

FIREMAN'S HANDBOOK

34 - DETECTION. Detection is the work or act of discovering and reporting fires. Discovering a fire or smoke and reporting it accurately is necessary before suppression work can begin. There are two systems of detection used by the Forest Service, ground and aerial.

34. 1 - Ground Detection. Ground detection is concerned with all detection that does not use aircraft.

34. 11 - Lookout Duties

1. Introduction. Forest lookouts are the ground eyes of the protection organization. Seeing a fire or smoke and reporting rapidly and accurately what is seen is essential to get early work on a fire.

This chapter includes specific qualifications and duties of a lookout. General items which also concern lookouts are covered in other chapters.

Some of these items are safety, public contacts, and communications. Lookout-firemen will also refer to suppression chapter.

34. 11a - Qualifications of Personnel. To do a good job, the lookout must have special qualities: good health; good eyesight; interest in his job, ability to live in isolated locations for long periods of time; read maps, use firefinder, use radio, and other tools; and to think clearly and coolly in an emergency.

34. 11b - Learning the Country. It is essential that a fireman know the location and names of the topographic features of the country which he sees. Refer to local landmarks repeatedly to check locations of smokes. Some of these landmarks are peaks, streams, roads, buildings--any feature which may be used to describe a location.

A fireman should acquire a basic knowledge of local landmarks as quickly as possible. He should study the country until confident that he knows its features. He must be able to locate accurately on the map and describe, by local name, landmarks of any point in his area.

1. How To Systematically Learn Country Seen From Lookout

a. Pick out prominent landmarks, peaks, streams, and buildings.

b. Learn their names from map or by asking questions. Ranger or dispatcher will assist.

FIREMAN'S HANDBOOK

- c. Use firefinder to locate them on map.
- d. Identify other landmarks by referring to these known points.
- e. Observe car dust to locate road locations.
- f. The smokes from sawmills, industrial plants, and residences may show their locations.
- g. Mirror flashes from field personnel can give definite locations on the ground. Arrange with the dispatcher for help of this kind. Description of location will be given by radio or telephone.
- h. A fireman should travel through as many different parts of his territory as possible to and from the lookout. He should look back toward the lookout tower frequently; this will help him get the lay of the land.

2. How To Identify Landmark by Use of Firefinder

- a. Set firefinder sights on the landmark.
- b. Study topography along line of sight. (The tape crosses the same objects on the map as appear along the line of sight.)
- c. Working from known topographic features, the location of the landmark can be determined as well as on the map, even if the name is not given or known.

34.11c - Record of Landmark Locations. Each fireman will keep a record of four kinds of landmarks.

1. Orientation Points. An orientation point is a landmark used to orient the firefinder and to check its adjustments. The azimuth of an orientation point is posted in each station.

2. Legitimate Smokes. Permanent and periodic smokes such as sawmills, refuse dumps, residences, campgrounds, railroads, logging operations, and industrial operations.

3. False Smokes. Any phenomenon likely to be mistaken for smoke, such as gray cliffs, livestock driveway, road dust, or fog.

4. Key Points. Any location which helps one know the country and may be useful in describing other locations. These may be peaks, saddles, ridges, canyons; streams, lakes, waterfalls, dams; points on roads or trails; or locations of heavy human use or high hazard.

Several systems have been developed to record these landmarks. The Ranger will suggest which one to use. A sample, figure 1, follows at the end of this code.

a. Use of Form, Orientation Point, Legitimate Smokes, False Smokes, and Key Points. The columns for this form will be filled in as follows: Place Name: Give the name of the orientation point (for example, Pinnacle Point), legitimate smoke (for example, Burton Mill), false smoke (for example, Salmon Highway Construction) or key point (for example, Payne's Peak).

The azimuth and vertical angles are recorded in the second and third columns.

b. Smoke Base or Point Visible From Lookout. Record "Yes" or "No." The smoke from some legitimate source, such as a mill, may not be seen until it rises above a ridge, or the glow of the lights of a town may be visible at night although the lights cannot be seen directly.

c. Elevation. Record the approximate elevation of the point of smoke.

d. Remarks. State whether the point listed is a key point, legitimate smoke, or orientation point, and give a brief description or pertinent information regarding the point.

Two general systems are used to record an orientation point, key points, false smokes and legitimate smokes; one is to record them in sequence just as they are seen as the fire-finder is turned from azimuth 0 to 360 degrees; the other is to group them separately--first the orientation points, then legitimate smokes, false smokes, and key points.

