PUBLISHED JAN. 1937

FIRE CONTROL NOTES

A PUBLICATION DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE - U. S. DEPARTMENT OF AGRICULTURE

FIRE CONTROL NOTES

Number Two of a Series of Publications Devoted to the
TECHNIQUE OF FIRE CONTROL

The value of these publications will be determined by what you and other readers contribute. Something in your fire control thinking or work would be interesting and helpful to others. Write it up and give other men some return for what they have given you.

Articles and notes are wanted on developments of any phase of Fire Research or Fire Control Management: theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, personnel management, training, fire fighting methods or reporting, and statistical systems. Whether an article is four lines or ten typewritten pages in length does not matter. The only requirement is that articles be interesting and worth while to a reasonable proportion of readers.

Address DIVISION OF FIRE CONTROL
FOREST SERVICE, WASHINGTON, D. C.

Published by
THE FOREST SERVICE — U. S. DEPARTMENT OF AGRICULTURE
JANUARY, 1937

CONTENTS

FIRE CONTROL NOTES

JANUARY, 1937

Forestry cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and technology may flow to and from every worker in the field of forest fire control.

SOME GENERAL PRINCIPLES OF RATING FIRE DANGER

H. T. GISBORNE

Senior Silviculturist, Northern Rocky Mountain Experiment Station

Many disasters have occurred because, with unaided judgment, fire control executives were unable to size up accurately the effect of a creeping increase in fire danger. Nothing can replace trained judgment in fire control management, but judgment needs every possible aid which can be provided. The author, a pioneer in the field of danger rating, outlines some principles which have been followed in developing the first adequate system for aiding judgment by measuring and integrating the elements of variable fire danger.

Although the measurement and rating of forest fire danger have been developed, tested, and found useful in Region 1 during the past few years, conditions in other parts of the country probably are such that different methods may be found preferable there. A few general principles, however, which have affected the results in Region 1 would seem to apply elsewhere.

Basic to fire danger rating is the recognition that fire danger as a whole is composed of two distinct parts: the relatively constant factors, and the decidedly variable or temporary factors. The constant factors include principally, slope, density, and character of cover type, exposure to prevailing winds, and the size, quantity, and arrangement of the fuels. These factors, together with the *normal* activity of the causative agencies, as illustrated by "spot maps," indicate the need for permanent fire control facilities and the strength of man-power that must be planned for use over a long period of years. These factors are relatively constant on any particular area. They differ from place to place.

The variable or temporary factors of fire danger include all those conditions which make one fire day or one fire season different from another in a particular ranger district, forest, or region. These factors differ from time to time. In Region 1 they include such conditions as the luxuriance and inflammability of green vegetation, the moisture content or inflamma-

bility of dead fuels, the wind velocity, occurrence of lightning storms, prevalence of debris disposal fires in and around the forest, the visibility distance, etc.

Efficient fire control at least cost obviously depends upon sizing up these constant and temporary danger factors, and building and operating a fire control organization accordingly. The progress of the past few years in sizing up these factors has been in recognizing the fact that each of them should be measured, instead of guessed at. The principal impediments to this progress have been the multiplicity and complexity of the factors, and the difficulty of measuring some of them.

The first principle of rating temporary fire danger is to identify all the significant variable factors. Identification can be readily commenced on the basis of the consensus of opinion of experienced men, because there are in every region a few outstanding factors. For many years attempts were made to find some *one* factor, but the present state of our knowledge shows that there are usually several. The first step is, therefore, to select those generally recognized by competent men.

One variable not yet included in the Region 1 method is the greater dryness and inflammability due to cumulative drought lasting over months and even several consecutive years. Its importance, during critical years at least, is recognized, but we do not yet know how to measure it.

After selecting the significant variables on the basis of experienced judgment by many men, there are two research tasks: first to check these factors by experiment and by test; second to devise methods of measuring each of them. As a rule, wholesale testing is dangerous during the developmental stage because uninterested and incompetent men will not make a fair test and will become prejudiced against the method if it seems to fail. Many years may then be required to overcome this initial prejudice even after a satisfactory method is devised. We are all "built that way," and we might profit by recognizing it. The development of methods of measuring each selected factor is a marked opportunity for all the ingenuity that can be brought to bear, and there is lots of ingenuity in the Forest Service.

The second principle of measuring fire danger, obviously, is to make these measurements represent the entire forest property. If the measurement stations are all located in the hottest, driest, windiest spots the results, when combined, will not represent the entire property. There again, it is necessary to consider another natural, human tendency, and that is the inclination to protect oneself. The Forest officer reveals this by trying to show high fire danger for his property, but he wants other Forest officers to be "fair and reasonable" by showing theirs correctly. The location of

fire danger measurement stations must be watched with this in mind. Periodic comparisons of data soon uncover the individuals who think that they benefit by measuring *only* their worst danger spots.

No guiding rules of how many stations per unit of area, or location of stations by altitude or timber type have yet been discovered in Region 1 to assist in the proper sampling of the forest property. Our policy has been to increase the number of stations slowly until the results indicate that commensurate, additional benefits are not obtained by adding more stations. A large field of work remains to be explored here.

The third principle of measuring and rating fire danger is that the net effect of the several significant variables must be determined by such a method that all men applying the method to certain data will arrive at the same answer. For example, if wind and fuel moisture alone are selected as the significant variables, and if wind is broken into five significant classes and fuel moisture into five stages then there will be 120 different combinations possible. If in addition there are three stages of vegetative readiness to burn, or resistance to being burned, there will be 720 combinations possible. Even if these 720 combinations actually produce only six or eight significantly different classes of fire danger the accurate integration of factors is too complex for the ordinary individual.

The integration of effects of the several factors must therefore be made by use of tables, charts, or mechanical devices such as the R-1 Danger Meter, if the measurements of the selected factors are to be used consistently by all men. Region 1 uses the danger meter device merely because it seems to be the most convenient and least bulky method. By making this device in pocket size its daily use for reference was encouraged.

The rating of fire danger produced by the integrating device must be in numerical terms if the ratings for days, seasons, districts, and forests are to be added and averaged. Terms such as "easy," "average," "bad," etc., cannot be so used. The range of the numerical scale does not seem to be important except that there is little use in defining 100 degrees or classes of fire danger, but there is a practical need of identifying each class which does or may require distinct administrative action. When the first fire danger meter was evolved, in 1931, seven classes of danger seemed like over-refinement. Today, the supervisors and rangers of Region 1 are distinguishing between a low, middle, and high class 4, class 5, and class 6, and they build up or decrease their forest protective organizations accordingly. Actually they are thereby recognizing from 13 to 15 classes of

danger, but the seven classes still serve adequately to differentiate the major organization steps specified by the fire plan.

As already indicated, the number of classes may well be suited to the number of steps the protective organization is likely to distinguish. Application of the danger rating scheme is thereby facilitated by specifying the size of organization force that is warranted for each class of danger. This can be done only tentatively, of course, until the scheme has been given careful field trial over a period of years.

One year of development, in the hands of a few of the most interested field men, and three additional years of gradually extended field trials were necessary in Region 1 before these methods were deemed sound enough to be made official practice. They have been in official use on the fire forests for two seasons. They are now being extended to the less critical forests.

Write It!—And write it plainly! Existing instructions set forth the importance of *written* messages in fire control work, but this is a matter which cannot be overemphasized. The memory of no man, no matter how trustworthy, is infallible. Add to that fact the drug of weariness, the imagination of excitement, and the sickness of heat exhaustion, and it can readily be appreciated why verbal messages should be avoided like the plague.

The written signed message establishes beyond doubt the author thereof, the responsibility of the man on the receiving end, and insures the content against the least change.

It is also very desirable to make a message complete. When sending for reinforcements give best estimate of the size of the job as well as the number of men desired. A truck driver or other messenger is likely to bring in a wild story of "the whole country's afire" with a message reading: "Send ten men—Jones." The question immediately arises as to whether Jones actually knows how big a job is in front of him. A better message would be: "Dispatcher. Fire north end Bell Mountain, approximately 40 acres, spreading slowly. Send ten men reinforcement crew and will be able to corral fire an hour after their arrival.—Jones." Think how a message like that would warm the cockles of a harassed ranger's heart! So let's write it, boys, and write it plain.—*Harley H. Thomas, Forest Ranger, Clark National Forest.*

WHAT RATED FIRE DANGER MEANS IN REGION 1

C. S. CROCKER

Fire Inspector, Region 1

When fire control management declines to accept the results of fire research there is room for debate as to who is wrong—management or research. But when management seizes upon and applies the results of research, the first and hardest test has been met. What management thinks about Gisborne's danger meter is expressed by the author in no uncertain terms.

"Feeling it in your bones" has long ago passed out of use as an adequate means of rating fire danger. Whether Kapoks and limousines have exterminated the rheumatic germ which made possible this lost art is not known nor is it worth our while to attempt a rejuvenation of this antiquated technique.

Time and fire control have marched on—the former in orderly uniformity, the latter in more or less sporadic spurts of progress accomplished through maneuvers founded too often upon guesses. Reversals, too, have been experienced to the extent that our record indicates a deficiency in the element of lucky guesses and hunches. Recognizing the fallacy in continuance of such a practice, fire control managers cast about for a new means of determining fire dangers by which the guessing element would be reduced to a minimum. Success of the many developments pointed toward this objective has been hindered by the reluctance of men to substitute the mechanical for the human element in calculation of dangers.

In the past, our calculations have been based upon current observation and past experience. Too often we did not see alike, and our experiences have varied accordingly. Consequently, our predictions, in many instances, have been influenced by experiences peculiar to individual rather than common factors. We all have some scheme for rating danger. In any group of a dozen men there are at least half as many methods of gauging fire potentialities and a like number of ideas concerning the organization requirements of any particular condition. How can we, as a whole, attain any uniform degree of success when the pessimistic manager overequips while the optimistic manager gets caught unprepared? How can the budget committee equitably allot funds for fire control when it has no uniform rating of dangers existent on individual administrative units?

How can we as guardians of the forest excuse vast suppression expenses

and staggering timber losses attributable to lack of preparedness when we have within our reach means of measuring potential and current dangers? The common "alibi" has been "emergency conditions." Is there such a thing? Except for an unpredicted deluge of lightning fires, there should be no such term as "emergency" in the fire vocabulary. All factors affecting fire behavior, except occurrence, are to a large extent measurable and predictable sufficiently in advance of critical conditions to permit adequate adjustment of protection facilities. We do adjust them, but not consistently with any carefully laid, mechanically gauged, uniform plan. The element of personal judgment carries too much weight in these decisions. After all, what is an "emergency fire condition"? Nine times in ten it is merely the prevalence of high inflammability of fuels and a high probability of occurrence—both measurable and usually predictable. If this is true, then emergency conditions are nothing more than the higher brackets of known danger conditions.

Why not select a few measurable factors having greatest influence on fire danger, assign definite weights to each and combine the coordinated total in a graduated scale of relative classes? These danger classes could then be interpreted in terms of preparedness needs and strength of force requirements. Plans would then specify a prescribed control objective and would provide adequate facilities to meet each class of rated danger.

It is realized that many factors other than inflammability of fuels and likelihood of fire occurrence play an important part in fire control planning. Values at stake, accessibility, character of fuel bodies, topography, and many other components less tangible all deserve consideration in setting up protection facilities. However, these are factors of fairly constant value or risk, and may be assigned weights of reasonably permanent nature in fire plans. These constants designate the intensity of organization, and the location and character of facilities and value to be insured through protection.

Other factors, variable in character, such as dryness of fuels, winds, likelihood of fire occurrence and other elements affecting spread of fire, will determine the time of placing in operation the facilities prescribed by the "constants."

Service-wide use of such a coordinated scheme would bring about uniform treatment of like conditions. Region 1, during the past two years, has

used this method in correlating man-power placement with measured fire danger. It has gone far in leveling off inconsistencies in preparedness expense and has brought about a more uniform and sane treatment of what was formerly termed "emergencies."

Why is some similar practice not feasible on a Service-wide basis?

Assume that we continue to disregard values of destructible resources, and lay our plans to corral every fire within the first work period—we should need as gauges upon which to determine preparedness only those factors governing the spread of fire, difficulty of control, and some measure of the probability of occurrence. These are grouped as follows:

I. Constants: (Determining place and kind of facilities)
   1. *Fuel inventories*
      a. Rate of spread
      b. Resistance to control
      c. Volume or amount
   2. Topography as it affects fire control
      a. Maps
   3. Accessibility as it affects mobilization of forces

II. Variables: (Dictating time and degree of preparedness)
   1. Fuel inflammability
   2. Probability of occurrence
   3. Wind
   4. Visibility as it affects detection
   5. Humidity
   6. Seasonal influence—(long or short burning periods)
   7. Predicted or existing fire-starting agencies

The last group of factors, as used in Gisborne's Danger Meter, are correlated in a manner to show the variation in spread of fire which results from any combination of these elements. Relative danger, as affected by fluctuation of visibility and occurrence conditions, is also incorporated in this rating.

The Gisborne Meter provides for seven classes of fire danger, and while these classes are not graduated in equal sevenths of the worst known condition, each is interpreted in terms of man-power needs and serves as an index for organization placement. Region 1 uses this rating scale as follows:

(All ratings assumed to be within fire season.)

