

b. <u>Use of the Sandstone Grinder</u>

1. Speed
2. Use of water
3. Direction of wheel
4. Position and correct method of holding
5. Pressure
6. Moving axe on stone

c. <u>Use of Carborundum Grinder</u>

1. Caution against overheating
2. Do not use water
3. Direction of wheels
4. Position, correct method of holding
5. Pressure
6. Moving axe on stone

LESSON II -- SHARPENING WITH FILE AND WHETSTONE

Instruction Suggestions

1. Have on hand sufficient dulled axes, files, and whetstones to provide one of each to each student.

2. Demonstrate filing by filing one axe yourself; the points listed in the outline.

3. Have each student file one axe. Point out mistakes to each, individually.

4. Demonstrate the use of the whetstone by whetting one axe yourself.

5. Have each student whet the axe he has filed or one of the axes ground in Lesson 1.

6. Keep the sharpened axes for use in Lesson 3.

LESSON II -- SHARPENING WITH FILE AND WHETSTONE

Lesson Outline

a. Use of the File

1. Only when grinders are not available
2. How to hold axe
3. Selection of proper file
4. Angle of application
5. File only on push stroke
6. Direction of stroke--from cutting edge to eye

b. Use of Whetstone

1. To smooth edge after grinding or filing
2. To smooth sides
3. Sharpen edge on the job
4. Angle and pressure--stone to bit

LESSON III -- HANDLING

Instruction Suggestions

1. Have on hand several axes to be rehandled, a supply of new handles, including some to be rejected for defect, wedges, tools for rehandling, oil for soaking.

2. Demonstrate the points of selecting good handles. Let each student himself go over several handles and learn to inspect and judge them.

3. Remove the old handle stub, fit and rehandle one axe yourself, demonstrating each step. Point out things to be observed.

4. Have each of the students rehandle an axe under your supervision.

5. Soak in oil to tighten.

6. Keep the axes for Lesson 4.

LESSON III -- HANDLING

Lesson Outline

a. Qualities of Good Handles and Wedges

1. Kind of wood
2. Grain and knots
3. Warp
4. Shape
5. Length
6. Flexibility
7. Hardwood wedges
8. Steel wedges

b. Fitting Handles

1. Removing old handle
2. Fitting handle to eye
3. Checking balance, hang and line
4. Wedging
5. Oiling

LESSON IV -- CARE AND USE

Instruction Suggestions

1. Take the group to a woods, convenient to the camp, where cutting may be done. Equip each man with one of the sharpened axes.

2. Demonstrate the various uses of the axes as listed in the Lesson Outline. For each use show the correct method of holding and swinging the axes.

3. Call attention to the proper care of the axe while in use and to the precautions for safety.

4. Have each student do each of the operations himself. Point out individual mistakes.

5. Upon return to the camp, store the axes properly in the tool house.

LESSON IV -- CARE AND USE

Lesson Outline

a. Uses

1. Felling small trees
2. Cutting stems of small trees into convenient or usable lengths
3. Limbing trees
4. Cutting brush
5. Undercutting large trees
6. Scoring logs to be hewed
7. Splitting wood
8. Ringing or girdling trees

b. How to Use

1. How to grip handle
2. Where to grip handle
3. Angle of bit to material

c. Care

1. Keep cutting edge sharp
2. Use one cutting edge for chopping brush or near ground; other edge for chopping in less dangerous places
3. Avoid chopping into ground or rocks
4. Avoid using as a hammer
5. Keep out of sun when not in use
6. Avoid using as a pry pole
7. When in storage suspend from a rack
8. Keep tight on handle

d. Safety with the Axe

1. Clear away brush and vines for a clear swing
2. See that the axe head is tight
3. Don't work close together
4. Don't work two men to the tree
5. Keep the axe from glancing
6. Work with the elbows held low

CARE AND USE OF HAND TOOLS

INSTRUCTION SUGGESTIONS

A. All of the members of the crew who are not experienced with the use of the tools should take the course.

B. A man skilled in the use of the tools should give the course.

C. Lessons should be given at the tool shop for the first part of the period. After instruction at the shop, a short time should be given over to actual use instruction at some previously located spot near the tool shop.

D. If classes are large, it might be wise to schedule a fourth lesson for general use of all tools in the woods.

E. Under ordinary conditions, the course will consist of three lessons.

F. Teaching aids to be used are pulaskis, shovels, grub hoes, sandstones and carborundum grinders, files, whetstones, and a location near the tool shop where all hand tools can be used.

G. Teaching periods should be about one hour each lesson.

H. No preparatory work by the students is necessary, however, they should have had the course on axes previous to this course.

I. Instruction methods to be used are demonstration and lecture by instructor and actual practice by students.

Compiled by Vaughn Hofeldt, School of Forestry, Oregon State College, 1941.

LESSON I -- SHOVEL

Instruction Suggestions

1. Take the group to the shop. Have several long and short handled shovels ready--perfectly sharpened, handled, and oiled. Have ready a good sandstone grinder, a carborundum grinder, files, a few dulled shovels, a shovel with splintered and loose handle.

2. Give each two or three students one of the sharpened shovels. Point out each of the points mentioned in the Lesson Outline, as desired in a well-sharpened shovel.

3. Use the grinder yourself. Sharpen one shovel and discuss the operation to review the use of the grinder (Lesson I -- "Care and Use of Axes") Best way is to ask individual students why care is exercised.

4. Have one student try his hand at grinder. Point out his mistakes and correct them.

5. Demonstrate the use of files and whetstones with shovels and explain when and why they might be used; see Lesson Outline.

6. Have students take short turn at use of file and stone on a shovel. Point out and correct individual mistakes.

7. Discuss and demonstrate the points of selecting good handles and fitting them to the shovel blade.

8. Remove the splintered handle, fit, and rehandle one shovel yourself. Point out things to be observed.

9. Take the group to the field and demonstrate the various uses of shovels as listed in the Lesson Outline.

10. Have each student do a turn at using the shovel. Point out individual mistakes.

11. Call attention to the proper care of the axe while in use and to the precautions for safety.

12. Call attention to the cleaning, oiling, and storing of

equipment after use.

