VOL. 13 APRIL 1952 NO. 2

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.

Volume 13 Number 2

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.

FIRE CONTROL NOTES is issued by the Forest Service of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by the direction of the Secretary of Agriculture as administrative information required for the proper transaction of the public business. The printing of this publication has been approved by the Director of the Bureau of the Budget (November 7, 1951).

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 20 cents a copy, or by subscription at the rate of 75 cents per year, domestic, or $1.00, foreign. Postage stamps will not be accepted in payment.

Forest Service, Washington, D. C.

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 1952

CONTENTS

TIMEKEEPING ON PROJECT FIRES

C. A. GUSTAFSON
Chief, Division of Fire Control, U. S. Forest Service

Timekeeping is important to successful fire operations. It must be fast, otherwise much valuable time will be lost getting men on the fire line. It must be accurate to make certain each fire fighter will receive the wages due him and that the large amount of public funds paid out each year as wages to fire fighters is a true reflection of the total time worked—$6,000,000 is an estimate of the wages that will be paid fire fighters in fiscal year 1952. Timekeeping also provides means for identifying a fire fighter and permits immediate notification of the nearest of kin should death or injury occur, or notification of the fire fighter should sickness, accident, or death occur to a member of his family while he is engaged on a fire. It forms the basis for collecting suppression wage costs in trespass cases. It permits paying fire fighters quickly and with certainty that the amounts paid are correct. It permits identification of suppression wage expenditures so administrative studies may be made on all Class D and E fires—very important from the viewpoint of efficient financial management of fire operations.

ITEMS FUNCTIONALLY IMPORTANT TO A TIME REPORT

Since speed, accuracy, identification, dependability, etc., are important to timekeeping, the form used must provide a means of attaining these ends. It must provide space for the name and address of the fire fighter to permit identification and payment. It must identify the fire and name the forest on which it burned so financial management studies may be made. It must have space for entering place of hire and means of travel in order that correctness of travel time may be audited.

Different rates of pay apply to the various types of fire-fighting work. The timekeeping form should make it possible to enter the proper rate of pay. Travel time rates are usually at the lowest rate prevailing. The year, the day, and time of day "on shift" and "off shift" for each fire fighter is vital to accurate timekeeping. Many fires, particularly those of project character, require more than a single shift for their control. Total hours worked under each job classification is important to a calculation of the total gross amount earned. Also the fire fighter may buy a pair of shoes or some tobacco, or may fail to return certain properties charged to him. Deductions involving goods purchased by the fire fighter or government property lost by him will have to be made to arrive at the net amount due.

Space for recording travel time, hours worked, rate per hour, gross amount earned, deductions for purchases or property losses, net amount due, etc., must be made available on the timekeeping form. Sometimes different rates of pay apply if the employee is released, discharged, or quits, and this must be noted. The form should provide space for signatures of

the employee and the timekeeper. Signature of the employee will prevent future arguments concerning net amount due him for fire fighting, particularly when deductions have been made in the gross amount earned.

Last, but by no means the least important, is quick identification of the fire fighter for time reporting purposes, when going "on shift" or coming "off shift," by means of a detachable slip with a serial number identical to the number on the Time Report.

MECHANICS OF TIMEKEEPING

The job of keeping time can actually be made very simple if certain procedures are well understood and followed. It is the purpose of the following narration to outline how time of fire fighters may be kept with ease and still obtain speed, accuracy, and certain identification so essential in this phase of fire operations on project fires.

Forms, materials, and equipment.—A standard timekeeping form is necessary. Such a form has been prescribed for U. S. Forest Service use by the Comptroller General and is known as Form FS-874-15A TIME REPORT (Revised July 1948). The supply of these forms for any particular fire should be equal to about twice the number of fire fighters to be employed, with one ring binder for each 100 forms. They should be numbered in sequence, such as D-198000, D-198001, etc., to D-198100. The starting number, in this case D-198000, should be written boldly in ink on the cover of the ring binder.

Material available should include several small lined tablets about 8 by 10 inches, a pencil sharpener, a supply of 4-H pencils with erasers, a couple of filing spikes, and indelible pencils for signatures of employees.

Equipment required consists of a collapsible table of standard height, and about 6 feet long and 26 inches wide, 2 collapsible chairs, stapler, rope, and lights. A box with alphabetical separations should be available so time slips posted and completed for payment may be filed. A locked commissary box should also be provided.

Location of the timekeeping office.—The office should be outdoors; never in a building. It should be in the shade. If shade cannot be provided by a tree erect a fly over the selected office site.

The timekeeping office should be located out of the way of the kitchen, communication center, dust, etc. The men should be able to pass freely through the setup without congestion. For property accountability and commissary purchases, the locked commissary box and the sleeping gear should be near the tool dump. The men can be outfitted and then passed through the timekeeping setup prior to going on shift and can return equipment to the tool dump after property accountability has been determined when going off shift.

Preventing congestion.—After the timekeeping table has been set up it should be provided with roped lanes to force the men to pass the timekeeping desk in single file while going on and off shift, or obtaining commissary or bedding gear. Direction of travel should be indicated by signs.

Signing up the men.—There are a few common essentials required to start the timekeeping off right, whether at the employment center or after the men have arrived at the fire camp:

1. Have ready books of Time Report forms, 100 per book, numbered in consecutive order.

2. Fill out *one* Time Report for each man, again with such reports in consecutive numerical order.

3. Fill in the name of the fire and forest.

4. Fill in the employee's name; make sure full first and last names and middle initial are entered.

5. Fill in address of employee.

6. Enter place of hire and means of travel and whether government or private.

7. Enter job classification title at which hired and indicate hourly rate.

8. Enter in first column month, day, and year, e.g., 6/2/52, on the first line opposite the words "To fire."

9. Tear off stub and give it to the employee, advising him this is his *one* means of identification and to keep it until paid.

10. If the men are recruited at an employment center the book of Time Reports properly filled out is usually given the driver for delivery to the camp boss upon arrival of men at the fire camp. The men immediately after arrival in camp from the recruitment center are marched past the timekeeper so that a count may be made and travel time checked off.

If the men are signed up after they arrive in camp points 1 through 9 are carried out. In addition a check on travel time is made so that a complete record for each employee prior to entry on shift is obtained.

After completion of items 1 through 10 the job consists of recording the men on and off shift, posting time worked, and posting commissary and property losses for which the men are accountable.

On-shift timekeeping.—1. The men should be arranged in crews and each crew assigned to a crew boss or foreman. It is not essential under this system for the crew boss or foreman to have a list of names; he can obtain a list of identification numbers as the men pass through the timekeeping setup. Later, before beginning work, he can list their names for use in his supervision of their work for the shift.

2. The crew boss should walk his men past the tool dump so each man can be issued equipment for the shift.

3. The crew boss should next request each man to have available in his right hand his time report identification number.

4. They should then be requested to pass by the timekeeping desk in single file, and as each one reaches the timekeeper to hesitate a second or two to enable the identification number stub and the tools checked out to be seen.

5. The timekeeper notes the identifying number and the tools carried by the fire fighter. He writes the last three digits of the number and the tools to be charged the fire fighter on a lined tablet (a single sheet for each crew) somewhat as follows:

073—S F C (S—shovel, F—headlamp, C—canteen, etc)
081—M F C
087—A F C
101—S F C
etc.

Upon completion of taking the identifying numbers of the crew (the crew boss will notify him when this has been done), the timekeeper notes the month, day, hour and minute on the tablet sheet, tears it off,

and places it on a filing spike or a nail driven through a block of wood marked "on shift" for future action. This same system is followed until all outgoing men have been recorded. One man calling off identification numbers and tools charged and the timekeeper recording should be able to check out a man every 5 seconds or 360 men every half hour if the men are organized in crews that file promptly past the timekeeper.

6. Usually the night shift begins to report in shortly after the day shift has left camp for work on the fire. Each crew boss should march his men coming off shift past the timekeeping setup. The timekeeper notes the last three numbers for each man on a tablet sheet following the same procedure as for the outgoing men. After checking the last man in the crew (who will be made known to him by the crew boss) the timekeeper notes the hour and day on the sheet and places it on the spike marked "incoming."

7. Usually after the on-shift and off-shift men have been checked through there is a lull in the urgent timekeeping activity. Plenty of work remains but the timekeeper may do it more leisurely. The next job for the timekeeper is to sort the tablet sheets on which crews were reported and staple the on-shift and off-shift sheets for each crew together in readiness for checking property and posting time.

8. He then compares outgoing property charges with property checked in by each individual and notes discrepancies for future reference.

9. The next job is transferring time from these tablet sheets to the Time Report. This is usually done by one man calling out each number and the time on the tablet sheet while the second man locates the Time Report and posts the day, hour, and minute. As each crew boss tablet sheet is posted on the Time Report a figure 8 is written through it indicating the time for the crew has been posted.

This work is continued until all time has been recorded. Some timekeepers follow the practice of posting on-shift time as soon as possible after the men have gone on shift. This practice is approved and will ease the pressure should emergency timekeeping work come up.

10. Bedding must be issued to off-shift men. To assure property accountability they should file past the bedding gear to be issued bedding and then pass the timekeeper one at a time so he can note the last three numbers on each identification stub and the bedding gear to be charged. This need not be done by crews but some forest officer should be assigned to see that order and discipline in issuance of bedding gear is maintained. After the rest period, overnight or day time, one of the first duties of the men will be to turn in their bedding gear, going through the timekeeper in the same manner as when bedding was issued. As time permits the tablet sheets on which the bedding gear was charged will be checked against those reporting incoming gear to determine who hasn't turned in the property charged to him. If any individual cannot satisfactorily explain why he failed to turn in his gear, a "lost" property charge will be made.

Once it is known that strict accountability of property will be followed, it is surprising to see how few losses will develop. Sloppy property accountability on the other hand often results in intentional failure to turn in property, gross carelessness, etc.

11. The above sequence will be continued until the fire is controlled.

12. On every fire, men are released in small numbers or individually. Under such circumstances as each man is released, is discharged, or quits the timekeeper will complete the Time Report immediately by (a) calculating the total time worked under each job classification title, (b) entering travel time, (c) entering the appropriate rate per hour, (d) calculating the amount earned under each job classification title, (e) entering the gross amount earned, (f) determining deductions for commissary or property losses, and (g) arriving by subtraction at the net amount due. The timekeeper will identify the individual, obtain his signature, and after signing the Time Report, file it alphabetically in the card box.

13. When large groups of men are released simultaneously following control, the men are marched past the timekeeper so he can obtain each man's identifying number. The Time Reports corresponding to these numbers are completed in the same manner as in 12.

When enough Time Reports are checked to provide a truck or bus load of men, the numbers are called off one by one, the man holding the corresponding number stepping forward to sign his Time Report. If payment is not to be made in camp the men are immediately loaded on trucks or busses for transportation back to their point of hire. If they are to be paid they are grouped to one side to await preparation and receipt of the checks.

The above procedure is followed until Time Reports for all men to be released have been completed.

Camp and other "back of the line" workers must also be required to check through the timekeeper. The camp boss should see that this is done.

Fire overhead from the strawboss to the fire boss should be required to check through the timekeeper; the strawbosses, crew bosses, and foremen at the time their crews are being checked out; the sector bosses, scouts, etc., as they go on or off shift. Every man should be reported on a fire time slip regardless of his job on a fire.

Time of line equipment should be kept by the operator and reported to the timekeeper. After each shift the time claimed must be immediately checked by a forest officer in position to audit the time claimed. Usually this is the sector or division boss or someone else in over-all charge of the line on which the equipment worked. A similar procedure should be followed for all other special services involving rental rates.

Beer Cans for Wet Water

Field personnel on the Superior and Black Hills (and perhaps other) National Forests have been using wet water to a limited extent in forest fire control work. They have found that a pint beer can with cap makes a desirable field container for wet water. Wet water is canned in these pint containers and carried on fire trucks or stored in fire caches for ready use. For the brands of wet water used a pint is mixed as needed with 5 gallons of water in a back-pack can.

A suggestion has been made by Ranger W. V. Kennedy, Superior National Forest, to request manufacturers to package wet water in similar small containers. This request will be acted upon if results of the wet water project being conducted in California indicate such packaging to be desirable.—DIVISION OF FIRE CONTROL, *Washington Office, U. S. Forest Service.*

PARACHUTING HEAVY CARGO

AERIAL EQUIPMENT DEVELOPMENT CENTER
U. S. Forest Service, Missoula, Montana

A study of aerial activities during recent years has revealed a particularly noticeable increase in the use of larger planes, both for freight and for crew transportation. This is not due entirely to availability. Records support the economy of using larger smoke-jumper crews on potentially dangerous forest fires. Although the contract rate is greater, the larger planes cost but little more on the longer trips, because of a much higher cruising speed. With little or no increase in cost and a substantial saving in travel time considered, the large ships are sometimes used for less-than-capacity loads, and space is often available for water or extra equipment that might shorten the control time on difficult fires. The greater carrying capacity, longer and larger freight compartment, and big doors make these ships suitable for many jobs which would not be possible or economical with smaller ships. Although these large planes cannot use many of the smaller fields, they are able to operate over a large area because of their greater cruising range.

The study also brought out that the larger planes of the DC-3 or C-47 type require considerably more maneuvering time over a drop spot and substantial savings could be made by a reduction of this dropping time.

The increased use of the C-47 airplanes for smoke-jumper attack on larger and potentially more dangerous fires has indicated the need to drop larger cargo bundles. Normally 30 minutes are required to complete the drop operation for a 16-man jumper outfit—eight to ten runs, depending upon the hazards of the approach and the time required for lining up bundles. At a cost of $195 per hour a considerable saving may be accomplished by reducing the number of cargo runs.

With such possibilities in mind the equipment development or equipment use program included the following:

1. Modification of the roller-platform for quicker reloading.
2. The investigation of the use of roller conveyors to handle materials inside the Ford and C-47 planes to speed unloading of cargo, and the use of large cargo bags and cluster parachutes for dropping heavy cargo.

PLATFORM FOR DISCHARGING HEAVY CARGO

A platform for discharging heavy cargo, or several bundles simultaneously, has been constructed and used successfully during 1950 and 1951. Materials dropped included a heavy lookout tower and house. Some slight modifications have been incorporated in the platform and detail drawings corrected.

This "C-47 Cargo Roller-platform" consists of an aluminum frame, 40 by 61 inches, in which are placed 23 aluminum rollers supported on each end by ball bearings for easy rotation under heavy loads (figs. 1 and 2). The deck between the rollers is constructed of .045 thickness

aluminum sheet and is so arranged that the rollers project about ¼ inch above the slots. A cam and lever is provided to raise the rear edge of the platform approximately 4 inches off the floor of the plane to discharge the load.

