FIRE CONTROL NOTES

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FIRE CONTROL NOTES

A quarterly periodical devoted to forest fire control

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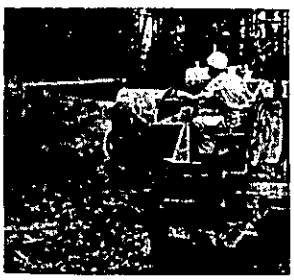

COVER.—This newly developed high-volume spray effectively applies fire retardant chemicals along a strip up to 60 feet wide. See related article on page 4.

(NOTE—Use of trade names is for information purposes and does not imply endorsement by the U.S. Department of Agriculture.)

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THINNING AS AN AID TO FIRE CONTROL

ROBERT H. CRON, *Assistant Regional Forester*
Division of Timber Management
Northern Region

Foresters and fire control people have often debated whether the slash created by thinning dense, young stands of conifers posed a greater threat to controlling fires than the original stand. Many have felt that the volume of dry fuel created by thinning would accentuate the control problem.

During August of the very severe season of 1967 in northern Idaho, northeastern Washington, and all of Montana, several thinned stands were burned by wildfire. On at least three fires, thinned stands aided in controlling fast-spreading fires under Extreme burning conditions.

A large fire in Glacier Park, across the North Fork of the Flathead River, crowned rapidly through dense pole stands of lodgepole, larch, and Douglas fir. At a bend in the river, it spotted across onto the Flathead National Forest into an unthinned lodgepole-larch stand (fig. 1). It crossed this stand as a crown fire, but when it hit an adjacent thinned stand it dropped to the ground. Although the surface fire was hot, the spread was much slower and the fire was checked by dozers and backfire at 50 acres (fig. 2). The aspect in both the thinned and unthinned stands was flat to rolling.

Again, on the Miller Creek fire of the Flathead, thinned stands aided control actions. The north flank of this 800-acre fire crossed Keith Mountain Ridge, crowning rapidly through a sapling and pole stand until it hit a thinned area. At this point, the fire dropped to the ground and spread much slower, enabling dozers and crews to complete lines on that sector during the night. Again the aspect or topography was no different between the thinned and unthinned stands. Green brush (mostly alder) was growing heavily as an understory beneath the thinned larch.

The Cotter Bar fire burned 7,100 acres on the Nezperce Forest. On the second day, it reached a series of clearcut blocks and a thinned area of ponderosa pine. Although the clearcuts and planted areas checked the fire and ultimately contributed to its control, it did burn between and over some of the plantations. Crews were able to backfire from the thinned area. The backfire burned hot but did not crown rapidly in adjacent unthinned areas, and it became one anchor point of the final control line.

In all three of the cases cited, the thinning slash was left on the ground. All areas had been thinned since 1962.

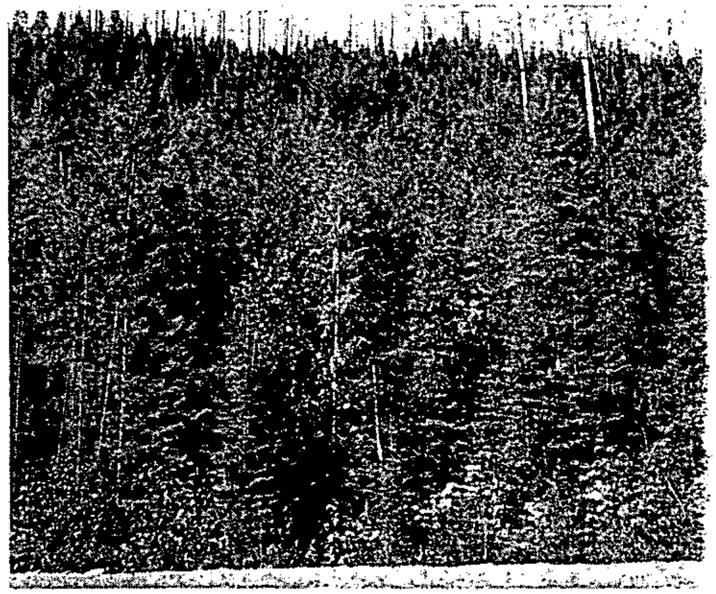

Figure 1.—A view of typical conditions in the unthinned stand through which the fire burned.

Editor's Note:—Mr. Cron has written on a controversial subject which we believe is of interest to many *Fire Control Notes* readers. We would like to receive other articles on experiences with thinning slash, particularly articles detailing the effects of its presence on fire behavior and suppression.

Figure 2.—View showing thinned stand where fire was stopped. Cleaned area on left was dozer-piled and burned after the wildfire.

HIGH-VOLUME RETARDANT SPRAYER

ARTHUR H. JUKKALA, *Forester*
Missoula Equipment Development Center

In the past decade, prescribed burning by many land management organizations has increased in both size and cost. Complexity has also increased because of accumulations of untreated logging slash and trends toward summer burning.

As prescribed burning has increased, so has the need for tools to accomplish such burning safely and efficiently. The Missoula Equipment Development Center is currently developing several tools for prescribed burning. One is a high-volume sprayer for ground application of retardants.

Several National Forests, other Federal agencies, and State agencies are now pretreating prescribed burn perimeters with fire-retardant chemicals to minimize problems related to the spread of spot fires. Reports indicate this practice is effective and offers a good chance of saving money. However, the availability of equipment for efficient application of the fire-retardant chemicals has been a problem.

The Missoula Equipment Development Center contracted for the construction of a sprayer that hopefully would improve efficiency in mixing and applying chemicals to perimeters of prescribed burns, high-hazard roadsides, and wildfire control lines.

The sprayer was custom-assembled from stock components to meet performance requirements established by the Center. It was received in the fall of 1967, and used for familiarization trials and on two prescribed burns.

The overall design, construction, and performance of the sprayer exceeded expectations in initial tests. The key design and performance features include:

Tank.—1,000-gallon capacity; double-baked, epoxy-coated to resist corrosion; three-paddle agitator mixer; and three-point torsional suspension for operation on uneven terrain.