DANGER CLASS	ANTICIPATED FIRE BEHAVIOR	ORGANIZATION NEEDS
No. 1	Brush and other fires do not spread enough to require trenching.	No men specially detailed to fire control.
No. 2	No spread under dense timber or on north slopes. Fires spread during heat of day on south slopes and open areas.	Man special danger areas as slash operations, etc.
No. 3	Fires spread slowly and hold overnight on north slopes and under dense timber—short runs in open and slash. Few crowns except with winds of 24 or more M.P.H.	Man key detection positions —usually about 1/5 average normal midseason force.
No. 4	Fires crown in single trees and small groups but no long runs in full timber on north slopes. Few crowns on south slopes and flats with winds of 18-24 M.P.H.	Complete full average or normal season planned organization.
No. 5	Occasional runs in full timber on north slopes but seldom crowning pronounced topographic divides. Fast spread certain on south slopes, cut-over, and heavily fueled old burns.	Complete manning of one-man protection positions. Place double-up men on key positions. (This formerly was "first emergency" force and equals one-half of the overload fireman organization.)
No. 6	Big runs common all exposures within a single drainage, but only occasional crossing of pronounced topographic barriers (previously known as "second call emergency").	After four consecutive days complete placing all smokechaser crews and others planned for "initial" attack.
No. 7	Worst known burning conditions. Explosive fuels—fires spread at 1500-2000 acres per hour, including densely timbered north slopes during afternoon and evening. Topographic and other usual barriers, such as rivers and large cultivated fields, ineffectual during peak of day.	Mobilize supplemental overhead. Organize reinforcements or second line of defense crews. Place in effect the maximum planned protection strength.

The use of this scheme has made possible a uniformity in strength of manning which eliminates much of the erratic organization practice of the past. Why can it not be adjusted to fit the needs of all fire Regions and thus provide a uniform basis for planning, organization, treatment of similar conditions, and perhaps for the allotment of protection funds?

Under this plan there is no "emergency condition." The top brackets of fire danger are merely recognized and planned for, and no longer are considered outside the range of probable occurrence. Such conditions are identified through mechanical measurements, are graduated on a mathematical scale, and are classified according to severity in scales which are interpreted in protection needs. Guessing and "feeling it in your bones" are reduced to the minimum. Should it be so?

TWO WAYS TO IMPROVE DETECTION

I. M. VARNER

Administrative Assistant, Boise National Forest

How much lost area is due to slow detection? We probably will never know. But when, as we do know, cold analysis credits primary lookouts with a very bad score in "first discoveries," it seems we should do something drastic to improve their batting average. The method presented in this article, supplemented by the systematic patrol detection in blind areas, should shorten discovery time appreciably.

Study of past fires on five Idaho forests, Region 4, shows:

(1) The primary lookouts have made first discovery of an average of 30 per cent of the total number of fires.

(2) Some fires have been class "B" when discovered.

(3) The size of fires upon arrival of first line of defense too often ranges from large class "A" to small class "C."

(4) Discovery time is greater than it should be in seen area.

(5) Fires which have long discovery time often develop into class "B" and class "C."

(6) Observation by lookout has not been systematically done.

(7) High hazard and fire danger areas do not obtain sufficient searching observation by lookouts to insure discovery of fires at the earliest time sufficient volume of smoke makes discovery possible.

With the objective of obtaining better and more certain detection by lookouts of fires when they are small, reduction in discovery and elapsed time, increase in the percentage of first discoveries by lookouts, decrease in size of fires upon arrival of first man, and reduction in burned area by accomplishing suppression while fires are small, a plan was devised and used on the Boise National Forest during 1936, designated as the "Synchronized Sector Observation Plan for Lookouts."

Synchronized Sector Observation Plan

In an effort to obtain better detection, especially of small fires soon after they start, the following plan has been designed to obtain more systematic detection, eliminate factors of uncertainty and increase the individual and combined effectiveness of the lookouts:

1. The area from each lookout is divided into five sectors to be allotted an equal time for searching observation.

2. Each lookout's sectors are numbered in rotation to agree with the sequence of observation.

3. All lookouts' sector observation rotations are synchronized so that

each area is under observation from some lookout at least twice during the rotation period.

4. An observation record will be kept by each lookout when sector observation is effective.

5. The sector schedule can be used by the dispatcher once each hour, or when deemed necessary.

6. The sector observation period can be any length of time desired—3, 4, 5, 6 minutes, etc.

7. When sector rotation is not effective the lookout will follow the old method of observation.

8. Sector schedule can be arranged by groups of lookouts for midday meal period so that observation is had, one group to have meals at 12:00 sharp, one at 12:30, and one at 1:00 p. m., or whatever schedule seems best.

9. The sector method will call for a searching study of the sector concerned to insure detection of small smokes, difficult to detect by casual observation.

10. This system will insure that all seen area will be covered by searching observation during the rotation period.

11. The rotation schedule is arranged so that the high hazard and danger areas obtain more frequent observation than areas of lesser degree of hazard or danger.

12. It is a systematic method of observation and an effective tool for the dispatcher, a means of giving limited and definite responsibility to each lookout. It provides a means of checking upon the ability, diligence, and effectiveness of each lookout.

Prior to the beginning of the fire season a map was prepared upon which the sectors for each lookout were laid out, numbered one to five to agree with the sequence of rotation desired for each lookout, and the visibility map on the fire finder of each lookout was marked with the sectors and their designated numbers to agree with the master map.

All lookouts' sector observation rotations were synchronized so that a maximum concentration of observation was had on all high fire danger and high hazard areas.

Each lookout was required to keep a record showing the exact time observation started and ended in each sector, recording by azimuth readings all smokes, dust clouds, fog banks, etc., observed in each sector.

Because of the fact that 1936 was the second most severe lightning fire season of record on the forest, it was considered necessary to have lookouts concentrate on areas in the path of the storms for periods of several hours to several days in order to detect fires where strikes were known to have occurred and where holdover fires were probable because of heavy local rains. For this reason, and because the plan was experimental, it was used to a limited degree.

The schedule for sector observation was one complete rotation by each lookout from 9:00 to 9:20 a. m., 11:00 to 11:20 a. m., 1:00 to 1:20 p. m., 3:00 to 3:20 p. m., 5:00 to 5:20 p. m., and 7:00 to 7:20 p. m. This schedule gave synchronized sector observation for 16⅔ per cent of the daily observation period.

Under the schedule a four-minute period of searching observation was required of each lookout for each sector; thus at 9:00 a. m. each lookout started a searching observation in his sector number 1, at 9:04 a. m. he moved to sector 2, leaving it at 9:08 a. m., and so on through the five sectors completing the rotation. Between sector observation periods the lookout was free to follow the standard observation practice of completing the search of his territory once each 15 minutes.

Considerable experimenting was done relative to the most desirable length of sector observation period, using 2, 3, 4, and 5 minutes each period for each 72° sector. The four-minute period was finally decided upon as giving the best results.

As a means of enforcing the rigid use of the sector plan by each lookout and as a check on effectiveness, smoke candles were used. These tests showed that 95 per cent of the test smokes were discovered by the lookouts within the four minutes allocated for the sector in which the smoke was placed and by the lookout in whose sector the smoke was started, under fair visibility conditions up to a distance of nine miles.

The plan was placed in actual use on the forest as a whole on July 17 and continued to October 7, 1936.

The first discovery by lookouts for the period was 47 fires. Twelve of these were discovered under synchronized sector observation, which amounts to 25 per cent of first discoveries being made while lookouts were making observations under the sector plan which was in operation 16⅔ per cent of the daily observation period.

The discovery of 16⅔ per cent of the fires under this plan would have indicated only normal detection and the record of 25 per cent first discoveries shows an increase of 8 per cent above the normal, indicating that

the sector plan of observation produced substantial results.

The use of the sector plan had a very marked influence upon the efficiency of the individual lookouts. The psychological effect was to create a more definite feeling of responsibility; to accomplish detection of fires at the earliest moment the smoke became visible; to make a thorough and systematic search throughout the daylight hours. Many of the lookouts voluntarily followed the sector observation scheme during most of each day when not required to do so, and all of them expressed approval of the plan as the most effective method used up to this time, recommending that the plan be used throughout the entire daily period of observation next season.

A study of the forest detection record for lookouts for the period 1922 to 1935 inclusive shows an average first discovery by lookouts of 43 per cent of all reportable fires.

The 1936 record was 49 per cent of discoveries by lookouts. This is an increase of 6 per cent, and when consideration is given to the size of fires upon arrival of the first man, which was 18 acres for the total 130 fires. and the final area, which was 24½ acres, the detection record is remarkably good.

There have been 117 class "A" and 13 class "B" fires on the forest so far this year—75 were lightning fires and 55 man-caused fires.

In connection with detection studies this year it was found that many small class "A" fires did not produce smoke in volume equal to that of a forestry smoke pot for several hours after the fire had started, and that the lookouts discovered nearly all fires as soon as the volume of smoke made it possible for them to be seen. It seems that we must take the size of fires upon discovery, and more especially upon arrival of the first man, as one of the measures of the efficiency of lookouts, as well as the discovery time based upon time of start, which is usually a guess.

The discovery of man-caused fires by lookouts has been very low over a period of years, and the increased efficiency in detection of this class of fires is very desirable. The lookouts on the Boise Forest averaged 22 per cent first discoveries of man-caused fires for the period 1922 to 1935 inclusive.

The 1936 record shows 31 per cent first discoveries, an increase of 9 per cent, which is a substantial improvement.

Experiments in the use of the sector observation plan this year showed that it should be more flexible to changes caused by the addition or removal

of lookouts, and a master control map was prepared for use by the dispatcher. This map was made by placing a small shaft through the map backing, which was one-half-inch cellotex backed with one-inch lumber, at the central point in the protractor for each lookout. On the face of the map a two-inch arrow was fastened to the shaft, and on the back each shaft was fitted with a one-and-one-fourth-inch pulley. A single control was then placed in one corner of the map by having a shaft through the map and its back board with a one-and-one-fourth-inch pulley on the back end of the shaft and an arrow and control knob on the front end of the shaft, which centered through a protractor secured to the face of the map.

All protractors, including the control protractor, were then marked off in five 72° sectors with numbers 1 to 5 on the sectors of the control protractor.

A small endless belt was then placed over the pulleys so that when the control arrow was rotated each of the arrows of the lookouts rotated with it. Arrows are removed from lookouts not occupied from day to day so that the map represents the actual detection setup existing at the moment.

By moving the control arrow to any sector the arrows of all lookouts move into corresponding sectors.

This device makes it possible to study detection in detail each day and to synchronize the rotation of the lookouts and the order in which each sector for each lookout is to receive observation. This control map shows at a glance the sectors and area under observation by each lookout individually and all lookouts in combination for each sector observation period.

The results produced this past season showed sufficient benefits in favor of the use of the Synchronized Sector Observation Plan to justify putting it into full use, which it is planned to do for the 1937 fire season.

Detection-Patrol Plan

The lookout system, at least as far as the Boise National Forest is concerned, does not provide adequate detection for the blind areas, where our greatest man-caused fire danger exists, and which, as a rule, are traversed by roads or trails.

Studies of the visibility map for the forest showed that 40 per cent of the forest is blind to the regular lookouts, and that 65 per cent of this area is in the deep canyon troughs traversed by roads or trails and is high hazard country. We set up a study to determine the additional lookouts needed to cover these areas and found the cost would be prohibitive under present conditions. As a result of this study we formulated the Detection-

Patrol Plan, which was outlined as follows:

1. For blind areas, such as the deep troughs of the Boise and Payette Rivers, detection in addition to that provided by the regular lookouts is necessary.

To accomplish this the emergency guard placement plan will provide for placement of men to serve as detection-patrol, setting up a definite patrol route, and selecting definite observation positions on and along this route from which the patrolman will make observations on a definite time schedule. This system will insure that the patrolman is actually making his assigned patrol and observations.

Each observation point will be equipped with a telephone line drop for connecting a field phone, or in case the route is not served by a telephone line, a radio antenna will be set up. Each patrolman will be equipped with either a field phone or portable radio set, or both, in accordance with the demands of his patrol route, so that he can be in scheduled contact with the dispatcher or ranger while on patrol.

2. Some of these observation points will be equipped with a fire finder and will be tied in with the lookout system to facilitate location of fire.

3. This plan will give detection in the blind areas once or twice each day, or whatever number of observations are considered necessary.

The detection-patrolman will contact the public along his travel route, give the required detection service, and be tied in with the control organization by communication so that he will be a mobile unit for first line of defense in fire suppression.

It is contemplated that this method will give maximum service, as contrasted with the use of additional emergency lookouts to provide detection in blind areas.

4. The maximum number of detection-patrolmen necessary for the critical period of a critical fire season has been set at 22 for the forest proper and 5 for the Southern Idaho Timber Protective Association area.

5. The number of detection-patrolmen to be placed, the routes to which they will be assigned, and the time of placement will be decided by the supervisor.

6. Each ranger will construct telephone line drops and install radio antennae at each observation point on each patrol route set up for his district, as called for in the graphic plan. This will be done prior to the date the route or routes are to be occupied.

7. The dispatcher and rangers will set up a patrol schedule, giving the time each patrol starts and ends each day, the time the patrolman will check in from each observation point, and the time check-in will be made from other stations or locations along the route.

8. The dispatcher will keep available for ready use a map showing all of the detection-patrol routes and points for observation, indicating whether they are equipped with telephone drop or radio antennae, and the headquarters station of each patrolman.

Each ranger will be supplied with a map showing the information for his district.

In developing this plan a fire occurrence map tracing was placed over a visibility map for the forest and the fires spotted on the visibility map on all of the blind areas. On this combination fire occurrence and visibility map sufficient lookout points were designated and marked to cover the blind areas. This latter job required a visibility survey.

After locating these points close to the travel routes, patrol routes were laid out and marked with a heavy line in a separate color for each route. The observation points were then given a symbol indicating the means of communication from the position. These symbols were made in the same color as the patrol route designation. With this done, the seen area from the selected observation points was colored the same as the patrol route, and last the headquarters symbol in the same color was placed on the map for each patrol route. This procedure was followed for all blind areas, resulting in a graphic plan which showed patrol routes, headquarters for patrolmen, observation points, seen area, and means of communication for each observation point, headquarters, and check station.

The completed plan provided detection for 70 per cent of the area blind to lookouts.

During 1936, which was a normal fire year, only nine of the detection-patrol routes were regularly used, and six of these were manned by regular guards. During critical weekend periods, when exceptionally heavy travel entered the forest, and during severe lightning storm periods other designated detection-patrol routes were manned by guards, rangers, and CCC foremen, to provide the additional detection and public contacts deemed necessary.

These detection-patrols made first discovery of 14 man-caused fires and 12 lightning fires during 1936, which amounted to 23 per cent of the total number of fires occurring during the period for which they were in service.