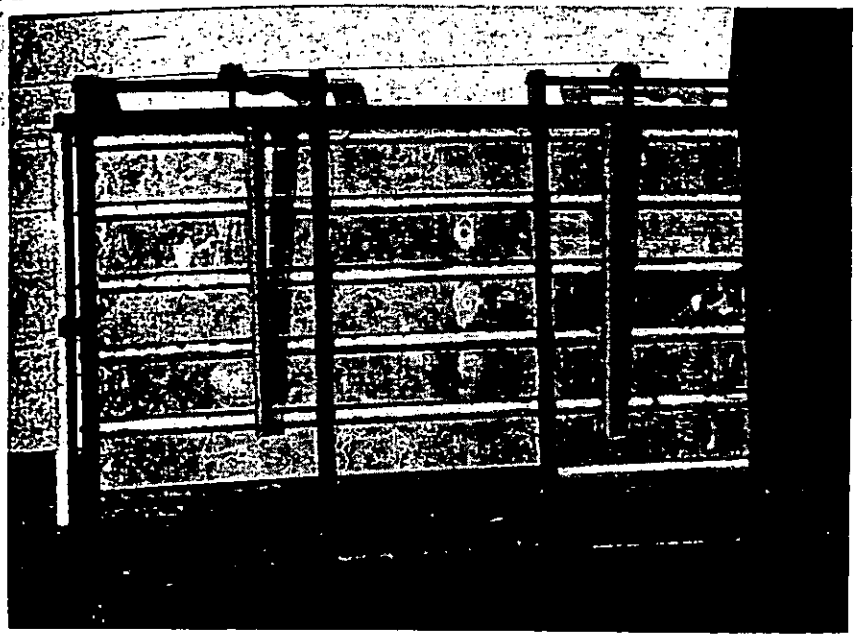

FIGURE 1.—Top of roller-platform as recently modified and strengthened.

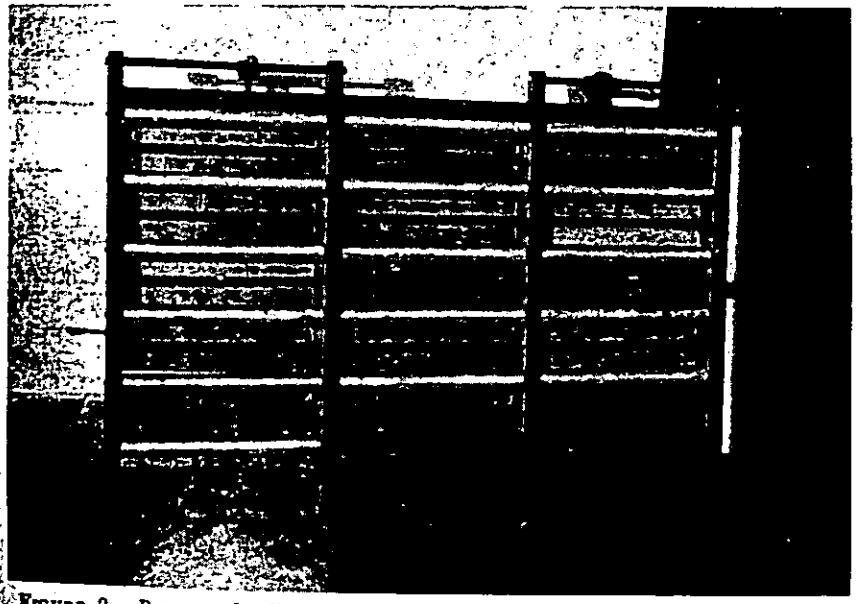

FIGURE 2.—Bottom of roller-platform showing arrangement of framing members.

Placement or installation of the roller-platform requires only a few minutes. A sponge-rubber pad, about the size of the platform, is placed on the floor of the plane. The platform is then laid on the rubber pad and two guide and retainer pins, located on the outside edge, are placed in slots at the edge of the door. All C-47 and DC-3 airplanes have these slots built into the plane for other uses. The discharge lever or bar is hooked into place and the platform is ready for operation. When the roller-platform is resting on the rubber pad all the rollers are held stationary by friction on the rubber. This is important for safety in loading and to prevent accidental discharge of the cargo in rough air before the proper time.

Operation is extremely simple and, we believe, foolproof. The package or packages are placed on the platform with parachutes on top. Static lines are connected and the load is ready. At the proper time the operator pulls back and down on the discharge lever. If bundles are tied with heavy rope or have sharp projections it is desirable to place them on a sheet of scrap cardboard to insure a positive and immediate start without assistance.

In testing and using the roller-platform we have had no failures in operation. The maximum load discharged at one time was 1,200 pounds. In all cases one man has easily operated the lever to raise the platform off the rubber pad and discharge the cargo.

Detail drawings and material lists for manufacture are available upon request from the Regional Forester, U. S. Forest Service, Missoula, Mont.

LARGE CARGO BAGS

The successful use of the C-47 cargo discharge platform for large and heavy packages, or for multiple drops, has made possible the use of large cargo containers which handle a complete 8-man or 16-man outfit (fig. 3). Although experimentation to date has been confined to a 16-man unit, it appears that the outfit should be developed around equipment for 8 men. Two units would then be dropped, at the same time, for 16-man crews. The 8-man unit would be small enough to drop from the Ford airplanes by means of a roller-platform or a roller conveyer.

Several factors must be considered in dropping large packages:

1. The large packages are less likely to "hang up" in tall timber.
2. Large packages require multiple parachutes which reduce oscillation and consequently landing damage and also reduce the chances for damage due to malfunction of one parachute.
3. Large packages reduce the time required in assembling tools and equipment on the ground.
4. While there is some chance of losing the large package through poor spotting, the cluster parachutes and large bundle are easy to find in dense timber. It is more common to lose a single small package, or spend considerable search time, as a result of malfunction of the single parachute.
5. Fewer parachutes are required with large packages as loads can be adjusted more easily to the capacity of the chute. The low-grade plywood platform can be used for a mess table and discarded. The canvas bag, folded, requires about the same space as a parachute for the return trip.

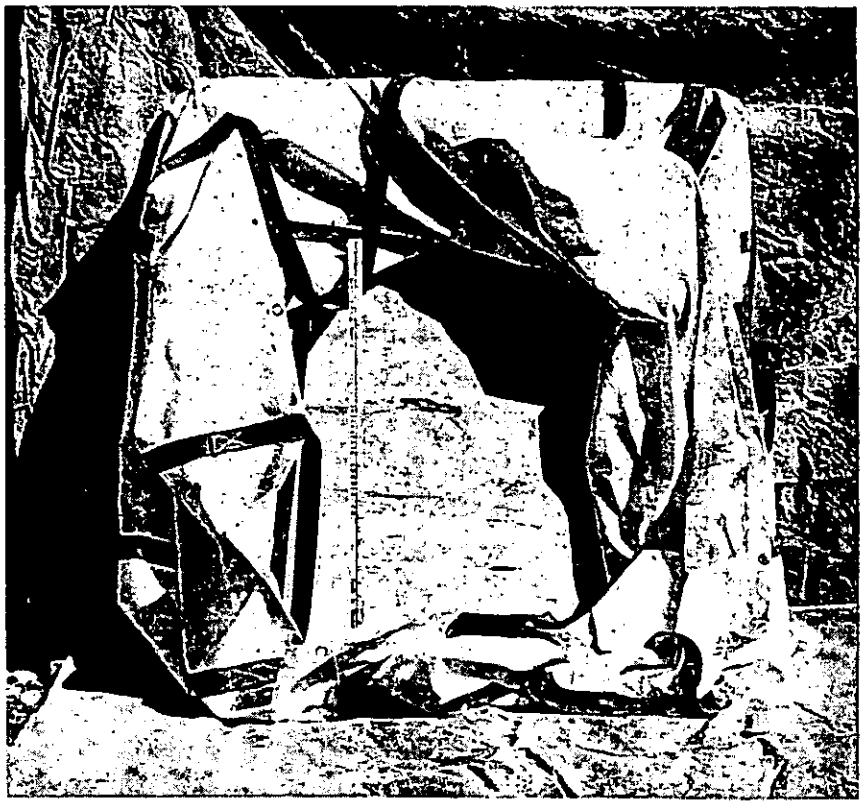

FIGURE 3.—Large cargo bag for carrying complete 16-man tool, subsistence, and camp outfit.

Experimental work has been conducted with a heavy cargo container large enough for a complete 16-man tool, subsistence, and camp outfit. Success with this bag should insure satisfactory performance with the container for an 8-man outfit.

The test bag was made of 12-ounce canvas reinforced with C-8 (2900-pound test) webbing at the corners and sides. A rough 5/8-inch plywood base 4 feet square is used as the bottom platform and stiffener for the bag. Corners are laced to facilitate packing and provide for removal of the contents in the event the load becomes suspended above the ground. Capacity is 64 cubic feet and when loaded with a 16-man outfit the gross weight is approximately 700 pounds. Four parachutes in cluster arrangement are needed.

The cost of materials and labor for the sample bag amounted to $65. Approximately 20 minutes saved in dropping time will pay for the container and we estimate the life of the container as six or seven trips.

Packing the container is important. Heavier packages should be on the bottom with the more fragile items, such as cans of water, placed on top. There are good possibilities of carrying fragile items in a container which is separated from the large bag by a 10-foot "lead" and arranged

to receive support of a large canopy area after the heavier package rests on the ground.

The 1952 program will include construction and test of a cargo bag or platform for dropping a complete 8-man unit. Detailed drawings and specifications for construction of cargo bag for a 16-man outfit are available upon request.

CLUSTER PARACHUTES

Cluster parachutes, two or more parachutes arranged to deliver heavy loads from plane to ground, have several distinct advantages:

1. Heavy loads can be safely delivered with a saving in flying time while over the drop spot.
2. In the event one parachute fails to open the remaining parachute or parachutes will retard the rate of descent and often land the load without damage. This safety factor is desirable in using surplus army cargo parachutes. These parachutes were made available at little or no cost but are not 100 percent dependable because of age and storage conditions.
3. Heavy loads are less likely to hang up in tall timber.
4. Parachutes are more easily adjusted to handle the weights and therefore a smaller number of parachutes is required when dropping large loads of equipment.
5. There is a saving in time required to assemble equipment on the ground.
6. There is less chance of losing a large package than a small one, particularly when a large number of packages are dropped.

In our experimental work to develop methods and equipment for using multiple parachutes we wished to utilize, so far as possible, standard cargo parachutes (fig. 4). We believe this will result in a minimum of modification and eliminate the need for stocking special parachutes.

Preliminary tests were conducted with small (12-foot diameter) flare chutes. Since their construction is identical to that of the 24-foot and 28-foot standard freight chutes, methods of packing, the cluster container, methods of extraction, and performance under load would also

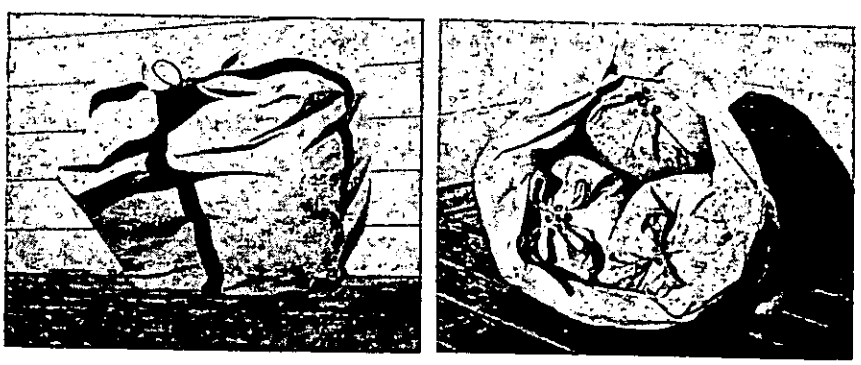

FIGURE 4.—Cluster parachute container. Holds 2, 3, or 4 standard cargo chutes for development in clusters.

be similar. Cost of testing and assembly was greatly reduced and test dropping could be done from smaller planes. After details were completely tested and developed with the small parachutes, the methods and equipment which proved best were used with the standard cargo chutes.

Two methods were selected, the difference being in the method of deployment.

Extraction by direct static line.—This method appears to be the most satisfactory and requires a minimum amount of special equipment and special packing.

A light-weight container is used to facilitate handling the parachute cluster in the plane. It contains a 40-foot webbing riser with two, three, or four leaders, each 10 feet long, at the upper end for attachment to the standard parachutes. Each leader has a loop sewn into the webbing for quick attachment and through which the standard freight riser is fastened.

The standard freight parachutes are opened and just enough of the apex on each chute pulled out of its container to circle it with stout rubber bands. The static line is then connected to the pull ring of each parachute to pull the canopies from the container.

Extractions by pilot chute.—This method is slower in action but also positive. It requires the addition of a small extraction chute which is operated by the static line. No lift is derived from the extraction chute after the cluster is deployed. Excessive stress is thrown on the apexes of the parachutes and reinforcement of the cluster chute apex is necessary.

It was believed that some increase in lift would be obtained from parachute clusters if they were "pig-tailed" or otherwise tied together. Normally the loss of air from each parachute causes them to repel each other, resulting in loss of lift. The arrangement of the pilot or extraction chute served to restrict the spread of the cluster and at the same time provided positive and simultaneous extraction.

Both types of extraction were tested successfully with no malfunctioning of parachutes or rigging. Analysis of packing operations and number of special items resulted in selection of the cluster arrangement which utilizes the direct static line for deployment.

Drawings, instructions for packing, and operational procedures are available upon request from the Regional Forester, U. S. Forest Service, Missoula, Mont.

Chief's Report Features Fire Control

The 1951 report of the Chief of the U. S. Forest Service is entitled "Natural Enemies of Timber Abundance." It prominently features fire as one of the natural enemies. The subject is discussed under the following titles: A complex problem, The status of protection today, Advances in fire-fighting methods and equipment, Forest fire research, Cooperative fire prevention campaign, Fire protection in civil defense, and Forest fires can be stopped.

PENNSYLVANIA'S FOREST FIRE PREVENTION PROGRAM

H. B. ROWLAND, *Chief*, and W. H. SMITH, *Assistant Chief*,
Division of Forest Protection, Pennsylvania Department of Forests and Waters

How can forest fires be effectively prevented? This question, which has faced foresters and fire control personnel for over 50 years, has provoked tremendous amounts of research and innumerable solutions, methods, and practices.

At the turn of the twentieth century the forest fire situation in Pennsylvania was extremely serious. It was actually the primary reason for the creation of the Department of Forestry, now the Department of Forests and Waters.