FIREMAN'S HANDBOOK

ORIENTATION POINT
LEGITIMATE SMOKES, FALSE SMOKES,
AND KEY POINTS

LOOKOUT STATION High Mountain OBSERVER Hugh L. Sauer DATE June 9, 1965

Place name	Azimuth reading	Vertical angle	Smoke base or point visible from lookout?	Elevation	Remarks: Significant description or information. State whether orientation point, legitimate smoke, * - false smoke, ** or key point.
<u>Great Peak</u>	<u>15° 45'</u>	<u>-3° 30'</u>	<u>Yes</u>	<u>4,245</u>	<u>Orientation Point</u>
<u>Sherut Point</u>	<u>37° 15'</u>	<u>-4° 30'</u>	<u>Yes</u>	<u>5,892</u>	<u>Alternate orientation point</u>
<u>White Pine Sawmill</u>	<u>3° 30'</u>	<u>-6°</u>	<u>Yes</u>	<u>4,300</u>	<u>Legitimate smoke</u>
<u>Butterfield Logging Camp</u>	<u>7° 00'</u>	<u>-6°</u>	<u>Yes</u>	<u>4,340</u>	<u>"</u>
<u>Jackson Paper Sawmill</u>	<u>46° 30'</u>	<u>-5° 30'</u>	<u>No</u>	<u>4,250</u>	<u>" Mill Chase Road 7/4 - " Fire tower beyond - " town ridge</u>
<u>King Solomon Trail</u>	<u>365° 45'</u>	<u>2° 30'</u>	<u>Yes</u>	<u>4,800</u>	<u>" significant dirt - " town smoke</u>
<u>William Clark C. Plant</u>	<u>210° 00'</u>	<u>-4° 30'</u>	<u>Yes</u>	<u>4,050</u>	<u>" " Fire above " burning strip plant</u>
<u>Opaville, Oregon</u>	<u>315° 00'</u>	<u>-1° 30'</u>	<u>No</u>	<u>4,600</u>	<u>" " smoke from " plant</u>
<u>Hunts Fork</u>	<u>5° 30'</u>	<u>71° 30'</u>	<u>Yes</u>	<u>7,600</u>	<u>Key Point</u>
<u>Butterfield</u>	<u>8° 30'</u>	<u>-2°</u>	<u>Yes</u>	<u>4,210</u>	<u>Key Point (light at night)</u>
<u>Marysville, Oregon</u>	<u>47° 15'</u>	<u>+2°</u>	<u>Yes</u>	<u>2,245</u>	<u>Key Point</u>
<u>Quincy, Oregon</u>	<u>113° 30'</u>	<u>-5° 30'</u>	<u>Yes</u>	<u>4,250</u>	<u>Key Point</u>
<u>Laylsville</u>	<u>117° 30'</u>	<u>-5° 30'</u>	<u>No</u>	<u>4,250</u>	<u>Key Point - glow from " lights at night</u>
<u>Quincy, Oregon</u>	<u>220°</u>	<u>-30'</u>	<u>Yes</u>	<u>6,100</u>	<u>" Summit of " Hill</u>

Figure 1

FIREMAN'S HANDBOOK

34. 11d - Locating and Identifying Smokes

1. Looking for Smoke. Observations for smoke, can be best obtained from a combination of general and intensive methods.

General observations are an extensive survey of the entire country instead of an intensive look at any particular point. Knowledge of the country will enable a fireman to pick out instantly anything unusual.

General observations are made continuously during daylight hours in the following manner: make a systematic slow scanning of the entire seen area (figure 1); do not actually look on any particular point unless attracted by something unusual. Spend more time in scanning areas of high risks such as logging operations, camping areas, fishing streams, and well traveled roads, but do not overlook or skip areas of low risk or little use. Following lightning storms, thoroughly scan areas with strikes.

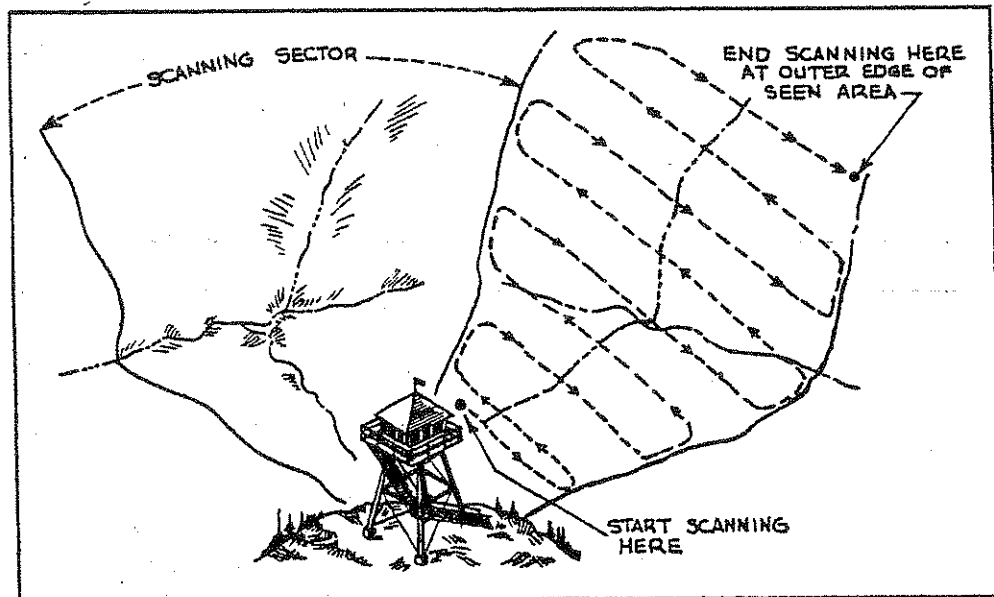


Figure 1. --Systematic method of searching for smoke.

