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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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 techniques may be communicated to and from every worker in the field of forest fire control.

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Volume 7 Number 3

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the

TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire-fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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Forest Service, Washington, D. C.

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USING BLOODHOUNDS TO PREVENT FOREST FIRES

D. W. Beck

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Many fire-control men have felt the urge to use bloodhounds to find persons guilty of causing forest fires. Relatively few, however, have actually employed them and determined their value in fire control. Some men hesitate for fear of public opinion or the possibility that grudge fires may follow use of dogs. Others point out that evidence obtained in this way is not admissible in court. Still more just don't like dogs or understand them.

Dogs on the Job

In certain areas bloodhounds have been used enough to prove their worth in fire prevention. Their chief value is in reducing the number of incendiary fires. Dogs may trail and find the guilty persons or scare them so thoroughly that they will start no more fires. In many areas the very fact that fire-control men have a bloodhound available reduces man-caused fires. In the Eastern National Forest Region dogs have been used with marked success on the Monongahela National Forest in West Virginia and on the Cumberland National Forest in Kentucky. The State of West Virginia has also used hounds successfully in reducing fires in the hot-spot southern section of the State. Good results have also followed the use of dogs on the Ouachita and other national forests in the Southern Forest Region. In every case public comment on the successful conclusion of a case has been, "It served him right," or "Now they really mean business."

A few successful fire-law-enforcement cases where the dog finds the suspect do much to increase the prevention value of the hounds. On the other hand, some hard-luck cases (and anyone who uses hounds will have them) will lower respect for the dog. A good dog has a 50–50 chance of pointing out a suspect. Hot, dry weather conditions and old trails work against him. He needs a sure starting point, and it should not be held against him if more than one man passed that point.

Shall We Use Dogs?

Several considerations, including the local point of view, must enter into the decision of the fire-control man to use bloodhounds. Do the persons who start the fires travel by foot? Are they local people or "outsiders"? Can the proper man be found to train, handle, and care for the dog? How can the most favorable public reaction to use of the hound be obtained? What weight will be given the dog's evidence in local courts?

A bloodhound is not a substitute for a well-trained investigator. Very few court cases have been won on the hound's evidence alone. The dog will do his part in most cases by following the trail to the man or to the point where he leaves no trail. His trailing will indicate who the suspect is and give reasonable assurance that the man was

English bloodhound Texas Black Sam with Fire Control Assistant Ledford Perry at Buck Knob Lookout, Laurel District, Cumberland National Forest, Ky.

at the point where the hound picked up the trail. Once the suspect is determined, it takes hard work and properly timed action to get all the facts for a court case. With the information supplied by the dog's trailing, the investigator can usually do the rest of the job.

Bloodhounds are not infallible; they differ even as people do. Some have a good nose, some don't; some work slowly, some fast; some will work with anyone, some only with a trainer who can handle them. All work better with a person to whom they are accustomed. Give the dogs every possible "break" on their first few cases and so help to build local respect for their ability.

If the decision is made to use the dogs, the job must be a thorough one. Very few dogs are suitable for fire law enforcement. Training is even more important than pedigree, but dogs purchased for a fire job should have both. Experience in using bloodhounds on the national forests in Arkansas, West Virginia, Virginia, and Kentucky shows that the best results are obtained by purchasing dogs 3 to 5 years old with at least 2 years' intensive training in trailing. Good dogs usually cost from $100 to $200.

Care of Dogs

Dogs require good care, good food, and a comfortable kennel with a good, well-fenced yard. They should have fresh water at all times. Straw should be changed at least every 2 weeks and the kennel kept clean. They should be washed with flea soap regularly and should be inoculated for rabies and examined for heartworms annually. Dogs should be wormed when necessary. Keep the public away from the kennel. Accustom the dogs to working with a local man. A man who does not like dogs will not do a good job. A trial run once or twice a week during periods when the dogs are not being used will keep them in good condition.

Trailing

Bloodhounds are trained to follow men. They will not follow a horse and cannot trail a man if he gets into a car. A great many cases end for the hound where a car has been parked. From this point on, the investigator must use other methods.

Dogs differ in their trailing methods. Some get the scent from bushes or even through wind currents. Such dogs sometimes short cut the exact trail. Some trail with nose to the ground, tail high. Most of them are difficult to hold, particularly on a downhill trail or through bushy or rough areas. Some dogs bay on the track; some trail silently, depending on their training. A silent trailer is preferable for obvious reasons.

When dogs are taken from the kennel for a chase, they should have both harness and collar in place. The leash should be attached to the collar until the dog is ready to trail. Hold the leash close to the dog's neck to prevent trailing until the desired starting point is reached. When trailing, change the leash from collar to harness and point or show the dog the starting point. Then take it easy and he will soon strike out on the trail. Some dogs get car sick. It is best not to feed them just before they are expected to work.

Local Requests for Use of Dogs

Frequently there are requests for the dog's services in work other than fire cases, once he has shown that he can work out a trail. Forest Service dogs have found persons lost in the woods. Calls are received from local police officers for the use of the dogs in cases involving everything from murder to theft. To assist in these cases on request takes the dog and handler from their regular duties. A local policy must be developed for handling these requests.

Summary

If the fire control administrator decides to use bloodhounds to clean up hot-spot areas, he should buy the best trained dogs obtainable. The best possible man should be hired to handle them. It is important that the dogs be given every advantage on their first three or four cases. They should have a good starting point. If the fire control man takes the attitude that every possible means must be used to stop fires from starting, public reaction will be favorable. Additional work will be needed to close each case satisfactorily after the dogs do their part. It must be recognized that dogs will not do the whole job and that other prevention methods are still required.

In most cases the use of dogs markedly reduces man-caused fires in areas where they have been numerous.

THE FOREST SERVICE ADOPTS FM RADIO

Harold K. Lawson

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If you are planning to install radio communication or to expand or revise your present facilities, you will be interested in the following discussion of the FM radio equipment which the U. S. Forest Service has adopted.

The form and characteristics of the new equipment are not described in detail. It is of interest to know, however, that the portable and mobile equipment is being designed to incorporate two fixed transmitting frequencies and only one fixed receiving frequency.

Many radio communication failures are due to equipment manipulation—especially the tuning of radio receivers. A fixed tuned receiver completely eliminates the possibility of maladjusted tuning or stand-by on the wrong frequency, both of which are prime causes for radio communication failures. It also eliminates all tuning knobs and controls and brings radio nearer to the simplicity of the telephone.

Methods of obtaining maximum radio network performance and traffic handling capability with a minimum number of frequencies, by use of the equipment now under development, will be discussed in a future issue of Fire Control Notes.

Forest Service communication officers and others have asked why the Forest Service radio equipment program did not follow the current trend in the use of frequency modulation (FM). In the first place, amplitude-modulated (AM) sets cannot communicate directly with FM sets, and our present investment in AM equipment must be considered before this equipment is isolated from our communication systems. Also, until very recently it has not been possible to produce truly portable FM radiophones because of their bulk and inherent complexities. Forest Service radio use is so intimately tied to portable communication service that, regardless of any advantages, FM could not be considered until portable equipment development was an assured fact. New techniques, parts, and materials now make it possible to produce portable FM radiophones.

Practically all commercial development of emergency service radio equipment is now centered in the FM field. Many law enforcement and similar agencies which formerly used AM have changed over to FM. Because of these facts and the technical advantages of the new system, we have swung our VHF radio development program over to FM. This decision is of major importance in our communication planning and execution.

A brief resume of facts relating to the subject of AM–FM follows:

1. Under identical conditions of frequency and power, FM radio waves travel in an identical manner and both will have the same effective strength at a given distance from the transmitter. In other words, under identical conditions, one is transmitted as effectively as the other.

2. Under conditions of absolutely noise-free radio station locations the effective communication range of the two systems will be nearly identical.

3. Under conditions of strong natural or man-made electrical interference FM signals are usable when AM signals may be completely drowned out by noise.

4. Precipitation or rain static that can completely disable an AM radio system is not heard on FM equipment.

5. The interstation noise-silencing system (squelch) on an AM radio receiver is subject to false operation by electrical noise and static bursts and allows blasts of noise to issue from the loud-speaker when the receiver is on stand-by. FM squelch is almost entirely free of such false operation. This factor allows noise-free stand-by in mobile service and in offices and similar installations where the usual loud-speaker background noise is objectionable.

6. Certain technical characteristics of an FM radio receiver make it possible to produce simpler and more reliable automatic radio relays or repeaters with this system than are possible with AM.

7. Manipulation of FM and AM equipment is practically identical, and no new operating problems arise from change of system.

8. Radio operating frequency distribution as between districts, forests, and regions will, at least for the present, remain as for AM. Further experience with FM may point to the possibility of closer geographic frequency repetition than is possible with AM, but this must await confirmation through use.

9. Basic equipment types will not be altered in the change-over to FM. We will continue with portable, semiportable, mobile, and repeater types of equipment. The user will not find any unusual differences in the two systems, and the net gain will be apparent only as a sum of the individual improved characteristics, which in turn will mean an over-all improvement in quality and reliability of service.

10. The change-over to FM affects only our VHF equipment. Our MF and HF frequency bands, which employ equipment types such as SPF and M, will remain the same.

We are still forced to carry out our own development and design of portable units, but we hope that much of our mobile and fixed station equipment can be obtained from commercial sources at less cost than that for custom-built items. Cost of the new equipment can only be estimated roughly, but should not vary greatly from that of comparable AM types.

The radio laboratory cannot possibly complete all items of equipment in time for contracted production in 1946. It will accordingly concentrate on the portable design in an attempt to be ready for quantity production by January 1, 1947. In the meantime, an attempt has been made to interest commercial concerns in some modifications of their standard mobile equipment to meet our needs. Other items, such as lookout radiophones and repeaters, will follow.

Transition will be based on removal of AM from one area to supply the needs of other areas and replacement of the shifted equipment with FM. This will prevent immediate obsolescence of usable AM equipment by concentrating it in selected areas that have an appreciable amount of AM equipment and need additional units. The logical starting point for introducing FM should be an area in which adjacent district, forest, or regional intercommunication is a minor factor and which has a reasonably well self-contained radio net.

Such a program will allow correction of certain undesirable radio equipment distribution problems which may now exist. At the same time, full opportunity should be taken to carefully plan equipment choice and distribution for the new networks. There are bound to be conflicts in this process before the entire AM system is liquidated by age and obsolescence, but there is no reason to discard usable AM sets immediately. A small amount of new AM equipment may be necessary in some instances, but every effort will be made to keep such purchases at a minimum.

Airborne Cooperation in Region 2.—Forest fire cooperation has reached a new high on the Harney National Forest, where Ranger Everett A. Shipek reports the following:

"Harry D. Putnam, Forest Fire Warden at Burdock, S. D., uses his private plane, a Cub J–3, to spot and suppress forest fires. While in Dewey, S. D., June 29, Putnam, a veteran of the American Air Force, received word of a fire on the Elk Mountain District of the Harney National Forest. Taking a local man with him and picking up fire tools at Dewey, he scouted the fire with his plane. Landing in a field within one-half mile of the fire, the two men controlled the 0.2 acre lightning fire within a few minutes. Warden Putnam's plane is an important factor on this portion of the forest where the high hazard makes minutes count in fire control."

THE PROFILING SLIDE RULE AND ITS USE

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Ranger, Yellowstone National Park

The potential value of a slide rule in checking the intersection of a line of sight with distant topography in making visible area maps was first brought out by Rudolph Stahelin in 1932.[1] Techniques were developed and perfected to put the slide rule to work in field sketching of visible areas by the California fire research group in 1932–35 and have been fully described in published material.[2]

District Ranger Albert D. Rose, of Mount Rainier National Park, helped to develop the original rule and made many tests with it while he was fire dispatcher. He found that a fire can be located in from one-third to one-half the time required by graphic profiling and that errors due to paper distortion and incorrect plotting of the vertical angle are eliminated. The following statement from Mount Rainier National Park is based on 6 years of thorough trial: "The accurate and rapid results obtained in plotting fire locations by use of the profiling sliding rule * * * has convinced us at Mount Rainier that it is the most reliable instrument available for such purposes."