13. Upon return to the camp, store the axes properly in the tool house.

LESSON I -- SHOVEL

Lesson Outline

a. Conditions Desired in Sharp Shovels

1. Sharp cutting edge
2. Durable cutting edge
3. Bevel of cutting edge should remain approximately the same
4. Smooth cutting edge
5. Preserve balance
6. Sharpened on inner side

b. Sharpening with File and Whetstone

1. Shovels usually sharpened by means of file only
2. How to hold shovel firmly
3. Selection of proper file
4. Angle of application
5. File only on push stroke
6. Whetstone used to smooth edge for special cutting

c. Qualities of Handle Stock

1. Species and grade of wood
2. Grain and knots
3. Warp, shape, length
4. Flexibility

d. Uses

1. Throwing dirt on burning snags etc.
2. Working in embers with damp earth
3. Temporarily covering or cooling hot spots
4. Mop-up tool for breaking up heat concentration
5. Scraping
6. Chopping
7. Digging line in heavy duff

e. Care

1. Keep cutting edge sharp
2. Avoid heavy rock work
3. Avoid using as a pry pole
4. Keep tight on handle
5. Keep clean and oiled when not in use
6. Should not be left lying about

LESSON II -- GRUB HOE

Instruction Suggestions

1. Take the group to the shop. Have several perfectly conditioned grub hoes, a carborundum grinder, files, a few dulled grub hoes.

2. Give each two or three students one of the sharpened grub hoes. Point out the points mentioned in the Lesson Outline, as desired in a well-sharpened hoe.

3. Use the grinder yourself. Sharpen one grub hoe and discuss the operation. Review the students on use of the grinder.

4. Have one student try his hand at grinder. Point out mistakes and correct them.

5. Demonstrate the use of files on grub hoes and explain when and why they might be used.

6. Discuss and demonstrate the points of selecting good handles and fitting them to the blade.

7. Remove and re-fit handle on one grub hoe. Explain difference between round and square eye grub hoes.

8. Take the group to the field and demonstrate the various uses of grub hoes.

9. Have each student take a turn at using a grub hoe. Point out individual mistakes.

10. Call attention to the proper care of the tool.

11. Upon return to the camp, store the grub hoes properly in the tool house.

LESSON III -- GRUB HOE

Lesson Outline

a. Conditions Desired in Grub Hoe Edge

1. Durable cutting edge
2. Smooth cutting edge
3. Preserve balance
4. Sharpened on under side
5. Sharp cutting edge

b. Sharpening with Carborundum Grinder

1. Caution against overheating
2. Direction of wheels
3. Position, correct method of holding
4. Pressure, moving tool on stone

c. Qualities of Handle Stock

1. Species and grade of wood
2. Grain and knots
3. Warp, shape, length
4. Round or square eye hoes must have proper handles

d. Uses

1. Fire line construction
2. Planting tool
3. Clearing land
4. Breaking up heat concentrations
5. Chopping and scraping
6. General trail construction

e. Care

1. Avoid using as a pry pole
2. Keep tight on handle
3. Protect edge as much as possible
4. Keep clean and oiled when not in use
5. Should not be left lying about

LESSON III -- PULASKI

Instruction Suggestions

1. Take the group to the shop. Have ready several pulaskis perfectly sharpened and hung, a good sandstone grinder, a carborundum grinder, files, whetstones, and a few dulled pulaskis.

2. Give each two or three students one of the sharpened tools. Point out each of the features mentioned in the Lesson Outline, as desired in a well-sharpened pulaski.

3. Use the grinder yourself and sharpen one tool. Explain, discuss, and review use of grinder.

4. Have as many students as possible take a turn at the grinder. Correct each mistake made at the time.

5. Review the use of files and whetstones as applied to other tools in light of the shape of this tool, i.e., axes, hoes.

6. Have students take a turn at the use of file and stone on a pulaski. Point out and correct individual mistakes.

7. Discuss and review points of selecting and fitting handles as outlined in Lesson III on Axes. Point out things to be observed.

8. Take the group to the field and demonstrate the various uses of shovels as listed in the Lesson Outline.

9. Have each student take a turn at using a pulaski. Point out individual mistakes.

10. Call attention to the proper care of the axe while in use and to the precautions for safety.

11. Call attention to the cleaning, oiling, and storing of equipment after use.

12. Upon return to the camp, store the pulaskis properly in the tool house.

LESSON III -- PULASKI

Lesson Outline

a. Conditions Desired in Sharp Pulaskis

1. Sharp cutting edge
2. Durable cutting edge
3. Smooth sides and cutting edge
4. Preserve balance and proper convexity
5. Centered edge

b. Sharpening a Pulaski

1. Hoe blade should be sharpened on under side
2. Files used when grinders are not available
3. Whetstones used to smooth edge, sides after grinding or filing

c. Qualities of Handle Stock

1. Species and grade of wood
2. Grain and knots
3. Warp, shape, length
4. Flexibility

d. Uses

1. Primarily a fire fighting tool
2. All general uses of axes
3. Can be utilized as tool for hazel hoe, grub hoe, and mattock work

e. Care

1. Keep cutting edge sharp
2. Avoid chopping into ground or rocks
3. Avoid using as a hammer
4. Avoid using as a pry pole
5. When in storage suspend from a rack
6. Keep tight on handle

f. Safety with the Pulaski

1. Make sure swing will be free
2. Keep tool from glancing and work clear of others
3. Work with the elbows held low
4. Exercise care when using hoe end toward feet

CARE, OPERATION, AND USE OF MOTOR TRUCKS

INSTRUCTION SUGGESTIONS

A. All truck drivers, mechanics' assistants, and truck service men should take the course. Classes should be limited to ten men. Repeat course as necessary or conduct as many classes as necessary. All enrollees should be encouraged to take the course.

B. The head mechanic of the repair shop, if one is available, should teach the course. The camp mechanic, or a qualified foreman, may teach the course.

C. Instruction should be given in afternoon after work hours.

D. Entire course should be given at shop or auto park where rack is available.

E. This course consists of six lessons.

F. Instruction methods should consist of demonstrated lecture by instructor with active participation by students.

G. Teaching aids are one or two trucks, the instruction books for the make of truck used, a rack permitting inspection from below, simple tools as needed.

H. Instruction periods should be two hours per lesson.

I. No preparatory work by the students is necessary.

LESSON I -- CHASSIS, BODY, AND SPRINGS

Instruction Suggestions

1. Put a truck on a rack or over a pit where light is available. View the truck from below, as well as from other points.

2. Use a picture or plate of the chassis if a truck is not available.

3. Use the manufacturer's handbook as a guide in pointing out the items mentioned in the Lesson Outline.

4. Question the students for names of various parts. Question them as to the function of various parts. Question them as to the frequency of care and what to do at each point.