Make intensive observations at 15-minute intervals during daylight hours in the following manner: divide the entire seen area into units or sectors with readily recognized boundaries. Use ridges and drainages as boundary markers or use the firefinder to form sectors of about 45 degrees (45°) each. These sectors must be small enough to allow thorough examination without too much shifting of the eye. Start the intensive search in the same place each time and progress

FIREMAN'S HANDBOOK

in a clockwise direction until all units have been examined. In each sector start by examining the country nearest, and progress outward to the limits of the seen area; make an intensive part-by-part examination of each sector. Focus your eyes on those particular points of high hazard, within the sector, which you have determined are areas of heavy use. Depending on size and character of seen area, an intensive check can be made effectively in from 4 to 6 minutes.

Colored glasses may be used to relieve eyestrain.

Good binoculars are an essential tool in making your observations. They will help identify small or difficult smokes, false smokes, and legitimate smokes. Excessive use of binoculars may result in eyestrain, so be careful.

Constant practice enables a lookout to make these general and intensive observations while performing his housekeeping duties, checking on a going fire, or in the presence of visitors.

A lookout must check with his dispatcher before leaving his station for even short periods of time.

2. Identifying Smokes. The lookouts ability to rapidly and properly identify smokes will aid the dispatcher in deciding the action to be taken.

There are three types of smokes to deal with--legitimate smokes, false smokes, and illegitimate smokes.

Whenever a lookout is in doubt about a smoke, he should report it at once to his dispatcher.

a. Legitimate smokes are authorized by law or permit, and are under control. They come from sources such as locomotives, sawmills, ranches, debris-burning, industrial operations, or campfires, and should be currently recorded on form "Orientation Point, Legitimate Smokes, and Key Points." This type of smoke has a definite pattern as to time of day it appears, volume and color of smoke, and length of time visible.

Any change from this pattern should be reported to the dispatcher on the chance the legitimate fire may have escaped control.

b. False smokes are anything that might be mistaken for smoke under certain light and weather conditions.

FIREMAN'S HANDBOOK

Common things reported as false smokes are distant rock slides, openings in timber or brush, small areas of dead timber, dust from vehicles or livestock, and fog or cloud puffs.

Permanently fixed false smokes, such as rock slides or dead timber, should be recorded on form "Orientation Point, Legitimate Smokes, and Key Points."

When in doubt about a possible false smoke, report it as a fire.

c. Illegitimate smokes are any smokes not authorized by law or permit, or any fires out of control.

Report all illegitimate smokes observed to the dispatcher at once.

3. Describing Smoke. The description of volume, character, and color of the smoke will be an indication to the dispatcher of size, intensity of fire, and of material burning.

a. Volume may be described in general terms as small--amount of smoke from average campfire; medium--amount of smoke from 10 campfires; and large--any smoke larger than above.

The fact that the volume is increasing or decreasing is most important.

b. Character may be described as thin--a smoke narrow in width and of light density; heavy--smoke of greater density; billowy--large volume of smoke rising vertically which may have a mushroom or thunderhead effect on top; drift--smoke that has followed air currents and gives a long strung-out effect; and blanket--layer of smoke over large area.

c. Color of smoke indicates the type of material burning, such as white smoke--generally grass, herbs; grey smoke--light brush, sage, buckwheat; black smoke--heavy brush, oak, manzanita, pitchy logs, sedgegrass; blue smoke--same as black smoke, less density; yellow smoke--generally pine trees, herbs; and coppery smoke--light brush, sage, buckwheat.

34.11e - Using Osborne Firefinder. The Osborne Firefinder is the basic tool for locating fires. The accuracy of reports of fires will depend on how well the instrument is adjusted and oriented. Knowledge of the various parts of the firefinder (figure 1) will enable the lookout to keep it in adjustment.