All except three of these 26 fires were in country which was blind to the regular lookouts.

The men on these patrols went to and completed suppression of 25 of 26 fires; 25 of these fires were class "A" and one class "B."

The total acreage of the 26 fires upon arrival of the first man was .77 of an acre and the final area was 1.1 acres.

The patrolmen apprehended three parties responsible for starting three of the man-caused fires, and three convictions were secured.

The detection-patrol was instrumental in preventing the occurrence of class "B" and possibly some class "C" fires from developing in some of these blind areas, and it proved beyond any doubt that the added detection could be obtained without the expenditure of funds out of proportion to the benefits derived. In fact, the application of both these methods involves no additional expenditure on the average fire forest.

The combination of the "Synchronized Sector Observation Plan for Lookouts" and "Detection-Patrol Plan" used this season, although to a limited degree, was a major factor in producing this year better accomplishment in detection and acreage burned than in any other year of record.

The One-Lick Method—We had occasion to try the one-lick method on the Bob Mt. State fire, November 27. At 11 a. m., 75 men arrived at the fire. A 35-mile-an-hour east wind was accompanied by low humidity. Some little time was taken in looking over the ground and deciding just what to do. Location of a trench to cut off a ¾-mile sector was finally decided upon and 75 men placed on the line with instructions to use the one-lick method. In just 55 minutes after starting, a line was constructed frm which we backfired successfully and held the fire. The line was through an old burn and logged-off area; no logs or snags were cut; speed of construction—72 feet per minute. All men were used on patrol during period of backfiring. More power to the one-lick method in country where it is practicable.—*C. F. Ritter, Superintendent of Construction, Columbia National Forest.*

POSSIBILITIES IN PERISCOPIC DETECTION

I. M. VARNER
Administrative Assistant, Boise National Forest
GEO. L. NICHOLS
Architectural Engineer, Region 4.

Experiments such as that described in this article may, in time to come, bring great changes in accepted fire discovery methods. The instrument used in these tests is expensive beyond reason, but no doubt ingenious re-design will reduce this materially. The main point is that for some reason, involved in the science of optics, haze and smoke are penetrated to a degree not achieved by direct vision.

In a study of past fire records evidence points to the fact that regular lookouts with present or existing equipment are not discovering more than about 30 per cent of the fires in Region 4. This is clearly evident from the tabulation that follows.

FIRE DETECTION RECORD
1931 - 1935

	Primary Lookouts	Lookout Firemen	Patrolmen	Other Forest Officers	Total Number Fires
Boise	180	5	51	69	427
Challis	*	*	*	*	*
Idaho	85	68	3	53	303
Payette	116	42	22	62	313
Salmon	25	186	10	34	342
Sawtooth	34	19	23	19	157
Weiser	79	25	24	34	216
TOTALS	519	345	133	271	1,758

*Figures not available in Regional Office.

In an effort to obtain better detection, especially of small fires soon after they start, a plan has been devised and designed to obtain more systematic action, eliminate factors of uncertainty, and increase the individual and combined effectiveness of the lookouts.

The plan devised included a synchronized Sector Observation Plan. Even with present equipment we are getting valuable improvement in the detection of fires on the Boise National Forest, where the plan has been under trial.

Periscopic Detection was thought of first in a detection experiment conducted on the Boise Forest during 1923 and 1924. In this experiment, heliograph mirrors were used to reflect the impression of a sector from Trinity Lookout. The two mirrors were used in a sort of periscopical arrangement.

It was found that a sector of country could be reflected to a mirror and

that the country could be studied very much in detail without the eyestrain experienced by looking at the country direct. This method permitted an opportunity to study the reflected sector under the best of light conditions. Contrasts under varying light conditions brought out sharper contrasts or definition than could be seen by the naked eye or with field glasses. Tests on fog rising after a rain storm indicated that fog could be detected clearly on the mirror. Smoke could be detected from a class "A" fire four miles from the lookout, the smoke appearing as a sharp image in the second mirror.

It was determined that a reflected image could be secured by protecting the mirrors from direct sun rays of sectors toward the sun during early morning and late evening and the reflected image was much clearer than direct observations. Direct observation with regular means of observation under haze conditions in such sectors during these periods of the day was almost impossible, but the reflections in the mirrors were fairly sharp.

From these early tests the possibilities of improved detection equipment were obvious, as follows:

1. Elimination of eyestrain in detection of smoke.
2. Concentration of observation on a definite sector.
3. Elimination by filters of haze and unfavorable light conditions.

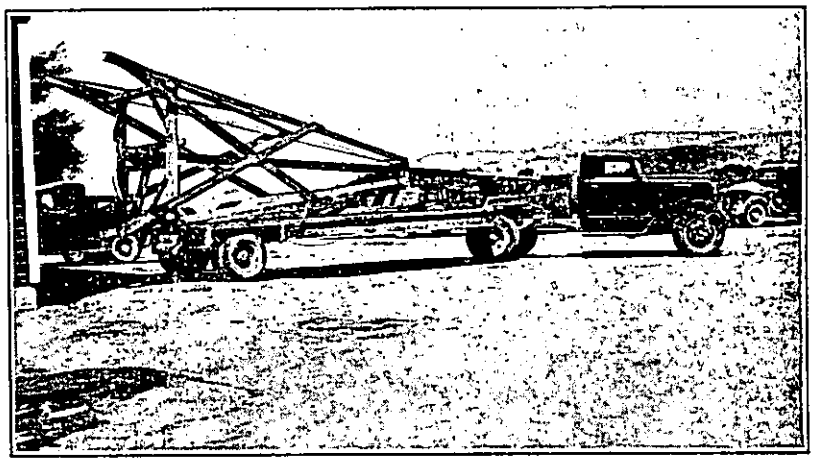
The mirrors of a heliograph, of course, are very cumbersome to handle and offered little except to point the way toward possible improvements in detection. It is our belief that detection has made less advance than any other phase of fire control and that our lookout system has failed to detect fires soon enough after the start; that small smokes, difficult to detect, are not being seen by our lookouts, and some better means for observing these small smokes is very necessary.

The periscope suggested itself as an instrument that might aid in obtaining better detection by concentrating the observer's study to a high degree on a definite sector at a time and allowing a progressive movement of the instrument in scanning one sector after another. The periscope also suggests itself as a means of providing mechanical benefits to aid the human eye.

Continuous efforts were made to secure a loan of a periscope from the Army and Navy, but it was not until August 28, 1936, that a loan was finally perfected, for which we are indebted to Mr. Haynie of the Supply

Depot at Government Island and the Commandant of the U. S. Navy Yard, Mare Island, California.

The periscope arrived in Boise early in September, and, due to its enormous size and weight, a special tower for its use had to be designed and built. Following this the periscope was placed or mounted in the tower and transported from the City of Boise to Shafer Butte (elevation 7591 feet) on the Boise National Forest.



Periscope mounted in tower and loaded on truck for transportation to Shafer Butte for test in fire detection.

EXPERIMENTS AND STUDIES FROM SHAFER BUTTE

On September 22 the periscope had been set up on Shafer Butte and tests were started, using the equipment in fire detection. The periscope was manned by I. M. Varner, Administrative Assistant of the Boise National Forest and originator of the periscopic idea; Geo. L. Nichols, Architectural Engineer of Region 4, responsible for Region 4 fire equipment assignments; J. W. Kimball, regular lookout of Shafer Butte, and Ranger Walter T. Berry, during the tests made September 22 and 23.

The fire tests were directed by Fire Dispatcher Show and Ranger Berry.

Equipment Used in Tests

Tests on Shafer Butte were handled by both the periscope set-up and regular lookout equipment. Shifts were worked so that all equipment was continuously manned during the daylight period.

SPECIFICATION DATA FROM U. S. NAVY PERISCOPE USED:

Submarine Periscope B.U.C. & R. Registry No. 433.

B.U.C. & R. Des. No. 40KA-27
Eye Piece Type A-1

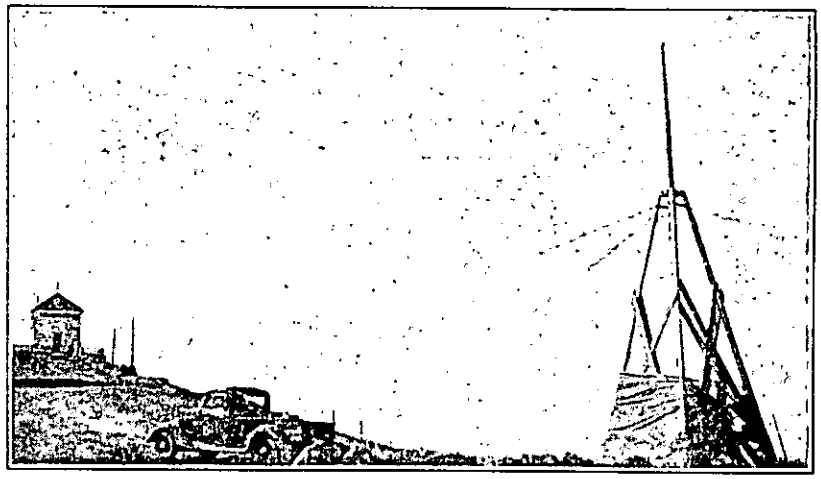
	H.P.	L.P.
Magnifications	6.1	1.5
Field Degrees	8°	32°
LIGHT TRANSMISSION		
Exit Pupil—D15	5.1MM	5.1MM
Eye Distance	25MM	25MM
Telemeter	15′	1°
Min. Div.	15′	1°
Center of Field	Elev. 20°	
	Dep. 10°	

Kollmorgen Optical Corporation, Brooklyn, New York.

Shafer Butte Lookout was also manned. Regular equipment included a 13 Power Navy Telescope and a Marine Binocular.

Bald Mountain Lookout, approximately 17 miles away, was also manned and observing during the tests. It was equipped with Bosch & Lomb 8 Power glasses.

Holly Mountain Lookout—regularly equipped, was also manned.



Shafer Butte Lookout and
Periscope Set-up

Communication Facilities

Shafer Butte periscope set-up included Forest Service portable radio.
Shafer Butte Lookout (Regular)—Telephone.
Bald Mountain Lookout—Telephone.
Holly Mountain Lookout—Telephone.

Idaho City Dispatcher's Office—Telephone and Radio.

Fire Crew—Forest Service Portable Radio.

Communication was possible from each of above at all times with Idaho City Fire Dispatcher.

Plan of Smoke Tests

Briefly, the fire tests were organized so that the lookouts did not know when or where to look for a possible fire (unless specifically noted in notes that follow)—communication made it possible to keep in touch with fire dispatcher and report discovery. The fire dispatcher was in touch with fire crew by radio.

Test No. 1

Test fire No. 1 was three feet across at base. Dry wood and green ponderosa boughs were used for the fire. Fire was set at 9:26 a. m. (9/22/36).

Picked up by Mr. Kimball in Shafer Butte Lookout with Navy telescope at 9:43 a. m.

Watched until 10:32 a. m., when it was put out.

Picked up by Mr. Varner with periscope at 9:43½ a. m. The fire appeared much plainer in the periscope than it did in Navy telescope.

Seventeen and one-half minutes elapsed before fire was picked up.

Holly Mountain Lookout or Bald Mountain Lookout failed to see this test fire.

Fire was located one mile north of Warm Springs Butte on Middle Ridge, 9½ miles from Shafer Butte.

Test No. 2

Test fire No. 2 was three feet across at base. Dry wood and green ponderosa boughs were used for the fire. Fire was set at 11 a. m. (9/22/36).

Neither Shafer Butte Lookout, Shafer Periscope, Holly Mountain Lookout or Bald Mountain Lookout were able to pick up this fire test.

It was on Ophir Creek near bridge, miles from Shafer, and was apparently placed in a blind spot.

Test No. 3

Test fire No. 3 was 30 feet in diameter. A large, dry willow clump was fired. Fire started at 3 p. m. (9/22/36).

No lookout was able to get it. The smoke did not rise high enough or there was not enough fuel in the dry willow clump to make a showing.

The fire was located on Henry Creek, 13 miles from Shafer Lookout.

Test No. 4

Test fire No. 4 was three feet in diameter at the base, and was made by using dry wood and green boughs. Fire was started at 6:17 p. m. (9/22/36).

Fire was picked up with periscope at Shafer Butte at 6:24, or in 7 minutes from time set. Bald Mountain Lookout picked up fire at 6:26, using an 8 power glass, and Shafer Butte Lookout picked it up at 6:27, using a 13 power glass.

The fire was located on Grimes Creek near Pioneersville—17 miles from Shafer Butte.

Test No. 5

Test fire No. 5 was 15 feet in diameter, A large pile of willow brush was burned. Fire was started at 10:16 a. m. (9/23/36).

Looked into drifting smoke, sun and mist for 1½ hours searching for the fire but failed to see it—then we were told where to look, but no smoke rose high enough to be visible. From Shafer Lookout we were forced to look over a hill in our foreground at least 2000 feet high—there was a strong wind blowing to the southeast, and this apparently spread the smoke close to the ground.

None of the lookouts picked this fire up even after they knew where to look.

Fire was located at Dredge on Moores Creek, 9 miles from Shafer Lookout.

Test No. 6

Test fire No. 6 was two and one-half feet in diameter at the base. Dry wood and green ponderosa pine bough were used. This fire was made at the lower edge of the fill on the Centerville-Idaho City Road, which has a white granite background. This was an extremely difficult test, as smoke had to be picked up against a white or smoke-colored background. The small size of the fire added to the difficulty. Fire was started at 2:45 p. m. (9/23/36).

The fire was located at 4:25 p. m. with periscope.

No other lookout could pick it up with the glasses. It was so located that it would have been directly visible to Holly Mountain Lookout and Bald Mountain Lookout, as well as Shafer Lookout.

The fire was 12½ miles from Shafer Lookout.

Following the six test fires used on September 22 and 23, additional tests were carried on, using standard forestry smoke pots or candles, manufactured by the Multnomah Fireworks Company, Aurora, Oregon. These tests continued through and including September 28. Changes were made in personnel manning equipment, and from this point on in the report reference is made to individuals operating equipment or concerned with the test.