In recent years the technique has been neglected. The author brings the method to attention again and shows how it may be adapted to regular lookout use by means of a specially constructed slide rule. The technique is necessarily limited to areas for which reasonably accurate topographic maps are available.

Locating "One-Shot" Fires

The profiling slide rule described in this article provides a speedy and accurate solution for a difficult fire problem. Rugged topography or poor visibility may make it impossible to observe a forest fire from more than one lookout station. The lookout observer usually has little to guide him in judging how far away the fire is. Photo-transit pictures are useful, but often inconclusive. If a good topographic map is available, a profile of the terrain can be constructed to determine where the line of sight intersects the ground. This can be done in two ways; graphically, with varying accuracy and loss of valuable dispatching time, or mathematically. The profiling sliding rule, developed at Mount Rainier National Park during the 1938 fire season, makes the mathematical solution practical by simplifying the necessary calculations. It has proved satisfactory for locating "one-shot" fires, checking doubtful triangulations, training new lookout men, and making seen-area studies.

[1] Stahelin, R. Visibility maps constructed with the slide rule. Jour. Forestry 30: 983–987, illus. 1932.

[2] Show, S. B., Kotok, E. I., Gowen, G. M., Curry, J. R., and Brown, A. A. Planning, constructing, and operating forest-fire lookout systems in California. U. S. Dept. Agr. Cir. 449, 56 pp., illus. 1937.

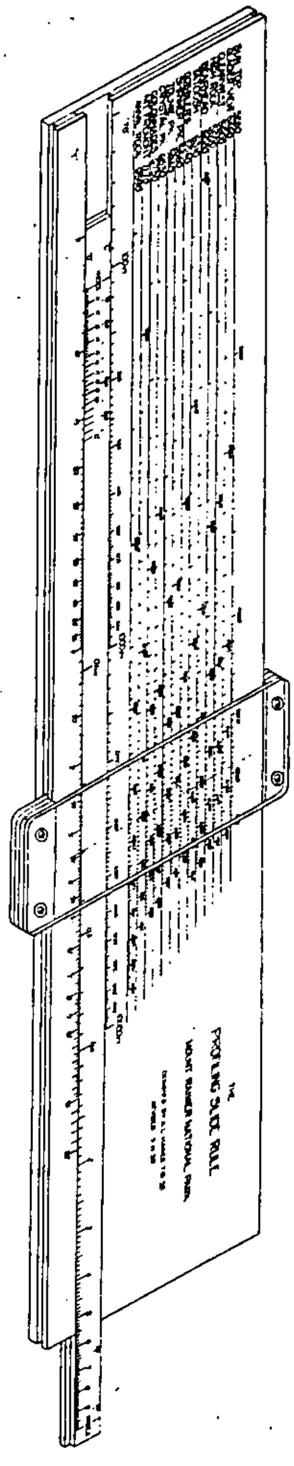
Description of the Profiling Slide Rule

This specialized instrument is designed for use by men with no knowledge of the theory or operation of slide rules. It is 32 inches long by 6 inches wide. The large size is not a disadvantage in a purely office instrument. The body is built up of three layers of 3/16-inch "Masonite" board worked to size with a saw and rasp and joined with waterproof glue and a few brads. The slide is 1 inch wide and is built up of two layers. Wood is not satisfactory for the construction of the slide rule, since shrinkage or warping will cause the slide to bind.

The three working scales, the tangent T on the lower limb, the distance D on the slide, and the tangent-offset TO on the upper limb are logarithmic. Each is composed of three cycles, with the first cycle beginning at the normal position of the left index. The length of the cycles allows graduation of the scales directly from logarithmic tables of numbers and angular functions.

The scales are graduated as follows: Tangent T graduation marks are placed by reference to a table of logarithmic tangents of angles. The mantissa of the value is multiplied by 10 and scaled off as inches from the left end of the cycle in which the graduation mark belongs. For example: The mantissa of the log-tangent of 5 minutes is 0.1627, which, multiplied by 10, places the 5 minutes graduation at a point 1.627 inches from the left end of the first cycle. Graduation marks are placed at 1-minute intervals from 5 minutes to 1°; at 5-minute intervals from 1° to 5°; at 10-minute intervals from 10° to 15°; and at 1° intervals on up to 20°.

Distance D graduation marks are placed by reference to a table of common logarithms of numbers. The procedure followed is the same as in graduating the tangent scale. The first cycle is graduated at 0.2-mile intervals from 10 to 15 miles; at half-mile intervals from 15 to 20 miles; and at 1-mile intervals on up to 25 miles. The second cycle is gradu-



ISOMETRIC VIEW

ated at 0.1-mile intervals from 0.1 to 1 mile, and the third cycle is graduated at the same interval from 1 to 10 miles. The left and right indices occupy the positions of the 10-mile graduations.

Tangent-offset *TO* graduation marks are placed by reference to the same table used for the distance scale. However, the tangent-offset scale is shifted to the right until the point 52.8 is opposite the normal position of the left index. Thus it becomes a scale of foot equivalents of miles. Graduation marks are placed at 10-foot intervals from 40 to 1,000 feet and at 100-foot intervals from 1,000 to 10,000 feet.

In addition to the distance scale on the slide, there is a scale of corrections for curvature and refraction C. The correction scale graduations are placed from the formula, $D=\sqrt{\frac{C}{0.574}}$, where D is the distance scale graduation opposite which the correction graduation C is placed. For example: To find the point on the distance scale at which the 25-foot correction mark is placed, $D=\sqrt{\frac{25}{0.574}}=6.6$ miles. Graduation marks are placed at 25-foot intervals from 25 to 200 feet and at 50-foot intervals from 200 to 300 feet.

A series of profile elevation scales on the upper limb are in effect a reference table in graphic form. The profile elevation scales are graduated by subtracting the tangent-offset scale values from the elevations of given lookout stations. For example: The 9,000-foot graduation for the Anvil Rock Lookout is found by subtracting 9,000 from 9,590, which places the graduation mark opposite 590 on the tangent-offset scale. Graduation marks are placed at 100-foot intervals on all profile elevation scales.

The slide rule is completed by a large cursor of heavy transparent plastic with "Masonite" runners. A vertical hairline inscribed on the cursor aids in reading the profile elevation scales.

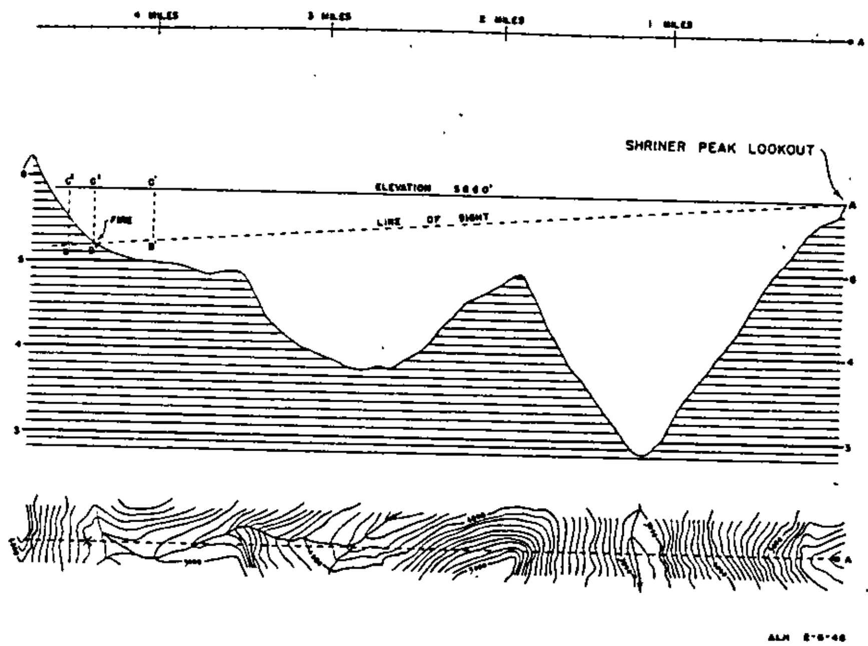
Operation of the Rule

The profiling slide rule determines the location of a fire by a method of approximation based on a trigonometric relationship of simple right triangles, $a=\tan A\times b$. Briefly, the tangent value of the vertical angle is multiplied by the estimated horizontal distance to obtain the tangent-offset or difference in elevation. That value subtracted from, or added to, the height of the lookout station gives the elevation of the point observed with reference to sea level. The elevation thus found is compared with the map elevation at the scaled distance and, if they do not agree, it is apparent at once that the estimated distance is wrong. The estimated distance is then adjusted in a direction which will tend to bring the values into agreement and a new solution is obtained. The second or third approximation will usually locate the point as closely as the topographic map will allow.

A typical problem is worked out below. It is assumed that the fire can be seen from a single lookout station, Shriner Peak. The lookout has given the dispatcher an azimuth, a vertical angle, and an estimated distance. The problem is to determine the position of the fire with the aid of a topographic map.

A tentative elevation is obtained on the profiling slide rule by setting the right-hand index of the slide opposite the vertical angle of −1°38′ and moving the cursor until the hairline lies over the estimated distance of 4 miles. The profile elevation of 5,250 feet is then read from the intersection of the hairline and the Shriner Peak scale. A difference of 250 feet exists between the profile elevation and the map elevation at the same distance, indicating that the estimated distance is not correct.

The profile elevation is higher than the map elevation, so it is necessary to extend the estimated distance to bring the line of sight to ground. A second approximation is therefore made by moving the cursor to 4.5 miles. The new profile elevation of 5,180 feet is lower



The method of approximation used on the profiling slide rule to locate a fire. Vertical angle, −1°38′. First trial: AC^1, 4 miles; C^1B^1, 610 feet; elevation of B^1, 5,250 feet. Second trial: AC^2, 4.5 miles; C^2B^2, 680 feet; elevation of B^2, 5,180 feet. Third trial: AC^3, 4.35 miles; C^3B^3, 660 feet, elevation of B^3, 5,200 feet.

than the map elevation at the same distance; the estimated distance used is too long. A third aproximation using 4.35 miles gives a profile elevation of 5,200 feet which checks with the map elevation at that distance. The fire is located as closely as possible with the available topographic map.

In this case the distance used is not great enough to make the correction for refraction and curvature of the earth necessary. If a distance greater than 5 miles is employed, the correction should be made by mentally adding to the profile elevation the value of the *C* scale graduation lying nearest the hairline of the cursor. In setting the slide for a solution, the right-hand index is ordinarily used for distances of less than 10 miles and the left-hand index for distances over 10 miles.

A check-back should be made on intervening ridges that might cut the line of sight. Otherwise an erroneous location of the fire might be made. In any case where the clearance is slight, a check should be made with the lookout and the vertical angle carefully verified. Check-backs are made rapidly by sliding the cursor to the scaled distance of the ridge and reading the profile elevation against the map elevation. The profiling slide rule will not locate a fire, however, if the base is not directly visible. Such a fire cannot be located by any method of profiling.

Other Uses

In addition to its use for locating fires observed from only one lookout station, the profiling slide rule can be used to check doubtful triangulations. It frequently happens that one fire lookout can see the base of a fire, while another one can see only the smoke rising from behind a ridge or other obstruction. The triangulation may be in error if the smoke drifts for a distance before it becomes visible. This can be detected by employing the profiling slide rule to check the data supplied by the station with direct observation.