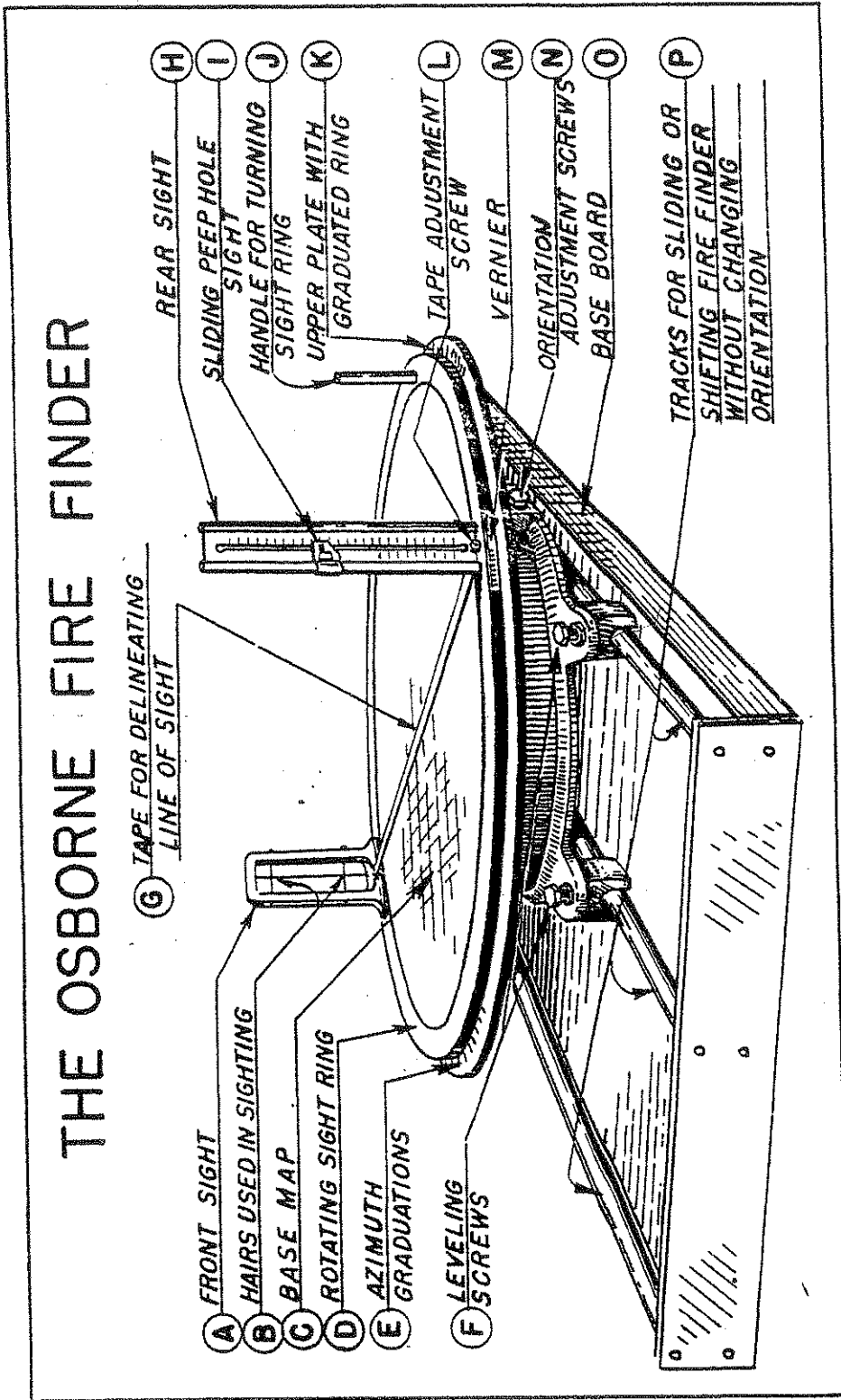


Figure 1.--The Osborne firefinder.

FIREMAN'S HANDBOOK

1. Adjusting and Orienting Firefinder

a. Leveling Firefinder. Each morning check to see that the firefinder is level (figure 2).

Place level tube on machined surface of graduated rim at about 45 degrees (45°) azimuth.

If the bubble in the level tube is not exactly centered, turn leveling screws until it is.

Then place the level on the graduated rim at approximately 135°, next at 225°, and last at 315°. If not level, adjust leveling screws at each setting.

To prevent errors in horizontal readings, keep guide lugs on the base of the firefinder below the center line of track to prevent sideplay. The slightest sideplay will make horizontal readings incorrect.

If the lookout has trouble leveling the finder in more than one position, he should contact the Ranger for proper instructions.

The firefinder must be level before any further adjustments can be made.

b. Checking Sights and Vertical Hair for Plumb. Firefinder has been leveled. Check vertical hair in front sight by following steps:

Hang weighted thread or string from nail inside window frame.

If vertical hair does not coincide with string, hair is not straight.

Adjustment: Loosen screw on sight fastening the horsehair; pull the horsehair tight; tighten the screw again; hair is then tight and straight. If it does not coincide with string, notify Ranger.

Replacing vertical hair: Have on hand extra supply of dark horsehair. (In emergency black thread or fine wire may be used temporarily.) Loosen both top and bottom screws holding hair; thread new hair through bottom holes in sight standard; wrap hair around bottom screw and tighten screw; thread hair through top hole; pull tight; wrap around top screw and tighten screw.

