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L. A. CARTER

# 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 16 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.

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# OPERATION FIRESTOP

R. KEITH ARNOLD

*Professor, University of California School of Forestry*

The effectiveness of mass-fire as a weapon was proved in World War II. Because of this, mass-fire is a civil defense problem that faces all agencies concerned with fire. Such questions as how and where will enemy-induced fires start, how can they be suppressed, and what organization and techniques are required to hold property damage and loss of life to acceptable limits for national survival are only a few of the many to be answered. In addition to this, we have our day-to-day peacetime fire problem. Why do fires burn as they do? What are the combinations of weather, fuel, topography, and fire pattern that can be used to predict spread and behavior? Which patterns set the stage for blowups? What combinations preclude any possibility of dangerous fire conditions? Are there chemicals now available that will effectively retard or stop wild-land fires? How can fires be attacked quickly in inaccessible places?

Because of these perplexing questions, Operation Firestop was established in January 1954 as a cooperative project to make exploratory studies in two research areas: civil defense against fire and the reduction of loss from large wild-land fires through the development of new or unconventional fire control measures. It is designed as, and limited to a one-year operational study, with a three-months field test program, ending July 1, 1955. Without exception, key personnel in the organization are men with other regular jobs and responsibilities. For the most part, the project relies heavily on earlier basic research studies and recent technological developments.

Manpower, equipment, and facilities for Operation Firestop are from many sources, principally the fire services themselves. These include the California Division of Forestry, the U. S. Forest Service, the Los Angeles County Fire Department, the Los Angeles City Fire Department, and the Pacific Intermountain Association of Fire Chiefs. Support is also provided by the Federal Civil Defense Administration and the California Office of Civil Defense. Certain activities of the U. S. Department of Defense make it possible for it to furnish facilities and the assistance of the following branches: Marine Corps, Camp Pendleton; Air Fleet Marine Force Pacific; Sixth Army Headquarters; Eleventh Naval District; Air Force and its Air Weather Service.

Research and equipment-development groups produced the strongest research program for Operation Firestop that could be established in the time available. These groups are the U. S. Forest Service California Forest and Range Experiment Station and the Service's Equipment Development Center, the University of California School of Forestry and the University's Los Angeles Engineering Research group, and the U. S. Weather Bureau. Many industries, principally chemical, aircraft, oil, and communications, felt the significance of the project and searched through their products for those adaptable to fire control problems. In all cases industry contributed men and materials generously.

Operation Firestop developed in a mushroomlike fashion. In the spring of 1954, plans were prepared, cooperators contacted, and equipment obtained. Site preparation began in May, but the 3-month field program did not start until July 1. All field work except wind survey and fuel measurements was stopped October 1. The working group averaged about 40 men. Two hundred test fires required the construction of 25 miles of firebreaks, 10 miles of roads and jeep trails, 3 heliports, and installation of 22 weather stations, 18 wind towers, and 14 continuous recording stations. (Fig. 1.)

The research program is divided into five studies. Prior to analyses of data, only preliminary results can be summarized in the following paragraphs.

*Fire retardant studies* show that readily available chemicals can be sprayed in water solution on forest fuels to make limited quantities of water go farther and to extend the time that prewetting of those fuels is effective. The flanks and rear of a fire, and sometimes even the head, can be stopped by chemical firelines. A hot crown fire in heavy brush will often drop out of the crowns when it hits chemically treated fuels, and its rate of spread may

FIGURE 1.—One of the Firestop test areas from the air, showing plots, firebreaks, and roads and trails constructed for the project.

thus be reduced by as much as 50 percent. Backfires can be started from chemical lines that are established faster than adequate firelines can be cleared (fig. 2). Smoldering spot fires can be held down by chemicals until conventional ground forces attack them. It also appears that chemical firelines can be put in by aerial application. The disadvantages: chemicals are expensive; they have to be applied at rates varying from 4 to 10 pounds per 100 square feet of treated fuel, and they still require conventional mopup and patrol work.

FIGURE 2.—Backfiring from a brush strip (left) sprayed with fire retardant.

*Firing technique studies* show that backfires can be made to burn when weather and fuel conditions are such that backfiring will normally not work. These tests included one method of drying out green vegetation in 6 to 8 hours by spraying with various weed killers, adding diesel fuel, smashing brush, dropping incendiaries from the air, and fanning by helicopter.

*Fire behavior studies* attempted to develop more accurate dimensions and specifications for fires. Fuel and microclimate measurements were made on all test fires. In addition 11 fires were set specifically to develop means of measuring heat transfer characteristics of the fires themselves. This information may in the long run be the most valuable to come out of Firestop.

The *wind survey* was designed to develop methods for conducting large-scale wind surveys to aid in predicting wind behavior in mountainous areas. Surface weather data were recorded at 22 weather stations, 18 wind towers, and anemometers hanging from cables across canyons in one of the principal drainages of the test area. Air soundings of temperature, humidity, and wind were made from ground level to 20,000 feet twice a day and oftener during critical burning conditions. In addition to their primary objective, these data also serve to record the actual conditions under which other Firestop tests were conducted.

*Application technique studies* were largely concerned with aerial delivery of water and other retardants. A torpedo bomber was rigged to drop 600 gallons of water or chemicals from its bomb bay. This craft puts a heavy drench over an area 50 feet wide and 270 feet long. The Sikorsky S-55, the Hiller 12-B, and the Bell 47 helicopters were used for water bombing and to lay hose; 1,000 to

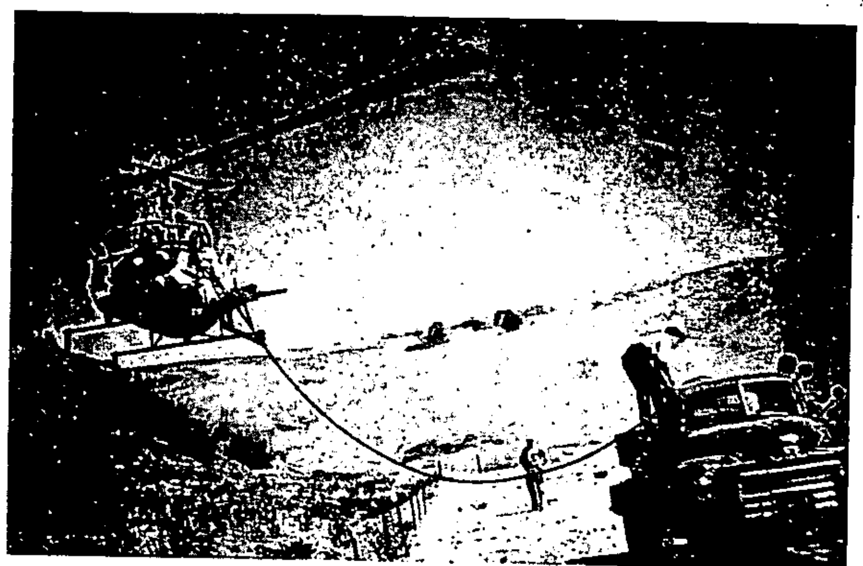

FIGURE 3.—*Top,* Small helicopter pulls hose from tanker live reel to inaccessible part of fire in a few seconds. *Bottom,* Helitanker unit picked up by large helicopter can be placed nearly anywhere on fireline.

2,000 feet of hose can be laid over rough terrain in less time than it takes to charge the line. In addition, the larger Sikorsky was used to drop 100 gallons of water by free fall on spot fires and along firelines, and for delivery of a small hook-on "helitanker" unit made up of a 100-gallon tank, small pump, and 300 feet of hose. This unit can be picked up from a truck or a tool cache and delivered to nearly any place on a fire with men to operate it. (Fig. 3.)

This sketch of Firestop tells in brief what was done but at the same time raises two important questions: How can these developments be applied in fire control? What is the part further research can play in fire control?

First, reports on each phase of the study which will be coming out this winter will present more detailed descriptions, results, and limitations demonstrated by the actual tests. Most of these new things, though, still require additional testing and equipment development since Firestop will only carry each successful idea to the point where its feasibility is demonstrated. Since most Firestop developments are for special or critical situations, men must then be trained to recognize these situations and apply the control measure to match.

In answer to the second question, even with the fine work of the U. S. Forest Service fire research units, the Fire Underwriters' Laboratory, the National Fire Protection Association, and others, Operation Firestop has demonstrated that the present total fire research effort falls far short of being able to keep us abreast of modern technology and scientific development. In contrast Canada and Great Britain both have National Fire Research Laboratories with appropriate staff and facilities.

Firestop has not provided answers to the many fire problems before the fire services and civil defense agencies. It has shown us, however, that concentrated research effort can bring results; and it has pointed the way to some important improvements. Firestop agencies are enthusiastic about the potential for improved fire control which lies in a permanent large-scale fire research program and are now concentrating on making this potential a reality.

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## Blotters for Flannel-board Placards

The general issue, white 9- by 4-inch blotters make satisfactory placards for presenting flannel-board subjects during training sessions. Paper cards must be backed with sandpaper or otherwise treated so that they will cling to the flannel, but the blotters need no treatment. A felt-tip marker is an ideal freehand scriber for preparing the blotters.—KEITH MACDONALD, *Fire Control Officer, Tahoe National Forest.*

# FOREST FIRE RESEARCH AS IT LOOKS IN 1955

A. A. BROWN

*Chief, Division of Forest Fire Research, U. S. Forest Service*

During World War II my first work for the Chief's Office took me on a tour of every region. There were a lot of interesting things happening everywhere. One small incident that was amusing at the time may have a point today. On one district the ranger had lost a lookout to the military services, so he picked a young fellow from his trail crew to fill the position. He was a bright chap with a lot of initiative and ingenuity but without much accurate knowledge of the woods. A few days later the ranger was in the vicinity of the tower so he hiked up the trail to see how the lookout was getting along and to give him some training in his new duties.

When the ranger was about 50 yards from the tower there was suddenly a zing of wire, something grabbed his right foot, and before he knew what was happening one leg was hoisted up in the air, his pack sack was over his face, and he banged his head on a rock. When he had recovered a bit from his bewilderment he found he was hung up by a loop of No. 9 wire. It took some scrambling around to get untangled and back on his feet looking like a self-respecting forest officer, and there was probably some fire in his eyes. It developed that the lookout had been told a lot of bear stories before he went up; he was worried about defending himself properly. He knew from Boy Scout days how to build a noose rabbit trap, so building on that knowledge he had fashioned a whole series of bear-sized rabbit traps out of wire he found at the tower. I don't recall what became of that lookout, but he was a bright chap—he had plenty of initiative and ingenuity, and he made use of the best he knew. We'll come back to him later.

We are now in the first 10 years of the atomic age. Science and technology are moving at a faster rate than ever before in history. This is particularly true of military research and development but is by no means confined to the military. Pick out the growing industries—every human activity that is pushing ahead now has the flow of new knowledge from research and development to support it. I have been fortunate enough to see this demonstrated firsthand. It is a stimulating thing, and it is also a challenge to us concerned with fire. If we can do a good job of bringing modern techniques to bear, I think we can eliminate heartbreak and coronary ailments as occupational hazards to fire control officers. It can't be done overnight, but we have the advantage of strong allies.

War clouds still hang over us. Any war now is going to be a fire war. The last war was only a start in incendiarism. Millions of dollars are now going into research on how to use fire more effectively as a weapon of war. Civilian officials of city, town, and country are beginning to demand research in *defense* against fire. Because of this, we find that our small group of researchers are very much in demand. They are in demand by all fire agencies because they know most about the behavior of big fires that respond to the free play of weather factors and atmospheric conditions. The group we have organized at Berkeley is part of our response to that demand and the cooperative project "Operation Firestop" is another. There is no one in forest fire research who wouldn't prefer to tackle the forest fire problem directly. But we are getting much needed basic research through going cooperative projects and they are helping us to build a stronger technical base for all future work.

What are some of the possibilities that are developing through forest fire research? First of all, research is evolving what might be termed a better concept of the third dimension in fire behavior. This third dimension is the amount of heat energy produced. We used to think of a going fire as a two dimensional control problem, like a problem in plane geometry. The fire was increasing its perimeter at a given rate, if fireline could be built at a faster rate, the problem was easily solved. This approach is valid only if the heat energy is below certain levels. A better measure of the controllability of a fire is the amount of heat energy it is developing per minute, just as you might rate the horsepower of a motor. Where heavy fuels prevail, an area of 100 acres or less may release energy equivalent to the 20 kiloton A-bomb, such as described in the Civilians Atomic Handbook. On some of our big fires the release of heat energy goes up to the equivalent of exploding one of these bombs every 5 to 10 minutes.

The effect of this energy release is the reason our blow-up fires have so many mysteries. It gives new meaning to atmospheric conditions at the time, and to vertical as well as the commonly measured horizontal air movements. It helps to explain the "fire storm," a phenomena already known to most experienced forest fire fighters in the West. It gives new meaning to fuels and to the significance of measures to reduce their volume. When we speak of how fast they burn, we are really saying how fast they release their energy. We find that there is a whole story in the thermal qualities of fuel, what the scientist terms "reflectance, absorption, transmission, etc." These ideas show us a new approach to our problems but they will have to be translated for operational use.

Close aerial support of ground fire fighting, the skilled use of chemicals and even water, still await development, though each has promise of great contributions to our problems.

A whole new methodology, called Operation Research, has grown up. It consists of a task-force attack in solving the repetitive type of problem: aerial support, lightning prevention, long-term forecasting, better extinguishers, more flexibility. Just as nationally we are preparing to defend ourselves without mass manpower, I think we can look toward methods in fire control where technics and skill can replace futile mass attack by manpower. If we don't muff our chance to keep up with progress, in 10 years we can look back to some of the things we are doing now and laugh at the ingenious bear traps we once used.