To appreciate properly the extent of the forest fire problem, it is necessary to obtain some background. This is needed to understand fully the forest fire prevention and control work that has been accomplished in Pennsylvania.

Fortunately the principles upon which the Department's Protection Division was founded were sound and sensible. This can best be exemplified by the following statement on the forest fire situation from the Report of Operations of the Department of Forestry for the years 1908 and 1909:

> The problem of forest fires in Pennsylvania will be solved only by means of education and the help of the people in the community. As soon as the mental training of those who inhabit the mountains, towns and cities are brought to the plane where they will appreciate the wrong and useless destruction and the great loss not only to individuals but to communities, which are wrought by forest fires, just so soon will the moral sentiment of the community turn against this annual performance; and those guilty of starting fires either through malice or negligence, will and should be ostracised in the community and treated as criminals who commit the grosser crimes. But education, or the ability to know and discriminate, must be followed up by active, earnest, helpful, willing cooperation in an effort to prevent or speedily extinguish every forest fire.

With this type of thinking being done by the early leaders, it was possible for the forest protection forces to move ahead with a minimum of confusion or changes in policy.

The first prevention program in Pennsylvania was a broad plan of education for people to use care with fire in or near the woods and not start forest fires. It endeavored to teach people to appreciate the forest from a value and need standpoint. About the only fixed source of fire was the railroads and here early efforts were made to fireproof the rights-of-way with safety strips and to inspect fire prevention equipment on locomotives. Education was directed toward brush and debris burners. Sawmills were inspected with fire prevention in mind. However, the prevention effort as a whole was a general one with wide coverage.

As fire reports, together with forms, maps, and statistics, accumulated each new year, a more specific analysis of the fire situation in the State

could be developed. Special hazardous and high risk areas began to stand out in the various forest districts. These specific areas and their definite problems offered the chance for stressing prevention efforts.

State records in the early 1930's indicated that the size of forest fires and the total area burned had begun to be reduced, although the number of fires appeared to increase. This was due not to an actual increase in numbers of fires but to the development of an effective fire reporting system. Such an increase in number of fires reported, not only in Pennsylvania but nationwide as well, was a result of the expansion and increased efficiency of the protection organizations throughout most of the United States.

The law setting up the Department of Forestry placed all the forest land in Pennsylvania under protection from fire. However, it was not until 1920 that a satisfactory protection organization was effected and a district forester made responsible for each section of the State. By 1921 forest fire reporting had become sufficiently accurate that statistics set forth after that date can be used for comparisons.

For the 15-year period 1921-35 the State records show a total of some 48,670 forest fires reported. During 1936-50 33,830 forest fires occurred. This is a reduction of 14,840 fires, or an average of slightly less than 1,000 fires per year, over the previous period. During these same two comparable periods forest area burned was reduced from 2,367,000 to 756,000 acres, an average yearly reduction of burned area of more than 100,000 acres.

It is reasonable to assume that weather as a factor can be discounted to a large extent when a 15-year period is used for a basis of comparison. Therefore, it can be said that the large reduction in the number of fires reported during the past 15 years was primarily due to the prevention practices employed by the Department of Forests and Waters and others interested in conservation. The downward trend of the fire problem in Pennsylvania is shown in the following tabulation of the forest fire statistics by 5-year averages:

	Fires per year		*Area burned per year (acres)*	*Forest land burned (percent)*
	Number	*Average size (acres)*		
1911-15	1,066	340	362,379	2.40
1916-20	1,454	149	216,869	1.43
1921-25	2,832	79	223,680	1.48
1926-30	3,189	46	145,160	.96
1931-35	3,713	28	104,587	.69
1936-40	3,213	15	46,868	.31
1941-45	2,160	32	68,480	.45
1946-50	1,393	26	35,885	.24

The reduction in area burned can for the most part be attributed to the continued improvement in the fire control organization, techniques, and equipment. The trend in average size of the individual fire is downward so long as the control organization keeps pace with the prevention activities and vice versa. When either one or the other gets out of line this figure will fluctuate. This accounts for the low average area per fire during the 1936-40 period when the emphasis was on extinction while the fixed area prevention program was just getting underway.

The percent of forest land burned follows the general trend of the

State's protection activities as it moves downward with each passing period. The present goal is one-tenth of one percent.

The anthracite coal region of Pennsylvania had long been known to be an especially serious forest fire area. This was a general idea and not limited to any specific place. It was realized that protection appropriations and personnel were being used in this region considerably out of proportion to other forested areas in the State.

By 1936 many of the records and statistics had been carefully analyzed and an effort was made to stop generalizing and to correlate fire occurrence with fixed areas or political subdivisions. The only practical and established units in Pennsylvania were the townships. It was well understood that this was not an ideal breakdown since no two townships were alike in size, forest area, fire risk or hazard. It did, however, offer an existing unit that could be used annually for comparative purposes within set limitations. It provided established subdivisions for study and assignment of prevention projects.

Township maps showing spot locations of fires were pointing out certain outstanding problem areas. Annual tabulations of fires by townships were showing quite clearly the relative importance of these problem areas. At the close of the 1940 season, the fire statistics for the 5-year period 1936-40 were closely analyzed and the average occurrence of fires by township determined. These studies pinpointed the areas of high fire occurrence. The figures for this period were then set up as a standard for future planning and evaluation.

In general it was noted that fires occurred in practically every part of the State. However, any unusual number of fires in any one township was taken as an indication that a definite fire problem existed. As a fire occurrence standard for designating a township as a problem area, the figure of 10 fires per year, based on 5-year averages, was arbitrarily chosen. The original list placed Hazle Township, Luzerne County, at the top with 99 fires per year. Altogether the list contained 48 townships each having more than 10 fires per year.

When it is considered that there are approximately 1,600 townships and civil divisions in Pennsylvania, it can be readily seen what a small part of the State was included in this list of problem townships. Further study, however, revealed that these 48 townships accounted for 35 percent of all the fires in the State but included only 5 percent of the total forest area of 15,127,640 acres. These townships, then, were the problem areas on which specific prevention practices could be concentrated.

During the spring of 1940 the first concentrated effort on specific prevention projects was made. The initial phase of the plan was to assign twelve young foresters to the projects, one man to several of the townships having the highest fire occurrence.

They were given lists of suggested activities, maps, and fire occurrence tabulations and charged with the task of making a definite plan for the prevention of fires in their assigned areas. Suggestions were made that they work with local officials, resident groups, and others in order to encourage cooperation, plan prevention, and promote educational programs for the people. This phase of the program was later followed by assigning certain forest inspectors (nontechnical fire control personnel)

to specific townships to work with the foresters in setting up actual prevention projects.

These projects included safety strip work along railroad rights-of-way. Here a 100-foot strip was burned out for the distance necessary after a bulldozed or hand-raked back line had been constructed down to mineral soil. All together there are over 300 miles of such safety strip maintained in the State to prevent railroad fires.

Many of the small mining communities in the coal region located adjacent to forest or brush land were causing innumerable debris and brush burning fires every year. To overcome this problem safety strip projects were set up. These consisted of bulldozing or hand digging a fire line adjacent to the wooded areas and control burning the flammable material, weeds and brush, between it and the community. This treatment tended to fireproof the area and thus prevent fires from occurring.

The playgrounds, sports fields, and recreational areas which were determined to be potential fire hazards were treated similarly each year. Areas along roads and highways known to be hazardous were also given the safety strip treatment. In most cases this entailed control burning the grassy areas adjacent to the roads, or hazard areas, the distance necessary to make it safe. The need for a back line depended upon the local conditions. In most cases careful control burning precluded the need for such a back line. In cooperation with the local officials city and local dumps, which are always a fire hazard, were also safety stripped.

In addition to these projects concentrated prevention education was carried on in the areas which showed a preponderance of forest fires. The idea was to fit the prevention means, methods, and media to the immediate problem and type of people concerned. For this purpose a large amount of specially designed, mimeographed prevention material was prepared.

As a means of quick suppression and also for on the spot prevention work, the number of 1- and 2-man smokechaser units was increased during the fire seasons in these problem areas. The very presence of these men was extremely helpful in preventing fires, from a psychological standpoint in addition to the assigned work which they did.

In the areas where this specific prevention work was in effect the 5-year average of fire occurrence from 1940 to 1945 showed a marked reduction. The average number of fires per year for all 48 townships, plus 4 more which entered into the more-than-10 fire class during this 5-year period, was 652 or 30 percent of the 2,160 fires for the entire State as indicated in the following tabulation:

	Average number of fires per year		
	1936-40	1941-45	1946-50
All 52 townships with high fire occurrence	1,136	652	288
State	3,213	2,160	1,393

Further analysis showed that the reduction in number of fires amounted to 42 percent in the 52 townships given treatment as compared to 28 percent for all other townships.

During the 5-year period ending in 1950 the prevention work was continued or intensified in these areas. Every effort was made to put in a suggested remedy for each fire that had occurred. Again the number of fires was substantially reduced, and, for many of the townships, car-

ried well below the 10-fire mark and held there. Hazle Township, Luzerne County, which had led the list with an average of 99 fires per year, now had an average of only 5 fires. The following tabulation shows the progress made in reducing the number of fires in the 12 counties at the top of the list in 1940:

Township and County	*Forest area (acres)*	*Average number of fires per year*		
		1936-40	1941-45	1946-50
Hazle, Luzerne	26,331	99	52	5
Foster, Luzerne	24,748	72	29	3
Mt. Carmel, Northumberland	10,286	63	12	5
Coal, Northumberland	13,387	55	14	3
Archbald, Lackawanna	9,518	53	9	10
Mahanoy, Schuylkill	10,259	42	26	8
Hanover, Luzerne	8,960	38	38	4
Kline, Schuylkill	6,462	37	23	7
Plains, Luzerne	7,473	32	6	6
Newport, Luzerne	7,067	32	14	2
Mauch Chunk, Carbon	24,892	32	29	12
W. Mahanoy, Schuylkill	4,070	28	23	8

For the 5-year period ending in 1950 the 52 townships had only 288 fires per year, or a reduction of 75 percent from the number that occurred during 1936-41. For all other townships the reduction was only 47 percent, and for the State as a whole 57 percent. This further emphasizes the value of specific treatment in areas of high fire occurrence. This reduction in fire numbers is especially interesting in that the number of persons using the woods during this period increased more than 50 percent over that of the previous 5 years.

After studying and observing the results of these prevention projects it is felt that outstanding progress has been made in Pennsylvania's forest fire prevention program. At present all but 5 of the original 52 townships have been removed from the problem list. One of these exceptions is Rush Township, Centre County, which is on the list primarily because of its size. It contains ten times the forest area of the average township, more forest area than each of 11 whole counties in Pennsylvania. The other four exceptions are townships in which this specific prevention treatment has not been applied as intensively as in the others.

Now that these problem areas have been brought back to average or better, the task ahead is to maintain or further improve the records. This leads to the next stage of planning for this purpose. At this writing a new list of townships has been made with the critical point for the problem area status set at 9 fires rather than 10. This list contains only 18 townships based on the latest 5-year averages. Plans have been made for applying specific prevention projects in each of these areas in an effort to bring the number of fires below the set critical point.

This does not mean that the work done in the original critical townships will be relaxed. Most of the projects will be carried on as before but possibly not to the same degree of intensity. Perhaps as time goes on and it is felt that the various problems are resolving themselves, the actual prevention work will be lessened to a greater extent. However, this will be gradual and dependent upon local conditions in each specific area.

This article is not meant to imply that this work is a solution to all of Pennsylvania's forest fire problems. It is well realized that only one fire occurring in the State at the right time and in the right place could burn

thousands of acres if it was not promptly and efficiently handled. The fact remains, however, that for each fire prevented the chance of this happening is proportionally reduced. In addition, each fire prevented means the continued availability of the control force for the fire that does occur.

This prevention program in Pennsylvania is designed to stop fires by eliminating the source of the trouble which causes them. The program set up to do this has been successful and its potentialities cannot be overlooked. As has been pointed out, the program will be continued with higher goals for attainment established as the fire problems are reduced in numbers.

Somewhere along the line there is an irreducible minimum insofar as forest fire occurrence is concerned. However, we do not believe that this point has been reached as yet. Nor do we believe that it will be realized State-wide in 1 year or 10 regardless of the funds spent each year to achieve that goal. Rather the prevention program is continuous year after year, each period's accomplishment adding its weight to the over-all job to be done. Whether this program will eventually solve all the forest fire problems in Pennsylvania remains for the future to answer, but it is hoped that this type of program will enable the State to reach the point where forest fires will not be a threat to her 15 million acres of growing forests. In the foreseeable future, however, it will be necessary to maintain an alert, well-trained, and well-equipped fire control organization primed to handle both the prevention and extinction phases at all times and under any emergency.

Fire Pruning of Slash Pine Doesn't Pay

In a recent test where severe fires should have hastened natural pruning of slash pine, a small gain in pruning was offset by a loss in height growth.

On February 28, 1949, a class 5 fire day, head-fires were set in three plots in a poorly stocked plantation on an upland site in south Mississippi. At that time the slash pines were 9 years from seed and averaged 23 feet tall. The fires caused only 2 percent mortality.

Measurements in March 1951 showed that 2-year height growth of the slash pine was 5.3 feet on burned plots and 6.8 feet on adjacent unburned plots. This loss of 1.5 feet was almost equal to a half year's height growth. For trees of equal height at the time of the fire, the lowest live limbs in 1951 were 1.9 feet higher on burned trees than on unburned.

Even for very tall burned trees (40 feet high in 1951), the average height of the lowest live limbs was only 14.2 feet. Thus the maximum pruning accomplished by fire has not been great. Any fire intense enough to prune southern pines is likely to cause growth losses similar to those measured on these plots. In this plantation, it seems likely that natural pruning of the unburned trees will catch up with that on the burned trees in about 3 years, and that the principal permanent effect will be the loss of about a half year's height growth.—DAVID BRUCE, *Southern Forest Experiment Station.*

MICHIGAN POWER-WAGON PLOW

STEVEN SUCH
Engineer, Michigan Forest Fire Experiment Station

Undergoing extensive field tests in Michigan at the present time is a hydraulically controlled fire line plow mounted on the rear of the four-wheel-drive power wagon described in the October 1950 issue of Fire Control Notes. This plow is the result of 2 years' work directed toward the development of an efficient, practical plow unit for trucks in the power-wagon class (fig. 1).