The profiling slide rule can also be used for making seen-area maps, either in the field or in the office. In the field the slide rule is used in the manner already described to interpret data obtained with a transit, plane-table alidade, or clinometer. A sheet of grained acetate film base taped over the profile elevation scales can be graduated quickly for both plus and minus angles from the point occupied. Erasures are readily made on such a surface. In the office the operation is changed slightly. The blind area behind a ridge is found by first setting the cursor against the map elevation (less the correction from the *C* scale), and then moving the slide until the scaled distance of the ridge lies under the hairline of the cursor. The vertical angle of the line of sight is thus established, and the solution proceeds by the method of approximation already described until the outer edge of the blind area is found. An experienced operator can complete an accurate seen-area study to a 15-mile radius in an average of 8 hours of working time.

HOW MUCH TIME DOES IT TAKE TO CATCH A FIREBUG?

HENRY SIPE

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The question frequently arises: How much time is required to investigate the origin of a fire to determine beyond a reasonable doubt who caused it? It comes up when analyzing the work load of any unit involving fire prevention. It is important when making actual work plans for personnel who are to do the fire prevention jobs.

Fire control men agree that the causes of fires must be known if adequate plans are to be made to prevent future fires. It must be known not only that a "smoker" caused the fire, but *who* was that smoker. Reprimand, payment of damages, or legal action must follow if full prevention value is to be obtained. The amount of time required to establish accountability for fires varies greatly. To secure data based on actual fires, the writer summarized the time spent by rangers and guards in law enforcement on the Cumberland National Forest in Kentucky during 1945. This time-study was carried on while making current diary summaries and checks on all kinds of work performed during the year on four ranger districts. The basic data in man-hours are given in Table 1.

TABLE 1.—*Man-hours spent in law enforcement on 51 fires on the Cumberland National Forest in 1945*

District	Number of fires	Office		Field job		Field travel		Total	
		Year's total	Average per fire	Year's total	Average per fire	Year's total	Average per fire	Year's total	Average per fire
		Man-hours	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*
A	12	23	1.9	149	12.4	62	5.2	234	19.5
B	7	5	.7	44	6.3	36	5.1	85	12.1
C	6	4	.7	108	18.0	39	6.5	151	25.2
D	26	48	1.8	13	5.2	46	1.8	228	8.8
Total or average	51	80	1.6	435	8.5	183	3.6	698	13.7

Table 1 includes 32 hours spent in closing out 6 fire cases which originated prior to 1945. These 6 are not included in the number 51 because there is always a carry-over of cases from one year to the next on the Cumberland. In other words, some of 1945's 51 fires will not be investigated and acted on until 1946, or even later.

The question now arises: How effective was the 1945 work? What was accomplished with the expenditure of the time shown in table 1?

Table 2 shows that in 26 out of 51 cases sufficient clues were uncovered either to open legal action for criminal cases, or to request and receive payment of damages. Civil damages were not collected in the 7 criminal cases, nor was criminal action taken in the 19 "damages collected" cases. Five of the 7 criminal cases were won and 2 lost. It will be noted that there is not a clear relation between the amount of time spent by districts as compared with the number of cases initiated (criminal plus damages). Various factors affect this lack of relationship, such as causes, groupings, ability and thoroughness of individual investigators, press of other work, and plain luck. For example, table 3 shows that smokers were responsible for most of District A's fires—very tough cases to solve. Nearly one-fourth of District D's fires were caused by railroads, which on this forest require little time to investigate; damages were collected on all of them. All personnel were operating under the same policies and instructions, but the writer could discern these variable factors in action.

TABLE 2.—*Results of law enforcement work on 51 fires on the Cumberland National Forest in 1945*

District	Actionable fires	Criminal cases initiated	Damages collected out of court
	Number	*Number*	*Number*
A	12	1	2
B	7	3	1
C	6	1	4
D	26	2	12
Total	51	7	19

Table 3 shows the causes listed on the fire reports. Most of the miscellaneous fires were caused by persons smoking bees or game out of trees or by children playing with matches. A comparison of tables 2 and 3 reveals that the number of smoker and incendiary fires equals approximately the number of cases on which action was not taken; actually cases on nearly all of these fires could not be initiated because of lack of evidence.

TABLE 3.—*Causes of 51 fires on the Cumberland National Forest in 1945*

District	Railroads	Lumbering	Campfires	Smokers	Debris burning	Incendiary	Miscellaneous	Total
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
A				8			4	12
B				3	2	2		7
C	1	1		2	1	1		6
D	6		4	4	1	6	5	26
Total	7	1	4	17	4	9	9	51

Before drawing conclusions concerning the time needed for law enforcement, a number of other factors must be examined. All of the following factors affect the amount of time required to process cases:

1. As mentioned before, most of the time used was spent on the easiest fires to solve. There was not adequate time for investigations because of the press of nonfire work or fire work other than law enforcement.

2. All the criminal cases in the study were brought into county courts; not one went into Federal Court or State Circuit Court. Thus, the long hours necessary to write up and prosecute cases in higher courts were not expended. Some cases should undoubtedly have gone

into these higher courts. In many of the county court cases the defendant voluntarily pled guilty before the county judge or a magistrate.

3. Two men working together will often get better results, but will increase the hours per case. In many of the fires on the Cumberland National Forest only one investigator was used because of lack of time, personnel, etc. In only one or two fires were there more than two investigators.

4. Often the investigator was also the fire boss and could not devote full time to law enforcement. This meant that some travel was charged to suppression.

5. A certain amount of dislike for this kind of work cuts down the time spent.

6. Supervisor and staff time above ranger grade was essential in processing the 51 cases, but is not included in the tables.

7. Some time actually used was probably not entered in diaries from which the statistics were taken. However, most of the men who investigated the fires were contacted personally by the writer with regard to such omissions.

8. In computing a yearly load for a unit, time must be added for investigating false alarms and nonreportable and nonactionable fires, none of which were included in this study. The writer has investigated and prosecuted nonreportable cases that required as much time as reportable ones.

Summary and Conclusions

A summary of these data shows that on the Cumberland National Forest in 1945, rangers and guards spent 13.7 hours per fire to investigate 51 fires and to prosecute or settle 26 of them. Even then, not one true "firebug"—a malicious incendiary—was caught! Eight and five-tenths hours of the 13.7 were spent on actual field work.

The frequency rate for reportable fires dropped below 10 per 100,000 acres protected in 1943, 1944, and 1945. Only in 1945 did the area burned drop below one tenth of 1 percent. As of May 15, 1946, there has been an increase in fires and the number may again go above 10 per 100,000 acres. However, the effect of law enforcement work on reduction in the number of fires is subject to factors not described in this article and must be treated separately.

It is safe to conclude, however, that if every man-caused fire is to be thoroughly investigated, more than 13.7 hours per case must be devoted to the job. Just how much more time will be needed must be determined by further study. Records show that 30 to 50 hours are required to investigate the more difficult individual cases; cases in Federal Court take even more time. The writer's observation is that the 13.7 hours should be doubled at least.

Perhaps more important than attempting to fix a certain number of hours as necessary for the investigation of a fire case is the need for administrators to recognize that *more time* must be allocated to law enforcement activities. When it is realized that some units—as large as States—are "initiating" only one-tenth of their actionable fires, a revision of priorities appears to be in order.

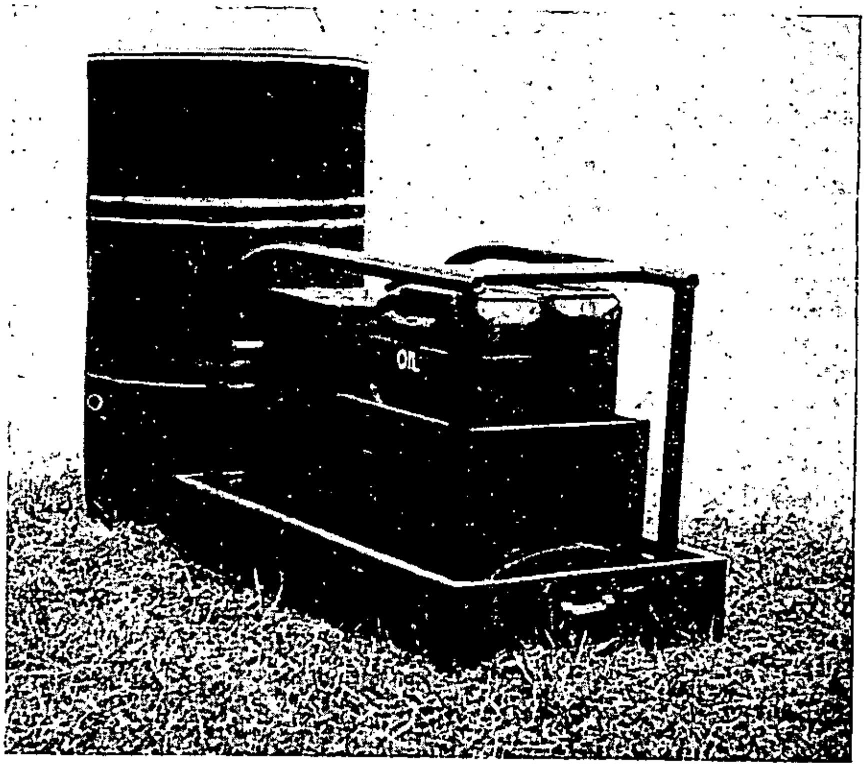
FOREST-FIRE GASOLINE AND OIL KIT

FRED G. AMES

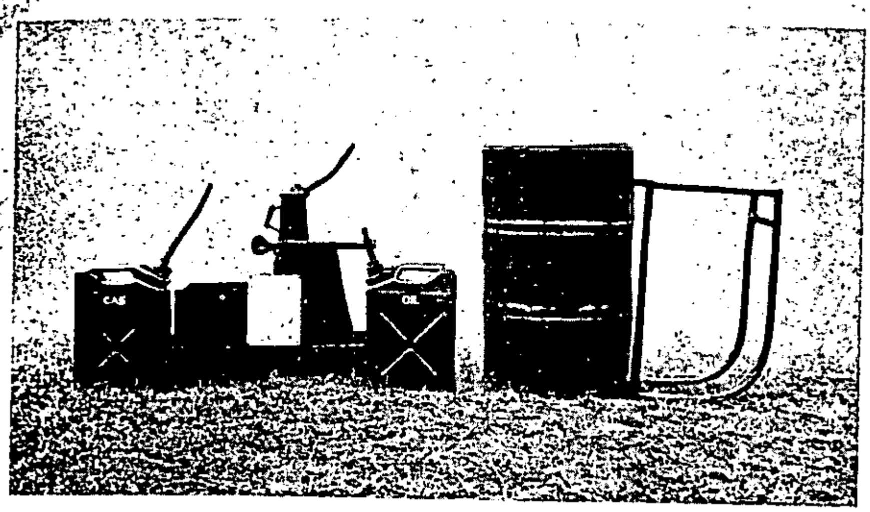
Ranger, Ocala National Forest, U. S. Forest Service

All the items necessary for transporting gasoline and oil to going fires and transferring clean oil and gas to equipment on the fire line are contained in a kit devised by the writer for the Ocala National Forest.