# DETACHABLE HOSE ROLLER FOR TANKERS

JOHN V. DAVIS

*Fire Control Assistant, Mendocino National Forest*

Re-rolling cotton-jacket fire hose by hand is a slow, awkward job. Sometimes it is done in the woods, before leaving the fire. The result is a loose, unworkmanlike roll, bristling with pine needles, foxtails, and similar "whiskers." Sometimes the hose is thrown into the truck in a heap and carried to the station for rolling. In this case, the truck and crew are not really prepared to make another efficient water attack until the hose has been rerolled.

Forest Warehouseman Alvin M. Edwards and I designed, perfected, and built a detachable hose roller for use on tankers. It has solved the problems listed above. With it, one man rolls a length of hose in less than a minute and does better than a factory job. All Mendocino tankers now carry the device as standard equipment.

The hose roller is made to roll hose with both couplings on the outside (and with male joint protected), in the standard fashion prescribed in R-5 handbooks. This permits fast coupling and fast unrolling without "barber poles."

The hose roller consists of an axle, a split hose reel, a handcrank to turn the reel, and a guide to line up the hose with the reel (fig. 1). All parts are constructed of lightweight material. The device is collapsible and is easy to assemble and operate. A pair of 3/4-inch pipe flanges spaced 17 1/2 inches apart are mounted permanently on both the back and the right side of the truck to allow attachment of the roller in either of two positions. The location of the unrolled hose in relation to the truck determines the best position of the roller to minimize dragging hose and maneuvering the truck.

The four parts of the roller are easily stored away in the truck when the roller is detached. The parts in order of assembly are: (1) The axle the reel turns on. This is a piece of 3/4-inch pipe 7 inches long. Threaded on one end, it screws into one of the pipe flanges on the truck. (2) The reel slips over this axle. The reel is in halves, each half made up of four 1/2-inch steel-tubing spokes. The spokes, each 13 inches long, are welded to a hub. They are crimped at the outer ends and bent slightly outward to prevent catching on the hose. The back half of the reel has a 1/4-inch pin welded to the hub 1 inch from center to hold the hose while rolling. This pin fits into a hole in the front half of the reel to lock the reel halves together. The reel is adjustable for 1-inch or 1 1/2-inch hose. (3) The handcrank fits over the squared hub of the front half of the reel. (4) The guide which lines the hose up with the reel screws into the other 3/4-inch pipe flange on the truck. This guide is a 6-inch length of 3/4-inch pipe with a 3-inch washer welded at the midpoint. Another 3-inch washer is welded to a

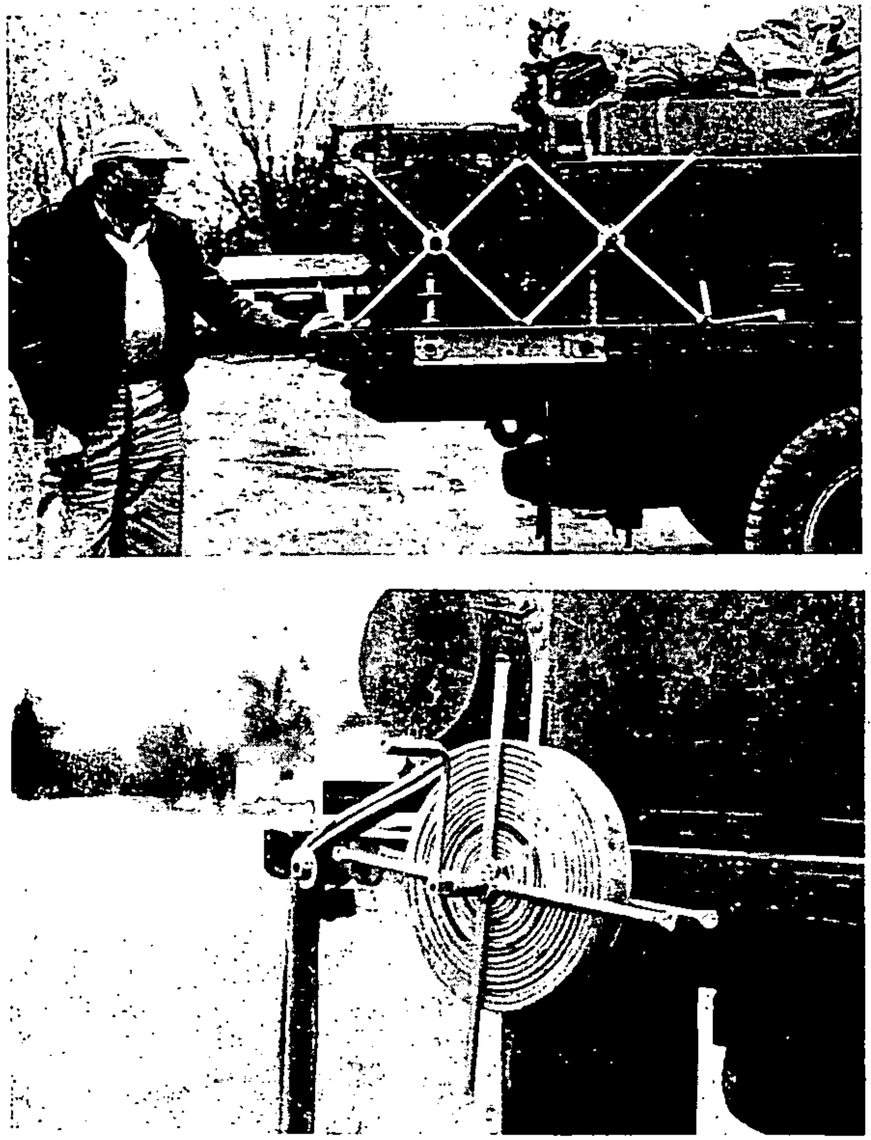

FIGURE 1.—*Top,* Mounting flanges and unassembled hose roller; *bottom,* assembled hose roller.

sleeve that slips over the pipe and allows adjustment of the guide for different size hose.

A rubber band about an inch wide cut from any used inner tube can be used to hold a rolled length of hose while it is being removed from the roller. To remove a roll of hose and to insert another length for rolling, only the outer half of the reel need be removed from the axle.

# MICHIGAN'S IMPROVED FIRE FINDERS

GILBERT STEWART and MAX BRADLEY

*Forest Fire Experiment Station, Michigan Conservation Department*

In 1951 the Michigan Forest Fire Experiment Station started investigations dealing with improved types of fire finders. Analyses of field requirements emphasized the need for accuracy in directional readings; hence, use of larger azimuth circles became imperative. A review of existing types of fire finders was made, and importance was placed upon accuracy and simplification in operating the instrument itself.

As a result of these investigations, several models of fire finders were designed and pilot models were made at the experiment station. Two final types were produced, both using the same basic azimuth plate. Each has a "parallel offset" mechanism that permits the upper limb of the instrument to be moved 5 inches, to either the right or left of the center position. A total motion of 10 inches enables a towerman to position the instrument so that it will miss obstacles that normally obstruct a line of sight, such as corner posts and window framing. This design eliminates need for shifting the cabinet top.

The azimuth plate consists of a high-grade aluminum casting 17 inches in diameter, graduated in numbered intervals of 10 degrees; 5-degree and single-degree markings are shorter; single degrees are the smallest subdivision on the circle. It is possible to estimate 10-minute readings by controlling the width of marking line on the plexiglass indicator attached to the alidade. The casting includes a base ring on the under surface as well as a center hub, and reinforcing ribs of ample size. Final weight of the finished azimuth plate is 8-3/4 pounds.

Castings are produced commercially over patterns supplied by the experiment station. The technique of casting figures into the plate against a stippled background guarantees numbers of bold, clear outline, and fine appearance. Casting figures into the parent metal has a number of advantages. It eliminates the need for stamping, engraving, or otherwise numbering each individual plate. Figures of decorative appearance result, and these require machine surfacing only to assure sharp definition. However, pattern work must be of high quality, and special types of figures must be chosen for the basic pattern. Castings of this kind and quality can only be obtained from manufacturers of memorial plaques. Most commercial foundries are unwilling to guarantee production of castings that have a sharp definition of figures and that are uniformly free from defects.

Machining operations for finishing castings are standard in machine shops. Surfaces of plates are turned and polished on large swing lathes. Figures are faced on a vertical milling machine, using a rotary table for accurate positioning under the spindle; the graduations are cut on a shaper, using a rotary table with indexing plate. To assure quality control and uniformity in manufacture, the usual compliment of patterns, fixtures, gages, and jigs has been produced. These items are manufacturing conveniences that facilitate quantity production.

A studbolt, especially designed for the purpose, is used to mount the plate on top of the tower cabinet; a large wingnut clamps against the underside of the cabinet top, after the azimuth plate is oriented. The top of this same bolt provides the pivot for the alidade. Since direct readings are taken at the rear end of the alidade, the azimuth plate must be oriented with the 180-degree division pointing true North.

The offset alidade consists of two basic parts. The lower limb rotates on a pivot on top of the studbolt and is locked in any desired position with the jamnut. Attached to the lower limb is a plexiglass indicator with a zero line on the underside that permits the azimuth reading to be taken and estimated within 10 minutes of angle.

The upper limb of the alidade is attached to the lower half by two arms that are held in a parallel position at all times. The principle involved is identical with that used in the mariners' parallel rule. Because of the three-tier design of the instrument, the top limb passes completely over the lower one to either side of center; a total movement of 270 degrees is possible.

A choice of two sighting devices has been provided for. One instrument uses the conventional vane type of sight (fig. 1, *top*). The second instrument is equipped with an erecting telescopic sight of approximately 3-power (fig. 1, *bottom*) ; all controls for the telescope provide micrometer adjustment and correspond in principle to those employed on surveying transits. It is equipped with a military type of reticle marked by a circle and dot. Because of the design of assembly and mounting, it is essential that the telescopic unit be kept light and compact.

In selecting a telescope of approximately 3-power, a preliminary study was made of more powerful instruments up to 20-power. Proper magnification may prove to be a matter of personal preference and individual eyesight. However, it is noticeable that smoke columns have blurred outlines, and when viewed through optical instruments of high power, border contrast is less well defined than through glasses of lower power. The instrument that may prove most useful from a magnification standpoint is not yet determined; field checks are being made by towermen. In addition to increased magnification, optical instruments offer possibilities of employing haze filters to extend range of visibility. Filters could be supplied as attachments and used as required.

During the fire season of 1954, 76 fire finders of the parallel-offset type were used in the Upper Peninsula of Michigan, Region I. At that time the aluminum azimuth plate was not fully developed, and a plastic disk was used. At the present time a manufacturing program is underway at the experiment station under which 70 units, like those shown in the photographs, will be built and issued to Regions II and III for use during the fire season of 1955.

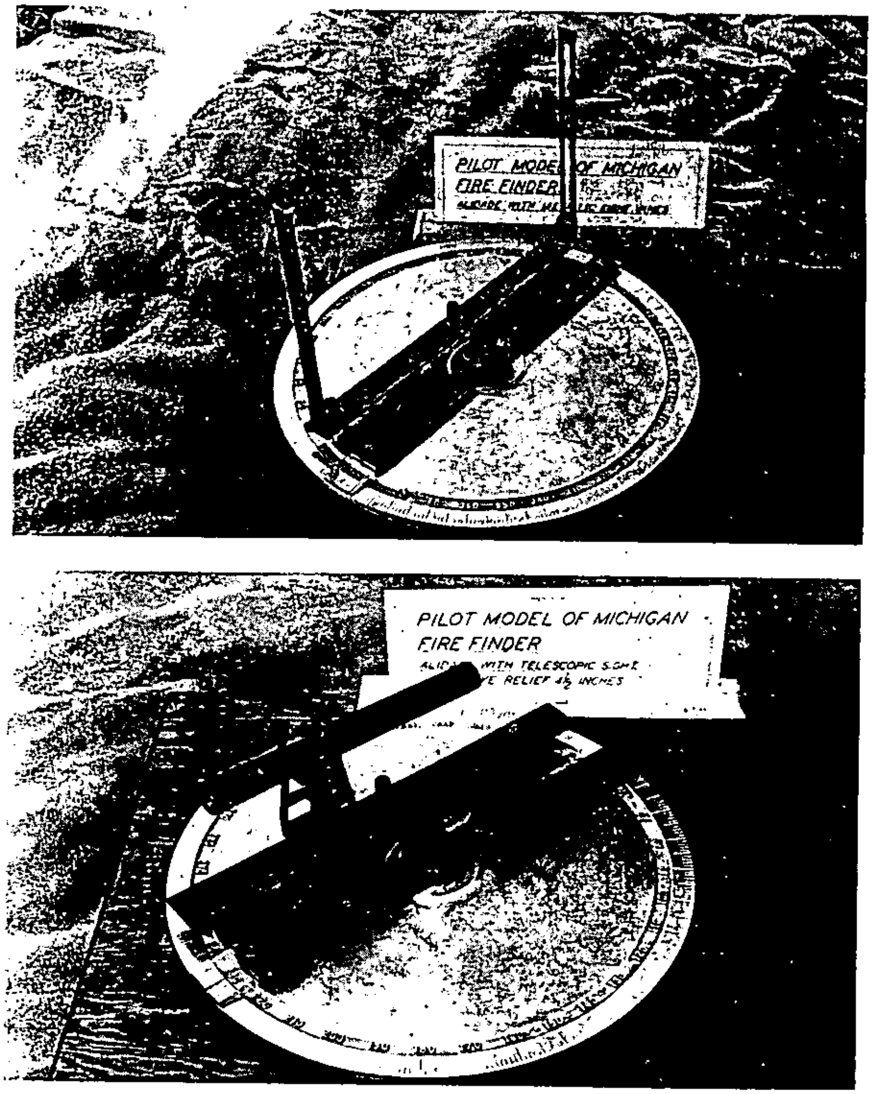


FIGURE 1.—Offset alidade: *Top*, with vane-type sight; *bottom*, with telescopic sight.

