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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

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

Volume 17 Number 3

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the

TECHNIQUE OF FOREST FIRE CONTROL

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

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FIRE EFFECTS IN SOUTHERN HARDWOODS

E. RICHARD TOOLE AND J. S. MCKNIGHT [1]

Much of the bottom-land hardwood forest in the Mississippi Delta has burned repeatedly during occasional severe droughts that create extreme fire hazards. The efforts of forestry agencies are reducing the acreage burned. Even so, every person interested in forestry should become familiar with fire damage in this hardwood type. A single fire in a bottom-land stand can completely undo 20 or 30 years of careful management.

THE STURDIVANT FIRE

In November 1952, a fire swept over a tract in the Yazoo-Mississippi Delta. It might have been just another fire, except that it happened to burn in a stand where the Southern Forest Experiment Station had laid out an experiment to measure the growth of well-managed hardwoods. The fire knocked out the growth study, but it led, directly and indirectly, to improved knowledge about the effects of fire, and to suggestions for handling damaged timber.

The fire began early one morning and was not brought under control until early the next morning, by which time it had burned nearly 1,200 acres. As with most large blazes, it was hotter on some areas than on others, and hence caused varying degrees of damage to the timber. From all appearances, though, the damage on the 70-acre experimental area was typical of that over the entire tract.

At the time they burned, these 70 acres were beginning to show the benefits of an improvement cut made 5 years before. The main stand consisted of about 111 trees per acre that ranged in diameter from 6 to 26 inches. Three-fourths of these trees were vigorous and clean boled, likely to produce high-quality wood rapidly. In addition, a generous stand of seedlings and saplings was growing thriftily in openings where mature or low-grade trees had been logged or used for firewood.

The fire virtually wiped out this promising young growth. All seedlings and saplings up to one inch in diameter were killed outright. Trees between 1 and 2 inches in diameter did not fare much better: two-thirds of them were killed and most of the rest were damaged. Among trees between 3 and 5 inches in diameter, mortality was 35 percent.

But the worst damage, at least in terms of immediate financial loss, was to larger trees. Where the fire ran with the wind (head fire), or where logging slash from the improvement cut increased the fuel supply, 33 percent of the trees larger than 6 inches in diameter were killed outright. Of the larger trees that had been classed before the fire as having exceptional promise, 9 out of 10 were killed or damaged severely.

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[1] Delta Research Center of the Southern Forest Experiment Station, Stoneville, Miss., in cooperation with the Mississippi Agricultural Experiment Station and the Southern Hardwood Forest Research Group. The Southern Forest Experiment Station is a part of the Forest Service, U. S. Department of Agriculture.

Where the fire burned across or against the wind (flank or backing fires), or where there was no slash, damage was somewhat less. Even where the flames were least hot, however, 20 percent of the high-grade trees were either killed or damaged so badly that it was no longer a paying proposition to keep them in the stand.

Of course, there will be new growth to replace the loss in the seedling sizes. One year after the fire, over 3,000 sprouts or seedlings per acre were found. Nevertheless, the fire set the seedling and sapling stand back at least 5 years, and it will take 60 or 70 years to replace the larger high-quality stems that were killed or damaged.

Damage to Individual Trees

Trees that are not killed by fire may be severely damaged that they have little, if any, value. The bark on at least one side is usually burned and charred; at first glance this often appears to be unimportant (fig. 1). However, when these trees are examined more closely, it is found that the charred bark adheres to dead wood. By the third year rot will start its work.

It may take as long as 4 years after a fire for rot to reach the heartwood, but once there it will spread steadily upward at rates varying from a few inches to nearly a foot a year. Thus what should be the most valuable part of a tree is rendered completely worthless after 15 to 20 years.

The amount of rot to be expected in the butt log of a tree depends largely on the size of the original wound and the time elapsed since the fire. When over 100 wounded trees were examined shortly after the Sturdivant fire, it was found that in white oaks and bitter pecan the area of the wound was nearly the same as the area of the bark char (ratio 1:1). In red oaks, the wound was generally 2½ times as high as the bark char, though the width of red oak wounds was about the same as the width of the char.

Should Damaged Trees be Kept in the Stand?

Death in larger hardwood trees can be determined without much trouble. But when a valuable tree is only wounded, the forest manager must decide if he can safely leave it for further growth or if he should salvage it before decay sets in. Experience with the Sturdivant fire yielded some suggestions for cruising or marking fire-damaged hardwood timber.

Trees killed or seriously damaged by the fire should be salvaged as soon as is feasible, with due consideration for the cutting cycle, and the vigor and length of stem of each affected tree. But generally a tree should be salvaged if:

1. The bark is charred for more than 6 feet above the stump (regardless of the width of the char).
2. The char extends around more than half of the tree's circumference and reaches more than 2½ feet above the stump.

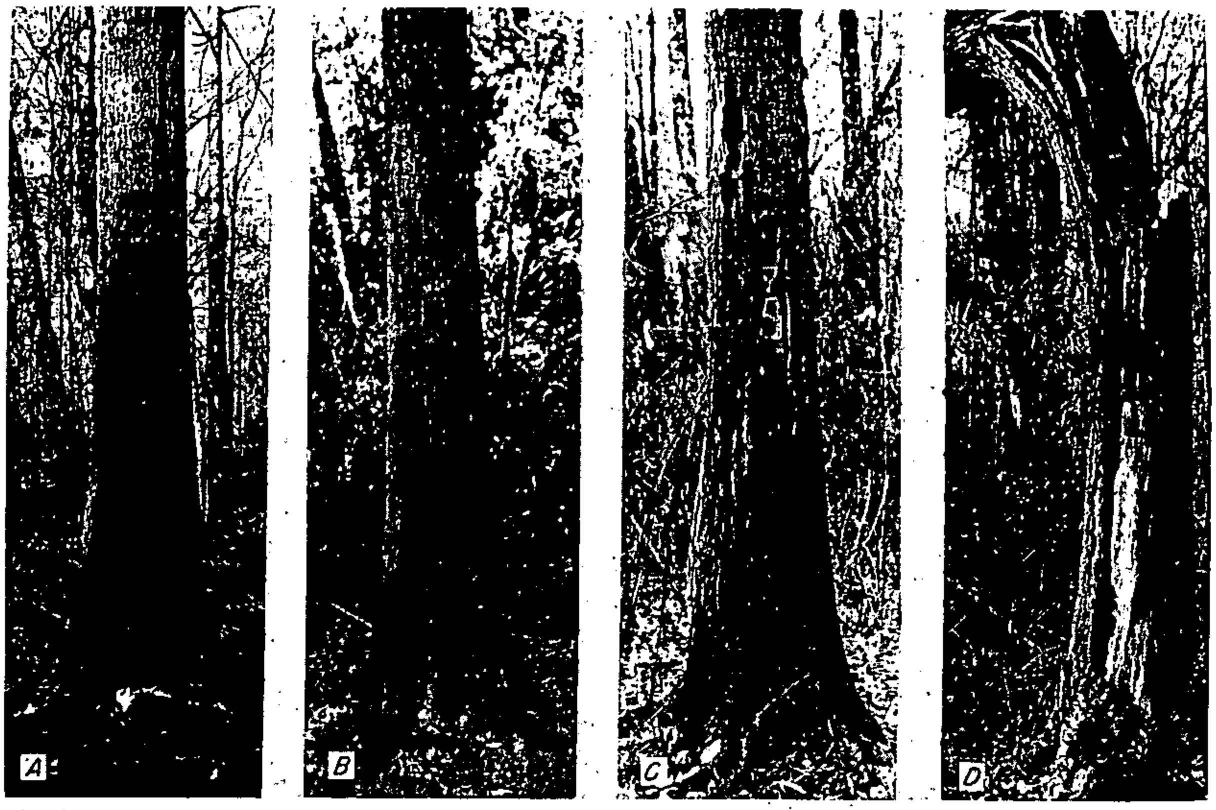


FIGURE 1.—*A*, The hardwood may appear little damaged immediately after a fire. *B*, 1 year later, cracks appear in bark. *C*, 2 years later, bark begins to fall off. *D*, 3 years later, rot starts its work on the underlying sapwood, and stem breakage may occur.

In estimating the extent of rot behind older wounds, and the rot to be expected in the future, it is helpful to keep in mind that, on the average:

1. Rot does not start in the heartwood until 4 years after a fire.
2. Wounds less than 2 inches wide are not important as a source of rot.
3. Rot exceeds hollow length about 2 feet.
4. Rot exceeds butt bulge about 3½ feet.
5. In 10 years, rot will extend 1½ feet above the original scar if about ¼ of the tree's circumference was damaged. If more than ¼ of the circumference was damaged, the rot may go higher.

Fire Always Hurts Hardwoods

The Sturdivant fire was put out more than 3 years ago, but research on it and other burns has settled once and for all some facts that seem obvious but are often forgotten. In hardwoods, there is no such thing as a harmless fire. All fires fry the reproduction and wound the larger trees. Any wound bigger than a silver dollar is probably going to admit rot that will surely destroy the valuable butt log.

Hardwoods are indeed hapless in the face of fire.

☆ ☆ ☆

Tractor Tilt Indicator

H. A. Yocum has designed and installed a simple device on our crawler tractor that indicates the angle of tilt on a side slope. This practical indicator may be more useful than most of the commercial tilt indicators available. It particularly lends itself to adaptation for the wide range of stability between the various tractors used by the service.

The device is a plumb bob that swings inside a slotted bar with a dial behind the plumb bob. The plumb bob swings from the hood above the instrument panel. The slotted bar is fastened to the hood with brackets and bolts holding it tight against the instrument panel. This bar prevents the plumb bob from swinging away from the instrument panel when the tractor is traveling upgrade.

The dial consists of five segments of a circle painted in three colors on the instrument panel. The extreme limits of the green center segment indicate 15-percent slope; of the two yellow segments, 30-percent; and of the two red segments, 45-percent. This calibration allows a large safety factor. On other tractors, and under other operating conditions, a different calibration may be preferred.

While the plumb bob is swinging in the green, no special safety precautions are required of the operator. When it swings into the yellow, he is required to start slowing down from maximum operating speed. When it swings into the red, he should come to a stop or nearly so, pick a less precipitous route, and proceed at a speed of not over one mile per hour until safer ground is reached.