LESSON I -- CHASSIS, BODY, AND SPRINGS

Lesson Outline

a. The Chassis as the Skeleton of the Truck

1. The members of the chassis
2. Their design and construction
3. How they are attached to each other
4. Strength and rigidity

b. The Body

1. How constructed
2. How attached to chassis
3. Points of weakness
4. Common repairs
5. Care of the body

c. The Springs

1. Purpose and action of springs
2. Points of suspension
3. Lubrication
4. Tightness of spring shackle bolts
5. Spring leaves
6. Function of shock absorbers
7. Care of shock absorbers

LESSON II -- STEERING ASSEMBLY, TIRES, WHEELS AND BRAKES

Instruction Suggestions

1. Use the manufacturer's handbook as a guide in pointing out the items listed in the Lesson Outline.

2. Teach the care and use of the various parts of the car through study and explanation of their functions.

3. Ask questions freely. Draw information from the students. Every boy who can drive thinks he is a first class driver and knows all about a car. Test and check the correctness of his information.

LESSON II -- STEERING ASSEMBLY, TIRES, WHEELS AND BRAKES

Lesson Outline

a. The Steering Assembly

1. The parts of the steering assembly and their functions
2. Points of wear and their care
3. Points to be checked for tightness or play
4. Lubrication

b. Tires, Wheels, and Brakes

1. The construction of a tire
2. Importance of proper inflation
3. Points of wear and tear on tires
4. Routine of tire care and inspection
5. Parts of the front wheel assembly and their functions
6. Wheel balance
7. Lubrication, care, and inspection of front wheels
8. Parts of the braking system and their functions
9. The action of brakes
10. Brake adjusting
11. Care and use of brakes
12. Brake lining

LESSON III -- THE ENGINE AND TRANSMISSION

Instruction Suggestions

1. If at all possible, use an engine with head and crank case removed to teach the operation of the engine. Show the movement of pistons, valves, and crankshaft by slowly turning over the engine with the crank.

2. Do not at this time dwell on the carburetion and ignition.

3. Use a stripped down truck if one is available for teaching the transmission system. Otherwise, put a truck on a rack and view it from below. Remove the gear housing cover or use manufacturer's instruction book.

4. Use a differential assembly for instruction if at all possible. If not available, use drawings or pictures.

LESSON III -- THE ENGINE AND TRANSMISSION

Lesson Outline

a. The Power Plant

1. The principal parts of the engine and their functions
2. The principle of the operation of a four cycle engine
3. The lubrication of wearing parts in the engine
4. The function and operation of the cooling system
5. The transformation of impulsive power in the pistons to rotary power in the crankshaft
6. Care in the operation of the engine

b. The Transmission of Power

1. The function and care of the clutch
2. The function, operation, lubrication of gears
3. The drive shaft and universals
4. The differential, its functions, operation, and care
5. The action on the driving wheels

LESSON IV -- THE FUEL SYSTEM

Instruction Suggestions

1. Teach the purpose, functioning, care, and use of the fuel system as a unit.

2. Use a truck for the teaching purpose, following the manufacturer's instruction book. If truck is not available use pictures to show interior.

3. If possible, borrow from dealer an exhibition carburetor cut away to show interior.

4. Make use of repair shop for demonstration.

5. Demonstrate the action of the carburetor at various engine speed.

LESSON IV -- THE FUEL SYSTEM

Lesson Outline

a. The Gasoline Tank and Fuel Lines

1. The mounting and construction of the tank
2. The location and construction of the fuel lines
3. Precautions in filling gasoline tanks
4. Dirt in tanks and fuel line

b. The Fuel Pump and Settlement Bulb

1. Action of the fuel pump
2. Action of the settlement bulb, care, and attention
3. Dirt and water in gasoline

c. The Carburetor

1. Purpose of the carburetor
2. Construction and operation
3. Care in operation
4. Adjustments for mixture and idling
5. The air cleaner

d. Gasoline Consumption

1. At idling
2. At low speeds
3. At high speeds
4. Economy in correct adjustments

LESSON V -- THE ELECTRICAL SYSTEM

Instruction Suggestions

1. In this lesson do not attempt to go into theory of Automotive Electricity. Emphasis should be placed on understanding the functions of the various parts, their use and operation, and ordinary care. Do not attempt to teach repairing in this lesson.

2. Trace the various circuits as thoroughly as possible on the truck or on manufacturer's diagrams.

3. Use questions as to part names, uses of various units, and functions freely.

4. If dismantled units are available in the repair shop, use them for illustration.

LESSON V -- THE ELECTRICAL SYSTEM

Lesson Outline

a. **The Storage Battery**

1. Parts of the battery, construction, and mounting
2. Function and operation of the storage battery
3. Care of the battery

b. **The Generator**

1. Function of the generator and its relation to the storage battery
2. The construction, mounting, and driving of the generator
3. Care and adjustment of the generator
4. The ammeter and its function

c. **The Starting Motor**

1. Function of the starter
2. Construction and mounting of starter
3. Operation of the starter, engaging and releasing
4. Care of the starter

d. **The Ignition System**

1. Function of the ignition system
2. The parts of the ignition system--battery, coil, switch, distributor, condenser, wiring, spark plugs, and their functions
3. Care of the ignition system

e. **The Lighting System**

1. Parts of the lighting system
2. Care of headlights and tail lights
3. Focusing headlights
4. Operation and use of "tilted beam" in headlights

LESSON VI -- OPERATION AND USE

Instruction Suggestions

1. It will probably be impracticable to give individual instruction to each man. For this lesson use round table discussion. Use a truck for demonstration if practicable. Let the students bring out the point listed in the lesson outline.

2. Impress the students with the toll of deaths and injuries from auto accidents in the country at large and in the CCC.

3. Encourage pride in carefulness and in safe driving.

4. Encourage pride in the painstaking care of a car as a wonderful piece of powerful machinery.

LESSON VI -- OPERATION AND USE

Lesson Outline

a. **Starting and Stopping**

1. Gears in neutral
2. Ignition on
3. Using the starter
4. Using the choke and throttle
5. Check gas, oil pressure, ammeter, brakes, clutch, lights
6. Cold weather starting
7. Engine deceleration
8. Braking in stopping
9. Wear on tires in starting and stopping
10. Leaving car parked, switch off, brakes set, gears, and lights

b. **Driving**

1. Shifting gears
2. Riding clutch
3. Passing other cars
4. Road courtesy
5. Traffic rules
6. Proper speed
   a. Load
   b. Road conditions
   c. Visibility
7. Stopping distance at various speeds
8. Safety rules in carrying men
9. Heavy freight hauling
10. Precautions in mountain driving
11. Driving with trailers

SUPPRESSION OF SMALL FIRES

INSTRUCTION SUGGESTIONS

A. Emphasize the fact that all small fires are potential big fires and that all big fires were at one time small fires.

B. This course is to follow a course in fire chasing if possible. It is not absolutely necessary that this sequence be followed but it is preferred.