Pump.—Two-stage certrifugal; 100 g.p.m. at 200 p.s.i.; double-baked, epoxy-coated; 1½-inch handline outlet.

Blower Assembly.—Manually operated turntable (360-degree horizontal plane); hydraulically operated blower outlet with 90-degree vertical control (45 degrees above the below horizontal); electric solenoid valves for nozzles and bypass line; 50,000 cu. ft./min. air displacement, and four independently adjustable nozzles to insure thorough, even retardant coverage and a wide swath (fig. 1).

Filling and Mixing.—Auxiliary pump is required for filling; total fill and mix time is approximately 15-20 minutes.

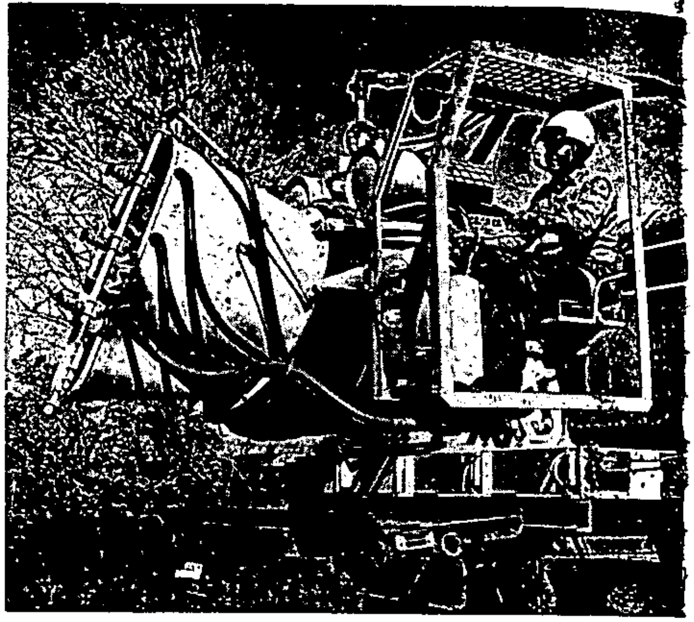

Figure 1.—The sprayer blower assembly. Direction of spray, width of swath, and application rate is readily controlled by operator.

Spraying.—Uniform coverage for swaths up to 60 ft. wide. For a 50-ft. swath at an application rate of 2 gal per 100 sq. ft., the vehicle must travel at approximately 1 m.p.h. One tank (1,000 gal.) will cover 1,000 linear ft.

A few minor additions and modifications were made in 1968. These were:

1. Protective canopy for blower operator.
2. Electrically controlled power traverse for moving blower across truckbed.
3. Larger pump-tank bypass for better pump cooling and mixing of caked retardants.
4. Independent opening and closing for top and bottom pairs of nozzles.
5. Mounting on 6 by 6 military surplus vehicle for greater mobility.

Phos-chek 259 slurry of 360-centipoise viscosity has been sprayed easily. Although Pyro, DAP, or Phos-chek 465 have not been tested, no problems are anticipated. In 1968, the improved model was used on many prescribed burns in the Northern Region. No problems with corrosion, wearing parts,

(Continued on page 12)

TRACER SHOTSHELL FIRES: A NEW HAZARD

MARVIN DODGE, *State Forest Ranger, California Division of Forestry*[1]

The recent development of tracer shotshells has added a new twist to the fire prevention problem. These shotshells are not a fire hazard *when they are used as intended,* primarily for training in trap and skeet shooting. On the cover of each packet of shells, there is a warning stating that they should be used "at gun clubs only . . . Use in the field for hunting is not recommended."

But some hunters may be tempted to fire tracer shotshells. In experiments we started fires by firing shells directly into matted grass and punky logs. The shell leaves its own evidence: the spherical tracer vehicle and a special doughnut-shaped wad.

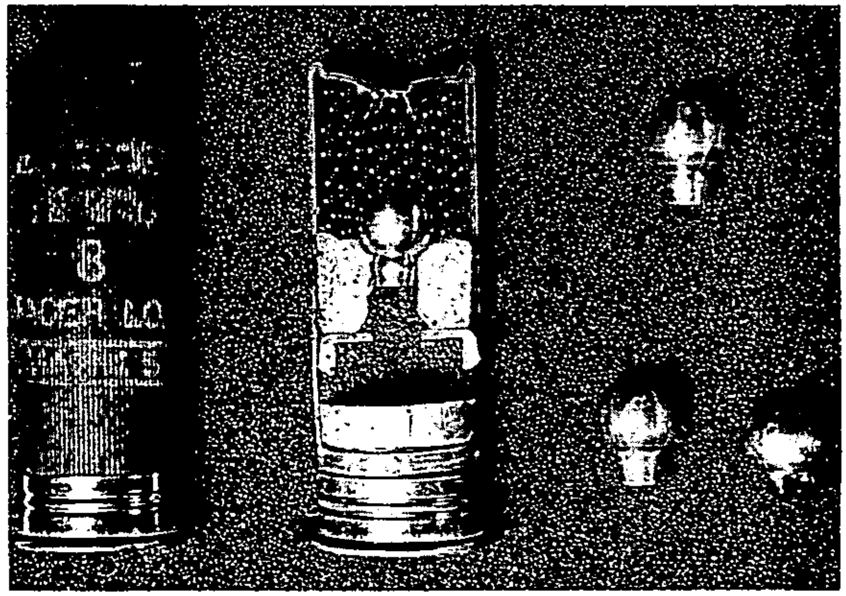

Figure 1.—A tracer shotshell is shown. At center is sectioned shell of tracer vehicle and "doughnut" wadding. At lower right are two fired tracer vehicles recovered from target area. The tail on one of the vehicles was broken when it struck a knot in a punky log and started a fire.

The shells, which are manufactured only in 12-gage, No. 8 shot, include the tracer charge carried in an aluminum alloy vehicle—a sphere with a short tail (fig. 1). The charge itself, in the tail of the sphere, is magnesium powder, a peroxide, and a plastic binder.

The overpowder wad in the tracer load differs from a normal shotshell wad. Its center is cut out so the tracer element can be ignited by the burning propellant powder. Shaped like a thick doughnut, the wad is quite distinctive.