FIREMAN'S HANDBOOK

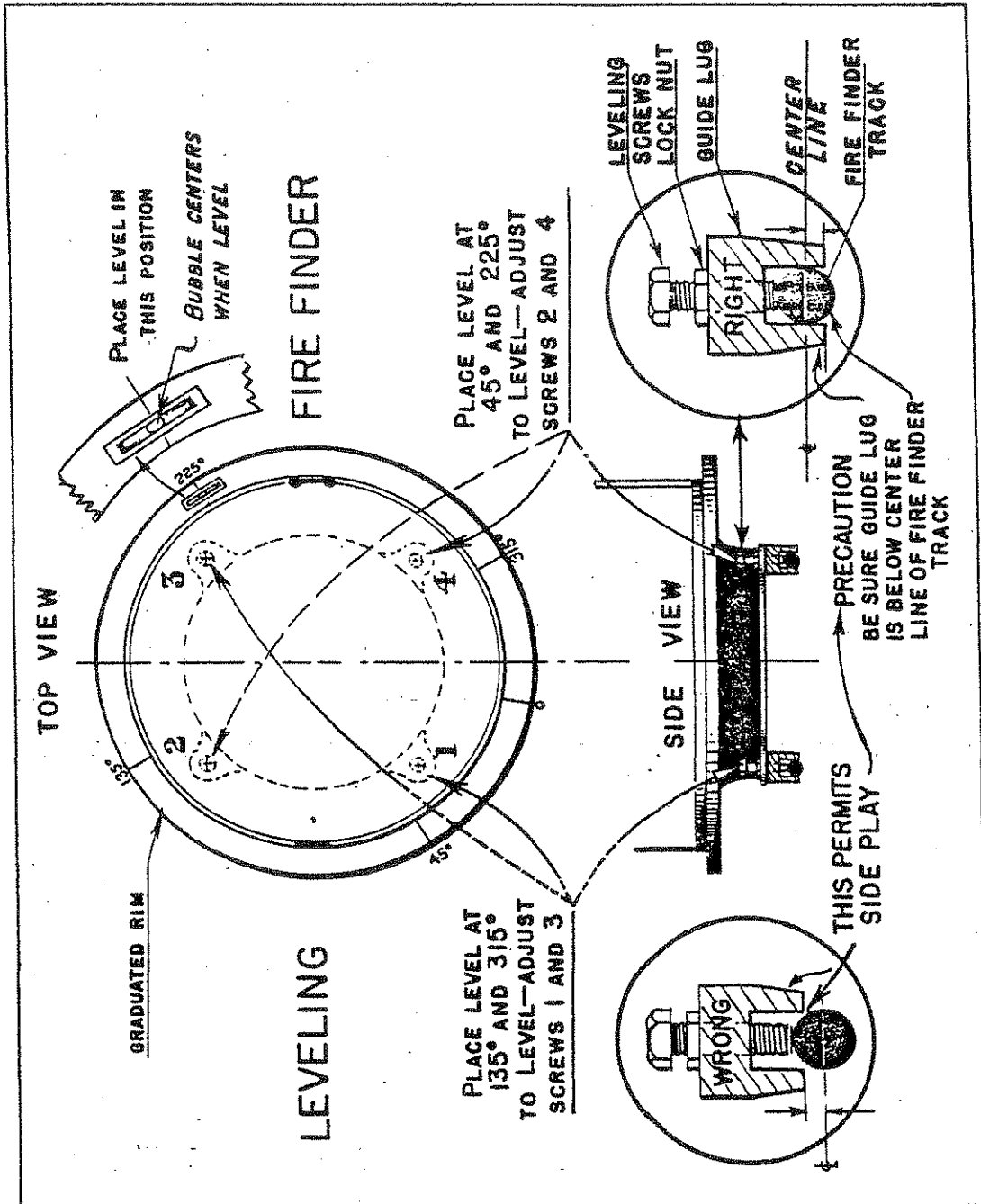


Figure 2. --Leveling the firefinder.

FIREMAN'S HANDBOOK

Checking rear sight slot to see if vertical: finder has been leveled; hair on front sight is plumb. Look through rear sight at small dot or point on the wall; raise eye slowly from bottom to top of slot. If dot is visible from bottom to top, rear sight is vertical. Report to Ranger if slot is not vertical.

c. Orienting Firefinder. This should be done daily. Firefinder has been leveled, cross hairs are plumb. A designated orientation point has been selected by the Ranger and the bearing recorded and posted in the lookout house. If this point does not check, the firefinder must be oriented in the following manner.

Loosen orientation adjustment screws below the upper plate of firefinder. See N, figure 1.

Set vernier at correct reading of orientation point.

Revolve, not the sights, but the entire plate of the instrument until sights are trained on orientation point.

Tighten screws below plate of finder.

Finder is then oriented.

d. Orienting Map Disk. This should be done daily. Finder has been leveled and oriented.

Set vernier at correct reading for designated orientation point selected by the Ranger. Locate this orientation point on your firefinder map. If the steel tape does not pass directly over the orientation point on the map, the disk is not oriented. Then follow these steps: loosen flat head screws around outer edge of map; revolve the map disk until the orientation point shown on the map lies directly under the steel tape; clamp disk in place by gently tightening the flathead screws being careful that the position of the disk is not disturbed in the process; repeat operation using a second and third orientation point to recheck. Notify the Ranger if the map cannot be oriented within 15' (minutes) on at least three orientation points.

e. Adjusting Distance Tape. Distance tape is suspended between front and rear sights by adjusting screws.

Adjust screws at either end of tape so that "O" point on the tape will be directly over the center pin. See tape G, figure 1.

Be careful--too much tension on the tape will spring the sight ring and cause it to turn hard.