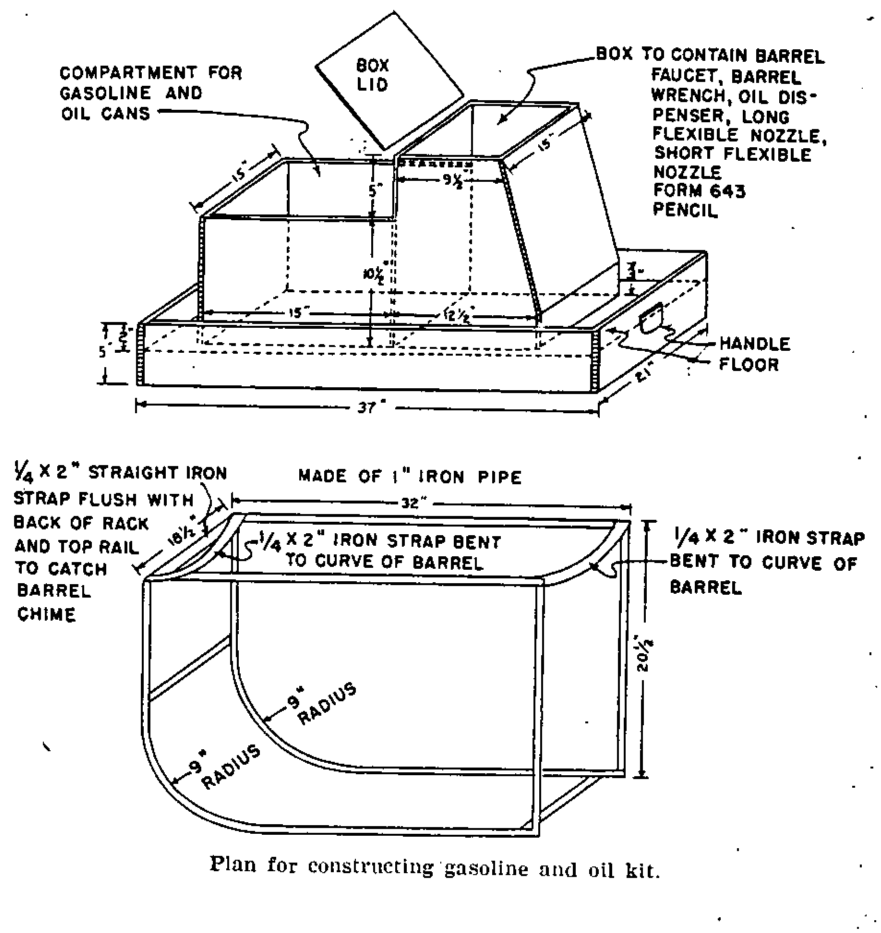
The unit is packed in two parts for transportation: (1) a steel barrel, and (2) cans, barrel jack, and accessories carrier. Two standard 5-gallon Army gasoline cans (U. S. W42, Monark or Nesco, 13 inches wide × 6½ inches thick) are used for the gasoline and lubricating oil, and are packed in the open compartment of the carrier. The use of Army type gasoline cans makes packing very simple. The closed compartment contains a barrel faucet, combination wrench, oil dispenser, one flexible nozzle for the gasoline can, one short nozzle for the lubricating oil can, Form 643 (gas and oil issue sheet), and a pencil. The barrel jack is inverted and placed down over the open



Complete servicing unit packed in two parts for transportation to fire line.



Servicing outfit disassembled to show individual items.



Plan for constructing gasoline and oil kit.

and closed compartments of the carrier and rests in the space between the compartments and the sides of the carrier.

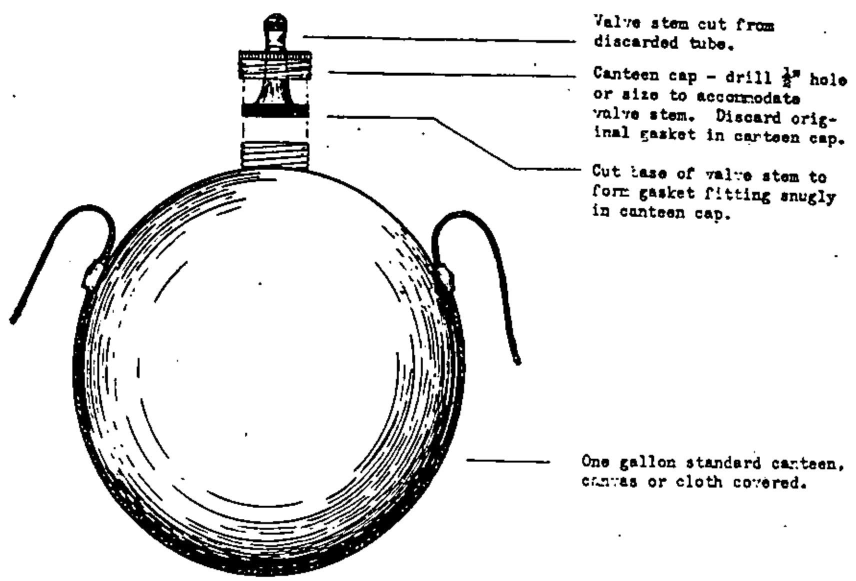
To use the barrel jack, stand the barrel on end and screw in the faucet. Place the barrel jack on end and slip the iron strap on the rear end of the jack under the edge of the barrel (chime), pull the top of the barrel forward until it and the jack are in a horizontal position. The curved runners of the jack serve as a fulcrum.

Gasoline being transferred to Army-type safety can.

METHOD FOR REPAIR OF CANTEENS

DEAN M. EARL

Forest Ranger, Apache National Forest



Purpose: To restore capacity of dented and crushed canteens. To locate leaks for resoldering.

Method: Restore shape and capacity

Prepare a new or good canteen cap as above. Screw snugly onto canteen. Apply air pressure from foot pump or air line. When pressure forces sides back to approximate original shape tap with light hammer to remove irregularities. This can be done without removing cover.

Leaks

Remove cover. Apply light pressure. Place in tub of water. Mark leaks and resolder. Replace cover.

HOT FOOD FOR FIRE FIGHTERS

R. H. Williams

Supply and Transportation Officer, Los Angeles County Department of Forester and Fire Warden

One of the toughest problems encountered in fighting brush and forest fires is the provision of adequate food for fire fighters. The difficulties are varied, depending on the size of the fire and the nature of the terrain. On large fires, personnel are frequently located on sectors remote from the base camp. This increases the responsibilities and problems of the supply officer.

We all realize that fire fighting is an exhausting physical activity. Yet very little progress has been made in improving the physical comfort of the fire fighter. Our fire-fighting facilities have been built up by the development and acquisition of the latest types of equipment, and rightly so. However, we are still largely dependent on manpower; and the best tool in the world is only as good as the operator. Therefore, it is imperative to provide good physical conditions and comforts for our fire fighters.

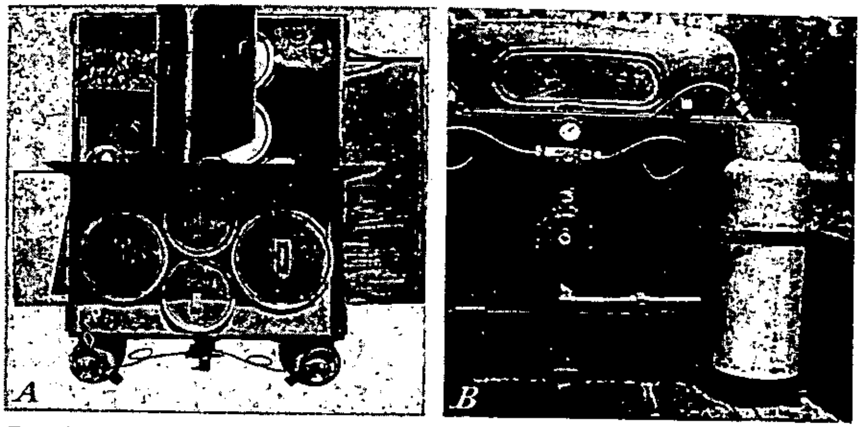
The feeding of personnel on fire-line duty has largely been a secondary consideration. In most cases fire fighters receive little or nothing to eat between the times of departure from and return to the fire camp. To alleviate this condition this department has taken steps to provide hot, nourishing meals to all personnel while on actual fire-line duty.

Portable Army field mess units and the Red Cross doughnut wagons were studied for possible adaptation to this purpose. After much thought and consideration it was decided that a portable unit, based on the steam-table principle, would be the most practicable. This unit was to be a skid type and of a size easy to handle and use on a half-ton pick-up truck. It was also to be capable of carrying food and the necessary equipment for serving approximately 100 men. All food would be prepared at the main camp. Our first construction problem was getting the necessary galvanized sheet iron, which at the time was practically nonexistent on the market. However, with the little material we had on hand, plus the results of a diligent search of used-stock piles, sufficient supplies were assembled for the job. Frank C. Barnes, the department's fire equipment repairman, was assigned to work out a unit based on the steam-table principle.

Some idea of its construction and lay-out may be obtained from the accompanying pictures. The writer will be glad to send interested persons prints showing details of construction of the unit.

One-half of the unit consists of a hot food compartment. This section is double-walled and interlined with ½-inch asbestos sheeting. It contains four stock pots—two 3-gallon, one 6-gallon, and one 9-

gallon. These pots are submerged to about two-thirds of their depth in a chamber containing approximately 22 gallons of water. This chamber is provided with a splash plate and several baffle plates to prevent surge. Actual practice has shown that better results are obtained when the chamber is filled with hot water. The water is maintained at a proper temperature by three gas burners supplied with fuel from two 9-pound cylinders of propane gas. The other half of the unit is divided into two compartments. One, insulated with



Portable mess unit: *A*, view from above showing utensil and cold food compartment, hot food compartment, and the two cylinders of propane gas; *B*, end view showing equipment for maintaining proper temperature of water in hot food compartment.

Compo Board, contains two 3-gallon stock pots for juices; the rest of this compartment is used for storing bread, sugar, salt, etc. The other compartment carries necessary utensils: cups, forks, knives, spoons, etc. All compartments are equipped with night lights connected with the truck electrical system. The over-all dimensions of this unit are: width, 40 inches; length, 48 inches; and depth, 24 inches. The unladen weight is approximately 400 pounds.

We have used this unit on several fires with most satisfactory results. In fact, we believe so sincerely that this type of unit will have a very definite place in our future program that we plan to construct another one for use during the coming fire season.

THE F. B. I. COOPERATES WITH THE FOREST SERVICE IN FIRE PREVENTION

B. F. SEIZERT

District Ranger, Talladega District, Alabama National Forest

In accordance with an understanding reached during the winter of 1945–46, the F. B. I. is increasing its cooperation with the Forest Service in fire prevention and law enforcement. Ranger B. F. Seizert of the Talladega District, Alabama National Forest, reports on action taken by the F. B. I. at the request of the Forest Service. While the action did not result in immediate trials and convictions, it is expected that some will follow. The real test of its value, however, will be the answer to the question, "How much fire prevention did the action buy?" In this respect the report is encouraging.

Since the establishment of national forests in Alabama, the Talladega Ranger District of the Alabama National Forest has had more fires annually than any other ranger district in the State. Sixty percent of the fires have occurred in the south half of the district, which coincides in a general way with a section which has had more incendiary fires than any other spot in Alabama. Division of the Talladega District into two parts in October 1945 still left the old "hot spots" in the south district. But, at the same time, it made possible concentration on fire prevention and law enforcement in those communities where fire occurrence had been high.

During the war the number of fires on the Talladega Destrict decreased. Many forest residents left to work in war plants, and there was less use of the forest by hunters. At the close of the war, however, use of the national forest and adjoining areas increased noticeably. Former forest residents returned to their homes, and the application for hunting permits was large. It was natural to fear a marked increase in fires in 1946.

From January 1 to February 20, 1946, 20 fires occurred, 5 of which were definitely of incendiary origin. On February 20, Assistant Supervisor Swarthout and the district ranger called at the Birmingham office of the Federal Bureau of Investigation and discussed the fire situation on the Talladega District with Mr. Roby, Assistant Special Agent in Charge.

Late in the afternoon of February 21, five incendiary sets occurred along a main highway. Assistance was requested from the F. B. I., and within a short time Special Agents Slate and Southworth arrived at district headquarters. The agents were made familiar with the fire history of the district and then, with the ranger, began an investigation of the fires. On the following day while these fires were still being investigated, three more incendiary sets occurred in the same vicinity on the opposite side of the highway. The F. B. I.

agents immediately set up a road block. A large number of persons were interviewed and the people generally became aware that the F. B. I. was trying to find out who was responsible for fires set on national forest lands. Later the agent and the district ranger enlisted the cooperation of local law enforcement officers and made plans for road blocks and other assistance. The agents continued their investigation of the fires and their interviews with local people throughout the week.