Test No. 7

Test No. 7 was a smoke pot or candle set off at 9:30 a. m. (9/26/36), nine miles from Shafer Butte.

J. W. Kimball, manning periscope, picked up smoke at 9:30½ a. m. The lookout did not know where the smoke would be set except that it would be in a 20° sector. Discovery was made looking into sun, moderate smoke haze. Smoke was 9 miles from periscope.

Test No. 8

Test No. 8 was a smoke pot located 14 miles from Shafer Butte. The smoke was started at 2:04 p. m. (9/26/36), and was discovered by Mr. Kimball with periscope at 2:05 p. m. The smoke could not be found with the naked eye. This smoke was 14 miles from the periscope.

Test No. 9

Test No. 9 was located 24 miles from Shafer Butte. Smoke pot was set off at 4:49 p. m. (9/26/36), and five more were added at 5:03 p. m. Mr. Kimball discovered the smoke through the periscope at 5:04 p. m. At 5:14 p. m. another smoke pot was set off, and at 5:14½ p. m. was discovered by Mr. Kimball, using the periscope.

The location was 24½ miles from the periscope. Mr. Kimball knew only the 30° sector in which the smoke might occur.

Test No. 10

Test No. 10 was made September 26, on the top of the ridge, with a small clump of timber for a background to the smoke. A 15-mile northwest wind was blowing, visibility was poor, and Mr. Kimball, at the periscope,

had to look into the sun. Mr. Kimball was given the information by radio that the smoke would be on the west Fall Creek ridge within a certain 7-mile sector.

The first smoke pot was set off at 10:15 a. m., and Mr. Kimball discovered it through the periscope at 10:16 a. m. The smoke was extinguished at 10:20 a. m., and Mr. Kimball told the exact time it disappeared.

At 10:22 a. m. two smoke pots were set off, one at the old position and one at a position 400 feet to the south. Mr. Kimball discovered the one at the old position at 10:23 and the second one at 10:24, and described their positions as less than one-fourth mile apart.

This location was 39 miles from the periscope. These smokes could not be seen by the naked eye or with a 13 Power Naval Glass.

Test No. 11

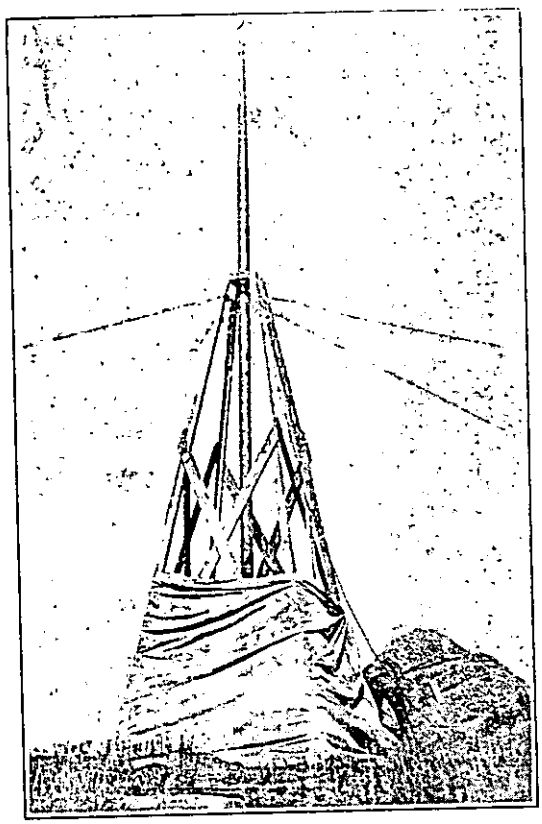
Test No. 11 was made September 28, at a position on the north slope of House Mountain, a distance of 40 miles from the periscope. Lookout L. Balter and Ranger Fest were at Shafer Butte, and Mr. Balter was manning the periscope. They were given the same information as was given in Test No. 10 to Mr. Kimball. There was a 10- to 20-mile northwest wind. The location for the smoke was in fir timber. Visibility was good.

One smoke pot was set off at 1:55 p. m., and was discovered by Mr. Balter at 1:57 p. m. At 2:05 p. m. one smoke pot was set off at the same location and one 500 feet west and a little higher on an open grass hillside. Mr. Balter discovered both of them at 2:05½ p. m., and correctly described their location, and told when they were extinguished.

At 3:05 p. m. another smoke pot was set off in heavy timber a few rods to the east of the position of the other tests, and Mr. Balter discovered the smoke at 3:06 p. m.

These smokes could not be seen by the naked eye, nor could the lookout be sure they could be seen through an 8 Power Binocular.

On September 21, at about 6 p. m., the first evening the periscope was set up, a fire was sighted on the Idaho National Forest east of Long Valley, about 75 miles away. The periscope beat Swanholm Lookout of the Boise National Forest one hour in discovering this fire. Radio reported fire to be one acre in size.



A close-up view of tower and periscope. The canvas enclosure was used on account of extreme cold winds. From size of man, the large size of periscope is apparent.

Conclusions

1. Small fires are hard to pick up unless the glass used is of high power. The periscopic 6 power lens, however, proved more efficient than the 13 Power Naval Spy Glass or the 8 Power Bosch & Lomb Binoculars. The periscope's 1.5 power glass proved of little value.

2. Spy glasses, binoculars, or field glasses are not the most feasible equipment to use in searching for fires in the sector method, until a check is wanted of suspicious spots located with the naked eye.

A spy glass puts an operator or lookout in extreme tension and is hard to hold, and sees only small spots at a time.

The periscope as it is rotated through each sector provides clear vision of country. A complete, accurate check of all country through which it is

rotated is definitely possible. Very little adjustment is needed to operate the periscope to secure clarity for forest fire detection. Greater concentration may be had in any sector viewed.

3. No fires of size tested could be picked up with naked eye.

4. The periscope is very practical in present form, except that it is believed that a cheaper and lighter instrument could be designed and built for our purpose of fire detection.

It is very evident that the height of a periscope above the lookout would be dependent on conditions of elevation at that lookout. It is believed that the increased height of a periscope tube on some points might prove a decided advantage (providing the same advantages of a short tower) and allow more seen area near or around the lookout point.

5. One extreme advantage of the periscope equipment is that it is not obstructed by structural elements of the lookout building in any part of a sector. Clear vision is possible around the entire circumference of a lookout house.

6. The periscope allows such an improvement in seeing detail that old methods at once seem inadequate.

A periscope allows vision of a moving cow six miles away. Details are clear and sharp. At 13 miles a truck moving along a road could be seen. Dead trees in the forest were clearly visible at 14 miles—the trunks appeared well in relief. White painted buildings on a lookout 36 miles away could be plainly seen. Test No. 11 proves that small smokes 40 miles away can be seen under average conditions.

7. The periscope proved that under even adverse conditions, in which visibility was considered poor by experienced lookouts, remarkable results were possible. At the time of the tests (except last day) haze clouds were in all depressed or low areas. Heavy smoke drifted throughout all country viewed, and the horizon was black with a dense smoke blowing in from other fires in adjacent country, yet under these conditions the periscope gave results equal to what would be expected in average visibility conditions.

8. The periscope proved that a power glass or mirror arrangement substantially mounted, with proper operating mechanism, can be operated easily without strain and to a greater degree of efficiency in detecting smoke than present or existing fire detection equipment.

Recommendations and Proposed Specifications

1. It is recommended that the Fire Equipment Committee give due consideration to these findings, and that the Forest Service secure the services of an expert or the cooperation of the Navy in designing the proper periscope for Forest Service detection needs.

Attached is a print from a drawing suggesting the type of equipment and manner of placing which is believed appropriate for our needs. No attempt has been made to technically design the operating lens or mirror mechanism, as it is believed the proper technical experts would save the service money and experimentation in this.

It will be noted that the proposed equipment (refer to prints of drawing attached) includes a complete unit of periscope, sector control disc, fire finder, alidade, etc., for two types of installations—one through side of roof and other through the peak of a lookout house.

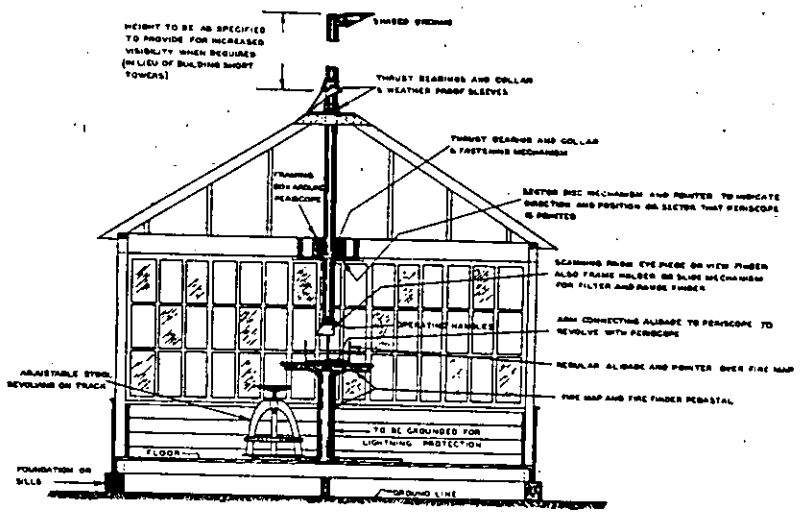
2. It is recommended that the power of the periscope be equal to the one borrowed from the Navy, as mentioned early in this report. The housing and other parts of the periscope can be made lighter in weight—in fact, we believe that sheet copper tubing as a housing will be sufficiently good.

3. In connection with the periscope, it is recommended that a range finder be developed or located on the periscope as an accessory which will give some idea of distance from the lookout to a fire.

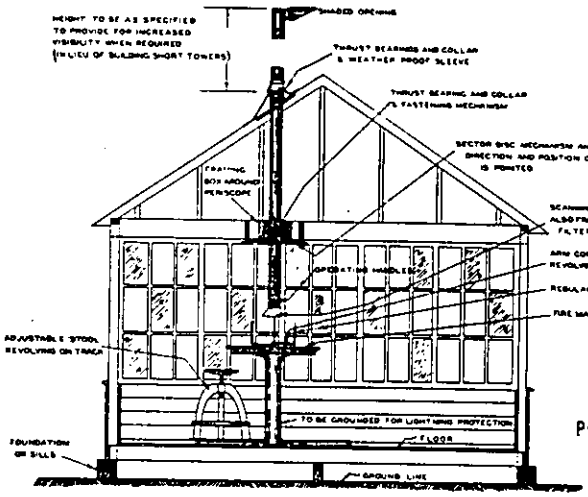
4. It is further recommended that a series of filters for looking to haze, direct sunlight, or smoke be attached in a frame or arranged to revolve in front of the eye piece or view finder.

Our studies and tests developed seven different filters of extreme value.

5. It is our recommendation that in developing the periscope for forest fire detection that the design be held to a minimum in cost, because it is believed that its use and general adoption is going to be dependent on this cost.



SECTION INDICATING INSTALLATION OF PERISCOPE
THROUGH PEAK OF ROOF OF LOOKOUT HOUSE



SECTION INDICATING INSTALLATION OF PERISCOPE
THROUGH SIDE OF ROOF OF LOOKOUT HOUSE

A PLAN
SUGGESTED BY REGION FOUR
FOR
PERISCOPIC EQUIPMENT FOR
FIRE DETECTION
IN FOREST SERVICE LOOKOUTS

SCALE DIAGRAMATIC
DESIGNED BY
DATE
TRACED BY

THE FIRE WARDEN SYSTEM IN VIRGINIA

JOHN W. MCNAIR

Forest Supervisor, Jefferson National Forest

This article and the four which follow it record real accomplishment in the build-up of organized local cooperation. They reflect great credit upon the men who, over a period of years, worked with energy and understanding to create a system of prevention and suppression which goes down to community roots. The fact that similar results were had in three widely differing sections of the country fosters the conviction that many other areas are susceptible to such treatment.

There was a time when the warden system of fire control now in use, or fast being adopted on the Eastern National Forests, was quite as visionary and impractical as the steam engine, the aeroplane, the radio, or the automobile. We feel, however, that we have now reached the point where this system is fully as indispensable and just as efficient as any of these present-day devices, although there is still plenty of room for improvements, and they are being made every season. It has been a quarter of a century—or in 1911, to be exact—since work was started on the first boundaries to be acquired in the Southern Appalachians, and in 1913 the first tract, the Alleghany Ore & Iron Company and a few smaller holdings, were placed under administration under the supervision of E. D. Clark, Forest Examiner in Charge.

Mr. Clark, whom I have never seen, was described by Mrs. Helen Gordon, Forest Clerk in his organization, as a man of small stature but of inexhaustible energy. From early morning until far into the night he gave the best of his mind and heart to the business of bringing the gospel of forest conservation to an untutored public.

According to the best information that she was able to obtain, the fire warden idea was really originated by a man who was closely associated with all of the early work of the Forest Service in this section, M. A. Price. Mr. Price was a native, owned a good deal of land in the mountains, and was thoroughly loved by all the mountain people. He had been in the habit of fighting fires to keep them from his own land and in helping other landowners to do the same. It was his idea that such cooperation could be carried a step further, and that by offering compensation these same people could be induced to protect all the forest. Mr. Price was considered by many to be a visionary, but Mr. Clark was quick to grasp the idea and to bend his indefatigable energy in carrying it out.

The original idea was to select in each community a man of outstanding ability and influence, pay him a retaining fee of say $5.00 per annum whether he fought fires or not, and allow him to select his own fire-fighters, who were paid at the rate of 25 cents per hour. This amount was calculated

to get the best in the way of man-power. Wages in the Valley at that time averaged $1.25 per day for a 10-hour day.