C. The objectives and policies of the U. S. Forest Service will be stressed as desirable objectives in all fire fighting.

D. To give practical experience in the suppression of small fires, each group of trainees should be given an actual small fire on which to work.

E. Draw as much from the experience and ideas of the class as you can. This will make the discussion more interesting to the individuals in the class.

U. S. F. S., North Pacific Region, Guard Handbook. Portland, Oregon, Revised, April 1933.
Department of Forestry, State of Oregon, Fire Warden's Handbook. Salem, Oregon, 1939.

LESSON I -- OBJECTIVES AND POLICIES

Instruction Suggestions

1. This course may be given indoors or in the field prior to the actual work on small fires.

2. The objectives discussed in the Lesson Outline are, for the most part, those of the U. S. Forest Service.

3. Emphasize the importance of observation.

4. Use the blackboard freely.

LESSON I -- OBJECTIVES AND POLICIES

Lesson Outline

a. Objectives

The principal objective of all fire suppression is to confine the fire to as small an area as is possible. This can only be done by immediate detection, quick action, prompt arrival, and hard and effective fire fighting.

Control: The control of fire must be made as soon as possible on the day of discovery. If this fails, the objective is to control before 10 o'clock of the next morning.

Small fires: Class A and Class B fires are to be completely extinguished to the last spark as quickly as possible.

Large fires: Larger fires are to be mopped up as quickly as possible to a point where they cannot escape.

All fires: All class A, B, and C fires should be completely extinguished before abandonment. On larger fires (Class D and E) mop-up work will be done until the fire is safe. Enough men must be retained until fire is out if necessary to insure safety.

b. Policies

Action: Action of every reported fire must be taken at once. Delay is dangerous.

Reports of fires will usually come to the fireman through the dispatcher. However, in some cases reports come through other channels. In these instances, if the dispatcher or some other responsible person cannot be reached, the fireman must take immediate action.

If an emergency arises, and the fireman considers extra men necessary, he should hire them. His protective organization will in every case grant him that emergency power.

The fireman, or anyone responsible for suppression, must be willing and capable of taking the initiative.

Night work: If the time of arrival at the fire is after dark the fire should be worked on immediately unless there is unusual danger to the men. Reasons must be furnished when night work is not carried out on a fire that has been found.

Staying with fire: A man who has been sent to a fire must stay with it until it is out or until his supplies are gone, or until he has been relieved by someone else under instructions from a superior officer.

The size of the fire makes no difference. If it is too big for him he must do all that he can. He may assume that reinforcements will be sent. It is up to the lookouts to keep close check on the fire to determine if follow-up is necessary.

The work that one or two men can do on hot spots or bad spots, even on a large fire, may be a deciding factor on the control of the fire.

An exception to the above may be made when a number of fires start in the same locality and it is necessary to control one and then go on to another. In these cases the fireman should keep going from one to the other and keep working on them until they are out.

If more than one man is on a fire, one of them should report to the dispatcher as soon as he can be spared.

Checking: It is the desirable policy to check every fire 24 hours after it has been reported as out.

Control: Large or small fires may be considered controlled only when a fire and any spot fires are surrounded with an adequate control line burned out adjacent to its edge, and all immediate threats to the line removed.

The immediate threats to the line include:

1. Falling of dangerous snags
2. Prevention of crowning or reburning by cooling down hot spots, removing low-hanging limbs and

moss, and by putting out fires in clumps of reproduction

3. Prevention of roll by a cupping trench and blocking or arranging heavy material
4. Protection from blowing sparks and embers by separating heavy burning material, putting out fires in stumps, and cooling down all fires near the line

Fire out: A fire is out only when the last spark has been put out. All class A, B, and C fires must be completely out before the fire can be left. Larger fires may be left provided sufficient mop-up has been done and enough of a crew remains to insure safety.

Fire classification: The classification of fire as used by the Forest Service is as follows:

Class A--One-fourth acre or less
Class B--More than one-fourth acre but less than ten acres
Class C--Ten acres or more, but less than 100 acres
Class D--100 acres or more, but less than 300 acres
Class E--300 acres or more

Extra period fires: Extra period fires are fires of any class that have not been controlled by 10 o'clock the following morning. Explanations are in order when any fire has reached extra period status.

LESSON II -- SUPPRESSION OF SMALL FIRES

Instruction Suggestions

1. This lesson is primarily designed to give the trainee the basic principals of small fire suppression.

2. Use an old small fire for purposes of discussion and practice in sizing up the situation as it could exist according to factors that may be assumed by the instructor.

3. The lesson should be given in the field.

4. Attempt to build the idea of an orderly procedure of decision, attack, mop-up, and report.

5. Encourage the trainees to express their ideas on the problem they are facing so that the instructor will have the opportunity of pointing out their strength or weakness.

6. The lesson should be followed, if safety will permit, by actual practice by the trainees on going small fires.

7. This lesson should follow a course in fire chasing. It is assumed in the examples taken that the fire has been located and that the fireman has arrived at the fire.

8. The instructor must emphasize and reemphasize the importance of the suppression of small fires.

LESSON II -- SUPPRESSION OF SMALL FIRES

Lesson Outline

a. Location

The fireman by means of the methods discussed under fire chasing has arrived at the fire as speedily as is possible.

On arrival at the fire, the fireman places his pack in a safe place, notes the time, and sizes up the fire.

b. Sizing Up the Fire

In sizing up the fire the fireman should take note of the following factors:

1. Go around the fire
2. Analyze the burning material and fuel adjacent to the fire edge. Consider any dangers such as snags, moss covered trees, or dead trees
3. Analyze topography, slope, wind, relative humidity, and the time of day as it affects present and future burning conditions and the rate of spread
4. Determine the points where the fire is most likely to escape and spread rapidly
5. Look for spot fires and determine if they need immediate attention
6. If fire is man caused, look for and preserve evidence. If the fire is dangerous, take action first and do the detecting after it is controlled
7. Determine the most vital point of attack. Consider snags, hot spots, and inflammability of adjacent fuel

While going through the almost instant process of determining the method of attack, other points to consider are:

1. Extreme heat is always dangerous and must be dealt with first
2. Fire travels faster uphill than down

3. If the slope is steep, firebrands may roll
4. Wind generally blows up slopes in day time and down at night
5. Wind will fan a quiet fire into a dangerous one
6. Fire is generally worse between 10 A.M. and 5 P.M.
7. Ordinarily fires do not spread rapidly in duff

When the fireman has quickly made the above survey and considered the above points, he will be ready to begin an intelligent attack. He cannot linger over his decision as to what to do.

c. Attack

Method: The direct method is used on all small fires possible. Certain places along the fire edge may be so hot as to prevent direct attack and this will make necessary the building of fire line away from the edge of the fire until the spot can be cooled down.