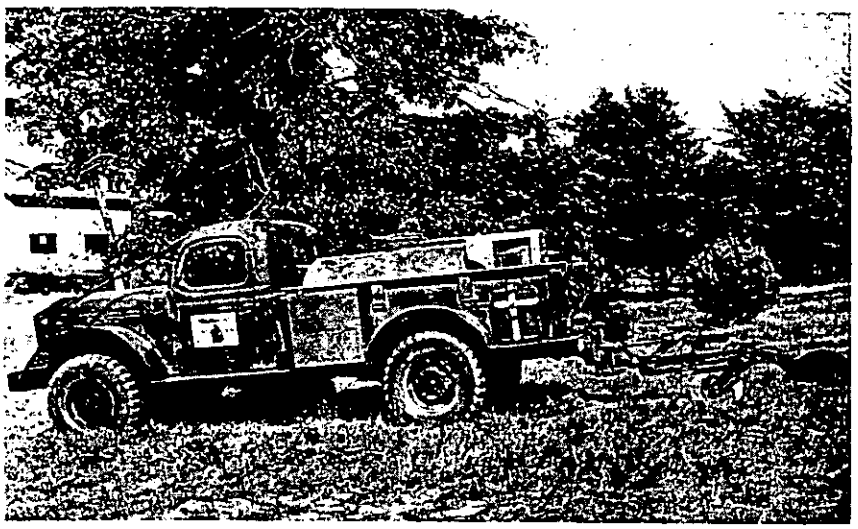

FIGURE 1.—Michigan power wagon with hydraulically controlled fire line plow ready for use.

Originating as an idea in the field, the plow was designed and tested at the Michigan Forest Fire Experiment Station, with several other models preceding the one now being tried. The present design seems to best satisfy all the conditions required of such a unit.

Some of the features of this plow, including a simple mechanical linkage, are:

Double hydraulic action, permitting the plow to be lifted behind the truck as well as being pushed into the ground.

Cylinder-over-beam design to obtain the most efficient use of the weights involved and to gain the maximum compactness for transportation purposes.

Depth control mechanism in a convenient place for quick and simple adjustment of depth when drawbar height changes as a result of a fluctuating water load.

Spring action through an integrally mounted spring which absorbs shock loading while creating a constant down pressure.
Tracking action permitting the plow to follow the truck around turns.
Quick detachability.
High clearance.
Low drawbar power requirements.

The control mechanism for the hydraulic circuit is located in the cab of the truck and requires only a lift or a downward push on a lever to get the desired action on the plow. For carrying, the beam rises into a vertical position where it can be held by the hydraulic force of the cylinder if the plow is to be used intermittently, or it can be secured with safety chains when highway travel is anticipated (fig. 2). Down pressure can be exerted to the point of actually raising the back of the truck.

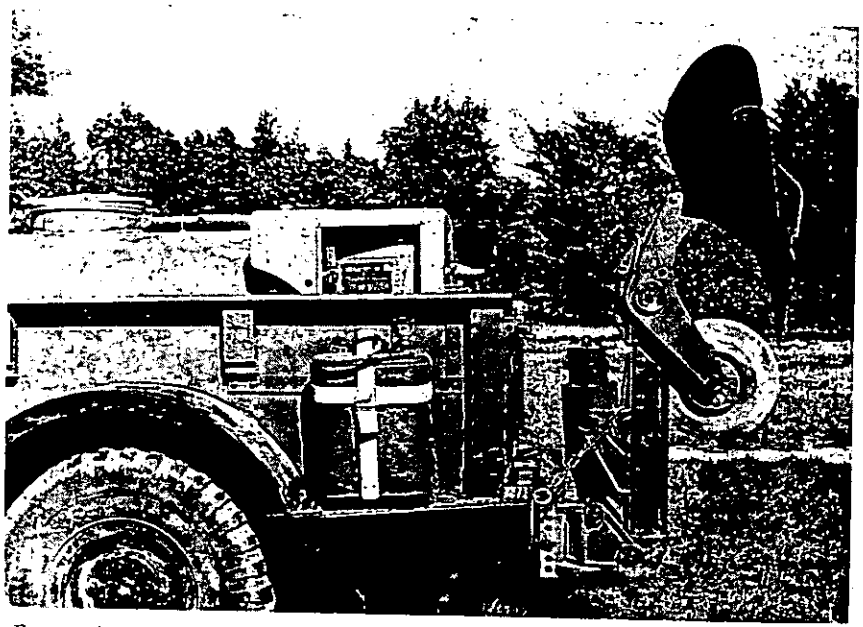

FIGURE 2.—Plow in vertical position secured by safety chains for highway travel.

When in operation, the hydraulic cylinder floats inside a larger cylinder. The floating action is obtained through the spring which is coiled around the smaller hydraulic cylinder. This feature is particularly desirable in rough country where long skips would be encountered with a stiffly mounted unit.

Because the truck bed rises as the water load decreases, thus changing the drawbar height, this condition is counteracted by the use of a depth control screw on the top of the beam at the rear of the plow. This screw eliminates a burdensome job of changing heights at the head of the plow. The principle involved here is simple, being centered around the pitch of the plow point. Any depth can be had by varying the degree of pitch. To insure a consistent pattern in operation between the rolling coulter and the plow bottom they are combined as a single assembly never

changing positional relationship through an entire cycle of depth adjustments.

Lateral or sidewise action takes place about a vertical pin which permits the plow to track freely after the truck even on the most acute turns. This action is necessary to minimize lost line. When being lifted on side slopes the plow swing is controlled by positive stops, and at the top carrying position it swings into a central position by a cam-like action about the vertical pin.

Maximum plowing depth is about 4½ inches, this depth being governed by wide flanges on the sides of the rolling coulter. The width of line at this depth averages about 54 inches, depending somewhat on the soil and cover types.

The use of a middlebuster type bottom with moldboard extensions, and the addition of turf knives, gives a most satisfactory, clean-cut line of suitable width for the purposes intended for this unit (fig. 3). This combination of bottom and turf knives creates the least amount of resistance to forward motion of any bottom tried to date. The entire bottom, with the exception of the turf knives, can be purchased commercially, as can the 18-inch diameter rolling coulter used. The extensions on the moldboards have been a helpful addition to the plow in that they hold and push aside the furrow slice, thus reducing the amount of lost line.

Total weight added to the power wagon by the installation of this unit is close to 700 pounds. This includes all the parts of the hydraulic devices, the castings, and the plow. It should be pointed out, however,

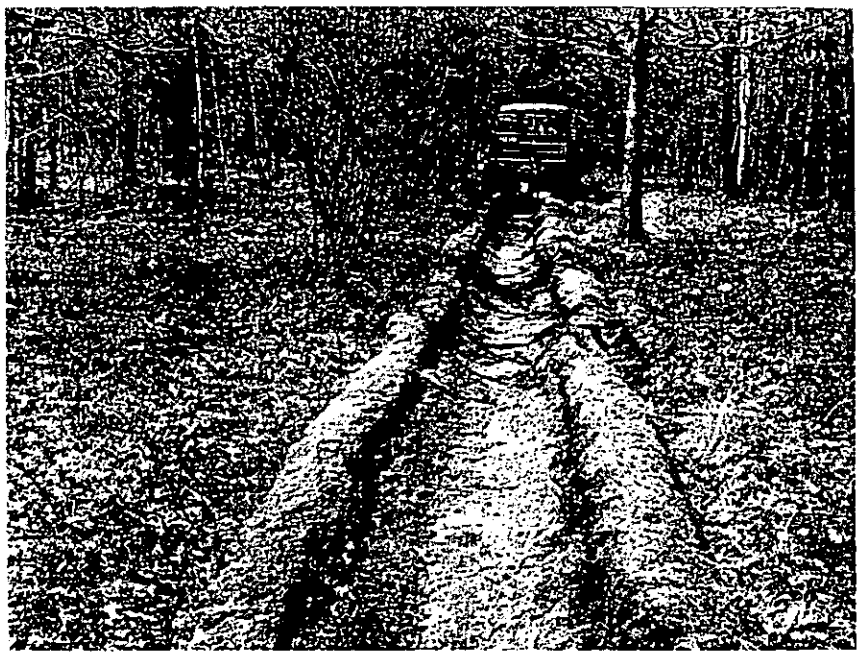

FIGURE 3.—Clean wide line made by power-wagon plow.

that close to 80 percent of this weight is on the plow when it is operating, and only 20 percent is carried as dead or nonfunctional weight on the truck.

The discriminate use of castings to combine functions and to simplify production has minimized work time necessary for manufacturing as well as greatly improving the ultimate design of the plow and its attachment to the truck.

Every effort has been made to reduce the cost of this unit to an absolute minimum without sacrificing quality, strength, or safety. At the present time no definite figures can be given on the exact cost of the completed outfit as installed and ready to work.

Future plans include similar hydraulic plow adaptations to crawler type tractors. In regard to power-wagon usage, further refinements unquestionably will arise, and already in the thinking stage are multiple uses for a form of hydraulic power package unit of which the plow would be only one element. Other tasks requiring a large force, such as lifting, pushing, or carrying, offer possibilities for expanding the use of the hydraulic units on four-wheel-drive trucks just as it has on crawler tractors.

Additional information on the power wagon and the power-wagon plow may be obtained from the State Department of Conservation, Lansing, Mich., or from the Michigan Forest Fire Experiment Station, Roscommon, Mich.

Improved Support for Fuel-Moisture Sticks

Ever since the fire danger rating system has been in effect fuel-moisture stick supports have been unstable. To overcome this a new support has been devised (fig. 1). It can be used with either the early standard system or the newer, open type station.

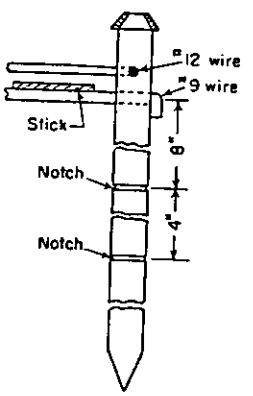

FIGURE 1.—Drift pin support.

Four iron drift pins ½ by ½ by 24 inches (or square or rod iron) are drilled 1 inch below the top with a hole large enough for No. 9 galvanized wire. Two pins have another hole drilled at right angles ¼ to ⅜ inch above the first. No. 9 wire runs through the lower holes to support the sticks; the other holes are used for wire laid across the top of sticks to hold them in place. File a notch around each pin 8 inches below the 1-inch hole, and a second notch 4 inches below the first. The first marks the top of leaf litter or ground level depending on the system used. The second notch marks ground level for open type stations.

Little can be held in place by using 2-by-4's around the screen supports. A neater, trimmer job is gotten by using a piece of 4-inch wide zinc. Leaf litter is covered with 2-inch mesh wire.—E. B. OLSON, *Cheat District, Monongahela National Forest.*

A FIRE-WHIRLWIND OF TORNADIC VIOLENCE

HOWARD E. GRAHAM,[1] *Meteorologist*
Fire Weather Service, U. S. Weather Bureau, Portland, Oreg.

Whirlwinds occasionally have been reported occurring within various types of fires. Accounts sufficiently detailed to give the reader a definite idea of what the reporter had actually seen are rare. Since the fire-whirlwind is a phenomenon of considerable importance to fire fighters, I will attempt to describe one which was observed by Robert S. Stevens, Forester, Oregon State Board of Forestry, and myself at 2 p.m. August 23, 1951, on the Vincent Creek fire in southwest Oregon. Figure 1 portrays the spectacular wind conditions.

From our vantage point about 200 yards away it was evident that violent whirling surface winds existed over a diameter of some 100 to 200 feet. In the middle of this circulation was a dark tornado-like tube which extended upward, the top being obscured by drift smoke above approximately 1,000 feet. The winds in this tube were so extreme that a green Douglas-fir tree, which at breast height was about 40 inches in diameter, was quickly twisted and broken off about 20 feet above the ground. In the area of the whirlwind, the fire flames leaped several times higher than those surrounding. A large tree top burst into flame like the flash of a powder keg when the whirl passed by. Within the tube, gases and debris were moving upward at a high velocity. The whirling column remained nearly stationary during its activity, moving little more than 50 yards. Had that not been the case, extremely rapid fire spread might have resulted. The whirlwind rapidly disappeared and as rapidly reformed a moment later, repeating this procedure at least 3 times during a 10-minute interval.

The general fire was on a 50-percent south-southwest slope. The trees were widely spaced with fuels consisting of low brush, weeds, snags, and down logs typical of an old burn in this region. The fire front was moving steadily along the contours and extended up the entire slope, about one-half mile from top to bottom. Flames along the front were about 5 feet in height. Shorter flames persisted to a distance of about 50 feet behind. A slight spur ridge projected from the slope so that updrafts were moving from both the south and the southwest into the area of the whirlwind. The fire-whirlwind developed a few feet behind the fire front 150 yards from the summit of the main ridge and on the spur ridge.

The meteorological condition of the atmosphere was one of conditional instability. Overturning of the air in the lower layers could readily occur if the surface were heated sufficiently. No cumulus clouds were to be seen. Winds at ridge top were north-northeast from 10 to 15 miles per hour. Above the ridge top level, winds were from north-northwest to

[1] The diagram was prepared by the Pacific Northwest Forest and Range Experiment Station draftsman.

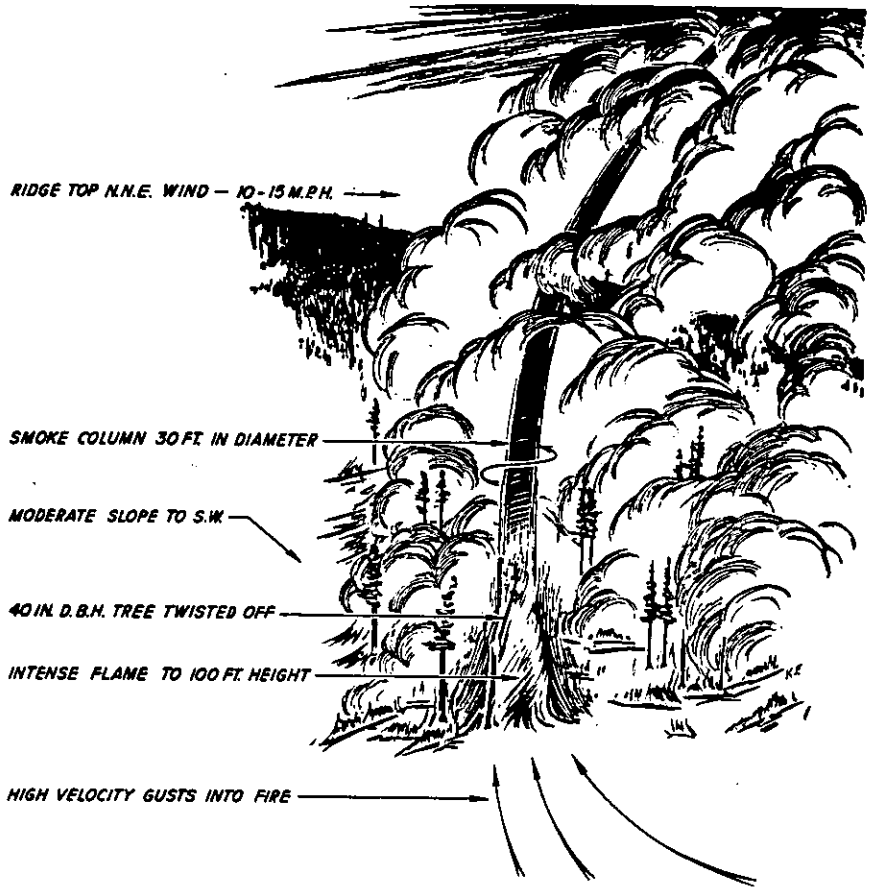

FIGURE 1.—Diagram of fire-whirlwind observed at the Vincent Creek fire.

north-northeast and ranged from 8 to 16 miles per hour up to 10,000 feet. The relative humidity was 46 percent and the temperature 67 degrees, neither being unusual.