Full blueprint details have been completed on the entire assemblies; and patterns and tooling have been developed for manufacture. Material cost for the assembly using the metallic sight vanes approximates $28 based on 70 units; the type using the telescope has a material cost of $55 based on 50 units. Total costs include metal finishing, and the finishes have been kept as simple as possible. All steel parts are colored deep black as in gun finishing. The natural color of the metal in the aluminum plates will be retained unless it proves to reflect excessive light.

# FIRE TOOLBOX FOR STAKESIDE TRUCKS

RICHARD F. JOHNSON

*Fire Prevention Officer, Angeles National Forest*

The problem of how to transport a crew of men and their tools safely on the same stakeside truck has plagued all of us for a long time. The usual method of carrying tools in boxes on the bed of the truck reduces the seating capacity and makes the tools inaccessible for immediate use. Because stakeside trucks with portable seats leave no safe place for carrying tools, the tools must be transported separately in a pickup. This means that frequently men and tools do not arrive at the same time or at the same location.

We recently designed and built an all-metal fire toolbox that has eliminated these problems. The new box, which takes advantage of the space under the bed of the truck between the cab and the rear wheels (fig. 1), is made of 16-gage metal and is 61 inches long, 16 inches high, and 20 inches deep. The door is 14-gage metal, 61 inches long, and 11 inches high, and is mounted with a piano hinge and equipped with slam locks. Welded to the back of the box are 2 brackets made of 2-inch by 1/2-inch flat iron, which fit over the frame of the truck and are held in place by set-bolts. Below each bracket is a 1-1/4-inch pipe spacer, 5 inches long, which rests against the frame of the truck and holds the box rigid. Tool racks were purposely left out of the interior of this box to insure maximum flexibility in type and number of tools that can be carried.

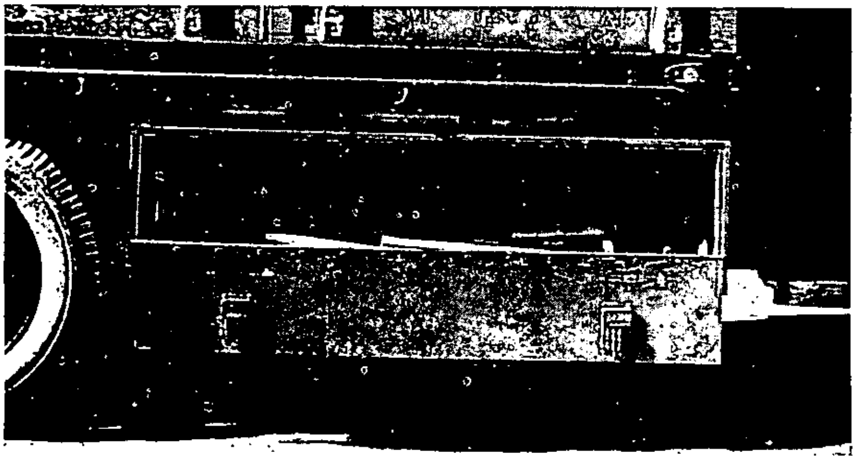

FIGURE 1.

The box is designed to fit any standard stakeside truck without adjustment, and it can be installed or removed in a matter of minutes without special tools.

# SWIVEL HITCH FOR FIRE SUPPRESSION PLOW

ARTHUR E. GREEN, *District Forester*, and CHESTER O'DONNELL, *Specialist in Visual Aids, Texas Forest Service*

When and where the first swivel hitch for pulling fire-suppression plows was developed is not known. More than 2 years ago, in an effort to overcome the disadvantages resulting from a rigid coupling between the plow and the mobile unit pulling it, the Texas Forest Service began experimenting with a swivel hitch of its own.

In the past, most suppression plows have had a small degree of traverse or none at all. This lack of traverse or lateral movement hindered the maneuverability both of the plow and mobile unit. Because the plow came out of the ground on short turns, it did not plow a smooth, even fire lane, and it had to be raised to allow the mobile unit to back up. Installation of the swivel hitch has corrected these deficiencies (fig. 1).

FIGURE 1.—Turns of very short radius are permitted when the plow is attached to tractor by means of a swivel hitch. Plow is shown at extreme left end of lateral arc.

The swivel hitch is rather simply constructed, but it is made very strong in order to withstand the abuse and strain to which it is subjected (fig. 2). The hitch attaches to the end of the drawbar of the mobile unit and is mounted on a heavy steel pin on which the entire hitch depends. This pin, or hub, is braced to the rear of the mobile unit to give it extra strength for handling large plows, and as an additional protection against strain. The vehicle's hydraulic lifting unit is attached to the hitch, and a seat and lock for the plow to fit into is provided so that the plow can be locked

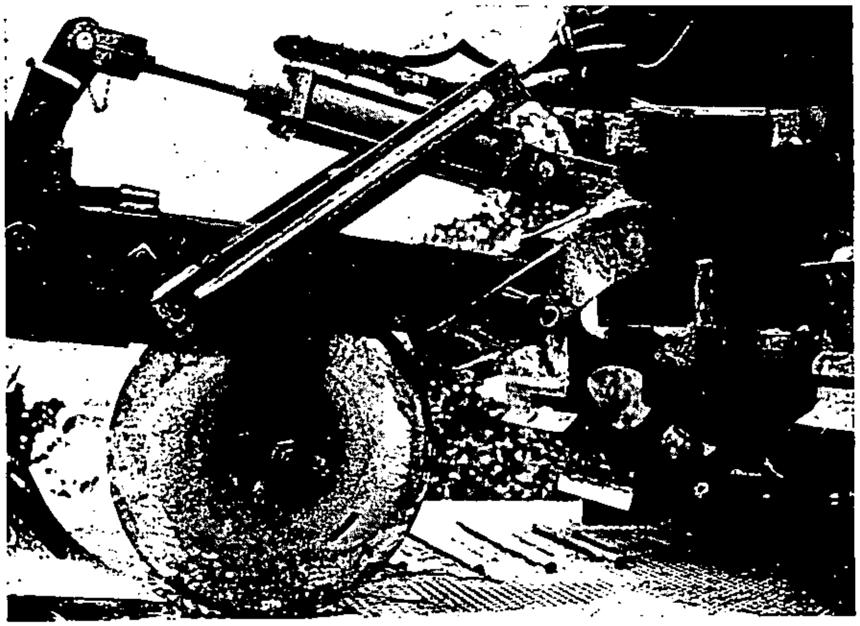

FIGURE 2.—Method of attaching plow to tractor by means of swivel hitch.

in place for cross-country movement. This locking seat prevents the plow from swinging from side to side on the rear of the mobile unit, thus saving wear and tear on all of the equipment involved and preventing possible property damage and injury.

Very little additional rigging is needed on a mobile unit to handle the plow, and the swivel hitch can be fitted on either a jeep or tractor. Several adjustments make it possible to set the plow for different types of soil.

One of the commercial disk-type plows now in use by the Texas Forest Service was modified to fit the swivel hitch. This modification consisted of eliminating the three-point suspension arrangement on the plow, and lengthening the beam for attaching the hitch. This also resulted in making the plow lighter. Attaching the plow to the swivel hitch was a comparatively easy matter, but considerable difficulty was experienced in designing a lock to hold the plow in a raised position while traveling. Many different locking designs were tried, but none proved satisfactory until one was designed by M. S. Lawrence of the Texas Forest Service. Although this locking device has had no field trial and will undoubtedly have to be modified through trial and error, it appears to be very satisfactory.

The new swivel hitch, as developed by the Texas Forest Service, seems to have justified all of the work and planning that went into its design and construction. Both it and the modified plow are to be produced commercially.

# DROOP TAIL ATTACHMENT FOR STAKEBODY TRUCKS

Frank D. Mayfield, *Ranger*, and Joseph J. B. Kennedy, *Assistant Ranger, Alabama National Forests*

In October 1944, the Alabama National Forests received two 25-horsepower crawler tractor-plow units which were put into service as their first mechanized units of fire control equipment. These units were to be transported on two stakebody trucks, a 1-1/2-ton and a 2-ton. It was at once apparent that a safe and efficient means of loading and unloading the tractor-plow units was needed as well as a means for lowering the center of gravity and stabilizing the position of the plow unit while the tractor-plow unit was being driven to and from the fire.

In the early part of 1945, Forest Engineer Noland, with the assistance of Automotive Mechanic Saxon, designed and constructed two droop tail attachments for the two stakebody trucks. These droop tails were designed for rigid type installation, i.e., welding all connections, including the welding of the assembled droop tails to the truck chassis, and were therefore fixed units.

As fire suppression activities became better mechanized, there necessarily resulted an increasing investment in costly and specialized fire control equipment which in most instances was restricted to use for a single purpose. The disadvantages of single-purpose use were particularly evident in the stakebody trucks which had been equipped with "fixed" droop tail attachments and could be used advantageously only during the fire season. It also became apparent, through observation of the loading and unloading of the tractor-plow units, that a safer and more efficient means of handling, fastening, and transporting the run planks was needed.

In an effort to eliminate the disadvantages noted in existing equipment, Noland, with the assistance of the district ranger and Mechanic Stewart, modified the original design of the droop tail to make it detachable, and constructed two units. Figure 1 gives a general idea of the way the droop tail is constructed and fastened to the standard stakebody bed. The plow is in its normal riding position with the stiff leg folded up over the run plank opening. In figure 2, the plow has been lifted to show the stiff leg in position and the run plank opening. One plank is hooked in place ready for unloading while the other rests on its rollers ready to be pulled out.

The stiff leg is fastened by strap iron hinges to a 3/4-inch rod running through pipe welded to the frame. It is made of angle iron and swings down in position under the frame of the droop tail unit to keep the truck from tilting when the tractor is being loaded and unloaded. In this position, the stiff leg must be in contact with the ground so that it will brace the droop tail. When not in use, the stiff leg folds up flush against the floor of the droop tail and over the opening for run planks, thus keeping them from slipping out. The flanges of a Morgan Hitch-type plow fit over the corners of the stiff leg when it is turned up. With other plows it is necessary to secure the stiff leg with a chain attached to a bolt in the platform decking.

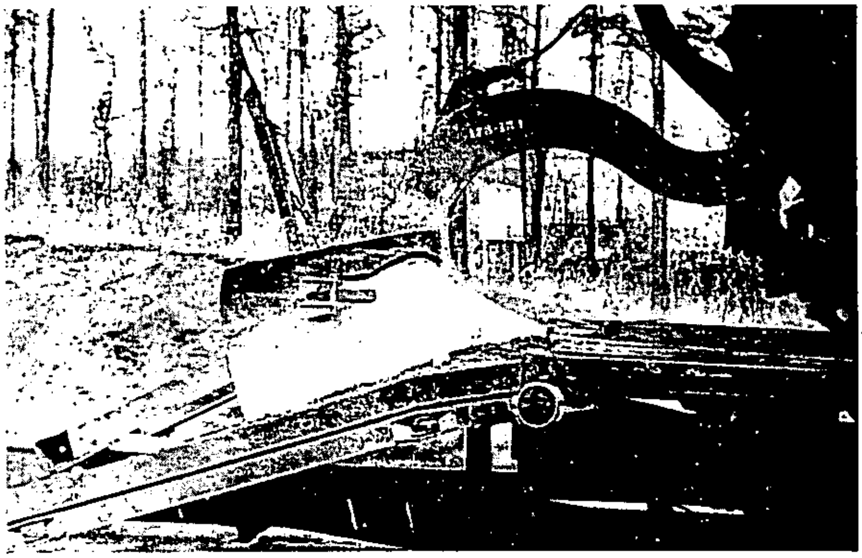

FIGURE 1.—Droop tail and its bracing; plow in traveling position.

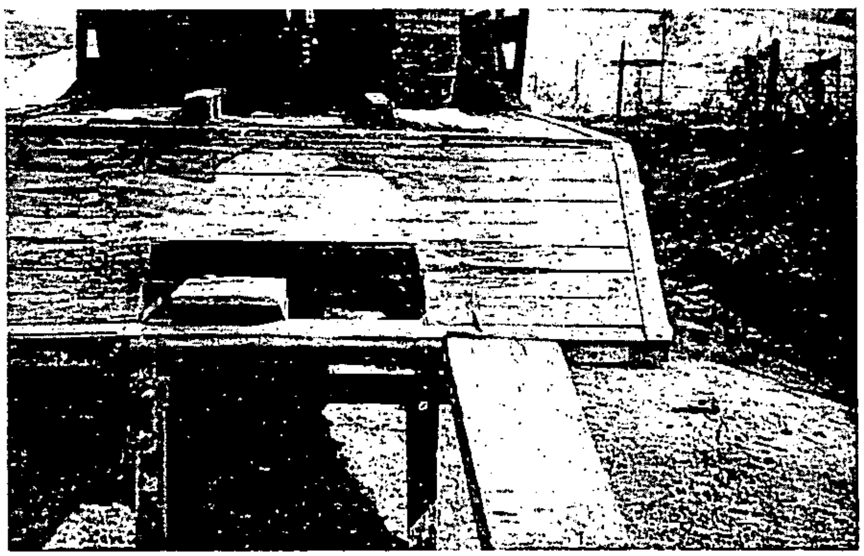

FIGURE 2.—Stiff leg in position. Rollers make it easy to pull out run planks.