FIREMAN'S HANDBOOK

2. Care of Firefinder (Figures 3 and 4)

a. Keep the firefinder clean. Use solvent if sticky or rusty and a powdered cleanser for general cleaning. Polish all brass parts.

b. The firefinder is not intended to be a table. Do not use it as a place to set cups, ashtrays, binoculars, clothing, or books. Use the shelves of the firefinder stand for storing items such as binoculars, instruction booklets, pencils, diary and log book, records, and first-aid kit. Keep the items on the shelves arranged neatly.

c. Keep a thin coat of light oil or graphite on tracks and sight ring to prevent wear and rust.

d. Map should be kept clean and in good condition. If a new map is needed, notify the Ranger.

e. Before closing the station, protect the finder as follows: clean thoroughly, coat all metal parts with mineral oil, release tension on cross hairs and distance tape; and remove map and store in dry place or send it to headquarters, as directed.

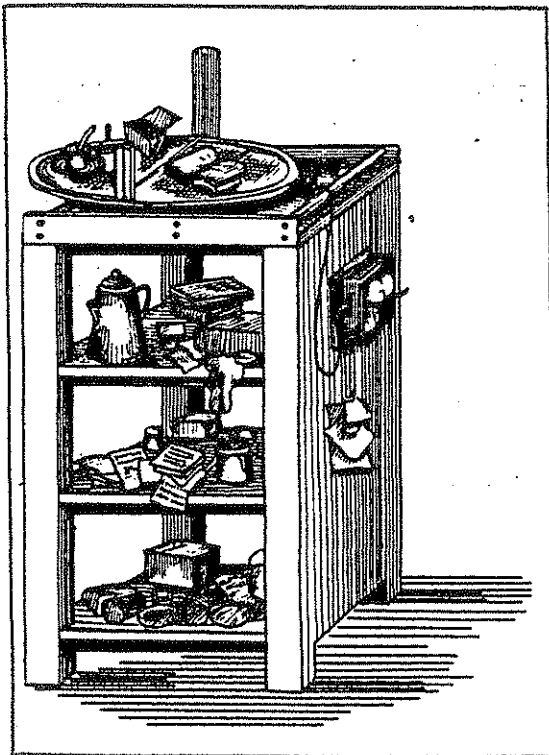


Figure 3. --Improper use.

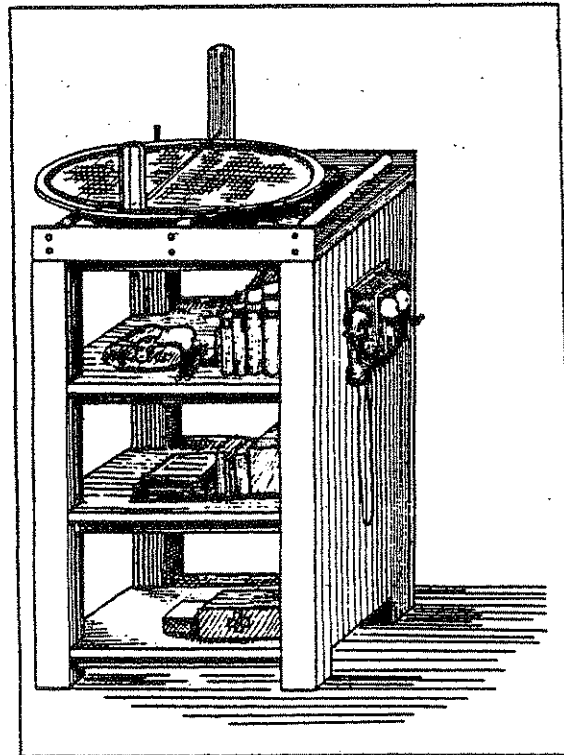


Figure 4. --Ready for use.

FIREMAN'S HANDBOOK

3. How To Use Osborne Firefinder. The Osborne firefinder measures angles to smokes in a manner similar to compass readings. These angles are known as horizontal angles and vertical angles. The horizontal angle is called the azimuth and is measured from the north in a clockwise direction. The azimuth circle is graduated into 360 degrees with true north indicated by 0. The horizontal angle, or azimuth, is more important than the vertical angle in cases where two or more lookouts see the fire. Vertical angle readings are helpful where only one lookout can see the fire. Azimuths are read from the graduated azimuth rim around the firefinder, and vertical angles are read from the scale on the rear sight.

The azimuth circle, or the rim around the outside of the finder plate, is marked with degrees and fractions of degrees, 0 (zero) on this rim, when the firefinder is properly oriented, is on the south side of the rim. This has been done for convenience in reading the azimuth. If the figures were placed in their true position, it would be necessary to go around the finder to the opposite side in order to take the reading, thereby consuming valuable time. Figure 1 pictures the Osborne firefinder, illustrating the different parts referred to in the following paragraphs.