There is a slight amount of friction between the guide bar and the plumb bob except when the tractor is perfectly level. The plumb bob won't hang up, however, even when the tractor is going up or down very steep slopes, because the constant movement and vibration of the machine continually shakes it free.

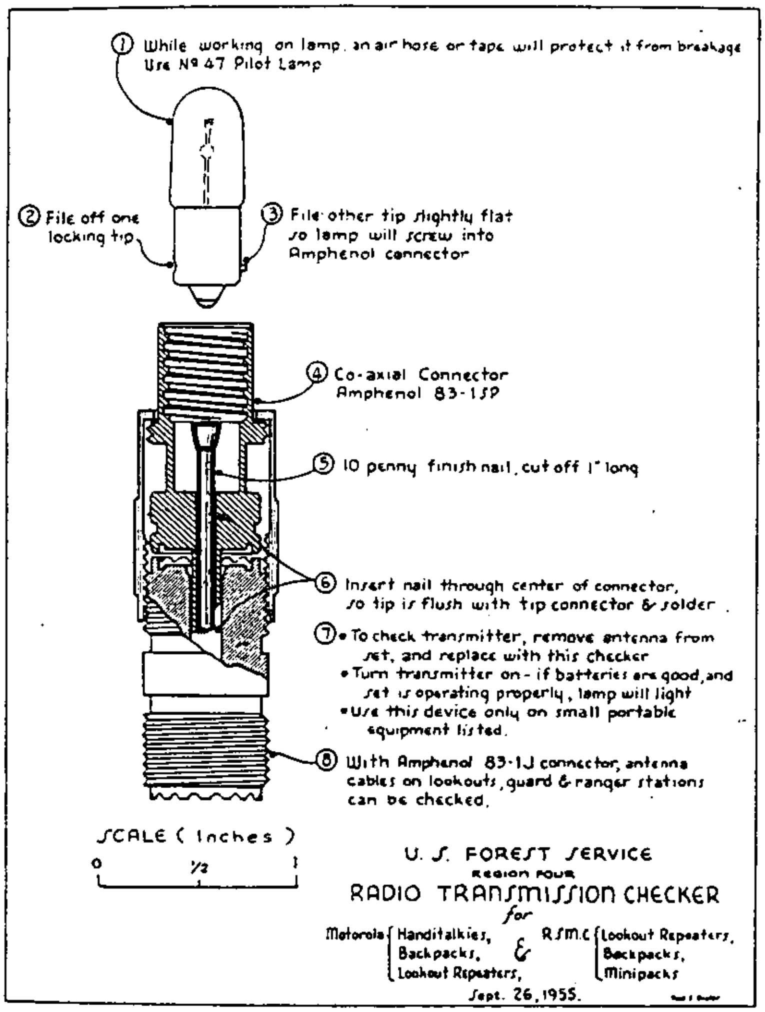
This device has worked satisfactorily, and we feel it can be effective in reducing potential tip-overs, and is particularly useful for operator training purposes.—H. H. Muntz, *Southern Forest Experiment Station.*

RADIO TRANSMISSION CHECKER

JOHN BARKDULL

Communications Technician, Boise National Forest, R-4

The radio transmission checker, as illustrated, has been made and used extensively in Region 4 and was found to be satisfactory. It is also used with an amphenol 83-1J connector for checking antenna cables. The cost of the unit is approximately $1. This



checker will give nontechnical personnel a simple visual means for determining whether the portable radio transmitter is operating with normal output.

BRUSH SAWS FOR "HOT SHOT" CREWS

MICHAEL A. ROBERTS
Foreman, "Hot Shot" Crew, San Bernardino National Forest

The "Hot Shot" crew was organized to be a well-trained, fast, hard-hitting line hand crew. Toward this goal foresters are always alert to ways and means for securing faster and better results in fireline construction with less fatigue for such a crew. It is well known that line construction with brush hooks and axes is good but very slow and tiring. The problem of converting chain saws for use on brush, particularly on northern slopes in southern California, was thoroughly considered, and when trial proved this type of saw effective, a number were purchased for this use.

The 2½ horsepower chain saws had a 16-inch bar and Oregon chipper type chains; the Oregon XX type chain was also purchased. Only one piece of brush could be cut at a time with this type of chain saw because of the hazard of hitting the end of the saw on other brush, which made the saw jump back and endangered the operator. To reduce this hazard and make the saw more effective a bow type attachment was purchased (fig. 1). The chain saw demonstrated on the fireline that it would cut ½-inch brush up to very heavy oak 12 inches in diameter with ease.

FIGURE 1.—*Left*, Saw with bow type attachment cutting brush. *Right*, Brush saw team packing in.

Teams of four men work together. One man operates the saw while the other three team members throw the brush the operator cuts. A man works as an operator for half an hour at which time another member of the team takes over his job. In the development of these teams problems of safety were encountered. A training program was necessary to teach the teams working together how to use these saws, since the group must be ever conscious of the hazard of the chain saw while in operation.

Transporting the brush saw to the job assignment was the next problem. A rucksack, used as a carrying case, proved very satisfactory for its weight of only 30 pounds. An extra quart of oil, a quart of gear oil, extra chain, and tools fitted easily into the extra pockets on the bag. A piece of 1½-inch condemned canvas hose was used to make a guard for the chain.

Judging by the work accomplished in using these brush saws, we would recommend that they be tried by all "Hot Shot" and other organized crews. Brush saws can be effective, and once tried may well take an important place on the fireline.

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Transporting Box For SF Handi-Talkie Radiophone

A metal box lined with sponge rubber to protect a SF handi-talkie radiophone while being transported by motor vehicle has been developed on the Black Creek Ranger District by Mechanic's Helper Elisha Bond (fig. 1). One radiophone was carried in such a box in a Forest Service pickup for 18 months without developing mechanical failures. In addition to the protection afforded by the shock-absorbent qualities of the sponge rubber, the radiophone is also protected from dirt and dust.

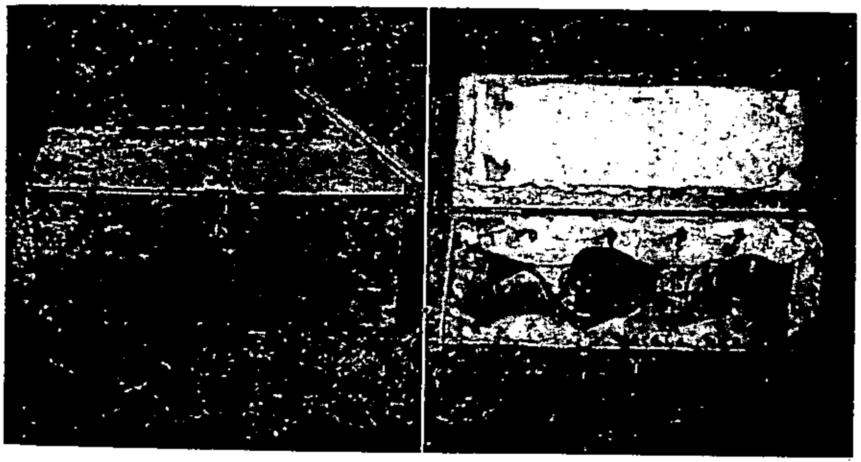

FIGURE 1.—*Left,* Closed radio transportation box constructed of aluminum plate. *Right,* Opened box showing lining of sponge rubber and radiophone in place.

The box is constructed of ⅛-inch aluminum plate and is lined with 1¼-inch sponge rubber. Although the sponge rubber was bolted to the box, an adhesive could be used satisfactorily. A box 16 inches long, 6½ inches wide, and 7½ inches high will accommodate the SF handi-talkie radiophone. It is recommended, however, that the box be built 19 inches long so that a spare set of batteries can be stored in the container. The cost of the box is more than offset by the savings in radio repairs during a one-year period.—DONALD A. POMERENING, *District Ranger, Mississippi National Forests.*

TRUCKS FOR "HOT SHOT" CREW ON THE SAN BERNARDINO NATIONAL FOREST

MICHAEL A. ROBERTS

Foreman, Del Rosa "Hot Shot" Crew, San Bernardino National Forest

Equipment plays an important part in the effectiveness of a fire fighting crew. To assist the well-trained "Hot Shot" crew on the San Bernardino National Forest, trucks and equipment have been developed for their use. The basic equipment consists of a ½-ton pickup with seats and side rails and two 1½-ton stakesides with toolbox seats, completely equipped with handtools, portable radios, headlamps, rations, and two brush saws.

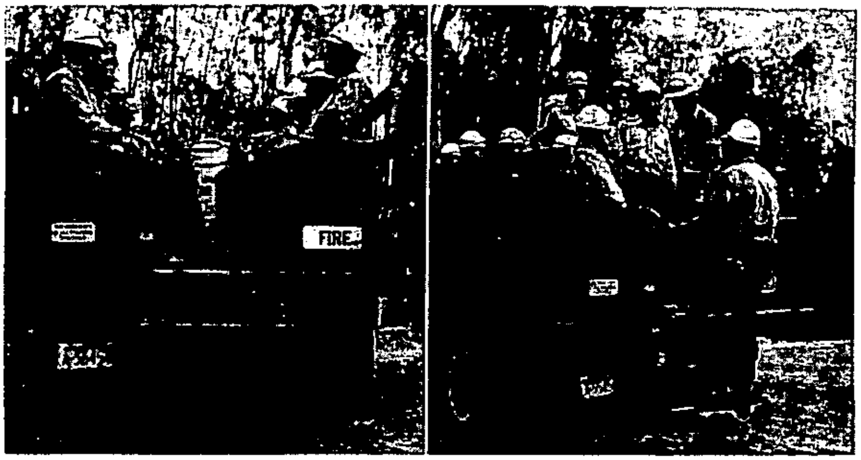

FIGURE 1.—*Left,* Truck ready to roll; rear step raised and in place for traveling. *Right,* Crew unloads by using handrails and the step developed at the Arcadia Equipment Depot.