The focal points of attack will be the hot spots that are the most serious. When the worst ones have been cooled down sufficiently to be comparatively safe work on the next one in order of danger.

Use of dirt: Properly used dirt is highly effective. Only mineral soil can be used and should be damp or moist. It may be used to put the fire out or to cool hot spots.

The effect of dirt is to smother the fire by cutting off its supply of oxygen. In the cooling of hot spots two or three shovelsful of dirt are frequently as effective as a bucketful of water.

Do not bury a fire with dirt. It is used merely as a cooling and smothering agent. The danger of burying a fire yet not completely shutting off the supply of oxygen so that it will continue to smoulder is very great.

Use of water: Water, if available, is one of the most effective aids that a fireman can have. However, the forest fireman generally has limited supplies of water so that it must be used wisely.

Use a pump if possible. Either a power pump or a back pack pump.

Throw or squirt the water at the base of the fire not into the flame. Do not sprinkle.

If supply of water is unlimited, drench the whole area with water.

Trenching: Dig out the edge of the fire with a shovel or mattock. This will be done hastily on the first time around. When the fire line is complete the fireman can go back and improve the line to make it safe.

Throw all material that is burning well within the fire line. Scrape fire from charring logs and sticks with axe and cool with dirt. Rob the fire of fuel that is not burning now.

Make sure that cold edges of fires are dead out and then use them as part of the fire line.

The trench must be dug to mineral soil with the roots removed so that they will not carry the fire across the line. The width of the trench will vary according to the material that the fire is burning in.

Snags: Snags are the most important source of trouble on a going fire. If a snag is throwing sparks it may be necessary to fall the snag before the ground fire is controlled.

Snags inside the fire edge but not burning should be safeguarded from catching fire. If snag is already burning, it should be put out. If it is rotten or punky and in danger of catching fire it should be felled. In most cases the snags will be felled before the fire is considered safe.

If possible, fall the snags within the burned area. If not possible, prepare a place for them to fall.

d. Mopping Up

The object of mop-up is to put the fire out as quickly as possible. It should and must be started immediately after the fire is controlled. Retain the full crew until the fire is mopped up to the point of safety.

What to do on the mop-up on all small fires is as follows;

1. Start work on mop-up as soon as control is accomplished
2. Search for spot fires outside of the control line and if any are found put them out
3. Dig out all underground fire if at all feasible, never bury any fire in the expectation that it will go out
4. Either burn out smouldering fuel or spread it and put fire out with dirt or water
5. Search for and eliminate all special threats such as singed brush, punky stumps, and rotten logs
6. Fall snags adjacent to and in the fire area
7. Search for burning roots that may carry fire over the control line
8. Leave the fire completely out

e. <u>Safety Measures</u>

1. If more than one man is on the fire see that each has room in which to work
2. When proceeding to the fire travel in a single file with the saw at the back
3. When falling snags, station one man to look for falling limbs and bark
4. See that the men do not become over fatigued
5. See that headlamps are available to the men doing night work

TEST ON SUPPRESSION OF SMALL FIRES

1. List five things which should take the fireman's attention when he first reaches the fire.

2. What are four conditions of burning that the fireman must take note of?

3. What are two precautions that must be used in the use of dirt in the control of fire?

4. In the trenching of a fire, what two things must be accomplished to make it safe?

5. When should mop-up be started on a fire?

6. In the falling of snags what precaution is vitally important?

7. What is the Forest Service policy concerning night travel to a fire?

8. List five things to be accomplished during mop-up operations.

9. What is the objective of any protection organization?

10. You are the fireman. You find a fire about ¼ acre in extent, burning rather slowly in heavy duff. The fire is burning actively at the base of a tall snag. Describe the procedure that you would follow in the suppression of this fire.

THE PROGRESSIVE METHOD OF FIRE CONTROL

INSTRUCTION SUGGESTIONS

A. This course is designed to provide the trainee with the principles of the Progressive Method of Fire Control.

B. At the close of the lesson the trainees should be drilled in the use of the various tools that they will be required to use.

C. When sufficient practice has been given to assure the instructor that the trainees can use the various tools actual practice periods in line construction should be held to insure perfect team work of the crew using the system. This will aid in the conditioning of the men as well as perfecting the technique.

D. Be sure that each trainee is aware of the safety measures that must be taken to insure the safety of his fellow workers.

E. This class will be the size of the unit that is to be used in the suppression crews. It may vary from 25 to 40 or 50 men. It must be understood that when the size of a crew has been decided upon it is to act as a unit throughout the season. When individuals leave for one reason or another their places in the unit will be filled. The size of the unit itself will not be changed.

F. The course should be taught and supervised by someone who has had experience with the system.

G. This course is largely one of practice under the direction of the man in charge of the training in this particular course. A suggested means of holding this training would be to have the squads trained by their squad bosses and then the whole crew worked under the foreman of the crew.

Schroeder, George. The Progressive Method of Forest Fire Control. A mimeographed paper, 1941.

LESSON I -- THE METHOD

Instruction Suggestions

1. This lesson should be given before the crew starts to practice so that the trainees will have a good understanding of the function and purposes of the Progressive Method of Fire Control.

2. This lesson should be given by the individual that will supervise the practice of the crews.

3. The lesson may be given indoors. However, it might be well to use the lesson again in conjunction with the practice.

4. Enlarge and extend the points in the Lesson Outline.

5. Emphasize the importance of a sense of teamwork on the part of the members of the crew.

LESSON I -- THE METHOD

Lesson Outline

a. Evolution

Experimenting in the field of fire control has resulted in the Progressive Method of Fire Control.

This method, previously called the "One Lick Method" was concerned with the construction of line. It is now known as the Progressive Method of Fire Line Construction but the principles involved are not generally applied to the other steps in the controlling of fire.

It is safe to assume that the same principles that make for efficiency of line construction can be employed for all of the steps in the control of fire.

b. Principles

Waste of time is eliminated, skills in special tasks is developed, morale is maintained through pride in the outstanding achievement made possible, and education of the entire crew allows a maximum of coordination in meeting each emergency problem.

The above is accomplished by careful selection of men, conditioning and training of the workmen, flexible division of labor to cope with conditions as they are encountered, and by careful organization and supervision.