Many gun clubs forbid tracer loads to be used on their ranges. In our experiments at a local gun club, we had to obtain special permission from the officers to use tracers. We fired several shots horizontally to determine the burning distance; in none of the tests could we detect tracers beyond 60 yards. Apparently any shots fired in the air will safely burn out and cool before the tracer vehicle falls back to the ground. The streak of fire from the tracer is evident at night, but in the day the shooter seldom sees the tracer.

When we fired 12 shots into dry fuels from 5 to 15 yards, we started two fires. One fire flared in heavily matted grass and light brush; the other started in a partly rotted log. In these tests air temperature was 95°. Relative humidity varied from 26 to 28 percent. The ignition index at the two nearest fire-danger-rating stations was 85 and 66.

To determine how far the flame projected from the vehicle, we went to a laboratory and ignited the tracer compound with a miniature heating coil (fig. 2). Flame lengths were scaled from photographs of the burning tracer.

Burning times of the tracer charges ranged from one-fourth to one-third of a second. During this split second, the charges hurled forth an intense flame and cascaded droplets of molten slag from 8 to nearly 40 inches from the vehicle (fig. 3).

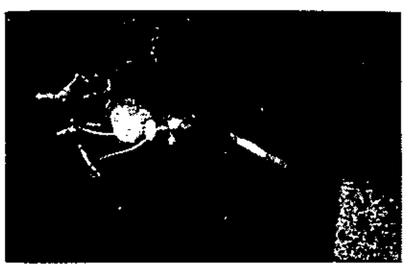

Figure 2.—In the laboratory a miniature heating coil was used to ignite a tracer vehicle of the shotshell.

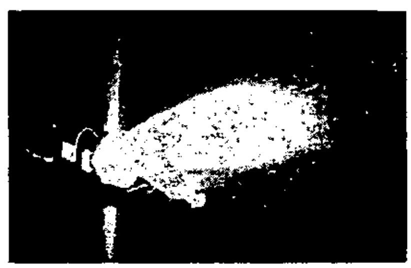

Figure 3.—After ignition, flame projected from tracer vehicle clamped in stand. Streaks are from molten slag.

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[1] The author is currently assigned to the Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif. He is stationed at Riverside, Calif.

EPOXY ADHESIVES FOR TOOL REHANDLING

Eugene T. Gould, *Fire Control Officer*
Shasta-Trinity National Forest

For years firemen have faced the problem of tool handles becoming loose, whether a tool was in use or in storage. The heads of firetools such as Pulaskis, brush hooks, and axes frequently become loose at the most embarrassing or critical times—usually when being checked by an inspector or on the fireline!

Since 1961 personnel of the Weaverville District have been using epoxy adhesives when rehandling tools. Tools may be stored for long periods without the handles becoming loose. Hard use on fireline construction has resulted in very few handle failures and no loose handles resulting from storage.

The following steps are used in rehandling tools:

1. All oil, paint, and dirt is removed from the eye of the tool. A file or wire brush aids in cleaning. The eye must be clean to secure a good bond between the handle and metal.

2. The handle is fitted to the eye in the usual manner, but the handle must fit without forcing. (The epoxy will fill minor imperfections between the handle and the metal.)[1]

3. Coat the section of the handle which fits the eye with epoxy, and put the handle into the eye (fig. 1).

4. Coat the wooden wedge with epoxy and drive it into place. Sufficient epoxy should be put on the wedge to completely fill the slot cut for the wedge (fig. 2).

5. Remove excess epoxy and cut off wedge flush with toolhead.

6. Seal handle at head with coating of epoxy. Usually enough excess epoxy is left to do this job, providing a smooth, weather-tight finish.

7. Let epoxy set for 24 hours before using tool.

New tools may also be epoxied by removing the wooden wedge from the handle, knocking the handle out, and then proceeding as described.

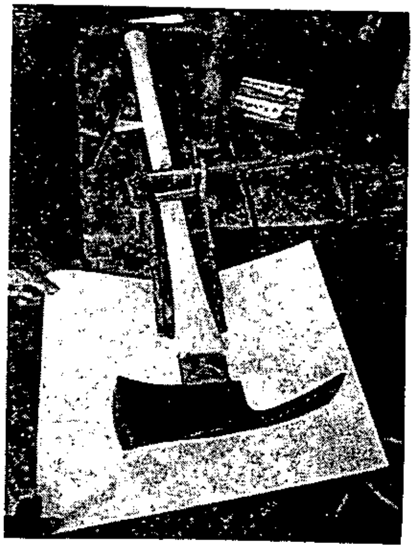

Figure 1.—Toolhead started onto epoxy-coated handle.

Epoxy filler has been very satisfactory to use, and it is much less expensive than the clear epoxy adhesives. Eight ounces of filler costs approximately $1.50 and will permit 20 to 50 tools to be rehandled.

As with all epoxy adhesives, the material must be handled carefully, and the safety precautions on each container must be followed.

Figure 2.—The wedge should be coated with epoxy prior to being driven into the handle.

Editor's note: Studies by the Missoula Equipment Development Center to find improved methods for handling tools substantiate Mr. Gould's findings and conclusions.

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[1] See Forest Service Handbook 5109.12—Firemen's Handbook, Chapter 60, for rehandling instructions.

ADEQUATE PRESUPPRESSION MANNING DEPENDS ON ACCURATE FIRE-WEATHER OBSERVATIONS

ARTHUR R. PIRSKO[1] and PAUL G. SCOWCROFT[2]
Pacific Southwest Forest and Range Experiment Station

Presuppression manning and fire-weather observations, while distinct entities, are directly related. These two operations are both related to the fire-danger rating index. Fire-weather observations are used to calculate the danger index; the index, in turn, is used to determine presuppression manning requirements. Therefore, inaccurate fire-weather readings can indirectly result in erroneous manpower requirements.

The primary reason for inaccurate observations is improper maintenance of instruments. Lowering maintenance standards nearly always reduces the danger indexes, and consequently, the manning requirement. The relation of these three variables can easily be comprehended if we examine the more common equipment problems associated with the measurement of three key variables—fuel moisture, relative humidity, and windspeed.