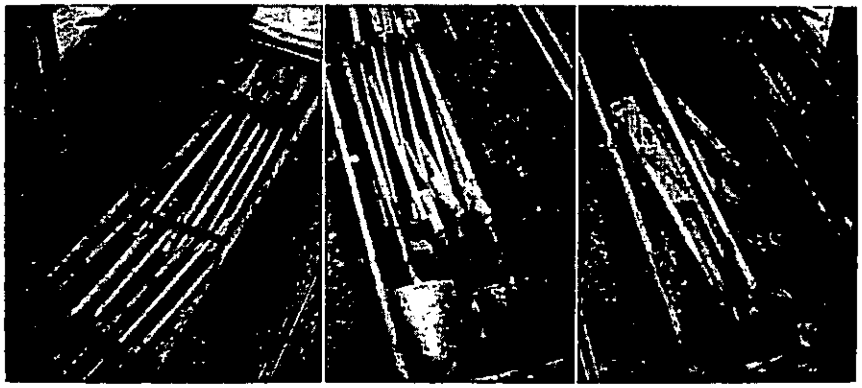

FIGURE 2.—Tools must be available for distribution in a minimum of time. These three toolbox seats contain brush hooks and double-bitted axes (note the used cotton hose as guards for exposed cutting-edges); shovels and pulaski tools; and McLeod tools, gas for brush saws, and extra chains.

Since a "Hot Shot" crew should basically be a self-sustaining unit, the following tools are carried on each crew truck:

Shears, pruning .... pair	2
Brush bobbers	3
Hooks, brush	10
Pulaski tools	8
Shovels, long-handled, round-pointed.	10
Hose tool guards	24
McLeod tools	8
Axes, double-bitted	7
Saw, felling	1
Handles, saw	2
Wedges, wooden	4
Hammer, sledge, 4-pound	1
Oil, saw .... quart	1
Saws, brush, chain	2
Chains, brush saw .... extra	2
Fuel for brush saw, in safety cans .... gallons	2
Oil, brush saw .... quart	1
Oil, gear, brush saw .... quart	1
Files	18
Hose, file holders	18
File guards	18
Handles, file	18
Canteens, 1-gallon	20
Lamps, electric, head	24
"A" batteries .... carton	1
Fuses	24
Gopher gassers .... carton	1
"B" batteries .... extra	2
Radio, handi-talkie	1
Rucksacks	2
Knapsacks	9
Rations, emergency .... boxes	2
Kit, first-aid, large	1
Kit, first-aid, cylinder	1
Kit, first-aid, belt	1
Kits, first-aid, pocket	7
Kits, snake bite	4
Water cooler, 15-gallon	1
Dispenser, paper cup	1
Extinguisher, fire	1
Blocks, chock	2

With this equipment available, the crew can use the truck as an operating base during the initial work period. Damaged tools may be exchanged for new ones. Damaged tools should be replaced as soon as the crew returns to the fire camp or headquarters.

The crew trucks are designed to carry men and tools safely to the fire. After arrival crews must unload as quickly as possible for the initial attack (fig. 1). Tooling up and hitting the fire must take only minutes (figs. 2 and 3). Additional information about the equipment and its arrangement may be obtained through the Forest Supervisor, San Bernardino National Forest, P. O. Box 112, San Bernardino, Calif.

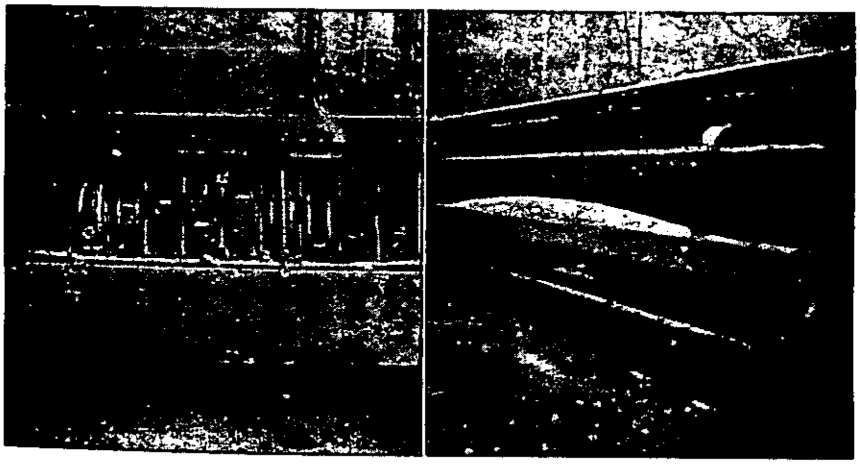

FIGURE 3.—*Left,* Two canteen boxes, one installed on each side underneath the truck bed, keep water cool. *Right,* A felling saw.

MECHANICAL TRAIL PACKER HITS THE SILK

A. B. EVERTS

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

[This progress report illustrates the appeal and versatility of use of automotive trail transportation equipment.]

In the July 1955 issue of *Fire Control Notes,* District Ranger Parks of the Payette National Forest reported on "A Mechanical Mule." In a footnote the editor remarked, "At least five other models of this versatile machine are being designed, tested, or produced by private and government agencies." This article reports on one of the commercial models and some of the modifications that have been made to it (fig. 1).

There are at least 30 of these machines in use in the region, most of them by trail crews. They are so common that they are no longer a topic of conversation and it is quite probable that we have not heard some of the interesting stories regarding their use. Packing lookouts in and out of their stations is commonplace. Considerable ingenuity has been exercised by various individuals for improving the units for trail use. Stands of various kinds have been devised to hold the loaded packer upright while loading and unloading, and during trail stops.

The Wenatchee Forest has one equipped with a winch which is used to pull out small stumps on a trail construction job. This forest has also recently completed a project in which they have modified a packer into a mobile trail compressor unit. The unit, complete with compressor, drill steel and bits, jackhammer and accessories, weighs 655 pounds, including the weight of the packer.

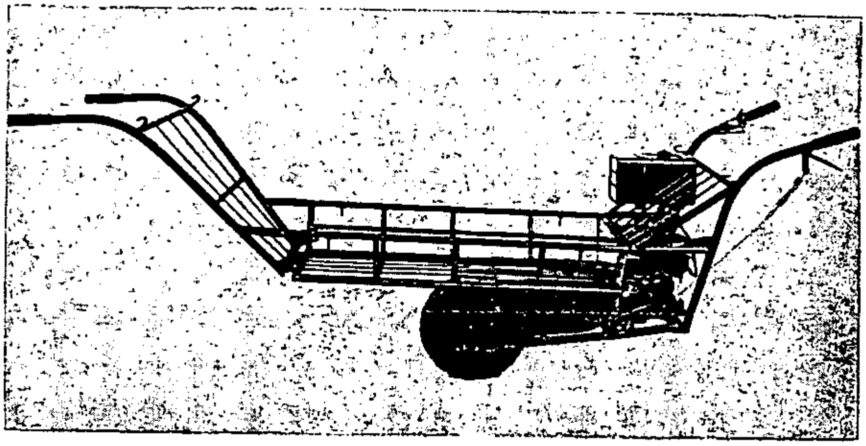

FIGURE 1.—This model of the packer weighs 175 pounds and is powered with a 2½-hp. 4-cycle motor. Gasoline consumption is 16 miles to the gallon; two speeds, 5 m.p.h. and 2½ m.p.h. Present cost is $175 f.o.b. factory.

The Mt. Hood Forest has used the packer for transporting rolls of paper for covering brush piles in connection with a clear-cut slash-disposal experiment. It was also a Mt. Hood 2-man trail crew that made a 70-mile, 10-day trail-opening expedition in which all their tools and supplies were transported on a packer.

The Wallowa-Whitman Forests have a trail kitchen packer, complete with plywood built-ins, that brings a touch of convenience, if not luxury, to an isolated camp (fig. 2).

We have not yet heard of anyone using the packer as a pumping unit or for transporting portable pumps into a water "show." If it hasn't been done, it's just a matter of time, along with a lot of other uses.

The manufacturer of the packer has a companion unit called the "trail grader," which is giving excellent results on trail construction jobs. This unit has considerable promise as a fireline digger and, while we do have some figures on rates of fireline construction, we are not yet ready to release the unit without more field experience. We do believe that in many types of fuel the grader will do the work of six to ten men with handtools.

Also now, Francis Lufkin, Aerial Project Foreman of the North Cascade Smokejumper Unit, has brought up the idea of using the packer to retrieve smokejumper equipment. What's more; Lufkin has demonstrated that his idea is sound.

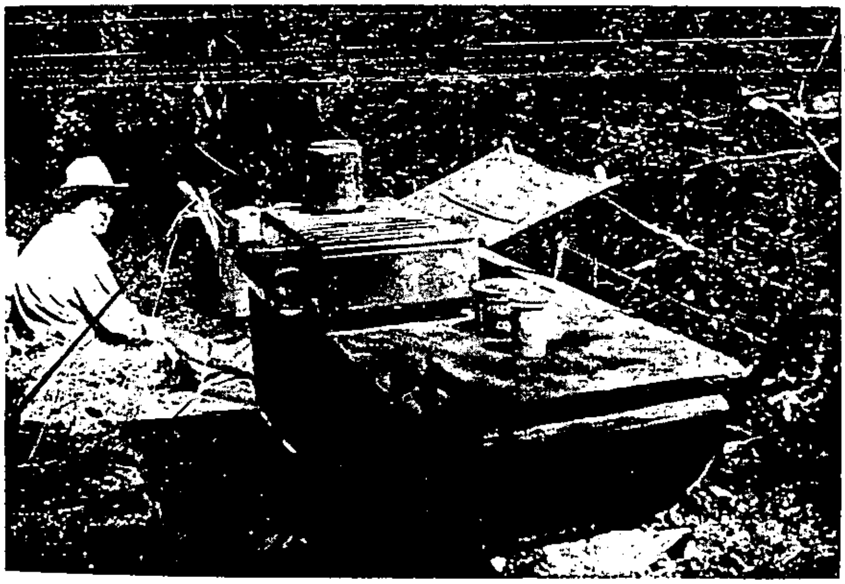

FIGURE 2.—The Wallowa-Whitman Forests trail unit with built-in plywood box. Complete unit includes the following equipment: Two axes, 1 hazel hoe, 1 crosscut saw, 1 pruning saw, 2 canteens, 3 sleeping bags, 3 knapsacks (personal), 3-man mess kit, 1 gasoline lantern, 1 gasoline two-burner stove, 1 tarp, groceries for three men for one week. Approximate load is 300 pounds.