The proper procedure in using the firefinder is as follows. When a fire is spotted, turn the sighting ring (D) by use of handle (J). The lookouts' eye should be within 2 inches of rear sight (H). Line up the vertical hair of front sight (A) and the slot in back sight (H) so that vertical hair appears in the center of the fire. Readings can now be made. (Slide firefinder on tracks or move to other set of tracks to give clear line of sight around obstructions such as corners of buildings, stovepipe, or window frame.)

a. How To Read Horizontal Angle or Azimuth. Proper azimuth readings are made as shown in figure 5. The vernier plate is attached to the movable sighting ring and is used to read the azimuth, not only in degrees, but in fractions of degrees. A degree is divided into smaller divisions known as minutes. There are 60 minutes in a degree. The symbol for degree is $^{\circ}$. Twenty-one degrees and 30 minutes is abbreviated 21° and $30'$. Look at the azimuth graduation in figure 5. Note that 0 rests between $21^{\circ} 30'$ and 22° . In order to find how many minutes past $21^{\circ} 30'$ the marker lies, look toward the left until a line on the vernier coinciding with a line on the azimuth graduation is seen. Note that the line on the vernier that does coincide with a line on azimuth graduation is 15. The vernier is graduated in minutes, so add 15 minutes to $21^{\circ} 30'$ to get $21^{\circ} 45'$.

Try for accuracy and speed in taking your "shots" as time is precious in fire control. By studying the country and using the orientation charts, a fireman should become proficient in the use of the firefinder.

FIREMAN'S HANDBOOK

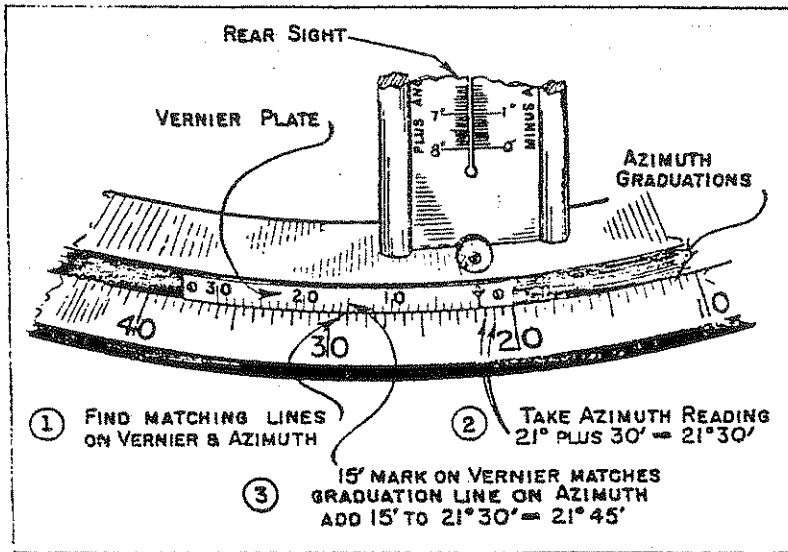


Figure 5. --Vernier plate on Osborne firefinder.

b. Obtaining Vertical Angle Reading. The vertical angle is measured by the sliding metal piece on the rear sight. Figure 6 shows a closeup of the rear sight mechanism. There are two sets of figures marked on this sight; one reads "Plus angle read from top hair" and the other reads "Minus angle read from bottom hair."

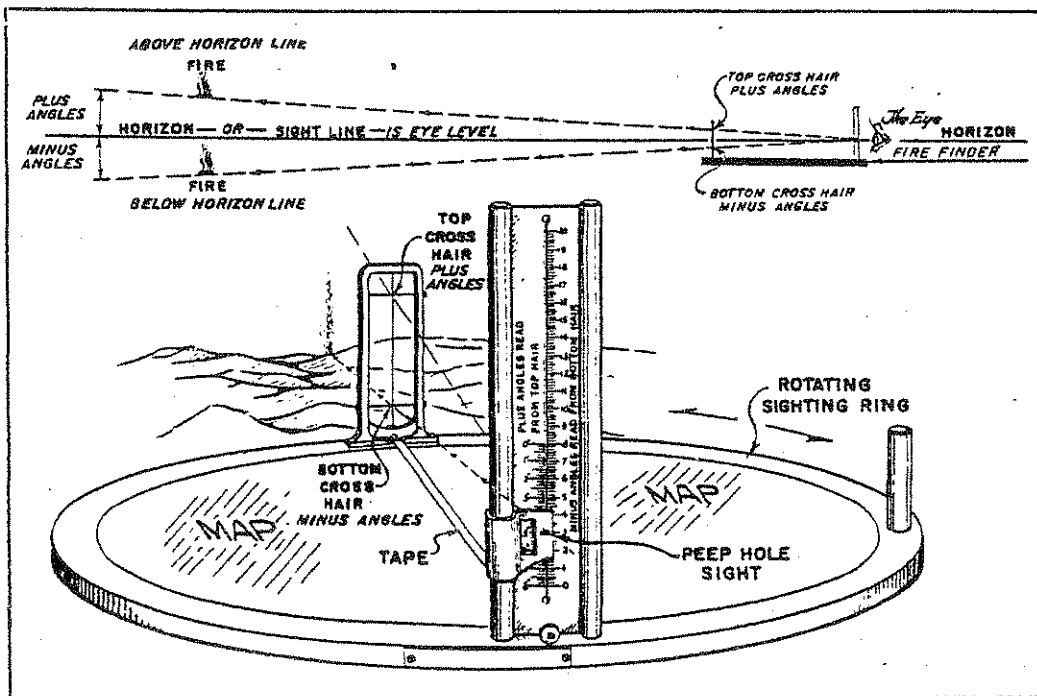


Figure 6. --How to read vertical angle.