Fuel-Moisture Readings

Fuel-moisture stick readings can be altered from the norm by several factors; the most subtle is shading of surrounding vegetation. Partially shaded sticks have a higher moisture content than those fully exposed; consequently, the danger index will be lower. Other factors contributing to erratic readings include mud, dust, bird excreta, body oil from hands, and weathering. They can change the weight, hygroscopic characteristics, or both of the moisture stick. For instance, weathered sticks will always have low readings, causing the danger index to be above the actual.

The Region 6 Western Type fuel-moisture scale may also provide erroneous readings as its bearing surfaces become worn. The pressure and movement of the steel pin of the scale beam enlarges the hole of the U-shaped support bracket (fig. 1). When the scale is used, the pin will climb the side of the hole, changing the fulcrum point and resulting in an error in measurement. However, the U-shaped support bracket can be replaced with one that has stainless steel inserts for the bearing surface. An accelerated-use test showed no appreciable wear after 2,200 hours.

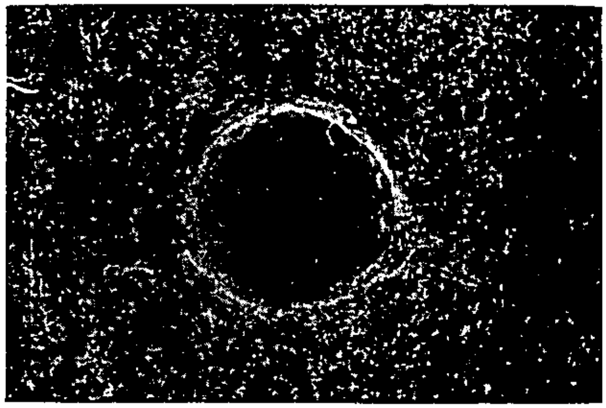


Figure 1.—The hole in the U-shaped support bracket of a fuel-moisture scale shows considerable wear after 2,200 hours of use.

Relative Humidity Readings

The fan psycrometer—used to measure relative humidity—is another possible source of error. If the wick on the wet-bulb is dirty, short, or crusted with residue, the indicated wet-bulb temperature will be too high. This, in turn, will give an erroneous, high relative humidity reading. The same error occurs if the wet-bulb has not been cooled enough by fanning.

[1] Deceased 1966.

[2] The author(s) were/is stationed at the Forest Fire Laboratory, Riverside, Calif.

Figure 2.—The anemometer is sheltered from the true windspeed by the trees at the left. Raising the anemometer or trimming the trees would correct the situation.

Windspeed Readings

Windspeed is the most critical factor that affects spread and danger indexes. Minor fluctuations will often cause large changes in index values. The windspeed measurement must be precise if an accurate danger rating is to be obtained.

Proper exposure of the anemometer is important if the true windspeed 20 feet above the tallest vegetation is to be measured. Growing vegetation can eventually shelter an anemometer from the true windspeed and thus result in low readings (fig. 2). Consequently, danger indexes will be correspondingly low.

Anemometers can also be slow because of improper servicing. Improperly lubricated bearing surfaces can become partially dried out, impeding the rotation of the cups, and an excessive lubricant will create the same problem. Other causes of low anemometer readings are faulty contacts and wiring, bent or damaged cups, and bent shafts. Each of these deficiencies will result in an incorrect, low reading of the danger index.

The effect of erroneous readings of relative humidity and windspeed on the fire-danger rating, manning, and success of initial attack in the California Region is illustrated in table 1. Comparative measurements at a station under proper and improper maintenance procedures are shown. The crusted wet-bulb gave a temperature 2 degrees too high, in turn, the reading raised the humidity 4 percent to 22. Similarly, the anemometer, which was dirty and sluggish, registered windspeed at 11 m.p.h. instead of a true speed of 15 m.p.h. The two errors compounded the burning index error. Instead of having a true burning index of 38, the improperly maintained station had one of only 25.

This difference of 13 index points can significantly alter the strength of initial-attack forces and their subsequent success or failure. If a fire was discovered on 0.2 acre in fuel type 6 (mixed Douglas-fir-white-fir with brush and reproduction), the number of men needed to control the head of the fire at an overall size of 10 acres could be determined from the chart (fig. 3) developed by Pirsko.[3]

Assuming an elapsed time of 34 minutes from discovery to attack, the number of men needed would be 10 and 19 for indexes of 25 and 38, respectively. Since 25 is lower than the true burning index, 10 men would not be enough to meet initial-attack goals—298 feet of line would be open at the head. However, 19 men would probably catch the fire by the time it reached 10 acres.

The need to maintain your weather stations and instruments is crucial. Proper maintenance habits can mean the difference between a small fire and a conflagration.

[3] Pirsko, Arthur R. Why tie fire control planning to burning index? Fire Control Notes 22(1): 16-18. 1961.

TABLE 1.—*Measured and computed values for properly and improperly maintained stations*

Item	Maintenance performance		
	Proper	Improper	Error
Dry bulb (°F)	85	85	0
Wet bulb (°F)	58	60	+2
Relative humidity (percent)	18	22	+4
Windspeed (m.p.h.)	15	11	−4
Burning index[1]	38	25	−13

[1] Based on the Wildland Fire Danger Rating System of Region 5.