This scheme, after a very short trial, was frowned upon by the Comptroller, probably because we were paying men who might or might not perform any work for the Government, and wardens were thereafter advised that the position was an honorary one entirely, except when they were actually engaged in fire-fighting. This, apparently, did not dampen their ardor, since we still have many cases in which men point with great pride to the fact that they are fire wardens. In those days the Forest Service idea of fire prevention and suppression was an entirely new one, particularly in this section. The experience gained in the administration of Western forests had not been applied to the purchased forests. The problem, everybody's problem, was how to secure the cooperation of a community accustomed to burn the woods each year to improve the grazing and to help the huckleberries along.

The first step was to secure men of such standing in their communities that their opinions and stand would have weight with the rank and file. Weeks were spent by Mr. Clark and Mr. Price in visiting and enlisting the aid of these men, and it is a monument to their judgment that several of the men whom they selected are still active wardens.

The wardens selected and their interests aroused, the next step was to secure the means of making their work effective. This meant that there must be some means of communication. Practically none of the wardens owned telephones, and without them a warden crew and the Supervisor's office were almost as far apart as before the organization. As has already been said, the Forest Service was entirely a new proposition, and many people had the idea that the Government had come in to take what it wanted, regardless of everybody's rights. This opinion was particularly strong in the mind of the man then in charge of the Shenandoah Telephone System, and, with the idea that the Government was planning to take his lines away from him without proper remuneration, he refused absolutely to allow the Forest Service to connect up with his lines or run into his switchboards without paying an entirely prohibitive sum. This was the only company having lines where we could use them; there was not sufficient money to equip the forest at once with Forest Service lines, so Mr. Clark did the characteristic thing—set about to elect Mr. Price, his co-worker, president of the telephone company. I have heard it said that Mr. Price was the only man in the whole country who stood a chance in a million of defeating the incumbent. There were weeks of intensive campaigning, when it is said that neither the Supervisor, his wife and family, the clerk, nor the office force slept except in snatches, but when the smoke cleared away Mr. Price had

been elected president of a somewhat defunct telephone company. It is a matter of record that when Mr. Price took over the presidency there was no money in the treasury to pay the operators, and a year later, when he relinquished the post, the company was again on its feet; so he not only did a good turn for the Forest Service, but the company and local subscribers as well.

The point had now been reached where wardens had been selected, crews organized, and telephone connections secured. The next question was how to keep up the interest. Through the good work of the wardens the number of fires was being greatly reduced and some further means of stimulation seemed advisable. The forest at that time consisted of two purchase units—the Potomac to the west, and the Massanutten to the east—separated by the Shenandoah Valley, which bisected the area. A certain amount of competition already existed in the matter of fires, and it was thought well to foster the new cooperative spirit of rivalry to the utmost.

A directory of fire wardens and their crews was prepared for each purchase unit. "Fire-fighters of the Massanutten; Massanutten Pioneers Old and New," consisted of eight pages bound in brilliant blue. "A New Story of the Virginia and West Virginia Borders," in gorgeous red binder, set forth the fire-fighting strength of the Potomac. Mrs. Gordon states that she has been unable to learn definitely whether these books were printed at Government expense or whether they were printed by "private subscription," Mr. Clark being the "private subscriber." She is strongly of the opinion, however, that the latter is true. The printing was done at Woodstock, and not by the Government Printing Office.

As a result of pooled ideas, the age-old scheme of competition was decided upon as a good way to further the interest, and there ensued a great orgy of letter writing to the wardens, of whom there were 34 on the Massanutten and 30 on the Potomac, inviting them to a get-together, or rather a pull-apart, party, a tug-of-war between the Massanutten and the Potomac wardens.

These contests were continued from 1913 through 1916, with the exception of 1915, when no contest was staged, with the Massanutten winning the best two out of three contests; so that the Massanutten is now the proud possessor of the shield which was prepared in the regulation Forest Service form and was to become the property of the side winning it four times.

Early in 1917 the Massanutten and Potomac units were merged, the entire area being known as the Shenandoah National Forest. Mr. Clark

shortly left the Service to buy bark for the Houck Tanning Company, and S. H. Marsh succeeded him as Forest Supervisor.

During the 20 years that have intervened since the organization of the Shenandoah National Forest, the warden system has continued not only to thrive on the Shenandoah National Forest, but was early extended to the neighboring Natural Bridge Forest, and is now being organized on the new Jefferson National Forest. The State of Virginia also makes use of a forest fire warden system quite similar to the system in effect on the National Forests. The State Warden System was authorized in 1919 by Section 542 and amended by Act of 1920, Chapter 416 of the Virginia Code. The Forest Warden System, with but few minor changes from its original setup, has continued to grow and develop with experience and training, until now it rightly deserves the reputation of a very efficient fire control organization.

The *esprit de corps* of the organization is maintained at present by warden meetings held once each year, when fire control problems are studied and object lessons, slide lectures, and good food combine to take the place of the old tug-of-war. There are now approximately 250 forest fire wardens on the National Forests in Virginia who form the backbone of our fire control organization for this area. The number of wardens will continue to increase as additional forest land is acquired. It is significant that within the 1,517,000 acres within the protection boundaries of these National Forests the only regular guard positions are a portion of the primary lookouts.

With the advent of the Emergency Conservation Work in 1933 a large number of men were assigned for work on the National Forests, and our warden organization was more or less pushed into the background. For one year at least no warden meeting was held. There has never been, however, the slightest inclination to allow our warden organization to disintegrate, and the work of maintaining the organization in its high state of efficiency is being given special attention this year. Warden meetings are being held, a special effort is being made to get as many wardens as possible on going fires, and the usual contact work is being continued.

A description of the organization and system is briefly as follows:

1. The National Forest is divided into warden districts usually of from 10,000 to 15,000 acres, such districts ordinarily comprising an individual watershed.

2. The best available man who is willing to serve is selected as a warden. He should possess leadership, not only in fire control work, but

in his community, and should be active enough to assume leadership and responsibility in suppressing any forest fire.

3. The man selected for warden, in conference with the local forest officer, then selects his assistants and enrolls a crew of from 6 to 12 men. In several instances particularly well qualified and outstanding men have been designated as chief wardens, who are responsible for three or more local warden crews. Such men act as sector bosses on larger fires.

4. After the warden and crew have been selected they are supplied with fire-fighting tools, placed usually at the warden's home or at the location of transportation for the crew.

5. Each crew must make arrangements for suitable transportation in the event of fire.

6. Every effort is made to tie in to our forest telephone system each warden and as many members of his crew as possible, so as to facilitate not only the dispatch of crews to fires, but the reporting of fires.

7. A Forest Warden Organization Directory is prepared which shows the name of the warden, assistant warden, means of communication, means of transportation, and strength of the crew.

8. Each warden is furnished with an identification card and badge, as well as written instructions.

9. Each warden has full authority, and it is his responsibility to attack immediately any fire occurring in his district and suppress it as quickly as possible. He is also subject to call if and when needed in any neighboring warden district. The selection of men to serve as wardens is of paramount importance. I feel that the job that requires real skill and leadership on the part of the local Forest officers is the maintenance of the *esprit de corps* of the organization and the training of the wardens and their crews, so that they will function effectively on fire prevention, a limited amount of presuppression, and suppression work. Our wardens represent some of our most effective key-men, and as such are in a position to function most effectively in fire prevention work. In all of my own contacts with our warden organizations I have made it a point to emphasize prevention work. It is true that our wardens receive no compensation for such work, being paid only when they are on actual suppression, but these men are, without exception, I believe, extremely public spirited citizens who are vitally interested in protecting the forests of our nation, and are therefore perfectly willing to give a certain amount of their time for this purpose.

I feel that the fire record of the George Washington is very good proof

of the effectiveness of the warden system on fire control and the occurrence of fires. There is little doubt in my mind that the type of people with whom we have to deal has a very marked effect upon the results that we will be able to secure from the organization of a warden system on any forest. We are fortunate in the Valley of Virginia in having a very high type of people who, through 25 years of National Forest administration, have come to see the benefits to be derived from the protection of our forests.

On the other hand, I have in mind a settlement on the Pedlar District of the forest, where in the early days a lot of trouble was experienced from fire. This trouble has now practically been eliminated by the selection of a member of the settlement as Forest Fire Warden. Working through him the standard of living of these people has been raised, and they are now ardent in their protection of the National Forest.

This is an indication to me that, by proper methods of approach, we can convert communities through training and exercise of the right kind of leadership and develop efficient wardens and crews from any of our forest population. At the same time I feel that we can render a valuable social service by more quickly and effectively raising the standards of living in this section.

Two Schemes for Luminous Sights—A considerable number of the fires in the Ozarks are started in the early part of the night, and it is the policy of the Forest to man the lookout towers during darkness hours on the Clark during the spring fire season. Since the more distant fires are generally merely a gleam or "glow" on the horizon, no artificial light can be employed in the use of the firefinder, since it would tend to blot out the glow of the fire. To overcome this the following method has been found effective:

Mount the cylindrical type of luminous light cord locator on the sighting upright on the Osborne Firefinder. The glow of the locater takes the place of the hair in the sighting bar and permits of a fairly accurate reading on the fire.—*Edward M. Howell, Principal Forest Ranger Clark National Forest.*

THE PER DIEM GUARD SYSTEM ON THE SANTA FE

F. E. ANDREWS

Forest Supervisor, Santa Fe National Forest

So far as I can recall the per diem guard system on the Santa Fe has always been with us. It was born of necessity. In the early days there was no telephone communication, travel was by horse or buckboard, and there were no improvement crews. Lookouts had not been invented. But to a small degree within the forest boundaries, and to a very large extent in the valleys and plains just outside, were groups of long-established settlers in admirable locations to detect fires and to reach those fires quickly, measured by that day's standards. The ranger rode, and perforce sought shelter at night for man and beast. Naturally he sought the best in a material way, and the best available companionship and understanding, and a cooperative spirit in his host. These qualities would generally be most evident in the more substantial and respected men of the respective groups.

As time passed funds became available for tools and tool boxes, telephone lines, lookout stations, trails, and eventually roads and other improvements. These early cooperators were among the first crew foremen, and laborers were selected with the help of their recommendations. The first tool boxes and telephones were often placed at their ranches; so it is without much conscious effort we have in many communities a well-knit force of leaders and laborers available on call or who will act upon their own initiative in case of fires. There was a direct common interest, even if they were not first interested in fires in the abstract. In only a few instances have we believed that fires were set or mishandled for the wage incentive.

Of course the system does not work automatically. Men fail. They sometimes take too much authority and responsibility, or not enough. The judgment used is not always satisfactory and has naturally a relation to the aptitude, experience, and training of the guard. A valuable educational effect is secured. The training and general fire consciousness permeates the settlement. We do not have to recruit our fire and other labor from town or transient sources.

Fire hazards on the Santa Fe are not in the upper brackets. We have plenty of cover, but our fires seldom crown. Our recognized fire season, May 10 to July 10, is frequently broken up by non-hazard periods, but in almost any month in the year we can drop for several days into valleys of very low humidity for a few days at a time, and threats of serious out-of-season fires have occurred. The strategic value of the per diem guard system under such situations is great.

We are using 97 per diem guards this year (1936). In 1934, the last year the records were analyzed from this standpoint, we had a total of 94 fires.

> "First discovery in 18 cases was made by P. D. Gs. Report received and men dispatched in 6 cases by P. D. Gs. Either discovered fire and took charge or received report and took complete suppression action in 27 cases."

This can be seen as extremely important supplementary action to that of our regular protective force, CCC camps, other improvement crews, and the rangers.

In selection and placement of guards consideration is given particularly to blind and sparsely occupied territory without communication facilities, as in such areas our organization is weakest. Nevertheless, in well-developed localities the force has proved its worth time and time again. Each guard is given a definite area of responsibility. Occasionally some jealousy and friction have developed in spite of this, because of some crew muscling in on the other fellow's job, and such cases result in added costs, due to overmanning.

Most of our per diem guards and their following are Spanish-Americans. No special requirements are necessary to secure cooperation up to the extent of their ability. In fact, they stay more closely on their farms and are more ready and willing to drop anything and go now than the Anglos, so as a whole they are more readily available and more willing to see the job to a finish. Elaborate food, bedding, and camp arrangements do not have to be provided, and they have their immediate transportation by horse close by. These are very important items in the initial stages of a fire.

A per diem guard system, like any other system, does not function automatically, but requires careful thought and planning in the selection and subsequent handling. The experience of Region 3 has shown, however, that efforts along this line are effective and well worth while. Its advantages are many, the costs are small, limited to the actual time spent on fire suppression, and if the men are carefully selected only occasionally will expenses become excessive due to over-zealousness in the prosecution of their tasks. These occasional excesses are more than made up by the fine cooperation received throughout the fire season and the feeling of security that many otherwise blind areas are thus covered.

Neither is the value of the per diem guard confined to actual suppression. Since these men are usually leaders in their communities and are looked up to, their influence in reducing man-caused fires is very effective.

THE COLVILLE'S COOPERATIVE FORCE

SUPERVISOR'S STAFF
Colville National Forest

The Colville National Forest lies next to the Canadian line in an out-of-the-way corner of northeastern Washington, 150 miles from Spokane.

Forest cover consists chiefly of fir-larch, lodgepole, and ponderosa pine. Idaho white pine is found only in the extreme eastern portion of the forest, but climatic conditions are very similar to those in the white pine area, with an average rainfall of 14 inches, fuel moisture content at 8 per cent, and relative humidity less than 10 per cent for weeks on end each summer. The forest is broken into a number of small units by strips of farm and pasture land in the valley bottoms. Much of this privately owned pasture is clothed with cheat and wheat grass that becomes powder dry early in the summer. Fires frequently originate on these grass-clothed areas and spread with great rapidity to the wooded slopes above.

Lightning storms are frequent, and occasionally are accompanied by little or no moisture. A single storm has set as many as 50 fires on the Colville in the space of a very few hours. To meet the peak lightning load we have for many years trained a number of local stockmen and loggers to act as emergency lookouts and firemen. These men have been trained individually by the rangers and at mass meetings called in connection with the spring training camps held each June for the instruction of our regular protective force. These trained cooperators have pretty well taken care of our extra man-power needs during lightning storm peak loads and of our extra needs for overhead on all suppression crews in an average year.