This detachable droop tail and roller carrier arrangement for run planks has given superior service in the field. It is economical to construct and, in addition, can be taken off a truck in a matter of a few minutes, releasing the vehicle for other work. Detailed specifications can be obtained from the Regional Forester, U. S. Forest Service, 50 Seventh St., N. E., Atlanta 5, Ga.

# FIRE CONTROL COOPERATION AT TALLADEGA, ALABAMA

H. W. JANELLE

*District Ranger, Alabama National Forests*

One night recently my telephone rang, and when I answered it: "Is this Ranger Janelle?" "Yes." "This is Burt Carlson, of the Coosa River Newsprint Co., you've got a fire down on the Wiregrass Road, near the Trammel Motorway, about 5 or 6 acres." "Okay Burt, thanks a lot, we'll be right down there and take care of it."

Another night near Sycamore, the Coosa River Newsprint Co. arrived with a plow and tractor unit and helped us control a fire before it reached national-forest land. The forester for the Kaul Lumber Co. often arrives with men and equipment at fires on or threatening national-forest land near Hollins, Ala., and stays until they are out, or until we tell him we can handle them alone. The State units usually have their hands full, but quite a few times we have worked together along the boundary of the Talladega National Forest to put out fires that could spread to national-forest lands. I mention the above occurrences because they are examples of the excellent spirit of cooperation between fire fighting outfits which has developed in this area over the years.

The Talladega Purchase Unit was established in 1935 and a program of land acquisition initiated. The area was given national-forest status by Presidential Proclamation on July 11, 1936. That year there were 511 forest fires on the Talladega Ranger District which burned an estimated 8,500 acres of Government land. A correspondingly large amount of private land was burned within the Talladega Forest boundaries. Organized fire protection was placed in effect in 1937, the first such attempt in this part of Alabama.

In the beginning the odds seemed insurmountable, and there was every indication that we were going to have to fight a lone battle. When crews went out to fight a fire, they were alone, no help was offered, and the attitude of the people was often hostile. Local residents wanted the woods to burn, and they felt that we were foolish to try to stop the spread of fire when they thought it was inevitable that the countryside would burn no matter what we did.

A change came in 1942 when the Kaul Lumber Co. hired a forester, Lewis Weaver, to manage its large holdings around Hollins. These lands were intermingled with ours through the whole southeastern part of the Ranger District. Weaver was an implacable foe of uncontrolled fire, and from the very beginning, the Forest Service and the company worked hand in hand. Our lookouts spotted fires on company land while in other cases the company found fires on our lands, often taking initial action. The records show the results of such close cooperation in the present low number of fires and small acreage burned.

In 1945 the State appointed a ranger for Talladega and Clay Counties, another vital step in the development of strong forest fire protection. An outgrowth of cooperation between the State, the Kaul Lumber Co., and the Forest Service was a decision by the State and Federal agencies in 1949 that a lookout tower on Rocky Mountain would be advantageous to all parties. This point is the last high mountain of the Allegheny range, and overlooks the wide flat valleys of the Coosa and Tallapoosa Rivers, where they meet to make the Alabama River. The lookout would cover a large area of the national forest and command an excellent view of the lands protected by the Alabama Division of Forestry, including company lands.

Rocky Tower is an outstanding example of cooperation between organizations striving for the same objective. After agreement was reached, the lookout point was developed by 2 public and 3 private agencies, as follows:

1. The tower itself was furnished by the Forest Service, and was delivered to the foot of the mountain.
2. The Kaul Lumber Co. and Elmer Dunnam, a sawmiller and logger, furnished tractors and trucks and hauled the materials up the mountain over a temporary road.
3. A. O. Mitchell, the State ranger, with the help of other State men, erected the tower.
4. In 1950, the Coosa River Newsprint Co. furnished heavy equipment and built a good road up to the tower over a route laid out by the district ranger and John Raeburn of the Coosa Co.

About 1950 the Coosa River Newsprint Co. acquired large holdings of land within and adjacent to the national forest. By 1951, it had foresters managing and protecting its lands, and was equipping its crews with tractor-plow units and handtools. With intermingled ownerships and similar objectives, it was inevitable that we would work together. We furnished the company with information on our fire control organization and, in turn, the company gave us maps and information on its crews, equipment, etc. On many fires in the forest we have worked side by side regardless of ownerships.

The U. S. Pipe and Foundry Co. has for many years owned large areas in and near the forest. Until recently, no effort had been made to control wildfires, but last year the company hired a forester to manage and protect its lands. Although it has no plows, the company has started to suppress fires and has done much to discourage promiscuous burning.

Two years ago a special radio link was set up between the State radio network and the Forest Service system. The Kaul Lumber Co. and the Coosa River Newsprint Co. are on the State frequency so there is a ready means of handling fire control business.

One of the most important results of close liaison between Federal, State, and private organizations has been the impression made on the public. It often seemed that people felt, in connection with fire fighting, "that's what the Government men get paid for." However, when private industries lined up with us against fires, the people realized that it was because the companies knew that fire protection was good business.

If we ever get a really big fire around here, it is more than probable that the U. S. Forest Service, the Alabama Division of Forestry, the Coosa River Newsprint Co., and the Kaul Lumber Co. will all be on it. We have learned to work together, and have found that it pays big returns in effectiveness and good will.

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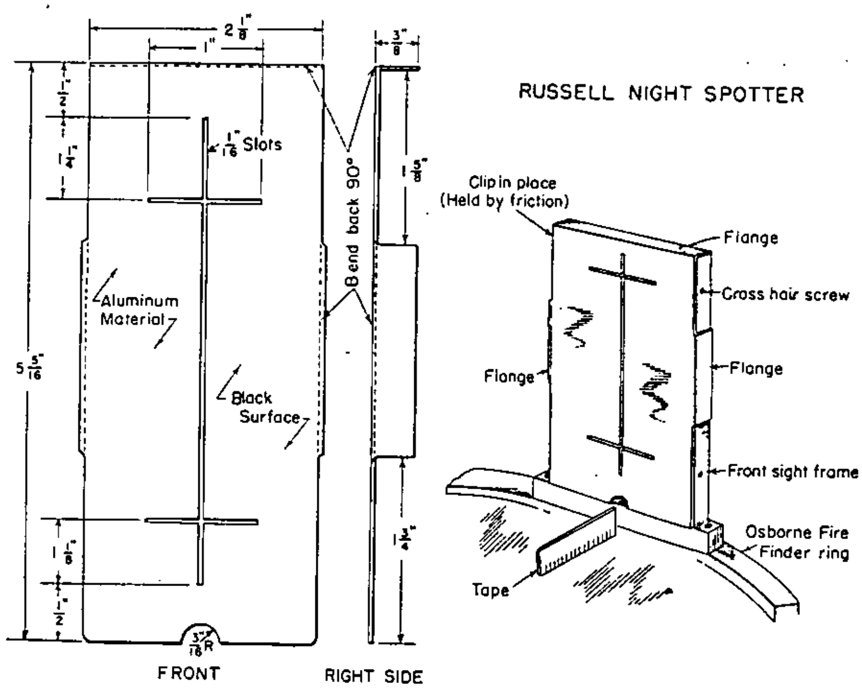
## Russell Night Spotter

A simple but useful device for locating and obtaining azimuth readings on fires at night was developed last season and tested by Lookout George Russell, who has completed 40 years of service on South Fork Mountain of the Mad River District. The device is a detachable clip that fastens to the front sight of an Osborne Fire Finder. Slots, which can pick up minutely faint glows, superimpose the regular vertical and horizontal cross-hairs. Troublesome and inaccurate methods are eliminated with the spotter.




The clip is easily made with ordinary handtools, the best material being malleable aluminum sheet metal. Three flanges bent at right angles afford quick, sure, friction placement. The slots can be cut in with a hacksaw after drilling a start, and a black painted surface will intensify any glow appearing through the openings.—ROBERT C. JANES, *District Ranger, Six Rivers National Forest.*

# ACCIDENTAL FIRES IN SLASH IN WESTERN OREGON AND WASHINGTON

WILLIAM G. MORRIS

*Forester, Pacific Northwest Forest and Range Experiment Station*

Slash from clear cutting, the common practice in western Oregon and Washington, is an exceedingly dangerous forest fuel. During dry weather, fires in this fuel usually spread so rapidly and burn so hotly that they evade even strong and efficient control effort. Consequently records of fires that started in slash were studied to learn more about their cause, behavior, and control. The results showed logging and related activities caused 60 percent of the fires and these became much larger than fires from other causes. This emphasizes that the greatest losses from fire in slash are likely to occur during logging.

Detailed records of accidental fires which burned entirely in slash from the time of origin to the time of attack were analyzed in the study. All fires of this class occurring on clear cuttings within national-forest protection districts during the period 1950 through 1953 were included. Fires caused by the escape of intentional slash burning or debris burning were eliminated because the object was to learn the importance of slash in accidental fires. The number of fires available for study after these eliminations was 88.

The number and percent of fires by causes were:

| Cause: | Fires | |
|---|---|---|
| | *Number* | *Percent* |
| Lightning | 9 | 10 |
| Logging equipment, logging operations, or smoking by loggers | 53 | 60 |
| Smoking by persons not associated with logging | 12 | 14 |
| Other causes | 14 | 16 |
| Total | 88 | 100 |

Of the 53 fires caused by logging, only 7 were caused by smoking by loggers.

The fires were next put in three groups: Lightning, logging (including logger smoking), and other man-caused (including smoking by nonloggers and other man-caused fires not in the logging group). Then facts concerning the behavior, attack, and area of the fires were compiled from the standardized descriptive data on the individual fire reports.

Fire weather during the early stages of each fire was recorded as the burning index class (based on fuel moisture and wind) at the time the fire was discovered. These records showed no difference in fire weather among the lightning, logging, and other fires. For each cause, average burning index class was 3.5 on a scale that ranges from 0 to 10. Classes 9 and 10 rarely occur.

Character of each fire at the time when the first fire fighter arrives was recorded as either smoldering, creeping, running, spotting, or crowning. Of the three principal cause groups, logging fires had the greatest proportion of fast-spreading fires; lightning fires had the smallest proportion.

Elapsed time from origin of the fire until it was first attacked averaged nearly the same for logging and other man-caused fires, but was ten times as great for lightning fires. In computing the average time for lightning and logging fires, one fire from each group was not counted because the discovery time of 5 days or more was excessive and would give an average obviously not representative. Excluding these fires, average elapsed time from origin to attack was: Lightning fires, 28 hours; logging fires, 2.9 hours; other man-caused fires, 2.7 hours. Comparisons of fires attacked within 1/2 hour, 1 hour, 2 hours, etc., showed that although the average attack time was about the same for logging and other man-caused fires, many more logging fires were attacked within 1/2 hour—43 percent of the logging fires and 15 percent of other man-caused fires.

Strength of attack was shown by the number of men used in the early attack stages and the proportion of fires on which bulldozers and machine-driven pumps were used. Logging fires were most strongly attacked. Number of men in the first attacking crew plus reinforcements arriving within 1/2 hour averaged 11.6 for logging fires, 5.9 for other man-caused fires, and 5.3 for lightning fires. The proportion of fires attacked with bulldozers within 1/2 hour after the first crew arrived was: Logging fires, 34 percent; other man-caused fires, 19 percent; lightning fires, 11 percent.

Area of logging fires when first attacked averaged several times as great as that for fires of other causes. Average size on attack for the 53 logging fires was 13.3 acres, but when three fires of more than 100 acres were eliminated, the average became 3.7 acres. Those from other causes averaged only 0.8 acre when first attacked.

Logging fires when finally controlled averaged much larger than the others. When one of 19,000 acres was eliminated, the remaining logging fires averaged 710 acres in size. Other man-caused fires averaged 23.0 acres, and lightning fires averaged 3.7 acres when controlled.

Possibly the reason for larger logging-caused fires in spite of quicker and stronger attack lies in a difference in condition of the slash. The logging fires usually start in more dangerous fuels than do other fires in slash because of the location of machines and men within slash of the current year. Other man-caused and lightning fires are as likely to start in older slash as in fresh slash. Slash becomes less flammable with age: the highly flammable needles drop from loosely piled branches to form a compact layer on the ground; vines, weeds, and brush moreover shield the fuel from the sun and wind. Furthermore, the older slash is more likely to be sparse and intrinsically a lower fire hazard because the highest hazard slash is usually intentionally burned soon after logging. In general, only the lower hazard slash is left unburned.

To see how fires in slash compared with those in other fuels, the average size of man-caused fires in all fuels was computed.

Logging fires in slash proved much the larger. For the period 1950-53 the average size of man-caused fires in all fuels was about 22 acres if one exceptionally large fire was excluded, about 39 acres if it was included. Either average is relatively close to the 23-acre average for other man-caused fires in slash, but only a small fraction of the average of 710 acres for logging fires in slash.

Rapid early spread and exceedingly large size of slash fires caused by logging emphasize the need for extreme care to prevent them. If a fire should start in current slash, every possible means must be used to attack with great force immediately after the fire starts.