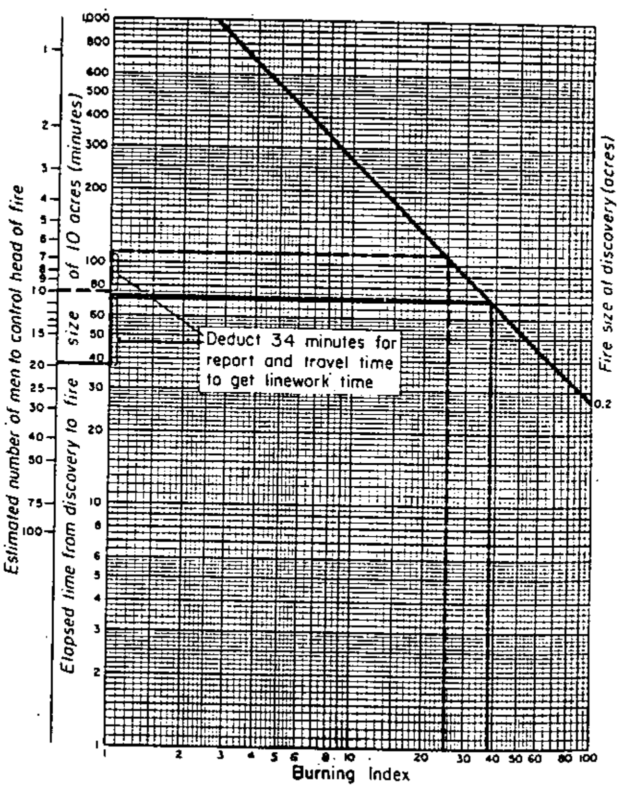


Figure 3.—The chart shows manpower required to suppress fire at 10 acres for mixed Douglas-fir-white-fir with brush and reproduction when the fireline construction rate is 1.1 chains per man-hour.

SUPERIMPOSED LIGHTNING SCARS AND TREE-BOLE IGNITION BY LIGHTNING

ALAN R. TAYLOR, *Research Forester*
Intermountain Forest and Range Experiment Station[1]

This note presents observations on a little-known method of tree-bole ignition by lightning—a fire-setting discharge partially superimposes its furrow upon an older lightning scar and ignites the older injury.

Throughout the world lightning strikes thousands of trees every day. A discharge usually does not cause fire but inflicts structural damage on the struck tree. Damage ranges from a lack of obvious injury to virtual destruction of the tree.[2] In conifers, the most common damage is a shallow furrow from 2 to 10 inches wide that spirals along the trunk, exposing only the outer layers of sapwood in its path.[3]

Superimposed Lightning Furrows

Occasionally lightning strikes the same tree more than once during the tree's lifetime. A later discharge sometimes follows essentially the same path taken by a previous discharge along the tree bole. Thus, one furrow is partially superimposed upon the other one. Evidence of this has been seen on 11 live conifer trees in western Montana. Three of the lightning strikes caused fire. In all three instances, ignition evidently occurred in superimposed-furrow regions on the boles. This article briefly describes these three events; emphasis is placed upon the most recent ignition—the only one for which both the fire-setting discharge and its effects were documented.

Three Instances

My first experience with this phenomenon occurred on June 30, 1962. The day before lightning had struck and ignited a small (40-ft.-tall, 12-in.-d.b.h.) ponderosa pine (*Pinus ponderosa* Laws.) near Missoula, Mont. On the portion of the tree 10 to 30 feet above the ground was a shallow, spiral lightning scar several years old, partly closed and containing exuded resin. Superimposed on the lower end of this scar, which terminated about 12 feet above ground, was a new lightning furrow. Based on evidence at the scene and an interview with the smokechaser clearly indicated that the more recent discharge ignited the resin-covered fuel in the lower section of the older scar. A burning wood sliver, 3 feet long, was ejected from the old wound and stuck in the ground some 13 feet from the burning tree.

The second event occurred on July 15, 1963, when lightning struck and fired a large (96-ft. tall, 35-in. d.b.h.), live, open-grown ponderosa pine near Missoula. The tree had been struck from 37 feet to about 85 feet above the ground. The new furrow, which had many protruding slivers, was superimposed on the old scar for only 1 foot at the 37-38-foot level. Ignition occurred only in this 1-foot zone of superimposition. Exuded resin had collected at the base of the old scar and evidently was ignited by the most recent discharge.

The third ignited tree was a large (120-ft. tall, 40-in. d.b.h.) western larch (*Larix occidentalis* Nutt.) growing in a cutover stand of western larch, Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco), and ponderosa pine in the Lolo National Forest of western Montana. A growth-ring indicated the tree had been struck 6 years prior to the fire-setting discharge. The tree had lost its top many years earlier, and an upper branch had become the terminal leader.

The fire-setting discharge occurred at 1316:02 M.S.T. on Sept. 14, 1966. Its electrical properties were recorded electronically at a station 16 miles from the tree, and the visible flash and subsequent fire were documented by an airborne lightning observer.[4]

The (1) methods and equipment used in the lightning recording system and (2) characteristics of the discharge that caused this fire are described elsewhere by Fuquay et al.[5]

The burning tree is shown in figure 1, photographed by the observer about 1 minute after the discharge occurred. The new damage was superimposed for about 60 percent of the old scar's length. Portions of the new and old damage appear in figure 2. This shows a section from about 50 feet below the tree's tip to about 1 foot above the highest fire damage. Note the ridges of 6

[1] The Station is located at Ogden, Utah. The author is stationed at the Northern Forest Fire Laboratory, Missoula, Mont.

[2] Taylor, Alan R. Lightning damage to forest trees in Montana. Weatherwise 17(2):12 61-65. 1964.

[3] Murray, J. S. Lightning damage to trees. Scottish Forest. 12(2):2, 70-71. 1958. See also Taylor, Alan R. Diameter of lightning as indicated by tree scars. J. Geophys. Res. 70(22) 5693-5695. 1965.

[4] J. E. Burns made substantial contributions in documenting lightning effects described in this article.

[5] Fuquay, D. M., Baughman, R. G., Taylor, A. R., and Hawe, R. G., Documentation of lightning discharges and resultant forest fires. U.S. Forest Serv. Res. Note INT-68, 7 pp. 1967.

Figure 1.—Western larch struck and ignited by lightning; photographed about 1 minute after discharge. The upper arrow indicates the treetip; the lower arrow shows the highest level of smoke on tree bole. The section between arrows is a volunteer terminal leader.

Figure 2.—New lightning damage partly superimposed on 6-year-old lightning scar. Lighter portion of furrow in upper part of scar is new damage. Callus tissue and thin sapwood strip were removed from this edge of furrow by the later, fire-setting discharge. The top of the tree is 50 feet to left. The ruler is 6 inches long.