There has been much written on various types of whirlwinds and their causes. Much is yet to be learned. Meteorologists know that these whirlwinds at present only where the atmosphere is in a particular condition of unstable equilibrium—where the temperature decreases so rapidly with height that the warmer air below, being lighter than the cooler air above it, tends to rise, and conversely, the cooler air aloft tends to sink. The result is intense vertical currents throughout the unstable layer.

In this case, we have the heat from the fire which caused the unstable conditions. However, this is an entirely normal situation over a large fire. Since these violent fire-whirlwinds are infrequent, there must be some condition other than heating to cause their formation. Perhaps the answer lies in the interplay of wind currents and topography. In the case under discussion, consider the position of the whirl near the top of a sunlit

south-southwest slope where it was fed by upslope drafts from the south and southwest in the surface layers. Above the level of the ridge the rising currents from the fire were played upon by the prevailing gentle to moderate north-northeasterly wind. Perhaps herein lies the answer. There were two opposing air currents with a column of rapidly rising gases between. This is an ideal condition for the formation of mechanically induced eddy currents. An eddy current, once started, might be sustained by the energy of the rising hot gases. This theory is substantiated by the repeated reappearance of the fire-whirlwind in the same spot. As the leading edge of the main fire progressed, the fuels in the area of the whirl were consumed and the volume and heat of the ascending gases became apparently insufficient to support the whirlwind. As the fire moved on to new fuel and new topographic features no further disturbance was noted.

From this analysis it would seem likely that there are certain ideal combinations of conditions under which this type of fire-whirlwind of extreme violence might occur. The necessary factors seem to be for the fire to be on the lee slope sheltered from the prevailing ridge top winds, a moderate or stronger wind at the ridge top and strong converging surface updraft currents along the burning or sunheated slopes. It would be desirable to have the necessary combination of conditions more positively identified so that fire fighters could learn to anticipate at least this one type of blow-up fire behavior. Additional detailed accounts of similar phenomena would contribute to the understanding of their causes and their effects on fire behavior. These accounts should attempt to describe the topography, surface wind, ridge top wind, fire intensity, cloud types, smoke column characteristics, and the intensity of the fire-whirlwind.

RECENT DEVELOPMENTS IN SOUTHERN FIRE CONTROL [1]

ARTHUR W. HARTMAN
Assistant Regional Forester, Region 8, U. S. Forest Service

The statements made here are meant to have application only to the 11 southern States. The thoughts and facts presented are not just my own. In evaluating and choosing for this paper those developments which must be credited with exercising the more significant and valuable effects, I have had the benefit of advice and suggestions from a cross section of men long and intimately familiar with southern forest fire and timber management problems.

For anyone properly to appreciate and measure the meaning of these developments, it is necessary first to have a general picture of the situation as it existed in the South only a few years back.

In round figures, there are 180 million acres of forest land in this area —about one third of all commercial forest land in the United States; land which now grades all the way from denuded of commercial tree species up to heavily stocked with high-value timber growth. Due in part to our long growing season and the nature of our tree species, these lands as a whole have the highest wood-yielding potential of any major area in the United States. This area can—and some day will—be this country's superior wood-producing area. One can safely say that the South would be occupying that position today except for one factor: The historic prevalence of an immense and widespread fire problem.

It would be oversimplification to say that through elimination of wildfire alone, southern pine lands would return to a highly productive state. Yet, the seeding proclivities and fire resistance qualities of the southern pines are such as to make the above statement nearly true.

The existing stands, vast in their aggregate, and all of which have been burned one or more times, are dense, understocked, or nonproductive in direct relation to the fire history of each. Bad cutting practices have had their effect. Nevertheless, in spite of former widespread exploitation logging, one can find near endless examples of fine naturally regenerated second-growth stands on those abused lands where it so happened that woods fires were infrequent. Fire control intensity has been and will continue to be the most decisive factor in determining the extent and quality of timber stands available to the landowner or silviculturist on which to apply good management practices.

Prior to the CCC program in 1933, only fractional and scattered parts of this area received any organized protection. Some States had not then created even a nucleus of a protective organization.

In 1932, 41,391,690 acres were under protection of some degree. On those protected areas occurred 21,776 fires which burned 2,342,960 acres.

[1] Paper presented at the annual meeting, Society of American Foresters, Biloxi, Miss., December 14, 1951.

On the 129,000,000 acres of unprotected forest land, there occurred (incomplete) 101,277 fires, burning 38,732,560 acres.

I do not wish to burden you with statistics. Certain figures, however, are essential in producing a picture of the changes which have occurred and the present situation:

	Protected area		*Unprotected area burned*	*Total burned*
	Total	*Burned*		
1932	41,391,690	2,342,960	38,732,560	41,075,520
1940	84,603,000	1,704,251	27,383,649	29,087,900
1945	96,647,000	1,354,741	13,986,527	15,341,268
1950	133,600,000	2,754,522	10,920,155	13,674,677

In other words, the area under protection has more than trebled. The area burned annually has been reduced by two-thirds.

While we are considering progress, a misconception of the existing southern fire problem could be formed if at this point I did not underscore the fact that in 1950 there remained 47,000,000 acres of unprotected forest land, on which occurred 97,395 fires, burning 10,920,155 acres.

The previously quoted figures do tell a story of steady and outstanding progress in fire control effectiveness. The question follows: What were the developments contributing most to those effects?

First, within the last few years there has been a tremendous reversal in the minds and viewpoints of the general public towards woods fires. Call it Fire Prevention, I&E, or what; the fact is that across the South, from a former combination of actual belief in woods burning and mass indifference, the business, civic, and political leaders, newspaper editors, folks in the small towns, and many rural residents have gained an understanding of the limitations imposed upon the general economy by past woods burning.

There now is widespread realization that the southern timberlands can produce so bountifully and steadily as to create large income to landowners, and the wages and business transactions which would go with the expanded wood-using industries can rise to where these industries would assume a major and stable role among all other contributors to southern economic health.

This change in public attitude is the fruit of: (a) The unremitting and extensive educational campaigns conducted by forestry and agricultural agencies and by the more farseeing and better led wood-using industries; and (b) the power of the dollar—the recent vigorous growth of all types of wood-using industries. This growth is illustrated by the southern pulp industry which during the last decade has expanded to 61 mills with 7 more building, and which now is consuming 12,250,000 cords per year or 60 percent of all pulp produced in this Nation.

This demand for stumpage at good prices at all points in the South, coupled with the creation of significant woods working pay rolls, has given concrete meaning to the foresters' story that tree growth is too valuable to destroy and has had much to do with the development of positive opposition to woods burning by such a large part of the public. Again, this is progress only. We still have a long way to go before that remnant of the population still prone to deliberate and careless woods burning is educated to where fire occurrences will approach reasonable numbers.

Under the best of prevention conditions, the southern woods will continue to have fires. As protection becomes more effective and fires less frequent, a marked change occurs in the nature and density of ground cover and behavior and intensity of fires. In frequently burned woods, the amount of fuel is of course relatively light, and fires are not too difficult to suprress. With protection, our fuels accumulate, young growth develops and fires tend to crown.

Down here we must contend with a lush growth and rapid development of fuels. They are flash fuels, will burn within a few hours after a heavy rain, and will burn at any time of the year. Our fires spread fast and before the high winter winds, will run and spread with extreme rapidity. Fire spread is so fast and the amounts of control line to be built pyramid so rapidly, that even with great reservoirs of trained manpower quickly available during CCC days, and the then much lighter fuels, we learned that manpower with hand tools could not do an acceptable suppression job.

After the close of CCC, the southern fire men soon learned that the combination of time required to gather and place manpower on the fire line, the rapid advance of the fires, the increased difficulty of building a control line, and the peak numbers of simultaneous fires in an operating area, added up to defeat.

The magnitude of our fire problems magnified the inherent weaknesses and limitations of old suppression methods and had the fortunate effect of supplying the impetus needed to rapidly develop and adopt more effective methods and facilities.

In addition to the major change in general public opinion toward woods burning and fire prevention and the marketability of woods products at good prices accompanying the expansion of southern industries, the following have been significant developments.

1. Of crucial importance was the increase in State fire budgets from $2,258,214 in 1941, to $4,898,000 in 1946, and $10,262,000 in 1951. Those increases reflect, of course, the development of more effective presentation of the value of fire control to the people and the State legislatures.

2. We have expanded the use of fire danger meters to guide the daily intensity of observation coverage and the activation and strength of key suppression forces.

3. Most protective organizations have developed effective radio networks that make direct communication possible between all levels from the chief to the crew leaders. This has resulted in a speed of action and degree of coordination between segments of organization not otherwise obtainable.

4. The most outstanding and revolutionary development has been in the field of powered fire line equipment. In the southern States, State foresters, national forests, and industrial landowners have acquired more than 1,300 mechanized fire line units during the past 6 years. These units, designed to meet specific performance requirements, are divided into four general weight or size classes, each with alternate designs to conform to the requirements presented by topography, soils, types and density of ground cover, and rates of fire spread found in the different areas and timber types.

These units, many of which require a crew of only 3 or 4 men, have a productive capacity equivalent to 40 or more trained and fresh men;

they can keep going day or night and handle a number of fires in one day. The relative effectiveness of equipment over straight manpower increases by the hour. In our climate at least, the exertions incident to building fire line by hand wears men out rapidly and their productive rate begins falling. Equipment fire control operations require less physical effort on the part of supporting manpower, and replacement of those crew members is a relatively simple problem.

One key to their outstanding success is that, with radio communication and fast transports, these units can be spotted at strategic points, and they start line building while fires are still small and usually have a fire suppressed in less than the time required to simply assemble a sufficiently strong manpower crew.

Another key is that the high mobility of these radio-controlled mechanized units make it possible in a short time to draw from a wide area and concentrate on a dangerous situation the numbers of these powerful forces that the situation may demand. Studies have revealed that under parallel situations, the total cost of mechanized suppression is about one-quarter of the cost of hand tool suppression.

Of even greater importance, the area burned, and consequently the amount of fire damage, on the equipment-fought fires is about 20 percent of that which we suffer under the hand tool control methods.

In the past, during periods of high burning conditions, fires—even with more than 1,000 men on them—reached major sizes and burned for days. In areas properly equipped with machines, no fire situation has developed which could not be controlled in a matter of hours.

5. The development of prescribed burning or the use of fire as a timber management tool has resulted in outstanding contributions to the know-how and quality of fire control operations. Nevertheless, it must be emphasized that properly conceived prescribed burning is primarily for silvicultural effects.

By some, this activity is misconstrued to include the old practice of "light burning" or the burning off of an area simply to prevent a later wildfire from running through it. Prescribed burning *does* lessen the probability of a disastrous fire. On a large and managed area normal use of fire for silvicultural objectives results in the removal of dangerous fuels from a number of separate blocks thereby increasing the probability of a bad fire running into one of these blocks where it can be stopped quickly. Its one direct protective use is in the breaking up of extensive bodies of dangerous fuels by burning a new pattern of strips annually at various strategic locations, with a technique that inflicts only minor damage to the commercial stems and continues those areas in timber production.

A more significant contribution is what the execution of prescribed burning has taught the fire man about the characteristics and behavior of fire in our fuels. Wildfires usually are suppressed under conditions of rush and excitement. There then is but limited time or opportunity to calmly study the many vagaries of fire.

When using fire as a planned work job, even the old timers exhibit nervousness during their early experiences. However, as time passes and they work steadily under conditions of calmness, they begin to observe and learn fire's more intimate behavior characteristics. They learn the ways fire actions can be predicted and directed. In time they gain a feeling

of confidence and surety of their ability to master fire. Out of this work has come a corps of men and attack methods having definitely superior effectiveness in the suppression of wildfires.

6. More effective training is being given through cooperative programs by the protection agencies. The quality of execution of any job is set by the quality of training given the men who are to do it. This fact assumes greater importance in the actions of suppressing live and moving fire where the penalties for delays or substandard performance can be so costly. One of the two more valuable developments has been the combined field training programs attended by key men from all protection agencies within a State and in which each organization takes leading parts. This approach results in rapid exchange of the lessons each organization has drawn from its experiences, a broader source of minds to consider each other's problems, and more uniform operating methods by agencies which frequently have to work together on the same fires. The second development has been more and more use of actual fires as models on which to demonstrate both good and bad practices and work out improvement suggestions.

The critiques which follow these "live ammunition" actions have demonstrated that these training lessons are more vivid, clear, and lasting than those using classrooms or simulated fires only.

Improved Stick-on Azimuth Circles

The Rocky Mountain Region of the U. S. Forest Service has for many years had a problem in the production of radial circle maps for fire control use. The azimuth circles were first drawn by hand, which was inordinately time-consuming even when done by skilled draftsmen.

In the mid-thirties the California Region developed a hand instrument for printing protractors on base maps. Known as the California Printer, it speeded up the process of adding radial circles; but great care had to be taken to get the placement and orientation right, and the imprints lacked the sharp definition that is desirable. The instrument is still used in many areas, however.

Attempts were also made to fasten printed radial circles to maps with adhesive. One of the first commercial products in this field, the "Glassine" radial circle, was printed on opaque paper. The fastening agent usually deteriorated in a few months, however, and the circles buckled and fell off. Another product, the "Visitype" protractor, was tried next. It used a paraffin-base adhesive, which was only a slight improvement. We then contacted the manufacturer, explained our difficulties, and eventually received for test purposes some improved Visitype protractors printed on clear cellulose acetate, with resinous adhesive backing.

The acetate protractors were mounted on a test map, which was then placed in use in a sunny location inside the cab of Squaw Mountain Lookout, on the Arapaho National Forest, at an elevation of 11,300 feet. Thirteen months later the circles were still in excellent condition, with no buckling, wrinkles, or fading, and without the slightest appearance of adhesive failure. During that time the map had been subjected to temperature variations of from 90° above to 30° below zero, and relative humidities from 10 to 90 percent.