FIREMAN'S HANDBOOK

Adjust the sliding peephole so that it rests on 0 at the bottom of the right hand or minus scale and look through the peephole. The bottom cross hair should appear in the center of the peephole. All objects sighted with the sight in this position are on the same level as the lookout point; subsequently, as the peephole is raised, other objects seen (using bottom cross hair) are below the elevation of the lookout.

To sight objects above the level of the lookout, the left hand or plus scale and top cross hair are used. Sighting through the peephole with the marker at the upper 0, one can see that objects seen through the top cross hair are also on a level with the lookout; but as the peephole slides downward, objects seen are above the lookout level.

The vertical reading pictured in figure 6 (using bottom hair scale) is -3° . Each mark between numerals is 10 minutes. The minus figure (-) indicates that origin of the fire is below the lookout level. Most of the readings will be a minus figure as fires generally start at the lower, more heavily used elevations below the lookout point.

c. Using Metal Tape. The metal tape stretched across the center of the map on the Osborne firefinder is used to estimate distance of a fire from the lookout point. The first mark near the center of the tape should be directly over the pin in the center of the map. The scale on the tape is in inches, thus on a 1/2-inch scale map a fire estimated to be 3 inches from the tower (on the map) would be 6 miles from the tower (on the ground). Sometimes it is very necessary that the distance to a fire be given to the dispatcher, as in the case where only one lookout man can see the fire.

d. Panoramic Photographs. The panoramic photograph is a valuable aid in locating, and describing the location of, fires. Each photograph carries a horizontal reference line corresponding to the elevation of the lookout station from which it was taken. It shows on the upper margin the azimuth angles corresponding to the azimuth circle on the firefinder at that station. A vertical angle scale is provided to define the line of sight and to read the vertical angle in reference to the horizontal line. The entire seen area of each station is covered by from 1 to 3 photographs. Each photograph should be neatly and accurately labeled with the names of all the principal topographic features, such as streams, drainages, peaks, and ridges.

FIREMAN'S HANDBOOK

e. How To Determine Size of Fire by Use of Firefinder.

A lookout can determine the approximate size of a large fire, if he can see both sides of it.

Take accurate azimuth reading to each edge of fire. Use vernier to give reading in minutes.

Subtract to find the azimuth difference between readings, and then convert the difference to minutes. (1 degree = 60 minutes.)

Multiply the number of minutes by 1-1/2, and the result by the number of miles from the lookout to the fire.

The final result will be the distance in feet, between the two edges of the fire at right angles to the line of sight.

Estimate the other dimension of the fire, and size can be computed. Another lookout may see the other dimension and be able to compute its width (figure 7).

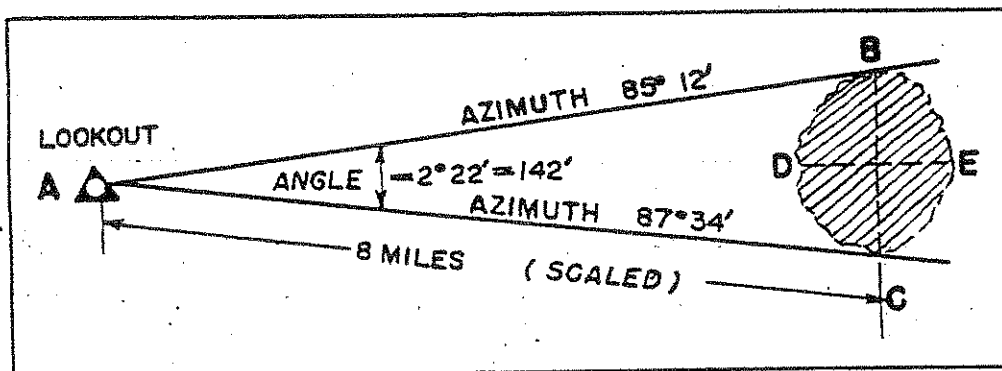


Figure 7. --How to determine size of fire.

A = Lookout station

AC = Azimuth reading, right edge of fire 87° 34'

AB = Azimuth reading, left edge of fire 85° 12'

Difference between azimuth readings $\frac{2^{\circ} 22'}{2^{\circ} 22'}$

2° 22' converted to minutes = 2° x 60 + 22' = 142'

AC = 8 miles (scaled by metal tape on map)

Apply rule: Number of minutes x 1-1/2 x number of miles

Insert values: 142' x 1-1/2 x 8 = 1,704 feet which is width of fire

Distance DE - estimated to be 800 feet

Area of fire = $\frac{1,700 \times 800}{43,560} = 31 + \text{acres}$

Note: 43,560 is the number of square feet in an acre.