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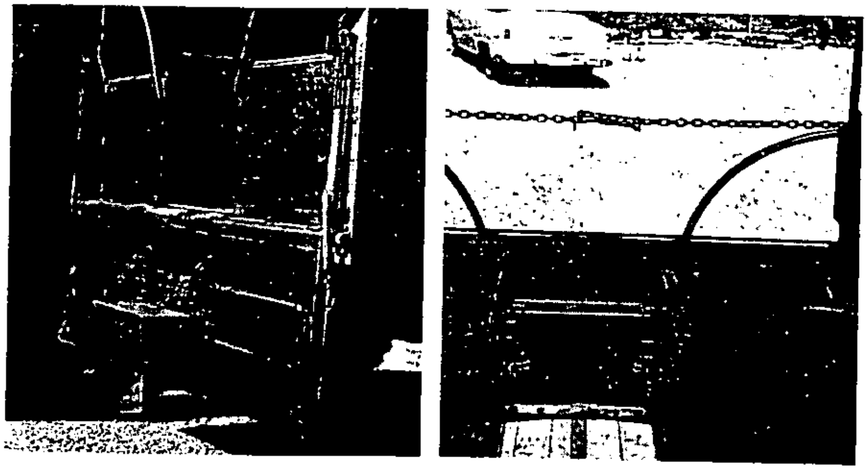
## Tailgate Step for Power Wagons

Loading and unloading crews on power wagons has proved unsafe at times. With the tailgate closed the men must use the bumper as a step; with the gate open the step is too high. To reduce the hazards involved, a tailgate step was designed and proved practical in use.



The step is hinged to the tailgate in such a way as to automatically lay flat against the gate when the gate is closed and at right angles when the gate is open. The step is made of corrugated or rough boiler plate to provide a skidproof surface even when wet. Other types of skid-resistant tread could be used. The short step cannot be overloaded and need not be removed when the truck is being used for purposes other than transporting crews.—J. J. BALDWIN, *Forester, Gila National Forest.*

# FIRE EXTINGUISHERS, THEIR TYPES AND USE. III. WATER-TYPE EXTINGUISHERS

A. B. EVERTS

*Equipment Engineer, Division of Fire Control, Region 6, U. S. Forest Service*

Everyone should have a basic knowledge of fire extinguishers and the type or class of fires on which these extinguishers are effective. No one type of fire extinguisher is effective on all classes of fires. These classes are as follows:

*Class A fire.*—A fire in paper, wood, cloth, excelsior, rubbish, etc.—or what we call forest fuels. For Class A fires the *quenching and cooling* effect of water is required.

*Class B fire.*—A fire in burning liquids (gasoline, oil, paint, cooking fats, etc.) in which a *smothering* action is required.

*Class C fire.*—A fire in *live* electrical equipment (motors, switches, fuse boxes, transformers, appliances, etc.). A *nonconducting* extinguishing agent is required.

To be sure, a fire may start as one class and then quickly develop into a second class—or even a third. In this case, it is necessary to use one or more types of extinguishers or methods to control the fire.

Let's remember, too, that fire extinguishers are first-aid treatment only. It's the old rule of "get 'em while they're small." There are three basic rules in extinguishing a fire with an extinguisher: (1) Locate the fire, (2) confine it so that it will not spread, and (3) extinguish it.

Now that we have the classes of fires in mind, let's go on to the basic types of fire extinguishers and the classes of fires for which they were designed. There are five basic types. Each major manufacturer has his own design. There are also variations within the type. The basic types are: (1) Carbon dioxide ($CO_2$); (2) dry chemical (dry powder); (3) water; (4) foam; (5) vaporizing liquid. Two of these types[1] were described in previous issues of this bulletin, and discussion of the others is planned for future issues.

The water-type extinguishers dealt with here are Class A extinguishers. The word "type" is employed because there are some interesting new extinguishing agents used in this extinguisher other than water.

There are three general types of extinguishers in this class: pump can; soda-acid; and loaded stream.

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[1]*Fire Extinguishers, Their Types and Use. I. Carbon Dioxide Extinguishers,* and *II. The Dry Chemical Extinguisher,* by A. B. Everts. Fire Control Notes 15 (4): 1-5, illus. 1954; 16 (1): 9-12, illus. 1955.

PUMP CANS: Pump cans, referred to as extinguishers, are usually the 2½-gallon size with a plunger type of hand pump and a short length of hose for directing the stream. They are so well understood that nothing further need be said about them.

SODA-ACID: Soda-acid fire extinguishers have been in use for many years and are standard equipment with all manufacturers. Sizes vary, but generally the 2½-gallon size is one that is thought of when hand extinguishers are mentioned.

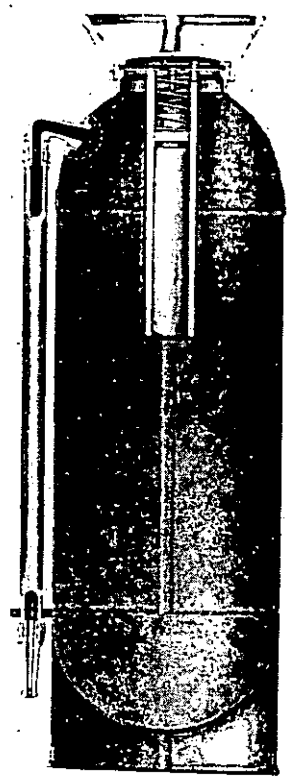

FIGURE 1.—Cut-away photograph of a $CO_2$ pressurized loaded-stream water extinguisher.

The extinguishing agent is water. A carbonate solution is premixed with the water, and a bottle of acid is suspended in a cage at the top of the extinguisher. To put the extinguisher into operation, the bottom is turned up. This action causes the acid to mix with the water solution. The resultant chemical action produces $CO_2$ gas, which expels the water directed at the fire through a short length of rubber hose. The range of the water stream is 40 to 45 feet. If it is possible to get close to the fire, a spray can be produced by placing a finger over the discharge tip.

In the past, most soda-acid extinguishers were made of copper. Newer models are made of stainless steel or silicon bronze and will withstand internal pressures up to 500 pounds per square inch. The list price of soda-acid extinguishers is approximately $30 and recharges cost $1.50 each.

Since the extinguishing agent is water, and water freezes at 32° F., the extinguisher is not a good one for use in cold climates, unless kept in heated rooms or other means of protection are provided.

**WARNING:** Nonfreeze compounds should not be added to the water in soda-acid extinguishers. To do so would cause a chemical reaction that would destroy the chemical charge and corrode the shell, and it might even result in an explosion.

LOADED STREAM: This term is applied to water-type extinguishers pressurized by a $CO_2$ cartridge (fig. 1).

In appearance and size, the extinguisher looks like the soda-acid foam extinguishers, size 2½ gallons. To operate, the extinguisher is inverted, grasped by the handle in the base (not shown in the cut-away photograph) and bumped down against the floor or ground. This action ruptures a disk in the $CO_2$ cartridge. The released gas then expels the water. Stream range is 45 to 55 feet, somewhat farther than for the soda-acid extinguisher. Clear-water types are made of stainless steel and cost approximately $35 each. Drawn brass and silicon bronze, recommended when antifreeze salts are to be used, are about $5 higher. Used cartridges can be exchanged for charged ones for $1.00 to $1.25 each. Nonfreeze charges, which will permit use at minus 40° F. temperatures, cost from $1.75 to $2.75 each.

The loaded-stream extinguisher permits the use of extinguishing agents other than plain water, or the addition of a wetting agent to the water. There is indisputable proof that "wet water" increases the efficiency of water, especially in fuels such as excelsior, paper, and overstuffed furniture, where quick penetration is desired. Fire retardants can also be used. One of these, now available commercially, is of special interest. It was discovered by research chemists while attempting to develop a nonfreeze foam charge. This particular liquid remains effective down to minus 40° F. It is a fire retardant and prevents reignition. But its most surprising characteristic is that, unlike water, it is also effective on small Class B fires. This is an example of a Class A extinguishing agent that is also effective on small Class B fires. It should *not* be used on Class C fires.

The loaded-stream extinguisher, then, can be used to expel any liquid not corrosive to the container. Small-capacity fog or spray type could be used if there were any advantage in using them.

*Maintenance.*—Loaded-stream extinguishers require minor maintenance. Simply weigh the $CO_2$ cartridge to see that it is fully charged, and check the contents of the extinguisher. Soda-acid extinguishers require annual recharging, because the chemicals deteriorate with age. The extinguisher should be thoroughly cleaned and the hose checked to make sure that the nozzle is not clogged. Acid bottles and stopples, if replaced, should be exact duplicates of those originally provided. The powdered chemical should be thoroughly dissolved in water outside the extinguisher, in accordance with instructions on the container.

*Summary.*—(a) Use on Class A fires; (b) needs annual maintenance; (c) will freeze, *do not use antifreeze compounds*—except in the loaded-stream type; (d) range 40 to 45 feet.

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## Red Hats For Fire Supervisors

An idea which we introduced on a fire in Gaspé last June and found to be a considerable benefit to the organization was the wearing of bright red hats by all rangers and auxiliary rangers. This enabled us to identify supervisory personnel at great distances and, also, served to advertise to the fire gang that the man giving them orders was a qualified ranger and not just some "joker" who happened to be passing by. We are now making up bright red arm bands to be worn by the crew foremen so that they too may be easily recognized in the excitement of battle.—D. M. JOHNSON, *Canadian International Paper Company.* (*From* Pulp and Paper Mag. Canada 55 (10): 191.)

# TILT-BED TRUCK DEVELOPED BY TEXAS FOREST SERVICE

CHESTER O'DONNELL

*Specialist in Visual Aids, Texas Forest Service*

The tilt-bed truck, a new addition to mobile fire fighting equipment, appears to be one of the most important developments of recent years for the quick suppression and control of forest fires.

The tilt-bed truck, as developed by the Texas Forest Service, is a modification of a somewhat similar unit constructed by the United States Forest Service in Albuquerque, N. Mex. It provides for the rapid transportation of the heavy duty, tractor-type plow unit to the scene of action, and it is so constructed that one man can effortlessly load and unload the heavy unit that it carries. The tilt-bed truck has undergone extensive testing by the Texas Forest Service and, as a result of its highly satisfactory performance during these tests, the units are now being furnished to each of the six districts of the Texas Forest Service as standard equipment.

The very simplicity of design makes the bed easy and economical to construct. Essentially, the unit consists of a ruggedly built steel tilting bed mounted on a 1½-ton, or larger, truck chassis. The tilting movement of the bed is dampened and limited by shock absorbers. Two ramps that slide easily in and out of their grooves just below the level of the bed are provided at the rear of the body for use in loading and unloading. When extended, these ramps are held rigidly in the same plane as the tilt-bed body and become, in effect, an extension of the bed itself.

The tilt-bed received its name from the fact the body tilts downward for loading or unloading (fig. 1). This tilting motion is accomplished by mounting the flat steel bed onto the chassis of the

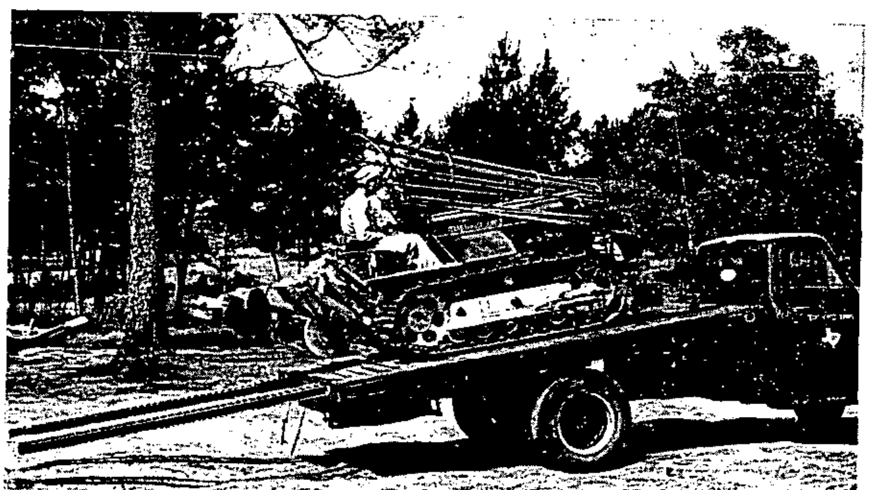

FIGURE 1.—Tilt-bed truck during one-man loading operation. Tractor unit has just passed center of balance and bed is returning to horizontal position. Pins attached to rear of truck are used to hold ramps in closed position.

truck in such a manner that it works on a pivot from a point at the exact center of balance. This action is similar to that of a balanced teeter-board.

In use, when it is desired to unload the tractor unit, the ramps are extended and the tractor is backed slowly off the truck. When the weight of the tractor passes the point of balance, the bed automatically tilts, the ramps rest on the ground, and the tractor is backed down the ramps to the ground. For loading, the process is reversed, and as the tractor nears the front of the tilted bed, it is gently lowered to the normal horizontal position. After sliding the ramps back into their grooves in the body, the unit is ready to roll.