It is our opinion that the new Visitype radial circles, printed on clear acetate and with a resinous adhesive backing, can be used to great advantage in the preparation of fire control radial maps. The product is inexpensive, can be mounted without tools or special equipment, and may be obtained in quantity.—WILFRED S. DAVIS, *Forester, Region 2, U. S. Forest Service.*

BUMPER SERVES AS CONTAINER FOR TORCH FLUID

D. A. ANDERSON
Head, Research & Education Department, Texas Forest Service

A novel container for holding a reserve supply of fuel oil for backfiring torches is being put to increasing use by the Texas Forest Service. It is actually the front bumper of fire fighting vehicles (fig. 1). The unit, which will hold about 2½ gallons, was developed by J. O. Burnside and M. S. Lawrence of the Fire Control Department.

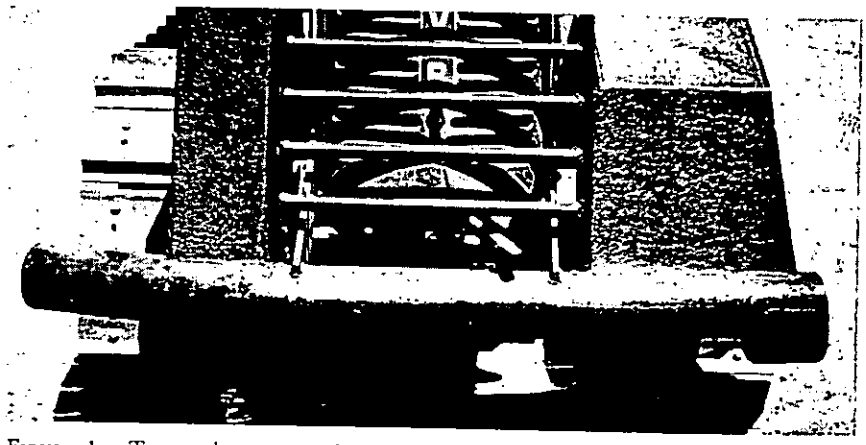

FIGURE 1.—Tractor bumper made to serve as a container for back-firing torch fluid.

The bumper is made from 4-inch, round, steel water pipe. For the tractor shown, a piece of pipe 57 inches in length was cut one-half through at a point 16 inches from each end. Each end was heated and bent back a distance of 4½ inches and welded electrically. One end of the pipe was capped with a piece of ¼-inch flat iron and welded. At the other end of the bottom half of the first 4½ inches was removed. Then, a disk of ¼-inch flat iron, which had previously been threaded for a ⅜-inch pipe, was welded as shown in figure 2.

To each side of the 4½-inch section removed from the pipe, there was welded a 2- by 4½-inch piece of flat iron, this being in turn welded back to the original cut on the bumper as pictured. Thus, the end of the pipe was given an oval shape to provide a place in which a valve could be installed and would be protected from damage.

A ¾-inch gas valve with stem cock was inserted at the bottom end of the pipe to serve as an outlet for the fire torch fluid.

For the intake point, a hole was cut in the top near the center of the pipe in which was inserted and welded a piece of threaded ¾-inch pipe, 1¾ inches long. A 2-inch piece of flat iron was welded to a ¾-inch pipe cap that served as a cover for the intake point (fig. 2).

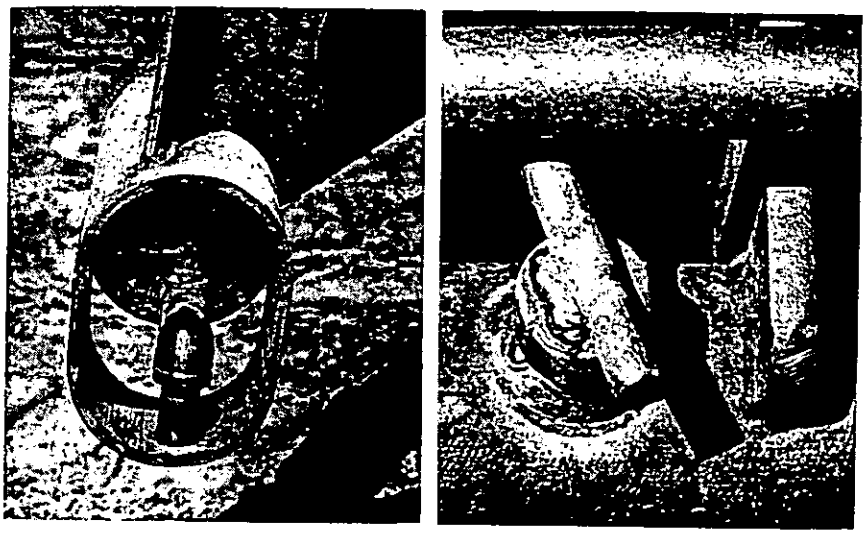

FIGURE 2.—*Left*, End of bumper container showing valve installed. *Right*, Intake with pipe cap in place.

Thomas Jefferson on Forest Fires

The following is quoted from a letter by Thomas Jefferson to John Adams written at Monticello, dated May 27, 1813:

"You ask if the usage of hunting in circles has ever been known among any of our tribes of Indians? It has been practised by them all; and is to this day, by those still remote from the settlements of the whites. But their numbers not enabling them, like Genghis Khan's seven hundred thousand, to form themselves into circles of one hundred miles diameter, they make their circle by firing the leaves fallen on the ground, which gradually forcing the animals to a centre, they there slaughter them with arrows, darts, and other missiles. This is called fire hunting, and has been practised in this State within my time, by the white inhabitants. This is the most probable cause of the origin and extension of the vast prairies in the western country, where the grass having been of extraordinary luxuriance, has made a conflagration sufficient to kill even the old as well as the young timber."—From "The Writings of Thomas Jefferson," edited by H. A. Washington.

CONVENIENT MAP CARRIER FOR FIRE TRUCKS

WILLIAM E. TOWELL
Chief of Fire Control, Missouri Conservation Commission

Harold J. Ruetz, Forest Assistant on the Meramec Fire Protection District, has developed a simple but convenient map carrier for his pickup. The carrier is a small metal frame to hold regular window shade rollers. [1] The frame is open at the bottom and fastened to the ceiling of the pickup cab; one end is held in place with screws so that the rollers can be easily removed. Maps printed on cloth can be stapled or glued direct to the rollers. Paper maps are mounted on unbleached muslin with wallpaper paste.

To keep down the size of the map carrier, Ruetz has used three rollers, with a one-half inch to the mile scale map of each of the three counties in his district (fig. 1). The same type frame could be used for more maps, or wide maps if desired, the limiting factor being the width of the cab. This map carrier is ideally suited for the district forester or ranger who needs to have fire map, ownership map, type map, and various others at his fingertips when away from headquarters. It is extremely handy for the fire crew leader who uses only one map frequently.

[1] Similar use of shade rollers reported by Ed. J. Smithburg in April 1949 issue of Fire Control Notes.

FIGURE 1.—Map carrier with three rollers.

USE OF AERIAL PHOTOS ON BOARDMAN RIDGE FIRE

K. A. CUFF, *Mendocino National Forest,* and
R. H. NEUNS, *California Forest and Range Experiment Station* [1]

Aerial photographs proved their worth on the Boardman Ridge fire, Mendocino National Forest, last summer. This fire, started September 11 by a careless camper, roared over 6,670 acres of rough terrain covered by mature timber, reproduction, brush, and woodland. When finally corralled, the fire had a 17-mile perimeter that wound across elevations from 2,000 to 7,000 feet above sea level. Properly used, aerial photos saved time and trouble on the job.

Scouting the fire, we found the photos great time-savers in giving the plans chief and fire boss much detailed information. Using the pictures made it possible to prepare maps quickly by sketching from a plane, helicopter, or vantage points on the ground. A map made with the help of a helicopter, for example, took about 20 minutes to complete and showed the perimeter, hot areas, spot fires, open cat lines, and safety lines. These maps were accurate, too. The last rough draft indicated an area of 6,700 acres, as compared to 6,670 acres on the final map prepared for statistical use.

The speed with which information could be obtained was especially valuable when quick decisions had to be made on the location of fire lines. In one sector the fire jumped its line and made necessary an immediate selection of a new location. At first it seemed that the best action was to backfire from a safety line, increasing the acreage considerably. But a few seconds of careful photo interpretation showed a hand line could be built readily in one location. The time from determination of this line until it was completed and backfired was slightly more than an hour. The line held and saved 1,500 acres.

Good photo interpretation can readily determine for the plans chief information on cover types and terrain that will help in ordering kinds of tools to be used in building line, computing rates of line construction, and picking access routes. Even though areas are hidden by smoke, vitally needed information—fuel types, possible control lines, slope of ground, dropping areas, helicopter ports, and safe routes of escape—can be determined in a hurry from aerial photos.

Experience on the Boardman Ridge fire, however, demonstrated that a special effort is necessary to make the most of the photographs' potentialities. One requirement is good coordination and use of photo information between Intelligence, line overhead, and other overhead. Another is good interpretation, an exacting task if all possible information is to be gleaned from the pictures. It was observed that many men who can see stereoscopically do not seem able to see detail. The ability to supply detailed information is the photo's main asset. Giving a group of selected men intensive training in aerial-photo interpretation would make this useful tool much more effective and encourage its wider use in fire control jobs.

[1] The California Forest and Range Experiment Station is maintained by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of California, Berkeley.

COOPERATIVE FIRE FIGHTING BY INDIANA SCHOOLS

DIVISION OF STATE AND PRIVATE FORESTRY
Region 9, U. S. Forest Service

The work of the Division of Forestry, Indiana Conservation Department, in training high school students under the Forest Fighters Service was begun during the last war as part of the Civilian Defense Program. [1] This important work has continued up to the present time with no let-up in intensity. In addition to accomplishing a better fire record, the possibility of carrying and selling the gospel of fire prevention to tomorrow's citizens in realized.

FIGURE 1.—Presentation of safety plaque to Indiana Forest Fire Fighters Service. Left to right: Vernard Rice, District Fire Warden; Emmeran Tretter, District Fire Warden; Henry F. Schricker, Governor of Indiana; Joe De Young, Coordinator, FFFS; Joe Brishaber, Austin K. Easley, and L. E. Kern, District Fire Wardens.

In 1941 prior to the start of the program, 610 fires burned over 42,329 acres in southern Indiana, an average of nearly 70 acres per fire. Since then there has been a gradual reduction until in 1950, 235 fires burned over 3,880 acres or a little over 16 acres per fire. Of course various other factors have to be recognized, but there is no doubt that the high school training program is in part responsible for this improved record. Since the beginning of the program, 30,000 volunteer fire fighters have been trained. Four hundred and fifty-eight different crews consisting of

[1] See the September 1951 issue of American Forests for a more complete description of this work.

4,058 high school boys have spent 13,596 man-hours fighting forest fires, and 81 high schools have been presented with a merit award by the State in recognition of their assistance in fire suppression.

An important part of the training course has been the demonstration of safety, and safety precautions have been stressed in actual work on the fire line. This part of the training has paid off because the Forest Fire Fighters Service, under the direction of the Division of Forestry, has completed 10 years of work without an accident. For this achievement, the Forest Fire Fighters Service was awarded a plaque by the Hon. Henry F. Schricker, Governor of the State. The plaque was presented to Joe De Young, Coordinator of the program, and to the five district fire wardens in a brief ceremony at the 1951 Indiana State Fair (fig. 1).

Pilot Balloons for Marking Fires

The use of pilot balloons for marking fires discovered by patrol aircraft, to facilitate their location by ground men or smoke jumpers, has been suggested from several sources.

After looking into the records and discussing the problem with others, we found that there were several instances where such a marker would have been of help. We set up a test program comtemplating the use of weather balloons, which were reasonable in cost and easily obtained. We believed it would not be too difficult to arrange for inflation by a small cylinder of helium or hydrogen gas, after the balloon was clear of the airplane, if another more simple arrangement could not be devised.

We found that weather balloons could be obtained in 30-gram, 100-gram, and 300-gram sizes. The 30-gram size inflates to approximately 2 feet in diameter, and costs about 20 cents each. The 100-gram size inflates to approximately 3 feet in diameter, and costs about 50 cents. The 300-gram size inflates to 4 or 5 feet, and costs about $1.60. All sizes are much more resistant to puncture if inflated to only about 2/3 size. The 30-gram balloons may be obtained in several colors, and the 100-gram balloons in white, red, black, and yellow. The 300-gram size was available only in white.

Several balloons were inflated, attached to anchor strings, and their action observed. It was found that with only a minimum of air movement (less than 4 m.p.h.) the balloon would drift until it rubbed on the tops of any timber. The balloons lasted only a short time until punctured by weeds or tree limbs.

Personnel who observed the behavior of the pilot balloons were of the opinion that balloons large enough to be used as markers, and strong enough to withstand puncture, would be too expensive. A balloon of 4 or 5 feet diameter would be required to provide enough lift to stay aloft when anchored near the fire on days with very little or no wind movement.

It appears that there are better possibilities in plane-to-ground radio and in working out methods of signalling the fire location from the patrol plane. This has been done successfully on several occasions in air-ground detection units now in operation.

The project is now discontinued until further information or a new method becomes available.—AERIAL EQUIPMENT DEVELOPMENT CENTER, *U. S. Forest Service, Missoula, Mont.*

POWER DEVICE FOR CLEANING STEEL BOOSTER TANKS

J. R. McLees

Fire Control Engineer, South Carolina State Commission of Forestry

The Branch of Forest Fire Control, S. C. State Commission of Forestry, is using as standard equipment ranger trucks outfitted with a set of three interconnected booster tanks. The cross tank back of the truck cab is 14 inches deep, 18 inches wide, and 48 inches long. Radio equipment in a weatherproof box is mounted on this tank. The two other tanks, located on the left and right side of truck bed, are each 14 inches deep, 12 inches wide, and 60 inches long. These side tanks serve also as seats for fire fighters. The tanks are made from 14-gage blue annealed steel sheets. All joints and connections are electric-welded.

Because rust and scale accumulated on the interiors of the tanks, annual maintenance was costly until the machine shown in figure 1 was developed. This cleaning device will accommodate the set of three tanks simultaneously. The tanks are clamped at the ends in angle-iron frames and are held there by stay bolts on two sides. The end clamps, one to each tank, have sprockets attached and are chain driven from a countershaft powered by a 1-hp. electric motor and connected to the countershaft by a rubber V-belt transmission. The individual drive from the countershaft is by roller chain and sprockets.