Our chief hazard, however, is not from lightning storms, but from man-caused fires that start at lower elevations between 10 a. m. and 2 p. m. of a bad fire day. If these cannot be reached by an adequate force within minutes they spread with amazing speed and sometimes reach large proportions before evening, and require the services of several hundred men to control before the beginning of the next burning period.

With several such fires burning at one time in 1929, and again in 1934, we were forced to employ hundreds of laborers from Spokane and other distant towns, and discovered that the volume of effective work accomplished by such forces was materially cut down because of the lack of sufficient trained foremen and strawbosses. In order to meet the emergency that may occur any summer we must have trained overhead to supervise the work of 1200 fire fighters. To meet this need, during the winter of 1934-35 we recruited 200 men from our 300-odd permittees who agreed to act in the various overhead positions needed. These men are so organized that 1200 green fire fighters can be turned over to them and in a few

minutes be transformed into an effective fire-fighting machine.

Each ranger, through his short-term force or a keyman in each community, keeps in constant touch with this cooperative force and makes current substitutions necessary to keep them at constant full strength. We had no opportunity to give these men a major test in 1935, but with so many involved we thought it desirable to provide for special training and encouragement, so during the past winter and spring we arranged 11 community meetings, to which these men turned out almost 100 per cent. We furnished a hot meal, and the cooperators donated their time and arranged their own transportation to the meeting place. A full day's training in their respective jobs was given at each meeting by district rangers and staff men. Since a majority of those trained had a good deal of experience in fire fighting, the conference method of teaching was used and the points brought out included everything in our training lists, and many others. A record was kept of all points discussed and a mimeographed copy sent to each cooperator for further study. Cooperators who attended the meetings unanimously agreed that systematic advance organization and training of overhead was not only desirable, but essential to successful handling of the fire situation. In order to renew his interest, at the beginning of the hazardous period, the district rangers wrote a "pep" letter to each cooperator.

During the 1936 fire season we were fortunate enough not to have to call for outside fire fighters, so our organization still awaits the supreme test; but initial action was taken by these cooperators on 25 fires. Each of these fires was checked by a ranger or regular fireman, and in every instance it was reported that the cooperator's action was satisfactory. We are convinced that our cooperative organization is conducive to more effective prevention, as well as suppression of large fires. Most of these men have a selfish interest in protecting the forest from fire because of the possible loss of their pasture, timber, livestock, and even their buildings, if fires are not controlled.

There are minor disadvantages in this cooperative plan. With CCC enrollees available to meet the average season's needs, it is difficult to give cooperators sufficient work to hold their interest. Furthermore, it requires a rather startling amount of time on the part of the ranger and his short-term force to keep the organization up to date. But these disadvantages are greatly outweighed by the tremendous advantage of having available on very short notice a trained organization of men who know just what is expected of them, who know the forest, have a vital interest in its protection, and who will prevent any attempt at incendiarism by the suppression force in order to lengthen the period of employment.

We predict that when the next fire emergency visits the Colville these cooperators will give a good account of themselves.

FIRE COOPERATION IN REGION 2—THE BEGINNING

JOHN MCLAREN
Liason Officer, Sixth Corps Area

For many years prior to the creation of the National Forests in Colorado, I lived in Pitkin County in wooded areas which later became part of the Holy Cross National Forest. In the fall during those years one could see smoke from unattended fires at almost any point of the compass, and naturally Colorado suffered enormous timber losses, for conditions in my locality were not materially different than in other sections of the State, as I afterward learned.

The Holy Cross and other Colorado Forests were placed under administration in 1905 and 1906, and an extremely limited field force was kept busy long hours each day trying to keep up with marking and scaling timber, and fire control was about the only interruption tolerated. From the beginning, however, all forest officers were impressed with the fact that they must be on the alert to prevent fire damage, and necessarily must act promptly if fires were to be suppressed.

Foresters coming into the service today can have no conception of the situation faced in those early years, for there was an almost universal antagonism from every quarter toward forest administration, and some of it was very bitter. Timber operators and grazing men were sure their individual rights were being jeopardized, and others were "agin" it because it was something new and they were not sure it would be of benefit, so preferred to let the old order ride.

This drab outlook faced a ranger when he found it necessary to tackle a fire. Perforce he must get as many men as possible as fire fighters from any and all walks of life, and "please each man bring his own ax or shovel," for those days preceded the era of fire tool caches, telephone lines, automobiles, truck trails, and lookout systems.

Most of the old timers in field service in those days have been replaced by men with more education and nimbler typewriter fingers, but my hat is off to that advance guard that had the hardihood to stick with and worry at the job in the face of the discouraging outlook; and boys, did that bunch do an honest-to-God P.R. job, though the term did not come into usage until some years later. Strangely enough, doggedness and perseverance in fire work seemed to be the opening wedge in getting public confidence, and after a while there was a sort of grudging admission that it did really seem possible to check and whip a fire with man-power, and the efforts of the field men began to bring some praise.

Thus it became apparent that fire publicity was the best means at hand to arouse public interest in the Service and its aims and policies. Fire suppression jobs were publicized in the newspapers, and particular effort was made to give credit to civilians who took part in the work either of detection or suppression. Stress was laid on the need for eliminating fire from the ranges in the interest of stockmen; on the fact that timber must be free of fire in the interest of loggers and lumbermen, and that success in the mining industry depended a great deal upon the elimination of fire. Furthermore, if returns to the counties from the 25 per cent fund were to be worth while and maintained, the resources must be kept free of fire damage. Naturally, individual selfish interests were played upon: Farmers might be bankrupt through the loss of their improvements and the reduced fertility of the soil; a mining operation might be stopped by fire through loss of surface buildings and the necessary timber; and, too, many towns and settlements might be wiped out, with loss of life.

I have been asked how our system of fire cooperation got started. The foregoing indicates something of the way in which the start was made. As to when and where it started, I cannot say. In all probability field men were doing the same thing simultaneously on all forests. Apparently the first universal step was to interest people in detection work. "Keep a sharp lookout for fires and make prompt report to the nearest forest office." As I recall, my first personal attempt along this line was to line up teamsters hauling lumber and logs into Norrie to report railroad fires.

Logging operations were confined largely to the mountainous slopes south of the Frying Pan River, while the Colorado Midland Railroad wound a tortuous route along the mountain slopes north of the river. Only a few miles of right-of-way could be sighted from the ranger station, but the teamsters had a panoramic view of the entire railroad, so they could and did watch for fires and report them. Among those lined up to scan large areas under their immediate control were a resort owner, a mine superintendent, and a German farmer. The latter was a valuable find, for he was German born, had a very intimate knowledge of German forests and forestry practices, and was inordinately proud of having a connection, even without pay, with the U. S. Forest Service in the capacity of a fire guard. He was so enthusiastic and so willing that in a very short time fire tools were placed in his barn, and he was given authority to take direct charge of any fire in his territory and to employ fire fighters as needed.

Even after a few lookouts were manned, the public was requested to see how many times they could beat the lookout observer in reporting fires, and they gleefully responded. This voluntary service was extended year after year until there was a very large number of individuals who could be

depended upon for detection and a smaller number who were entrusted to take initial action and incur expense in fire suppression. Let me repeat that this was not the only territory where progress was being made. No doubt much was accomplished in other regions, but there was a lack of general knowledge among the field men of the various forests as to how results were obtained, and such information as was obtained came largely from inspectors of the Regional Office at infrequent intervals and at rangers and supervisors' meetings.

When the Regional Office established the position of Fire Chief, a survey disclosed that while excellent progress had been made in rousing the public to be fire-minded and co-operative, it was very spotted even as to individual forests: There was a lack of standardization in fire tools both as to kind and number, and the majority of the fire plans were of the old narrative type—too voluminous and bulky to be of much value even to the men who made them. Fire tools were standardized rapidly, and Region One's Fire Organization Chart was adopted in modified form.

Effort was immediately centered on convincing each and every field man of the importance of enlisting dependable public co-operation. This, by the way, was not accomplished in a season. Eventually it did exist well toward 100 per cent as a mass consciousness from the newest member of the force, through the Supervisor's office to the Regional office, to the Regional Forester himself. There was an essential objective, for mass effort produces mass results. The chart referred to became the fire plan for each ranger district, and responsible citizens at strategic points were listed as keymen. These were men who were, and are, called on to drop their private work and devote time and energy to public interests. These plans were frequently inspected and checked in the field to insure that they were not paper plans only.

The methods employed were many and varied, and depended upon the initiative of individual forest officers and the individuals to be worked on. In general terms: "We are a skeleton force willing and anxious to do everything possible to protect the resources, but you are the owners of these forests—the stockholders in this concern—and without your whole-hearted interest and action we must fall short of the success otherwise possible."

Each forest officer must believe whole-heartedly in the worth of converting apathetic or indifferent individuals and communities to an active sense of duty in fire control—it can be done. The forest ranger has better chance for success than others, for he personally knows the people in his territory, has a knowledge of their personal interests and their idiosyn-

crasies, and therefore has the best approach.

The system works, and where maximum effort is put forth you will find fewer fires and less damage than formerly. In certain localities more than half of the fires in a season are extinguished before a forest officer knows of their occurrence.

For any section where there are settlers or other inhabitants, I will take co-operators. The citizen who takes pride in a record for his territory is more dependable and will get better results than the average run of salaried guards.

Mechanized Line Construction—Recognizing geographic opportunities for the use of machines for fire line construction, and quickly taking advantage of them, Columbia National Forest personnel gave an effective and practical demonstration in the use of tractors on fire line construction by stopping at the forest boundary the advance of a State fire which originated within the Pacific Logging Company slash near Underwood, Wash.

On October 13 this fire had reached proportions endangering Forest lands. In anticipation of the fire's further spread, a "60" Cruiser type "CAT" and a "50" "CAT" with trailbuilder were dispatched to the scene, where the cruiser "60" went into action breaking trail and moving the heaviest of the logs and debris, followed by the "50" trailbuilder, opening the fire line to mineral soil. The terrain was rolling to steep, covered for the most part with heavy brush and reproduction, and many down logs. The equipment as used reduced to the minimum the necessity of hand bucking and slashing.

An idea can be gained of the efficiency of the "50" "CAT" with dozer attachment working alone as shown by results: 8200 feet of 6- to 10-foot fire line was constructed in 13 hours' operating time, approximately 630 feet of line per hour, with an average width of 8 feet. Immediate back firing was undertaken along the various sections of line as the fire approached, and, needless to say, no fire reached the forest or crossed the "CAT" trail. In addition to this, a large log was extensively used in connection with the "60" "CAT" by dragging it behind to construct a fire line down to mineral soil. Several miles of this type line were constructed, generally on types of country where the "50" and dozer could not be operated. This system works extremely well, and is one of the fastest fire trail builders that I know of. The "60" "CAT" knocks down the brush, which is removed by the log, and at the same time removes duff and other debris, leaving a fire line not only down to but below mineral soil. Generally we found it necessary for a squad of men to follow the machine and clean up sections that were missed by the logs on account of deep gullies or sharp ridges. Line was constructed by this method at an average rate of 1 mile per hour.

In one particular instance the "60" and crew were skirting a fast fire when the "CAT" got into trouble and it became necessary to concentrate the crew to construct a line around the machine and backfire in all directions. This worked, and after the rush was over line building was continued, but the moral is, have a "drum" or power winch attached to the tractor to facilitate getting out of "tight or cramped" positions in the least possible time under emergency conditions.—*C. F. Ritter, Fire Assistant, Columbia National Forest.*

FIRE COOPERATION IN REGION 2—THE TASK OF MAINTENANCE

C. J. STAHL

Associate Regional Forester, Region 2

The cooperative fire control organization conceived and put into practice by John McLaren, Region 2, is, as the name implies, a cooperative undertaking. The public's interest in the organization depends very largely upon the interest which the organization engaged to do the job of National Forest protection displays, and to a very large extent on the effectiveness of that organization's efforts. It is something which will not continue on momentum. It is an uphill route all of the way, and when the current is turned off the machinery stops. Whenever it slows down it is harder to get it at full speed ahead again than it was in the first place.

The cooperative organization is beset with discouragement and interference. It is a delicate thing to bring to a cooperator's attention failure to fully extinguish a fire which was fanned into life after having been left by him. One man does not like to take instructions from his neighbor when more than one of them goes to the same fire. Each likes to have full credit for having discovered and assumed responsibility for extinguishing the fire.

Interest must be kept alive by constant effort on the part of the local Forest officer. Settlers naturally take a greater interest in the territory immediately surrounding them than in the National Forest unit as a whole. It is not hard to convince a man that territory in which his range is located, or where water for his irrigation rises, or building materials are grown, or fuel for his heating plants is supplied, should be of special interest to him. He can even be persuaded to believe that country within view from his home is of far greater value to him if covered with timber than if damaged by fire, so that he, as a result, must gaze upon a denuded slope.

Once a man agrees to act as a cooperator or keyman, he may not be neglected. His interest in the protection of the forest will never become so great that he does not require an occasional stimulant, and it is doubtful if he would be sincerely interested if it were not for his liking for the Forest officer, who is responsible for the territory, and who has presented the subject to him. There must first of all have been established friendly relations between the two, and it is more often a result of the settler's friendship for the officer that influences him in protecting the area than his sense of public duty.

An annual visit to the settler to discuss his continued cooperation is not

sufficient. His friendship must be kept in repair, and the officer must display an interest in the settler's affairs commensurate with the interest which he seeks to develop in the settler for the protection of his resources. In the last three or four years Forest officers have been so driven with additional duties that contact with the settlers has been neglected. Nowhere has this shown up to greater disadvantage than in cooperative fire control.

Another thing which has materially affected the interest of the settler is the use of CCC in fire control. In many cases the cooperators have gone to a fire as usual and then when the difficult task of bringing it under control has been accomplished, the CCC arrives and takes on the responsibility of completely extinguishing the fire. There is a very general feeling among the cooperators that they are no longer required, and the same haste to get to the fire without delay and the same determination to put it out to the last spark is lacking. Where there have been no CCC camps the cooperative scheme still works very well. It still works everywhere, but not as perfectly as formerly.