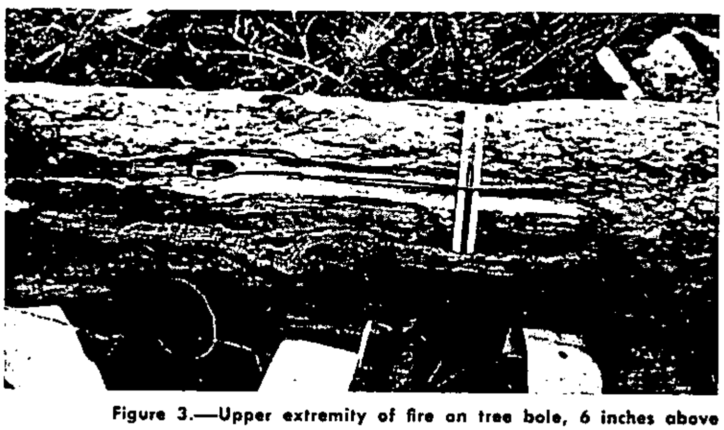


Figure 3.—Upper extremity of fire on tree bole, 6 inches above crosscut. Massive char and wood loss on underside of bole, right, corresponds with highest level of smoke (lower arrow, fig. 1).

years' callus tissue and the weathered, exposed sapwood on the edge of the old furrow (lower edge in photo). Compare this edge with the opposite edge, where the callus tissue was removed and a thin strip of sapwood was loosened by the fire-setting discharge. This appearance is typical of that of the other 10 trees on which superimposition of scars was observed. Also note that the old and new furrows appear to terminate at the right side of the photograph. Figure 3, however, shows that both furrows reappear about 1 foot lower on the bole. Here most of the evidence of the new furrow was destroyed by fire, but, as in figure 2, the callus tissue of the old wound was removed from the margin of the scar by the recent discharge.

The highest point of massive char (fig. 3, lower right) was about 55 feet below the tip of the tree, near the base of the volunteer main stem, and coincided with the highest point at which smoke obscures the bole in figure 1 (lower arrow). Thus, the older lightning scar at this point was a primary ignition site for the more recent discharge. The massive charring in this region precluded determination of the amount of resin exudation, if any, from the old wound. However, the old scar in figure 2 contained only small amounts of such deposits.

Figure 1 also suggests that ignition occurred at other points farther down the bole, either on the old lightning scar or in decayed heartwood of the lower trunk. Evidence from those areas was destroyed by fire and by severe breakage when the tree was felled to suppress the fire.

Discussion

The three instances described in this note show that tree-bole ignition by lightning sometimes occurs in an injury caused by a previous discharge. Therefore, the presence of exuded resin in an old lightning scar may increase the probability of tree-bole ignition by a later discharge. If it does, other types of injuries might similarly increase chances of bole ignition by lightning.

PORTABLE COLLAPSIBLE TANKS FOR DELIVERY OF WATER TO THE FIRELINE WITH HELICOPTERS AND CARGO SLINGS

JACK P. CURRAN, *District Fire Control Officer*
Los Padres National Forest

Since the advent of the helicopter in firefighting, numerous methods have been devised to deliver water on fires. Varying success has been attained. The biggest drawback of most of the methods has been the need for special attachments—restricting the use of the helicopter.

To devise a simpler method of delivering water to the fireline, we secured collapsible portable tanks with an 80- and 150-gallon capacity that can be sling-loaded and delivered to anyplace on a fireline where a helicopter can maneuver close enough to the ground to set off a sling load. The 80-gallon tank can be carried in a sling by the small helicopters commonly employed in fire suppression (fig. 1). When full, the larger tank can be carried by the larger helicopters now being used on many major fires.

When possible, the tanks are delivered on a ridge or high point of the fire so that delivery of the water from the tank to the fire can be by gravity flow through the hoseline (fig. 2). This situation is often encountered when work is done on slopovers on the back side of a ridge. The tanks have also been used for refilling 4 by 4 pickup pumpers that were holding a fire on a tractor line that was a great distance from a water source and was inaccessible to larger water-carrying vehicles.

When gravity pressure is not possible, the water can easily be pumped on the fire with the small, portable pumps now carried by most helitack crews. (fig. 3).

This small tank was designed so that it contained 70 gallons when the water level was at the bottom of the overflow line and vent on top of the tank, but it will contain 80 gallons when it is filled to the point where the water will flow out of the overflow, a 6-inch piece of garden hose. When a pump is to be sent in with the initial load of water, the tank loading should be restricted to 70 gallons to compensate for the weight of the pump.

With three tanks and cargo slings, one helicopter can normally keep a continuous supply of water on any trouble spot on a fire. This system can be particularly effective in backing up backfiring operations that are not accessible to motorized equipment.

This system has the following advantages:

1. A low-cost, lightweight, collapsible tank is utilized.

(Continued on page 16)

Figure 1.—A filled tank, hose, and pump can be quickly delivered to a remote section of the fireline by a small helicopter.

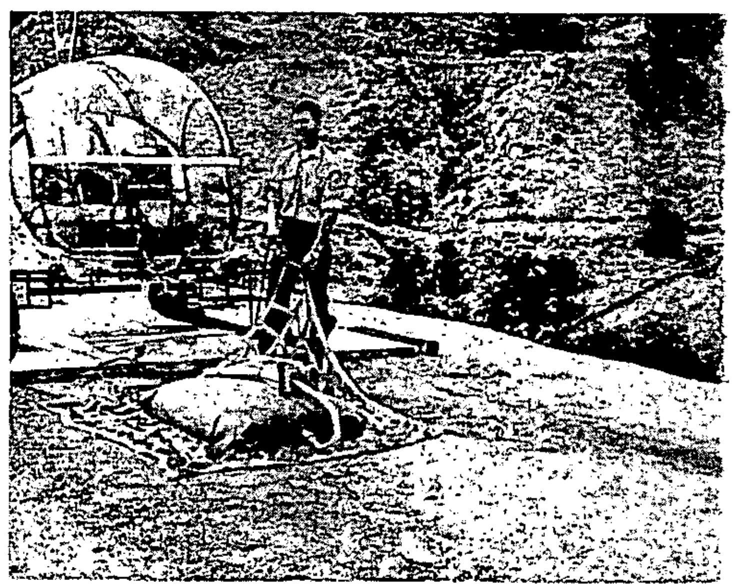


Figure 2.—An 80-gallon tank, hose, and nozzle ready for loading. Where gravity feed can be utilized, the water is available for instant use upon delivery.