The agents were most cooperative and helpful, and the ranger working with them learned new angles of investigative and law enforcement work. Through their contacts with local individuals, the agents were able also to pass on to the district ranger some good leads for future fire prevention work. These ideas were used later in spot announcements and broadcasts from the local radio station. Up to this time no more fires have occurred along this highway.

On March 1, following a number of incendiary fires, the district ranger again called on the F. B. I. for assistance. This time the fire was in a community where it has been the usual thing for incendiary fires to burn off a large area each year. Special Agent Slate investigated the fire the next day, and key individuals and suspects in the area were contacted. Since this investigation by the F. B. I. agent, neither incendiary nor any other fires have occurred in this immediate vicinity.

Fifty-seven man-caused fires occurred on the Talladega District between January 1 and April 29, 1946. Twenty of these fires were definitely of incendiary origin. Since March 14, however, there have been no incendiary fires on the area.

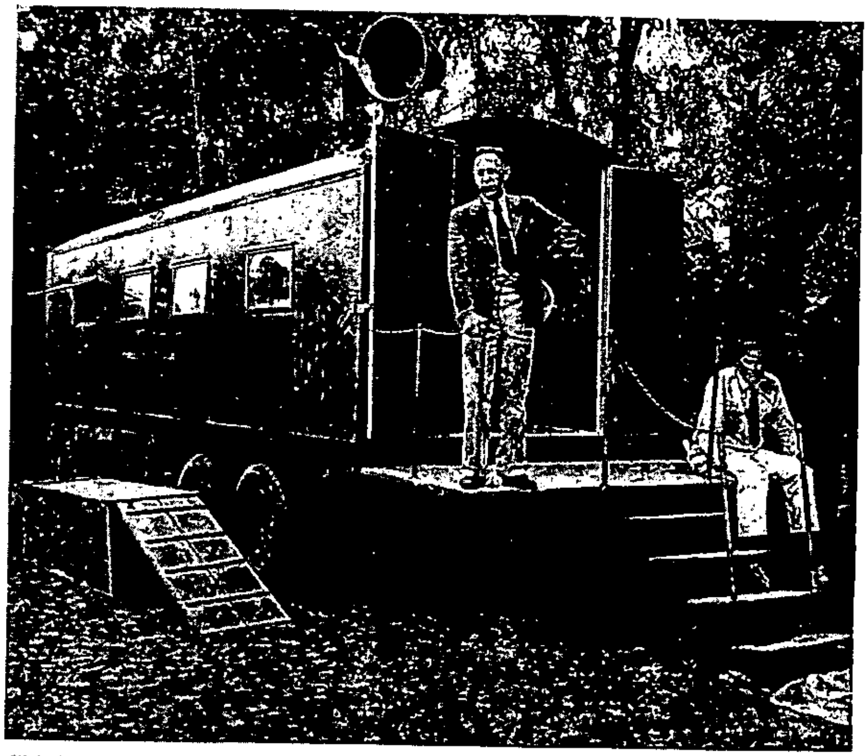
From April 17 to 19, F. B. I. Agent Hartley and the district ranger conducted a joint crime and fire prevention campaign at 14 schools in and near the Talladega Ranger District. A total of 3,225 students and teachers were reached. One of the subjects discussed was the jurisdiction of the Federal Bureau of Investigation over national forest lands. The campaign resulted in increased interest in the work of both the Federal Bureau of Investigation and the Forest Service. It was a "trial run," but judging from the interest displayed by both students and teachers it was very successful. Tentative plans have been made for another cooperative tour of the same kind at the beginning of the school year in the fall of 1946.

FIRE-CAMP TRAILER

Leslie S. Percey

Forestry Construction Superintendent, Los Angeles County Department of Forester and Fire Warden

During the past 25 years, the Los Angeles County Department of Forester and Fire Warden has been active in the development of equipment and methods to cope more effectively with the ever-present fire problem. These efforts have not been confined to fire-fighting equipment alone, but have been applied to the improvement of all phases of fire operations. The development of an efficient fire camp set-up has not been overlooked. Perhaps the facility usually given the least attention is the fire-camp operations office. Not so many years ago, it was considered that a few packing boxes or shipping cases would suffice. Later, a tent was added. Both were crude and

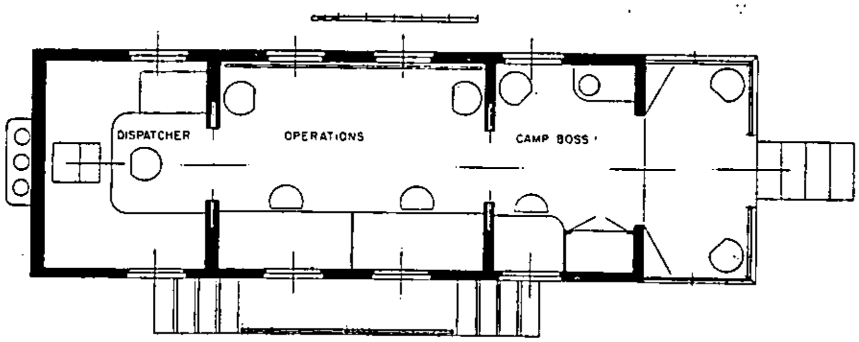


Chief Fire Warden addressing fire school from folding platform at rear of fire-camp trailer office.

afforded little or no protection from wind, dust, and cold nights, and the clerical work of the fire camp reflected the lack of equipment planning.

Then came the Civilian Conservation Corps and similar programs, effecting the construction of a transportation network of fire motorways and truck trails, which wrote finis to the reliance on pack trains to supply fire camps on fires in territory under the jurisdiction of this department. When two-way radio was installed in all fire apparatus, it became apparent that an improved fire-camp field office was essential to efficiently handle dispatching and clerical work under all climatic conditions.

At this point, Chief Spence D. Turner directed the Department's construction division to design and construct a fire-camp trailer—an office on wheels to accommodate the fire-camp boss and house the dispatcher, timekeeper, and clerical force. The author held several



Floor plan of fire-camp trailer office.

conferences with fire-camp dispatchers, timekeepers, and fieldmen usually assigned to the fire camp to obtain their ideas and recommendations. On this basis, the fire-camp trailer was developed.

Since funds were limited, it was necessary to start with a large cargo trailer made available by another department. On this was constructed a three-room office with insulated exterior walls, ceiling, and floor, and insulated partitions with sliding doors.

The forward compartment is designed as a communications office, in which is installed the PBX switchboard, teletype, two-way radio, and public address system. The middle section is constructed with built-in desks, drawers and cabinets for forms and stationery, maps, and dispatcher's operations board. The rear compartment is the office of the fire-camp boss. All offices are lighted with electricity, heated by butane wall heaters, ventilated with electric fans, and interconnected by telephone. Since many of the worst fires in Southern California occur in the fall months, the heating arrangement is very much appreciated by those assigned to fire-camp office operations. The fire-camp trailer is a proven success and provides a complete field office for maximum operating efficiency in dealing with fires and major disasters in any kind of weather.

FOREST FIRE FIGHTING EQUIPMENT DEMONSTRATION

Division of State Cooperative Fire Control—Washington Office, U. S. Forest Service

Michigan, Wisconsin, and Minnesota were hosts to a group of 73 State and Federal forest fire control men from U. S. Forest Service Regions 7, 8, and 9, from June 10 through 15 of the present year. The purpose of the meeting was to afford an exchange of ideas on fire-fighting equipment, stimulated by field showings of special types of equipment. The 6-day field demonstration was arranged by the Lake States.

Interest was widespread. Fifty-nine State men, who came from Texas, Georgia, and Connecticut, and many of the other States between these widely separated points and the Lake States, were in attendance for the full week.

The group assembled at the Higgins Lake Training School, operated by Michigan's Department of Conservation as a year-round training center for departmental personnel.

Michigan's demonstration ran from noon of June 10 until noon, June 13. Briefly, it included an inspection of forest fire control improvements, such as a regional and district office set-up, a fire equipment shed, the Roscommon fire equipment experiment station, radio laboratory, a remote control radio station, a typical fire tower, and fire prevention practices in an oil field. One day was devoted to a field demonstration of Michigan's mechanical fire-fighting equipment. Enough models were on hand to show the steps in the development of some types of equipment. Michigan featured new plowing units, the sand-throwing trencher, pumping units, backfiring torches, and well-sinking units employing water pressure for drilling. Equipment was shown and demonstrated in a large abandoned field, surrounded by woods. This provided opportunity for showing performance on both open and forested land. Announcements and comments regarding equipment while in operation were made over loud speakers mounted on a sound truck. (This feature added much to the clarity and speed of running the demonstration.)

En route to Wisconsin short stops were made at old burned areas, the Central Repair and Sign Shop at Gaylord, and the Escanaba District Headquarters. A field demonstration of building fire lines with a bulldozer in a heavy slash and blowdown area was also seen.

Wisconsin fieldmen took over at Norway, Mich., near the State line. On the way to Eagle River, stops were made at a typical Wisconsin State ranger station, a lookout tower, and the plant of the Goodman Lumber Co.

The Wisconsin Conservation Department arranged with the "Trees for Tomorrow" organization to house and feed the group at its Eagle River Conservation Training Camp leased from the United States

Forest Service. Both here and at Higgins Lake, accomodations and food were excellent.

The demonstration of Wisconsin's fire-fighting equipment was held in a natural amphitheatre, with a truck trail running on a contour along the foot of the slope. The audience sat on the ground or in an improvised bleacher on the slope of the hill. Each piece to be demonstrated was brought in along the truck trail from around the hill, unloaded, and put to work in the valley where everyone could see it. This demonstration covered tilting bed trailers, the chain saw, and various types of plowing and pumper units. Here also, announcements were made from a sound truck. Following the demonstration, equipment was parked conveniently for inspection.

On the way to Tomahawk a stop was made for a demonstration of Wisconsin's new seedling planting machine.

At Tomahawk, Wis., the men were shown through the State's forest protection headquarters, central warehouse, and shops. Also, Minnesota personnel demonstrated some of their portable and semiportable water-pumping equipment here. This wound up the demonstrations. Because of lack of time and since much of Minnesota's heavy equipment is similar to that of Wisconsin, it was considered unnecessary to transport the heavier pieces to Wisconsin for display or demonstration.

The week of demonstrations and the swapping of ideas and experiences was exceptionally worth while. Many of the men expressed the hope that other intersectional fire equipment meetings would follow. The Lake States have set a very high standard as hosts and as efficient builders and demonstrators of equipment. They are to be congratulated on staging a show which will prove highly beneficial to those who attended.