It is not a scheme which can be made to work by written prescription. Each individual must be handled in the way in which his disposition requires. The approach is always different. Settlers have been known to leave the hayfield and take their men with them. The manager of a dude ranch has been known to cancel a pack trip and handle a fire. On rare occasion a settler has neglected to go to a fire which was reported to him, and dude parties have been known to start fires by failure to put out camp fires when breaking camp and by carelessly smoking along the trail.

To keep the system working requires constant and sustained effort. It will work, and does work, if the field can be kept on its toes; and it is another job to keep the field on its toes. The heavy turnover in the field force is responsible somewhat for a slackening in the interest displayed by cooperators. The machinery, if kept keyed up, is as effective as an organization of salaried guards, and is probably no more difficult to train and keep efficiently functioning than are guards.

A FIRE GUARD TRAINING HANDBOOK IN THE MAKING

J. F. CAMPBELL
Fire Control, Region 6

The number of emphatic remarks at the 1936 Spokane Conference on the importance of training among fire control activities is an indication of the high priority given this subject. The author, who is taking a leading part in the handbook building, presents here an encouraging progress report.

For many years attention has been given to training fire protection men for their jobs. In some instances this training has been good, but more often not so good. Observation and inquiry into what goes wrong in fire suppression gradually brought about a realization that there is a wide gap between the knowledge of what should be done on fires and what is actually done on them. The perfection of protection practice lags far behind knowledge. With this realization has come an appreciation of the fact that, since the success of the protection projects depends so much upon the human element, it is necessary to go the limit in finding and using the best methods of selecting and training the protection force.

During the last few years a great deal of excellent training work has been done in the Forest Service. This has consisted of individual "in-place" training, training camps, conferences, study courses, correspondence courses, and the preparation of a number of handbooks. However, the greatest advance, so far as fire training is concerned, came with the introduction of vocational training methods.

Recognizing that while much had been done, training offered one of the greatest fields for improvement in fire control, Mr. Roy Headley, Chief of Fire Control, arranged for a meeting of fire and training men from Regions 1, 4, 5, 6, 7 and 8. This committee met at Portland, Oregon, December 2 for the purpose of pooling their knowledge and experience in the preparation of a fire guard training handbook which would be suitable for use throughout the Forest Service and also serve the needs of other protection agencies.

The first few sessions of the committee, under the chairmanship of A. H. Hodgson, were devoted to deciding upon the scope of the handbook and outlining its chapters. Sub-committees were then appointed to prepare the subject matter of the chapters. The committees had Forest Service training handbooks, a number of textbooks, and other works on personnel training available for reference. The first rough manuscript prepared by the committees indicates that, while liberal use was made of these references, much

original thinking and the rich experience of the committee members is reflected in their work.

It was decided that the handbook should be prepared primarily for use in fire training, although the principles of training men for fire work are not fundamentally different from training them for other forest jobs. The handbook will contain six chapters. Chapter I will be devoted to an introductory statement and a description of the fire-training project in the Forest Service. Chapter II outlines the types of training, such as group training, training on the job, and training by telephone. Chapter III deals with methods of training, such as the four-step method, conferences, dramatization, and lectures. It also includes sample lesson plans, and suggests a method for making them. Chapter IV proposes a plan for training instructors, or, in other words, training others to train. Chapter V has to do with the subject of "Determination of Training Needs." Starting with a breakdown of the job, it describes a method of appraising or estimating the needs of individuals to be trained, and leads up to the final Chapter VI, which is entitled, "Planning the Training Program," and which describes a method of planning the complete season-long training program for each member of the protection force.

The work of each sub-committee was presented to the committee of the whole for consideration, adjustment, and approval. The rough manuscript was turned over to Ray Lindberg, Personnel Training Assistant in Region 6, for editing. It is expected that the Fire Guard Training Handbook will be printed and available for use by the beginning of the 1937 fire season.

Difficulty is encountered in getting accurate readings on night fires, because of the fact that when a light is made in a lookout tower at night the reflection of the light in the windows interferes with sighting, particularly on a small fire at a distance. To overcome this, the Angeles National Forest has been experimenting during the fire season of 1936 with radium-treated cross hairs on the Osborne Firefinder.

It is necessary to replace the hair with an iron wire of similar size to withstand the action of the radium. This wire is treated with a preparation of radium compound. The cost is nominal, as it is necessary to treat only one inch on each of the intersecting points of the cross hairs or wires. Anyone who has used a luminous dial watch can readily appreciate how this will show up at night, and still not interfere with daylight sighting. This improvement has been used on the Angeles during the past season, and the lookouts and rangers who have used it consider it a real improvement.—*Angeles National Forest.*

TWO WELL-WON TRESPASS CASES

REGION 1

Law enforcement, whether directed toward a large corporation or an individual, is an instrument of fire prevention whose importance should have greater general recognition. This article records the successful prosecution by Region 1 of two difficult Trespass cases—one against a railroad and the other against a bank. Thorough preparation and vigorous handling brought splendid results. These were both fine jobs. We all have much to learn from these examples of aggressive spirit and detailed preparation.

RAILROAD CASE

Region 1 scored a substantial victory in the trial of the fire trespass case against the Milwaukee Railroad Company at Coeur d'Alene, Idaho, when a jury in the United States District Court for Idaho, on December 9, 1936, brought in a verdict for the Government of $25,911.40 for fire damage to brush, young tree growth, and other forest cover, in the St. Joe Forest, and $49.859.65 for fire suppression costs. The jury, mostly farmers, awarded the Government the entire sum asked for fire damage to forest cover. This case shows recognition of the value of brush, small trees, and other forest cover in the National Forests, in the minds of that jury.

The case arose from the Avery Fire of 1934, which, the Government contended, started on the railroad right-of-way near Avery, Idaho, and which for a time threatened the town of Avery. The case is distinguished from preceding fire trespass cases. The Government based its suit solely on the railroad's failure to keep the right-of-way clear of all inflammable and combustible material, as required by the stipulations filed in connection with the grant of the right-of-way through the St. Joe Forest, and by the law of the State of Idaho. The Government's contention that the fire started close to the north rail of the track in the right-of-way, spread to Northern Pacific land and then to Forest Service land, was disputed by the railroad company. The company claimed the flames started a short distance outside of the right-of-way and spread down-slope onto the defendant's lands. Twelve witnesses were put on the stand to uphold this point.

The Forest Service, however, qualified four witnesses as experts in fire behavior, and specifically as to the origin of fires. These stated that, because of the slope and the wind prevailing at the time, the fire spread upslope, and that it had started on the right-of-way. The jury placed greater weight upon the testimony of men long experienced in the ways of forest fires than it did in that of the railroad's less impressive witnesses. Most of the railroad's witnesses were recruited from the Civilian Conservation Corps enrollees who were sent to the fire for duty thereon.

One of the great difficulties in handling the case came in proving expenditures made in the suppression of the fire. The court refused to accept the fiscal papers of the Government showing the expenditures made at the fire. It was necessary to produce the Forest Supervisor who had actual charge of fighting the fire to prove that he had personal knowledge that the expenditures actually were made as shown by the papers. The court held that proof of payment of items was not necessarily proof that the work for which claim was made was actually done on the fire. The case, attorneys said, exemplifies the need for close observation by the first Forest Service employees who arrive at a fire. Some of the witnesses for the Government were not entirely sure as to some details which became important in the case. The need for keeping in close touch with fire expenditures so as to be in a position to prove that money was spent for fire suppression also is stressed, along with the need for having simple, understandable statements of fire expenditures.

The judge indicated in his charge to the jury that he would award to the Northern Pacific a proportionate share of the judgment for fire suppression costs. The Northern Pacific had intervened in the suit, without objection from either the plaintiff or the defendant. This company, whose lands are protected by the Forest Service under cooperative agreement, had already paid to the Government a sum of money representing its proportionate share of the costs of suppression.

The Bank Case

On December 16, 1936, the Solicitor of the Department of Agriculture, referring to the opinion and judgment of the U. S. District Court for Montana in the case of the United States vs. The First State Bank of Thompson Falls, wrote as follows to the Attorney General of the United States:

"Aside from the amount of money recovered—$1,163.28, together with interest in the sum of $338.66 and costs of the suit—the decision of the court upholding the constitutionality of the State statute under which the suit was brought is of great value to the Forest Service in carrying out its fire protective program.

"The suit was brought under a State statute for the costs incurred in the suppression of a forest fire originating on land owned by the bank. The statute declares that an uncontrolled or spreading fire in forest material from May 1 to September 30 is a public nuisance which may be summarily abated by the State or the Forest Service of this Department or any forest protective association recognized by the State Forester. The owner is made responsible for the cost of suppression which, unless paid within thirty days from date of demand, may be recovered in an action of debt by the State or the United States or the association which abated the nuisance.

"It will be recalled that when the matter was first brought to his attention the United States Attorney questioned the constitutionality of the statute, citing a number of cases in support of his belief and stating that in a similar suit a State court had sustained a demurrer to the complaint upon the view that the statute was unconstitutional. He subsequently filed the suit and won the case. The bank employed able counsel to argue the constitutionality of the act.

"Statutes similar to the Montana statute are in force in other States. The decision in this case will, therefore, be helpful in the event it is necessary for the Government to file suits under those statutes.

"In the circumstances, the Department would be glad to have you express to the United States Attorney its appreciation in this behalf."—*Mastin G. White, Solicitor.*

The decision is of such importance generally that the pertinent portion of it is quoted herewith:

"The fire, so it is agreed, was discovered about 3 p. m. on the land, hereinafter described, by James Goff, who with his mother, went immediately and tried to extinguish it, but were unable to do so; later the father joined them but with no better success. The fire started in an old chicken house on the SE¼ of SE¼, of Section 24, being the land in question, and 'from a cause or source unknown to and for which it is not claimed that the defendant was in any way responsible save as herein specified.' The fire was finally put out by Supervisor A. N. Abbott and his men on September 7, 1931, at an expense of $1163.28. The parties agreed that: 'The defendant was never at any time in actual physical possession of the property or any part thereof and never at any time made any effort to cultivate or operate the same or to rent or sell the same to any person or persons whatsoever.' The defendant knew nothing of the existence of the fire on August 28th, but knew about it in the forenoon of August 29th. This was long after the supervisor and his men—34 in number—had taken charge.

"The statutory provision relating to fire and applicable here is Section 2, Chapter 95, Laws of Montana 1927, also Revised Codes of Montana, supplement, Section 2776.2, which reads as follows: 'Uncontrolled fires nuisances—Liability—Abatement. Any uncontrolled or spreading fire in forest material in the State of Montana, from May 1 to September 30, inclusive, is hereby declared a public nuisance. The person, firm, or corporation on whose property such fire exists or from whose property such fire spreads, is hereby made responsible, to the extent hereinafter set forth for its control and extinguishment. If the person, firm or corporation thus responsible, shall refuse, or neglect, or fail to take reasonable steps to control or extinguish it, the State Forester, the United States or any organized and functioning forest protective association recognized by the State Forester, may summarily abate such nuisance by controlling or extinguishing the fire, and the cost thereof may be recovered from such person, firm or corporation responsible for such fire by the State of Montana, or the United States, or the association, which extinguished or controlled it. If the person, firm or corporation shall fail to pay in full the total amount due within

thirty (30) days after date of written demand for payment, such amount may be collected in an action for debt by the State, the United States, or the association which abated the nuisance.

"Provided, that when any person, firm or corporation has listed his lands with any such regularly organized and functioning forest protective association recognized by the State Forester, or with the State Forester or the United States Forest Service, it shall be considered that he has taken reasonable steps to control and extinguish fires as described in this section except such fires as may be the result of his negligent act, conduct or operations.

"The principal questions here are, was defendant the absolute owner of the land, and if so, did he fail to take reasonable steps to control or extinguish the fire. Defendant held the legal title and transferred the property under contract. So far as the agreed statement and the record disclose defendant was the owner. It claims to have retained a note, but that does not seem to have any particular significance in view of the other circumstances. Did defendant fail to exercise reasonable care? He did not list the land as provided in the statute. On hearing of the fire defendant might have sent a representative to cooperate with the men who were fighting the fire from September 27th to October 9th. But, as it appears, no effort was made to help the fire fighters. This was not only not taking reasonable steps to control or extinguish the fire, it was not exercising any care or taking any steps whatsoever to control or extinguish it. To be sure, defendant did not learn of the fire until the following forenoon but it was still burning and spreading and continued to burn until October 9th, thereby affording defendant ample time to manifest some interest in this devastating fire that had its origin on property of which it was the owner.

"If the statute is not applicable to the state of facts found here it would be difficult to find a case following within its provisions. It seems to the court that there is sufficient evidence to warrant the finding that the deed was in fact a deed absolute and not a mortgage, and it is so determined, and that under the evidence and a plain reading of the statute that the defendant failed in the performance of the duty thereby imposed, and is therefore liable for the cost sought to be recovered in the foregoing action, and judgment will be entered accordingly. The court has considered the arguments of counsel as to the validity of the act in question and is of the opinion that it meets constitutional requirements and is therefore valid."—*Charles N. Pray, Judge, United States District Court of Montana.*

Use of Firemen's Masks—During the past summer fire season intense heat (both atmospheric and that from fires) was encountered, as well as suffocating smoke because of the large amount of green material being burned. Several men used goggles to protect their eyes from smoke, with some success, and it is contemplated trying out masks for this purpose (probably a regular fireman's mask). These firemen's masks, or others of similar type, should protect not only the fire fighter's eyes but his face and lungs as well. We should like to know of any experience anyone has had along this line.—*Edward M. Howell, Forest Ranger, Clark National Forest.*

REFLECTIONS OF AN "INSPECTED"‡

(On a Busy Fire Forest)

NUMBER OF WORK DAYS IN YEAR

Total days in the year	365	
Minus Sundays	52	
	313	
Minus holidays (legal)	7	
	306	
Minus annual leave	26	
	280	
Remainder	52	
Plus Sundays I don't get		
	332	
Plus holidays I don't get*	4	
	336	
Plus annual leave I don't get	25	3/7
Net work days in year	361	3/7

*Exclude New Year's Day, Washington's Birthday and Christmas.