To prevent the sudden drop that would occur when the weight of the tractor unit passes the balance point, an ingenious hydraulic shock absorber has been designed and installed between the frame and the front of the tilt-bed. A cushioning effect is achieved by means of a connecting, or bypass line from the top to the bottom of the hydraulic shock-absorber cylinder (fig. 2). By placing re-

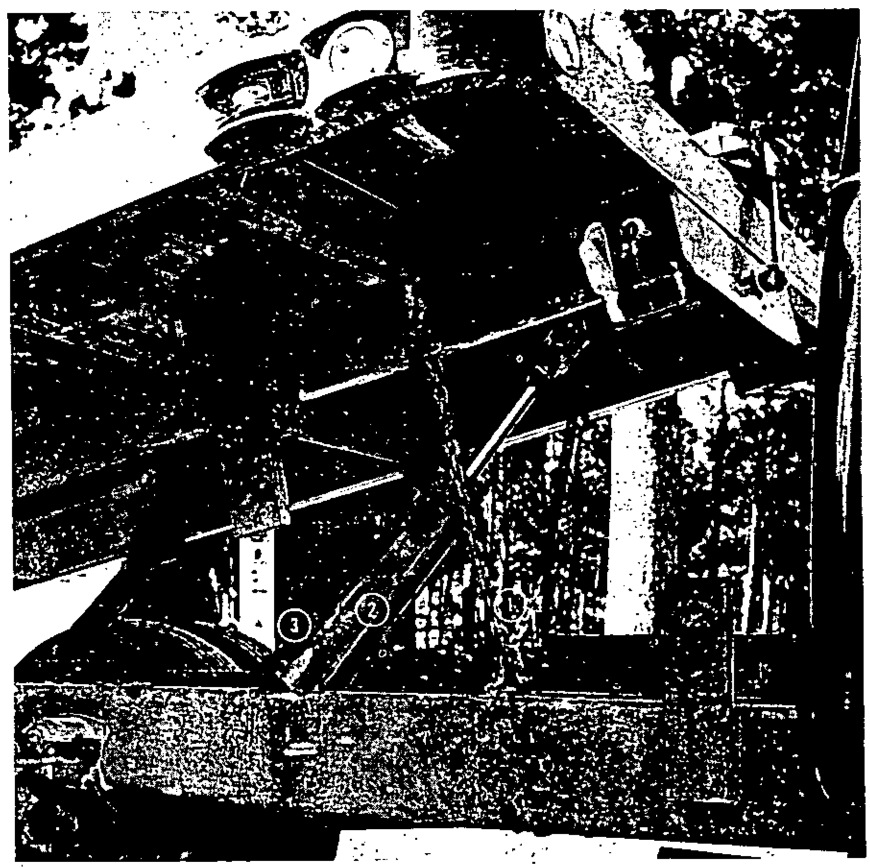


FIGURE 2.—View of bed tilted for loading or unloading purposes. Shown are (1) safety chains, (2) hydraulic shock absorber, (3) bypass line, and (4) locking device.

stricting apertures in this line, the speed of movement of the tilt-bed is controlled and the bed is allowed to move slowly and smoothly even under the heavy weight of the tractor.

Heavy duty, tractor-type plows are much more effective than jeep plows in certain types of woods and terrain, although the mobility of the jeep unit outweighs this advantage at times. Use of the tilt-bed truck makes up for this lack of mobility on the part of the tractor plows and increases their usefulness over a very large area.

Many representatives of the forest services of other States have witnessed demonstrations of the tilt-bed, and whenever demonstrated, it has aroused much interest and enthusiasm. Several States are now considering including the tilt-bed as part of their standard forest fire fighting equipment.

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## Smoker Fires Decrease In British Columbia

During the past decade there has been a significant decrease in the number of fires caused by smokers in British Columbia. Data taken from Annual Reports of the British Columbia Forest Service show that for the 10-year period 1944-53 smoker-caused fires dropped from 20.52 percent of fires from all causes in 1944 to 12.04 percent in 1953. This gave a yearly average of 18.05 percent for smoker-caused fires.

Ian Cameron of the Protection Division of the British Columbia Forest Service states that so far as he knows there has been no change in classification of fire causes. He attributes the decrease in fires caused by smokers to the expanded program of public education in British Columbia, the rest of Canada, and the United States.

The downward trend for the decade is just significant at the 5-percent level of probability. It is interesting to note that the predicted percentage of smoker-caused fires for 1954, 15.5 percent, agreed very closely with the actual percentage for 1954. By November 1954, 118 of the Provincial total of 763 fires, i.e. 15.47 percent, had been caused by smokers.—J. HARRY G. SMITH, *Assistant Professor, Faculty of Forestry, The University of British Columbia.*

# LIGHTWEIGHT SLIP-ON PATROL TANKER

ARCADIA EQUIPMENT DEVELOPMENT CENTER

*California Region, U. S. Forest Service*

Most fire tankers are designed to utilize the full capacities of a vehicle. Such units provide maximum service for fire fighting, but leave little room in a pickup truck to haul equipment and materials. There has been a need for a low-cost small fire fighting unit that can be mounted on pickups used by patrolmen, recreation guards, etc., leaving ample room for hauling the variety of items necessary in field operation. This includes drums of gas, personal belongings, miscellaneous tools, directional signs, posts, garbage cans, etc.

As a result of field requests for such a tanker, the design problem was assigned to the Arcadia Equipment Development Center. A lightweight, slip-on tanker has been developed, and 18 units are now undergoing field-service test in the California Region. The unit consists of a 50-gallon water tank on which is mounted the reel and pumper (fig. 1).

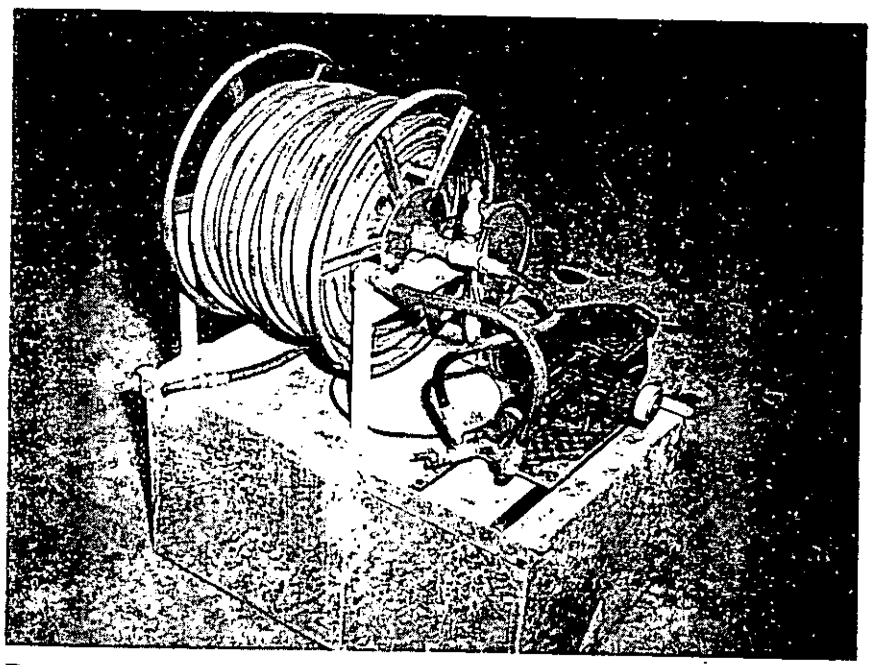

FIGURE 1.—Base dimensions of tank, 36 by 24 inches; height to top of reel, 40 inches; tank capacity, 50 gallons. Inside dimension of reel, 13 by 23 inches; core, 10 inches; reel capacity, 200 feet of ¾-inch hose. Total weight of unit when filled with water, 640 pounds.

The tank measures 36 by 24 inches and is 14 inches high; it is constructed of 14-gage steel, includes a baffle, and is galvanized to prevent corrosion. A large cleanout hole is provided as well as a 2-inch fill opening and a 1-inch drain.

The pumper unit weighs 26 pounds and consists of a small, positive displacement pump that is driven by a 1.6-horsepower gasoline engine. Actually, the engine is the same as those used on some lawn mowers. The pump is rated at 7½ gallons per minute at 150 pounds per square inch and, as with the engine, was borrowed from commercial application. Pumps similar to these are now used in aircraft hydraulics and are under consideration for use in automotive power steering. It has no connecting rods, gears, springs, cones, or clutches, and only one point for occasional lubrication. Only one manual valve is included with the outfit. It is of the small petcock type which is opened for priming.

The characteristics of the pump and the design of the suction side are such that draft from overboard with the usual suction hose is not recommended. For filling the tank from draft, a small ejector should be used. Details of suitable ejector for this purpose are given in U. S. Department of Agriculture, Forest Service, Equipment Development Report No. 20, Water Ejectors.

The live reel standards are made of 1-inch pipe and extend into the tank. The two pipes near the pumper extend to within ½ inch of the bottom and serve as suction line for the pump and discharge line for the relief valve. The other two pipes serve as vents.

A garden-type nozzle is used on these units which provides means for shutoff and spray adjustments. During shutoff, the relief valve permits the full discharge to return to the tank.

Further information can be obtained by writing to the Arcadia Equipment Development Center, U. S. Forest Service, P. O. Box 586, Arcadia, Calif.

# RADIO MAINTENANCE COST ANALYSIS

MAX GUIBERSON

*Radio Engineer, State of Washington Division of Forestry*

In this competitive and price-conscious era, it has become increasingly necessary that accurate, complete cost records be maintained in both private and public industry. A breakdown on costs of the communications facilities of the State of Washington Division of Forestry for the fiscal year ending April 1, 1953, showed the average maintenance cost per month of a headquarters radiophone to be $7.51; a mobile, $6.45; and a lookout, $9.78. Depreciation of the radios, truck expense, meals, lodging, office expense, and all other expenditures necessary for the operation of the communications section are included in these costs. While the figures are based on a 12-month year, the majority of the radios are in use approximately 7 months.

The various radios owned by the Division of Forestry are distributed among 21 forestry districts within the State of Washington, with each district assuming the maintenance cost of radios assigned to it. As in many other departments, most of our purchases of parts are made in quantity once a year, and are achieved by submitted bids. When the parts are received in our stockroom, each item is checked and entered in a master-inventory record book.

The radio technicians of the Division of Forestry communications section maintain individual, less comprehensive stocks that are obtained from the main stockroom. When parts are issued to a technician, the stock clerk fills out a sales check, a copy of which is given to the technician for his reference. The original sales check is kept by the stock clerk for use in transferring items from the master-inventory record book to the technician's inventory record book; it is then filed numerically with the stockroom records.

Each technician is assigned an individual workbench for radio shopwork, and a State panel delivery truck to be used for field maintenance. The workbenches have cabinets with drawers for storing radio parts. When field maintenance is necessary, these drawers can be used in a similar cabinet permanently installed in the technician's truck, permitting safe conveyance of fragile radio parts to the field.

After a technician services a radio, he fills out a triplicate sales check showing the various parts used. He retains a copy for reference and gives the stock clerk the original and duplicate. The duplicate copies are sent to the districts as supporting detail for monthly billing. The originals are used by the stock clerk for removing from the technician's inventory the items listed on the sales check, and for other bookkeeping purposes, after which they are filed numerically with the stockroom records. From maintaining the technicians' inventory records, the stock clerk is familiar with the items in the technician's stock, and there is little chance of a technician making a field maintenance trip without adequate parts for repair of the radios involved.

Since a file folder containing completed maintenance record forms and a master cost card is kept for each radio, a complete history of each radio, from the time it was put into service, is available. The information shown includes the nature of the trouble reported; repairs that were made to correct it; frequency measurement, in compliance with FCC rules; the number of the sales check listing the parts used; and the total hours of labor necessary to repair the radio. These complete individual maintenance histories, available to each technician, ensure more adequate servicing.

When the cost of maintaining individual radios is known, it is a simple matter to prorate the balance of the communications section expenses among the radios and arrive at the cost per radio of maintaining the communications network. Although our record system has been in use for only a few years, it has proved to be an accurate method of controlling the various large and small items of stock necessary to such an enterprise, all of which contribute to the overall cost.

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## Canteen Gaskets

On the basis of an employee suggestion by Jack Shumate of the Coconino National Forest, Southwestern Region, the Arcadia Equipment Development Center has the following to say with regard to canteen gaskets:

> Past use of paper and cork canteen gaskets has long indicated a need for consideration of other materials. Mr. Shumate's suggestion for utilizing inner tube material, preferably of the synthetic type as noted, is certainly a practical method for obtaining gaskets at locations or under emergency conditions where supply problems are involved.
>
> However, after a survey of local warehouses, we were informed that rubber gaskets are being purchased separately for installation in all canteens, both old and new, at a cost of approximately 4 cents apiece. In the interest of economy and of obtaining a uniform product it is felt that commercial procurement would be the more satisfactory method. They should be purchased as "Gaskets, neoprene, medium Shore Durometer, ⅞-inch i.d. x 1½-inch o.d. x ⅛-inch thick." These gaskets generally have an average hardness of 50-55 Durometer.

Perhaps we have seen the end of the irritating, leaky canteen.

# HOW CORBIN, KENTUCKY, GOT A COOPERATIVE FIRE-SUPPRESSION ORGANIZATION

EARLE H. MEEKINS

*District Ranger, Cumberland National Forest*

Gaining cooperation in forest fire suppression work has been an objective of private, State, and Federal agencies since the first attempts to protect the forest resources from wildfires. During the 1952 fall forest fire emergency in eastern Kentucky, a group of public-spirited sportsmen talked seriously about the situation. They decided that sportsmen had a primary interest in forest protection and that they should offer their help in the emergency. As Cyril Fields, sporting-goods store owner termed it, it was a cracker-box organization formed by retired railroaders, weekend hunters, newspapermen, a jeweler, and other interested people.

The first fire they hit with any strength was the one on Arches Creek in the Jellico District, Cumberland National Forest. Two volunteer crews came to this 1,172-acre fire in their own cars to give a helping hand. The 30 men drove about 25 miles, much of it over rough dirt roads, to man the firelines.

Following this first volunteer effort by untrained but willing workers, the organization grew. During the winter, several meetings were held by the key people and a formal organization was developed to meet fire and flood disasters. The newspaper and the radio station were asked to give spot news and send out calls for help during emergencies. Available equipment, transportation, food, blankets, and first-aid supplies were to be listed on three sets of cards. Volunteer help was also to be listed for dispatching.