This method calls for a crew of men each of which is assigned to a job according to his aptitude and training. The crews are supervised by men spaced and trained so that each man in the crew is directed in his effort. The crew is so complete that it scouts the fire, locates and builds the line, takes care of special hazards, burns out the line if necessary, and mops up the fire to a point of safety in a minimum of time.

The efficiency of the crew is primarily dependent on the overhead of the crew. The men in overhead positions must keep pace with the interest and incentive of the men under them.

c. The Crew in Action

A scout or scouts would be studying the fire, topography, and fuel as he covers the area, relaying back information as to the pertinent conditions. This scouting detail will be working ahead of the advance line locator.

The advance line locator decides on the general location of the line.

The line locator then follows making the final location of the line.

The first tools are the cutting tools or axes. They are strung out so that each man has plenty of room in which to work.

Next will come the digging tools making the actual trail to mineral earth after the way has been cleared by the cutting tools.

The burning-out crew will follow the digging tools. If the completed trail is finished to the top of a ridge the burning-out crew will probably burn out a safety area at the top of the ridge from which they will work back down the hill.

Behind the torches will be men using shovels to improve the line and hold the flames in check by throwing dirt or beating the fire.

Farther back, firemen will be mopping up the fire from the trail.

In the extreme rear will be men scattered at wide intervals patrolling and putting out the last spark near the completed line.

d. Coordination

Details of fire: A clear picture of the fire, its location, the fuels, topography, and all other pertinent details should be available at the time that the crew is ready to initiate control action.

Overall scouting is essential as long as the fire is not under control. This scouting may be done by plane, by lookouts, or by scouts on the ground.

This will make possible the shifting of crews to more important or dangerous areas, protect men in dangerous positions, and will allow the fire boss to use his men and materials according to the need.

Communication: It is essential that communication be maintained with the other sectors of the fire just as in any other method of fighting fire.

Servicing: As far as is possible the Progressive Fire Control units should be self sustaining.

e. The Specific Jobs

The scouts: The scout working ahead of the line locator must be physically fit to be able to stand the rigors of hiking all day up hill and down through brush and other cover.

It is important that the scout be trained in the science of fire. He must be able to evaluate the factors of the rate of spread and resistance to control.

It is most important that the scout does not get out of touch with the crew behind him while at the same time he is covering his scouting detail. He will be most effective when equipped with a radio.

In strange country with variable fuels and broken topography, it will probably be necessary to give him help. This help should be able to be supplied from the crew.

The advance line locator: This man chooses the general location of the line based on the information relayed to him by the scouting detail.

It is important that he conserve his strength, keep a clear head, and use the information obtained to the best of his judgment.

This is one of the two positions of the greatest importance to the efficiency of the crew.

The axemen: The first of the men must be trained to replace the advance line locator if it becomes necessary. This man chooses the final location of the line as he works ahead of the cutting crew. He works as he goes as well as locates the fire line.

The other men with cutting tools will each work out a given segment of line that is usually fifteen feet. If one man completes his segment before the men ahead of him, the others move up one segment. Thus each axeman always has his work to do and no one man interferes with the work of the other. There is no passing in the line.

The fifteen foot interval is secured on the initiation of action on a fire by having the leading man pace off from a starting point a distance roughly equal to the number of cutting tools behind him.

After cutting has started the fifteen foot principle may be adhered to rigidly or it may be flexed by proportioning the work among the crew so that the last cutting tool finishes the job. This will mean that the cutting tools go ahead without any one man completing a segment by himself before moving on.

Clearing: In some types of cover it may be desirable to have men without tools to clear out the material cut by the axemen .

The pulaski men: The pulaski men serve as the expansion and contraction medium between the cutting tools and the digging tools. When the axe work is holding up the entire crew, the pulaski men can switch from use of the digging blade and start supplementing the work of the axes.

When the pulaski men are acting as cutting units they space themselves in the usual manner. When they are acting as digging units they may still do a small amount of cutting as necessity arises.

The first digging unit (pulaski or hazel hoe) acts as spacer for the rest of the digging units, spacing their strokes far enough apart so that the line is completed only when the last digging tool has passed the first segment of line. A segment of line is completed equal to the blade of the digging tool and the width of the fire line to be. The next digging tool completes a like amount of work adjoining the first segment. The rest of the digging tools do likewise until the last tool completes the line with the final bit of work.

Cleaning up men: The function of these men is to put the finishing touches to the line to make it safe for the burning out process. They follow behind the digging tools.

The Kortic tool (a combination hoe and rake) has been found very effective for this purpose. It can be used for cutting, digging, or raking and its wide blade allows for a maximum of "cleaning up."

The "baby" shovel is often preferred for the "cleaning up" process as it is lighter and easier for the men to carry with them.

Buckers and fallers: At least two men (preferably four) must be trained in falling snags and bucking logs. In some cases a bucking saw will serve for both falling and bucking when falling is a minor item. In most cases a third man must be detailed to carry the other saw.

If the job involves a large amount of falling of dead trees, a "lookout" must be detailed to watch the safety of the fallers.

In most cases the timing of the saw workers is not important. In the case of heavy work, the logs will be treated in a temporary manner until the buckers can get to them.

The backfiring detail: If a large amount of fuel lies between the constructed line and the fire backfiring is necessary. When dealing with a spreading fire a few feet of flashy fuel may make burning out necessary.

The number of torchmen varies with the size of the crew. Usually, one man to every twenty-five is about right.

The fire may be applied in strips from the highest point to the lowest or, in flashy fuels in favorable locations, the fire may be applied to the inside area from the fire line itself.

It is important that the torchmen set only the amount of fuel on fire that can be held by the patrol and mop-up detail.

The line holding detail: The men in this detail are armed with "baby" shovels if the fire is in a coniferous type of forest. A cutting tool or two is usually needed to do the occasional cutting necessary.

The main force of this detail works close behind the burning out process since the first fifteen or twenty minutes after firing usually sees the greatest risk of the fire crossing the fire trail. The objective is not to put out the fire but to keep it under control. The line is not considered safe until the fire has consumed the fuel on the inside of the fire line.

As the fire dies down there is a continuous re-adjustment of line holding detail. When the fire near the line is flashing high the men are grouped closely. On line that has been burned out for several hours one man may be able to safely hold up to a quarter of a mile. A properly trained crew will make the adjustment to changing needs automatically.

f. Factors Affecting Speed of Line Construction

Burning out: When it is necessary to burn out a large segment of the fire's perimeter the crew will not make much headway because the line construction men will be needed for the holding of the line.