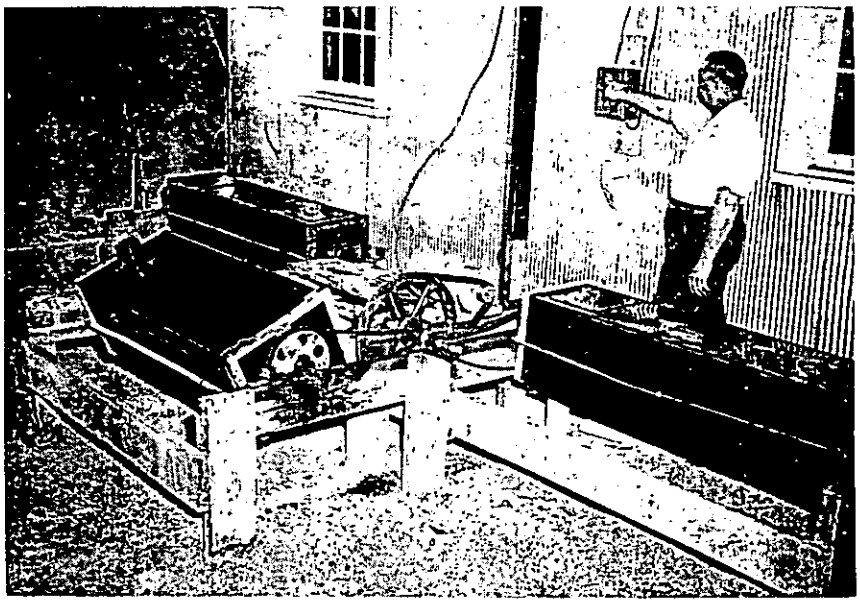

FIGURE 1.—Set of booster tanks being cleaned.

The tanks are filled to approximately one-eighth of their depth with ¾-inch sharp crushed stone, and then water is added to one-fourth of the tank depth. When the tanks are turned at 55 r.p.m. for a period of 8 hours, the scouring action of the tumbling stone will thoroughly clean the interiors. The only hand cleaning required is the face of the two baffles in each tank. These are accessible through three handholes, the cover plates of which show clearly in figure 1.

After a thorough cleaning and drying, the interiors of all tanks are treated with a special asphaltic tank-coating compound. If the tanks are allowed to go too long without treatment, the stone and water tumbling may have to continue for as long as 16 hours. It has been found that tanks of this type when properly cleaned and treated can be kept in service for 3 years without retreatment.

Published Material of Interest to Fire Control Men

All Fires Start Small, Let's Talk of Little Ones That Never Got Away, by T. C. Hargrave. Brit. Columbia Lumberman. August 1951.

An Annotated Bibliography of Aerial Photographic Applications to Forestry, by C. William Garrard. Published by State University of New York, College of Forestry, Syracuse 10, N. Y. 1951.

CMV—A New Herbicide, by H. C. Bucha and C. W. Todd. Science. Nov. 9, 1951.

Cooperative Forest Fire Control, by John B. Kling. Published by State University of New York, College of Forestry, Syracuse 10, N. Y. 1951.

Correction of Burning Index for the Effects of Altitude, Aspect, and Time of Day, by George R. Fahnestack. U. S. Forest Serv. North. Rocky Mountain, Forest & Range Experiment Sta., Research Note 100. June 1951.

Engineering in Fire Protection. Comments on article by G. I. Stewart. Mechanical Engineering. December 1951.

Fires Went Up, Damages Went Down. Alabama Conservation. Sept.-Oct. 1951.

Flying Forester, by D. Perlman. American Forests, Sept. 1951, and Reader's Digest, Oct. 1951.

Forest Fire Danger Measurement in the United States, by A. W. Lindenmuth and Ralph M. Nelson. Unasylva. April-June 1951.

Forest Fires in the Northern Rocky Mountains, by J. S. Barrows. An analysis of 36,000 forest fires. U. S. Forest Serv. North. Rocky Mountain Forest & Range Expt. Sta., Sta. Paper 29. April 1951.

Forest Fire Losses in Canada, 1950. Published by Forestry Branch, Canadian Department of Resources and Development, Ottawa. 1951.

Forest Fire-Thunderstorm Knockout Combination for Watersheds, by C. Allan Friedrich. U. S. Forest Service Northern Rocky Mountain Forest & Range Expt. Sta., Research Note 102. July 1951.

Ignition of Fibrous Material by Self-Heating. National Bureau of Standards Technical News Bulletin. November 1951.

Protection From Range Fires. A chapter in "Rebuilding The Federal Range." Bureau of Land Management. 1951.

The Smokejumpers, by Bernard De Voto. Harpers Magazine. November 1951.

Two Men and a Rock, by O. A. Fitzgerald. American Forests. September 1951.

Use of Certain Chemicals As Vegetation Eradicators and Soil Sterilizers, by R. W. Chorlton. Canada Dept. of Res. and Devlpmt. Fire Research Leaflet No. 6. 1951.

When, Where, Why and How Do Forest Fires Start?, by S. P. Ringstad. Wis. Conserv. Bul. October 1951.

TOOL GRINDING TABLE

ALVIN EDWARDS

Warehouse Clerk, Mendocino National Forest

The tremendous job of reconditioning hand tools in fire camps and in the warehouse following large fires has led to the development of the following method of doing the job.

An ordinary automobile body and fender disk sander with a 8- or 9-inch flexible phenol abrasive disk, #24 or #36 grit, is used for grinding. This will grind a smooth, sharp edge on any tool very quickly and does not heat the metal enough to burn it as does the ordinary grinding stone.

Tools are held solid and in position on a table with holding jigs for all of the types of sharp tools ordinarily used in fighting fire (figs. 1 and 2). The disk sander is held by the operator. This enables the operator to look directly at the side of the tool he is sharpening. By so doing, he can better shape the tool (fig. 3). As for safety, all material thrown from the blade or the disk is directed down by the disk so there is no danger of getting particles in the eye.

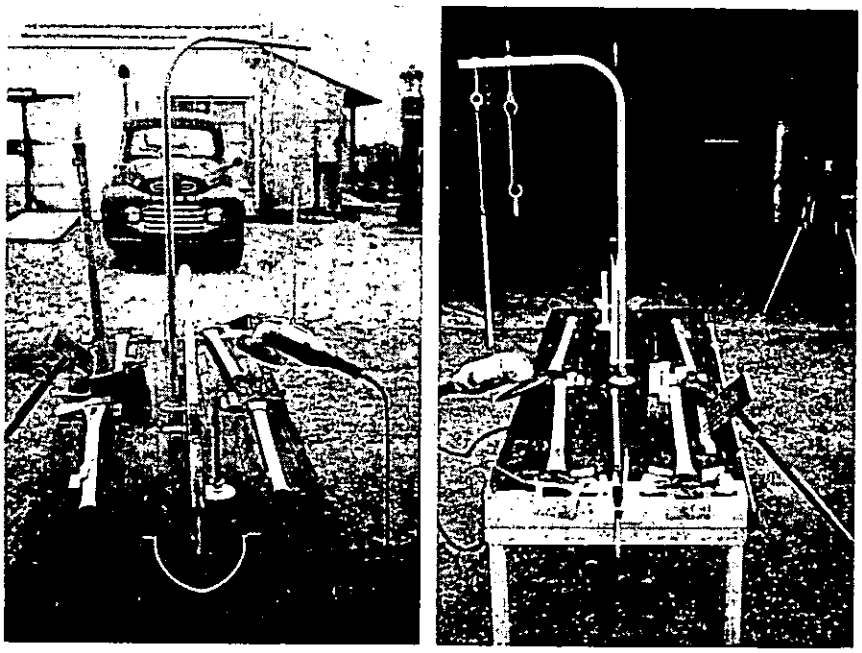

FIGURE 1.—Tool grinding table: *Left,* Tools in position for grinding; *Right,* jigs for holding tools from which handles are to be removed.

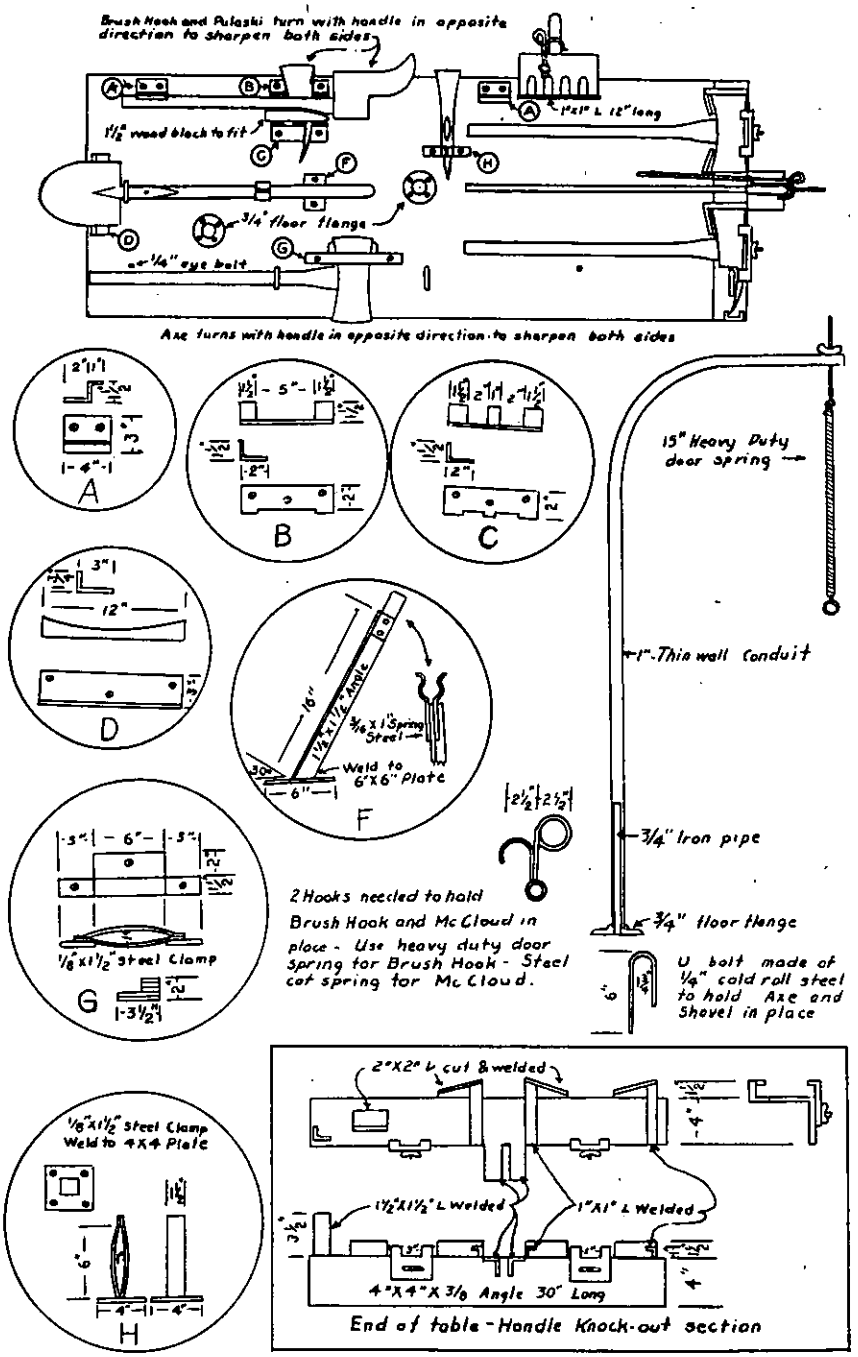

FIGURE 2.—Details of tool grinding table.

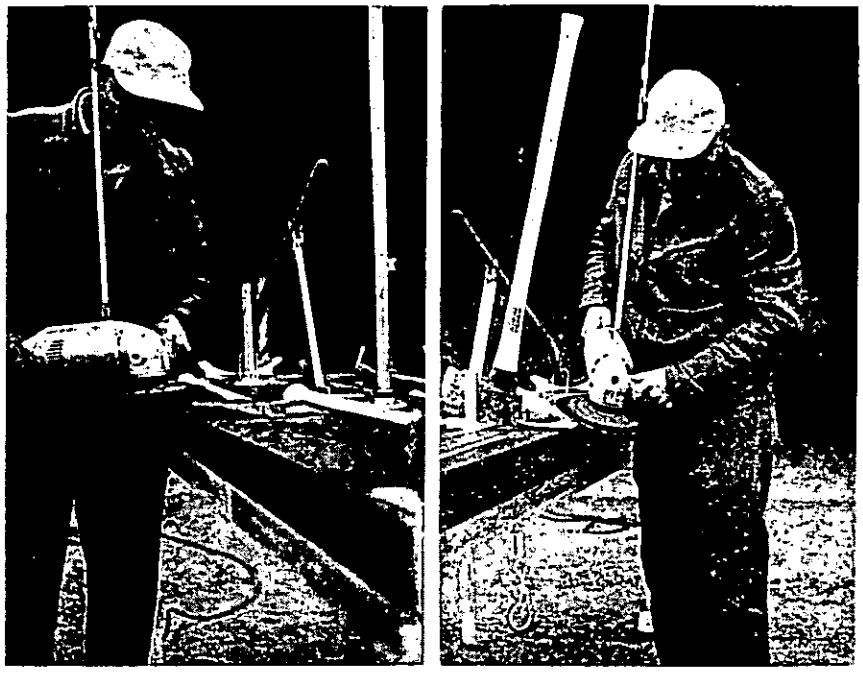

FIGURE 3.—Grinding ax and Pulaski blades.

Jigs were also made to hold tools in place for drilling and knocking out handles which are to be replaced. New handles are placed in a vise and shaped to fit the eye of the tool by using the same grinder with a #16 grit disk.

The table and grinding unit were used on two large fires and at the forest warehouse during the 1951 season. It is estimated that 50 percent of labor time is saved over the old method of grinding, as well as a saving in that tools are better sharpened and blades are not burned. Two men with two grinding units may work on the same table with little interference.

The fender and body sander may be used with commercial electric power, or with a small portable generator.

Starting Cables for Chain Saws

Small cables for starting cords on chain saws break frequently at the handle. The most often used method of repairing is to tie a knot in the cable to prevent it from pulling back through the handle. The result is further breaks in the cable at the knot.

By cutting a small piece off a #12 nicopress sleeve, slipping it over the end of the cable, and compressing with a nicopress tool, the broken cable can be prevented from slipping through the handle and will last as long as the original factory job.—KENNETH W. WILSON, *Wenatchee National Forest.*

SMOKEY—AT POINT OF SALE

CLINT DAVIS
Director, Cooperative Forest Fire Prevention Campaign[1]

Ranger Earl F. Sullaway of the McCloud District, Shasta National Forest in California, put me on the spot recently. He sent in a clipping from his local newspaper which told an interesting story about how Smokey Bear had directly prevented a forest fire.