A smokejumper's "come-out" equipment, including his fire tools, which are dropped to him, weighs about 105 pounds. This is a sizeable load, even for the young huskies that hit the silk on these back-country fires.

In times past, it was the procedure for the jumpers to backpack their equipment out to the nearest trail where it would be picked up by a packstring. This still occurs to be sure, but in this changing world packstrings certainly aren't increasing in number, and packing is beginning to be spoken of as a "lost art." There are still plenty of mules. The same cannot be said of packers, however. The result is that on many fires the jumpers backpack their equipment "all the way out."

Mr. Lufkin wants to change this, at least on the long packs, and it looks as though he's going to do it. He made some changes in the packer:

(a) Changed the clutch arrangement to contain its own tighteners and for easier control.

(b) Added side stands to hold the machine upright while motionless.

(c) Added a crazy wheel in the rear to eliminate the need for fore and aft balancing.

Then Mr. Lufkin devised a way to break the machine down into two parts since, with the accessories, it was too heavy and too awkard to get it out of the aircraft door easily (fig. 3).

FIGURE 3.—Packer, in two sections, packaged for dropping. Note the padding under the engine on the left-hand section, designed to lessen the landing impact.

There was one more important step: training. After successfully completing test dropping, a few of the jumpers were given training in assembling the unit, how to start the engine, how to use the clutch and tighten the belt, etc. They had confidence in the machine before it ever came drifting down to them "out of the blue," as it did shortly afterward on the Hungry Ridge fires. There were two fires, both started by lightning, a little over a quarter of a mile apart. Four jumpers went down, two to a fire. They got their fires and mopped them up. Then they loaded their equipment on the packer, 410 pounds of it, and headed out (fig. 4).

FIGURE 4.—Smokejumpers coming out from the Hungry Ridge fire over an old sheep driveway.

The packer has its limitations, but its area of operation is increasing. Region 6 is beginning to talk about better trail maintenance, a different kind of a water bar. Fording streams is a problem. The Wenatchee Forest personnel say that in many crossings they can solve this by a small cable stretched across the stream. They simply hook the packer to the cable and skyline it across, load and all.

There is no doubt about it; the mechanical trail packer is here to stay. It's not at all improbable that within 5 years one or two of these units will be standard equipment at many ranger stations, at least on those districts that have an extensive trail system. You will hear repeatedly as you talk to the boys who are pioneering their use, "Sure, there's work connected with them. So what! You don't have to round 'em up when you crawl out of the sack in the morning. And you don't have to feed 'em all winter long like you do the long-eared hay burners."

FIRE HEADQUARTERS SUPPLY CABINET

JOHN A. ANGUILM

Assistant Regional Supervisor, Region 1, Michigan Department of Conservation

A few years ago 3 extra-period fires, i. e., fires not controlled by 10 a.m. of the day following discovery, taught us the desirability of having a well-organized and well-equipped fire headquarters supply cabinet ready to roll on a minute's notice. Such a cabinet was designed and built for us by our Central Repair Shop at Gaylord, Mich. (fig. 1).

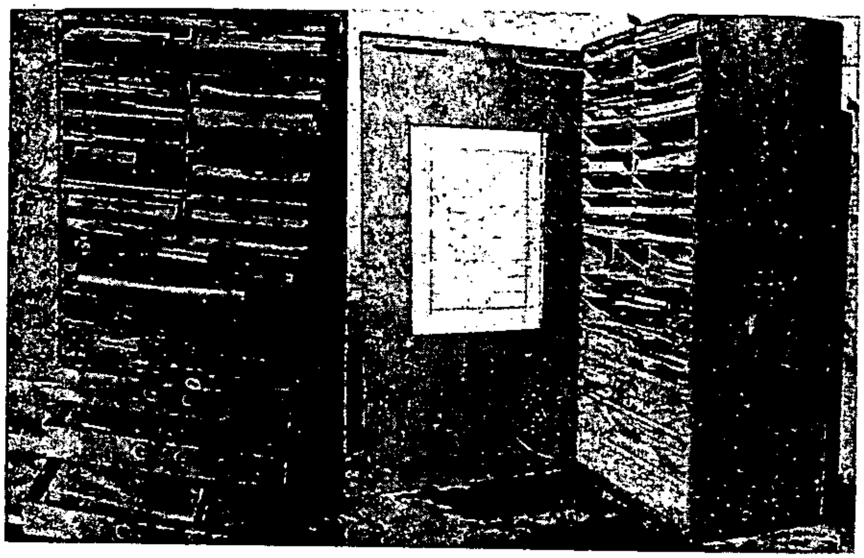

FIGURE 1.—Fire headquarters supply cabinet.

The cabinet is made of ½-inch plywood with ¼-inch dividers and is 19 inches wide, 36½ inches high, and 12 inches deep. Its removable door recesses into the box foot and fastens at the top with a trunk-type fastener. On a fire, this door serves as a tabletop; a layout of the box is posted on it (fig. 2).

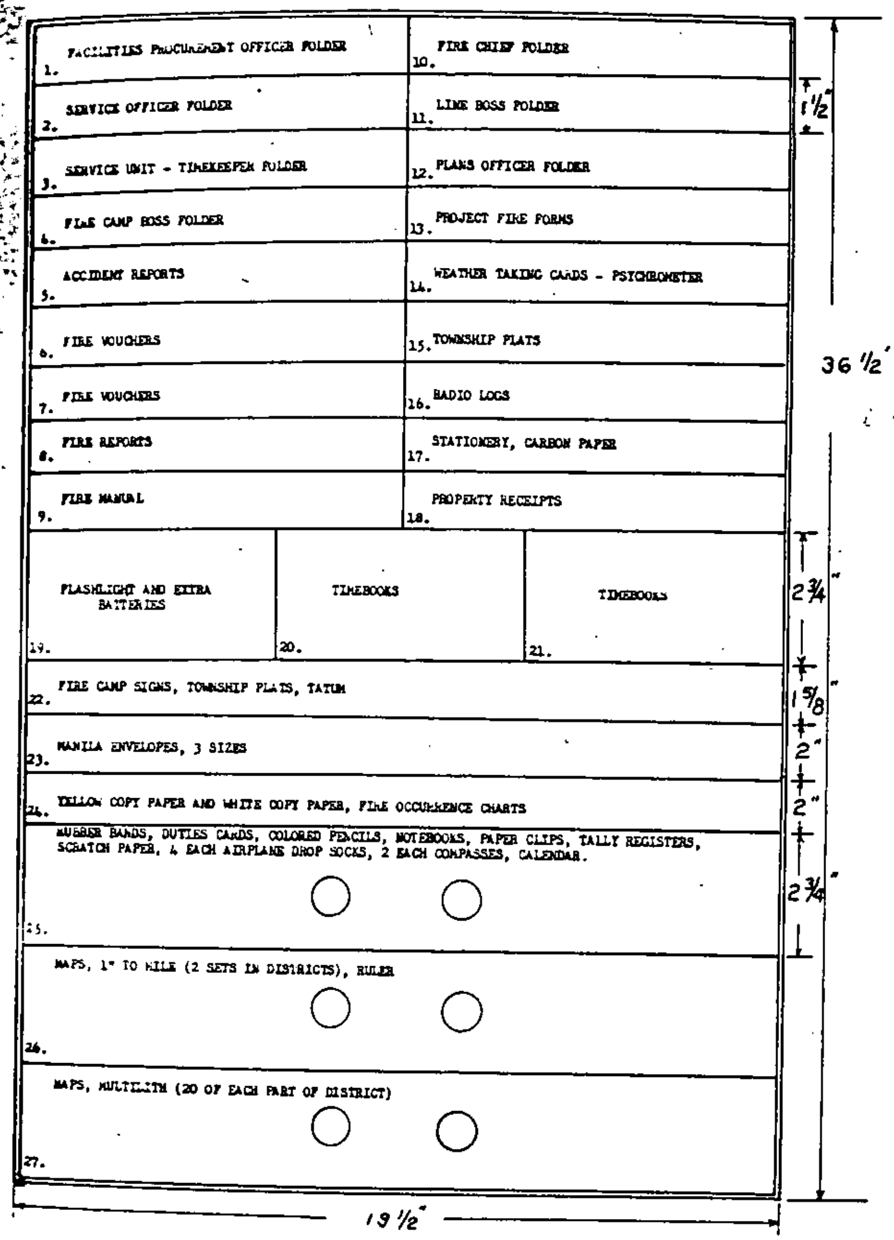

FIGURE 2.—Supply cabinet layout.

SIMPLIFICATION IN DISPATCH SYSTEMS

MAX A. BRADLEY AND GILBERT I. STEWART
Michigan Forest Fire Experiment Station, Michigan Department of Conservation

From the beginning, organized forest fire control in North America has depended upon fire detection and map systems. These, differing somewhat in detail according to the agencies involved, have remained basically the same. Detection has come chiefly by actual observation of fires from elevated positions—ultimately towers—strategically located. Fire finding instruments have also differed greatly, even though variations are chiefly refinements. All detection systems utilize "cross shots" from two or more towers measured in azimuth directions. When these readings are plotted on a dispatch map at some headquarters, the map location of a fire is established. Until this is done, initial action on suppression cannot be undertaken efficiently. However, once the map position is established, a great deal of efficient action can start promptly, for not only is the location known, but also associated information is available immediately dealing chiefly with base features, forest cover, and water supplies.

Functions of detection cannot be separated from those of dispatch, and good map systems constitute the basis of all effort in these fields. Completeness and accuracy are essential in maps themselves, but equally important is the accuracy of plotting azimuth readings from tower sightings.

Almost without exception surfaces of dispatch maps have been dominated by azimuth circles stamped, printed, or pasted upon them, the center of each circle indicating the position of a tower. In those instances where towers were located fairly near each other, circles overlapped or became so numerous that base features were seriously blocked out. Usually, reconstructions of tower readings were made with cords stretched from the centers of the azimuth circles concerned, and crossed to establish the map positions of fire. Even though the desired results were obtained in establishing positions of fires, many disadvantages have been recognized.

The Michigan Department of Conservation recently undertook to investigate means of improving instrumentation of fire detection, as well as map systems employed in dispatch. Investigative work was broken down into two major phases; fire finding instruments and map systems.