A CONVERTED MILK TRUCK MAKES A HOT-FOOD DISPENSER

K. E. KLINGER

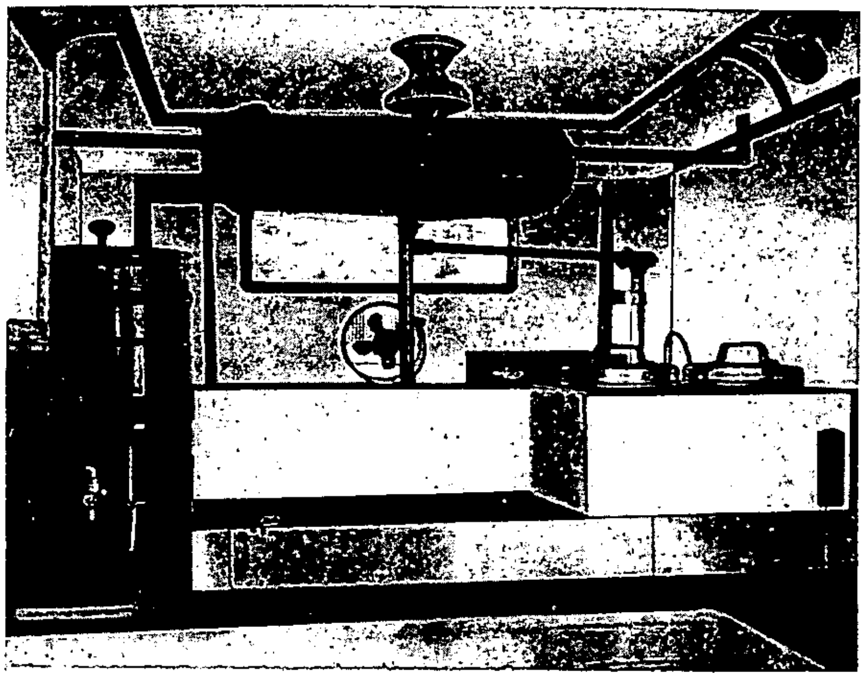
Battalion Chief, Los Angeles County Fire Department

It has been recognized for years that fire fighters on prolonged fire duty miss many meals, which results in lowered efficiency. In the fall of 1944, the members of Battalion 2, Los Angeles County Fire Department decided to do something about it. They were tired of eating cold sandwiches and drinking lukewarm coffee while fighting stubborn fires. Each member donating toward the cost, they purchased a 1936 four-cylinder Stutz package car, formerly used as a milk truck. The men steam-cleaned the truck, overhauled the motor and chassis, repainted the body inside and out, and fitted it up for a kitchen.

A steam table was built from old boiler plate and ice cream containers, and a hot plate and two-burner gas plate, made from old stove parts from junk yards, were installed. Fuel enough for several

Traveling commissary.

days' continuous use was supplied from a butane tank. A 6-gallon butane coffee urn was donated and installed, and a 22-gallon water tank gravity flow connected to a faucet and sink supplied water for cooking and dishwashing. Other equipment included was a 25-pound capacity ice box, an electric fan for ventilation, a lighting system for 110 volts from Home-lite generator or domestic outlets, and a sup-



Interior of traveling commissary showing coffee urn, hot-food dispenser, steam table, and grill.

plemental 6-volt lighting system. The truck has all the conveniences of an up-to-date kitchen and ample room for storage of food and dishes. The outside of the truck body carries brackets to which detachable counters can be fastened for serving purposes.

This commissary unit was rebuilt and financed entirely by members of battalion 2. They presented it to the Department for use in battalion 2 area, and the County Board of Supervisors accepted it with thanks.

BUILDING A COOPERATIVE TANKER

A. G. Randall

District Ranger, Harney National Forest

The Volunteer Fire Department of Hot Springs, in the Black Hills of South Dakota, is now using a forest fire tank truck which shows what can be done with a limited amount of money. Building the tanker was a joint undertaking of the fire department and the Harney National Forest.

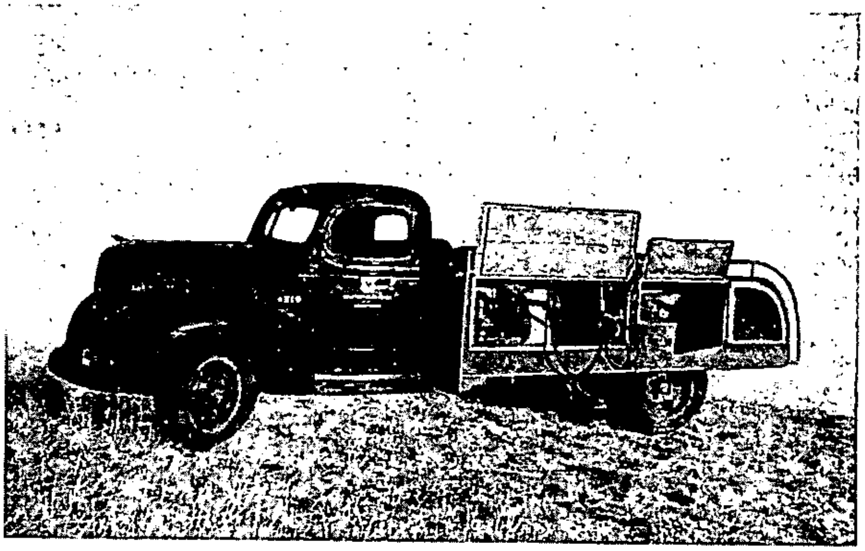
The department, founded in 1890, not only has done a good job taking care of the city of Hot Springs, but also has fought both farm and range fires in the surrounding country. In 1938, land west of Hot Springs was added to the Harney Forest so that grass and timber cover on a vital watershed might have better protection from fire. It was natural that the Hot Springs fire department and the Forest Service should work together.

In October 1944, the Forest Service made available a Dodge ton-and-a-half truck chassis and a Bingham Type Z portable pumper. The Hot Springs fire department undertook to build a tanker body as streamlined and efficient as its other equipment, which includes a powerful modern pumper; booster tank-pumper; a well-equipped hook, ladder, and salvage truck; a pick-up-mounted smoke extractor designed and built by the department; and an iron lung.

Materials were obtained at little or no cost from various sources. Steel, consisting mostly of ¼-inch bridge tread material, came chiefly from Fall River County. The department employed one of its members, an experienced welder. Other members helped cut the steel in their spare time. Chief Victor C. Englebert did most of the designing and led in carrying on the work.

The central part of the body is a rectangular steel tank, 3 x 2 x 9½ feet, holding slightly more than 400 gallons of water. It is fitted with three bulkheads to prevent surge and is coated inside with anti-rust compound. The bottom is supported by 2-inch planking, resting on the truck frame and held in place by flanges. On either side, cabinets were constructed with tops and bottoms flush with the tank, except that the bottoms over the hind wheels were necessarily raised. The cabinets were made 24 inches wide to give the whole body the width of a standard truck platform. The body has perpendicular sides and a flat deck. The rear is rounded to give a streamlined appearance. The sides are dropped 7 inches and have hinged sections, which may be raised to change tires. The cabinets are framed with ⅛-inch steel and the covers with ½-inch angle iron.

The body is welded throughout to form a solid unit, which is fastened to the truck frame by means of four U-bolts. It can be changed readily from one chassis to another. The edges of the body have a bead of ½-inch pipe, and the deck is surmounted by a railing of 1-inch pipe at a height of 6 inches. Steps are provided in the rear, making it possible to carry extra men. The sides are painted red and the deck, aluminum. The green cab has been retained. The colors give the truck a pleasing appearance. The side sections covering the cabinets are hinged at the top. They are held shut by slide bolt fasteners and may be held up by wing nuts which fasten them to the railing. The cabinets are painted aluminum inside and are provided with outlet boxes for lights. The truck carries an electric siren. The fire department spent some $450 of its funds but now operates a unit which it estimates would cost $1,500 if purchased from a manufacturer. This estimate does not include the chassis and equipment furnished by the Forest Service.



Hot Springs tanker with cabinets open, showing Bingham pump in first compartment, pump accessories in second, and hand tools in tail section. Hoses are shown attached at the pump. Reels have been installed since this picture was taken.

The Bingham pump is mounted in the front left-hand cabinet. Its fuel tank is on top of the deck, immediately behind the cab. Pipes and valves are so arranged that water can be pumped into the tank from a suction hose or under pressure to 1½ or ¾-inch outlets. A by-pass is provided so pressure can be regulated. Back-pack pumps can be filled from the tank by gravity. There is a filling dome on top of the tank so that any source of water can be used. The department prefers an independent pump motor to a power take-off from the truck motor, because pump pressure can be maintained while the speed of the truck is varied as needed.

The unit has two ¾-inch rubber hoses mounted on live reels. "Stayput" hose couplings keep the pressure from forcing the hose off the connections. Instead of conventional nozzles, the hoses have been fitted with adjustable shower heads, mounted on pipes 6 feet long for convenient handling. To avoid wasting water or stopping the pump, these can be thrust temporarily into the top dome. In this vicinity, fuels are generally light. Therefore, use of the ¾-inch hoses gives adequate wetting, and 2 to 3 miles of fire edge in grass can be controlled with one load of water. The shower heads can be adjusted to give a very fine spray, approaching a fog. This had a powerful extinguishing effect, even when tried experimentally on an oil fire. Nozzle operators may either ride on the truck or walk alongside. One or two men with shovels should follow the truck, since it is possible to miss small spots which may flare up, particularly if the truck is moving fairly fast and the nozzle men are riding. Actually, no trouble has been experienced so far from the survival of small spots, the wetting apparently being sufficient to extinguish fire in grass completely. Fire is quickly knocked down in fuels such as dry sweet clover, where flames often leap 10 feet in the air. In this type, the truck travels more slowly than in grass. The truck also carries 1,000 feet of 1½-inch linen hose. The main use of this hose is expected to be on fires which the truck cannot approach directly because of rimrock, etc. The 1,000 feet of hose may either reach the fire or materially shorten the distance to fill back-pack cans. Of course, many uses may be found for an extra 1½-inch line on both rural and urban fires.

In addition to the equipment already mentioned, the truck carries in the cabinets 5 back-pack pumps, 3 Pulaskis, 4 McLeods, 3 axes, 3 picks, 27 shovels, tarpaulin, first-aid chest, and bolt-cutters for getting through wire fences. Both Forest Service and State tools are included. Although the tools do not make a balanced unit, the truck is ready for almost any situation.

The truck is kept in the fire station with the other equipment, ready to go at all times. Since grass fires may occur in below freezing weather, storage in a heated garage is particularly valuable.

The operation and use of the truck is covered by a cooperative agreement between the Forest Service and the Volunteer Fire Department. The agreement also provides that equipment furnished by each agency shall remain its own property. The pooled equipment is providing, in the southern Black Hills, a highly valuable fire control unit with which both parties are highly pleased.

THE LOUISIANA FIRE JEEP

Louisiana Forestry Commission, Baton Rouge, La.

From the earliest use of the jeep by the Army, the fire control men of the Louisiana Forestry Commission were interested in it. They watched thousands of jeeps brought into army training centers in Louisiana and saw them swarm along the highways and through the woods, traveling through seemingly impassable areas. In July 1944, the report of Maj. A. C. Rowland on "Development of Forest Fire Fighting Equipment,"[1] issued by the Forestry Branch of the Army Air Forces Proving Ground Command at Eglin Field, Fla., through the Forest Service, called the attention of the commission to further development of the jeep. Finally, in November 1945, the commission purchased one of the first civilian jeeps sold in Louisiana.

It was the idea of the commission to make a fire-fighting unit out of this jeep. Major Rowland's conclusions as to the combination of equipment were valuable, but the problem of the commission was

The four-wheel drive, low-range gears, snow- and mud-grip tires, and driver skill enable the jeep to climb steep slopes in the woods.

[1] See condensation of report in FIRE CONTROL NOTES, 7 (1) : 6. 1946.

the installation of a Panama pump on the truck. This was done successfully by the men at the central repair shop on the Alexander State Forest. The pump was mounted on a sturdy, hand-made bracket bolted to the head of the engine on the forward right side and driven by a belt from a double pulley mounted at the forward end of the crankshaft. A 70-gallon water tank was mounted in the rear compartment of the jeep. Thirty feet of "spray" hose and 20 feet of "filler" hose were provided. A second front seat was added. In January 1946, the jeep was assigned to a standard mobile crew

The hose man varies his position with forest conditions. The stream here is from a forest fog nozzle, which operates at pressures of 80 to 120 pounds. Its spread is satisfactory, its pressure sufficient to give good penetration, and its use of water economical. Because the volume of the stream is small it isn't necessary to speed up the motor. The nozzle exhausts 6½ gallons per minute.

area in southwest Louisiana, consisting of approximately 100,000 acres. Some 20,000 acres of this area are planted slash and loblolly pine. On the whole, the unit was more satisfactory than a standard pick-up truck similarly equipped. The one disadvantage was the size of the crew, which because of the higher-mounted water tank had to be limited to three men. Four men is the minimum crew usually employed by the commission.