Out of the 520, or so, members of the Rod and Gun Club, the officers believed that at least 100 would turn out for emergencies. The plan provided for a disaster organization to cooperate with the Red Cross. Special equipment, including tools, would be supplied by State and Federal agencies.

When the second dry fall, that of 1953, rolled around, Fields, Distad, and other leaders in the movement found that calls for help on forest fires were becoming frequent. The word soon spread by word of mouth and radio that there was a new forest fire fighting outfit at Corbin. What started out to be an emergency organization was becoming a frontline, volunteer, forest fire fighting unit available to anyone who had an uncontrolled fire. Soon many business men found that when they fought fire all night they were unable to perform their normal quota of work the next day. The cooperative effort suffered, as did the morale of the group, and many of the older men did not respond to fire calls in November.

During the spring of 1954, the movement away from the organization continued until only a half dozen of the older men of the original fire fighting group were left. Fields and Distad stayed.

As the older men dropped out of the organization, they were replaced by Junior Conservation Club members who were high school juniors and seniors.

From the fall of '53 through the spring of '54, the organizational record shows that it fought 23 forest fires (14 in Knox County, 6 in Whitley County, and 3 in Laurel County). Of these, 19 were fall fires, and 4 spring fires. There were 148 man-trips, 603 hours on fires, and 770 miles driven. Of the 23 fires fought, 2 were on national-forest lands, the remainder on private lands. No division was made in the organizational records between those which were State fought and those which were private.

Payment to fire fighters has been on a voluntary basis. The United States Forest Service paid the fire fighters, since it paid other emergency fire fighting personnel. Some of the men turned their fire fighting earnings over to the parent organization as donations.

What of the future? According to Fields, the Fowler Club—an 18-man volunteer firemen's club at Corbin—will take over the burden of leadership. The members are all young men who enjoy the adventure of town and forest fire fighting. They are at present remodeling a 4-wheel-drive command car for forest fire fighting, flood emergencies, and use on other jobs where the going is rough. These 18 members of the Fowler Club, plus 6 especially interested members of the Rod and Gun Club, are to take over the leadership positions during forest fire emergencies. According to Fields, they will take over the sectors, communications, scouting positions, and services of supply when needed.

Leaders of the emergency unit insist on two provisions: (1) The protection organizations shall not depend on it except in a case of real emergency, and (2) if other forest fire fighters are paid, the men in their organization shall be too.

The Jellico District has planned a training program for the 24 leaders; it will include motion pictures, discussions, and a field demonstration. Although the training will not turn out finished fire fighters, it should serve to acquaint these men with the duties and responsibilities of leadership and how the organization on a large fire works as a team.

## YOUR GUARD STATIONS: HAVE THEY BEEN EQUIPPED WITH EXTERIOR EMERGENCY TELEPHONES

A/1c E. M. Park

*Fire Prevention Section, 77th Installation Sq.*
*Long Beach Air Force Base*

Whenever a fire call "hits" at one of your stations, or when one of your patrolmen leaves his quarters to begin his rounds, does your protection agency still follow the outdated procedure of hanging a "Ranger Out" sign on the front porch, leaving the premises locked up, and simply trusting good fortune to carry on from there?

While it may seem offhand that there is nothing particularly wrong with this course of action, stop for just a moment and think: what would happen if a forest inhabitant, suddenly finding himself in need of immediate emergency communication with "the outside," hurried to your station and discovered a locked door and sign reading "Ranger Out"—In case of emergency use phone at Dugan's Mill, 7 miles south of here."

This writer is personally familiar with no less than three instances in which medical aid was delayed in reaching forest occupants suffering from personal injuries. In each case the hindrance was due to an identical cause: the person who discovered the accident went to the nearest guard station to summon assistance but found a locked building and no means of calling for help. Of course, one might conclude that an instance of this nature is a personal matter and of no direct concern to a fire protection agency. This is a shaky conclusion, because the same circumstances could apply to a fire situation. What happens then? Would it be necessary for the person discovering a blaze to "use phone 7 miles south" of the guard station, with a resulting delay in alarm transmittal?

Why make it necessary for a person to waste vital minutes in traveling to a distant instrument when an exterior telephone extension, exclusively for the emergency use of forest users, can be easily and inexpensively installed. Such phones have been in use for many years at mountain stations of the Los Angeles County, Calif., Fire Department. A typical exterior phone installation is shown in figure 1. Notice especially that it is placed in as prominent a location as possible—directly at the main entrance to the station. Observe also that the callbox is painted in sharply contrasting colors—aluminum body with red or black letters, and that all lettering is large enough to be read at a distance. Special attention is also directed to the yellow-and-black sign mounted above the callbox. Here, reflecting paint is used, which lights up brilliantly when vehicle headlights are directed toward it at night.


FIGURE 1.—A carefully planned emergency telephone installation. Notice that regardless of your direction of approach toward this callbox, its purpose is instantly understandable.

Inside the box, in a conspicuous place, is a concise but complete set of telephone operating instructions. This may seem to be of minor importance; however, it is well to keep in mind that a magneto-type telephone may be confusing to some people. Making it easier for forest users to communicate with "the outside" during times of emergency can mean the difference between life or death, a prompt fire report or the catastrophe of a delayed alarm.

# COALMONT'S VOLUNTEER TRAILER-TANKER FIRE FIGHTING UNIT

JOSEPH S. DEYOUNG

*Forester, Indiana Department of Conservation*

A group of trained volunteer forest fire fighters in the small town of Coalmont, Ind., spearheaded by a part-time fire warden and a garage owner, built a unique forest fire fighting unit (fig. 1). It consists of a trailer with tanks and power pump, and carries enough fire fighting equipment—rakes, beaters, axes, shovels, back-pack pumps, first-aid kits and water canteens—to outfit a crew of 20 men. This unit is thought to be the only trailer-housed piece of forest fire fighting equipment owned and constructed by volunteer forest fire fighters.

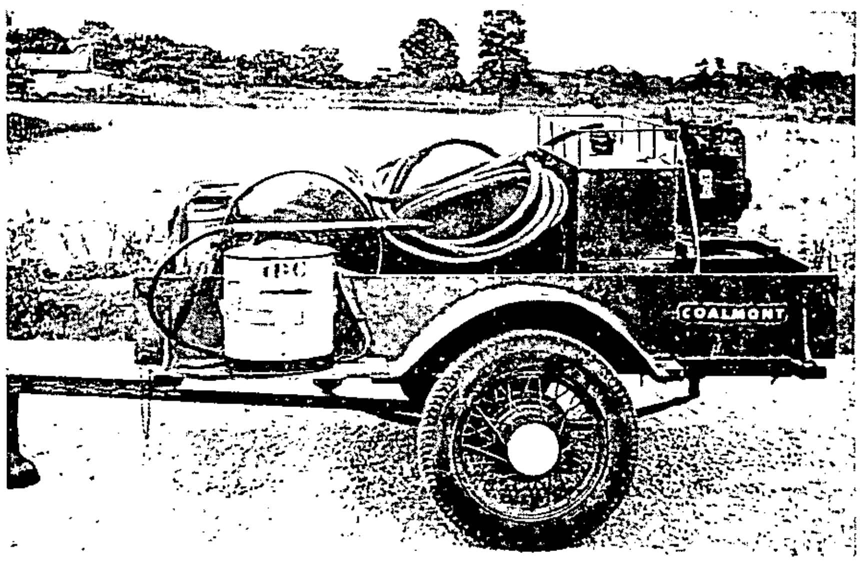


FIGURE 1.

The trailer-tanker was made from salvage material. The State provided an old surplus water tank and a Panama pump that was rebuilt and reconditioned. All the labor, including welding, was donated by members of the group. The water capacity of the tank is 205 gallons. The trailer is painted bright red, and has the name "Coalmont" printed on its sides. Fire fighting equipment is carried on the trailer at all times.

Coalmont's forest fire fighting unit, manned by local volunteers, is ready at all times to make runs to suppress outdoor fires and to fight building fires; the town does not have a fire department. The cars and trucks of all the volunteer fire fighters are equipped with trailer hitches, so that the first man to reach the trailer is able to take it to the scene of any fire. This efficient group has appreciably reduced the size of the average outdoor fire in its area.

The efforts of these civic-minded citizens and their active interest in forest conservation should be an inspiration to conservationists in other communities who may wish to equip themselves in a similar manner for forest fire fighting. The Coalmont volunteers deserve great credit for their worthwhile project.

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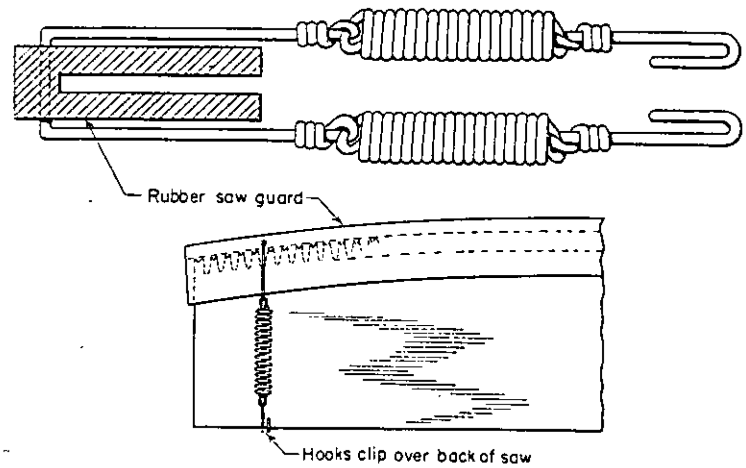
## Simple Saw Guard Fastener

This simple, economical clip for fastening rubber guards to crosscut saws is made from ordinary door spring and number 12 wire. This type of rubber guard is often wrapped with rope, wire, or tape to hold it to the saw. The clips are faster, simpler, safe, and cheap.

Each clip consists of two sections of spring about 1½ inches long and 3 pieces of wire fabricated as follows:

A length of wire about 10 inches long is passed through a hole in the rubber guard to the midpoint of the wire. Both ends are then bent as shown and fastened to the coil springs. Excess wire is cut off. Then a hook is formed with another piece of wire and fastened on the other end of each spring.




The type and size of saw determines the length of wire needed for the hooks. About five clips are needed on a 6-foot saw. Two screen door springs cut into 1- to 2-inch lengths are ample for one saw guard.—W. D. BROADHURST, *Fire Crew Foreman*, and D. H. EULER, *District Ranger, Modoc National Forest.*

# ATTACHING FIRE-HOSE COUPLINGS

Robert St. J. Orr.[1]

Probably no subject in the field of fire-fighting equipment has received less attention than the attachment of expansion ring-type fire-hose couplings. The old proverb that "A chain is as strong as its weakest link" applies most truly to fire-hose couplings. The entire layout of pump, hose, and nozzles may be rendered useless if an improperly attached coupling blows off the hose while in service on a fire. Yet a correctly designed expansion-ring coupling, properly attached, will definitely withstand the bursting pressure of the hose for which it was designed.

## Equipment and Material

In approaching this subject, let us first consider the basic equipment and the mechanical principles involved.

*Expanding tools.*—These are made in two types, hand operated and power operated. Hand-operated types are usually adequate unless constant use justifies investment in a power-operated machine. They are made in individual sizes, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, etc., up to 4 1/2 inches, and can only be used on hose of corresponding inside diameter, disregarding outside diameter entirely. Basically, this machine consists of a drawbar, threaded at one end, tapered at opposite end and mounted in a heavy cast bronze housing provided with a thrust bearing. A set of segments consisting of 8 to 12 individual tool-steel sections forms a collar at the tapered end of a drawbar. The expansion ring fits over these segments and is expanded as the tapered part of the drawbar is drawn into the housing by the machine. An adjustable spacing gage is provided on the housing; adjustment of this permits placing the ring in an exact, predetermined distance inside the coupling. Because this tool is subjected to severe stress, only tool-steel segments are adequate to produce reliable performance.

*Couplings.*—These are usually provided in sets consisting of one male with external thread, and one female with internally threaded swivel connection. Both are provided with a hose bowl that must fit snugly over the outside of the hose, or not be more than 1/32 inch larger than hose. The interior of the hose bowl is machined next to the throat of the coupling to provide a suitable seat for the hose-bowl gasket, and the balance of the interior is provided with circular serrations that grip the hose when the expansion ring is installed. The throat or waterway through the threaded part of the male coupling must at all times equal the inside diameter of the hose—except on special reducing or increasing couplings.

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[1]General Manager of the Western Fire Equipment Co. This is an abridgement of an article of the same title that appeared in Forester Fire Equipment Notes, and is published here by permission of the Western Fire Equipment Co.

First-grade couplings will pay dividends in service if properly attached. They are usually made of red brass (80 to 85 percent copper alloy), and are designed to grip the hose securely. They are uniformly machined and must fit the hose accurately. Poor couplings, made of yellow brass, will often stretch freely as the ring is expanded; this may cause them to blow off under high-pressure service. The interior serrations must be uniform, of adequate depth, and with fairly sharp edges to securely grip the hose. Uneven serrations obstructed by core-sand or miscast are sure to cause trouble. All machined dimensions in couplings of the same size, type, and manufacture should be uniform.