It seems that a party of campers from San Francisco had been spending the week end fishing on the McCloud River, camping at a nearby recreational area. On their way home they stopped in McCloud to make some purchases. In the store window was one of the posters of Smokey Bear and the message, "You Can Stop This Shameful Waste!" Looking at the poster thoughtfully, one of the members of the party turned to the other and said, "Are you sure we put out our campfire?" The other fisherman was not sure, so together they went back to where they had been camping.

Sure enough, in spite of the coffee grounds and dishwater which had been dumped on their fire before leaving, there were still hot coals burning, and at one corner the fire had crept away and was beginning to burn in the thick pine duff which had not been cleared away from the campfire.

This time they put their fire out right, and on their way out again stopped in at the Ranger Station and frankly told Ranger Sullaway exactly what had happened. The newspaper quoted Ranger Sullaway as saying, "If that fire had gotten away with the burning condition which we have had during the past two or three weeks, it could have very easily made such a start before being discovered that it would have destroyed much valuable timber and blackened a great many acres. Smokey Bear sure did his part in keeping California Green and Golden."

That was a very interesting article. As a matter of fact, it was the first case history that documented Smokey Bear as actually preventing a forest fire. I knew it would interest our friends at The Advertising Council, the organization which has so generously sponsored and guided our efforts in the Cooperative Forest Fire Prevention Campaign for the past 10 years. So at the first opportunity I showed it to Ted Repplier, President of The Advertising Council. Repplier read the article with interest. There was an enthusiastic gleam in his eyes when he had finished. "By gosh," he exclaimed, "you foresters are finally beginning to do point-of-sale merchandising."

Well, that put me on the spot. And it was all Ranger Sullaway's fault. You see, I thought the story was kind of cute, but with my limited knowledge of advertising lingo the pieces didn't quite fit together on this point-of-sale merchandising business. But Repplier is a kind and patient individual, and he spelled it out. He explained that, in the advertising business, when a manufacturer decides to introduce a new product Nation-wide, the first objective is to develop public recognition of the product. Let's say the product is Cancan Pork and Beans. Public acceptance of this product must first be built around brand recognition, so the advertising

[1] Sponsored by State Foresters and U. S. Forest Service. A brief history of the campaign, reprinted from the April 1951 issue of American Forests, may be obtained from the editor of Fire Control Notes.

agency in charge of introducing this new product decides on the media to be used.

The agency calls in an artist, the idea boys, copy writers, and they come up with several pieces of art, develop a gimmick in the advertising, usually something in the way of a symbol that will forever-after be associated with the product. Say, in this case, our symbol is an animated bean on which the artist with full liberty depicts a broad smiling face, chubby legs and arms, and a well-filled tummy. His general appearance seems to exude "Yum, Yum!" Usually several different channels of advertising are selected and the promotion is then kicked off. Soon afterward, when you board a streetcar or bus you will subconsciously begin noticing a colorful car card showing a steaming, appetizing plate of Cancan's Pork and Beans. Along side the mouth-watering dish stands our friend "Beanie" inviting you to try his tasty treat after the day's toil. Perhaps it doesn't make much of an impression at first, but it registers on the subconscious mind.

That evening when you get home and start thumbing through your favorite magazine, you run across a doubletruck spread (this is advertising lingo for two full pages of advertisement facing each other) and there is Cancan's steaming, tantalizing plate of pork and beans. Our little friend Beanie is sure to be around some place in the ad with that Yum Yum expression. Perhaps a week later you hear a commercial on the radio which tells you the virtues of Cancan's Pork and Beans. The average person goes through all of this and rarely ever gets the urge to drop what he is doing and rush right out and buy a can. But in that subconscious mind there is building up a little reaction that says, "Boy, if I ever buy pork and beans, I'll take Beanie's advice and try Cancan's." That, according to Repplier, is building up public acceptance for brand recognition.

Up to this point, there seemed nothing very different in this line of thinking than what was being done in the CFFP campaign. Car cards have extolled the importance of preventing "This Shameful Waste." Radio has hammered home the need for each individual to use care in preventing forest fires; fire rules cards have graphically portrayed how each individual could take step-by-step measures to prevent his acts from causing a fire; the tag line slogan on every poster, "Remember—Only *You* Can Prevent Forest Fires!", definitely personalized the job.

I pointed this out to Repplier and asked how his mythical Cancan Pork and Beans could do any better selling job than we have to date on forest fire prevention. "Oh, but that is where point-of-sale merchandising comes in," he exclaimed. After the business firms develop public acceptance and brand recognition, they concentrate on reaching the potential customer at the point where he is most apt to be exposed to the product. In the case of pork and beans, naturally, it would be in the grocery store; a large poster on the front of the store, a colorful display of the product neatly stacked where the customer can't miss it. This has all been arranged by representatives of the manufacturer. A big red arrow points to the stack and says, "Here it is!" And without thinking, you rely on that subconscious force and before you know it you have three cans of Cancan Pork and Beans in the market basket. The manufacturer, following the strategy planned by his advertising agency, had cleverly channeled his advertising until the customer was finally confronted with the product and a forceful invitation to purchase same. That, according to Repplier, is point-of-sale merchandising, exactly the type of psychological reaction that entered into

the case of the two fishermen that saw the Smokey poster in a store window in McCloud, California. "The only improvement on that particular case," said Repplier, "would have been for the customer to have encountered a poster right in the campground." But even so, it's an excellent example of point-of-sale merchandising. In other words, impressing our client, the public, with a fire prevention message *when* he is right in the woods and *his chance of preventing a forest fire is greatest.*

Repplier pointed out that progress in reducing man-caused forest fires during the next few years will depend largely on how efficient we are in our point-of-sale merchandising. He feels that this is the weakest link in our over-all fire prevention program. Pointing out his own experience on a trip West last summer, he said that he stopped in numerous campgrounds and picnic areas of National Forests and State Parks, and other centers of outdoor activity and found some excellent examples of point-of-sale merchandising—a fire prevention message at a registration booth, or a poster mounted close by a camping spot (fig. 1). But generally, many of the areas that he visited, private and public alike, were weak in this important phase of the prevention sales job. A live-wire merchandiser would never pass up these sure-fire sales opportunities.

With a better understanding of the importance of point-of-sales merchandising on my own part, I tried to analyze some of our experiences in the past few years. Some organizations have been doing an outstanding job on point-of-sale contacts: The Virginia Forest Service, with its metal highway signs, and a Smokey Bear card reminding the public at every roadside picnic ground; Idaho, with its huge signs painted on the highways; California, with display cards tacked on the back of car stalls at tourist courts, and State patrolmen handing all entering motorists a rules card with Smokey's message. I imagine that numbers of New York tourists who first met Smokey on the subways of that city were reminded of many of his messages when they were handed a card with this familiar figure on it as they entered the State of California. Ours is a Nation of travelers and it is important to channel our messages so that the public will recognize their importance a long way from home.

Often it is fairly easy to localize Smokey and his message in order to capitalize on the national recognition already developed for this "million-dollar" character. For example, the South Carolina Commission of Forestry feels that selling the local people on the importance of saving the little trees through the preventing of grass fires is a most important appeal. They have developed a special poster, showing Smokey on his knees pointing to little seedlings that are destroyed when a grass fire, usually considered harmless, is allowed to burn across thinly stocked areas. The Texas Forest Service has developed a colorful and attractive folder which they mail to farmers and others in rural areas. The folder capitalizes on the Smokey theme by showing the two little cubs, the same designs that were used on the fire rules poster last year, crushing out cigarettes and drowning campfires.

The Keep Idaho Green Committee used a combination of its localized character "Guberif" (firebug spelled backwards) as the villain with Smokey chasing him down. A recent report from Idaho states, "Although a new character, GUBERIF, was introduced into the fire prevention program, the Keep Idaho Green Committee did not neglect the great potential of our friend, Smokey the Bear. In contrast, this peace-loving character and

FIGURE 1.—This is a 1952 poster, designed for point-of-sale use. It shows how to prevent forest fires while the basic poster, on back cover, is designed to develop awareness of the need to do something about forest fires.

the culprit, the Guberif, formed an ideal team which depicted the hero and the villain. It is the Committee's belief that the Guberif idea has somewhat localized our prevention program, thereby creating a fine, wholesome interest in the preservation of our natural resources." Up in Washington State, home of the Keep Green movement, the Keep Washington Green campaign developed an interesting skit for an important

Forest Festival Pageant. Smokey, one of the officials dressed in a bear skin, ranger's hat and dungarees, was constantly on the chase of the Fire Fiend. Undoubtedly there have been many other similar uses localizing our national fire prevention character. I hope to hear about them.

Recognizing the value of such localized use, I can't help but recall some of the many occasions where excellent opportunities were overlooked. Last summer, I had lunch with a ranger in a small tourist town on the Transcontinental Highway. Ninety percent of the community's livelihood was gained from tourists stopping at motor courts, cafes, and novelty shops enroute to California. For a six-block area tourist cars were parked solidly along the curbs, yet while browsing around the various shops before lunch time I was rather surprised in not seeing a single poster with a forest fire prevention message. Posters were not taboo in the stores, because quite a few were displayed in the interest of Savings Bonds, Armed Force Enlistment, and other programs.

At lunch the ranger and I noticed the headline on a newspaper being read at the next table. It reported several serious forest fires in California, 150 miles away. In discussing the fire situation in California, I remarked to the ranger that I was rather surprised not to see a single fire prevention poster in the various stores which I had visited in this little tourist center. He very proudly advised me that there had been only one forest fire on his district in the past 3 years and that it was considered practically a fire-proof forest. There wasn't much need in arguing against a record of that kind, so we passed the subject up.

But now, since this point-of-sale business has come up, I realize that we were overlooking a wonderful opportunity. Here was a spot where thousands of tourists, going into California, could be conditioned for a fire prevention sale. This was an excellent example of the need for teamwork in the prevention job. In many places where fire danger admittedly is not serious it may still be highly important, from the standpoint of conditioning the public, to put Smokey Bear to work. These factors are worth considering in the development of local forest fire prevention plans.

The Nation-wide campaign will continue developing mass appreciation for the need to prevent forest fires. American business and industry will back it in 1952 by contributing around 6 million dollars worth of advertising time and space to help us do the job. Many new aids will be introduced. One highlight is bound to be the song, "Smokey The Bear," now being groomed for release by a nationally known music publishing house. The music and lyrics have already been completed and they are considered very catchy and intriguing. Several recording companies are already under contract to release the number early in the summer. It won't be long before the American public will be hearing a little ditty which opens like this, "With a ranger's hat and shovel and a pair of dungarees, you will find him in the forest always sniffin' at the breeze. People stop and pay attention when he tells them to be aware, because everybody knows that he's the fire preventin' bear."

In addition, posters and car cards, radio and TV messages this year will extol Smokey's appeal—"This Shameful Waste Weakens America!" There will be a big national play all right. But what will it all buy? How many fires will Smokey actually prevent?

That, it appears to me, depends in very large measure, on the readers of this little article—on you men, privately or publicly employed, who find

the problem of forest fire prevention right on your own doorsteps, so to speak—and on how Smokey Bear is put to work on a point-of-sales basis.

And as for Ranger Sullaway, "I'm much obliged to you for putting me on the spot!"

Bottle Gas Heater Installations for Lookout Cabs

Gas burning space heater installations with small bottle gas containers are being used for heating lookout tower cabs on the Lower Michigan, and are found to be highly satisfactory. These heaters have a 15,000 BTU output rating. They take up little floor space, even when allowing for safe clearance to the combustible cab lining. The burners are easily lit, burn free and clean, are readily controlled, and are practically fume free. About 20 pounds of bottle gas is used for heating for an average year.

The gas supply cylinders used by the Lower Michigan are those originally furnished with the propane gas backfiring torches. The cylinders, which are approximately 8 inches in diameter and 26 inches long, can be charged with 9½ pounds of gas. Filling at a bulk plant costs about 7½ cents per pound. The cylinders are hung in the center of the underside of the cab, to provide the best shaded position. The gas is piped through the floor to the space heater with ⅜-inch copper tubing. A manual regulating valve is required for the installation, and can be obtained from the bottle gas dealer. We believe that two cylinder installations would be desirable, to provide an adequate fuel supply at all times.

The cost of an installation will vary somewhat, but the cost of a typical installation with a single cylinder, as made on the Lower Michigan, is as follows, omitting the cost of labor, gas cylinder, and initial charging of gas:

1 Gas burning space heater	$13.23
2 Flare nuts	.24
1 Half union adaptor	.20
1 Regulator, obtained from bottle gas dealer	3.50
6 Feet, ⅜-inch copper tubing	1.20
Total	$18.37

Labor for the installation averaged 4 hours for 2 men, including transportation to and from the job.

Local distributors of bottle gas are generally able to furnish fuel supply tanks as a service to purchasers of their product. Of the various sizes of tanks available, the 20-pound tank lends itself to installation in a manner similar to the propane gas cylinder used by the Lower Michigan. The 20-pound tank is approximately 18 inches high and 12 inches in diameter (kettle shaped), and is equipped with handles for carrying and mounting. While a single tank may provide an adequate supply for a season's use, a 2-tank installation will no doubt be desirable. However, the distributor can be consulted in this regard. The current cost of 20-pound cylinders in the Milwaukee area is $2.10, which includes the loan of the tank. The cost of an installation using a commercial bottle gas tank should not vary appreciably from the installation made by the Lower Michigan.

These safety precautions, given by the Lower Michigan, should be followed for bottle gas heating installations made in lookout cabs:

1. Check local regulations and instructions governing the use of bottle gas.
2. Follow safety regulations governing installation of heating units.
3. Always light burner with a long taper.
4. If old propane gas cylinders are used, test safety release valves. Release valve pops off at 300-pound pressure. This pressure would be developed at about 130° to 135° F., with cylinder containing 9½ pounds of gas.
5. To avoid accidental discharge, containers of propane gas must not be filled above the specified capacity and should not be stored where temperatures are excessive. The capacity of a propane torch cylinder is 9½ pounds of gas. The net weight of the cylinder should be determined before filling to assure an excess of 9½ pounds is *not* put in the cylinder. Net weight of cylinder plus 9½ pounds of gas equals maximum gross weight after filling.
6. Test all connections thoroughly for leaks. This can be done with heavy soapsuds and a brush.
7. Close cylinder shut-off valve during periods of nonuse.—From "Give 'N Take," *Region 9, U. S. Forest Service.*

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 in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. 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 illustrations. 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.

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


This shameful waste
WEAKENS AMERICA!
Remember—Only you can
PREVENT FOREST FIRES!