Four standard Army jeeps were bought by the commission in February 1946. A "perfect" factory installation of the Panama pump was made for the jeep by Mr. Speedy Freeman, of the Panama Pump Co., Hattiesburg, Miss. The basic change in the mounting of the pump was a relocation to the left side of the engine, with the sturdy mounting bolted to the inside of the fender and reinforced with a steel plate on the under side. The bypass was removed from the pump and placed on the water tank. The pump was still driven by belt from a double pulley on the front of the crankshaft, an arrangement which made more room under the hood. A tank was also installed on the jeep by the Panama Pump Co. It has a reduced capacity of 55 gallons, which gives a lower center of gravity and better riding space for extra crew members.

The first standard Army jeep was equipped and delivered for test in April 1946. Although the spring fire season was almost over, an immediate test period was set up to determine the use of this unit on special fires. It was used on control-burning projects and several large fires. As a fire unit, it has been highly satisfactory, though usage has been limited and no statistical data are available.

All of the units are to be equipped identically with the unit developed by the Panama Pump Co. Standard Army quarter-ton trailers have also been purchased. They will be equipped with water tanks having a capacity of from 150 to 200 gallons. They will be towed by the jeep to fires and dropped where travel is no longer practical. This extra, readily accessible water will supplement the small supply carried in the jeep-mounted 55-gallon tank.

At present the Louisiana Forestry Commission feels that the Louisiana Fire Jeep is the most valuable piece of fire-fighting equipment that can be used on small areas and to supplement the work of heavier types of equipment in larger areas. It will carry the two-way radio equipment at present being installed in the communication set-up. As equipped, the unit will be fast moving, highly mobile, and good for reconnaissance work. It can reach a fire in the early stage, scout the area, and attack the blaze. Where necessary, it will be reinforced with a second line of heavier equipment and more men.

The illustrations which accompany the article are of the standard Army jeep equipped by the Panama Pump Co.

Specifications for the Louisiana Fire Jeep

Type: Truck, ¼-ton, 4 x 4.
Cost:

	Civilian	*Army*
Truck	$1,220.11	$912.20
Pump and tank	196.20	191.60
Top	---------	52.96
Paint	---------	35.00
	1,416.31	1,191.76

NOTE.—The four Army jeeps purchased did not have tops when delivered and it was necessary to paint them. Two were new and two were used, with 12,000 and 14,000 miles reading on the speedometers.

Measurements:	*Inches*
Length	122¾
Width	59
Height (windshield up)	67⅝
Height (windshield down)	52⅝
Ground clearance	8⅝
Tire tread	48¼
Wheelbase	80
Tire size	6.00 x 16

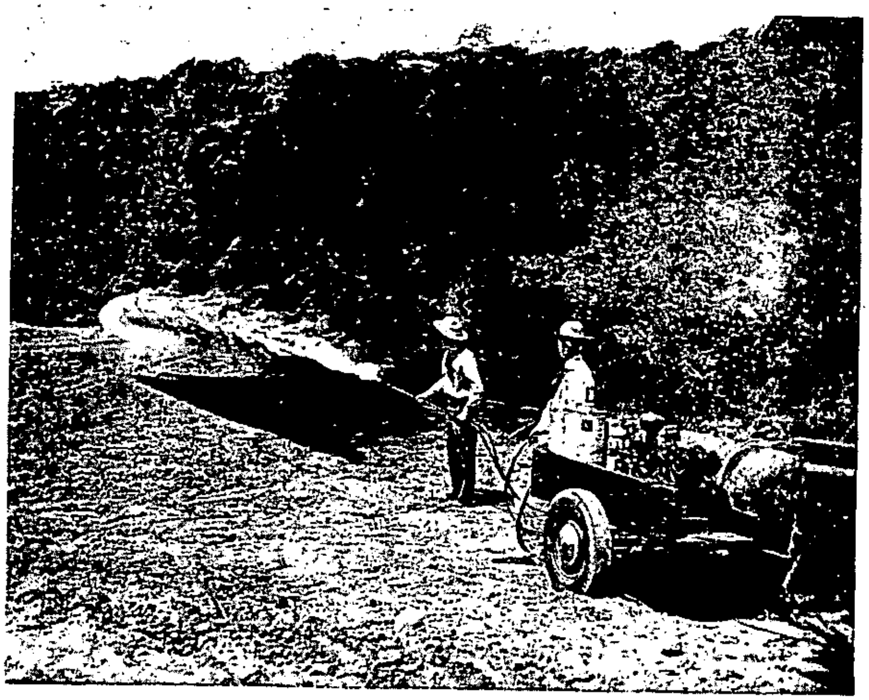
Weights:	*Pounds*
Shipping weight	2,120
Curb weight	2,220
With equipment, full water tank, 2 men at 150 pounds	3,090

A NEW MOBILE FLAME THROWER

HENRY WERTZ, JR. *and* C. VERNON MAY
Los Angeles County Department of Forester and Fire Warden

Some time ago, Spence D. Turner, County Forester and Fire Warden, appointed a committee to study the problem of developing a better backfiring torch. With his encouragement, the writers worked out a combination butane-Diesel flame thrower which gives promise of being a valuable addition to fire control equipment. Several of the new units are now in use. It is hoped that they will be capable of backfiring cover more thoroughly on watersheds similar to those of Los Angeles County.

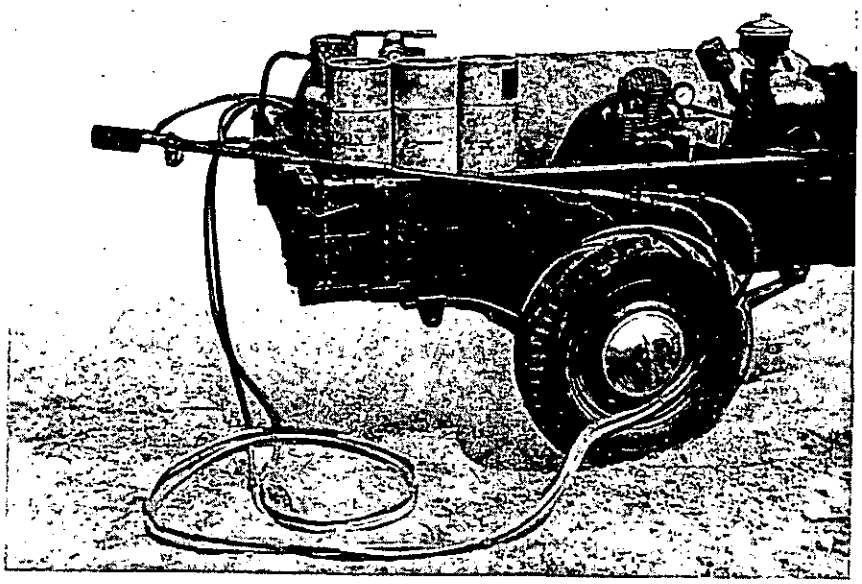
This unit, as shown in the illustration, consists of a gasoline-driven compressor and 70-gallon tank of Diesel oil, a battery of six 10-pound butane tanks connected to a manifold, 75 feet of 3/8-inch oil-resistant hose, and a specially built butane-Diesel flame-throwing gun. The gun is so constructed that the heat of the flame is far enough from the nozzle so no shield is required for the operator. Mounted on a



Fifty-foot flame thrown from portable flame thrower.

two-wheel trailer, it can be towed by truck over fire roads and then by tractor into strategic locations.

Of all volatile fuels with which experiments were made, a combination Diesel oil and butane gas gave the best results. These two fuels were already being used, the former in the tractors, the latter in portable fire-camp kitchens, etc. Jellied gasoline was tried, but it gummed up the pipes, caked the nozzle, and was consumed too rapidly. Liquid gasoline and kerosene tended to burn completely before reaching the maximum distance, leaving no burning substance on the brush or other cover. These three fuels were also unsuitable because their high volatility made them hazardous to personnel in backfiring.



Flame thrower equipment.

When backfiring in light cover such as grass, sage, and greasewood, the butane is used alone. It is capable of throwing a flame a maximum of 4 feet. In heavier materials such as trees and dense green cover, where there is very little dry undergrowth, the combination butane and Diesel oil is used. The operator can throw a mass of flaming fuel over a distance of 50 feet, leaving enough of the slower burning Diesel oil to insure thorough ignition. The heat generated by this torch is so intense that it burns the greenest vegetation cleanly, thus saving many man-hours of line-cutting with hand tools. In the heavier type of cover, more than 300 yards of fire line has been burned over in 19 minutes, using 20 gallons of Diesel fuel.

The mobile unit will be equipped with small portable units operating under the same principle. These will be useful in backfiring the more inaccessible areas.

The portable unit weighs 62 pounds. It has one 10-pound butane tank and a 3-gallon Diesel fuel tank with a hand-operated pump. Attached are 15 feet of oil-resistant hose and a lighter-weight gun than the one used on the mobile unit. It makes a compact unit 12 by 15 by 22 inches with retractable handles. This unit can throw flaming fuel for a maximum of 30 feet. The butane flame will last approximately 3 hours and has a maximum of 4 feet. The Diesel fuel, if used continuously, will last approximately only 3 minutes. However, with the usual intermittent bursts it will cover about 100 yards of fire line in average heavy growth. Back-pack boards are used to transport additional fuel supplies.

The larger mobile unit, operated by a three-man crew, has already been used successfully on several fires. It holds great promise for use when emergency methods are necessary to halt forest or brush fires.

FORESTERS ALOFT IN '46

P. A. Thompson, *Chief, Fire Control Division, U. S. Forest Service, and* D. M. Thompson, *Forest Ecologist, Southwestern Forest and Range Experiment Station, U. S. Forest Service*

The old timer shifted his heavy fire pack from one sweaty position on his aching back to another not quite so chafed and spat a stream of tobacco juice at a disinterested beetle. "Just look at that, would you! I *knew* that confounded smoke would be over on that slope! There she sits—4 hours down into that canyon and out onto that blasted ridge; and from here I can dang near spit on it! If I just had one of those flying machines. * * *" Nobody knows how many times such thoughts have been voiced since the first flight of the Wright brothers excited the imagination of men everywhere.

The history of aviation in the Forest Service has been a history of the struggle between an idea and its practical application. After the last war when men like H. H. Arnold, now General of the Army Air Forces (retired), flew fire patrol over the hills of California, it looked as though the airplane might become a regular piece of Forest Service equipment. However, inadequacy of communication between the ground and the air, plus the general lack of dependability of the airplanes of that day, prevented the development of "idea" into "application." Aerial reconnaissance has long been sporadically adopted as an emergency measure during periods of exceptional fire danger or poor visibility. It was not until the years just prior to World War II, however, that planes began to pay their way in saving of cost and time like any other piece of equipment. And it was not in the direction of detection that they first began to "pay off," but principally in the field of aerial delivery. During the late thirties, food, tools, beds, and supplies of all kinds were dropped on practically all the major blazes in the back country for the use of weary fire fighters thereby saving time, manpower, and pack mules.

The smoke-jumper program which was capturing the popular imagination before the recent war was a natural outgrowth of and a step beyond the cargo-dropping techniques. If supplies could be placed accurately at the site of a blaze, then why not men? Careful pioneering in the forest regions of the Northwest, from 1937 to 1940, had turned this idea into a functioning and highly valuable tool for use where "force enough, fast enough" could not be realized by ground travel.

Extraordinary impetus was given to airmindedness by the second World War. The Forest Service shared in this increasing interest. During the war the size of the smoke-jumper program was greatly expanded in order to conserve manpower. Results were encouraging. The practical use of airplanes in any situation where time, distance, or transport enter the equation is now being carefully studied.

Planned use of aircraft for the whole job of fire detection is being given a thorough try-out in several forest areas. The actual savings effected by the removal of fixed look-outs are applied against the costs of replacement service by planes. Trial runs indicate that in some places, particularly where lightning fires constitute the major risk, real savings are possible, both in money spent and in better protection of the forests.