As the burning out is completed the men will again stretch out into their normal jobs until the crew is again working at a maximum speed.

g. Importance of Trained Crews

Forest protection is concerned with enormous values in natural resources and artificial improvements. Therefore, it is logical too, that trained and organized fire fighting forces should be used. Time is so limited when fires are burning that we cannot afford to place dependence on pick-up labor and inefficient methods.

The answer to this problem seems to be the Progressive Method of Fire Control applied by trained, organized crews of picked men.

LESSON II -- APPLICATION OF THE METHOD

Instruction Suggestions

1. This lesson is primarily one of practice and should be given in the field simulating actual working conditions.

2. The preliminary training could be given under the squad bosses of each of the details. After the men have learned their jobs in each of the details, they could then be coordinated into the complete crew.

3. This lesson will have to be directed by men who have had experience in the Progressive Method of Fire Control.

4. Emphasize the need for safety and caution when working as a unit. The loss of one man will interfere with the efficiency of the crew.

5. The drill and practice on this lesson will also serve as a means of conditioning for the rigors of actual fire duty.

6. The goal to be striven for is to train the crew so well that they will make adjustments to changing conditions without direction.

7. Emphasize the importance of each individual to the functioning of the whole.

8. Strive for a feeling of pride on the part of the trainees for their part of a well organized unit that is unsurpassed as a fire fighting crew.

9. See that the trainees understand all the jobs of the various details so that, in case of emergency, they will be able to fill other jobs in the crew satisfactorily without undue impairment to the efficiency of the unit.

EXAMINATION ON THE PROGRESSIVE METHOD OF FIRE CONTROL

1. List three of the objectives of the Progressive Method of Fire Control.

2. To what does the efficiency of a crew primarily depend?

3. List the usual order of tools in the Progressive Method of Fire Control.

4. Explain the function of the axemen and how they are spaced.

5. Name the two positions that are of the greatest importance to the crew.

6. What is a very necessary safety detail in the falling of snags?

7. What is the rule of thumb for the number of torchmen that a crew should have?

8. What is the most important function of the pulaski men?

9. List the things that can be accomplished with a Kortic tool.

10. List the information that should be obtained by the scout.

LINE ORGANIZATION ON A PROJECT FIRE

INSTRUCTION SUGGESTIONS

A. This course is given to enable the trainee to obtain a knowledge of the organization on a large fire and the duties and responsibilities of the suppression positions so that should he be required to take one of them over in an emergency he will not be completely at loss as to know what to do.

B. The course should be given by someone who has had experience on big fires.

C. Emphasize the importance of personal perfection on the part of the men in charge of the various divisions of the project fire.

D. The course should be preceded by a course on leadership which will apply to all of the following positions as represented in the lesson plans.

E. Draw on the experience of the class as much as possible. Try to obtain from them the fundamental principles filling in where they fall short.

Show, S. B., Price, J. H., Deering, R. L., Gowen, G. M., and Gustafson, C. A. Fire Control Handbook, Region Five. United States Department of Agriculture, Forest Service, 1937.

United States Department of Agriculture, Forest Service. Fireman's Guide, Region One, 1940.

LESSON I -- FIRE BOSS

Instruction Suggestions

1. Emphasize the importance of the fire boss as the leader and setter of the entire policy of the suppression crews on the fire.

2. Impress on the trainees the importance of noting the action of the fire boss of the fires on which they have been sent. Experience and observation are the best teachers.

3. Make sure that the trainees understand the basic organization of a large fire. This should come out in the disuocssion of the duties of each leader that is associated in the big fire organization.

LESSON I -- FIRE BOSS

Lesson Outline

a. Introduction

Once a fire gets beyond the smokechaser stage, new problems arise in the handling of that fire. There must be a division in the duties of leaders on the line and in service of supply. There is a need for co-ordination of effort that is dependent on obtainance of information so that the plan of execution of attack may be intelligently made and carried out with the least possible delay.

Effective organization for any big fire requires the following:

1. Clear recognization of the size of the organization required to effectively combat the going fire

2. Understanding of accepted lines of authority and standard plans of organization

3. Knowledge of the duties and responsibilities of each suppression position in the organization

b. Responsibility and Authority

The fire boss is in general charge of the fire. He has full authority for all action taken to suppress the fire.

In a single sector fire the job is not too complex and the fire boss will have direct charge of all the activities of suppression.

In a fire of more than one sector, the fire boss will delegate part of his responsibilities to the sector bosses. If the fire becomes one of a large number of sectors, the fire boss will designate authority to the division bosses who will be in direct charge of the sector bosses in their division.

If the fire becomes sufficiently large the fire boss may appoint an assistant whose duty will be to take over part of the load of the fire boss. The assistant fire boss may also act as alternate for the fire boss.

c. Jobs of the Fire Boss

Reconnaissance: The fire boss must initiate steps to give him the information necessary to plan the course of action. This will entail the setting up of a scouting organization to obtain information as to the physical conditions, the condition of each sector and spot area, the location of possible control lines, the spread of the fire and the control measures.

He should cover as much of the actual fire as is possible for him so that he may see conditions for himself.

On division stage fires he must not leave his communication so as to be able to direct the fight against any changing conditions.

The fire boss should do little or no scouting.

Strategy: The basis of all fire strategy is to formulate a plan for the control of the fire before the start of the next burning period. He issues orders to secure what is needed within a given time for the control of the fire.

If changes require it, he confers with division and sector bosses to revise the plans.

Tactics: He determines the best method to carry out the plan that has been formulated.

Organization: The fire boss must assign specific jobs to the designated officers depending on the size of the fire.

In this designation of duties the fire boss must be duly careful of the qualities of the men assigned responsible positions.

Camp location: The fire boss must determine the location of the camp, decide which one is to be the base camp, the supply bases, etc.

In the selection of camp sites he must exercise care as to their safety and convenience.

Inspection: The fire boss must spend as much time on the line as possible so as to check the performance of subordinates in the carrying out of plans and orders.

On large fires much of the responsibility for inspection will rest with the division and sector bosses. One method is to have cross section inspection so that it is certain that each phase of the job is being carried out according to orders.

Training: The fire boss should take every opportunity to train and aid the experience of other officers. The next fire is going to require trained help to fight it more successfully and the present fire can be used as a training field.

Personnel: It is important that the fire boss maintain and acquire information as to the performance of all of the officers under him for purposes of recommending those who have done good work and getting rid of those who are not effective.