Retardant Sprayer—*Continued from page 4*

or maintenance have been encountered. Occasionally debris clogs nozzles during spraying, but it is easily remedied by cleaning the sediment chamber and by temporarily opening nozzles to flush them out. No further modifications are planned. To improve mobility, we intend to study the practicality of mounting the unit on a trailer for towing behind a bulldozer.

Though primarily developed for pretreating prescribed burn perimeters and high-hazard roadsides and for reinforcing control lines on wildfires, the unit has many other possible uses including:

1. Laying temporary retardant firelines in light, flashy fuels.

2. Suppressing fire directly by spraying water or retardants onto burning fuels. This can be done with the blower shut off.

3. Spraying water as an aid in mopup.

4. Applying many other chemicals including herbicides, insecticides, and fertilizers for other land management jobs.

The prototype unit cost $8,500. The cost of future units is expected to remain about the same.

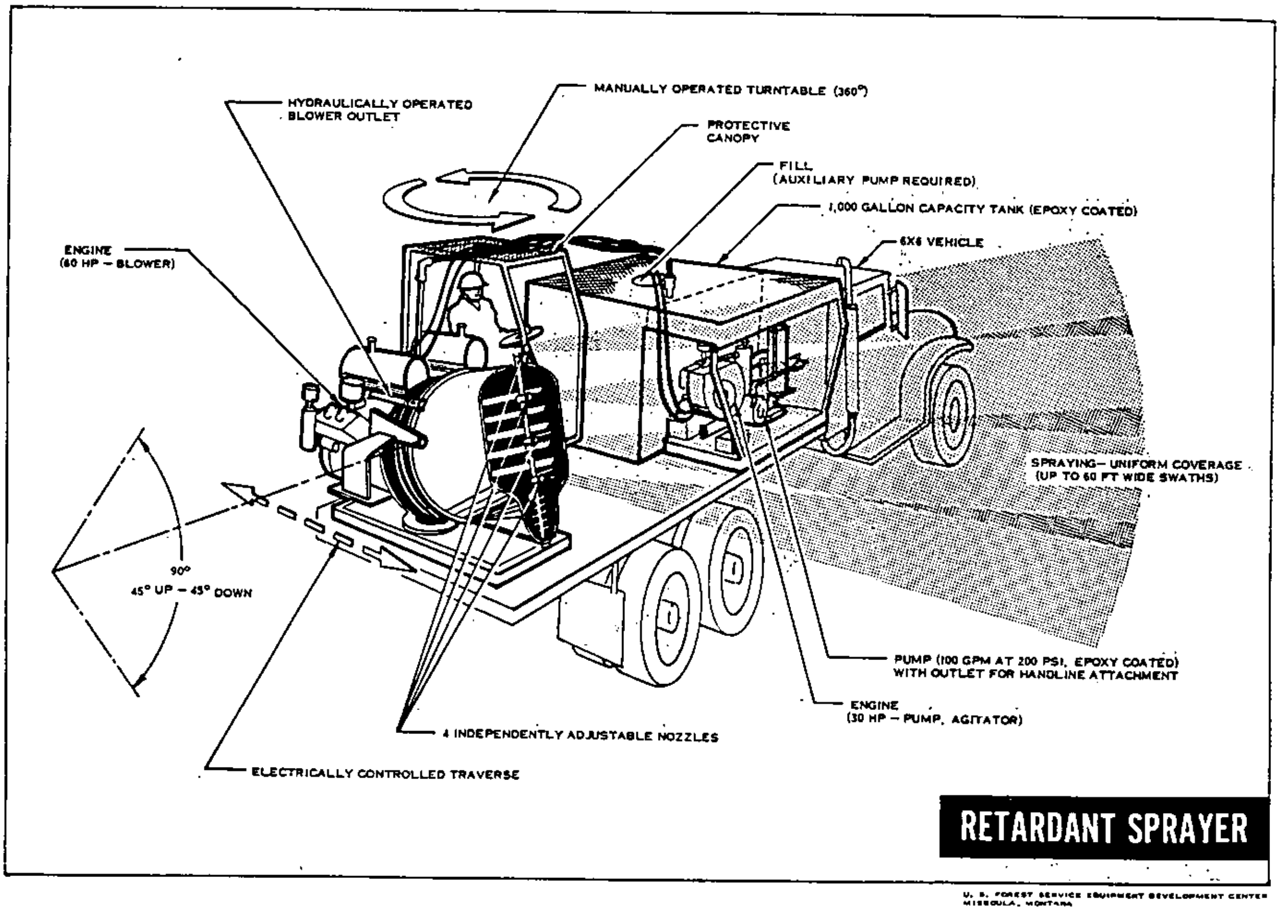


Figure 2.—Schematic of retardant sprayer.

NEW SYSTEM FOR STORING AND MIXING FIRE RETARDANT

Los Angeles County Fire Department

A new demand-type system for storing and mixing fire retardant for air tanker use has been developed and installed by the Los Angeles County Fire Department at its base at the Hollywood-Burbank airport. According to Chief Keith E. Klinger, this system is the first such facility in the Nation and will increase the county's efficiency in the fast handling of retardant air tankers.

This new "clean" system provides bulk storage and handling of Phos-chek fire retardant, and reduces the number of men needed to handle the mixing from 10 to 1. Of course, additional men are needed to load the aircraft. Four planes can be loaded simultaneously at the Department's facility.

Battalion Chief Frank Hamp, the Department's equipment and development officer, designed the new facility. Two 32-foot-long bulk storage trailers (fig. 1), both with a capacity of 18 tons of powder, provide dry storage. Each trailer is equipped with an internal airslide and a compressor.