Improved types of fire finding instruments were reported upon in *Fire Control Notes* for April 1955. Work progressed simultaneously on map systems, and in May 1955 all map methods existing prior to that time were declared obsolete, to be supplanted by a new system as soon as replacement maps could be issued.

The study of existing methods brought out that improvements could be attained only if the following features could be assured:

1. Accuracy must be assured in reconstructing cross shots from towers. Also accuracy should be consistent and comparable with that guaranteed by fire finding instruments.

2. Full details of base features must remain visible, not obliterated by azimuth circles.

3. Maps must be replaced less often, their details protected from fading as much as possible, and their surfaces shielded from abrasion and dirt.

4. When replacement of maps becomes necessary no changes should occur in the positioning of markings from which azimuth readings are taken.

5. Means should be provided for setting off two or more simultaneous readings from any tower if it should be concerned with more than one fire at the same time.

6. The system of "Cross out" must not require pencil marking on the surface of a map, nor mar its surface by holes from pins, thumb tacks, or other markers.

Obviously the old methods could not be retained, and accomplish these improvements. By May 1955 an improved method had been developed. Its workability depended upon a new instrument combining an arm or arrow and an azimuth circle. This instrument, which has been called the "protractor arrow," was designed and perfected at the Experiment Station (fig. 1). It assured realization of all requirements listed above.

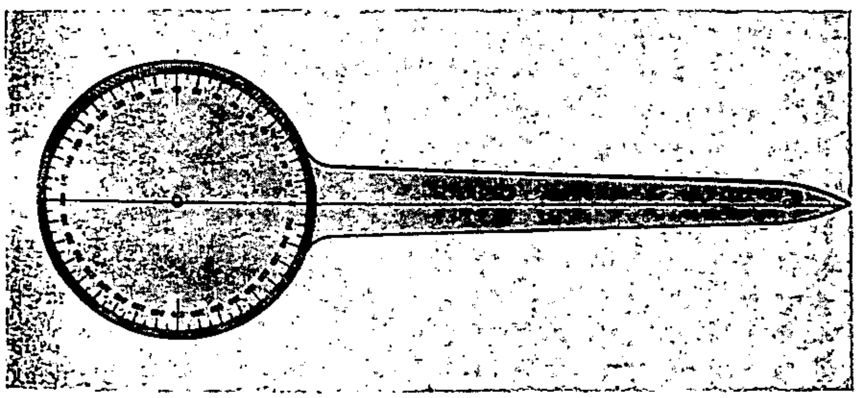

FIGURE 1.—The plastic "protractor arrow."

The protractor arrow was designed for production in transparent plastic, and several custom-made samples proved its practicality. Detailed specifications were formulated at the Experiment Station and, along with drawings, submitted to manufacturers. Satisfactory bids and estimates were received, and subsequently 1,500 of the instruments were ordered (fig. 2).

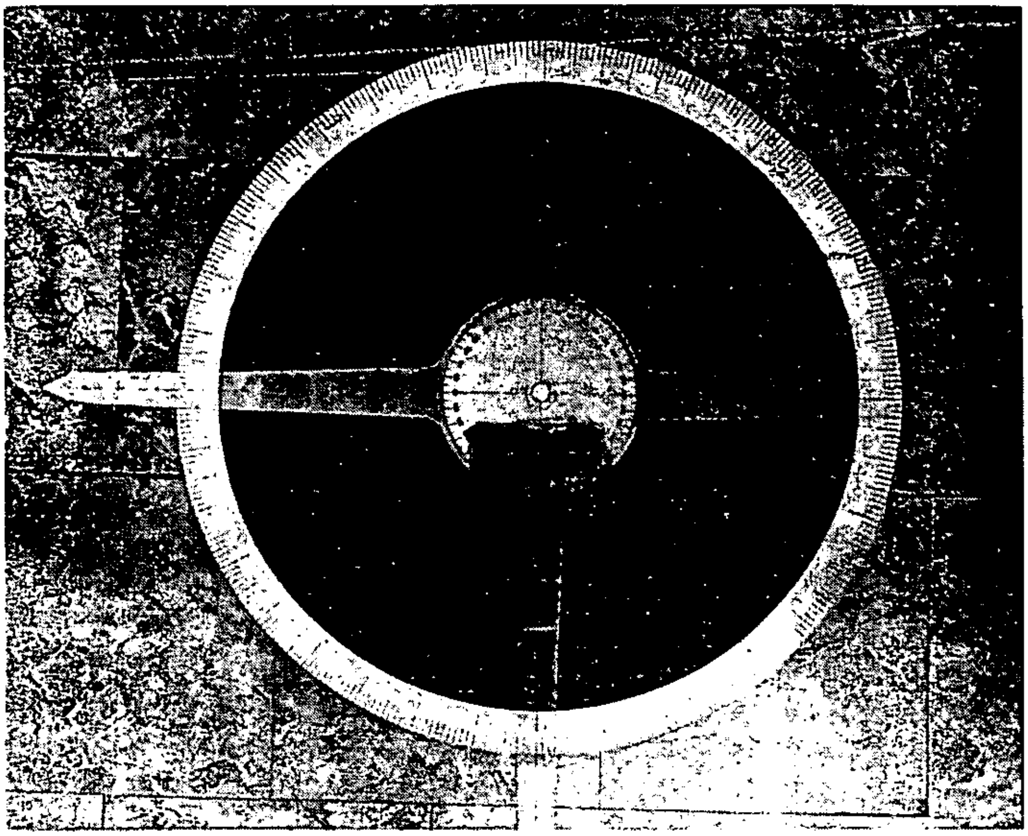

FIGURE 2.—A graduated gage was developed for testing the accuracy of protractor instruments. They were checked against each other in stacked position and on the gage as well.

The new maps bear no azimuth circles on their surfaces. Each map is mounted on relatively soft composition board that is laminated to a hard backing panel known as Novoply. The lamination is 7/8-inch thick, and the entire panel is framed with light aluminum channel. A plastic coating is applied by brushing the surface of the map. It dries hard, clear, and transparent, leaving every map detail clearly defined and visible.

At the time of map printing, each tower location was marked with a short line extending north from the tower position. After maps were mounted and framed, a small hole was drilled at each tower location (fig. 3), threaded screw posts were pressed, friction tight, into these holes from the back of the map panel. Thumb screw studs can be inserted into them from the face of the map. Each protractor arrow is center-drilled to accept the screw stud; it can be clamped against the surface of the map and held in any position required by the azimuth reading (fig. 4). The "zero" or north line serves as the orientation point for any desired protractor setting.

At the present time six protractor arrows accompany each dispatch map; more can be issued with larger maps that include greater numbers of towers. Ultimately all maps used on towers will conform to this same system, and three to six protractor arrows should serve the need of each tower. Any arrow can be

FIGURE 3.—Equipment developed for drilling map panels at tower locations. It is essential that every hole be accurately centered and drilled in exact alinement with the "zero" line already placed on the map surface. The circular opening in the base of the stand contains a transparent disk; a locating hole insures placement of the drill directly over each tower location.

moved about at will, and clamped at any tower location. If any one tower should be involved in more than one fire at the same time, arrows can be stacked on that particular screw post, and made to point in the required number of directions. The system can be used identically at all dispatch headquarters and towers.

A project to produce all of the dispatch maps required for issue to field headquarters and administrative offices throughout the State was finished in October 1955. All maps will be put into service for the fire season of 1956.

Changeover to this new method made obsolete all existing dispatch maps. However, future economy will be realized in a number of ways. Map replacement is expected to be much less frequent. The plastic protractor arrows are of high quality and should be usable for 10 years. When crossed, the centerlines of arrows establish the location of a fire very clearly; the setting can remain fixed as long as desired, and no marking of any kind need be made on the map surface. All techniques utilizing cords, with their attendant weights, springs, magnets, and stick pins are eliminated.

The protractor arrows have printed figures sandwiched between two layers of plastic. Graduations are very accurate, and permit plotting azimuth readings with no instrumental error. The

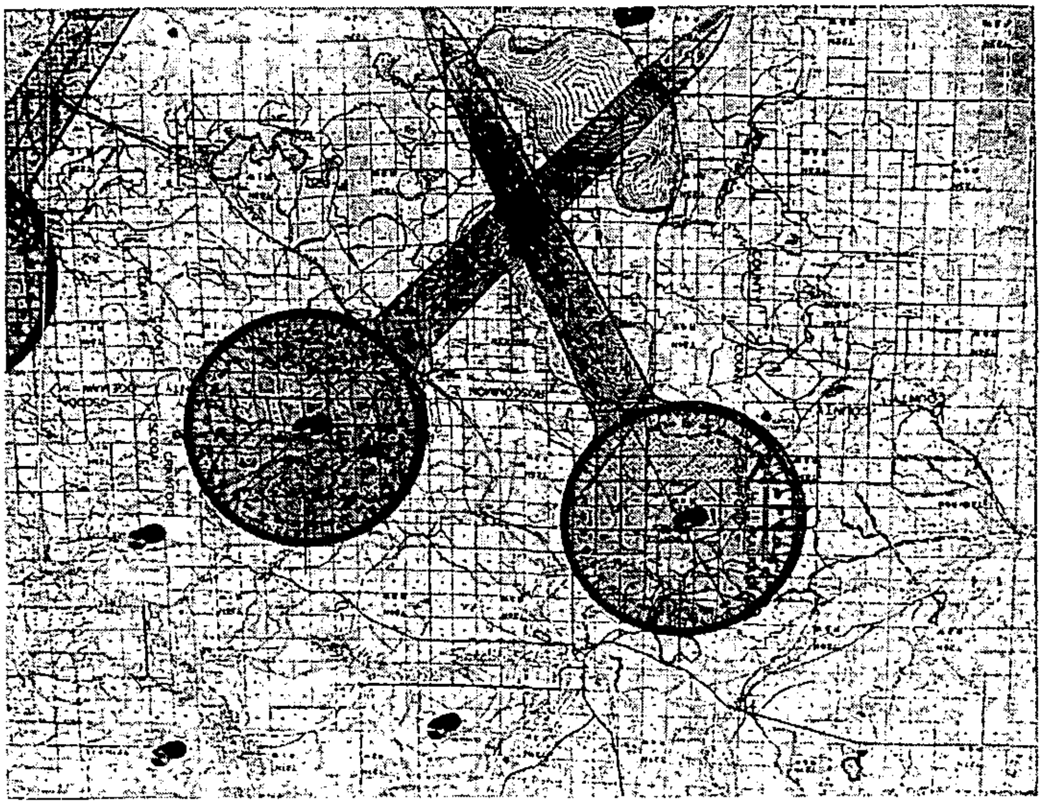

FIGURE 4.—Each tower location on the dispatch map is provided with a base screw post. Thumb studs screw into them from the front of the map and clamp the protractor arrow in any desired position. Note the concise intersection of center lines. Surface of the map is completely free of any other details that detract from map purposes.

azimuth circle is 5 inches in diameter, total length of instrument is 14½ inches, thickness is .060 inch. The material is classed as clear vinylite. Further information can be obtained from the Michigan Forest Experiment Station, Michigan Department of Conservation, Roscommon, Mich.