Herbert K. Harris, office of Fire Control, Northern Forest Region, and William G. Morris, Pacific Northwest Forest Experiment Station, are developing planned programs for selected areas in Washington, Montana, and Idaho. They are studying carefully all phases of the problem, from degree of supplemental aircraft use to analysis of cost data. They are also testing the feasibility of new suggestions and ideas in the field of detection as they are advanced or evolved. They are pretty well satisfied, for example, that fast flying planes which will cover a given area more times in the same period than will slower planes now in use are going to prove more efficient in the long run. This is a somewhat startling new idea. It runs counter to the old theory that slow moving or hovering aircraft are more effective.

It has been proved that where detection coverage in excess of 40 to 50 percent is needed, it can frequently be provided more cheaply by air patrols. And what is more the whole system becomes flexible in its application. Increased flexibility usually means economy and greater efficiency. Where lightning causes nearly all the fires, areas need not be covered until the necessity arises. Ground coverage to be effective must be in place, each lookout manned and waiting before any real storms occur, an excessive use of effort. This is a common situation in the higher mountain ranges of the Northwest. Areas such as the Salmon Range in Idaho, the Bitterroot and Flathead in Montana, and the Chelan in Washington, may lend themselves well to total air-detection systems at the present time. Tests are now going forward as fast as practicable with the men and equipment available. Region 9 is using a float plane for detection over much of the Superior National Forest. One thing is certain—the trend is toward increased air coverage. Just where this will come into balance with fixed ground coverage is something for the future to decide.

Detection values have always been hard to catalogue and analyze. If "force enough, fast enough" is to be attained, detection must be prompt. In a sense then, detection is prevention—prevention of large and costly fires. Like fire insurance, it is hard to justify on a cost basis until there is a blaze. Suppression, on the other hand, is a natural field for wide use of planes. Suppression of going fires which are destroying public timber or forage values, and threatening watershed damage demand the use of any method which will put an immediate end to the danger. Public acceptance of the use of aircraft on going fires has always been prompt. In fact, the public occasionally has gone a step beyond the present capabilities of the aerial equipment in its demands for the use of spectacular methods.

The end of the war brought an increased interest in the aerial phases of forestry. Hundreds of applications have poured in from ex-paratroopers who want to re-experience the thrill of leaping into space high above the earth. Great numbers of school students want to sign up for this "front-line" duty. The smoke-jumper program, already proved successful, is then the first field for postwar expansion.

As originally conceived and worked out, the smoke-jumper squads were small units held in readiness to go into the remote areas of some of the West's most isolated forests. It might take a man on foot a day or more to reach such places. Fires in this type of country too often grew to sizable proportions before the firemen on the ground could reach them. Whole crews of men with pack animals were needed to bring in the tools and supplies. Sometimes it took weeks to put out the last spark, and large areas of timber were scorched and burned.

During the war, when manpower was scarce, smoke-jumper crews were grouped by necessity in larger units for use on big fires. The success of this wider use led the Regional Foresters to set aside several million acres of remote and isolated country. These are now being protected entirely from the air—from the detection of lightning strikes to the suppression of sizable going fires. To date, the smoke jumpers have justified the additional trust.

The speed with which smoke jumpers can be put on a fire holds out hope for solution of the vexing "flash fuels" problem. In relatively accessible areas where large bodies of flash fuels exist, the lag between detection of the smoke and arrival of the first men on the fire has always been discouraging. Blazes on such fuel types can in 30 minutes or less reach a size too large for 1 or 2 men to handle. A fast-acting squad of smoke-jumpers, say 10 to 25 men, can get to fires starting in the grass-brush fringes of the timber bodies and stop them before they reach threatening proportions. If that "first-run" that fire fighters dread can be stopped by fast aerial delivery of sufficient force, then protection in such areas takes a long step forward! There are millions of acres of this type, particularly in Idaho, where the inflammable fringes of the Boise, Salmon, and Payette Forests have been recognized for years as a potential threat to adjacent valuable timberlands.

Taking thought a step further, what has been the experience on large fires in the past? Many fire chiefs have watched helplessly from a ridge top while a sector of their line "blew-up" to start a run into a new drainage. In order to reach this new front, men have had to detour into almost impassable canyons and up steep slopes. They have hiked for hours to reach the point of spread and then arrived too exhausted to be effective! In one such situation last summer, smoke jumpers from an air base more than 50 miles away were used successfully. They arrived at the breakover more quickly than men from the main suppression crew could possibly have done.

The use to which air aids can be put on big fires is easy to visualize. Scouting on any large fire is a vital factor in expedient and adequate use of manpower. New development in air-to-ground communication, using ultra-high frequencies is opening up new possibilities. The fire chief must have accurate information delivered without delay. Photographs taken from the air and developed in a matter of minutes in the plane, can be dropped to the "command post" of the fire boss. This is unquestionably a most effective scouting service. If photographs of the area made prior to the fire are always at hand, showing bodies of fuels and details of terrain not gained from ordinary maps, the overhead on any large fire can direct prompt and accurate action.

It may not be too fantastic to visualize a future fire chief on a project fire, maintaining his daytime control from a plane. Aloft, he may assign ground forces to their sectors, as factors of slope, fuel type, and wind, change the picture; and dispatch smoke-jumper units to "spot fires" out ahead of the main fire or to sectors of critical need as they develop.

Air freighting into the back country or cargo dropping may be more prosaic, but it is just as essential a part of the whole aerial picture. As previously brought out, it was in this phase that the airplane first began to pay dividends in savings to the public treasury. In 1945, three-quarters of a million pounds of tools, equipment, and supplies were dropped to camps by parachutes or put on back-country landing strips by air delivery. Crews going in to fires have been able to "travel light" and find food and tools on the spot. This lessens the fatigue factor and is a vital addition to the straight saving in delivery time and cost. Firemen can be "serviced" cheaply by light airplanes where the pilot doubles as dropper. Tossing out a 35- to 50-pound pack to a one- or two-man crew at the scene of action can effect great savings in the use of highly trained personnel.

The use of expendable equipment on fires is increasing. Delivery of hot food to crews is an accomplished feat, and the use of paper food containers obviates the necessity of packing out anything but beds and tools. Experiments with the use of paper beds indicate that before long beds too may be expendable. Crews who come off a fire with nothing in their hands but the tools with which they work will obviously be ready to go on more quickly to another blaze.

Extensive freighting into the back country calls for landing fields. These fields fall into two major classifications; class A for use by larger cargo-type planes, and class B for smaller light planes. Where heavy freight or crews of men are to be delivered, class A fields with level runways and clear approaches are necessary. Quick pick-up or delivery of one or two men and light equipment can be made on class B fields, which may be small cleared strips with one-way landing and take-off chances and sloping or undulating runways. Forest Service pilots must be good! In Oregon and Washington, tentative planning calls for class A fields at 12- to 20-mile intervals and class B strips as close as 6 to 10 miles. In most areas, however, rough topography will prevent attainment of this spacing. Where it is possible, it will bring men and supplies to within an hour's hike of practically any portion of most forests. Airfield development of this spacing would make it unnecessary to construct a large part of the planned road and trail systems on many national forests. Therefore, use of aircraft immediately becomes of interest to transportation planners.

Bringing back highly trained personnel, such as smoke jumpers, becomes a factor of increasing importance as their use expands. Quick return to base by air can double the effectiveness of a given squad during periods of high fire occurrence such as follow a series of lightning storms. Furthermore, in case of injury or sickness, it is difficult to measure the value of air transportation in saving lives and suffering.

Straight transportation of skilled personnel over long distances on the Western forests steps up the efficiency of overhead during the summer. In 1945 more than 1,000 trained fire-overhead were moved by airplanes to fire jobs. In one instance the Army Air Force moved 200 fire fighters 300 miles in a few hours.

In many places throughout the mountainous West, much valuable time may be lost in travel. On the Wallowa National Forest in Oregon, for instance, overhead and men leaving the Snake River Canyon must travel down the river to Lewiston, Idaho, and thence around to Enterprise, Oregon, by car to get back to headquarters—a distance of over 200 miles requiring almost 2 days' travel. This same trip can be made by air in less than an hour! Light planes with 2- or 3-passenger capacity are being used in many places like this in the Western regions for several months during the field seasons.

Four new, bright-red, four-place Stinson airplanes were purchased by the Forest Service for fire control use on the Western forests. They have been kept busy. When not in use by Fire Control, they have been in demand by the other divisions which pay a flat-rate charge for the service. The savings in cost to the renting parties have been amazing at times!

A new program is under way in Region 3, Arizona and New Mexico. When disastrous fires occurred on the Gila Wilderness Area during the early spring fire season, observers thought that smoke jumpers might have prevented considerable loss. Great altitude and the strong winds prevailing over the upland mesas have in the past discouraged smoke-jumper tests. Now, however, trials are proposed by a squad of jumpers and cargo droppers from one of the Northwest Regions. It is thought that new methods will be evolved or existing practices altered to fit the situation in the Southwest. Dovetailing the April to July fire season of the Southwest into that of the Northwest Regions may provide a longer period of training and usefulness for the present smoke-jumper program.

Helicopters for use by the Forest Service are still in the offing, but testing is going ahead as rapidly as possible. Present limits on useful load capacity, altitude range, and functional dependability, are being extended slowly by Army search and rescue units working out of March Field, Calif., in cooperation with the Forest Service. The R-5 model of the Sikorsky helicopter is the only one that has been tested, since the Army had the machines and the pilots to operate them. Other manufacturers are, however, entering the "direct lift" field, and it may not be too long before competition and increased demand for their specialized service will bring an "egg-beater" on the market which will fit Forest Service needs.

Bombing fires from the air has always kindled interested speculation by the general public. It has enthusiastic backers in the Army and the Forest Service. Army search and rescue units have a moderately successful record in the flat pine belt of Florida where water and chemical bombs were effective in slowing the progress of fires. Trials are to be continued during the summer of 1946 on an area in the high, rugged mountain country of the Lolo National Forest, in Montana. B-17 bombers, based at Great Falls, will drop special 165- and 300-gallon tanks on actual and test fires.

At this stage of program development, expert assistance is needed, Standards of practice and method must be established on a national basis if "foresters aloft" are to be efficient and effective. Fire Control has been fortunate in obtaining the part-time services of Don Hamilton, head of the Equipment Section of Engineering, who will act as aviation consultant for the Washington office and all Forest Service Regions. Mr. Hamilton, formerly a colonel in the Army Air Forces, has had wide experience in operating and maintaining aircraft of all types. During this summer he is traveling throughout the Western regions studying Forest Service aviation equipment and aerial operations.

The authors are well aware that the Federal Forest Service has not had a monopoly on the use of aircraft for forestry and fire fighting. Many State organizations and other Federal agencies have made wide use of planes for years. However, there has not been time to contact these organizations and gather information relative to their current programs. We have, therefore, confined our discussion to aviation as it concerned the Forest Service. Greater scope and range of protection afforded by a well-organized aerial service may lead eventually to a cooperative effort on the part of the various States and Federal agencies. It is expected that effective teamwork will result here as it has where activities have overlapped in the past.

The successful steps already taken in the use of aircraft in forest fire control work send thoughts flying ahead to search out other and practicable steps which undoubtedly lie in the future. Success in speeding men and supplies to fires opens new and exciting avenues of conjecture to the men who must plan for transportation and for recreational use of our forests. But for fire control planners it has passed the point of conjecture. Use of aircraft is an integral part of our job. "Force enough, fast enough" is now on the visible horizon.

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INFORMATION FOR CONTRIBUTORS

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

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

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed on a strip of paper attached to illustrations with rubber cement. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustration. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired. Do not submit copyrighted pictures, or photographs from commercial photographers on which a credit line is required.

India ink line drawings will reproduce properly, but no prints (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.

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