On male couplings, the distance from face of male thread through the waterway to seat of hose-bowl gasket should not vary materially. This measurement is used to set the spacing gage on the expanding tool in relation to the expansion ring. Consequently, serious variation causes the ring to lodge in the throat of the coupling or too deeply in the hose bowl. Female couplings may differ from male couplings in measurement at this point, but should otherwise be uniform. The waterway in both male and female couplings should be at least 1/64 inch larger than nominal inside diameter of hose to permit free entry of the expansion ring. Secure attachment of even the finest couplings is impossible if the hose bowl is too large in diameter. This is especially true on ¾- or 1-inch high-pressure hose. Normally, the hose should enter the hose bowl with only slight assistance, never very freely. A tight fit is preferable to a loose one. Since expansion ring couplings are made in various diameters, weights, and lengths, and with many different threads, and are equipped with several different styles of spanner lugs on the female swivel, when ordering couplings only, the outside diameter of hose to which they are to be attached must be considered.

*Hose.*—Hose varies according to service and performance requirements. Unlined linen hose, rubber-lined cotton-jacketed hose, and rubber-covered hose differ in materials and design. They are broken down into various types: Commercial linen hose and mildewproof linen forestry hose; single, double or triple cotton-jacketed rubber-lined hose; wrapped, braided or woven, rubber-lined rubber-covered hose; also circular woven or wrapped wire reinforced-suction hose. The inside diameters are made to nominal standards of almost any dimension (1, 1½, 2 inches, etc.), but these have no relation to the outside diameter. For instance, linen hose of 2½-inch inside diameter usually measures 2-11/16 inches outside diameter, whereas cotton-jacketed 2½-inch hose may measure up to 3¼ inches outside diameter and 2½-inch suction hose as much as 3½ inches outside diameter. Therefore, the hose bowl of the couplings must match the outside diameter of the hose to which they are to be attached, and the waterway of couplings must match inside diameter of hose. Hose designed for high pressure such as double cotton-jacketed hose must be provided with couplings designed for use in similar service. These are of heavier construction with longer hose bowls and longer expansion rings than those used on low-pressure hose.

*Expansion rings.*—These are made of special composition copper base alloys with ductile characteristics permitting 40 percent expansion above original diameter without breakage. A minimum wall thickness of 0.050 inch is essential in 2-inch and smaller diameters, and 0.062 in 2½-inch sizes with corresponding increases in larger sizes. The length of rings required is determined by depth of coupling hose bowl on which installed. At no time should the ring project beyond the end of the hose bowl, as it will tend to shear the hose at that point. Usually, the ring should be ⅛ inch shorter than the hose bowl and free of any sharp edges that might cut the inside of hose. If one edge is beveled at a 45° to 60° angle, it will facilitate installation, especially when hose diameter is contracted by very tight-fitting couplings.

*Hose bowl gaskets.*—These serve to prevent leakage behind the expansion ring or between layers of rubber and fabric. They are not needed and are of no value when coupling unlined linen hose. Neither are they required for use on rubber-lined rubber-covered hose *if* the hose ends are securely sealed with vulcanized rubber by the manufacturer so that not a single strand of fabric is exposed. Their use is definitely imperative on all rubber-lined rubber-covered hose with *fabric exposed at the ends.* If omitted, water will seep into the fabric between the rubber lining and rubber cover, forming blisters on outside of hose that will rupture the rubber cover. They are likewise essential to prevent leakage at couplings on all cotton-jacketed rubber-lined hose. These gaskets are made of medium-soft rubber, free of any fabric. They are lodged in the end of the coupling hose bowl adjacent to the throat, where a machined seat is provided. Their inside diameter is 1/16 inch larger than the nominal inside diameter of hose on which used. Thickness of gaskets varies from 3/16 inch for hose of ¾- to 1½-inch inside diameter, to ¼ inch for hose of 2- to 4½-inch inside diameter and ⅜ inch for 5-inch or larger hose. The outside diameter depends entirely on the diameter of the gasket seat provided inside the coupling hose bowl. This dimension has never been standardized by any manufacturer and is not governed by any rules; *it must be* measured and the gaskets fitted. Gaskets of too small inside diameter will obstruct passage of the expansion ring and make coupling difficult or impossible. If too resilient, they may be squeezed out by the expansion ring. If too small in outside diameter, they will not seal.

## Supplemental Equipment

The following items should also be provided. They are essential to satisfactory work.

1. A standard 6-inch long machinist's steel rule calibrated in 32ds for measuring hose bowls and setting spacing gage.
2. An 8-inch spring type inside caliper, for measuring the diameter of hose bowl gasket seats.
3. A "rubber worker's knife" with 8-inch long straight-edged blade, for cutting hose ends accurately.

4. A medium-grit carborundum sharpening stone 6- to 8-inches long, for sharpening knives. When cutting high-grade rubber, a sharp knife is imperative.

5. Make up rubber lubricant consisting of a concentrated soap solution. Use ½ cake of soap, or equivalent, to 1 quart of warm water. Cut soap into shavings and stir into water until dissolved. Add water from time to time if necessary.

6. A small paintbrush, about ½-inch round, for applying rubber lubricant.

7. A hose test pump, if no other means is available, for adequately testing high-pressure hose (150 pounds or more working pressure).

### Use of Expanding Tool

1. Check expanding tool to see that drawbar is fully extended so that segments can collapse to smallest possible diameter.

2. If drawbar is dry, lubricate with a very small amount of heavy cup grease, especially underneath the segments. Wipe off any excess grease; it may damage rubber-lined hose.

3. Select expansion ring of proper length for the particular coupling and with beveled edge outward, fit it over segments till it lodges against shoulder. Operate expander until *very light* tension is exerted by segments to hold ring firmly in position—about ⅛ to ½ turn.

4. Place coupling on machine and note where it contacts spacing gage. Point of contact will differ between male and female couplings. Remove coupling and measure *accurately* the distance from shoulder, where hose bowl gasket lodges, to outer face of thread that contacts spacing gage on expanding tool. Add 1/16 inch to this measurement for all couplings of 2½ inches or smaller inside diameter, 3/32 to ⅛ inch for larger couplings. Now set spacing gage on expander to this exact distance, measuring from nearest edge of expansion ring to point where coupling previously contacted spacing gage. Because this measurement can be more easily determined on the male coupling, it is best to attach that coupling first. Repeat same procedure for female coupling, but note that contact point is different on spacing gage to compensate for greater length of female coupling. Adjust spacing gage if necessary.

5. Examine end of hose to be sure it is cut cleanly at 90° angle to its length. Frequently it is necessary to trim off loose ends on linen or cotton-jacketed hose. Usually, a clean end can be obtained by cutting off an inch or two completely, but this should never be done with rubber vulcanized ends—it might expose the fabric.

6. Fit the hose-bowl gasket into gasket seat provided at forward end of hose bowl. Then place coupling onto hose and work it down until it seats against hose-bowl gasket. Examine carefully inside to see that hose is properly lodged and beware of any loose strands of thread that may project into waterway; they will act as wicks for seepage if not cut off.

7. Fit hose and coupling assembly over expander drawbar and force into position over expansion ring until face of coupling contacts spacing gage. In doing this, grasp the hose, *not* the coupling,

to prevent dislocation of the hose in hose bowl. Do not twist, but exert steady pressure until properly seated.

8. Begin expanding by turning expanding tool clockwise. Note *carefully how tension increases;* this "feel" is the primary means of determining degree of expansion. Number of revolutions will vary according to wall thickness of hose. Usually at some point between 10 and 15 revolutions a sudden increase in tension will be noted. This indicates that the hose has been compressed and that the coupling now provides resistance to expansion. Proceed slowly one or two revolutions and carefully examine outside of hose bowl on all sides for any distortion. Such distortion will be preceded by "sweating" of the metal, which is easily recognized on polished couplings but difficult to detect on unpolished ones. It will be recognized by the appearance of minute ripples on the surface of the hose bowl. Do not apply further tension if sweating is noted, as this will break the coupling or render it useless by distortion. Count the number of revolutions as you reverse the expanding tool to starting position. This will help you in gaging the tension required for attaching next coupling of same type and size. Examine inside of hose carefully to see that expansion ring is lodged directly adjacent to waterway. If properly expanded, it will bury itself in rubber-lined hose to a point where inside diameter of ring about equals inside diameter of hose—on hose with heavy walls to a greater extent, and on linen hose to a lesser extent. If ring shows inadequate expansion, replace on machine and apply additional pressure, proceeding cautiously. If any part of hose-bowl gasket has been forced out into waterway, trim this off with small sharp knife, being careful not to injure interior of hose. Remember that use of the expanding tool will be facilitated by experience and by learning to "feel" the tension applied.

9. Test hose after coupling if at all possible by subjecting it to at least the normal working pressure at which it will be used—preferably test to 25 percent beyond maximum working pressure to which it may ever be subjected if you have means of applying such pressure. Couplings attached by novices and not pressure-tested may blow off in service.

### Correcting Troubles

*Expansion ring will not fit over expander segments.*

1. See that drawbar is fully extended.

2. Examine for dirt that spreads segments apart; disassemble and clean with kerosene; grease and reassemble.

3. Excessive use without lubrication has created burrs on sides of segments; disassemble and carefully remove burrs with fine-tooth file; grease and reassemble.

4. Ring may be substandard on inside diameter.

*Expansion ring is lodged in throat of coupling or too far into hose bowl.*

1. Inaccurate measurement of coupling or in spotting space gage.

2. Ring was moved out of position when coupling and hose assembly was forced over it.

*Hose-bowl gasket projects into waterway and prevents fitting of coupling and hose assembly onto expanding tool.*

Remove hose from coupling, leaving gasket in hose bowl, and trim inside of gasket to full diameter of waterway, using a razor-sharp knife.

*Hose fits too loosely into coupling hose bowl.*

Replace coupling with one that fits properly; there is no other *safe* correction.

*Hose too large to enter hose bowl.*

Action depends on how much too large. 1/32 inch on small hose and 1/16 inch on large hose can be overcome by lubricating the inside of hose bowl with an ample quantity of rubber lubricant (see Supplemental Equipment, No. 5, above). Also, apply lubricant freely to hose on inside, outside, and at end. Clamp coupling in a vise to hold securely while forcing hose into bowl.

*Hose will not fit over expansion ring.*

1. Apply ample rubber lubricant to expansion ring while mounted on expander; also to inside of hose.

2. Be sure that a restricted hose-bowl gasket is not the cause.

3. On rubber-lined hose, trim edge of inner tube with a sharp knife to a 45° to 60° angle.

4. Remove ring from expander; place hose and coupling assembly in position on expander; apply expander pressure *moderately* to stretch hose and force it into position in hose bowl. Remove hose assembly; replace ring on expander and proceed as usual.

*Expansion ring breaks before it is fully expanded.*

1. Due to poor quality of product or annealing.

2. Rubber-covered hose with wall thickness of 3/8 inch or more, if very resilient, may permit excessive expansion of ring. Remove broken ring and start again; proceed until ring is about 3/4 inch expanded, just before point where previous ring broke. Remove hose and install a second ring, proceeding as before. Then expand both rings simultaneously. If outer one breaks, it will serve as a space filler and inner ring will hold. Be sure to apply pressure test to hose after coupling.

*Linen hose shows broken strands directly adjacent to coupling.*

Coupling is too large for hose. Linen hose is not resilient. Use coupling with snug-fitting hose bowl.

*Reattaching used couplings.*

They should be examined first to determine whether they are in good condition. To remove old expansion rings, cut hose off directly adjacent to hose bowl, then drive a 10- to 12-inch solid-shank screwdriver between the ring and the hose. Drive down two-thirds the length of ring, then bend ring toward center and kink same. Avoid damage to coupling by careless use of tools. Clean all remnants of old hose out of hose bowl. Check threads to see they are not damaged. Examine swivel on female coupling to be sure it turns freely. If it does not, examine for dirt and clean if required. If it still binds turn to point where it binds, locate point, and strike swivel 3 or 4 sharp blows with wooden mallet while holding coupling in one hand.

The above information should enable an average person with a little mechanical experience to perform a satisfactory job. It should be carefully studied to prevent damaging couplings through careless use of the expanding tool. As experience is gained, handling of this work will be greatly facilitated.

Salvaging fire hose that has been discarded because of physical injuries or damaged couplings will pay substantial dividends. Most organizations that have several thousand feet of fire hose in service also have damaged hose on hand that is out of service. Present high costs of hose and couplings will probably justify the cost of necessary repair tools. Please feel free to call on our Engineering Department for any information or assistance we can render in connection with hose and coupling problems.

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## Published Material Of Interest To Fire Control Men

*Burning Techniques and Crew Organizations*, by T. A. Coates. Brit. Columbia Lumberman 38 (7) : 95-96, 98. 1954.

*Forest Fire Fighting Equipment*, by E. L. Howie. Pulp and Paper Mag. Canada 55 (10) : 154, 157, 159-160, 163, illus.

*Ontario Uses Helicopters to Aid in Forest Fire Fighting and Protection*, by Ontario Department of Lands and Forest. Pulp and Paper Mag. Canada 55 (10) : 164, 167-168, illus.

*Lightning Fire Research in the Rocky Mountains*, by J. S. Barrows. Jour. Forestry 52: 845-847. 1954.

*Maintaining an Effective Organization to Control the Occasional Large Fire*, by M. H. Davis. Jour. Forestry 52: 750, 753-755. 1954.

*Early Fire Protection Insures a 50-Year Partnership in Forest Research*, by N. R. Hawley. AT-FA Journal 16 (12) : 4-6. 1954.

*Will Forest Fire Insurance Work?*, by H. B. Shepard. Amer. Forests 60 (10) : 20-21, 47-49. 1954.

## 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 (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.

# God gave us this...

# Don't you give us this!

*Remember*- Only <u>you</u> can

**PREVENT FOREST FIRES!**