SELECTING AND TRAINING DISTRICT FIRE WARDENS

FRANCIS L. COYLE

Forestry Aid, Mio Ranger District, Lower Mich. National Forest

A successful warden force depends upon the men selected. They should be picked for leadership, ability to get along with people, geographic location, availability, and willingness to cooperate with the Forest Service. Just because a man lives in an area where a warden is needed and has a telephone does not make him a competent warden. Even if he has had experience on fires and is well acquainted with his zone, if he is unwilling to cooperate or to follow orders he is of little use.

After selection the warden's importance in the fire suppression program should be made clear to him. He should know that he was selected because he is respected by his neighbors, because of leadership abilities, because of good judgment, and because of willingness to cooperate. District personnel should visit their wardens when in the locality whether during the fire season or not. Regardless of the occupation a warden may have—farmer, businessman, logger, or resort owner—he should know we are interested in him and are depending on him. His Fire Warden sign should be prominently displayed, and his fire cache box should be kept in a neat condition.

To train new wardens and to bring experienced wardens up to date, warden meetings are usually held annually. An all day meeting should be planned to present the latest skills, techniques, and new equipment for fire fighting. Although our wardens do not receive pay either for their time or mileage, we have almost 100 percent attendance. This is in spite of the fact that some of the wardens drive 30 miles one way and most of them lose a day's work. This is partly because our wardens realize we are proud of them—and we don't hesitate to tell them so!

The first hour is usually spent in introductions; in passing out warden cards, books of burning permits, franked envelopes, and zone maps; and in having the wardens sign equipment agreements.

Next on the program is a discussion of last year's fires. Here again the wardens' work is stressed. Specific techniques that have proved helpful are pointed out. This leads logically to future work and methods by which the wardens can assist us in prevention as well as fire suppression. These include talking to people, posting fire prevention material in their zones, and advising their neighbors when it is safe or unsafe to burn. Fire fighters frequently have suggestions of value and their comments are encouraged.

If time is left before lunch, a movie on fire can be shown. Since new films are available, the same film should not be shown year after year.

After lunch take the wardens for a field demonstration on new equipment acquired since the last meeting. The men should be given a chance to use the equipment and to ask questions about its use. If new equipment or tools have not been acquired, the wardens can be organized for a project fire setup. Select a fire boss and explain the project through him. Instruct the group on how the fire boss should select his sectors and appoint such assistants as sector bosses, line bosses, tractor and tanker unit bosses, timekeeper, and radio operators. Each position and the reason for each one should be explained; maps and blackboard can be used to illustrate reasons for deployment of men and equipment. This simulated exercise can be made more interesting by such activities as having spot fires occur, and studying wind shifts. Questions and comments should be encouraged. In inclement weather this project can be held indoors.

No demonstration should last more than 2 hours. The final 2 hours of the meeting should be an open discussion. The wardens should know that we will support them. They have authority to issue burning permits, they may refuse permits if they believe it unsafe to burn. Also if some people in their zones burn promiscuously, we will do all we can to prevent further violations even if court action is necessary. At this time the wardens are asked to present their particular problems and we answer their questions if possible. If not, we get the answer for them at the first opportunity. Wardens should be asked for comments, suggestions, and criticism on the work of the Forest Service in fire prevention and control. The meeting should stop early enough so that those who have important chores, especially farm ones, can get home to do them. But anyone who still has questions can stay for help in their solution.

After the warden force has been set up, the wardens should be used as much as possible. They should be dispatched on any fire in their zones, even though a Forest Service crew could handle the fire. The wardens should also be used as reinforcement in adjoining zones; they should be utilized as much as possible as line or sector bosses on project fires. A good warden force can easily become a poor one, especially if fires occur in the wardens' zones and they are not used. Proper selection, training, and use of district fire wardens will result in a good warden force.

REFLECTIVE PREVENTION SIGN FOR PROTECTION VEHICLES

MARTIN E. CRAINE
Assistant State Forester, Utah Board of Forestry and Fire Control

While trying to take advantage of every known medium for the promotion of wildland fire prevention in Utah, one day we suddenly awoke to the fact that our own field vehicles were reaching into every corner of the State without carrying a direct plug for fire prevention. Immediate steps were taken to put this free advertising space to use (fig. 1).

FIGURE 1.—Utah Board of Forestry and Fire Control reflective prevention sign. The first 5 signs were produced in the State Road Commission sign shop at a total cost for labor and material of $32.50, or $6.50 each.

The signs were to be as large as practical for the vehicle tailgates. We wanted the message in large letters, legible from a distance and hard to overlook. This demanded use of the shortest possible phrase. Each sign was to be a unit that could readily be removed from a vehicle for refinishing or for transfer as vehicles are replaced. We selected 8-gage metal for the base material. So it would be equally effective in hours of darkness, each sign was made of reflective material. The finished product is black letters on a white reflective background with overall dimensions of 10 by 48 inches.

ADJUSTABLE TRAILER HITCH ASSEMBLY FOR STAKE TRUCKS

CLAUDE L. SMITH

Equipment Repairman, Michigan Department of Conservation

Fire control people frequently find they need to enlarge their truck fleet in high hazard periods by renting private trucks. Among the jobs for these rented units is delivery of trailer-mounted fire pumps, plows, and pipe and hose outfits to fire locations.

Our Norway station requested a trailer hitch assembly that could be easily installed and removed from any stake truck they might procure for temporary fire duty. We made up the illustrated hitch in 1953 (figs. 1 and 2) and in 1955 produced 20 additional units for use at other stations.

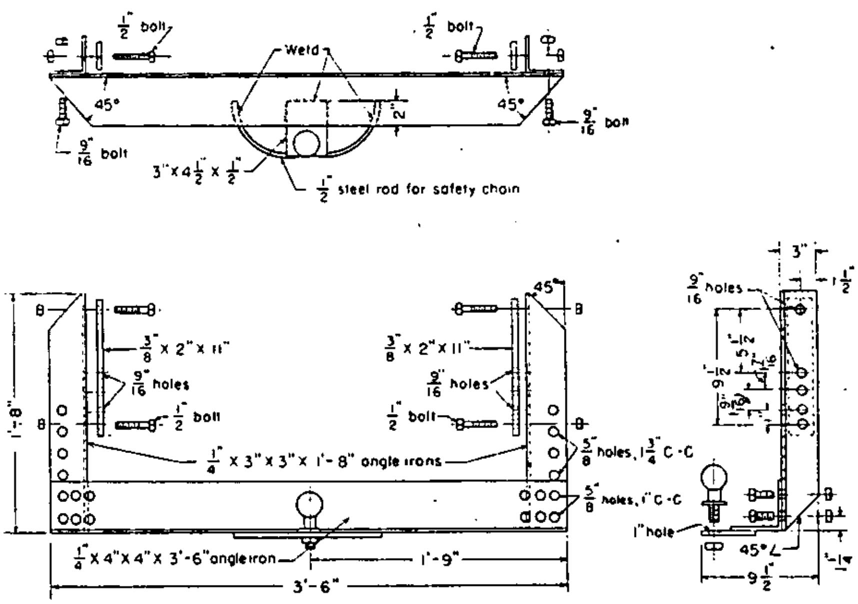

FIGURE 1.—Construction details of adjustable trailer hitch assembly.

This hitch is easily fastened (without boring holes) to the stringers of a stake truck by use of clamp plates. Several holes in the clamp plate and in the upright angle iron permit adjustment to a snug fit over the stringers. Holes drilled in the upright angle iron permit setting the hitch at the desired height. Extra holes drilled in the crosspiece of the hitch permit adjusting the width to the varying width between truck stringers.

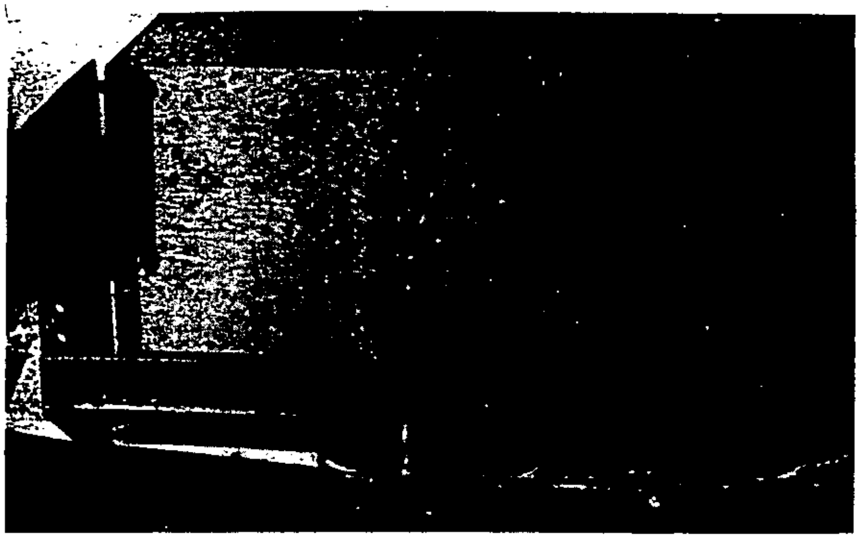

FIGURE 2.—Trailer hitch assembled.

CAUTION: This hitch is for temporary emergency use; because the bolts can work loose, the assembly should be checked frequently. Care should also be taken to see that the trailer is not loaded too heavily.