Reports: The fire boss must assemble the daily reports of the sector bosses and report them each day.

d. Importance

It must be remembered that the fire boss is the leader of the entire fire suppression crew. The success of the suppression action and the lives of the men in the suppression crews is dependent on his action and decision.

The fire boss cannot make snap or rash judgments. He must have a reason for every action taken.

He must be in communication with all parts of the fire so that he will know at all times what the fire is doing.

LESSON II -- DIVISION BOSS

Instruction Suggestions

1. This class may be given indoors as a lecture or discussion.
2. Emphasize the fact that the division boss is also a leader.
3. Encourage class discussion and suggestion.

LESSON II -- DIVISION BOSS

Lesson Outline

a. Responsibility and Authority

When the number of sectors on a fire becomes too great for the fire boss, it becomes necessary to break the fire into divisions. Each division boss will be in charge of two or more sectors.

Each division boss has full authority to make and execute plans for the control of the fire in each division. These detailed plans must be within the general plan outlined by the fire boss.

The division boss is responsible for the coordination of the work of the sector bosses in his division.

b. Jobs

1. He obtains and checks the written instructions of the fire boss for the following:

    a. General plan of action for the division and the correlation with other divisions
    b. Location and boundary of division
    c. Camp locations planned

2. Secures from the fire boss the following information:

    a. Names and qualifications of overhead
    b. The man power on the job and ordered to come
    c. Special equipment available
    d. Transportation on hand for movement of men and supplies
    e. The best map of the fire that is available
    f. The current weather reports and transmits them to the sector bosses

3. Discuss and outline the work on each sector with the boss to whom each is assigned. These instructions should be confirmed in writing.

4. Checks in communication needed to facilitate the working of the division and orders that which is needed.

5. The boss must anticipate the need for special equipment and additional man power and place advance orders so that they will be there when he needs them.

6. He must inspect the division in detail once each day for the quality of the work and the progress of the work so that corrective measures may be taken in case of necessity.

7. He must take note of all changing conditions in weather and fire behavior and notify the fire boss if a change in plan seems necessary.

8. The fire boss must be kept currently informed and in detail as to all of the developments on the division.

9. Keeps in touch with the adjoining division bosses to unify the work program.

10. The division boss must also see that the sector bosses turn in the information necessary for the reports to the fire boss. This information must be collected into one report and sent in.

11. Discuss the division plans for each day with sector bosses and make plans for their carrying out.

12. Attends daily conference called by the fire boss to plan action for the next day.

c. <u>Importance of the Division Boss</u>

The division boss is in reality the fire boss of a given division of the fire. If the plans of control are not carried out he is the responsible person.

As a leader of a section of the fire he must be on the alert at all times for the condition and welfare of the men.

The failure of the control plans in a division could endanger the entire fire plan and the men carrying them out.

LESSON III -- SECTOR BOSS

Instruction Suggestions

1. This class may be given indoors as a lecture or discussion.

2. Emphasize the importance of the sector boss as part of the line of authority.

3. Stress the importance of the sector boss not going over the heads of his foreman. He must give orders through them not over them.

4. Encourage discussion on the part of the class.

LESSON III -- SECTOR BOSS

Lesson Outline

a. Responsibility and Authority

A sector boss is usually placed in charge of a section of a fire requiring the establishment of a camp. Each camp or unit requiring the use of 100 men or more is set up as a sector. A sector boss should not be responsible for more than 250 men.

The sector boss executes the detailed plans for his sector. He is in charge of all activities connected with his camp and sector. The duties are similar to those of the fire boss of the whole fire.

On small fires the sector boss reports directly to the fire boss. On large fires the sector boss reports to the division boss.

b. Jobs

In order to carry out his job the sector boss must carry out the following assignments:

1. On large fires, he must obtain from the division boss written instructions as to the location and boundaries of his sector, the best route of travel, and detailed plans of action to attain control objectives.

2. Keep lists, by shifts, of foreman and the number of men available for each, adjusting numbers in crews to meet certain needs.

3. See that foreman check their men through the timekeeper, and that they obtain the proper number and types of tools.

4. Assigns specific jobs on definitely described portions of line to each foreman.

5. Covers in detail and checks progress and quality of work on his entire sector at least four times each shift.

6. Stimulates crew bosses, and where satisfactory accomplishment is not taking place, takes immediate corrective action.

7. Trains foremen in their jobs and in training crew personnel. Sees that foremen give adequate training to crew personnel.

8. Contacts adjoining sector bosses and correlates his work with theirs.

9. When conditions change, making it impossible or impracticable to carry out detailed plans previously agreed upon, notifies the division boss at once and agrees with him on new action. In case of sudden emergency requiring immediate action, he uses his own judgment, reporting action taken to division boss as promptly as is practical.

10. Turns in record of accomplishments, such as lines built, backfired and mopped-up, to camp boss for entering on progress sheet record.

11. Remains on sector until relieved.

12. Acquaints relief sector boss with all conditions pertaining to sector.

13. Checks to determine that all his crews have been relieved and his foremen have checked all men and equipment before leaving line.

14. In fire camp checks to see if foremen have checked in their men and tools, and have provided for their welfare.

15. Finds out where his foremen are sleeping while off shift in order to be able to mobilize in a hurry if required.

16. Obtains from the division boss the time crews are to be awakened, fed, and dispatched from camp, and advises foremen to take appropriate action.

c. Special Cautions to Sector Bosses

The sector boss should delegate as much authority to subordinates as is practical.

Always give instructions to subordinates in writing.

Do not do any errand running. Use messengers.

Be on the fire line at the point of greatest action. Do not scout away from the crews but let the scout do that work. Be sure that you are on the most critical part of the line during the burning period.

Assign the agitators and men who cause trouble to camp detail in the morning. Have time slips and transportation ready and discharge them as soon as the crews leave camp.

Be constantly on the alert for the use of power equipment that will aid the men on the fire line.

Discuss and decide on the following with the straw bosses and foremen for the next day:

1. Reassignment of crews
2. Equipment
3. Changes in tactics
4. Lunching arrangements
5. Arrangements of day shifts
6. Night crew assignments
7. Special mop-up crews
8. Use of special equipment

Remember that the place of the sector boss is on the fire line directing the attack, improving the technique, and seeing that the planned-for progress is being accomplished. The organization should permit him to spend ninety per cent of his time planning, co-ordinating, and directing the fire suppression work on the fire line.

Before leaving the fire be sure that the fire boss has given his approval.

Insist that all reports be kept currently ready to go in at the designated times.

Be the leader of the sector. Do not hesitate in making decisions and do not rely entirely on the fire boss or the division boss. Use your initiative to the fullest extent.