Why don't I get these days for rest, recuperation, meditation, etc.? To be specific, there are some 50 very active activities on a National Forest, each of which is broken down to details that run to 00 (infinity to you—not goose eggs), many of which have from one to six functionaries going under the general classification of "Inspector," to each of whom I am expected to devote some time, varying in amount from a few minutes to a few days every month.

Inspectors can be subdivided into classes almost without limit. A logical subdivision for future reference might be as follows:

Class 1 Inspectors (real)	5% of total
Class 2 Inspectors (vacationist)	10% of total
Class 3 Inspectors (visitors)	15% of total
Class 4 Inspectors (Junketer)	30% of total
Class 5 Inspectors (expert)	40% of total

That wouldn't be half bad if the frequency were completely reversed. It's a pleasure to know that some of them can get a vacation—maybe we'll be an Inspector some day, and we wouldn't want a complete halt called on that sort of thing!

Let's see, what do we need—statement of the problem; method of procedure (plan); put plan in action. (PK will be horrified at anything so simple as that for an outline.) In this case the plan and putting the plan in action may be considered one and the same.

‡Article received as an anonymous contribution.

Plan for Distribution of My Time to Be Devoted to Inspectors (Days Per Month)

CLASS	1ST QUARTER*	2ND QUARTER*	3RD QUARTER*	4TH QUARTER*
1	1.0	2.0	2.0	1.0
2	.005	.000	.000	.01
3	.0005	.005	.005	1.0†
4	.005	.000	.000	.005
5	.000	.000	.000	.000

*Calendar year.
†Practically any amount if talk is of duck hunting.

Test Smokes—This summer the Regional Office sent out orders to use test smokes to check lookouts for alertness in detection, accuracy in location and size of smoke, but mostly for attention to the job.

In using these test smokes several difficulties have been encountered. Because of the fire hazard, a method which would be both safe and practical and at the same time give a fair test to the lookouts had to be devised. It has been a considerable problem to make a smoke that will rise above the tree tops and still be safe. If there isn't enough heat under the smoke it will condense before it rises high enough to be seen.

I tried several different methods this summer, and found that the most satisfactory results were obtained by using a barrel from which the top had been removed, and in the side of which a four-inch hole had been cut about two inches from the bottom. Over this hole I had a tight-fitting door hinged. This was the draft opening. Then I placed a piece of stovepipe, which had been punched with half-inch holes three inches apart, across the bottom of the steel barrel with one end against the draft opening. By opening or closing the door I could control the heat.

It was difficult at first to find fuel that smoked sufficiently and still had heat enough to lift the smoke above the tree tops. I tried used motor oil together with green boughs, but there was so much gas in the oil that it caused the fire to flare up and didn't send out an even volume of smoke.

After experimenting a while, I found that the best results were obtained by using motor oil and a small quantity of dry wood, then placing the green boughs on slowly enough to keep the blaze down and an even supply of smoke rising continuously. Placing a blow torch at the draft opening will increase the volume of smoke.

In order to manage the barrel easily, I fastened a handle on each side of it, about half-way down. Then I cut a lid of heavy tin to fit the top of the barrel. When I got through with one test smoke, I loaded the barrel into the truck and started to another location with the fire all ready to make another test. The bottom of the barrel stays cool, so danger of setting the ground afire is very low, and the barrel is easily transported in a truck without burning the truck bed or scattering sparks. The heavy, tight fitting lid and tightly closed draft make truck transportation a safe and quick method of carrying the barrel from one test to the next.—*R. C. Paullin, Ranger, Cabinet National Forest.*

FOREST FIRES IN EUROPE

C. E. RACHORD

Assistant Chief, Forest Service, Washington

What a contrast there is between man-caused fires in America and in Europe! Here, wild land continues to be abused by the same deep-rooted carelessness with fire which has largely converted our heritage of forested land into wreckage; there man-caused fires are almost unknown. How did they get that way, and how can we promote the formation of habits such as the author found in European countries? We do not enjoy the favorable climate and close utilization of those countries. We are compelled to try to make up for those deficiencies by introducing the human habits so common in Europe, where they are less necessary than here.

Sixty-two and one-half hectares (156 acres) burned over in three years!

That was the answer given by one forester to my question regarding fire control in one European country.

Space does not permit a description of the condition in each country through which we traveled which would enable one to reach a fair conclusion on how they got that way in fire prevention in Europe. I shall therefore have to resort to some broad generalizations (Mr. Silcox says "all generalizations are dangerous, including the one I'm making") on Germany, Denmark, Sweden, Finland, Austria, Hungary, and Czechoslovakia.

In the first instance we should remember that these countries are operating stands of timber of the second, third or fourth generation. In other words, practically all timber land has been cut over from two to four times, except those areas reserved from cutting for special purposes. This means there is little inflammable material resulting from old age and decay. I saw nothing comparable to our mature or overmature stands. Utilization in one way or another is complete. Tops and limbs are removed for fuel or paper pulp purposes. Needles, twigs, etc., are needed and removed by farmers for fuel or stable bedding. The result is a clean forest floor, except in cases where the deposition of litter is essential to a restoration of soil fertility, and in the more remote sparsely settled regions. While there may be some, I saw no areas of a heavy understory of brush, although young plantations, and they are numerous, are the nearest approach to what we might term high danger areas.

One is impressed with moisture conditions. I saw only one forest where moist earth could not be seen or raised with a slight scraping with the toe of the shoe. While I have no voluminous weather data to support the conclusions, the impression gained from discussions with foresters was that the long protracted dry periods we experience are seldom encountered. Normal precipitation is high in comparison with that in much of our forest

areas and much more evenly distributed through the months of high temperatures (which, by the way, do not approach our highs). High winds at certain seasons are prevalent and might be a serious factor if other conditions were more favorable to fire. We saw numerous windfalls, but a wind-felled tree, occurring on areas too heavily cut, is promptly removed. Wood being the basic resource of most of these countries, waste is unthinkable.

Even though debris is not allowed to accumulate, except on the areas mentioned, and even though climate is favorable, these, in my judgment, are not the main factors responsible for small fire loss.

Due to the dense population in most forest areas, and intensive forestry practices with a very large forest personnel, a fire has little chance to spread once it gets started. On one area of 10,000 hectares there were 150 families, 10 lookout towers manned, and 10 rangers with an overhead of 3 men. This area was reported to be a dangerous one from the standpoint of fire, but the five fires during the past three years burned a total of three and one-half hectares.

The average European as I know him has a great respect for laws. He believes laws were passed for specific purposes, and as a good citizen he tries to obey them. He has been taught for generations that fire not only injures himself, but is a menace to the commonwealth. I heard of no incendiaries. Then, too, law enforcement is quick and sure even on the man who does his best to prevent fire from getting away. To keep in good standing in a community and retain the friendship of his neighbors he must not be responsible for a fire doing damage to his or his neighbor's or the State's property. This deep respect for law and order is reflected in the habits of country folk and city man alike. Seldom do you see the accumulation of waste around farm buildings.

Pride in appearance of home is evident as one traverses the countryside. I use the word waste advisedly. You may find the stable attached to the house, and both solid and liquid materials fully conserved, with their odor permeating the household, but, considering the economic importance, it is not waste and is seldom unsightly. A walk in the parks of the cities will also impress one with order and neatness. Seldom do you see litter of any nature scattered over these areas.

The habit of depositing a burned match, butt of cigarette always extinguished, an empty cigarette package, a discarded newspaper, etc., in a proper receptacle conveniently located, impresses one so forcibly that you find yourself doing the same thing. And I expect this habit is so ingrained in the average citizen that he *thinks* before he discards a match or burning

tobacco when he is out in the woods. My lesson was learned in the city of Breslau when a little boy of seven quietly walked over, picked up and deposited in a receptacle a match I had pinched out and discarded in the gutter.

So in answer to Mr. Headley's question of how Europe gets that way:

(1) Deep-rooted habits of neatness and order.
(2) An ingrained respect for laws and their strict enforcement.
(3) Complete utilization of what we consider waste material.
(4) The absence of inflammable material on the forest floor.
(5) Favorable climate.

But all of this has not come about in a short space of time. It is the result of the pressure of economics—generation after generation of training to obtain a national viewpoint, and an inherent love of trees.

Preservation of Water Containers—A great deal of trouble has been encountered by the rusting of water containers used in fire control work. A 5-gallon water can cost us $2.70, so a rust preventative measure at a nominal cost would soon pay for itself. It was found that there are two methods of preventing rust on the inside of water cans: (1) the use of a rust preventative solution; (2) painting or coating the inside of the can with a preservative.

A rust prevention solution known as Anti-Rust can be secured at $2.95 per gallon in 5-gallon pails and $2.55 per gallon in 55-gallon drums. One gallon of Anti-Rust will treat approximately 60 to 75 gallons of water. The solution is not harmful, but is not recommended to be used in connection with drinking water, as it would affect the taste of the water. Anti-Rust is manufactured by the Radiator Specialty Company, Charlotte, N. C.

The cost of this solution is too high for practical use where a great deal of water is used for fire control.

Coating the inside of the water can with aluminum paint is much more practical and will aid in lengthening the life of the water cans a good deal. Before painting the inside of the can, it should be carefully cleaned by removing any rust spots with steel wool, washing the interior of the can with gasoline then with warm soapy water, and finally rinsing with fresh water and thoroughly drying it. The interior and the outside bottom of the can should then be given two coats of aluminum paint at 24-hour intervals. The outside flange of the lid where contact with the can is made should be wiped with a clean oiled rag at least once each month, or whenever the cans are used and refilled. One pint of common aluminum paint, at 24 cents per pint, will treat about four 5-gallon cans. It has been found that this nominal expenditure for coating the inside of the can is well worth while.—*Gerald S. Horton, Forest Supervisor, Shawnee National Forest.*

LOADING ARRANGEMENT OF FIRE TRUCK

KENNETH B. POMEROY

District Ranger, Oconto District, Nicolet National Forest

A Chevrolet 1935 long wheelbase truck is used as a fire truck on this district. The inside dimensions of the truck stake platform are 6 feet 9 inches by 11 feet 9 inches.

The loading arrangement is shown on the attached sketch and more fully described as follows:

1. A box 24 inches wide, 20½ inches high, and 6 feet 6 inches long which contains all of the 20-man cache tools and equipment, except the eight 10-gallon milk cans and the eight back-pack pumps. By a neat and orderly arrangement all of the tools and equipment can easily be placed in a box of this size. The box is well constructed, braced and painted, and provides seating space for five members of the crew.

2. A box containing a Pacific Marine Pumper sets on top of the tool cache. It has rope handles, and is easily pulled over on to the milk cans upon arrival at a fire so that access can be quickly had to the fire hand tools. Alongside of this box is a sealed box containing the pumper tools and accessories.

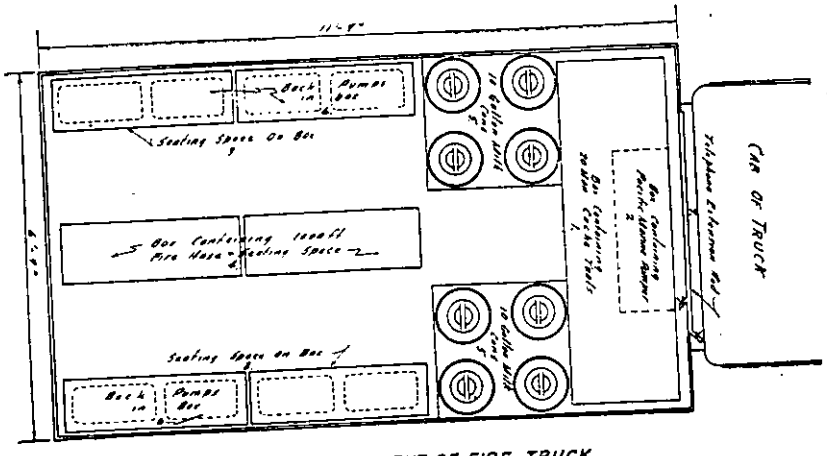
3. Two boxes 11½ inches wide, 18 inches high, and 6 feet 10 inches long, constructed with 1-inch sides and a 2-inch thick top which is hinged. These boxes provide seating space for eight men of the crew. In these boxes are placed the eight back-pack pumps set on rubber cushioning made of old tire tubes; the burlap bags used on grass fires are packed around these pumps. With this arrangement, the same eight cans were used throughout the season without any damage to any of them.

4. A box 18 inches wide, 18 inches high, and 6 feet 10 inches long constructed with 1-inch sides and ends and with a 2-inch thick top which is hinged. This box contains from 1000 to 1200 feet of 1½-inch fire hose, and provides seating for six or seven members of the crew. (300 to 500 feet of hose are carried in the forward end of the truck between the 20-man cache and the stakes of the truck.)

5. Shows the arrangement of the 10-gallon milk cans.

6. Shows the arrangement of the back-pack pumps in the two boxes numbered three.

7. Shows the telephone line extension rod. Two brackets with straps through the loops hold the rod securely in place. The portable telephone is carried in the truck cab.



LOADING ARRANGEMENT OF FIRE TRUCK
OCONTO RANGER DISTRICT
NICOLET NATIONAL FOREST

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and that no paragraphs be broken over to the next page.

The title of the article should be typed in capitals at top of first page, and immediately underneath it should appear the author's name, position and unit.

If there is any introductory or explanatory information it should not be included in the body of the article, but stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Text for illustrations should be typed on strip of paper and pasted on back of illustration. All diagrams should be drawn with the type page proportions in mind, and lettered so as to reduce well. In mailing illustrations, place between cardboards held together with rubber bands. Paper clips should never be used.

The approximate position that illustrations bear to the printed text should be indicated in the manuscript. This position is usually directly following the first reference to the illustration.

(OAKLAND-2-1-37-6000)