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Test-of-Friendship Fire

To the long and varied list of causes for forest fires, a new one was added last month.

The report comes from the Pleasant Hill District of the Ozark National Forest that a 59-year-old resident of that area set fire to his farm buildings last month to find out, as he told law officers, "if he had any friends who would come to help him put it out." Except for a crew of U. S. Forest Service men, no friends came. They controlled the blaze after it had spread over seven adjoining acres of National Forest land.

In court, the judge, prosecuting attorney, and witness were sympathetic. The old man was fined $25 for letting a fire burn to other lands, but a 90-day jail sentence was suspended, he was placed on probation for 6 months, and a charge of drunkeness was dismissed. Yet, on leaving the court of justice, the old man still seemed puzzled as to the extent and quality of his friendship.—*Quarterly Review*, Vol. VI, No. 4, Forest Service, U. S. Dept. Agr., Atlanta, Ga. Oct. 1955.

FIRE CONTROL PRACTICES: A TRAINING COURSE

CRAIG A. GIFFEN
Assistant District Ranger, Tahoe National Forest

For the past two years the Tahoe National Forest has used a different approach to fire control training at its annual fire training meeting. Several phases are integrated into one basic course for first and second year fire protection personnel. Classes are limited to five or six trainees each so that individual trainees can actively participate.

Prior to use of this method our fire training meetings depended on the lecture-demonstration type of class. Fire behavior, line location, line construction, initial attack procedure, mopup practices, and other courses were taught to groups of 20 to 40 trainees Attempts were made to encourage individual trainee participation, but in too many cases most trainee activity was confined to looking and listening. Even the final crew-sized fire, culmination of our fire training meeting, took on the appearance of a demonstration for spectators. There was simply no opportunity for large numbers of trainees to actively participate.

Our new technique, called the "Fire Control Practices" course, is alloted about 3 days of our normal 4-day training meeting. A short orientation lecture and a required course in use of basic fire fighting handtools must precede it.

The 40 to 60 first and second year men attending are divided into groups of about 6 trainees each. Each group is assigned to an instructor who is assisted by a "demonstrator" and a "fire stopper." The more experienced personnel either attend specialized classes designed for their particular needs or they serve as demonstrators and fire stoppers.

The "Fire Control Practices" course aims to teach the principles of fire control by the use of many separate lessons. Each lesson stresses one principle or basic point in fire behavior, line location, line construction, initial attack, or mopup. Every lesson uses an actual fire. For the first several lessons very small fires are sufficient, maybe only a foot or two across, but the fires and the smoke are real. With classes small, interest is high. Informal explanation is necessary, to be sure, but an outdoor laboratory with lots of small fires is the key; individual trainee participation becomes a reality.

The first lesson might logically be a demonstration of fire behavior under the simplest possible conditions: No wind, no slope, and fuel of pure type and of uniform density and moisture. Grass or pine needles are very satisfactory and provide a good base for discussing the fuel-heat-oxygen triangle. The fire is started and the even rate of spread from the center in all directions is pointed out. The instructor asks for questions and answers them but does not become involved in other principles at this time. Handling these is planned for subsequent lessons. The instructor does not even put the fire out. He simply moves his class away from the area and his fire stopper steps in behind and mops up. If trainees are permitted to observe the suppression action, they will think about other things instead of the basic lesson at hand. Next, a trainee repeats the process with his own small fire and explanation. A critique completes lesson one.

The second lesson could demonstrate the effect of different fuel types or different fuel density on the rate of spread. An actual fire is used to show how heavier or sparser fuels affect its spread. No doubt the instructor will have to prepare his fuels a bit so that the principle can be adequately demonstrated under simple conditions. Slope, wind, and other factors should remain unchanged and should not affect the demonstration. Only one principle should be stressed. After questions have been answered, the group moves away from the fire. And again a trainee, preferably a different one, prepares similar conditions, lights his fire, and proceeds with a full explanation and demonstration of the principle involved. The critique completes the lesson.

Additional lessons in fire behavior follow, but each successive lesson stresses only one basic principle. Points which have been previously covered may be referred to as they relate to a current lesson, but principles reserved for future lessons should not be discussed until their time. Wind, slope, and fuel moisture can be covered in whichever order the instructor prefers. Sometimes windy conditions in the field will make it difficult to isolate this factor, but at least its influence can be seen and explained. Our experience has been that a good instructor can handle such unforeseen occurrences without excessive trouble. If the day is calm, wind can be generated by a portable fan and battery.

It is important that each trainee gets several opportunities to participate actively in both demonstration and explanation. This method of instruction with trainee participation is basically similar to the four-step method:

1. Instructor outlines the conditions and the lesson to be learned.

2. Instructor starts his fire and explains the key point.

3. Trainee presents similar conditions, starts his own fire, and explains the key point.

4. Follow-up is accomplished back on the ranger district as employee puts training into practice on going fires.

After the class has covered the basic points of fire behavior, the instructor proceeds, one point at a time, through the principles of line location. He explains how the various principles of fire behavior just learned affect the location of firelines. The presence of natural barriers, heavy or flash fuel, the proximity of slope, the problem of a fire just starting up both sides of a draw, and the effect of rolling material on a slope are just a few of the factors influencing line location that can be demonstrated by small fires.

The demonstrator should actually build what line is necessary, while the instructor explains the theory of a particular piece of line location but does not mention line building techniques. As lessons in line location progress, larger fires may be necessary so that realistic conditions can be had. Nevertheless, for each lesson a trainee should be required to move to a new spot (already picked out for proper conditions), light a new fire, and thoroughly explain the principle involved. He should use the demonstrator for actual line building just as the instructor did. And, of course, a critique is still necessary to conclude the lesson.

After several lessons in line location, the class may progress to the methods of line construction. As successive lessons are introduced the four-step method of instruction is adjusted somewhat in order that all trainees may participate in each line construction problem. Trainee activity is very closely supervised in these lessons since the demonstrator is able to spend part of his time assisting the instructor in the correction of unsound work methods. Fires are permitted to become larger now and the instructor is teaching basic points of the one-lick, progressive, and leap frog methods of line construction. Since trainees have been introduced to the use of basic tools in a previous course, line construction lessons move along fairly rapidly with plenty of fire and lots of smoke. Mopup work is still done by the fire stopper who may now have a small tanker at his disposal, but all trainees work on the control line.

By now trainees are beginning to perspire and they may even develop a smoke eater's cough. Small groups and many fires have made possible an understanding never before reached by spectator training.

The instructor has now had a couple of days to size up his crew and to determine how much more training they can take and at what speed. Principles of initial attack and mopup are still to come. Perhaps several major points can now be stressed in each lesson. Perhaps even more flexibility can be introduced into the mechanics of the four-step method of instruction. The course is brought to an end with two or three one-man fires of good size on which everybody mops up after initial control has been achieved.

Three days are really not enough for this type of course. Four or five days would probably be sufficient but are seldom available. Nevertheless, we feel that three days of instruction as described herein buys a lot more trainee understanding than three days of classroom theory and a moderate amount of spectator training.

Every reader knows, of course, that the success or failure of the "Fire Control Practices" course rests almost entirely on the caliber of the instructor, because of the large number of critical points involved. The very nature of the course requires that one instructor and one demonstrator stay with the class for the full time. They can maintain the continuity of the course and at the same time use as valuable training aids questions and happenings that occur. Then, too, instruction will be far more effective if the teacher is able to adjust the speed of instruction to the learning capabilities of his group. Such adjustment is impossible where instructors are changed during the course.

The "Fire Control Practices" technique of instruction is hard on teachers. A great deal more time is required for adequate preparation and instruction than would be required of any instructor under the system of larger classes and divided teaching responsibility. And adequate preparation for instruction is essential. The Tahoe has discovered that a thorough field briefing and demonstration period for instructors is necessary. The thinking required in the point by point development of the course can present problems. For example, we find that instructors not thoroughly briefed in the theory of the course have difficulty in moving their groups away from a going fire to let the fire stopper move in and finish the job.

We have found that one short day is not enough for this preparatory meeting. Perhaps one long day or two short days would do the job. We think that this amount of time is justified. If the program is retained over the years and if the theory of the course is accepted throughout the ranks, perhaps such an intensive preparatory meeting will become unnecessary.

In addition to this preliminary get-together on theory and techniques, instructors must look over their demonstration area ahead of time so as to determine which spots should be used for which lessons. Considerable picking and choosing is necessary and the job cannot be done in a few minutes. Quite possibly an instructor will want to mark his planned route of travel with string, and he may even want to leave notes for himself at the many spots he has chosen for his various lessons. The string is helpful to a checker who will make a final inspection of all fires a day or two after the training session.

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Compact Cleaning Kit For Lookout Cabs

A standard ammunition box (Cal 30 M) is a very satisfactory storage container for the cleaning materials necessary for good tower-cab housekeeping (fig. 1). This 4- by 8- by 12-inch metal container, with a close sealing cover, is available at surplus stores for about 50 cents. The following items fit neatly into the box and are recommended for the essential cleaning jobs: "Squeegee" cleaner with wiping blade in combination, 6-inch width; bottle of nonflammable cleaner fluid, 8 to 10 ounces; whisk broom, 6- to 8-inch length; cellulose sponge, 4 by 6 inches; soap in tin or plastic box; 2 cleaning cloths.—LLOYD MAKI, *Forest Fire Officer, Michigan Department of Conservation.*

VARIATIONS IN BACKFIRING IN THE SOUTH

R. J. RIEBOLD

Forest Supervisor, South Carolina National Forests

When large-scale fire protection in the Southeast began about 1933, grass fires in 1-year roughs on cutover longleaf land were whipped out with pine tops or swatters. As fire protection succeeded, pine reproduction came in and dense stands of seedlings and saplings were formed over large areas. By 1943 the growth of reproduction had been accompanied by the growth of a dense hardwood understory and the accumulation of deep layers of pine needle fuels, often draped head high on the understory brush. Accumulation of light flash fuels alone amounted to 10 to 20 tons per acre *(4)*.[1] These conditions led to prescribed burning for fuel reduction and hardwood control *(1, 2, 7)*. In combination with other factors, they also led to the development and widespread use of the tractor-plow outfit *(5, 6)*. Standard practice today in the Coastal Plain forests is generally to stop the forward movement of the head of a fire by plowing a line in front of it, backfiring, and holding the plowed line. The control line is located far enough in advance of the fire so that the backfire and the head fire meet 25 to 50 feet from the control line. Ordinarily, little difficulty is experienced in holding the line.