Air, at a pressure of 1-2 p.s.i., is introduced at the bottom of the tank (at the airslide), and the powder flows to the outlet in the manner a fluid flows. The Phos-chek is carried to the elevated mixing platform under a vacuum; two eductors are supplied with water from a stationary fire pumper. At this point the mixing is completed; 600 g.p.m. is produced. Under this system the quantity of mixed Phos-chek produced is limited only by the capacity of the pump and by the available water supply. The mixed retardants is stored in a 5,000-gallon tank until needed. Two pumps, capable of delivering 900 gallons of retardant per minute, feed the delivery system.

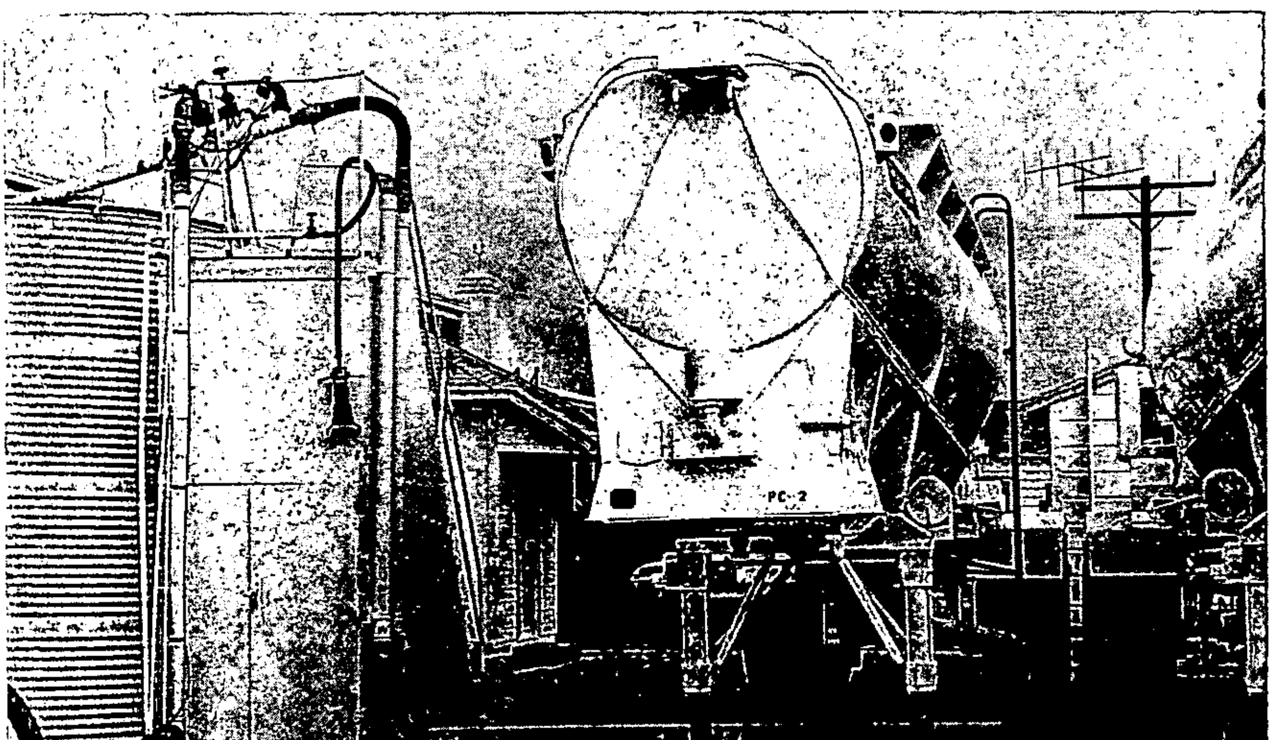
Unique features of the system permit one operator to control the quality of the finished product through a single valve. As retardant becomes needed, he activates the main control valve, which automatically increases the number of the pumper's revolutions per minute to a predetermined level to maintain the desired pressure.

On the delivery pumps, a waterflow microswitch is activated when the nozzles are opened at the aircraft, and the pump engines increase pressure automatically.

The new system alleviates the need for sacked retardant and for a system for opening and emptying the sacks. Its bulk storage and semi-automated mixing features lend themselves to the possibility that an entire mixing plant may someday be able to be picked up and easily trucked to an airfield; there it can supply aircraft at a nearby fire.

The County Fire Department has operated the mixing facility at the Lockheed airbase for 3 years. During the first 9 months of 1968, 234,900 gallons of retardant have been mixed and delivered.

Figure 1.—Large bulk storage trailers supply Phos-chek to mixing platform at left. Mixed retardents is stored in a 5,000-gallon metal tank, ready for loading into aircraft.



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Portable Collapsible Tanks—*Continued from page 11*

2. Such a tank is easy to place in service on short notice without any special attachment to the helicopter.

3. It is easy to deliver to anyplace on a fire where a helicopter can maneuver within 30 feet above the ground.

4. It should secure more widespread use of water or retardants on a fire via helicopter.

5. Water or retardants delivered on a fire via a hose are more efficient and effective than when delivered by an airdrop.

Editor's note: The General Services Administration now stocks these collapsible tanks in five sizes with 50-, 100-, 150-, 250-, and 500-gallon capacity. The smaller (50-150 gallon) tanks are pillow-shaped as illustrated; the two larger tanks are pyramid shaped.

Figure 3.—The lightweight, portable pumps now available are ideal for use with the portable tanks. With positive displacement pumps, the bypass should be connected back into the tank overflow pipe to conserve water.

REMOTE WIND MEASUREMENTS

Many fire-danger stations now use the Ten-Minute Wind Counter to obtain windspeed measurements. However, some personnel may not be aware that when this device is used, the anemometer can be placed as much as 1 mile away. Thus, at stations where obstructions or other factors make onsite exposure of the anemometer unsatisfactory, the instrument can easily be placed at a more suitable location some distance from the station. Number 20 or 22 copperweld twin-conductor wire is satisfactory for connecting the anemometer to the counter. The voltage supplied to the counter should not be increased to compensate for the greater distance because damage to the anemometer contacts may result.