When burning conditions become severe, however, surface fires burn harder and crown occasionally. Exceptionally dry conditions are sometimes coupled with erratic fire behavior. Speaking of conditions on the Francis Marion National Forest in South Carolina in 1950, Byram and Nelson *(3)* said: "It should be emphasized again that the changing fuel and stand types occurring in the Southeast may be a necessary condition for the large whirling fires which burned in South Carolina last year. These fires burned in dense stands of reproduction (predominantly loblolly pine) in which the compact crowns constituted the main source of fuel. In turn, the availability of this green fuel for combustion was increased by an unstable atmosphere plus a high rate of energy release in the ground fuels."

Under severe burning conditions the commonly used single backfire set from the control line fails in many cases to hold the head fires. The usual meeting place of head fire and backfire is too close to the control line. With backfires moving at the rate of about 1 chain per hour and head fires advancing at rates of 1 to 4 miles per hour, there is simply not time enough for the width of the burned out strip to be increased sufficiently merely by the burning of the backfire away from the control line. The need to increase this width, to place the meeting of head fire and backfire farther from the control line, has led fire control men to devise variations in backfiring practice. Those described here have been used on the Francis Marion National Forest. Probably similar variations have been developed on other fire control units throughout the South.

[1] Italic numbers in parentheses refer to Literature Cited, p. 33.

One variation is termed "parallel backfiring." Instead of merely firing along the control line, an additional line of backfire is set between the head fire and the control line and roughly parallel to it. The first torchman works 50 to 100 feet from the control line and between it and the head fire. The second torchman fires the control line about 100 feet behind the first torchman, or close enough to keep the interior backfire from sweeping up to the control line and crossing it. Both men move in the same direction. This method puts the meeting place of head fire and backfire about twice as far from the control line as the usual practice does. It tends to reduce the heat and smoke along the control line because the two backfires draw together.

A second variation, called "delaying backfire," is similar to parallel backfiring. Its purpose is the same: to cause a crowning head fire to stop for lack of fuel at a greater and safer distance from the control line. The delaying backfire is set 5 to 20 chains from the control line instead of 50 to 100 feet as in parallel backfiring. The method of firing is the same. The control line is fired in the usual manner to hold the leeward edge of the delaying backfire, which, in the distance indicated, may acquire considerable volume and velocity.

Another variation, also intended to break the forward movement of the head of a fire, is "perpendicular backfiring." Two torchmen, 100 feet to 100 yards apart, move out from the place on the control line where the center of the head will probably hit and set backfire squarely into the wind toward the head of the fire. When they have gone as far toward the head of the fire as they safely can, they turn away from each other and return to the control line along the flanks of their backfires. The control line is fired in the ordinary manner. The two strips of backfire, advancing and spreading, break up the head of the fire at a good distance from the control line.

The movement of men setting backfires between the control line and the head of the fire is, of course, hazardous. Such work is to be undertaken only by experienced men, directed by experienced fire bosses, and supported by well-trained, well-organized crews. The woods must be fairly open and free from brush so the men can see and move. A great deal of danger is always present when men are in front of crown fires or fast moving surface fires. A crew of men strung out along a singly fired line in front of a head fire is placed in greater jeopardy than is usually realized. The burned out strip is necessarily shallow and the meeting of the backfire with the head fire may take place close to the line. The men are subjected to great heat and possibly flames. There is considerable likelihood that the woods behind them will ignite and their escape routes be closed. Backfiring methods which stop the head fire at a greater distance from the manned control line actually increase the safety of the men holding the line.

The meeting of head fire and backfire causes a tremendous updraft of heat and flame, which often result in a strip of complete kill, even when the head fire alone is not hot enough to do so. Several variations in backfiring have been employed or suggested to eliminate this belt of severe damage. The commonest is to use a road as the fireline and let the head fire come up to the road without backfiring at all. Since the clearing widths for most State, county and national-forest roads is from 30 to 80 feet, this "width of no fuel" is often sufficient. When it is not, Forester John T. Hills, Jr., who has had many years of fire suppression experience on the Francis Marion, suggests that the width of no fuel can be increased by plowing a line and burning out a 50 or 60 foot strip on the side of the road away from the fire. The added width would give the same effect as a backfire burned out 100 to 150 feet from the control line. However, the head fire would burn up to the road, instead of meeting a backfire, and, consequently, no strip of severe damage would occur.

The same result has been obtained with two plowed lines. If two tractor plows are available, paralleling lines 100 feet to 100 yards apart are plowed in front of the head fire. Instead of backfiring the inner line toward the head fire, the space between the two plowed lines is burned out in strips as in prescribed burning. The head fire burns up to the area of no fuel and stops. There is no moving backfire for it to meet and, again, no strip of complete kill occurs.

Pond pine and titi bays throughout the longleaf-loblolly pine stands create special backfiring problems. Most of the time tractor-plow outfits cannot cross the bays, and control lines must be cut around them. In dry times the bays can be plowed but backfiring in the dense undergrowth is hazardous even on the flanks and rear of a fire. Because prescribed burning for fuel reduction cannot be used in the bays, they may have a 20-year fuel accumulation. Rate of spread of the backfire may be slow and the burn-out incomplete, but a shift of the wind can cause both crew and plow to be trapped in an area of heavy brush and heavy fuel.

To deal with such a condition, Fire Control Aid James Parker used the following method. He sent the tractor-plow about 150 yards into the bay without plowing, merely breaking down brush. He then had it turn and plow out on the same line, returning to a safe place on the edge of the bay. About 100 yards of this line was backfired. When the backfire had burned out to a safe distance from the line, he sent the plow in again to repeat the maneuver. Each time, the plow returned to a safely burned out part of the line before the line ahead was backfired. The tractor-plow was thus not at any time at the end of a plow line in very thick brush while a long line of backfire was being set behind it. This method requires time and is not suited to stopping a fast-moving head fire. It does provide greater safety for men and equipment in an area of high hazard.

The successful execution of these variations in backfiring requires not only boldness and skill on the part of the men but a higher degree of organization, training, and discipline on the part of the whole attack force than is generally found in hastily mobilized crews of untrained volunteers.

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Demerol To Kill Pain

Where there have been accidents, demerol has relieved pain and stopped a lot of suffering. Use demerol only when pain is severe and immediate relief not available. Never use it for skull fractures or illness. Avoid freezing and demerol will last indefinitely.

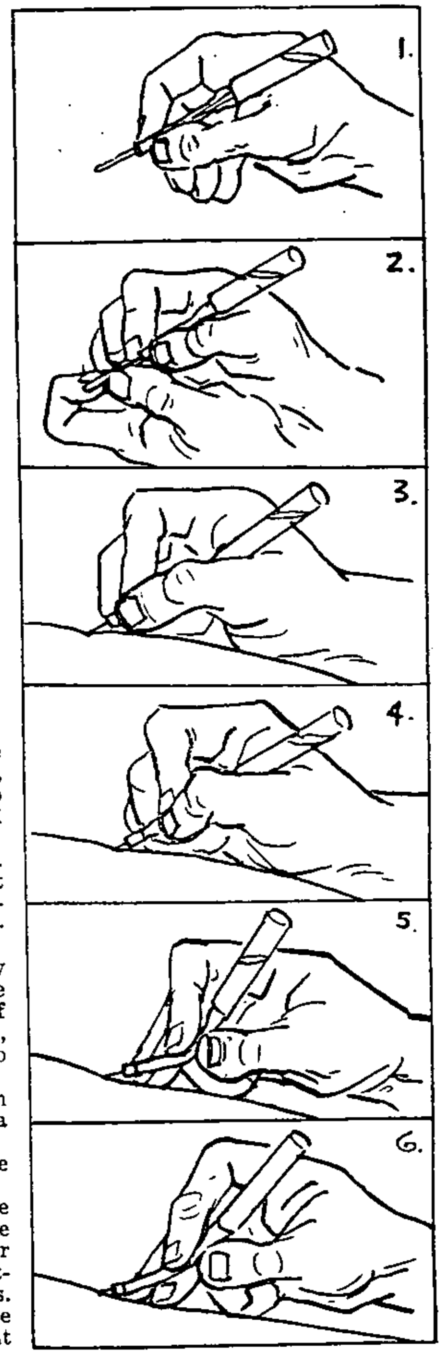
Distribute your supply for ready availability on field jobs. If demerol is stored in regional and supervisor's offices, it does little good. Place it where work crews and fire fighters may benefit from its use.

So far demerol packaging has been fragile. On the Superior National Forest this difficulty has been overcome by developing a ⅝ by 6⅝-inch metal tube with a cork in each end. The demerol is then inserted in the tube with cotton pads on either end. To get the demerol out of the tube easily, one cork has a wire pull ring to which is attached a string tied to the demerol vial. Each tube has instructions for use. Administer as shown in the six easy steps.

IMPORTANT: ALWAYS HOLD GLASS VIAL IN "BOTTOMS-UP" POSITION ABOVE NEEDLE WHEN ADMINISTERING. (The liquid is forced out by compressed gas. *If not bottoms-up, gas will escape without forcing out liquid.*)

1. After thoroughly cleansing the injection area with soap and water, alcohol, or other disinfectant, grasp hub of needle between the thumb and index finger.
2. Remove needle cover by twisting.
3. Insert needle into body in almost any place. Preferred spots are muscles of upper arm, thigh, calf, buttocks, abdomen.
4. Squeeze before injecting fluid by flattening rubber tube just above needle hub, then release tube. If needle unfortunately strikes a vein, blood will show at top of needle hub and needle must be inserted again.
5. If no blood shows, break ampin tip inside rubber tube like breaking a matchstick with the fingers.
6. Allow to remain until complete dose has been expelled.

NOTICE: Some of the possible side effects that may accompany use of demerol are dizziness, nausea or vomiting, face flushing, profuse sweating, dryness of mouth, and weakness. These are not abnormal and can be prevented usually by keeping patient in prome position.



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.

Remember—Only you can

PREVENT FOREST FIRES!